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## Analytical Solution to The Non-Linear Partial Differential Equation for Water Infiltration in Unsaturated Soils by Laplace Transform Homotopy Perturbation Method

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**Abstract.** This paper is intended to show the applicability of combination of Homotopy Perturbation Method (HPM) and Laplace transform(LT) gives approximate analytical solution to the Non-linear partial differential equation(NLPD) for water infiltration in unsaturated soils known as Richard's equation (RE). The nonlinear terms in Richards Equation can be dealt with by utilizing HPM. The methods give an analytic solution to the Richards Equation in the form of a convergent series. The validity and application of existing method is tried and tested by applying it to three different examples. The outcomes got by LTHPM are additionally contrasted with existing arrangements with show the precision and appropriateness of the technique. It shows that the technique LTHPM has a decent concurrence with the arrangement in examination with accurate arrangement.

#### INTRODUCTION

LT was first introduced by a French mathematician Pierre Simon Marquis de Laplace about 1780's [1,2]. LT is an integral transform method which is very effective and useful for solving differential equations. However, the LT is absolutely unequipped for taking care of nonlinear conditions. It is on the grounds that the challenges that are brought about by the nonlinear terms and numerous actual wonders that are constrained by linear or nonlinear differential conditions. Because of this explanation numerous scientists liked to utilize the HPM to deal with nonlinear conditions. The strategy gives an exceptionally fast convergence of the solution series in the most cases. The HPM was first proposed by the Chinese mathematician He in 1999 [3] and was additionally improved by He [4], [5]. Remarkable research work has been developed by using the HPM to the linear and non-linear equations [6,7,8,9,10]. Since this technique is protracted and hard for tackling these sorts of mathematical issues.

Numerous scientists attempted various approaches to tackle the issue. The proposed strategy by Ghorbani [11], is a coupling of the LT and HPM. Because of the ability of joining these two incredible assets, the LTHPM is discovered powerful strategy. As of late, numerous creators have focused on investigation the solutions of linear and nonlinear partial differential equations utilizing HPM with LT [12,13,14,15]. In 2015,Gupta & Kumar Das used this coupling for solving convection diffusion problems [16]. Also in 2016 Rajnee Tripathi used this coupling for solving Lane Emden type differential equation [17] and Dr. P. G. Bhadane used for solving nonlinear partial differential equation [18].

The conservation equation is combined with Darcy transition condition, and the RE is gotten to predict the moisture content in soil during transient stream in 1931[19,20]. REs is a notable second order nonlinear PDE, which addresses the development of water in unsaturated soil. The importance of REs in geotechnical and geoenvironmental. The Numerical solution of the REs is perhaps the most difficult issues in geology, since which is hard to rough. Subsequently it doesn't have a closed form analytic solution.

Already many scientific techniques have been used for finding the answer for REs, as a result of its significance in the fields of designing, like waste, water system, ecological, soil and petrol designing. But the numerical solutions of the REs are very difficult due to the nonlinear terms. Therefore, much attention has been paid by researchers using various methods for REs. In 2010, Omidvar and Barari [21] discovered new class of answers for REs. Additionally In 2017, Kunjan Shah and T Singh utilized new integral transform and HPM [22] to get approximate solution of  $\theta$ -based REs. Later on, in 2020, Varsoliwala et.[23] used Elzaki transform and HPM.

In the current paper, a LTHPM is used and proposed to address the Non-linear PDE for water infiltration in unsaturated soils.

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#### 020008-1

#### **RICHARD'S EQUATION**

#### Formulation of $\theta$ -based Richard's Equation

There are three standard forms of Richard's equations

- a) Mixed form containing the pressure and saturation.
- b) Head based (h-based) and
- c) Saturation based ( $\theta$ -based).

In this article saturation based Richard's equation is considered using Brookes and Corey Model.

We inferred the protection of mass of fluid water in an unsaturated permeable media having stream one way.  $\frac{\partial \theta}{\partial t} + \frac{\partial q}{\partial z} = 0$ , this expression becomes  $\frac{\partial \theta}{\partial t} + \nabla \cdot q = 0$ . Where  $\theta$  and q are unknowns. Receiving conservation of linear momentum standards, We get an equation for Darcy speed. i.e. q = -Ki where, K = water driven conductivity [ $LT^{-1}$ ]

water powered head,

$$H = \frac{p}{pg} + z$$

$$i = \text{Hydraulic gradient} = \frac{\partial}{\partial t} \left[ \frac{p}{pg} + z \right]$$

The expression q = -Ki, was really inferred for saturated flow through sand segment. It can extend for Darcy speed in unsaturated conditions as

$$q = -K \frac{\partial H}{\partial z}$$

Where  $H = SuctionHead + GravityHead = \Psi + z$ 

so that 
$$q = -K \frac{\partial}{\partial z} \Psi + z$$

Let  $K \to K(\Psi)$ , Also,  $K = K(\theta)$  Since,  $\theta$  and  $\Psi$  are naturally related. By Chain Rule,

$$\frac{\partial \Psi}{\partial z} = \frac{\partial \Psi}{\partial \theta} \cdot \frac{\partial \theta}{\partial z}$$

where,  $\frac{\partial \theta}{\partial z}$  is the angle of water content vertical way &  $\frac{\partial \Psi}{\partial \theta}$ - is specific water capacity. Hence,

$$q = -K\left(\frac{\partial\Psi}{\partial z} + \frac{\partial z}{\partial z}\right) = -K\left\{\left(\frac{\partial\Psi}{\partial z} \cdot \frac{\partial\theta}{\partial z}\right) + 1\right\} = -K\left(\frac{\partial\Psi}{\partial z} \cdot \frac{\partial\theta}{\partial z}\right) - K$$

Let  $D = k \left[ \frac{\partial \Psi}{\partial \theta} \right]$ , where, *D* is soil-water diffusivity, to get  $q = - \left[ D(\frac{\partial \theta}{\partial z}) + K \right]$ From continuity equation,

$$\frac{\partial \theta}{\partial t} = -\frac{\partial q}{\partial z} \qquad i.e \quad \frac{\partial \theta}{\partial t} = \frac{\partial}{\partial z} D(\theta) \left[ \frac{\partial \theta}{\partial z} \right] + \frac{\partial K}{\partial z} \tag{1}$$

This is one dimensional RE's for unsaturated flow has two independent variables  $\theta$ , and h. Getting answers for this condition, subsequently requires constitutive relations to portray the reliance among pressure, saturation and water driven conductivity. it is feasible to eliminate either  $\theta$  or h defined as the derivative of the soil water retention curve.

$$C(h) = \frac{d\theta}{dh} \tag{2}$$

Using Eq. (2) in Eq. (1) the *h*-based RE is thus obtained

$$C(h) \cdot \frac{\partial h}{\partial t} = \frac{\partial}{\partial z} \left[ K \left( \frac{\partial h}{\partial z} \right) \right] + \frac{\partial K}{\partial z}$$
(3)

This is a fundamental condition in geotechnical and geo-natural designing. Presenting another term D, pore water diffusivity, characterized as the proportion of the pressure driven conductivity to the differential water capacity, the  $\theta$ -based type of RE's might be gotten. D can subsequently be composed as

$$D = \frac{K}{C} = \frac{K}{\frac{d\theta}{dh}} = K(\frac{dh}{d\theta})$$
(4)

Since D and K are exceptionally reliant on water content. Consolidating (4) with Eq. (1) gives RE's as

$$\frac{\partial \theta}{\partial t} = \frac{\partial}{\partial z} \left[ D(\frac{\partial \theta}{\partial z}) \right] + \frac{\partial K}{\partial z}$$
(5)

The Van Genuchten model [24] and Brook's and Corey's model [20] are the more much of the time utilized models. The Van Genuchten model is along these lines hard to execute it in most insightful arrangement plans. Then again Brooks and Corey's model has an all the more obvious definition and is subsequently embraced in the current examination. By this model the accompanying condition is acquired as

$$D(\theta) = D_0(n+1)\theta^n, n \ge 0, K(\theta) = K_0\theta^k, k \ge 1,$$
(6)

where  $K_0$ ,  $D_0$  and k are constants addressing soil properties. In this exhibit of D and K,  $\theta$  is scaled somewhere in the range of 0 and 1

$$\int_0^1 D(\theta) d\theta$$

Therefore the  $\theta$ -based RE's in order of (n, 1) is obtained as

$$\frac{\partial \theta}{\partial t} + \alpha \cdot \theta^n \frac{\partial \theta}{\partial z} - \frac{\partial^2 \theta}{\partial z^2} = 0$$
(7)

also, its precise arrangement is given by

$$\theta(z,t) = [(\gamma/2) + (\gamma/2) \tanh[A_1(z - A_2 t)]^{1/n}]$$
(8)

where  $A_1 = -\frac{\alpha n + n|\alpha|}{4(1+n)}$ ;  $(n \neq 0)$ ,  $A_2 = \frac{\gamma \alpha}{1+n}$ , where  $\gamma$  is a subjective coefficient which is chosen as 1 in the given examination. By expecting t = 0 in Eq. (8), the underlying condition for (7) can be found. For various estimations of *n*, the  $\theta$ -based Richard's condition, which has been focus point of this examination, is addressed here by the combination of LT and HPM. The essential thought of this strategy will be clarified in the following segment.

#### Laplace Transform Homotopy Perturbation Method

Consider general nonlinear partial differential equation with the underlying states of the structure

$$D\theta(z,t) + R\theta(z,t) + N\theta(z,t) = g(z,t)$$
(9)

$$\boldsymbol{\theta}(z,0) = h(z), \boldsymbol{\theta}_t(z,0) = f(z). \tag{10}$$

where *D* is the second order linear differential operator  $D = \frac{\partial^2}{\partial t^2}$ , *R* is the linear differential operator of less order than *D*; *N* represents the general nonlinear differential operator and g(z,t) is the source term. Appling LT on both sides of Eq. (10), to get

$$L[D\theta(z,t)] + L[R\theta(z,t)] + L[N\theta(z,t)] = L[g(z,t)]$$
<sup>(11)</sup>

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Utilizing the differentiation property of the LT, to get

$$L[\theta(z,t)] = \frac{h(z)}{s} + \left[\frac{f(z)}{s^2}\right] - \frac{1}{s^2}L[R\theta(z,t)] + \frac{1}{s^2}L[g(z,t)] - \frac{1}{s^2}L[N\theta(z,t)]$$
(12)

Working with the Laplace opposite on the two sides of Eq. (12) gives

$$\theta(z,t) = G(z,t) - L^{-1} \left\{ \frac{1}{s^2} L[R\theta(z,t) + N\theta(z,t)] \right\}$$
(13)

where G(z,t) addresses the term emerging from the source term and the endorsed introductory conditions. Now we apply the HPM

$$\theta(z,t) = \sum_{n=0}^{\infty} p^n \theta_n(z,t)$$
(14)

furthermore, the nonlinear term can be decomposed as

$$N\theta(z,t) = \sum_{n=0}^{\infty} p^n H_n(\theta)$$
(15)

for some He's polynomials  $H_n(\theta)$  that are given by

$$H_n(\theta_0, \theta_1, \dots, \theta_n) = \frac{1}{n!} \frac{\partial^n}{\partial p^n} \left\{ N \sum_{i=0}^{\infty} p^i u_i \right\}_{p=0} \quad i = 0, 1, 2, \dots$$
(16)

Substituting Eqs. , (14), (15) in Eq. (13) we get

$$\sum_{n=0}^{\infty} P^n \theta_n(z,t) = G(z,t) - p \left\{ L^{-1} \left[ \frac{1}{s^2} L \left( R \sum_{n=0}^{\infty} p^n \theta_n(z,t) \right) + \sum_{n=0}^{\infty} p^n H_n(\theta) \right] \right\}$$
(17)

Which is the coupling of the LT and the HPM utilizing He's polynomials. Comparing at the coefficient of like forces of p, the accompanying approximations are acquired.

$$p^{0}: \theta_{0}(z,t) = G(z,t)$$

$$p^{1}: \theta_{1}(z,t) = -L^{-1} \left\{ \frac{1}{s^{2}} L[R\theta_{0}(z,t) + H_{0}(\theta)] \right\}$$

$$p^{2}: \theta_{2}(z,t) = -L^{-1} \left\{ \frac{1}{s^{2}} L[R\theta_{1}(z,t) + H_{1}(\theta)] \right\}$$

$$p^{3}: \theta_{3}(z,t) = -L^{-1} \left\{ \frac{1}{s^{2}} L[R\theta_{2}(z,t) + H_{2}(\theta)] \right\}$$

Continuing in this equivalent way, the rest of the components  $\theta_n(z,t)$  can be totally acquired and the series solution is thus entirely determined, finally we approximate the analytical  $\theta(z,t)$  as

$$\theta(z,t) = \lim_{p \to 1} \sum_{n=0}^{\infty} \theta_n(z,t)$$
  
$$\theta(z,t) = \theta_0(z,t) + \theta_1(z,t) + \theta_2(z,t) + \theta_3(z,t) + \dots$$

#### **Numerical Examples**

#### **Example 1**

The equation derived below is obtained by assuming n=1 in the equation

$$\frac{\partial \theta}{\partial t} = \frac{\partial^2 \theta}{\partial z^2} - \theta \frac{\partial \theta}{\partial z}$$
(18)

with the initial condition

$$\theta(z,0) = \frac{1}{2} + \frac{1}{2} \tanh(\frac{-z}{4})$$
(19)

Solution:- By applying the Laplace transform to both sides of equation (18)

$$L\left(\frac{\partial\theta}{\partial t}\right) = L\left[\frac{\partial^2\theta}{\partial z^2} - \theta\frac{\partial\theta}{\partial z}\right]$$
(20)

Using differential properties of Laplace transform equation (20) as

$$sL[\theta(z,t)] - \theta(z,0) = L\left[\frac{\partial^2 \theta}{\partial z^2} - \theta \frac{\partial \theta}{\partial z}\right]$$
(21)

Using initial condition (19), equation (21) as

$$L[\theta(z,t)] = \frac{1}{s} \left[ \frac{1}{2} + \frac{1}{2} \tanh(\frac{-z}{4}) \right] + \frac{1}{s} L \left[ \frac{\partial^2 \theta}{\partial z^2} - \theta \frac{\partial \theta}{\partial z} \right]$$
(22)

Taking inverse Laplace transform on both sides of the equation (22), we get

$$\theta(z,t) = \left[\frac{1}{2} + \frac{1}{2} \tanh\left(\frac{-z}{4}\right)\right] + L^{-1} \left\{\frac{1}{s} L\left[\frac{\partial^2 \theta}{\partial z^2} - \theta \frac{\partial \theta}{\partial z}\right]\right\}$$
(23)

Now we apply the HPM.

$$\theta(z,t) = \sum_{n=0}^{\infty} p^n \theta_n(z,t)$$
(24)

and the nonlinear term can be decomposed as

$$N[\theta(z,t)] = \sum_{n=0}^{\infty} p^n H(\theta)$$
(25)

Using equation (24),(25) in the equation(23) we get

$$\sum_{n=0}^{\infty} p^n \theta_n(z,t) = \left[\frac{1}{2} + \frac{1}{2} \tanh\left(\frac{-z}{4}\right)\right] + p \left\{ L^{-1} \left[\frac{1}{s} L\left(\sum_{n=0}^{\infty} p^n H(\theta)\right)\right] \right\}$$
(26)

which is the compiling of the LT and HPM using He's polynomial where

$$H_n(\theta) = \left(\frac{\partial^2 \theta}{\partial z^2}\right)_n - \theta_n \left(\frac{\partial \theta}{\partial z}\right)_n$$
$$H_0(\theta) = \left(\frac{\partial^2 \theta}{\partial z^2}\right)_0 - \theta_0 \left(\frac{\partial \theta}{\partial z}\right)_0$$
$$= \theta_{0zz} - \theta_0 \theta_{0z}$$
$$H_1(\theta) = \theta_{1zz} - \theta_1 \theta_{0z} - \theta_0 \theta_{1z}$$
$$H_2(\theta) = \theta_{2zz} - \theta_2 \theta_{0z} - \theta_1 \theta_{1z} - \theta_0 \theta_{2z}$$
$$H_3(\theta) = \theta_{3zz} - \theta_3 \theta_{0z} - \theta_2 \theta_{1z} - \theta_1 \theta_{2z} - \theta_0 \theta_{3z}$$

and so on. comparing the coefficients of the various powers of p in equation (26), we get

$$p^{0}: \theta_{0}(z,t) = \frac{1}{2} + \frac{1}{2} \tanh(-\frac{z}{4})$$
(27)

$$p^{1}: \theta_{1}(z,t) = L^{-1} \left\{ \frac{1}{s} L[H_{0}(\theta)] \right\}$$

$$= L^{-1} \left\{ \frac{1}{s} L\left( \frac{\partial^{2} \theta}{\partial z^{2}} - \theta_{0} \frac{\partial \theta_{0}}{\partial z} \right) \right\}$$

$$= L^{-1} \left\{ \frac{1}{s} L\left[ \frac{1}{16} \sec^{2} h(\frac{-z}{4}) \tanh(\frac{-z}{4}) + \frac{1}{16} \sec^{2} h(\frac{-z}{4}) - \frac{1}{16} \sec^{2} h(\frac{-z}{4}) . \tanh(\frac{-z}{4}) \right] \right\}$$

$$= L^{-1} \left\{ \frac{1}{s} L\left[ \frac{1}{16} \sec^{2} h\left(\frac{-z}{4}\right) \right] \right\}$$

$$\theta_1(z,t) = \frac{1}{16} \sec^2 h\left(\frac{-z}{4}\right).t \tag{28}$$

$$\begin{split} p^{2} : \theta_{2}(z,t) &= L^{-1} \left\{ \frac{1}{s} L[H_{1}(\theta)] \right\} \\ &= L^{-1} \left\{ \frac{1}{s} L[\theta_{1zz} - \theta_{1} \theta_{0z} - \theta_{0} \theta_{1z}] \right\} \\ &= L^{-1} \left\{ \frac{1}{s} L\left[ \left( \frac{1}{16} \sec^{2} h\left( \frac{-z}{4} \right) \right) t - 2\left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-z}{4}) \right) \left( \frac{1}{16} \sec^{2} h\left( \frac{-z}{4} \right) \right) t \right] \right\} \\ &= L^{-1} \left\{ \frac{1}{s} L\left[ \frac{1}{16} \sec^{2} h\left( \frac{-z}{4} \right) t \left( 1 - 2\left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-z}{4}) \right) \right) \right] \right\} \\ &= L^{-1} \left\{ \frac{1}{s} L\left[ \frac{1}{16} \sec^{2} h\left( \frac{-z}{4} \right) t \left( 1 - 2\left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-z}{4}) \right) \right) \right] \right\} \end{split}$$

$$\theta_2(z,t) \cong \frac{1}{32} \sec^2 h\left(\frac{-z}{4}\right) \cdot \tanh\left(\frac{-z}{4}\right) t^2$$
(29)

Proceeding in the similar manner we obtain further values. The solution  $\theta(z,t)$  of equation (18), by using equation (27),(28) and (29) is gives

$$\boldsymbol{\theta}(z,t) = \boldsymbol{\theta}_0(z,t) + \boldsymbol{\theta}_1(z,t) + \boldsymbol{\theta}_2(z,t) + \dots$$

$$\theta(z,t) = \left(\frac{1}{2} + \frac{1}{2}\tanh\left(\frac{-z}{4}\right)\right) + \frac{1}{16}\sec^2 h\left(\frac{-z}{4}\right) \cdot t + \frac{1}{32}\sec^2 h\left(\frac{-z}{4}\right) \cdot \tanh\left(\frac{-z}{4}\right) t^2 + \dots$$
(30)

TABLE I.

n = 1			t = 1				t = 2	
Z	LTHPM	Exact	Error	Absolute Error	LTHPM	Exact	Error	Absolute Error
0	0.5625	0.562177	-0.000323	0.000323	0.625	0.622459	-0.002541	0.002541
1	0.429	0.437823	0.008823	0.008823	0.4662	0.5	0.0338	0.0338
2	0.3067	0.320821	0.014121	0.014121	0.3218	0.377541	0.055741	0.055741
3	0.2078	0.2227	0.0149	0.0149	0.2096	0.268941	0.059341	0.059341
4	0.1354	0.148047	0.012647	0.012647	0.1317	0.182426	0.050726	0.050726
5	0.0859	0.0953495	0.0094495	0.0094495	0.0811	0.119203	0.038103	0.038103





**FIGURE 1.** Comparison between solution n = 1, t = 1

**FIGURE 2.** Comparison between solution n = 1, t = 2

**FIGURE 3.** 3D behavior of an approximate solution n = 1

#### Example 2

The condition determined underneath is acquired by expecting n = 2 in condition

$$\frac{\partial \theta}{\partial t} = \frac{\partial^2 \theta}{\partial z^2} - \theta^2 \frac{\partial \theta}{\partial z}$$
(31)

with the underlying condition

$$\theta(z,0) = \left(\frac{1}{2} + \frac{1}{2}\tanh(\frac{-z}{3})\right)^{\frac{1}{2}}$$
(32)

Solution : - By applying the LT to both sides of equation (31)

$$L\left(\frac{\partial\theta}{\partial t}\right) = L\left[\frac{\partial^2\theta}{\partial z^2} - \theta^2 \frac{\partial\theta}{\partial z}\right]$$
(33)

Utilizing differential properties of LT, condition (33) as

$$sL[\theta(z,t)] - \theta(z,0) = L\left[\frac{\partial^2 \theta}{\partial z^2} - \theta^2 \frac{\partial \theta}{\partial z}\right]$$
(34)

Using initial condition (32), equation (34) becomes

$$L[\theta(z,t)] = \frac{1}{s} \left[ \frac{1}{2} + \frac{1}{2} \tanh(\frac{-z}{3}) \right]^{\frac{1}{2}} + \frac{1}{s} L \left[ \frac{\partial^2 \theta}{\partial z^2} - \theta^2 \frac{\partial \theta}{\partial z} \right]$$
(35)

Taking backwards LT on the two sides of the condition (35), we obtain

$$\theta(z,t) = \left(\frac{1}{2} + \frac{1}{2} \tanh\left(\frac{-z}{3}\right)\right)^{\frac{1}{2}} + L^{-1} \left\{\frac{1}{s} L\left[\frac{\partial^2 \theta}{\partial z^2} - \theta^2 \frac{\partial \theta}{\partial z}\right]\right\}$$
(36)

Presently we apply the HPM.

$$\theta(z,t) = \sum_{n=0}^{\infty} p^n \theta_n(z,t)$$
(37)

Furthermore, the nonlinear term can be decayed as

$$N[\theta(z,t)] = \sum_{n=0}^{\infty} p^n H(\theta)$$
(38)

Utilizing condition (37),(38) in condition (36) to obtain

$$\sum_{n=0}^{\infty} p^n \theta_n(z,t) = \left[\frac{1}{2} + \frac{1}{2} \tanh\left(\frac{-z}{3}\right)\right]^{\frac{1}{2}} + p \left\{ L^{-1} \left[\frac{1}{s} L\left(\sum_{n=0}^{\infty} p^n H(\theta)\right)\right] \right\}$$
(39)

which is the accumulating of the LT and HPM utilizing He's polynomial where

$$H_n(\theta) = \left(\frac{\partial^2 \theta}{\partial z^2}\right)_n - \theta_n^2 \left(\frac{\partial \theta}{\partial z}\right)_n$$
$$H_0(\theta) = \left(\frac{\partial^2 \theta}{\partial z^2}\right)_0 - \theta_0^2 \left(\frac{\partial \theta}{\partial z}\right)_0$$
$$= \theta_{0zz} - \theta_0^2 \theta_{0z}$$
$$H_1(\theta) = \theta_{1zz} - \theta_0 \theta_{0z}^2 - \theta_0^2 \theta_{1z}$$
$$H_2(\theta) = \theta_{2zz} - \theta_{0z}^3 - \theta_0 \theta_{0z} \theta_{1z} - \theta_0^2 \theta_{2z}$$

and so on.

looking at the coefficients of the different powers of p in condition (39), we get

$$p^{0}: \theta_{0}(z,t) = \left[\frac{1}{2} + \frac{1}{2}\tanh(-\frac{z}{3})\right]^{\frac{1}{2}}$$
(40)

$$p^{1}: \theta_{1}(z,t) = L^{-1} \left\{ \frac{1}{s} L[H_{0}(\theta)] \right\}$$

$$= L^{-1} \left\{ \frac{1}{s} L\left[ \theta_{0zz} - \theta_{0}^{2} \theta_{0z} \right] \right\}$$

$$= L^{-1} \left[ \frac{1}{s} \left[ \frac{1}{18} \sec^{2} h(\frac{-z}{3}) \tanh(\frac{-z}{3}) \left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-z}{3}) \right)^{\frac{-1}{2}} - \frac{1}{144} \sec^{4} h(\frac{-z}{3}) \left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-z}{3}) \right)^{\frac{-3}{2}} + \frac{1}{12} \sec^{2} h(\frac{-z}{3}) \left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-z}{3}) \right)^{\frac{1}{2}} \right] \right]$$

$$= \theta_{1}(z,t) \approx \frac{1}{18} \sec^{2} h\left( \frac{-z}{3} \right) \tanh\left( \frac{-z}{3} \right) \left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-z}{3}) \right)^{\frac{-1}{2}} .t$$
(41)

Continuing in the comparable way we acquire further qualities.

The solution  $\theta(z,t)$  of equation (31), by using equation (40) and (41) is gives

$$\boldsymbol{\theta}(z,t) = \boldsymbol{\theta}_0(z,t) + \boldsymbol{\theta}_1(z,t) + \boldsymbol{\theta}_2(z,t) + \dots$$

$$\theta(z,t) = \left[\frac{1}{2} + \frac{1}{2}\tanh(-\frac{z}{3})\right]^{\frac{1}{2}} + \frac{1}{18}\sec^2 h\left(\frac{-z}{3}\right)\tanh\left(\frac{-z}{3}\right)\left(\frac{1}{2} + \frac{1}{2}\tanh(\frac{-z}{3})\right)^{\frac{-1}{2}}.t + \dots$$
(42)

TABLE II.

n = 2			t = 1				t = 2	
Z	LTHPM	Exact	Error	Absolute Error	LTHPM	Exact	Error	Absolute Error
0	0.707107	0.744799	0.037692	0.037692	0.707107	0.779842	0.072735	0.072735
1	0.554949	0.62585	0.070901	0.070901	0.527453	0.667167	0.139714	0.139714
2	0.409925	0.499699	0.089774	0.089774	0.363114	0.541375	0.178261	0.178261
3	0.293791	0.383096	0.089305	0.089305	0.242323	0.420085	0.177762	0.177762
4	0.20881	0.285734	0.076924	0.076924	0.16273	0.31577	0.15304	0.15304
5	0.148515	0.209596	0.061081	0.061081	0.111436	0.232689	0.121253	0.121253







**FIGURE 4.** Comparison between solution n = 2, t = 1

**FIGURE 5.** Comparison between solution n = 2, t = 2

**FIGURE 6.** 3D behavior of an approximate solution n = 2

#### Example 3

The equation determined beneath is gotten by presumption n = 3 in condition

$$\frac{\partial \theta}{\partial t} = \frac{\partial^2 \theta}{\partial z^2} - \theta^3 \frac{\partial \theta}{\partial z}$$
(43)

with the underlying condition

$$\theta(z,0) = \left(\frac{1}{2} + \frac{1}{2}\tanh(\frac{-3z}{8})\right)^{\frac{1}{3}}$$
(44)

Solution:- Performing the LT to both sides of equation (43)

$$L\left(\frac{\partial\theta}{\partial t}\right) = L\left[\frac{\partial^2\theta}{\partial z^2} - \theta^3 \frac{\partial\theta}{\partial z}\right]$$
(45)

Utilizing differential properties of LT condition (45) as

$$sL[\theta(z,t)] - \theta(z,0) = L\left[\frac{\partial^2 \theta}{\partial z^2} - \theta^3 \frac{\partial \theta}{\partial z}\right]$$
(46)

Using initial condition (44), equation (46) as

$$L[\theta(z,t)] = \frac{1}{s} \left[ \frac{1}{2} + \frac{1}{2} \tanh(\frac{-3z}{8}) \right]^{\frac{1}{3}} + \frac{1}{s} L \left[ \frac{\partial^2 \theta}{\partial z^2} - \theta^3 \frac{\partial \theta}{\partial z} \right]$$
(47)

Taking backwards Laplace change on the two sides of the condition (47), we get

$$\theta(z,t) = \left[\frac{1}{2} + \frac{1}{2} \tanh\left(\frac{-3z}{8}\right)\right]^{\frac{1}{3}} + L^{-1} \left\{\frac{1}{s}L\left[\frac{\partial^2\theta}{\partial z^2} - \theta^3\frac{\partial\theta}{\partial z}\right]\right\}$$
(48)

Presently we apply HPM.

$$\theta(z,t) = \sum_{n=0}^{\infty} p^n \theta_n(z,t)$$
(49)

what's more, the nonlinear term can be disintegrated as

$$N[\theta(z,t)] = \sum_{n=0}^{\infty} p^n H(\theta)$$
(50)

Using (49),(50) in equation (48) we get

$$\sum_{n=0}^{\infty} p^n \theta_n(z,t) = \left[\frac{1}{2} + \frac{1}{2} \tanh\left(\frac{-3z}{8}\right)\right]^{\frac{1}{3}} + p \left\{L^{-1}\left[\frac{1}{s}L\left(\sum_{n=0}^{\infty} p^n H(\theta)\right)\right]\right\}$$
(51)

which is the assembling of the LT and HPM utilizing He's polynomial where

$$H_n(\theta) = \left(\frac{\partial^2 \theta}{\partial z^2}\right)_n - \theta_n^3 \left(\frac{\partial \theta}{\partial z}\right)_n$$

$$H_0(\theta) = \left(\frac{\partial^2 \theta_0}{\partial z^2}\right)_0 - \theta_0^3 \left(\frac{\partial \theta_0}{\partial z}\right)_0$$

$$= \theta_{0zz} - \theta_0^3 \theta_{0z}$$

$$H_1(\theta) = \theta_{1zz} - \theta_0^2 \theta_1 \theta_{0z} - \theta_0^3 \theta_{1z}^2$$

$$H_2(\theta) = \theta_{2zz} - \theta_0 \theta_1 \theta_{0z} - \theta_0^2 \theta_2 \theta_{0z} - \theta_0^2 \theta_1 \theta_{1z} - \theta_0^2 \theta_{1z}^3 - \theta_0^3 \theta_{2z}^2$$

and so on.

Looking at the coefficients of different forces of p in equation (51), to obtain

$$p^{0}: \theta_{0}(z,t) = \left[\frac{1}{2} + \frac{1}{2}\tanh(-\frac{3z}{8})\right]^{\frac{1}{3}}$$
(52)

$$\begin{split} p^{1} : \theta_{1}(z,t) \\ &= L^{-1} \left\{ \frac{1}{s} L[H_{0}(\theta)] \right\} \\ &= L^{-1} \left\{ \frac{1}{s} L\left[ \theta_{0zz} - \theta_{0}^{3} \theta_{0z} \right] \right\} \\ &= L^{-1} \left[ \frac{1}{s} \left[ \frac{3}{32} \sec^{2} h(\frac{-3z}{8}) \tanh(\frac{-3z}{8}) \left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-3z}{8}) \right)^{\frac{-2}{3}} \right. \\ &- \frac{1}{32} \sec^{4} h(\frac{-3z}{8}) \left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-3z}{8}) \right)^{\frac{-5}{3}} + \frac{1}{8} \sec^{2} h(\frac{-3z}{8}) \cdot \left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-3z}{8}) \right)^{\frac{1}{3}} \right] \right] \\ &= \left[ \frac{3}{32} \sec^{2} h(\frac{-3z}{8}) \tanh(\frac{-3z}{8}) \left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-3z}{8}) \right)^{\frac{-5}{3}} \\ &- \frac{1}{32} \sec^{4} h(\frac{-3z}{8}) \left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-3z}{8}) \right)^{\frac{-5}{3}} + \frac{1}{8} \sec^{2} h(\frac{-3z}{8}) \cdot \left( \frac{1}{2} + \frac{1}{2} \tanh(\frac{-3z}{8}) \right)^{\frac{1}{3}} \right] . \end{split}$$

TABLE III.

n = 3			t = 1		t = 2			
Z	LTHPM	Exact	Error	Absolute Error	LTHPM	Exact	Error	Absolute Error
0	0.793701	0.817698	0.023997	0.023997	0.793701	0.839982	0.046281	0.046281
1	0.538784	0.713329	0.174545	0.174545	0.392994	0.741282	0.348288	0.348288
2	0.309451	0.596338	0.286887	0.286887	0.0517562	0.625805	0.5740488	0.5740488
3	0.164183	0.483167	0.318984	0.318984	-0.128482	0.510401	0.638883	0.638883
4	0.088884	0.384066	0.295182	0.295182	-0.184201	0.407257	0.591458	0.591458
5	0.0524213	0.302152	0.2497307	0.2497307	-0.179451	0.321032	0.500483	0.500483







FIGURE 7. Comparison between solution n = 3, t = 1

FIGURE 8. Comparison between solution n = 3, t = 2

FIGURE 9. 3D behavior of an approximate solution n = 3

Continuing in the comparative way we get further qualities. The solution  $\theta(z,t)$  of equation (31), by using equation (40) and (41) is gives  $\boldsymbol{\theta}(z,t) = \boldsymbol{\theta}_0(z,t) + \boldsymbol{\theta}_1(z,t) + \boldsymbol{\theta}_2(z,t) + \dots$ 

$$\theta(z,t) = \left[\frac{1}{2} + \frac{1}{2}\tanh(-\frac{z}{8})\right]^{\frac{1}{3}} + \left[\frac{3}{32}\sec^{2}h(\frac{-3z}{8})\tanh(\frac{-3z}{8})\left(\frac{1}{2} + \frac{1}{2}\tanh(\frac{-3z}{8})\right)^{-23} + \frac{1}{32}\sec^{4}h(\frac{-3z}{8})\left(\frac{1}{2} + \frac{1}{2}\tanh(\frac{-3z}{8})\right)^{\frac{-5}{3}} + \frac{1}{8}\sec^{2}h(\frac{-3z}{8})\cdot\left(\frac{1}{2} + \frac{1}{2}\tanh(\frac{-3z}{8})\right)^{\frac{1}{3}}\right].t + \dots$$
(53)

#### **CONVERGENCE THEOREM AND EXAMPLE**

We would study convergence theorem on series's solution to the Rechards Equation , which is convergent.

#### **Convergence Theorem**

Let  $(U, \|.\|)$  be the Banach space of all continuous functions on I and sequence of partial sum's of the series's solution  $\sum_{k=0}^{\infty} \theta_k \text{ obtain to the problem then the series solution } \sum_{k=0}^{\infty} \theta_k \text{ is convergent if for every given } \delta > 0 \text{ such that } \|\theta_{k+1}\| \le \delta \|\theta_k\|.$ 

**Proof:** We have  $\sum_{k=0}^{\infty} \theta_k$  be the given series solution to the RE's. Now to show that  $\{s_n\}_{n=0}^{\infty}$  be the sequence of partial sum's of the series solution  $\sum_{k=0}^{\infty} \theta_k$  is a cauchy in U. We have,

$$s_n = \theta_1 + \theta_2 + \theta_3 + \cdots + \theta_n$$

Consider,

$$\|s_{n+1}-s_n\| = \|\theta_{n+1}\| \le \delta \|\theta_n\| \le \delta^2 \|\theta_{n-1}\| \le \dots \le \delta^{n+1} \|\theta_0\|$$

Let  $m, n \in N$  with  $n \ge m$ Consider

$$\begin{split} \|s_n - s_m\| &= \|(s_n - s_{n-1}) + (s_{n-1} - s_{n-2}) + \dots + (s_{m+1} - s_m)\| \\ &\leq \|s_n - s_{n-1}\| + \|s_{n-1} - s_{n-2}\| + \dots + \|s_{m+1} - s_m\| \\ &\leq \delta^n \|\theta_0\| + \delta^{n-1} \|\theta_0\| + \dots + \delta^{m+1} \|\theta_0\| \\ &= \|\theta_0\| \left(\delta^n + \delta^{n-1} + \dots + \delta^{m+1}\right) \\ &= \|\theta_0\| \left(\delta^{m+1} \left(1 + \delta + \delta^2 + \dots + \delta^{n-m-1}\right) \right) \\ &= \|\theta_0\| \left[\frac{1 - \delta^{n-m}}{1 - \delta}\right] \delta^{m+1} \end{split}$$

⇒ sequence  $\{s_n\}_{n=1}^{\infty}$  is bounded. When  $0 < \delta < 1$  and  $n \ge m$ 

 $\therefore 1 - \delta^{n-m} < 1$ 

from above equation

$$\|s_n - s_m\| \le \|\theta_0\| \left[\frac{\delta^{m+1}}{1-\delta}\right]$$
$$\implies \|s_n - s_m\| \le k\|\theta_0\|$$

where  $k = \frac{\delta^{m+1}}{1-\delta}$  is an error in  $\theta(z,t)$ .

Taking limit as  $n, m \to \infty$  then  $||s_n - s_m|| \to 0$ 

This shows that the sequence of partial sum  $\{s_n\}_{n=0}^{\infty}$  is a cauchy's sequence and subsequently it is convergent. : Clearly the series's solution is not divergent.

#### **Numerical Example**

If Richards Equation (18) assuming n = 1, then its series solution equation (30) i.e.  $\sum_{k=0}^{\infty} \theta_k$  is convergent whenever for given  $\delta > 0$  such that  $\|\theta_{k+1}\| \leq \delta \|\theta_k\|$ .

Solution :- Let  $\sum_{k=0}^{\infty} \theta_k$  be given series solution to the Richards equation (18). Now to show that  $\{S_n\}_{n=1}^{\infty}$  be the sequence of partial sum s of the series solution  $\sum_{k=0}^{\infty} \theta_k$  is convergent, Where  $S_n = \theta_1 + \theta_2 + {}^{+\infty} + \theta_n$  By Theorem (4.1), We have  $||S_n - S_m|| \le k ||\theta_0||$ , Where  $K = \delta^{m+1}/1 - \delta$  is an error in series solution,  $0 < \delta < 1$ 

$$= k ||(1/2) + (1/2) \tanh(-z/4)|| , \text{ From equation (27)}$$
  
= k ||(1/2) + (1/2) [(z/4) - (z<sup>3</sup>/192) + (z<sup>5</sup>/15360) - ....] || since |Z| < \pi/4

Bracketed term is a convergent series, So  $||S_n - S_m|| \to 0$  as m,  $n \to \infty$  We conclude that the  $\{S_n\}$  is cauchy sequence, Hence the solution series (30) to the equation (18) is convergent.

#### CONCLUSION

This paper intends to show the applicability of Laplace transform Homotopy perturbation method to acquire precise answer for Richards' equation, which is employed for modeling infiltration in unsaturated soil. The got arrangements are found in acceptable concurrence with the standard arrangement. The negligible error is observed between numerical result obtained by LTHPM and exact solution. Consequently LTHPM can be better choice to tackle such sort of issues for getting the specific arrangement.

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#### Cranial morphology of adult *Deudorix isocrates* (Fab.) (Lepidoptera: Lycaenidae)

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#### Abstract

*Deudorix Isocrates* (Fab.) is a polyphagous horticultural pest. This is the first study has been done on morphology of adult cranium and its appendages. The cranial surface with gray scales, ring of white scales around compound eyes, alternate ring of black and white scales on antennal flagellum and orange scales on club of the antennae were found as identification marks of adult. The frontal cranial surface reveals central frontoclypeus which extends lower side up to ventral furrow, laterally located gena around the compound eyes. The posterior face of cranium is contributed by rim like post occiput around occipital foramen, postgenal-occipital area, postgenal -occipital protuberance. These areas are separated from each other and the cranial wall is strengthened by postoccipital suture and temporal sulcus as a lycaenid characteristic. Ventrally the cranial surface has hypostomal area with which the siphoning type of gnathal appendages are articulated. The distal part of galea possesses sickle shaped rasping scales and sensilla chaetica, sensilla basiconica, two rows of ridged sensilla styloconica in support to pest activity. The hair sensilla and sunken pegs are distributed on flagellomeres of antennae. Results add to our knowledge of adult cranium and its appendages and provide a standard for further research on the morphological characters of *Deudorix Isocrates* (Fab.) and other members of Lycaenidae.

Keywords: pest, cranial areas, cranial sutures, gnathal appendages, sensilla

#### Introduction

The morphological characteristic of many insect groups is unexplored. Studies focusing on the morphological aspects of Lepidopteran adults are critical for the filling the gaps in group's systematic and taxonomic knowledge. Results of morphological studies are crucial for analysis of intraspecific variation and useful for classification. There are some major studies on external morphology Papilionidae (Leite *et al.*, 2010) <sup>[27]</sup>, Pieridae (Eassa, 1963) <sup>[15]</sup>, Lycaenidae (Sorensen 1980; Duarte *et al.*, 2001) <sup>[51, 13]</sup>. Nymphalidae: Brassolinae (Casagrande, 1979), Morphinae (Bilotta 1992) <sup>[4]</sup>, Ithomiinae (Bizarro *et al.*, 2003) <sup>[5]</sup>, Charaxinae (Mielke *et al.*, 2004; Dias *et al.*, 2010) <sup>[33, 11]</sup> and Hesperiidae (Miller, 1971) <sup>[4]</sup>.

The cranium of adult butterfly is crucial for feeding and sensory functions. The cranium mainly consist cranial suture, compound eyes, antennae, and mouthparts. The cranium and the sensilla present particularly on the antennae and mouthparts, play key roles in many actions, including host selection, feeding, mate attraction, oviposition, defense, and migration (Schoonhoven et al., 1998; Anton et al., 2003) [46, 3]. The chemical and mechanical senses are sensed by the receptors on the cranium (Davis & Tammaru, 2019). The lepidopteran mouthparts are best studied in terms of anatomy, morphology and evolutionary biology (Krenn, 2005). The mouthparts of butterflies are diverse in terms of morphology and function. Differences in mouthpart structure can be used as a key feature in identifying and classifying organisms (Brożek, 2014)<sup>[6]</sup>. The antennal sensilla of insects perform significant roles in insect behaviours (Skiri et al., 2005) [49]. The study of cranial morphology is crucial for understanding the behavior and ecology of butterfly. Due to the lack of studies in the majority of the families, the number of descriptive external morphological studies that illustrate cranial morphology is still minimal. Lycaenidae is the second largest butterfly family in the world, with over 6000 species. (Pierce et al., 2002) [42]. Significant progress in systematics and taxonomy of Lycaenidae has been hindered due to a lack of data (Duarte, 2007)<sup>[12]</sup>. The pest *Deudorix Isocrates* is belongs to family Lycaenidae. D. Isocrates is a serious pest that attacks pomegranate, guava, peach, and apple crops (Khandare et al., 2018)<sup>[21]</sup>. The majority of D. Isocrates research is focused on its life cycle and ecology (Devi & Jha, 2017) [10]. The cranial and mouthpart morphology of D. Isocrates larvae are investigated (Patil & Dethe., 2021; Patil & Dethe, 2022). Because the morphology of adult D. Isocrates is still obscure, a comprehensive morphological study is required.

The objective of this study is to describe the exterior cranial morphology of adult *D. Isocrates*. In order to improve morphological knowledge and identify features that are more informative that can be employed in systematics. There is currently no data on the cranial morphology of adult *D. Isocrates*. This study provides the morphology of cranium and its appendages in detail, with the goal of better understanding the behavior and morphology of the adult *D. Isocrates*.

#### **Materials and Methods**

The infested fruits due to last stage larval instar of *D. isocrates* were collected from pomegranate field and reared in plastic jars up to eclosion of adults. The eclosed adults were observed under dissecting binocular to report general morphological features of cranium. The specimens then preserved in 10% formalin for further use. The light microscopic details were studied using permanent mounting preparations of cranium, compound eyes and cranial appendages like gnathal appendages and antennae. For permanent preparations the cranium was dissected out from the rest of the body, rinsed in distilled water and boiled in10% KOH to make them translucent. As a whole the cranium was processed further to study cranial areas, sulci and articulation of cranial appendages were dissected out from the cranium to study their morphological details through separate preparation. The cranium and these organs were washed in Distilled water and dehydrated with ethanol at increasing concentrations (30%, 50 %, 70 %, 90% and 100 % for 1 hr. each). The clearing was done with xylene and mounted in DPX. The observations were made under low (10x) and high (45x) magnification of light microscope. Micrometry was used for morphometric report and illustrations were made by camera lucida.

#### Results

The cranium is covered densely with gray scales. The compound eyes take lateral position and occupy major part of the head. The ring of white scales encircles the compound eyes on anterior face. The antennae show alternate ring of white and black scales and orange scales on the flagellomeres of club. The vertex and posterior face of head capsule both are clothed with brown hairy scales. The labial palpi project anteriorly in front of the anterior face of cranium. Dorsally, each labial palp is clothed with black scales while lateroventrally with white scales. The sclerotized pale brown proboscis is coiled and laterally concealed by labial palpi. The ventral cranial surface is clothed with white scales.

#### Light microscopic details of cranium and its appendages

The anterior view of cranium (Fig.1) reveals large and bulged compound eyes on lateral portion of the head. The frontoclypeus covers most of the portion of anterior face of cranium. Truly there is no distinguishing mark between frons and clypeus. The gena appears curved strip like around the eye. Ventrally, the clypeal portion is delimited by ventrally arched furrow. The labrum is concealed below the ventral furrow. The anterior tentorial pits are situated immediately, at dorsolateral ends of ventral furrow. Dorsally, the clypeal portion is extended beyond and between the bases of antennae. It reaches up to the median depression of cranial wall. The cranium if viewed anteriodorsally, it reveals the dorsal extension of clypeal portion, frontal portion, median depression at the center of vertex, the transverse groove between antennal bases. The posterior side of cranium (Fig.2) exhibits occipital foramen, postocciput and postgenal-occipital area and the postgenal-occipital protuberance along with temporal sulcus and postoccipital suture. The occipital foramen lies centrally, which is divided in to dorsal and ventral half due to transverse tentorial bridge. the postocciput encircles the occipital foramen and separated from postgenal-occipital area by postoccipital suture. The postgenal-occipital area extends dorsally in the form of postgenal-occipital protuberance which is divided from postgenal-occipital area by temporal suture. The ventral half of occipital foramen is ventrally limited by posterior edge of the labium. The conspicuous compound eyes bear hexagonal facets with circular corneal lens in each facet of an ommatidium. The interommatidial portion is sclerotized and shows interommatidial setae. The ventral surface of head capsule is occupied by 'hypostoma' to which the gnathal appendages are articulated. Anteriorly, the hypostoma reaches up to ventral furrow.

#### **Cranial appendages**

The cranium of adult *D. Isocrates* possesses siphoning type of gnathal appendages and clavate type of antennae. The gnathal appendages include an unpaired labrum, paired maxillae give rise to lepidopterist siphoning type of proboscis and labium. The labrum is very narrow, transverse plate. The ventral edge of labrum is bluntly pointed at the median axis. There is straight, pointed, translucent setae like hair are distributed submarginally to the ventral edge. Proximally, the labrum has thick, sclerotized plate. The Maxilla from each side contributing siphoning type of mouthparts. Each maxilla consists of proximal sclerite like cardo, stipes and distal elongated galea with 'c' shaped concave structure. The 'c' shaped galea from both the sides faces each other and articulated leaving a tubular food channel in between the two. The cardo is oval sclerite. It articulates with the hypostoma. Stipes is large elongated sclerotized plate. It is articulated with cardo by a narrow proximal end. With wide distal end, it is articulated with galea. Ventral surface of stipes bears a central dark brown groove, which runs from proximal to distal end of the stipes and joins itself to the base of galea. Elongated galea bears transversely placed alternate chitinized ring and a membranous band. The formation runs up to distal tip of the galea. Distally the galeae bears two rows of styloconic sensilla distributed on dorsal surface of the tube. Each styloconic sensillum (Fig.3) consists of two parts: i. sensillum and ii. cuticular ridged projection. The sensillum is situated on the tip of cuticular projection, which bears 5-6 lengthwise ridges. Dorsal surface of galea in this region is also provided with sharp edged sickle shaped rasping scales. Sensilla chaetica and sensilla basiconica are also evident on distal part of proboscis. The labium is roughly triangular plate, which occupies central part of the ventral surface of the head capsule. The labium is immediately adjacent to the occipital foramen. The posterior edge of labium is arched posterior wards slightly. A pair of labial palpi is articulated with the labium at proximolateral angle of the labial plate. The labium is much extended anteriorly and reaches up to the base of proboscis. The small portion of forwardly extended region is erected. So that it appears as vertical wall. The edge

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of this erected wall is provided with a tuft of hair. The microscopic sensilla are present at the distal end of labium. The labial palp consists of three palpomeres. With the proximal palpomere, the labial palp is articulated to the labium. This segment is roughly curved. The middle palpomere is elongated and tapers gradually towards distal end. The distal palpomere is spatulate. The paired antennae are fixed in antennal socket through the scape. It is comparatively large and somewhat dome shaped. The annulus distal to scape is the pedicel. It is articulated to scape by its proximal end while by its distal end it is articulated to the flagellum. Flagellum is the rest portion of antenna made up of flagellomeres. The number of flagellomeres in male ranges from 36 to 39 (n = 25) whereas in female the range is between 37 to 42 (n = 25). The basal portion of flagellum consists of rectangular flagellomeres but some distally situated flagellomere, each flagellomere shows single hair like sensillum, which lies on middle region. The hair like sensillum is transparent and straight. It is directed towards the club. Besides the said sensilla, the flagellomere of club bear much blunt hair sensilla. The number of these sensilla goes on increasing from basal flagellomere of club to the apical flagellomere. Similarly, the sunken pegs are present on the flagellomeres of the club. The pegs are situated in the circular depressions.



Fig 1-3: 1. Frontal view of cranium of adult *D.isocrates* (Flagellum of antenna removed) 2.Posterior view of cranium of adult *D.isocrates*. (Flagellum of antenna removed) 3. Distal region of galea (in part magnified) of adult *D.isocrates*. AN: Antenna, ATP: Anterior tentorial pit, CE: Compound eye, CL: Clypeal portion of frontoclypeus, CR: Chitinized ring, DOF: Dorsal half of occipital foramen, GE: Gena, LB: Labium, LCS: Lateral cervical sclerite, LP: Labial palp, MD: Median depression, PB: Proboscis, PGO: Postgenal-occipital area, PO: Post occiput, POP: postgenal-occipital Protuberance, POS: Post occipital suture, SB: Sensilla basiconica, SCE: Sensilla chaetica SNS: Sensillum, SS: Sensilla styloconica, RP: Ridged projection, SSS: Sickle shaped scales.TA: Tentorial arm, TBT: Transverse tentorial bridge, TS: Temporal sulcus, VF: Ventral furrow, VOF: Ventral half of foramen

#### Discussion

The cranial surface is densely clothed with various types of scales and their different patterns like uniform distribution of gray scale on anterior surface, white ring around each compound eye, orange scales on distal annulus of antennae and black scales on dorsolateral part of labial palpi were found as a species-specific characteristic in D. isocrates. However, the cranium covered with scales is the general lepidopterist feature of adult cranium. To study microscopic details of cranium necessarily the scales were removed before proceeding for permanent slide preparations. In present study the details of cranial areas and sutures are described by the terms have been adopted from the fundamental classical work on insect morphology (Sharplin, 1963; Matsuda, 1965, 1970, 1976; Kristensen, 2003) <sup>[48, 25]</sup>. The frontal view of cranium exhibits frontoclypeus as an anterior face of cranium delimited dorsally by antennal suture and ventrally by clypeolabral boundary as it is reported in the Nymphalidae (Kawahara et al., 2012)<sup>[20]</sup> and Papilionidae (Leite et al., 2010)<sup>[27]</sup>. An inverted 'V' shaped elevated frons around median depression is appeared as a special feature of frontal area in D. isocrates. There is no trace of frontoclypeal suture (Duporte, 1946) in D. isocrates. This observation is supported by previous work on lepidoptera (Casagrande, 1979; Sorensen, 1980)<sup>[8, 51]</sup>. That is why in the present work the clypeus and frons are appeared without distinction. A pair of anterior tentorial pits located. The anterior tentorial pits are located laterally along the frontoclypeal sclerite, at dorsolateral ends of ventral furrow which acts as clypeolabral boundary to separate clypeus from ventrally located labrum. It is clypeal-labral articulation (Miller, 1971)<sup>[4]</sup>. In present work, this structure is referred as clypeolabral sulcus (Sorensen, 1980)<sup>[51]</sup> which is present in the form of ventral furrow in D. isocrates.

Dorsolateral large and bulged compound eyes of *D. isocrates* exhibit hexagonal ommatidia with circular corneal facet in each ommatidium and interommatidial setae under the light microscope. The interommatidial setae have also been reported in a member of Lycaenidae, *G. lygdamus* (Sorensen, 1980)<sup>[51]</sup> and in *A. unifascia* (Kristensen, 2014). The same structure has been termed as 'Setaeform hair' (Adamski & Peters, 1982)<sup>[1]</sup>. The gena on the anterior face appears band likearea runs parallel to the eyes, which may be reduced because of the development of conspicuous eyes (Michener, 1953)<sup>[32]</sup>. Some authors described this band in lepidoptera as ocular sclerite (Casagrande, 1979; Bilotta, 1992)<sup>[8, 4]</sup>. and paraocular area (Sorensen, 1980)<sup>[51]</sup>.

The most of the posterior face of cranium is occupied by postgena (Snodgrass, 1960, Kawahara, 2012; Queiroz-Santos *et al.*, 2018) which covers the back of compound eyes and expanded centrally towards occipital foramen. In Lycaenidae, this cranial area has been referred as postgenal-occipital area (Sorensen, 1980) <sup>[51]</sup>. This area is cleaved dorsolaterally by temporal sulcus which delimits the temporal protuberance. These features are in concurrence with the present study on *D. isocrates*. The postocciput is appeared as the most restricted ring like cranial area around the occipital foramen (Leite *et al.*, 2010) <sup>[27]</sup> and bound with postoccipital sulcus are the usual lepidopterists characteristics found in *D. isocrates*. The occipital foramen is divided in to dorsal and ventral halves due to transverse tentorial bridge. This observation is supported by earlier work on papilionid species, *Heraclides anchisiades capys* (Leite *et al.*, 2010) <sup>[27]</sup>. Ventrally the cranium exhibits hypostomal-postgenal sulcus which separates the laterally located postgena and central hypostoma. Bases of gnathal appendages lie in the centre of the cranium.

Siphoning mouthparts, consisting of proboscis and labial palps, are the exclusive feeding organs and important chemosensory organs in most adult Lepidoptera (Guo et al., 2018)<sup>[18]</sup>. The present study on gnathal appendages revealed the microscopic details of siphoning mouthparts in the form of proboscis which is contributed by maxillae and particularly composed with galea. The cardo and stipes are clearly evident while maxillary palps are absent. Absence of maxillary palp in D. isocrates is supported by earlier work on Hesperiidae (Carneiro, 2012). The present study revealed three types of sensilla like Sensilla chaetica, sensilla basiconica and sensilla styloconica with their particular pattern of distribution on the galea. Four types of sensilla have been reported in various lepidopterans, such as Nymphalidae (Molleman et al., 2005; Ômura et al., 2008, Ômura et al., 2009)<sup>[35,</sup> <sup>38, 37]</sup>. Micropterigidae (Krenn, 2010) <sup>[23]</sup>, Noctuidae (Guo, et al., 2018) <sup>[18]</sup> Plusiinae and Noctuinae (Xue et al., 2016; Wang, 2012). According to previous studies, sensilla chaetica, sensilla basiconica, and sensilla styloconica are common types of sensilla in Lepidoptera (Krenn, 1998; 2010; Faucheux, 2013) including Lycaenidae (Ma et al., 2019). These reports support the present observations in D. isocrates. However, ultrastructural studies on these sensilla are needed to find their details. The studies on sensilla reflects taxonomic relationships and has been used to infer phylogenetic relationship (Paulus & Krenn, 1996; Castro Gerardino & Liorente Bousquets, 2019) [41, 9]. Besides the sensilla the tip of galeae bears rasping sickle shaped scales which are also reported in (Goldware & Barnes, 1973)<sup>[17]</sup>. The present study also revealed absence of mandibles, labium in the form of reduced small plate (Richards & Davies, 1977)<sup>[44]</sup>, segmented labial palpi with three palpomeres (Kawahara et al., 2012)<sup>[20]</sup> as the usual lepidopterist mouthparts. However, more emphasis is needed to find details of sensory organs on labial palp. The clubbed antennae of D. isocrates shows two types of hair sensilla and sunken pegs under the light microscope.

Present study on antennae of *D. isocrates*, revealed hair sensilla and sunken pegs on flagellomere of its antenna with the aid of light microscope. However, details of hair Sensilla and sunken pegs could not be observed under the light microscope. The antennae of insects have various types of sensilla that play important roles in insect behaviors, including host location, feeding, mate attraction and oviposition (Skiri *et al.*, 2005) <sup>[49]</sup>. Recently antennal morphology and sensilla have been recorded in different lepidopteran species including the crop pests (Seada, 2015; Yan *et al.*, 2017). The hair sensilla observed in the present work are correspond to the trichoid sensilla reported in these earlier reports and Presence, of sunken pegs on flagellomeres in present study concur

with the observations reported in *D. gilippus berenice* (Myers, 1968) and in *Plutella xylosella* (Yan *et al.*, 2017). But still the ultrastructural studies on the antennal sensilla in *D. isocrates* is needed.

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## Comprehensive Review on Photovoltaic- Battery and Diesel Generator Based Electric Vehicle Charging Station

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#### Abstract

Global large adoption of Electric Vehicles(EVs) which appear to be the best replacement to IC engines. Increased EVs in the road, charging of the vehicles with conventional fossil fuel based grid is not economical and efficient. The never ending fuel demand of the vehicle, Hybrid Vehicle was introduced in the research. Generally a hybrid vehicle is the combination of an internal combustion engine (ICE) and electrical drive system. The performance of the vehicle is largely dependent on the accuracy and efficiency of the electrical system of the vehicle power train. This paper analyzed an electrical system of Hybrid Electric vehicle which is powered by Fuel cell, Battery and PV panel. The model is developed in MATLAB/Simulink environment, the circuit operation is examined and its methodological model is derived to study the parametric design features. Furthermore, the complete hardware setup has developed to test the performance of the power factor correction under the steady-state condition with respect to variation in load

Keywords: Hybrid electric vehicle, Power system of vehicle, solar vehicle Charging Station, Electric Vehicles, Solar, Battery Energy Storage System.

#### 1. Introduction

The worsening of air quality, issues of global warming, and continuous reduction of fossil fuels are serious issues to consider. The traditional electricity generation sector and the carrying sector are the major contributor to these issues. The advent of the renewable energy-based production and electrification of transportation convoy is aimed to provide a sustainable solution to these issue. Due to the irregular nature of the renewable energy mainly solar photovoltaic (PV), such as batteries need to be deploy to flat out the variable power output. The battery of the EVs can be leveraged for this point making EVs more practicable than internal combustion engine (ICE) vehicles. In a concept of grid-integrated solar PV-battery recharge frame to enhance the system dependability is proposed. An energy running system in EV-based charging transportation integrated with an energy storage system (ESS) in a smart micro grid atmosphere reviewed the technique related solar-powered EV charging station. Present a vehicle-to-home policy for utilize distributed generation such as the solar power to contract with the intricacy of dynamic electricity prices. Some other papers have also available in the literature in the context of EV-PV charging schemes. Thus have studied the modelling of a solar PV-based EV charging that is suitable for dc quick charging arrangement in order to minimize the grid stress through a vehicle-to-grid scheme. A best EMS for a synchronized charging scheme and the proposed method has been practically realized by setting up a hardware model of a PV-based charging plug-in EVs included renewable energy source for attractive cost and emission reductions. [1] It has contribute to the concept of electrification that has lead to the increase in status of Electric Vehicles (EVs). With the operation of more EVs on the road, charging of the vehicle will be arduous if electric grid power is used. When more number of EVs are connected to the grid, it will unavoidably bring a huge impact to its function and control. The approach introduces for PV system and projection of EV pattern according to collected data. In charging scheduling for EVs by PV and Grid is given by reducing the total cost of the parking lot. With the real- time information about EVs, Model Predictive Control is applied for present time slot and projected information in the coming time slots. [2]. Power electronics devices like converter, switches and motor drives. This paper introduces complete power system of power train of the hybrid electric vehicle powered by fuel cell and photovoltaic panel. In this detail analysis of what will happen after adding the photovoltaic panel to charge the auxiliary battery of the vehicle is discussed. In these the possibility of creating an electric vehicle charging infrastructure using

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PV panels as shown in Fig. 1. These is to maximize the use of PV energy for EV charging with minimal energy swap with the grid. [3]



Fig. 1. Design of solar EV charging station.

A major disadvantage of charging EV from PV is the unpredictability in the PV manufacture. Smart charging provide for litheness of EV charging in order to intimately match the PV production has shown that smart charging shared with V2G has the dual advantage of growing PV self-consumption and plummeting peak demand on grid. In the EV charging side view is varied with time so that greatest PV utilization occurs. In can be excess PV energy reduces with higher EV infiltration.[1] Alternately, the total number of vehicles that are charging at a stable power can be vigorously varied so that the net charging power follows the PV generation, as seen. This type of chronological charging shows great benefit than instantaneous EV charging of scooters so that the charging power follows the PV side view. Paper analysis the PV system design and EV charging in a holistic manner allowing for the above aspects. The new charity of the work compared to earlier works are as strength of mind of PV panels for maximizing energy compare it with the use of tracking systems.2.option of over sizing the PV array power rating with respect to the power converter size based on metrological situation of the location.3.Dynamic charging of EV using Gaussian charging profile and EV prioritization, which is better to constant power charge.[3][4]

#### 2. EV charging using PV

In this paper, a 10 kW EV–PV charger will be careful that provides both charge and discharge of car as shown in Fig. 2. This is in line with the standard for enabling V2G. The PV converter, grid inverter and the isolated EV charger are integrated on a central DC- link. Direct interfacing of EV and PV on DC would be more beneficial than AC interfacing due to lower conversion steps and improved efficiency.[1]



Fig. 2. System of the grid connected three-port EV–PV charger. PV. The PV converter grid. shortest interfacing of EV and PV on DC would be more useful than AC interfacing due to lower exchange steps and better competence.[2]





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#### 3. System Design

To approximation the solar irradiance on a module  $(S_m)$  with a exact azimuth  $(A_m)$  and tilt angle  $(h_m)$  as shown in Fig. 3, judgment of the position of the sun all through the time is required.



Fig. 3. Orientation of the PV panel is defined by azimuth angle  $A_m$  (measured from the South) and module tilt angle  $h_m$  (measured from horizontal surface).

#### A. expressive Vehicle as load

A load of five electric vehicles, 48V, 28Ah with 0.5 hours to utmost 2 hours as charge time [3], is considered for the charging station. charge needs of inward EVs varies. The user can state the State of Charge (SOC) limit, SOC<sub>1t</sub> and the time necessary h hours for charge the EVs.

The residual SOC,  $SOC_r$  requisite to charge the vehicle is intended from time to time with the difference connecting  $SOC_{lt}$  and current SOC,  $SOC_c$ .

$$SOC_r = SC_{lt} - SC_c$$
 (1)

#### B. Solar PV with increase Converter

PV array of 250W at 37.3V as open course voltage is careful for the charging situation design in MATLAB/Simulink. To step-up, a boost converter is used to get the necessary DC bus power. With boost converter efficiency as 90%, the solar PV is intended for a load of EVs to accuse from 20% to 100% SOC for 2 hours. Thus, total panels are necessary for the particular charge station.

#### C. Bidirectional DC-DC Converters

A battery energy storage space system is used to amass the excess power from the solar for charge the EVs at night. A bi- directional DC-DC converter controls the charge and discharge process of the BESS. consider charge-discharge efficiency and bi-directional converter competence as 90%, for supplying utmost energy to the connected EVs for 2 hours.[3]

It must be kept in mind that in exercise, it might not be likely to install the PV panels along the best compass reading due to kind of the roof. For physical locations in the northern hemisphere like Netherlands, the best azimuth for the PV panels is  $A_m = 0^\circ$  i.e. opposite south. To decide the optimal tilt angle  $h_m$ , the annual energy give way of the 10 kW PV scheme is strong-minded for different tilt angles, as shown in Fig. 4.





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Fig. 4. Annual energy yield as a function module tilt. The PV modules were oriented south with azimuth of 0°.

#### 4. Control Methodology



Fig. 5. Vehicle charging control architecture block schematic

Fig. 5 shows the charge manager circuit schematics. Various function are perform through the EVSE by using the relays of elevated power score in the circuit. For securely in force the relay, a driver with a apposite guard circuit should be practical as the following.[1]

1) An over existing relay (solid state type) for short circuit and overload protection.

2) An electronic contactor switch for latching-up the connector with the supply. A controller circuitry which

interfaces the on board charger error circuit interrupter.

3) Alarm rank and assist the users to appreciate the working sequence.

#### A. working Sequence of the PWM-Based Vehicle Charging manager

Light emitting diode (LED) indicator viewed simply from a distant location could make the holder to determine the EVSE status. Hence, through these highlighted indicators, the following mention states of charging can express easily (see Table II):

- 1) the charging station is active, i.e., ac supply is obtainable;
- 2) the connector is linked to the vehicle, i.e., not charging but linked mechanically;
- 3) charging start, i.e., in growth through electrical link;
- 4) fault or alarm condition.





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#### TABLE II

PWM-BASED CHARGING MANAGE SCHEME BASED ON THE CCS BENCHMARK

Total Resistance between CP- PE	Open circuit	2700 ohm (Ω)	880 ohm (Ω)	240 ohm (Ω)		
Resistors R2 + R3 = 2740 Ω	-	2740 Ω	1300 Ω 2740 Ω	270 Ω 2740 Ω		
Voltage Measured: CP-PE	+12 V	+9 V ±1 V	+6 V ±1 V	+3 V ±1 V	0 V	-12 V
State of charging	State A	State B	State C	State D		
Charging status	standby	Vehicle detected	Ready (charging)	With ventilation	power	

#### 5. portrayal of the module used in the structural design

#### A. ESS as EV Charging Load

The study of vehicle parking figures reveal how much time do one vehicle take for charge and how many vehicles could be charge at a time per day. fundamentally, it deals with the obtainable solar production, types of charging (i.e., the voltage and power rating of the charger) and the battery chemistry used in the EVs. It characterize the four particular strategy of the charge stations that are currently used, i.e., Level-1, Level-2, Level-3, and dc fast charge. The huge popular of the Indian organization and MNCs and administration places will, in universal, pursue five days, 8–9 h each day functioning schedule.

B. Battery Storage and Converter aim

Another important part of the solar PV off-grid scheme is the battery storage. The storage is essential in such systems, due to the variation in the PV generated output. When sunshine is available, the photovoltaic system supply the load nonstop and the extra power is stored to the battery storage. While through night hours, or when sunshine is not available, the customer load require can be satisfied by the battery storage. For a solar charging model, a divide battery bank (Lead Acid). The converter system in the separate solar PV necessitate a control scheme to be applied to all the supply system that define the relations between dissimilar rudiments. The battery usage as an energy storage component necessitate the addition of the charge regulator (controller).



Fig. 6. Solar PV-EV charging circuit topology





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Fig. 7. EV battery charger equivalent circuit

The improve mode working of the PWM rectifier depends on gate pulse trigger of the individual switch combination slanted to every switching sequence to trace the current through an inductor by a sinusoidal arc defined by the digital indicator processor (DSP) base microcontroller. Due to the high-frequency switching pulse than that of line frequency (50 Hz), in one total cycle, the PWM rectifier enter voltage can be practical as consistent. The operation of the circuit can be realize in both, i.e., CCM and irregular conduction mode (DCM). Now in the DCM mode, the current during an inductor reach zero at the end of every switching cycle.

#### 6. Conclusion

A DSP manager board for the proper action of the circuit with deference to the steady-state action of the PFC, the transient response of the circuit as well as the active EV charging load response based on the SOC, has also been shown. furthermore, the assumption from the model results shows that the performance of the overall system depends on solar emission and the battery SOC.[1] With increase of EVs on the road, charging of EVs own as a critical issue. Using PID, current control and voltage control desired power is obtained by maintain the DC bus voltage constant for the station[2].

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## पिस्तोल व रायफल शुटींग खेळाडूंच्या शारीरिक सुदृढतेचा तुलनात्मक अभ्यास प्रा. दिपक प्रकाश सौदागर प्रा. डॉ. सुनील पोपट पानसरे

#### सारांश:

पिस्तोल व रायफल शुटींग खेळाडूना आपले कौशल्य सादर करताना खांयाची ताकद या शारीरिक सुद्दढता घटकाची आवश्यकता असते. सदर संशोधनात पिस्तोल व रायफल शुटींग खेळाडूंच्या शारीरिक सुद्दढतेचा तुलनात्मक अभ्यास केला आहे. या संशोधनाचे मुख्य उद्दिष्ट महाराष्ट्रातील वरिष्ठ गटातील पिस्तोल व रायफल शुटींग खेळाडूंच्या खांयाच्या ताकदीचे मापन करणे. परिकल्पना अशी होती की, पिस्तोल व रायफल शुटींग खेळाडूंच्या शारीरिक सुद्दढता घटकामध्ये सार्थक फरक आढळून येणार नाही. सदर संशोधनात १० मीटर एयर पिस्तोल व १० मीटर एयर रायफल पुरुष या क्रीडा प्रकारांचा समावेश केलेला आहे. प्रस्तुत संशोधनाकरिता संशोधकाने महाराष्ट्रातील वरिष्ठ गटातील राज्यस्तरीय रायफल व पिस्तोल शुटींग स्पर्धेमध्ये सहभागी झालेल्या १०० रायफल व १०० पिस्तोल शुटींग खेळाडूंची सहेतुक पढतीने निवड केली आहे. त्यांचे वय १८-२८ वर्ष होते. प्रस्तृत संशोधनात वर्णनात्मक सर्वेक्षण पद्धतीचा अवलंब केला आहे. २ कि.ग्रॅम डम्येल धरून ठेवण्याची क्षमता (शारीरिक सुद्दढता) ही कसोटी माहिती संकलनाचे साधन म्हणून वापरण्यात आले. सांख्यिकीय विश्लेषणासाठी मध्यमान, प्रमाण'विचलन, टी परिक्षीका, प्रमाण विचलन त्रुटी, मध्यमानातील फरक, या संख्याशास्त्रीय साधनांचा वापर करण्यात आला आहे. पिस्तोल शुटींग आणि रायफल शुटींग खेळाडूंच्या खांयाच्या ताकदीमध्ये सार्थक फरक नाही हे स्पष्ट झाले.

महत्वाच्या संज्ञा: पिस्तोल शुटींग, रायफल शुटींग, शारीरिक सुदृढता

प्रस्तावनाः

पिस्तोल व रायफल शूटिंग खेळामध्ये शारीरिक सुदृढता महत्त्वाची आहे. शारीरिक सुदृढता घटकांमध्ये रनायूंची ताकद, दमदारपणा, लवचिकता, शरीर संघटन यांचा समावेश होतो. सदर संशोधनात स्नायूंची ताकद हा घटक महत्त्वाचा असून तो अभ्यासला आहे. पिस्तोल व रायफल शूटिंग खेळाडूंसाठी खांचाची ताकद महत्त्वाची आहे. शूटिंग करताना नेमबाजांना शरीर नेहमी स्थिर ठेवावे लागते. त्यासाठी खांचाची ताकद महत्वपूर्ण असते. शूटींग खेळाचा व शारीरिक सुदृढता घटकाचा फार जवळचा संबंध आहे.

प्रत्यक्ष शूटिंग करताना खेळाडूंच्या शरीराची हालचाल होते त्यामुळे अस्वस्थता वाढते आणि नेमबाजीच्या तंत्रावर लक्ष राहत नाही. त्यामुळेही चुका होतात आणि कार्यमान खालावते. त्यामुळे शुटींग खेळाडूना खांधाची ताकद व हाताची ताकद या शारीरिक सुदृढता घटकाची आवश्यकता असते.

अंतिम फेरीत भाग घेत असताना अस्वस्थता व उत्सुकताही असते या सर्व घटकांवर नियंत्रण मिळवण्यासाठी शारीरिक व्यायाम केल्याने या घटकांवर नियंत्रण मिळविणे सोपे जाते. नेमबाजी खेळामध्ये शारीरिक सुदृढता घटक कार्यमानासाठी उपयुक्त आहे. हे शोधण्यासाठी खांद्याची ताकद या घटकाचा समावेश केला आहे.

संशोधनाचे महत्व:

- प्रस्तुत संशोधनाचा पिस्तोल व रायफल शूटिंग खेळाडूंचे कार्यमान उंचावण्यासाठी शारीरिक सुदृढतेची मदत होईल.
- सदर संशोधनातून शूटिंग या खेळाचे कार्यमान व शारीरिक सुदृढतेचे महत्व कळेल.
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संशोधनाची उद्दिष्टेः

१. महाराष्ट्रातील वरिष्ठ गटातील पिस्तोल व रायफल नेमवाजांची शारीरिक सुदृढता मोजणे.

२. दहा मीटर पिस्तोल शूटिंग व दहा मीटर रायफल शूटिंग खेळाडूंच्या शारीरिक सुदृढतेची तुलना करणे. परिकल्पना:

H₀ : दहा मीटर पिस्तोल शूटिंग व दहा मीटर रायफल शूटिंग खेळाइंच्या शारीरिक सुदृढता घटकामध्ये सार्थक फरक आढळून येणार नाही.

संशोधन पद्धती:

प्रस्तृत संशोधनात वर्णनात्मक सर्वेक्षण पद्धतीचा अवलंब केला आहे.

जनसंख्या व न्यादर्शः

संशोधकाने महाराष्ट्रातील वरिष्ठ गटातील एकूण १०० रायफल व १०० पिस्तोल शुटींग खेळाडूंची सहेतुक पद्धतीने निवड केली आहे.

संख्याशास्त्रीय साधनेः

सदर संशोधनातील माहितीचे विक्षेषण करण्यासाठी मध्यमान, प्रमाण विचलन, टू टेल्ड टी परीक्षिका, मध्यामानातील फरक, स्वाधीनता मात्रा, या संख्याशास्त्रीय साधनांचा वापर केला आहे.

संख्याशास्त्रीय माहितीचे विक्षेषण व अर्थनिर्वेचनः

प्रस्तुत संशोधनात SPSS (Statistical Package for the Social Sciences) सॉफ्टवेअरचा वापर करून संख्याशास्त्रीय विक्षेषणावरून योग्य अर्थनिर्वेचन करून निष्कर्ष काढले.

### कोष्टक क्र. १

पिस्तोल व रायफल शुटींग खेळाडूं यांच्यासील २ कि.ग्रॅम डम्बेल धरून ठेवण्याच्या क्षमतेची तुलना

शारीरिक सुदृढता घटक	क्रीडा प्रकार	मध्यमान	प्रमाण विचलन	मध्यामानातील फरक	टी मूल्य	स्वाधीनता मात्रा	सार्थकता स्तर
खांचाची	पिस्तोल	8.0	0.4352				
ताकद	रायफल	8.0	•.४४५६	-	0.692	192	॰.४४९

पिस्तोल व रायफल शुर्टींग खेळाडूं यांच्यातील २ कि.ग्रॅम डम्बेल धरून ठेवण्याच्या क्षमतेचे वर्णनात्मक विक्षेषण

कोष्टक क्र. १ वरून पिस्तोल शूटर व रायफल शूटर यांच्यातील २ कि.ग्रॅम डम्बेल धरून ठेवण्याच्या क्षमतेची तुलना केली असता असे दिसून येते की, पिस्तोल शूटिंग खेळाडूंचे २ कि.ग्रॅम डम्बेल धरून ठेवण्याच्या क्षमतेचे मध्यमान १.० (प्रमाण विचलन ± ०.५३६८) आणि रायफल शूटिंग खेळाडूंचे मध्यमान १.० (प्रमाण विचलन ± ०.४४५६) एवढे आढळले.

रायफल आणि पिस्तोल शूटिंग खेळाडूंच्या २ कि.ग्रेंम डम्बेल धरून ठेवण्याच्या क्षमतेचे मध्यमानातील फरक हा ५२.९०० एवढा आहे. पिस्तोल शूटिंग आणि रायफल शूटिंग खेळाडूंच्या २ कि.ग्रेंम डम्बेल धरून ठेवण्याच्या क्षमतेमध्ये फरकातील सार्थकता तपासण्यासाठी "टी" परीक्षिकेचा वापर करण्यात आला. प्राप्त 'टी' मूल्य हे ०.७५८ असून स्वाधीनता मात्रा १९८ साठी ०.०५ सार्थकता स्तरावर पिस्तोल शूटिंग आणि रायफल शूटिंग खेळाडूंच्या २ कि.ग्रेंम डम्बेल धरून ठेवण्याच्या क्षमतेच्या मध्यमानातील फरक (५२.९००) सार्थक आढळून आलेला नाही.

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म्हणून संशोधकाने H₀: दहा मीटर पिस्तोल शूटिंग व दहा मीटर रायफल शूटिंग खेळाडूंच्या शारीरिक सुदृढता घटकामध्ये सार्थक फरक आढळून येणार नाही. या शून्य परिकल्पनेचा स्विकार केला व पर्यायी परिकल्पनेचा त्याग केला आहे.

निष्कर्ष:

पिस्तोल शूटिंग व रायफल शूटिंग खेळाडूंची खांदाची ताकद समान आढळून आली. त्यामध्ये सार्थक फरक आढळून आलेला नाही.

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# व्हॉलीबॉल खेळाडूंच्या समन्वय घटकावर योग प्रशिक्षणाचा होणारा परिणाम

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सारांश :

ब्हॉलीबॉल खेळाडूंना आपले कौशल्य सादर करताना उत्तम प्रकारचे समन्वय आवश्यक असते. ही गरज योगद्वारे पूर्ण केली जाऊ शकते का हे पाहण्यासाठी नाशिक शहरामधील १९ वयोगटातील एकूण २५ पुरुष खेळाडूंची सहेतुक पूर्ण निवड करण्यात आली. सदर संशोधनासाठी प्रायोगिक पद्धत वापरण्यात आली. हँडवॉल टॉस कसोटी (समन्वय) भूका संकलनाचे साधन म्हणून वापरण्यात आली. सांख्यिकीय विश्लेपणासाठी मध्यमान, प्रमाणविचलन, मध्यमानातील करक, यांचा वापर करण्यात आला. योगामुळे व्हॉलीबॉल खेळाडूंच्या समन्वय व कौशल्य कार्यमान या घटकावर योग <sub>प्रशिक्षणाचा</sub> सार्थक परिणाम होतो हे स्पष्ट झाले.

महत्वाच्या संज्ञा: व्हॉलीवॉल खेळाडू, समन्वय, योग प्रशिक्षण प्रस्तावनाः

योग शरीराची लवचिकता सुधारतो आणि स्नायूंना मजबूत करतो. तसेच योगाने संतुलन सुधारते. तथापि, सर्वात महत्वाची गोष्ट अशी आहे की, योगामुळे व्हॉलीवॉल खेळाडूंना प्रभावीपणे ताणतणावांचा सामना करण्यास आणि सामन्यांसाठी मानसिक तयारी करण्यास मदत होते. योगामुळे व्हॉलीवॉल खेळाडूंच्या कामगिरीवंर सकारात्मक परिणाम होतो.

विविध खेळांमध्ये कौशल्यसंबंधित घटक महत्त्वाचे असतात त्यामध्ये चपळता, तोल, समन्वय, वेग, शक्ती आणि <sub>प्रतिक्रिया</sub> वेळ हे घटक महत्वाचे असतात. त्याचप्रमाणे व्हॉलीवॉल खेळात पासिंग, व्लॉकींग, सर्व्हिस, स्मॅशींग व लिफिंटग इ. कौशल्य करताना समन्वय आवश्यक असतो. व्हॉलीवॉल खेळासाठी योगाचा कितपत उपयोग होईल याची माहिती पाहण्यासाठी संशोधकाने योगा आणि व्हॉलीवॉल या खेळाची सांगड घालण्यासाठी हा विषय हाती घेतला आहे. संशोधन पध्दती:

नाशिक शहरामधील १९ वयोगटातील एकूण २५ व्हॉलीबॉल पुरुष खेळाडूंची सहेतुक पद्धतीने निवड करण्यात आली. हैंडबॉल टॉस कसोटी, व्हॉलीवॉल कौशल्य कार्यमान इ. माहिती संकलनाची साधने वापरण्यात आली.

प्रस्तुत संशोधनासाठी संशोधकाने प्रायोगिक पध्दतीची निवड केली आहे. प्रायोगिक अभिकल्प- Time series Design.

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माहीतीचे संकलन व विश्लेषण:

प्रस्तुत संशोधनामध्ये संशोधकाने कसोट्यांच्या आलेल्या प्राप्ताकांच्या सांख्यीकीय विश्लेषणासाठी (SPSS) सॉफ्टवेअरचा वापर केलेला आहे.

कसोठ	न्हालाबाल खळाडू ग	विद्यार्थी संख्या	मध्यमान	प्रमाण विचलन	प्रमाण तृटी
हँडवॉल टॉस कसोटी	चाचणी क्र.१	રષ	19.20	६.५३	8.30
(समन्वय)	चाचणी क्र.२	રષ	28.42	4.00	8.84
	चाचणी क्र.३	24	२८.२८	4.68	8.85

		कोष्ट	क क. १			
 स्रोक	 रंडवॉल	टॉस	कसोटीचे	वर्णनात्म	क सांखिकी	(N=24)

कोष्टक क्र.१ नुसार चाचणी क्र.१, २ व ३ चे हैंडवॉल टॉस कसोटीचे मध्यमान १९.८०, २१.५२ व २८.२८ (प्रमाण विचलन= ६.५३, ५.७७ व ५.८१)



'Akshar Wangmay' UGC Care Listed, International Research Journal, ISSN: 2229-4929, July 2021, Special Issue, Volume-IV "Challenges of Higher Education in India to Compete with Global Level"

	कसोट्या	मध्यामानातील फरक	प्रमाण त्रुटी	
हँडबॉल टॉस कसोटी	चाचणीक १ चाचणीक २		2.62	2.92
		चाचणी क्र. ३	6.86*	8.98
	चाचणी क्र. २	चाचणी क्र. १	१.७२	2.92
		चाचणी क्र. ३	६.७६*	8.98
	चाचणी क्र. ३	चाचणीक्र १	6.86"	80.5
		चाचणीक २	£.9E*	2.92

कोष्टक क्र. २ हॉलीबॉल खेळाडूंच्या हॅंडबॉल टॉस चाचणीची वहुविध तुलना

कोष्टक क्र.२ नुसार चाचणी क्र. १ व ३ मधील मध्यमानातील फरक ८.४८ इतका असून संख्याशास्त्रीय दृष्ट्या तो ०.०५ या स्तरावर सार्थक आहे. चाचणी क्र. २ व ३ मधील मध्यमानातील फरक ६.७६ इतका आहे हा फरक सुद्धा ०.०५ स्तरावर सार्थक आहे.

यावरून असे आढळून येते की, योग प्रशिक्षणामुळे व्हॉलीबॉल खेळाडूंच्या समन्वय व कौशल्य कार्यमानावर सार्थक परीणाम होतो. व या घटकात वाढ होते. याठिकाणी संशोधक H₁ योग प्रशिक्षणामुळे व्हॉलीवॉल खेळाडूंच्या समन्वय व कौशल्य कार्यमान या घटकावर सार्थक परिणाम होईल. या संशोधन परिकल्पनेचा स्वीकार करतो. चर्चा:

वरील संख्याशास्त्रीय विश्लेषणावरून असे आढळून आले की, 'समन्वय' या घटकाचा विचार केला असता असे सिद्ध झाले की, हँडवॉल टॉस कसोटीच्या मोकळ्यावेळी (चाचणी क्र.१ व २ दरम्यान) प्राप्तांकात सार्थक फरक आढळत नाही. व प्रयोगावेळी (चाचणी क्र. २ व ३ दरम्यान) च्या कार्यमानाच्या प्राप्तांकात सार्थक फरक आढळतो. म्हणजेच योग प्रशिक्षणामुळे व्हॉलीवॉल खेळाडूंच्या समन्वय या घटकात वाढ होते असे सिद्ध झाले.

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**RESEARCH, SPORTS SCIENCE AND YOGA DURING 21ST** 

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पुणे जिल्ह्यातील महाविद्यालयीन युवकाच्या हृदयाच्या शारीरिक सुदृढता घटकाच्या स्तराचा अभ्यास	दमदारपणा या आरोग्यधिष्ठीत । व मानांकन निर्मिती
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### सारश

महाविद्यालयीन विद्यार्थांसाठी हृृदयाच्या दमदारपणा या आरोग्यधिष्ठीत शारीरिक सुदृढतेची मानके तयार करून त्याच्या शारीरिक सुदृढता स्तराचा चिकित्सक अभ्यास करणे हे या संशोधन अभ्यासाचे प्रमुख उद्दिष्ट आहे .हे उद्दिष्ट साध्य करण्यासाठी संशोधकांनी पुणेविद्यापीठाशी संलग्न असणाऱ्या पुणे जिल्ह्यातील ३२ महाविद्यालयांची निवड सहेतुक पद्धतीने करून त्यामधून प्रथम वर्ष विज्ञान शाखेत शिकणाऱ्या८००विद्यार्थांची यादृच्छिक पद्धतीने निवड केली .निवडलेल्या विद्यार्थांची शारीरिक सुदृढता हि१२मिनिट चालणे किंवा धावणे या चाचणीच्या साह्याने मोजली . मिळालेल्या प्राप्तकाचे संख्या शास्त्रीय विशलेषण करून पाच श्रेणी मध्ये मानकाची निर्मिती केली आणि विद्यार्थांच्या शारीरिक सुदृढता स्तराचा चिकित्सक अभ्यास केला .प्रस्तुत अभ्यासावरून पुणे जिल्ह्यातील प्रथम वर्ष वीएसी मध्ये शिकणाऱ्या विद्यार्थांचा हृदयाचा दमदारपणा सरासरी चांगला आढळला .

महत्वाचे शब्द :हृदयाचा दमंदारपणा ,शारीरिक सुदृढता ,महाविद्यालयीन विद्यार्थी ,मानके . प्रस्तावना

सर्वसामान्य लोकांना दैनंदिन जीवन चांगल्या प्रकारे जगण्यासाठी किमान शारीरिक सुदृढतेची आवशकता असते .व्यक्ती शारीरिक रित्या सुदृढ आहे असे तेव्हाच म्हणता येईल जेव्हा तो दैनंदिन जीवनातील सामान्य व अतिरिक्त गरजा सुरक्षित पणे व परिणामकारक रीत्या न थकता पूर्ण करू शकते.परंतु अलीकडील काळात विद्यार्थी सततचा अभ्यासाचं ताण ,थेरीक्लासेस ,कोचिंग क्सासेस यामुळे येणार थकवा , मोबाईलचा अतिरिक्त वापर त्यामुळे व्यायामा साठी मिळणारा अपुरा वेळ ,खाण्याच्या वेळेकडे केलेले दुर्लक्ष्य ,फास्ट फूड संस्कृती व पुढील भवितव्याची चिंता यामुळे विद्यार्थांच्या आरोग्यावर परिणाम होऊ लागला. प्रामुख्याने महाविद्यालयातील विद्यार्थी हा विविध प्रकारच्या मानसिक व शारीरिक समस्येतून जात आहे .महाविद्यालयीन विद्यार्थी हा प्रौढावस्थेत प्रवेश करण्यापूर्वी त्याला त्याच्या शारीरिक सुदृढतेचा स्तर काय आहे हे कळले तर त्यांना आपली शारीरिक सुदृढता सुधारण्यासाठी योग्य ते उपाय करता येतील व आरोग्याच्या चांगल्या सवयीं अंगीकारून जीवनभरासाठी स्वास्थ कमावता येईल .याच दृष्टीकोनातून संशोधकाने सदर संशोधन करण्याचे ठरविले होते .

### संशोधनाची उद्दिष्ट्ये

१- महाविद्यालयीन विद्यार्थांच्या हृदयाच्या दमदारपणा आरोग्यधिष्ठीत शारीरिक सुदृढतेचे मापन करणे .

२-महाविद्यालयीन विद्यार्थांच्या हृदयाच्या दमदारपणा आरोग्यधिष्ठीत शारीरिक सुदृढतेचा स्तर अभ्यासणे .

३.-महाविद्यालयीन विद्यार्थांसाठी हृदयाच्या दमदारपणा आरोग्यधिष्ठीत शारीरिक सुदृढतेची मानके तयार करणे .

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परिसीमा

१-प्रस्तुत संशोधन हे पुणे विद्यापीठ अंतर्गत पुणे जिल्ह्यातील पुणे जिल्हा क्रीडा विभाग व पुणे शहर क्रीडा विभागा पुरतेच मर्यादित आहे .

२-प्रस्तुत संशोधन हे पुणे विद्यापीठाशी संलग्न .पुणे जिल्ह्यातील विज्ञान शाखेचा पदवी अभ्यासक्रम उपलब्ध असणाऱ्या महाविद्यालयातील शैक्षणिक वर्ष२०१५ते२०१७पर्यंत प्रथम वर्षात शिक्षण घेत असलेले १७ ते२०वर्ष वयोगटातील विद्यार्था पुरतेच मर्यादित आहे .

३-प्रस्तुत संशोधन हे हृदयाचा दमदारपणा या घटकापुरतेच मर्यादित आहे .

संशोधनपद्धती

प्रस्तुत संशोधनासाठी वर्णनात्मक पद्धतीतील सर्वेक्षण पद्धतीचा वापर केला आहे .

न्यादर्श

संशोधकाने पुणे विद्यापीठाशी संलग्न असणाऱ्या पुणे जिल्ह्यातील पुणे जिल्हा व पुणे शहर या दोन क्रीडा विभागातील विज्ञान शाखा असणाऱ्या प्रत्यकी१६महाविद्यालयाची निवड सहेतुक पद्धतीने करून प्रत्येक महाविद्यालयातून लॉटरी पद्धतीने५०विद्यार्थी निवडले अशा प्रकारे दोन क्रीडा विभागातील ऐकूण८००विद्यार्थांची यादृच्छिक पद्धतीने निवड केली.

माहिती संकलनाची साधने

हृदयाचा दमदारपणा या आरोग्य धिष्ठीत शारीरिक सुदृढता घटकाचे मापन करण्यासाठी खालील चाचणीच्या साह्याने विद्यार्थांचे कार्यमान मोजण्यात आले

शारारिक सुदृढतेचे घटक	मापन चाचणी	एकक
हृदयाचा दमदारपणा	१२मिनिट चालणे किंवा धावणे	मीटर

माहितीचे संख्याशास्त्रीय विश्लेषण व अर्थनिर्वचन

माहितीचे संख्याशास्त्रीय विश्लेषण करण्यासाठी एस पी एस एस १७. ०व्हर्जनचा वापर करून मध्यमान ,प्रमाण विचलन ,वारंवारता टक्केवारी ,तिरपेपणा ,कुकदवक्रता व पर्सेटाईल यावर्णनात्मक संख्याशास्त्रीय साधनांचा वापर करण्यात आला . त्यापैकी२०व्या ,४०व्या ,६०व्या व८० व्या पर्सेटाईलच्या साहाय्याने शारीरिक सुदृढतेचे घटकाचे पाच श्रेणी तयार करून मानके तयार करण्यात आली .सामान्य संभाव्यता वक्राच्या साहाय्याने प्राप्तकाचे वितरण स्पष्ट करण्यात आले :

शारीरिक सुदृढता घटक -१२मिनिट चालणे किंवा धावणे वर्णनात्मक सांख्यिकी

संख्या	600
मध्यमान	१८७२. २४
प्रमाण विचलन	३६८. २४
तिरपेपणा	০, ৬৬४
तिरपेपणा मधील प्रमाणत्रुटी	०. ०८६
कुकदवक्रता	0.069

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१२मि चालणे व धावणे चाचणीचे मानके व त्यानुसार विद्यार्थांचे वर्गीकरण

श्रेणी	१२मि .कापलेलं अंतर	विद्यार्थी संख्या	शेकडा प्रमाण
अतिशयकमी	ह१६२०	१७४	२१.८%
कमी	१६२०. ०१ते१६५९. ९९	१५५	१९.४%
समाधानकारक	१६६०. ००ते१७४५. . ९९	१५१	१८. ९%
चांगला	१७४६. ००ते२२५०. ००	१६३	२०.४%
उत्तम	२२५०≨	१५७	१९. ६%
	ऐकूण	600	200.0%

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१२मिनिट चालणे किंवा धावणे या चाचणीच्या मानकांनुसार ३२० (४०%) विद्यार्थांच्या हृदयाचा दमदारपणा चांगला व उत्तम आहे .त्यापैकी१६३(२०.४%)विद्यार्थांच्या हृदयाचा दमदारपणा चांगला आहे व१५७(१९. ६%)विद्यार्थांच्या हृदयाचा दमदारपणा उत्तम आहे . हृदयाचा दमदारपणा समाधानकारक असणाऱ्या विद्यार्थांची संख्या काहीशी कमी म्हणजेच१५१(१८. ९%) दिसून येते .१५५(१९. ४%)विद्यार्थांच्या हृदयाचा दमदारपणा कमी असून१७४म्हणजेच२१.८% विद्यार्थांच्या हृदयाचा दमदारपणा अतिशय कमी आहे .परंतु सरासरी सर्व विद्यार्थांच्या हृदयाचा दमदारपणा चांगला आहे .

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**RESEARCH NEBULA** 

 या संशोधनादवारे आपल्याला नेमबाजांसाठी आवश्यक असणारे शरीरमापन घटकाची निवड करून त्या खेळाडूस शूटिंग खेळामध्ये सहभागी करून घेता येईल.

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संशोधनाची उददिष्टे:

महाराष्ट्रातील वरिष्ठ गटातील दहा मीटर रायफल शूटिंग व दहा मीटर पिस्तोल शूटिंग खेळाडूंच्या उभ्याने उंचीची तुलना करणे. परिकल्पनाः

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कार्यमान गाठता येते. सदर संशोधनासाठी संशोधकाने नेमबाजी

खेळामध्ये उच्च कार्यमान गाठण्यासाठी कोणते शरीरमापन घटक

महत्त्वाचे आहे हे तपासण्यासाठी संशोधकाने उभ्याने उंची या शरीरमापन घटकाचा प्रस्तुत संशोधनामध्ये समावेश केलेला आहे.

"रायफल व पिस्तोल शुटींग खेळाडू यांच्यातील शरीरमापन

(मोंडल, २०११)

संशोधन समस्या व स्पष्टीकरणः

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H₀ : दहा मीटर खेळाडूंच्या शरीरम नाही. परिसीमा / संशोध या क्रीडा प्रका 2. सदर संशोधन रायफल व पि 3. सदर संशोधन समावेश असेत संशोधन पद्धती: प्रस्तृत संशोधनात आहे. न्यादर्श महाराष्ट्रातील वर्ति व १०० पिस्तोल वर्ति महाराष्ट्रातील वर्ति व १०० पिस्तोल मत्रा, या संख्या प्रस्तुत संशोधनात प्रसतुत संशोधनात प्रसतुत संशोधनात प्रसतुत संशोधनात प्रसतुत संशोधनात प्रसतुत संशोधनात हा the Soci संख्याशास्त्रीय वि काढले.	रायफल ापन घटव नाची व्या नात दहा रांचा समाग त महाराग स्तोल शूति ात उभ्या त नर्णनात्म एवात आत धने: ते परिक्षीव स्त्रीय सा ाहितीचे ति ा संशोधव वे रायफल दे तुलना	शूटिंग व दहा जमध्ये सार्थव प्ती व मर्यादा मीटर रायफल वेश केलेला अ ष्ट्रातील वरिष्ट टंग पुरुष खेळ ने उंची व तक सर्वेक्षण ले एकूण १०० खेळाडूंची सहे त्री. विधे विश्लेषण ज, मध्यमान धनांचा वापर वेश्लेषण व अ जने SPSS ( nces) सॉफ्ट न योग्य अर्थ ष्टटक क्र. १ ग शूटर यांच्या त्मक विश्लेषण	Journal ] मीटर 1 5 फरक े व दहा हे. 5 गटाती हूंचा सम कार्यमान पद्धतीचा • रायफल तुक पध करण्यास त्तुक पध करण्यास तीले फ तील (33	<u>n Arts, (</u> पिस्तोल आढळून मीटर पि ल राज्य गवेश आ या घ या घ या घ या घ या घ या घ दतीने दतीने दतीने दतीने दतीने दतीने दतीने दतीने दतीने दतीने द्या करून वापर करून द्या दे या घ दतीने दे दाने दतीने दे दाने दतीने दे दाने दतीने दे दाने दतीने दे दाने दाने दाने दतीने दे दाने दाने दाने दाने दाने दाने दाने	् <u>गातारि</u> शूटिंग येणार पेस्तोल स्तरीय हे. टकांचा हे. टकांचा ब केला खेळाडू न्यादर्श यमान, धीनता ckage कस्ज्न निष्कर्ष चीचे	(प्रमाण विचलन ± ५.९१९) आणि रायफल शूटिंग खेळाडूं मध्यमान १७१ (प्रमाण विचलन ± ६.१४०) एवढे आढळले. वर्णनात्मक सांख्यिकीवरून असे दिसून येते की रायफत शूटिंग व पिस्तोल शूटिंग या दोन्ही खेळांतील खेळाडूंच (उभ्याने) उंची सारखीच आहे. मात्र ती सार्थक आहे किंवा नाह हे तपासण्याकरिता संशोधकाने या दोन्ही गटांतील खेळाडूंच्य (उभ्याने) उंचीची टी' परीक्षिका वापरून तुलना केली ती पुढीत प्रमाण. पिस्तोल शुटींग खेळाडूंच्या (उभ्याने) उंचीची मध्यमानातील प्रमाणत्रुटी ०.५१९ व रायफल शुटींग खेळाडूंच्या मध्यमानातील प्रमाणत्रुटी ०.६१४ आढळून आले. (उभ्याने) उंचीचे रायफल आणि पिस्तोल शुटींग खेळाडूंच्या मध्यमानातील फरक हा ०.४६८ एवढ आहे. पिस्तोल शुटींग आणि रायफल शुटींग खेळाडूंच्या (उभ्याने) उंचीमध्ये फरक वघण्यासाठी दोन गटामध्ये टी-टेस्टचा वापर करण्यात आला. प्राप्त टी-मूल्य हे ०.५४८ असून स्वाधीनता मात्रा १९८ साठी ०.०५ सार्थकता स्तरावर हा फरक सार्थक नही. त्यामुळे संशोधकाने H <sub>0</sub> : दहा मीटर रायफल शूटिंग व दहा मीटर पिस्तोल शूटिंग खेळाडूंच्या शरीरमापन घटकामध्ये सार्थक फरक आढळून येणार नाही. या शून्य परिकल्पनेचा स्विकार केला व पर्यायी परिकल्पनेचा त्याग केला आहे. निष्कर्ष: पिस्तोल शूटिंग व रायफल शूटिंग खेळाडूंची उभ्याने उंची सारखी असून त्यामध्ये सार्थक फरक नाही. शिफारशी: प्रस्तुत संशोधनात संशोधकाने रायफल व पिस्तोल शूटिंग पुरुष खेळाडूंकरिताच संशोधकाने रायफल व पिस्तोल शूटिंग पुरुष खेळाडूंकरिताच संशोधकाने रायफल व पिस्तोल शूटिंग पुरुष खेळाडूंकरिताच संशोधकाने सार्थक खेळाडूंचरती संशोधन करता येईल. संदर्भ:
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<u>। राषा  </u> कोष्टक क्र. १ वस् (उझ्याने) उंचीची पिस्तोल शटिंग	<u> </u>	<u>ै।</u> न शूटर व रा ज्ली असता	। यफल शू असे दिः	। टर यांच् सून येतं	। यातील ने की,	<ol> <li>माडल, ए., मजुमदार, आ., अँड पाल, ए. (२०११). ॲन्ग्रोपोमेट्री अँड फ़िजिओलॉजिकल प्रोफाईल ऑफ इंडियन शुटर. इंटरनॅशनल जर्नल ऑफ अप्लाईड स्पोर्ट्स सायंसेस, २३, ३९४- प्रनः</li> </ol>



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# International Journal of Health, Physical Education and



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International Federation of Physical Education, Fitness and Sports Science Association

# बास्केटबॉल खेळाडूंच्या एकाग्रतेवर यो।ाचा होणारा परिणाम अभ्यासणे

प्रा. दिपक प्रकाश सौदा। र, संचालक, शारीरिक शिक्षण व क्रीडा म.वि.प्र. कला, विज्ञान व वाणिज्य महाविद्यालय, ओझर मिग, ता. निफाड, जि. नाशिक इमेल- dpsaudagar@gmail.com मोबाईल- ९३७००४९५०७/८४४६३५७२३२

# सारांश:

बास्केटबॉल खेळाडूंना आपले कौशल्य सादर करताना उत्तम प्रकारची एकाग्रता या घटकाची आवश्यकता असते. ही गरज योग प्रशिक्षणाद्वारे पूर्ण केली जाऊ शकते का? हे तपासण्यासाठी बास्केटबॉल खेळाडूंच्या एकाग्रता या घटकावर योग प्रशिक्षणाचा काय परिणाम होतो. हे पाहण्यासाठी नाशिक शहरातील १८ वर्षाखालील २५ खेळाडूंची सहेतुक पद्धतीने निवड करण्यात आली होती. सदर संशोधनासाठी प्रायोगिक पद्धत वापरण्यात आली. जी.सी.आय.कसोटी (एकाग्रता) हे माहिती संकलनाचे साधन वापरण्यात आले असून सांख्यिकीय विश्लेषणासाठी मध्यमान, प्रमाणविचलन, मध्यमानातील फरक, एफ मुल्ये यांचा वापर करण्यात आला. योग प्रशिक्षणामुळे बास्केटबॉल खेळाडूंच्या एकाग्रता या घटकावर योग प्रशिक्षणाचा सार्थक परिणाम होतो हे स्पष्ट झाले.

महत्वाच्या संज्ञा: बास्केटबॉल खेळाडू, एकाग्रता, योगा

# प्रस्तावनाः

बास्केटबॉल खेळामध्ये मनाची एकाग्रता हा घटक महत्वाचा आहे. बास्केटबॉल खेळ खेळताना पासिंग, ड्रिबलिंग, बास्केट शूटींग असे विविध कौशल्य करताना एकाग्रता आवश्यक असते. बास्केटबॉल खेळासाठी योगाचा कितपत उपयोग होईल याची माहिती नसल्याने संशोधकाने योगा व बास्केटबॉल खेळ यांची सांगड घालण्यासाठी हा विषय हाती घेतला आहे.

योग प्रशिक्षणाद्वारे बास्केटबॉल खेळाडूंच्या एकाग्रता या घटकावर प्रभुत्व मिळवून का-यामानात वाढ होते का? हे अभ्यासण्यासाठी संशोधकाने हा विषय निवडला आहे. संशोधनाची उद्दिष्ट्ये:

- बास्केटबॉल खेळाडूंची एकाग्रता व कौशल्य कार्यमान या घटकांच्या सध्यस्थितीचे चाचणीद्वारे निरीक्षण करणे व या घटकांचे कार्यमान वाढविण्यासाठी कार्यक्रम राबविणे.
- बास्केटबॉल खेळाडूंची एकाग्रता व कौशल्य कार्यमान या घटकांचे मापन तीन महिन्याच्या योग प्रशिक्षणानंतर करणे.

## परिकल्पनाः

H1 योग प्रशिक्षणाम्ळे बास्केटबॉल खेळाडूंच्या

एकाग्रतेवर व कौशल्य कार्यमानावर सार्थक परिणाम होईल.

- परीसीमाः 1. प्रस्तुत संशोधन हे बास्केटबॉल खेळाडूंपुरतेच म-यादित आहे.
- प्रस्तुत संशोधनात नाशिक शहरातील १८ वर्षाखालील बास्केटबॉल मुले खेळाडूंचा समावेश करण्यात आला आहे.
- प्रस्तुत संशोधनात एकाग्रता या घटकाचाच विचार करण्यात आला आहे

संशोधन पध्दती:

प्रस्तुत संशोधनात प्रायोगिक पध्दतीचा वापर करण्यात आला आहे.

प्रायोगिक अभिकल्प- Time series Design.

पुर्व चाचणी-(मोकळा वेळ) - मध्य चाचणी- प्रायोगीक पध्दत-उत्तर चाचणी



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न्यादर्श: प्रस्तुत संशोधनात (n=२५) नाशिक शहरातील १८ वर्षाखालील एकूण २५ बास्केटबॉल मुले खेळाडुंची





al Impact Factor 7.217 ed) International Research Journal International Federation of Physical Education, Fitness and Sports Science Association

निवड सहेतुक पद्धतीने केली आहे माहिती संकलनाची साधने:

एकाग्रता- बेरा जी.सी.आय.कसोटी, बास्केटबॉल कौशल्य कार्यमान

संख्याशासीय साधने: मध्यमान, प्रमाणविचलन, मध्यमानातील फरक, प्रमाणत्रुटी मध्यमानातील फरक आणि एफ-परिक्षीका इ.

# माहीतीचे संकलन व विश्लेषण:

प्रस्तुत संशोधनामध्ये संशोधकाने कसोट्यांच्या आलेल्या प्राप्ताकांच्या सांख्यीकीय विश्लेषणासाठी (SPSS) सॉफ्टवेअरची मदत घेऊन मध्यमान, प्रमाणविचलन, मध्यमानातील फरक, प्रमाणत्रुटी फरक, स्वाधीनता मात्रा आणि एफ मुल्ये यांचा वापर केलेला आहे.

# कोष्टक क्र. १ बेरा जी.सी.आय कसोटीच्या तीन चाचण्यांचे वर्णनात्मक सांखिकी

कसोट	्या	विद्या र्थी संख्या	मध्यमा न	प्रमाण विचल न	प्रमा ण तृटी
बेरा जी.सी.आ य	चाच णी क्र.१	રક	७२.७९	4.08	8.08
(एकाग्रता)	चाच णी क्र.२	રષ	66.6 <del>2</del>	8.23	o.90
	चाच णी क ३	२५	92.38	8.84	٥.2٤

कोष्टक क्र.१ मध्ये बेरा जी.सी.आय या कसोटीचे वर्णनात्मक सांखिकी विश्लेषण दर्शिविले आहे. ज्यामध्ये बेरा जी.सी.आय कसोटीचे मध्यमान ७२.७९ प्रमाण विचलन ५.०१ तर प्रमाण नुटी मध्यमान १.०१ एवढे आहे.

चाचणी क्र.२ नुसार बेरा जी.सी.आय कसोटीचे मध्यमान, प्रमाण विचलन, प्रमाणत्र्टी मध्यमान अनुक्रमे ७७.७५, 8.८२ व ०.९७ एवढे आहे. चाचणी क्र.३ नुसार बेरा जी.सी.आय कसोटीचे मध्यमान ९८.३१, प्रमाण विचलन ४.१५ व प्रमाणत्रुटी मध्यमान ०.८६ एवढे आहे. कोष्टक क्र. २ बेरा जी.सी.आय कसोटीची 0 टातील

तलना

कसोट्या			स्वाधीन	वर्गाचे	एफ
		वर्गाची बेरीज	ता मात्रा	मध्यमा न	मूल्य
बेरा जी.सी.आ	गटातील	6380.E	२	5.19918 R	963.9
य (एकाग्रता )	गटाअंतर्ग त	१६३०.९ २	59	90.95	3

कोष्टक क्र.२ नुसार गटातील व गटांतर्गत बेरा जी.सी.आय कसोटीची तुलना केली असता 'एफ' चे मूल्य अनुक्रमे १८३.१३ इतके आहे. हे मुल्ये ०.०५ या सार्थकता स्तरावर सार्थक आहे. त्यावरून असा निष्कर्ष येतो की, बेरा जी.सी.आय कसोटीच्या तीन ही चाचण्यांच्या सरासरी कार्यमानात संख्याशास्त्रीयदृष्ट्या सार्थक फरक आहे.

# कोष्टक क्र. ३ बेरा जी.सी.आय कसोटी (एकाग्रता) चाचण्यांची बहविध तुलना

	कसोट्या		मध्यमानातील फरक	प्रमाण त्रुटी
बेरा जी.सी.आय	चाचणी क्र. १	चाचणी क्र. २	४.८२	8.34
कसोटी		चाचणी क्र. ३	२३.४९ +	8.34
	चाचणी क्र. २	चाचणी क्र. १	8.23	8.34
		चाचणी क्र. ३	<b>१८.६०+</b>	8.34
1 A.	चाचणी क्र. ३	चाचणी क्र. १	२३.४९+	8.34
		चाचणी क्र. २	<b>٢</b> ८.६۰۰	8.34

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कोष्टक क्र.३ नुसार बेरा जी.सी.आय कसोट्यांची बहुविध तुलना केली असता बेरा जी.सी.आय कसोटीमध्ये चाचणी क्र.१ व २ मधील मध्यमानातील फरक ४.८२ असून संख्याशास्त्रीयदृष्ट्या तो सार्थक नाही. (०.०५) तर चाचणी क्र.१ व ३ मधील मध्यमानातील फरक २३.४९\* एवढा आहे. हा फरक ०.०५ या सार्थकता स्तरावर सार्थक आहे. तर चाचणी क्र.२ व ३ मधील मध्यमानातील फरक १८.६०+ इतका आहे की जो ०.०५ या स्तरावर सार्थक आहे.

वरील चाचणीची बहुविध तुलना केल्यावर असे लक्ष्यात येते की, विविध योग प्रशिक्षणामुळे बेरा जी.सी.आय कसोटीच्या कार्यमानात तीन महिन्यांच्या कालावधी नंतर संख्याशास्त्रीय दृष्टीकोनातून सार्थक अशी वाढ झाली आहे.

# निष्कर्ष:

FCSS

- योग प्रशिक्षणामुळे बास्केटबॉल खेळाडूंच्या एकाग्रता या घटकावर सार्थक परीणाम होतो व या घटकात वाढ होते.
- 2. योग प्रशिक्षणामुळे बास्केटबॉल खेळाडूंच्या कौशल्य कार्यमानावर सार्थक परीणाम होतो व यात वाढ होते. म्हणून संशोधक याठिकाणी H<sub>1</sub> योग प्रशिक्षणामुळे बास्केटबॉल खेळाडूंच्या एकाग्रतेवर व कौशल्य कार्यमानावर सार्थक परिणाम होईल. या संशोधन परिकल्पनेचा स्वीकार करतो

# चर्चा:

वरिल संख्याशास्त्रीय विश्लेषणावरून असे आढळून आले की, बेरा जी.सी.आय. या चाचणीच्या मोकळ्या वेळी (चाचणी क्र.१ व २ दरम्यान) च्या प्राप्तांकात सार्थक फरक आढळत नाही. प्रयोगावेळी (चाचणी क्र. २ व ३ दरम्यान) च्या का-यामानाच्या प्राप्तांकात सार्थक फरक आढळतो. या ठिकाणी संशोधकाने संशोधन परीकल्पना क्र.१ H<sub>1</sub> चा स्वीकार केला आहे, म्हणजेच योग प्रशिक्षणामुळे बास्केटबॉल खेळाडूंच्या एकाग्रता घटकात वाढ होते हे सिद्ध झाले.

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# Aayushi International Interdisciplinary Research Journal

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# A Study on Fungal Diversity and Soil pH of North East region of Nashik Tehsil of Nashik District, Maharashtra, (India)

# Dr. Sharad A. Dhat

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## Abstract

Soil fertility play a significant role in the farming crop production, in the soil fertility edaphic factors and microbial community has an important role. The excessive application of fertilizers changes the production capability of the soil where as it makes some impact over the fungal diversity of the soil. Fertilizer management and farmers cultivation practices are important associated factors with fertility and fungal diversity of soil. In this study we did a try to explore the interrelation of farmer cultivation practices and fertilizer management with the soil fertility and fungal diversity of North eastern region of Nashik Tehsil of Nashik District, Maharashtra India. The farming practices and fertilizer management results increase in fungal diversity and soil fertility. The region characterized the deep black soil where the farmers are well known with modern fertilizers management and farming practices. **Keywords: Diversity, Edaphic factors, Fertilizer, Management, Soil fungi.** 

## I. Introduction:

Soil fertility is associated with physical factors, microbial factors, fertilizer management and farming practices and it collectively result in production capability of soil. The fungal biodiversity is the important element of ecosystem progress and make deep impact over the soil pH (Dan Liu, 2018). fungi are the important inhabitant of soil and it have a capacity to adopt any unfavourable condition. Because of their ability to generate variety of extracellular enzymes, they can decompose any kind of organic matter and it results in carbon and nutrients (Zifcakova L. 2016). Some species of fungi have ability to possess as bio sorbent of toxic metals like zinc, cadmium, mercury, lead they absorbing then their bodies (Baldrian, P. 2003). The fungal diversity and fungal activity are regulated by biotic factors like plant and living organism and also by abiotic factors like temperature, pH, salinity, moisture etc.

The fungal communities are highly influenced by environmental factors and the anthropogenic activities. The current scenario of climate change and changing land use pattern has a crucial role in the fungal diversity transition (Lluvia Vargas-Gastélum, 2015). Arbuscular mycorrhizal fungi are very important class of supporting microorganism for agriculture soil, it helps to increase the crop production and health. The general diseases of crops are controlled by some antagonistic fungi such as *Glomus* sp. or *Trichoderma* sp. suppressing fungal pathogens (Dawidziuk, 2016). The present study is carried out on five rural localities of north eastern Nashik tehsil of Nashik District.

# **II.** Materials and Methods

## II.I. Study area:

Nashik is tehsil headquarter tehsil of Nashik District which is surrounded by Nashik, Sinner, Igeatpuri, Tryambakeshwar, Peth, Dindori and Niphad tehsil of the district. Five villages of the study region are selected for the study area is a part of deccan plateau. The parent rock of soil is basalt so the black deep soil found over the study area. The region is drain by river Godavari. The geographical coordinates of study region are 19.9975° N, 73.7898° E. Location map of study region have been prepared by using Arc GIS DEM Model.



Prepared by Dr. Sharad Dhat Arc GIS DEM

#### **II.II.** Collection of Soil samples

The random sampling method has been adopted for the sample collection. Five villages of the north eastern Nashik tehsil have been selected for soil sample collection; these were. Adgaon, Vinchur Gavli, Sayyed Pimpri, Dahegaon and Devargaon from each locality 50 gm of soil sample was collected from a depth of 10-15 cms. The collected soil samples were brought to the laboratory and stored at 4°C until further use.

# II.III. Methodology

The soil pH calculation has done by placing a glass electrode in a mixture of soil and deionized water, for that soil samples are collected form the study area on 10 to 15 cm depth. The collected samples are stored in normal temperature till the testing. The soil fungi were isolated by using the soil dilution plate count method (Subba Rao, 2004) on Czapek's Dox Agar. 1 gm of soil sample was suspended in 200 ml of sterile autoclaved water. 1 ml of the microbial suspension was added to sterile Petri dishes upon which the Czapek's Dox Agar medium was added by pour plate method.

#### **III.** Results and Discussion

All the five localities are agriculturally well grown sides where the horticulture and intensive agriculture have been practiced. all the localities are adjoining with the district headquarter so the large demand of vegetables and fruits have results in the intensive agriculture practices. In recent time farmers fertilizer management and farming practices makes favourable environment for the fungal diversity growth. In recent time for the development of plant crop productivity the application of cultivating soil fungal diversity has been adopted and it boost the soil quality (Bagyaraj, D. J. and Ashwin, R. (2017). in the assessment of fungal biodiversity, the structural analysis of fungal population is important to determine their function for soil and plant health and directly and indirectly effect on fungal community (Abawi, G. S. 2000). Soil health means ability of the soil to sustain biological productivity, environmental quality, and provide fertile condition to living organism in the soil (Magdalena Frac, 2018)

In the present study, a total of 37 fungal types were detected from 5 villages of Nashik tehsil namely Adgaon, Sayyed Pimpri Devergaon, Dahegaon and Vinchur Gawli.. A total of 38 fungal species belonging to 26 genera were recorded during the study from these villages. The soil microflora was observed to study the

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diversity of the fungi in study area. The most common and dominant genus recorded was *Aspergillus* with 15 species. *Aspergillus niger* was the dominant species among them some are Pathogenic and it causes skin infections where species like *Aspergillus flavipes* causes allergy, hypersensitivity; Also useful and can be used as biocontrol agent. The species like *Trichoderma lignorum, Trichoderma viride* are helpful as biocontrol agent, biofungicide. The fungal species like *Fusarium moniliformae, Fusarium oxysporum, Fusarium rodlens, Fusarium semitectum* are plant pathogen which causes disease on the plant. The diversity of fungi in the study region was found to be significantly high. The growth of other fungal species may have been prevented due to the toxins produced by *Aspergillus* species. Among the five localities of the study region Adgaon village have maximum fungal diversity and soil fertility.

# **IV.** Conclusion

The result of the survey indicates that the study region is characterised by agriculture and horticulture practices, black soil has been extended over the area which have high potential. The regional farmers are well known with fertilizer management. The fungal diversity and soil Fertility have positive corelation in the study region. Around 37 species of the fungi are detected among the five localities of the study region. The *Aspergillus genus* of fungi dominantly recorded over the study region. Farming practices and fertilizer management results positive growth in fungal diversity and soil health. Tehsil have very rich fungal diversity and is characterized by a larger proportion of *Aspergillu genus* of fungi. The fungal diversity of tehsil is influenced by anthropogenic activity and changing agriculture patterns.

Sr. No.	Name of the Fungi	Adgaon	Sayyad Pimpri	Devargaon	Dahegaon	Vinchur Gawali
1	Absidia corymbifera	+	-	-	-	-
2	Alternaria <mark>a</mark> lternata	+	-		- 2	-
3	Aspergillus carbonarius	+	+	+	+	+
4	Aspergillus <mark>chaveleri</mark>	+	/		- 5	-
5	Aspergillus flavipes	+	+	+	+	-
6	Aspergillus f <mark>la</mark> vus	+	+	+	18	-
7	Aspergillus fumigatus	+	+	+	-	+
8	Aspergillus nidulans	+	+	- /	<ul> <li>&lt;=</li> <li></li></ul> <li>&lt;=</li> <li>&lt;=&lt;</li>	+
9	Aspergillus niger	+	+	+	+	+
10	Aspergillus petrakii	1Ston-		ten	+	+
11	Aspergillus repens	+	+	-	-	+
12	Aspergillus sclerotium	+	+		- /	+
13	Aspergillus sulphureus	+	-	+	+	-
14	Aspergillus terreus	" H a	iriour	nal.co.	-	+
15	Aspergillus ustus	+	+	+	-	-
16	Bispora sp.	+	-	+	-	+
17	Cladosporium herbarum	+	-	+	+	+
18	Curvularia lunata	+	-	+	-	-
19	Fusarium moniliformae	+	+	+	+	+
20	Fusarium oxysporum	+	+	+	+	+
21	Fusarium rodelens	+	-	+	-	-
22	Fusarium semitectum	+	-	-	+	+
23	Geotrichum sp.	+	-	-	-	-

 Table 1: Occurrence of fungal species and Soil pH in North eastern Nashik Tehsil

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24	Mortierella sp.	+	-	-	-	-
25	Mucor globosus	+	-	-	-	-
26	Mucor plumbeus	+	-	+	+	+
27	Penicillium funiculosum	+	+	+	+	-
28	Penicillium varians	+	+	-	-	-
29	Penicillium verrucosum	+	-	+	-	-
30	Phoma eupyrena	+	+	-	-	-
31	Phoma herbarum	+	-	+	-	-
32	Rhizoctonia bataticola	+	-	-	+	-
33	Rhizoctonia solani	+	-	-	-	-
34	Rhizopus nigricans	+	-	-	-	-
35	Rhizopus stolonifer	+	+	+	+	+
36	Stemphylium sp.	+	-	-	-	+
37	Trichoderma viride	+	+	+	+	+
	Number of fungal Species	37	8	13	09	10
	detected			J		
	Soil pH	7.58	7.32	7.28	7.38	7.26



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### Geographical Structure and Potability of Cold-water spring -Taked, Nashik Dr. Sharad A. Dhat

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#### Introduction

In the study of the warm or cold springs, Geomorphology and geology has main influence on the occurrence, distribution, movement and storage of ground water in the earth surface. Geomorphologic processes are generally complex and it reflects in many ways on the surface. The geographical aspects of cold spring its discharge temperature and its locational aspect are also studied for this investigation. basically, in the study of the springs, the geographical location of spring is the place where small stream of ground water appears over the surface or where the groundwater reservoir is discharging on the land surface. Generally it is the result of existence of impermeable layer of surface rock and there is natural leakage of ground water on the surface. Springs are varying on their characteristic of temperature, flow and chemical properties of the water. Some springs are being seasonal and some are perennial, some springs have almost continuous and constant flow of clear water and even temperature while some springs cannot flow regularly. Spring water has usually metrological character that is, rain that has infiltrate in to the ground and emerged as a spring at some other point on a lower level. on the basis of chemical properties are available in the spring water the spring are classified in different types like Sulphur spring, salt springs and many other.

#### Study region

Taked cold water spring is located near to Taked budruk village in Igatpuri tehsil of Nashik district Maharashtra. It is around 38 km west to Nashik city. This place locally famously known as "Sarv Tirth Jatayu Mandir Taked" it is famous local religious tourist point for local and district tourist. Taked cold water spring is located near to Kadva Dam the small stream of kadva river disappear in to kadva dam. It is hilly terrain of western ghats or Sahyadri. The morphological setup of the terrain has significant role in the occurrence of taked cold water spring, the terrain is ideal site to undertake estimation of Cold Spring. It represents possible various geomorphic characteristics, the water characteristics also varies in nature throughout the area, the latitudinal and longitudinal extent of the taked cold spring is 19° 30'12" N to19° 45'14" N latitude and 73° 45'00" E

to 74° 00'03" longitude.



**Objectives:** 

- 1. To study Geological aspects of cold-water spring.
- 2. To study the potability of cold-water spring.

#### **Methods and Materials**

The primary data regarding the geographical and geomorphological aspects are collected with the help of survey of India toposheet of the study region and field visit. Geological setup of the study region is collected from various sources like reference books of geology of Maharashtra. The morphology of the region is investigated with the help of google earth and satellite image of the study region. Arc GIS tool is used to form the location map of the study region. The water samples of the cold spring of taked are collected from actual spring location, the temperature of the water is calculated at the origin of the spring. The various characteristics of the cold-spring water are tested at chemistry laboratory of the college.

# **Result and Discussion:**

# **Relief of the study region:**

The study area has a rigid topography it is a part of western ghats or Sahyadri of state Maharashtra. Study region is the south west part of Igeatpuri tehsil of Nashik district. The region is characterized by hilly terrain and shows reared nature in terms of relief. It exhibits moderate to high relief. Thus, the elevation ranges is from 600 meters and highest peak of Sahyadri rage "Kalsubai" is situated near to study area in the Ahmednagar district.

#### Geology:

The western ghat or Sahyadri is mountain range which runs along with the western cost of Indian peninsula. Western ghat is one of the worlds important hotspot of natural biodiversity. In the Geology of the study region it has volcanic formation. whole study region is covered by deccan plateau. The Deccan plateau began forming 66.25 million years ago, at the end of the Cretaceous period. The maximum volcanic eruption occurred at the Western side of the deccan plateau around 66 million years ago. The mountain ranges of the study region are flat-topped and separated by valleys. The hill ranges of the region have alternate strata of different rock which represents considerable situation for springs.

#### **Climate:**

The study region is serving with tropical type of climate, where whole region of deccan trap is comes under the tropical type of climate which strongly influenced by southwest monsoon. The local variation of climate ranging from sub humid to arid. In some patches of the district humid tropical climate has been observed. The study area has the monsoon dominated characteristic; the area commonly varies the following weather conditions over the year.

- 1. Cold weather season during **December to February** months of the year, when the temperature on lowest point in the year. In coldest time of the region rainfall is completely absent where the temperature recorded between 26° to 30° c
- 2. Hot weather season during March to May or starting weeks of the June when the temperature reaches on it peaks these days are the hottest days of the year, where the temperature range found between 40° to 45° C and at night it reaches on 15° to 18° c.
- 3. South West Monsoon period or Rainy season during the June to September it is the period of south west monsoon, when the study area receives the maximum rainfall of the year. The average range of the rainfall in the area is between 200cm to 250cm, where the temperature found between  $30^{\circ}$  to  $35^{\circ}$ during this time of the year relative humidity remains very high around 80 %.
- 4. Post monsoon period which is also known as retreating monsoon period of the year between October to December when the temperature is showing increasing trend it founds around 30° to 35°C.

## Drainage Pattern of the study Area:

The Taked cold spring located in the Igeatpuri tehsil of the Nashik district. Igeatpuri tehsil is the western most tehsil of the district which adjoin with western ghat. Sahyadri mountain ranges are prime source region of all the revers of the area, the region has eastward slope so maximum rivers of the region are east flowing rivers. Taked Cold Spring is located near to left bank of Kadva river basin. Which originates from hills of Sahyadri and flow towards the east according to slope, where the rainfall around 200 cm annually. Kadva river is seasonal river which receives large water supply during the monsoon season of the year. The surrounding area of the taked cold spring is covered by evergreen forest.

#### **Properties of Cold Spring Water:**

The quality of groundwater is equally important as its quantity. To recognize the quality of water, the measurement of quality criteria is important which include measures of chemical Physical, biological and radiological components are specified as well standard methods for reporting and comparing results of water analyses. Dissolve's gases in groundwater can pose hazard if their presence goes unrecognized. The uniformity of groundwater temperature is advantageous for water supply and industrial purpose. Physical

#### properties and Physical Analysis of Cold Spring water:

In physical properties of cold-water Spring contain various physical components such as temperature, colors of water, organism, testes, dissolved gasses, mineral matter, or phenols, etc. In a physical analyses of cold Spring water , Temperature is reported in degree Celsius and necessarily measured immediately after collecting the sample . Color of groundwater may be due to mineral or organic matter in solution and is reported in MG/2 by comparison with standard solutions. Turbidity is a measure of the suspended and colloidal matter in water, such as , silt organic matter and microscopic organism. Measurements are often based on the length light path through the water which just cases the image of a flame of standard candle to disappear, The natural filtration produced by unconsolidated aquifers largely eliminator turbidity, but odors may be divided from bacteria, dissolved gases, mineral matter or phenols Following table shows the physical properties of study areas

Sr. No	Physical parameters	Taked	Units
1)	Color	Clear	-
2)	Odour	Odour free	-
3)	Temperature	24.3	С
4)	Suspended solids	21	MG/L
5)	Dissolved solids	419	MG/L
6)	Total	440	MG/L
7)	Turbidity	1.1	N.T.U.
8)	Dissolve's oxygen	6.3	MG/L

#### **Chemical Properties of Cold Springs Water:**

Various chemical properties of water are varies with regional variation, cold Spring waters contain the chemical components such as alkalinity, carbonate, bi carbonate, sulfates fluoride chlorides, calcium, hardness, sodium, potassium, nitrate, ammonia, nitrogen, phosphorus, chlorophyll, biochemical oxygen demand, chemical oxygen demand, aluminum, iron, manganese, silica etc. a sample of Cold Spring water has been analyzed in a laboratory. Methods for reporting water analysis be considered from an understanding of expression and units for decreasing water quality, standard is been established so that analysis interpreted in term of the ultimate purpose of the water supply. In a chemical analysis of cold Spring water, concentration of different lone is expressed by weight or dry chemical equivalence. Total dissolved solids also been measured in term of electrical conductance. Total dissolved solids by electrical conductance of a Cold Spring water sample conductance is preferred rather than its reciprocal, resistance, because it increase with salt content. Specific electrical conductance defines the conductance of a cubic centimeter of water at a standard temperature of 25 °C; an increase of 1°C increase conductance by about 2 percent. Further observations are found in spring water.

The following table shows chemical properties of Cold water spring of Taked.						
Sr.no	Parameter	Results	Units			
1	pH	8.0	_			
2	Electrical conduct	470	Cm			
3	Alkalinity	156	Mg/L			
4	Carbonate	1.5	Mg/L			
5	Bio carbonate	154.5	Mg/L			
6	Chloride	14.89	Mg/L			
7	Sulphate	4.40	Mg/L			
8	Florid	0.28	Mg/L			
9	Calcium	72.14	Mg/L			
10	Total hardness	284	Mg/L			
11	Sodium	30.9	Mg/L			
12	Potassium	0.545	Mg/L			
13	Nitrate (No2)	0.084	Mg/L			
14	Nitrate (No3)	2.14	Mg/L			
15	Ammonia (NH3)	0.037	Mg/L			
16	Nitrogen (N)	0.27	Mg/L			
17	Orthophosphorus (O-PO4-P)	0.25	Mg/L			
18	Total Phosphorus	0.5	Mg/L			
19	Chlorophyll. A	6.0	Mg/L			
	1	1	1			

The following table shows chemical properties of Cold water spring of Taked.

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20	Biochemical Oxygen	1.6	Mg/L
21	Chemical Oxygen	8.22	Mg/L
22	Boron	ND	Mg/L
23	Aluminum (Al)	0.047	Mg/L
24	Iron (Fe)	0.7	Mg/L
25	Manganese (Mn)	0.28	Mg/L
26	Silica (Sio2)	3.8	Mg/L

#### **Biological Analysis and Properties of Cold Spring Water:**

In biological properties of Cold Spring water contain part of humus, microorganisms, bacteria etc. As mentioned before, bacteria logical analysis is important detecting biological pollutions of ground water. Most pathogenic bacteria found in water are indigenous to the intestinal tract of animal and humans, but isolating theme natural water is difficult in the laboratory. Because bacteria of the coli form group are relatively easy to isolating and identified. Standard test to determine their presence or absences in a water sample are taken as a direct indication of the safely of the water for drinking purpose. Coli form test result is reported as the Most Probable Number (MPN) of Coli form group organisms in a given volume of water. By analysis of a number of separate portions of water sample, Most Probable Number (MPN) is computed from probability table for this purpose. **Conclusions:** 

The complete investigation has been done in the study of the cold-water spring of the Taked, all the geographical aspect are considered for the study. The occurrence of the taked cold water spring is influenced by collective impact of geographical factors, which includes geology and geomorphology of the region, morphological slope of the area, climatic characteristic, annual rainfall and vegetation of the study area. In the occurrence of cold spring the geological set up of the area has played important role. In the analysis of potability of spring water the PH value of water is 8 so the quality of water is good for drinking purpose. Where the color of water is clear and odorless, temperature is 24.3 °C. In the chemical properties of the water are as follows electrical conduct is 470 cm, Alkalinity is 156 Mg/L, Carbonate is 1.5 Mg/l, Bio carbonate 154.4 Mg/L, Calcium-72.14 Mg/L some others are shown in above table. In the biological analysis of spring water the part of humus microorganisms, bacteria have been found. The religious faith of the people on the spring water (Sarv Tirth) is associated with the chemical properties in the water.

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# STUDY OF FUNGI ARE HELPFUL FOR PROTECTION OF LIVING THINGS AND HARMONIZING SURROUNDINGS.

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#### ABSTRACT:

There are no. of species in freshwater fungi with a greater number know from temperate, as compared to tropical, regions. Three main groups can consider which include Ingoldian fungi, aquatic ascomycetes and non-Ingoldian *Hyphomycetes, chytrids* and oomycetes. The fungi occurring in lentic habits mostly differ from those occurring in lotic habitats. Although there is no comprehensive work dealing with biogeography of all group of freshwater fungi, their distribution probably follows that of Ingoldian fungi, there distribution probably follows that of Ingoldian fungi, there either cosmopolitan, restricted to pan temperate or pan tropical regions, or in a few cases, have a restricted distribution. Freshwater fungi are thought to have evolved from terrestrial ancestors. Many species are clearly adapted life in freshwater as their propagules have specialized aquatic dispersal abilities. Freshwater fungi are evolved in the decay of wood and leafy material and also cause diseases of plants and animals. These areas are briefly reviewed. Gaps in our knowledge of freshwater fungi are discussed and areas in need of research are suggested. **Key words:** - *biodiversity, freshwater fungi*.

#### **INTRODUCTION:**

This paper reviews the biology of fungi in freshwater sediments. We use the terms sediments a broad sense to mean freshwater sand, gravel, slit, mud (Anon, 1998), wood, leaves and other organic matter the accumulates on the floor of freshwater habitats. We have not treated lichen-forming fungi on rocks in or by lake or stream margins, which merit a modern separate review.

#### **MATERIALS AND METHODS:**

#### **Biodiversity of freshwater fungi:-**

There are no of species of freshwater fungi and greater numbers are known from temperate, as compared to tropical. These include ascomycetes, mitosporic fungi and a number of chytrids and oomycetes (Goh and Hyde, 1996). Three main groups can a considered.

- The Ingoldian fungi which occur on decaying leaves in streams and lakes and which are probably the most well studies. They have been documented in many countries around the world, although the tropics have received less attention.
- 2. The aquatic ascomycetes and Hyphomycetes occurring in submerged woody material have received less attention. Studies on these fungi in temperate regions are mainly based in North America, around Chesapeake Bay (Sheare, 1993a) and Hong Kong (Hyde et al., unpubl.). Less intensive collections have been made in Australia, Brunei. England, Philippines, Seychelles and South Africa.
- The chytrids and oomycetes, including those that cause disease, are welldocumented (Laidlaw, 1985; Fuller and





Jaworski, 1987, Barr, 1988, Burning, 1991; Powell, 1993) these fungi generally lack the ability to degrade cellulose, and are probably important in degrading no cellulosic entities the freshwater ecosystem (e.g. dead insects, Keratin and pollen grains).

Freshwater habitats that support fungi can be divided can be divided into:

- 1) lentic (lakes, ponds, swamps, pools): and
- Lotic (reservoirs. Streams. creels. Brooks) in addition, many freshwater fungi have been reported from artificial habitats, such as water – cooling towers (Jones and Easton, 1969, Eaton and Jones, 1970, 1971 la,b;) Udaiyan and Hosagoudar, 1991).

#### **RESULT & DISCUSSION:**

#### Origin of freshwater fungi:-

Freshwater fungi are a diverse and heterogeneous group comprising species from different orders. The dominant groups are the ascomycetes and Hyphomycetes, depending on geographical location and substrate. Shearer (1993a) stated that "the presence of fungi in aquatic habitats along may not be appropriate to define ascomycetes as freshwater ascomycetes". This is because the occurrence of a species may simply be fortuitous and presence in therefore not conclusive evidence in assigning a particular fungus as "freshwater". The fungus could have its origin in terrestrial habitats and may have entered the freshwater system as spores. There are, however, numerous ascomycetes (and Hyphomycetes) species which commonly occur in freshwater and have not been found in terrestrial habitats. These can confidently be categorized as freshwater fungi.

Certain genera, e.g. Jahnula and Proboscispora, are confined to freshwater habitats, while others have representatives in both terrestrial and marine habitats. Annulatascus has terrestrial (mainly on bamboo and palms) as well as freshwater habitats, while Ascotaiwania which was first reported as a freshwater genus, is now known from terrestrial palms (Hyde, 1995). However, individual species are generally restricted to freshwater, marine or terrestrial habitats. The main differences between species in a genus are found in the Ascospores, with sheaths or appendages often occurring in freshwater and marine or terrestrial habitats. The main difference between species in a genus are found in the Ascospores, with sheaths or appendages often occurring in freshwater and marine representative, while other morphological characters very little.

It has been suggested that some marine fungi have a fungal-algal ancestor, which gave rise to ancestral pyrenomycetes, and which were mainly parasites of algae (Kohlmeyer and Kohlmeyer, 1979). Terrestrial loculoascomycetes and pyrenomycetes are thought to have originated from these parasitic pyrenomycetes. Subsequently these terrestrial ascomycetes moved back into the marine environment and are known as secondary marine fungi. These secondary marine fungi include the terrestrial loculoascomycetes Holotthia, Leptosphaeria, Mycosphacerella, Pontoporeia, and pyrenomycetes such as Chaetosphaeria and Kallichroma.

Kohlmeyer and Kohlmeyer (1979) organized marine fungi in two groups:

(1) Primary marine fungi (e.g. Ceriosporopsis, Corollospora, Halosphaeria) thought to have been derived from marine ancestors, that have not left their original marine environment; and (2) marine fungi which were thought to have evolved from terrestrial ancestors which have migrated back into the sea. An analogy can be made between freshwater and marine fungi. The genus Aniptodera (Shearer and Miller, 1977) may be classified as a primary freshwater fungus as species occur in both freshwater and



marine environment and no terrestrial representatives have been found. Genera such as Annulatascus and Ascotaiwania may be classified as secondary freshwater fungi since they originate most probably from terrestrial habitats, since they have terrestrial representatives.

Recent Phylogenetic studies (Spatafora et al. 1995) have shown that many marine ascomycetes are likely to have evolved from terrestrial ancestors (e.g. Micro scales), which have lost many of their characters. Features such as active ascospore ejection are thought to be unnecessary in the sea. It is probably also true, that most, if not all, freshwater ascomycetes evolved from terrestrial ancestor.

The main role of freshwater ascomycetes, basidomycetes and mitosporic fungi in freshwater ecosystems is in the degradation of dead plant material (e.g. Jencus, leaves and wood) that finds its way into the water (Goh and Hyde, 1996). They may also be involved in the degradation of animal pars such as insect exoskeletons, fish scales, and hair. Other ecological groups present are the plant pathogens and Endophytes that may colonies living plant tissues. The decay of dead plant tissues is a result of the fungi's ability to degrading woody celluloses and lignocelluloses (Zara - maivan and Shearer, 1988a b). Their success in degrading woody tissues lies in an ability to form soft-rot cavities (Shearer, 1993a; Yuen et al. pers Obs.) Basidomycetes are rare and mainly absent in freshwater as they are not soft rotters, although they can degrade cellulose.

#### CONCLUSION:

It appears that the ability to degrade the lignocelluloses from within the  $S_2$  layer of the cell wall is important in submerged waterlogged wood. Several species have now been tested for their ability to cause soft-rot decay an although we have information for only a small proportion of know species, it is probably representative.

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#### Influence of Water Pollution on Stomatal Density of the Plant Growing on the Banks Of River Kadawa (M.S) India

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#### Abstract:

The stomatal studies of plant growing along the bank of river kadawa viz Alternanthera sessillis, Amaranthus spinosus, Acmela oppositifoloa, Ricinus communis were carried out the and it was found that the stomatal density increase on both the leaf surface and it was higher on the lower surface as compared to upper surface. Key-words: effluent; pollution; stomata.

#### Introduction:

Pollution is the result of undesirable changes in our environment which have harmful effects on plants, animals and human beings; No dought the pollution is the outcome of urban industrial technological revaluation and fast exploitation of natural resources. Polluting is due to it increased rate of exchange of matter and energy and ever -increasing industrial wastes, urban effluents and consumer goods. Pollution means Jowering of environmental quality at local scale caused exclusively by human activities. According to Y. S. Khan (2006) pollution may be defined as an average changes in the physical, chemical or illogical characteristics of air, water and land in our environment that may cause harmful effects on various forms of life Water is most significant element on the earth. Water is vital for the and property. maintenance of all forms of life because it helps in the movement, circulation and recycling of nutrients in the biosphere. Water is also essential for power generation, navigation, irrigation of the crops and disposal of sewage. According to Savindra Singh (1991) 'Water pollution refers to deterioration of physical, chemical and biological characteristics of water from various storages, through natural and anthropogenic processes to such an extent that it becomes harmful to human beings, plants and animal communities'.

#### Stomata

Stomata are the microscopic pores found in the leaf and stem epidermis of higher plants that are used for gas exchange. The pore is formed by a specialized epidermal cell termed guard cell, which controls the opening and closing of the pore by changing their turgidity, and thus regulates the gaseous exchange between the plant and environment. Stomata are found on all above the ground parts of plants including the petals of flowers, petioles, soft herbaceous stems and leaves. Stomata allows gases such as carbon-dioxide, water vapour and oxygen to move rapidly into and out of the leaf. Stomata occur most abundantly on all parts of the leaf lamina except over the veins. But in some cases where the lamina is very thick, stomata may be found along the veins. They are found in both upper and lower surface and such leaves are called amphistomatous leaf. The leaves are said to be hypostomatous where stomata occur on the lower surface only. The leaves are called epistomatous where stomata are located on the upper surface only. Normally upper surface of the leaf contains fewer stomata than the lower surface. De-candole (1827) first called the epiderml pores of stomata in Greek means mouth. The pores are the inter cellular spaces between the two guard cells, which together with the pore constitute the stomata. In many plants some epiderml cells are associated with the guard cells. These are subsidiary cells. The term stomatal complex refers to the guard cells and subsidiary cells collectively. Below each stoma there is a large intercellular space, directed towards to the mesophyll, called Substomatal chamber.

# Material and Methods:

# Material:

Plant species like Alternanthera sessillis, Amaranthus spinosus, Acmela oppositifoloa, Ricinus communis etc.

Growing along the bank of the river kadawa which was affected by the effluent (Textile,Industrial,sewage etc) were taken for the present study.

# Method:

Method described by Stoddard (1965) was followed for stomatal studies total no. of stomata were estimated in the pre-calibrated microscope on films obtained by nail paint application. Nail paint was applied to the middle portion on te lower surface as well as upper surface after drying the nail paint films were removed. The stomatal investigations were made from morning to noon that is from 10 am to 2 pm . Maximum care was taken to select green and mature leaves from identical position on the plants.

For the study of influence of effluents on the stomatal behavior the plants like *Alternanthera sessillis, Amaranthus spinosus*, *Acmela oppositifoloa*, *Ricinus communis* growing along the bank of the river kadawa where effluents was released were selected and for control, plants growing in the near by fields were selected. A comparison of both i.e. control and affected was studied. The peels were taken in triplicate to minimize the error.

Sr.No.	Time	Control leaf No.of stomata/mm2		Effluent affected No.of stomata/mm2	
		Upper	Lower	Upper	Lower
1	10 am	110	141	70	90
2	11 am	125	150	89	108
3	12 am	135	160	95	115
4	1 pm	145	165	110	135
5	2pm	165	189	129	149

Table no.1: Effect of effluents on stomatal density of Alternanthera sessillis.

Table No.2: Effect of effluents on stomatal density of Amaranthus spinosus.

Sr.No.	Time	Control leaf No.of stomata/mm2		Effluent affected No.of stomata/mm2	
		Upper	Lower	Upper	Lower
1	10 am	82	104	40	59
2	11 am	90	112	71	91
3	12 am	102	122	89	95
4	1 pm	100	115	70	81
5	2pm	120	137	75	81

Table No.3: Effect of effluents on stomatal density of Acmela oppositifoloa.

Sr.No.	Time	Control le Time No.of stomat		ol leaf Effluent affec nata/mm2 No.of stomata/	
		Upper	Lower	Upper	Lower
1	10 am	98	120	67	100

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2	11 am	111	130	91	112
3	12 am	133	142	103	119
4	1 pm	147	160	111	141
5	2pm	152	170	118	150

Table No.4: Effect of effluents on stomatal density of *Ricinus communis*.

Sr.No.	Time	Control leaf No.of stomata/mm2		Effluent affected No.of stomata/mm2	
		Upper	Lower	Upper	Lower
1	10 am	110	130	83	92
2	11 am	140	170	60	75
3	12 am	166	180	130	135
4	1 pm	180	199	155	170
5	2pm	198	217	125	190

## **Result:**

Alternanthera sessillis increased on both the surfaces of control as well as effluent affected . Amaranthus spinosus increased on the both surfaces except slight decrease in the stomatal density has been observed at 1 pm.

Acmela oppositifoloa increased on the both the surfaces of control as well as effluent affected. *Ricinus communis* decresed on both the surfaces except slight increased in the stomatal density has been observed upper surface at 12 am & 2pm.and lower surface 1 pm. **Refference:** 

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# STUDY OF THE GENUS: HELICOMYCES LINK AERO-AQUATIC HYPHOMYCETES FUNGI IN BHIMA BASIN OF AHMEDNAGAR **DISTRICT (MAHARASHTRA)**

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#### **ABSTRACT:**

The present paper deals with freshwater higher fungi The Aero-Aquatic Hyphomycetes) from Ahmednagar district (Maharashtra). These species of fungi belonging to three sp. of Hyphomycetes in one genera) of freshwater higher fungi. These fungi were encountered on decaying submerged wood and leaves. Conidia of some fungi encountered in foam samples. The data provide information on the distribution of these fungi in India, apart from description and illustrations. The taxonomy, morphology and ecology of these fungi are discussed.

Key words: - Aero-Aquatic Hyphomycetes, Bhima basin, foam samples

#### **INTRODUCTION:**

Ahmednagar district(Maharashtra state) is located between 18º2'and 19º9' North latitude and 75º9'and 75º 5'East longitude and is situated partly in the upper Godavari basin andpartly in the Bhima basin. It is bounded on north-east by Nashik and Aurangabad districts, on the east by Beed and Osmanabad districts, and on the south by Solapur district. The major part on the west issurrounded by Pune district. On the north-west it is surrounded byThane district. It is occupying more or less the central position in the state with an area of 17,035sq km. The district at present isdivided into 14 revenue talukas. The main rivers are Godavari, Pravara, Mula, Bhima, Sina and Dhora (Pradhan and Singh, 1999).

The aero-aquatic Hyphomycetes were first termed by van Beverwjik (1951 a, b; 1953; 1954). Later Fisher (1977) defined them as indwelling organisms characterized by the production of purely vegetative mycelium in substrates under water and formation of conidia with special flotation devices, formed only when the substrates on which the fungus is growing are exposed to a moist environment. These fungi are usually found in stagnant ponds, ditches, or slow flowing water and are capable of vegetative growth on submerged leaves and woody substrates under semi-anaerobic conditions.

These multicellular dispersal units are morphologically diverse, but all have one feature in common; they entrap air between in their cells, therefore float on air water interface (Webster and Descals, 1981; Michaelides and Kendrick, 1982; Goh and Hyde, 1996). These Hyphomycetes with special floatation or air-trapping device were dispersed from one static water habitat to another by the topography, contour and environmental conditions of ponds or ditches and substrate-water interface (Fisher 1977; Subramanian, 1983; Webster and Descals, 1981). The conidia or forms of propagules are



mostly coloured. They are often tightly helicoids in more than one plane. Examples of these fungi are *Helicomyces*, *Helicoon*, and *Helicodendron* etc.

In the present paper Freshwater higher fungi from Ahmednagar district (Maharashtra) are reported. These include threespecies of fungi belonging to one genera The Aero-Aquatic Hyphomycetesof freshwater higher fungi. The data provide information on the distribution of these fungi in the Ahmednagar district (Maharashtra) and India, apart from illustrations.

#### **MATERIALS AND METHODS:**

Sample of foam, submerged decaying wood and submerged decaying leaves were collected from various localities along major streams and water reservoirs fromAhmednagar district (Maharashtra state). The survey was undertaken for two years during 2013-2015. The sample analysis was done by the following methods:

1) Wood analysis:-Submerged woody debris was collected and placed in polythene bags from various streams, rivers and lakes. Samples were transported to the laboratory. Collections contaminated by sediments or fouling organisms were washed with tap water. Specimens were observed forsporulating structures (Ascomata and conidia). After initialobservations, samples were placed in plastic boxes and after one week periodically examined for the presence of fungal fruiting bodies.

2) Leaf litter analysis: -Submerged leaves were collected from sampling sites and brought to the laboratory inpolythene bags. They were washed in tap water and finally in distilled water. They were cut into small bits and incubated, separated in Petri dishes containing distill water at laboratorytemp. (25-30°c).The water was replaced in Petri dishes once in three days to minimize the growth of bacteria and other aquatic organisms (algae, animalsetc.). The leaf bits were screened under microscope at 72 hourintervals

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for 60 days to detect the water borne fungi appearing onmargin and petiole of the leaves.

3) Foam analysis:-Foam samples were collected inwide mouthed plastic bottles and kept for 24 hours to enable the foamto dissolve. It was preserved by adding FAA to yield 5% foamsolution. Then samples were scanned under high power of a microscopeusing 10x or 15x eyepieces for the presence of conidia ofHyphomycetes.

The slides were made permanent by using double cover glass method (Volkmann-Kohlmeyer and Kohlmeyer, 1996). The measurement of various parts of fungi were taken and usedin the identification and classification of different species. Reports of fungi from India and Maharashtra state were confirmed withthe help of Bilgramiet al.(1979,1981, 1991), Sridhar et al.(1992),Sarbhoy et al. (1975, 1986, 1996), Jamaludden et al. (2004), Borse etal. (2014), Patil and Borse (2015) and other relevant literature.

#### **RESULT & DISCUSSION:**

#### Genus: Helicomyces Link

The genus was introduced by Link in 1809, with H. roseus Link as its type species. The species of genus are charecterised by having, the Colonies: effuse to arachnoid or tuberculate, white to pinkish, or becoming brownish in age. Mycelium: immersed or superficial, composed of branched, septate, hyaline to dilute fuscous hyphae. Conidiophores:lacking or formed as short, lateral branches of the repent mycelium. Conidiogenous cells:monoor polyblastic, producing conidia from the apex, or synchronously and /or successively from short denticles. Conidia: hyaline, dry, hygroscopic, frequently uncoiling in water. Conidial filament: coiled 1-8 times, usually in one plane to form a disk-like body, but sometimes in three planes and resembling a loosely coiled spring; basal cell attached eccentrically; conidial secession schizolytic. The genus is represented by 12 species (Zhao et al., 2007).

#### 1) Helicomyces colligatus R.T. Moore

Colonies: Effuse coraceous, coarsely flocculose or nearly crust-like, pale rose when fresh; when old composed almost entirely of conidia. Mycelium and conidiophores: not apparent, when young the whole stratum composed of semi agglutinated mycelium, conidia and conidiophores; conidia arising directly from the mycelium or else borne on robost conidiophores up to 45 µm tall. Conidia: loosely coiled 1 - 2times, hygroscopic, multiseptate at maturity, each cell containing one large vacuole or two smaller ones; filament tapering at both ends, the basal end  $3.5 \ \mu m$ broad, filament enlarging to 8 µm broad in the middle and becoming slightly less at the distal end, easily broken into segments; diameter of coils 50-60 µm.

#### 2) Helicomyces roseus

Colonies: effuse. Mycelium: immersed and superficial, fuscous composed of branched, septate, hyphae. Stalked sclerotia often present. Conidiophores: short, pale brown, mostly as lateral branches of the repent mycelium. Conidiogenous cells: mono- or polyblastic, developing as denticles on the repent hyphae, or as the terminal cell of the conidiophores. Conidia: hyaline, white to pinkish in mass, frequently with hyaline secondary conidia, 25-60  $\mu$ m in diam. Conidial filament:4-5  $\mu$ m in diam, multiseptate, tapering to an enlarged, obliquely flattened basal cell, coiled 2 <sup>1</sup>/<sub>4</sub> -3 times.

#### 3) Helicomyces torquatus Lane & Shearer

Colonies: floccose, light brown to dark blackishbrown on aging. *Mycelium*: immersed, composed of branched, septate, hyphae, subhyaline to light brown. *Conidiophores*: micronematous formed laterally on repent hyphae, 2-3-septate, 19-56 x 4-5  $\mu$ m. *Conidiogenous cells*: monoblastic, hyaline, 12–24 x 4–5  $\mu$ m. Conidia produced holoblastically, terminally, and singly at tips of conidiogenous cells. *Conidia*: hyaline, multiseptate, dry, coiled 2 to 3 times, 58–132  $\mu$ m diam, end cells broadly spathulate, end of basal cell bearing flattened attachment scar. Conidia in water are hydrophilic and floating or unwinding to assume a torque-like or sigmoid form,  $372-528 \times 5-7 \mu m$ .

About1.7 million species of fungi are estimated to occur in the world (Hawksworth, 1991). Above 1, 00,000 species of fungi are known fromall over the world (Kirk et al.,2008).Thus, only 5 % of the total number of fungi species are so far beenrecorded and the remaining are still to explore and their ecological role yet to be determined.

In the present work extensive collections of higher freshwater fungi were made from Ahmednagar district. Most of the fungi were found on naturally submerged woody debris and conidia of mitosporic fungi in foam sample and few on submerged leaf litter. The present work highlights on several unrecorded freshwater fungi from India.

Studies of these fungi help us to elucidate the fungi involved in decomposition of dead organic material in freshwater and will provide better understanding of the aquatic ecosystems. Diversityon higher freshwater fungi has been more or less neglected fromMaharashtra and very few reports of these fungi have been recorded (Borse et al., 2014; Patil and Borse, 2015). As such, this is more orless a pioneering work in this region so for as the higher freshwater fungi are concerned.

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Sr.no	Name of Fungi				
1	Helicomyces colligatus R.T. Moore				
2	Helicomyces roseus Link				
3	Helicomyces torquatus L.C. Lane & Shearer				

Table shows three species of Aero Aquatic Hyphomycetes (Table;-1)

#### **Figures of Helicomycetes**







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# **Ethanomedicinal Information of Medicinal Plants Use by Tribals of Baglan** Taluka Dist-Nashik.

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Abstract: The present study deals with the ethno medicinal plants used by the peoples of Baglan District Nashik (MS) India. The information is collected from tribal people of Baglan. By approaching personally to the Vaidus and medicine man. By taking interviews during the year 2018-2020. They traditionally use the plant resources as medicine. This knowledge is percolates from generation to generation. They use medicinal plants as a medicine on common diseases. But due to deforestation, loss of biodiversity and indiscriminate exploitation of wild and natural resources many valuable herbs are at the stage of extinction. A total of 30 medicinal plants species distributed in 24 families are documented. The documented ethno medicinal plants were mostly used for to cure various common diseases, infections and general weakness.

Key Words: Ethno-medicinal plants, Vaidus, Diseases.

## **1. INTRODUCTION:**

The ethno medicinal plants are used by the tribal's like Vaidus community of Baglan region of Nashik on various diseases as day today ailments. The quest for documentation of traditional knowledge has been concentrated especially around traditional health practices. In India many indigenous plants are used in herbal medicine to cure diseases and heal injuries. The tribal peoples have been in the practice of preserving a rich heritage of information on medicinal plants for preparing the medicine and administration. If this information is yet to be collected systematically and comprehensively maintain in databases in a manner they would help in protecting their valuable knowledge. The traditional medicine and ethno medicinal information play an important role in scientific research [1, 6] the need for the integration of local indigenous knowledge for a sustainable management and conservation of natural resources receives more and more recognition. The objectives of this study are to document the traditional medicinal plants used by the peoples of Baglan region, Nashik District in Maharashtra.

## 2. MATERIALS AND METHODS:

The traditional knowledge about the plants for treating on the common diseases was collected from the tribal peoples especially traditional healers during the year 2018-2020.monthly visits and interviews of local and tribal peoples of Baglan region was carried out for gathering the information about ethno medicinal plants and documented their knowledge for future generations.

#### **3. RESULTS AND DISCUSSION:**

The present study was concentrated on documentation of traditional knowledge of Vaidus communities. During the present investigation 30 Plants species belongs to 23 families have been recorded. (Table no.1) The local tribals of Kalwan are using these plants to cure many diseases like Asthma, Jaundice, Cough, fever, Toothache, Bronchitis, Burn injury etc. The number of researchers carried out the work on ethno medicinal plants in Maharashtra. [2,3,4,9 & 10] It was observed that practices were freshly. The knowledge of certain plants that curative and palliative efforts were transmits from generation to generation. The traditional herbalists are integral part of the community and take care of the common ailments of the folk in their home setting.[5]

No	Local	B.N.	Family	Medicinal Uses	Plant Part used
1	Ashwagandha	Withania somnifera L.	Solanaceae	Asthama, Branchitis	Leaf, root
2	Amla	Emblica officinalis Gearth	Eaphorbiaceae	Acidity	Fruit,Bark

3	Bahava	Cassia fistula L.	Caesalpiniaceae	Digestion	Bark, Seeds
4	Babul	Acacia arabica Wild	Mimosaceae	Dressing	Bark. Leaf
5	Bhairaingin	Solanum virginianum L.	Solanaceae	Toothache	Leaf
6	Bel	Aegle marmelos carr	Rutaceae	Diabetes	Leaf
7	Chinch	Tamarindus indica L.	Fabaceae	Burn injuty	Leaf, Bark
8	Dumpan	Tylophora indica	Apocynaceae	Bronchitis	Leaf
9	Arjun	Terminalia arjuna roxb.	Combretaceae	Inflamation,swelling bone joining	Bark
10	Rui	Calotropis procera R.Br.	Asclepiadaceae	Injuries by thorn & glass	Latex
11	Vad	Ficus benghalensis L.	Moraceae	Waterborne disease to finger of legs	Latex
12	Bhang(Ganza)	Cannabis sativa L.	Cannabaceae	Eacrache	Leaf
13	Zendu	Tagetes eracta L.	Asteraceae	Eacrache	Leaf
14	Korphad	Aloe vera	Liliaceae	Burn,Injury	Leaf, latex
15	Haldi	Curcuma longa L.	Zingiberaceae	Fever,Cough	Tuber
16	Jamun	Syzygium cumini L.	Myrtaceae	Jaundice	Seed, Bark
17	Karli	Momordica charantia L.	Cucurbitaceae	Septic Injuries	Leaf
18	Neem	Azardirachta indica A.Juss	Meliaceae	Alternative Fever,stomach Problem	Leaf, Bark
19	Palas	Butea Monosperma(Lam)	Fabaceae	In Menstrual,Problem	Bark
20	Tarota	Cassia tora L.	Leguminosae	Good Tonic	root
21	Pimpal	Ficus religiosa L.	Moraceae	Clea Blood Flow in Female	Bark, Leaf
				Stops Blood Flow From eye.	
22	Shetavari	Asparagus racemosus	Liliaceae	Urinal Problem,Fatique	Root
23	Shisav	Dalbergia sissoo Roxb.	Fabaceae	In Menstrual,Problem	Bark
24	Tulsi	Ocimum sanctum L.	Lamiaceae	Cough,Stomach Problem	Seed, Leaf
25	Sitaphal	Annona squamosa L.	Annonaceae	Septic Injuries	Leaf, Bark
26	Nilgiri	Euculyptus globulus Labill	Myrtaceae	Cough	Leaf, Oil
27	Tivis	Dalbergia oojeinenisis	Fabaceae	Cough	Bark
28	Nipanivel	Sarcostemma brevistigma	Asclepiadaceae	Lacto genetic	Latex(2 drops)
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29	Sonara	Achyranthes aspera L.	Amaranthaceae	Tothache,Earache	All Part Of Plant
30	Harali	Cynodon dactylon(L)Pers	Poaceae	Fever	Leaf, Stem

### 4. CONCLUSION:

The studied survey concludes that, the role of ethno medicinal plants for the treatment of various diseases and disorders amongst the tribals of Baglan is crucial. They use various plants, weeds, flowers, seeds, bark, stems in their day today treatment. Beyond the documented plants the tribal peoples used several other non medicinal plants. The collected information is good for next generation. In the studied area, the many tribals still have faith on the herbal remedy which plays an important role in the life of these communities.

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## नैसर्गिक साधनसंपत्तीचे संवर्धन व शाश्वत विकास काळाची गरज

### डॉ. काळनर सुनिता

सहाय्यक प्राध्यापक, म.वि. प्र.समाजाचे कला , विज्ञान व वाणिज्य महाविद्यालय ओझर मिग ता.निफाड जि. नाशिक,

### प्रस्तावना :

माणसाची प्रत्येक गरज ही निसर्गामुळेच पूर्ण होते. निसर्गातूनच मिळणाऱ्या विविध प्रकारच्या वस्तूंचा आणि सेवांचा उपयोग करून माणूस आपल्या गरज भागवत असतो. पाणी, माती, हवा, खनिजे आणि कोळसा इत्यादी. अजैविक संसाधने आहेत तर जंगले, वने, पिके, वन्यजीव आणि वन्यप्राणी इत्यादी जैविक संसाधनांची उदाहरणे आहेत. संसाधने म्हणजे काय तर जीवना जगण्यासाठी लागणारी किंवा वापरली जाणारी कोणतीही सामग्री म्हणजे संसाधन होय. मानवाच्या वाढत्या गरजा आणि त्या पूर्ण करण्यासाठी होत असलेल्या नैसर्गिक साधनसंपत्तीचा अमाप वापर यांमुळे आज पृथ्वीवरील नैसर्गिक संसाधनांचे साठे दिवसेंदिवस कमी होताना दिसत आहेत. हे जर असेच चालू राहिले तर येणाऱ्या भविष्यामध्ये नैसर्गिक संसाधनाची माणसाला कमतरता भासू लागेल.म्हणून नैसर्गिक साधनसंपत्ती चे संवर्धन काळाची गरज आहे.

साधन संपत्ती या शब्दाचा अर्थ पुरवठ्याचा एक स्रोत किंवा गरजांची पूर्तता करणारा एक साठा होय. निसर्गातील जे घटक मानवी जीवनाला वत्याच्या अस्तित्वाला उपयोगी आहेत, ते म्हणजे नैसर्गिक साधन संपत्ती होय.

पर्यावरणातील ज्या घटकांमुळे मानवी गरजांची पूर्तता होते तसेच जे घटक राहणीमान सुधारण्यास मदत करतात त्यांना साधन संपत्ती असे म्हणतात. नैसर्गिक संसाधने अन्न वस्त्र व निवारा या मूलभूत गरजांची पूर्तता करतातच शिवाय नवीन काहीतरी करण्यासाठी मानवाला संधी उपलब्ध करून देतात.

थोडक्यात निसर्गातून उपलब्ध झालेल्या वस्तू व पदार्थांना नैसर्गिक साधन संपत्ती असे म्हणतात. व्याख्या :

मराठी विश्वकोश : " मानवाला उपयुक्त अशा निसर्गातील द्रव्यांना नैसर्गिक साधन संपत्ती असे म्हणतात."

ग्रीन्सबर्ग आणि नॉटन : मानवी क्रियांच्या क्षेत्रात निसर्गाने मुक्तपणे प्रधान केलेले सर्व भौतिक घटक म्हणजे नैसर्गिक साधन संपत्ती होय.

थोडक्यात मानवी जीवनाच्या अस्तित्वासाठी उपयुक्त ठरणाऱ्या घटकांना नैसर्गिक साधनसंपत्ती असे म्हणतात. मानव आपल्या कौशल्याचा वापर करून नैसर्गिक घटक उपयोगात आणतो. ठराविक पुरवठा, उपयोगिता, विनिमय क्षमता हे गुण नैसर्गिक साधन संपत्ती ला लागू पडतात.

**साधनसंपत्तीचा उगम** :नैसर्गिक साधन संपत्ती चा उगम हा जैविक साधन संपत्ती व अजैविक साधन संपत्ती च्या माध्यमातून झाला आहे.

१) जैविक साधन संपत्ती मध्ये वृक्ष, वनस्पती, प्राणी यासारख्या सर्व सजीव घटकांचा समावेश होतो.

२) अजैविक साधन संपत्तीमध्ये पाणी, जमीन, हवा, सौर ऊर्जा, खनिजे, विविध प्रकारचे धातू यासारख्या घटकांचा समावेश होतो.

नैसर्गिक साधन संपत्ती च्या संदर्भातील समस्या :

१) जलप्रदूषण

२) वायू प्रदूषण

३) जंगलक्षेत्रात होणारी घट

- ४) भूजल पातळीत घट
- ५) ऊर्जेची समस्या
- ६) वातावरणातील बदल

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७) नैसर्गिक साधन संपत्तीचा ऱ्हास

### भारतातील ऊर्जा संसाधने :

"ऊर्जा म्हणजे कोणताही भौतिक बदल घडविण्याची अथवा कार्य करण्याची क्षमता होय." ऊर्जा म्हणजे कार्य करण्याची क्षमता होय.

दैनंदिन जीवनामध्ये घरगुती वापरासाठी किंवा औद्योगिक कारणासाठी लागणारी ऊर्जा मिळविण्यासाठी जे पदार्थ अथवा वस्तू वापरल्या जातात त्यांना ऊर्जा संसाधने असे म्हणतात. उदाहरणार्थ उष्णता, प्रकाश किंवा विज.

भू कवचाखाली जीवाश्म इंधने आणि भूपृष्ठावरील जल,वायु,सूर्यप्रकाश,वनस्पती ही सर्व ऊर्जा संसाधने आहेत. ऊर्जा संसाधनांचे प्रामुख्याने दोन विभागात वर्गीकरण केले जाते.

१) क्षयक्षम ऊर्जा संसाधने

२) अक्षयक्षम ऊर्जा संसाधने

१)क्षयक्षम ऊर्जा संसाधने (Non Renewable Energy) :

व्याख्या : " ज्या ऊर्जा संसाधनांच्या प्रमाणात त्यांच्या वापरानंतर घट होते ते क्षयक्षम ऊर्जा संसाधने होय."

ही संसाधने नैसर्गिक संसाधने असून त्यांना कृत्रिमरित्या पुन्हा निर्माण करता येत नाही. निसर्गातील या संसाधनांचे प्रमाण मर्यादित असून नैसर्गिकरीत्या त्यांना तयार होण्यासाठी लाखो वर्ष लागतात. क्षयक्षम ऊर्जा संसाधन मध्ये पुढील संसाधनांचा समावेश होतो.

१) दगडी कोळसा (Coal)

२) पेट्रोलियम (petrolium)

३) नैसर्गिक वायू (Natural gas)

४) आण्विक उर्जा

२)अक्षयक्षम ऊर्जा संसाधने/ पुनर्निर्मितीक्षम (Renewable Sources of Energy):

आधुनिक काळामध्ये जगातील सर्वच देशात ऊर्जेच्या मागणीमध्ये प्रचंड वाढ होत आहे. त्या तुलनेत पुरवठा वाढत नाही. वाढत्या मागणीची पूर्तता करण्यासाठी पारंपारिक ऊर्जा स्रोतांवर अवलंबून राहिल्यास पर्यावरण विषयक समस्या निर्माण होतील. म्हणून जगातील सर्वच देशांमध्ये अपारंपारिक ऊर्जा निर्मिती वर आणि वापरावर भर देण्यात येत आहे. पुनर्निर्मितीक्षम स्रोतांपासून ऊर्जेची निर्मिती करणारा भारत हा जगत मोठा प्रमुख देश आहे. व्याख्या : " जी ऊर्जा अल्पकाळात पुन्हा निर्माण करता येते त्या ऊर्जेला पुननिर्मितीक्षम किंवा अक्षयक्षम ऊर्जा असे म्हणतात.

अक्षयक्षम किंवा पुनर्निर्मिती क्षम ऊर्जेचे स्रोत :

१) सौर ऊर्जा : सूर्य हा ऊर्जेचा आपला सर्वात बलवान स्रोत आहे. सूर्यप्रकाश किंवा सौर ऊर्जेचा हीटिंग, लाइटिंग आणि कूलिंग होम्स आणि इतर इमारती विज, पाणी गरम करणे आणि विविध औद्योगिक प्रक्रियांसाठी केला जाऊ शकतो. भारत हा देश उष्णकटिबंधीय देश असल्यामुळे सौर ऊर्जा जास्त प्रमाणात मिळते. आधुनिक तंत्रज्ञानाच्या वापरामुळे सूर्यप्रकाशातील ऊर्जेचा वापर करण्यात येणारी तंत्रज्ञान सतत विकसित होत आहे.

२) पवन ऊर्जा : पवन ऊर्जा ही पवनचक्की द्वारे उत्पादित केली जाते. पवनचक्की मध्ये असणाऱ्या पात्यांना गती निर्माण होते. पात्यांच्या चक्राकार फिरण्यामुळे टरबाइन द्वारे विद्युत ऊर्जा निर्माण केली जाते.

पवन ऊर्जा ही स्वस्त, प्रदूषण मुक्त, पर्यावरण पूरक आणि जीवाश्म इंधनाचा पासून दूर विकसित करता येते. पवन ऊर्जेचे उपयोग जहाजे चालविण्यासाठी, पाण्याचा उपसा करण्यासाठी, प्रकाश देण्यासाठी, पिठाची गिरणी चालविण्यासाठी केला जातो.

३) जल ऊर्जा : पाण्यामध्ये असणारी ऊर्जा संचयित करून जल ऊर्जा निर्माण केली जाते. नदीचे वाहते पाणी मोठ्या धरणांची बांधणी करून अडविले जाते. त्याची साठवणूक केली जाते आणि नंतर मोठ्या उंचीवरून टर्बइन Worldwide International Inter Disciplinary Research Journal (A Peer Reviewed Referred) ISSN – 24

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फिरविण्यासाठी वापरले जाते. जल विद्युत ऊर्जेचा उपयोग हा शेती,औद्योगिक, घरगुती आणि व्यापारी कारणासाठी करता येतो.

जलविद्युत निर्मिती मुळे नैसर्गिक संसाधनांचा ऱ्हास होत नाही व पर्यावरण प्रदूषणाची समस्या देखील निर्माण होत नाही.

४) बायोमास ऊर्जा : लोकांनी हिवाळ्यात स्वतःला उबदार ठेवण्यासाठी जेव्हा लाकूड वापरायला सुरुवात केली तेव्हापासून बायोमास हा ऊर्जेचा एक अक्षयक्षम स्रोत बनला. लाकूड हा बायोमास ऊर्जेचा सर्वात सामान्य स्त्रोत आहे. बायोमास ऊर्जा ही अन्न पिके, शेती व वन कचरा, नगरपालिका आणि औद्योगिक कचरा, हिरव्या वनस्पती व प्राणी यांच्यापासून सेंद्रिय विघटनशील घटकांपासून ऊर्जा निर्मिती करता येते.

५) हायड्रोजन : हायड्रोजन मध्ये इंधन आणि ऊर्जा स्त्रोत म्हणून क्षमता आहे. हायड्रोजन हा पृथ्वीवरील सर्वात सामान्य घटक आहे. उदाहरणार्थ पाणी दोन तृतीयांश हायड्रोजन आहे. परंतु निसर्गात नेहमी इतर घटकांसह ते आढळते. इतर घटकांपासून वेगळे केले तर हायड्रोजनचा वापर वीज वाहणे, हिटिंग आणि स्वयंपाक यासाठी नैसर्गिक वायूच्या जागी करता येईल, तसेच वीज निर्मितीसाठी देखील करता येईल.

६) भु- तापीय ऊर्जा : पृथ्वीच्या आत उष्णता वाफ आणि गरम पाणी उत्पन्न करते. ज्याचा वापर वीज निर्मितीसाठी आणि विद्युत निर्मिती साठी केला जाऊ शकतो किंवा घरगुती हिटिंग आणि उद्योगासाठी ऊर्जा निर्मिती सारख्या इतर अनु प्रयोगासाठी भूऔष्णिक ऊर्जा खोल जमिनीखालील जलाशयातून ड्रिलिंग द्वारे किंवा इतर भूधातूंच्या जलाशय यापैकी जवळून पृष्ठभागावर काढता येते.

७) महासागर ऊर्जा : महासागरात निरनिराळ्या ऊर्जा स्त्रोतांचे अनेक प्रकार आहेत. आणि प्रत्येक जण वेगवेगळ्या शक्तींनी चालतो. समुद्रातील लाटांपासून ऊर्जेचा वापर वीजनिर्मितीसाठी केला जाऊ शकतो आणि महासागर तापीय ऊर्जेतून समुद्रातील पाण्याची साठवण असलेल्या उष्णतेपासून देखील रूपांतरित करता येतो.

८) द्रव जैवइंधन : जैव इंधनामध्ये इथेनॉल, जैविक डिझेल किंवा वनस्पतींपासून काढलेले तेल यांचा समावेश होतो. पेट्रोल व डिझेलची टंचाई आणि वाढत्या किमती वर मात करण्यासाठी वाहनांसाठी जैव डिझेलचा वापर वाढविण्याची गरज आहे. डिझेलमध्ये काही प्रमाणात जैवइंधन मिसळून इंधन म्हणून वापरल्यास निश्चितच डिझेलच्या वाढत्या किमतीला आळा बसेल.

जैवइंधनाच्या वापरामुळे वाहनांमुळे होणारे प्रदूषण कमी होण्यास मदत होईल. द्रव इंधनांचा वापर वाढल्यास पेट्रोल व डिझेलच्या टंचाईवर मात करता येईल.

नैसर्गिक साधन संपत्तीचे संवर्धन करण्यासाठी उपाय:

1) नैसर्गिक साधन संपत्तीचे संवर्धन करण्यासाठी घनकचऱ्याच्या व्यवस्थापनाच्या संदर्भात विशिष्ट प्रकारची कार्यप्रणाली वापरात आणली पाहिजे.

2) वृक्ष लागवड व संवर्धन यावर विशेष भर दिला पाहिजे.

3) नैसर्गिक साधने दुर्मिळ असल्याने साधन संपत्तीचा आवश्यकतेनुसार काटेकोर वापर केला पाहिजे.

4) पुननिर्मितीक्षम ऊर्जा साधने विकसित करण्यावर जास्त भर दिला पाहिजे.

5) औद्योगिक वसाहतींची रचना योग्य प्रकारे केल्यास वातानुकूलन साठी लागणाऱ्या ऊर्जेची बचत होऊ शकते.

### शाश्वत विकास संकल्पना

शाश्वत विकास (किंवा टिकाऊ विकास) मध्ये पर्यावरणीय संतुलन टिकविण्यासाठी नैसर्गिक संसाधनांच्या कार्यक्षम आणि जबाबदार प्रशासनाचा समावेश आहे, जेणेकरून सध्याच्या स्त्रोतांच्या योग्य प्रमाणात वितरण आणि भविष्यातील पिढ्यांसाठी त्यांची उपलब्धता याची हमी दिली जाऊ शकते.

टिकाऊ विकासाची कल्पना ही विकासाच्या जुन्या संकल्पनेची उत्क्रांती आहे, कारण ती आर्थिक आणि भौतिक प्रगतीचा विचार करते, परंतु नैसर्गिक संसाधनांच्या जबाबदार वापराद्वारे सामाजिक कल्याणाशी संतुलन साधते. अशा प्रकारे, ते टिकाव देण्याच्या तीन मूलभूत अक्षांशी समेट करतो: आर्थिक, पर्यावरणीय आणि सामाजिक.

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पर्यावरणीय समतोल जीवनाचा स्रोत म्हणून न विचारता, आर्थिक विकासाची पारंपारिक संकल्पना केवळ वस्तू आणि संपत्तीचे उत्पादन आणि वितरण याचा संदर्भ देते. टिकाऊ विकासाची संकल्पना या विकासाच्या मॉडेलने पर्यावरणाची जोखीम पत्करली आहे आणि त्यासह, जीवनशैलीची गुणवत्ता आणि मानवी अस्तित्व यावर आधारित आहे.

व्याख्या :

शाश्वत विकास म्हणजे भविष्यातील पिढ्यांच्या स्वतःच्या गरजा पूर्ण करण्याच्या क्षमतेशी तडजोड न करता वर्तमान गरजा पूर्ण करणारा विकास.

### शाश्वत विकासा साठी उपाययोजना :

१. मानवी भूभार कमी करणे - आधी आपण बघितले तसं माणसाने बरीच जमीन हडप केली आहे. ती जमीन निसर्गाला परत करणे ही एक महत्त्वाची पायरी आहे. म्हणजे नक्की काय करायचे तर सध्या जी औद्योगिक शेती केली जाते ती बहुतांशी रासायनिक असते. या औद्योगिक शेतीच्या प्रारूपाकडून नैसर्गिक पद्धतीने शेती करण्याकडे वळणे. यात एका पिकाऐवजी अनेक पिके एकाच वेळी घेणे रासायनिक खते न वापरणे, आणि मांसाहार कमी करणे अथवा बंद करणे या गोष्टी येतात. समजा, आपण शंभर एकर जमीनीवर फक्त मका पिकवत असू तर त्या ऐवजी पाच ते दहा एकर जमीनीवर किमान 4 ते 5 विविध प्रकारच्या धान्य अथवा भाज्या लावणे. फिरती शेती, असे करता येईल. उरलेल्या जमिनीवर किमान 4 ते 5 विविध प्रकारच्या धान्य अथवा भाज्या लावणे. फिरती शेती, असे करता येईल. उरलेल्या जमिनीवर तिथल्या मूळ वनस्पती उगवतील असे पोषक वातावरण निर्माण करता येईल. मात्र केवळ झाडे लावून जंगल तयार करणे म्हणजे निसर्ग नव्हे. निसर्गाच्या अनेक परिसंस्था आहत. आपल्या भात्र प्रदेश, पाणथळ जागा, रेतीचे मैदान, वाळवंट ह्या सगळ्या नैसर्गिक परिसंस्था आहेत. आपल्या भौगोलिक प्रदेश, पाणथळ जागा, रेतीचे मैदान, वाळवंट ह्या परीघात राहून तेथील स्थानिक बियाणे वापरून शेती करणे हे शाश्वत विकासाचे एक महत्वाचे ध्येय आहे. या प्रकारे केलेली शेती ही भरपूर उत्पन्न देणारी, शेतकऱ्याला जगवणारी आहे हे अनेक संशोधनांमधून सिद्ध झाले आहे. या प्रकारे केलेली शेती ही भरपूर उत्पन्न देणारी, शेतकऱ्याला जगवणारी आहे हे अनेक संशोधनांमधून सिद्ध झाले आहे. यातून मांसाहार व दुग्धजन्य पदार्थ यासाठी खर्च होणारे पाणी व उर्जा यांची बचत झाल्याने पृथ्वीवरील भार कमी होईल.

२. संसाधनांचे विकेन्द्रिकरण - सध्याची आपली अर्थव्यवस्था केंद्रिकरणावर भर देणारी आहे. चीनमध्ये माल उत्पादन करणे हे आर्थिकदृष्टय़ा स्वस्त पडते म्हणून तिथे सर्व जगातील वस्तूंचे उत्पादन केले जाते. अन्नधान्य, दूध, कपडे, पाणी, उर्जा या आपल्या दैनंदिन जीवनात गरजेच्या वस्तू देखील कधी कधी सातासमुद्रापार तयार झालेल्या असतात. मग त्या आपल्यापर्यंत पोहोचण्यासाठी विपणनाची एक मोठी साखळी तयार करावी लागते. या साऱ्याची नैसर्गिक किंमत आपण मोजत नसल्याने आर्थिकदृष्टय़ा आपल्याला ते परवडते. मात्र या साखळीतील एखाद्या गोष्टीवर बंदी आली तर काय भयानक परिस्थिती निर्माण होऊ शकते याची अगदी छोटी चुणुक आपल्याला कोरोना मुळे दिसली आहे. किमान अन्न आणि उर्जा या दोन बाबतीत स्वयंपूर्ण असलेल्या छोट्या छोट्या मानवी वसाहती निर्माण करणे हे शाश्वत विकासाचे एक महत्वाचे ध्येय आहे. आज भारतातल्या कुठल्याही शहरात पाणी दूरच्या धरणातून येते, धान्य भाजीपाला दूध आसपासच्या खेड्यातून येते, वीज दूरच्या कोणत्या तरी वीज केंद्रात तयार होते. या साऱ्या गोष्टी शहरात येतात पण शहरात काय तयार होते तर प्रदुषण, सांडपाणी आणि कचरा. पुन्हा या सर्व गोष्टी शहराबाहेर नेऊन प्रक्रिया करून सोडण्याची व्यवस्था निर्माण करावी लागते. या उलट शाश्वत प्रारूपात शहरातील प्रत्येक प्रभागात दैनंदिन गरजेचा भाजीपाला फळे पिकवता येईल, कदाचित एखादा गोठा असेल. सर्व प्रभागातील सांडपाण्यावर आणि ओल्या कचऱ्यावर प्रक्रिया करून त्या पासून बायोगॅस तयार करता येईल. त्यातून तिथल्या लोकांची उर्जेची गरज काही प्रमाणात भाग शकेल. गावाकडे हेच मॉडेल राबवले तर शहराकडे येणारे माणसांचे लोंढे कमी होतील. गावातील लोकांना गावातच अधिक चांगल्या प्रकारे जगता येईल. शेतीच्या जोडीला छोटे कुटीर उद्योग चालवता येतील. ही एक शोषण न करणारी शाश्वत अर्थव्यवस्था असेल.

३. चक्राकार अर्थव्यवस्था - या शाश्वत विकासाच्या स्वप्नांमध्ये उद्योग धंदे कसे चालतील? तर त्यासाठी circular economy चे प्रारूप मांडले आहे. यामध्ये कोणत्याही उत्पादनात कचरा निर्माण होणार नाही. कारण एका Worldwide International Inter Disciplinary Research Journal (A Peer Reviewed Referred) ISSN – 2454 - 7905

उत्पादनात तयार झालेला कचरा हा दुसऱ्या उद्योगाचा कच्चा माल असेल. हे उद्योग अर्थात जास्तीत जास्त विकेन्द्रीत आणि उर्जेच्या बाबतीत स्वयंपूर्ण असतील. उदाहरणार्थ, आज आपण बिस्किटाचा पुडा घेऊन येतो. त्याच्या वेष्टनाची जबाबदारी कोणाची असते? शाश्वत उद्योग end to end responsibility घेणारा असेल. यालाच cradle to cradle approach अशी संज्ञा आहे. मग अशा परिस्थितीत कदाचित single use plastic चे वेष्टण बिस्किट कंपनीला परवडणार नाही! याच धर्तीवर जर आपली इलेक्ट्रॉनिक उपकरणे उत्पादन करणाऱ्या कंपनीला परत घेण्याचा कायदा आला तर कदाचित मोबाईल कंपन्या इतक्या वेगाने नवीन मॉडेल्स आणणार नाहीत. कारण कंपनीला केवळ एका नवीन चीप साठी अख्खा फोन परत घेणे परवडणार नाही मग कदाचित ती एक चीप बदलून तोच फोन अधिक काळ वापरता येईल.

४. अपारंपरिक ऊर्जा स्रोत - मूळ उर्जेची गरज भागवण्यासाठी सौरऊर्जा आणि जलविद्युत हे दोन सर्वात चांगले पर्याय आहेत. मात्र त्यासाठी मोठी धरणे बांधण्यापेक्षा छोट्या छोट्या प्रमाणात विकेंद्रीत उर्जा निर्माण करणे आणि गरज पडल्यास ती ग्रिडने जोडणे अधिक शाश्वत आहे. सौर ऊर्जा सोलार पॅनेलच्या माध्यमातून वापरणे जरी सोयीचे असले तरी तो सर्वात चांगला पर्याय नाही. जशी मिळते त्या स्वरूपात सौर ऊर्जा वापरणे सर्वात सोपे आणि चांगले. यात गवत आणि शेतात निर्माण होणाऱ्या ओल्या कचऱ्यापासून तयार होणारा बायोगॅस हा एक शाश्वत पर्याय असू शकतो. मूलतः उर्जेची गरज कमी भासेल असे जीवनशैलीत बदल करणे हा एक मोठा बदल आध्यारूत आहे. उदाहरणार्थ, चालत, सायकलने, किंवा सार्वजनिक वाहनाने प्रवास, भरपूर सूर्यप्रकाश आणि उत्तम वायुवीजन व insulation असलेली शाश्वत पद्धतीने बांधलेली घरे इत्यादी मुळे उर्जेची गरज कमी होऊ शकते.

सारांश : अशाप्रकारे पुननिर्मितीक्षम किंवा अक्षयक्षम ऊर्जेचे स्रोत दीर्घ कालावधीसाठी टिकून राहू शकतात व सहजपणे नूतनीकरण केले जाऊ शकतात.आणि शाश्वत विकासासाठी उपयुक्त ठरू शकतात.शाश्वत स्रोत म्हणजे बायोमास, अणुउर्जा, भूऔष्णिक ऊर्जा, पवन ऊर्जा, सौर ऊर्जा .अक्षयक्षम ऊर्जेचे स्रोत हे कमी प्रदूषण कारी म्हणून ओळखले जातात.

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## ७. अंधश्रद्धाः : महिला सक्षमीकरणातील प्रमुख समस्या

प्रा. नारायण बाबुराव पार्टील कला विज्ञान व वाणिज्य महाविद्यालय, ओझर, जि. नाशिक.

#### १. प्रास्ताविक

विसाव्या शतकात विज्ञानाने झपाट्याने प्रगती केली. माणूस विज्ञानाची फळे चाखू लागला, सुखसमृद्धी अनुभवू लागला, खेड्यातून शहरात येऊन स्थायिक होऊ लागला. यंत्रयुगाचा विस्तार झपाट्याने झाला. संगणकाने जीवनाच्या सर्वच क्षेत्रामध्ये हातपाय पसरले आहेत. असे असतांना समाजात विज्ञाननिष्ठ दृष्टिकोन निर्माण व्हायला हवा होता शतकानुशतके अज्ञान आणि अंधश्वढेच्या अंधारातून माणूस बाहेर यायला हवा होता मात्र तसे झालेले दिसत नाही. आजही समाजात नवस - सायास, बुवाबाजी, जाद्टोणा, भूत-आनामती, धर्माधता, जाती आधारित भेदभाव, स्त्रियांवरील अन्याय आणि त्यांचे होणारे शोषण या गोष्टी थांबलेल्या नाहीत. स्वातंत्रोत्तर काळात शिक्षणाच्या आणि आधुनिकरणाच्या प्रभावाने सुशिक्षित आणि डोळस असलेल्या बोटावर मोजण्याइतक्या काहीजणांचा अपवाद सोडला तर अंधश्वढेलाच धर्माचे, श्रद्धेचे आणि संस्कृतीचे स्वरूप देऊन त्यावरच जगणारा एक मोठा वर्ग तयार झालेला आहे. त्यातून आर्थिक, सामाजिक, राजकीय इतकेच नव्हे तर लैंगिक शोषणही मोठ्या प्रमाणात होऊ लागले. समाजात आणि विशेषतः महिलावर्गात आजही मोठ्या प्रमाणात आढळणारी अंधश्रद्धा ही आजच्या महिला सक्षमीकरणातील सर्वात मोठा अडथळा ठरू पाहत आहे. प्रस्तुत लेखात महिलांमधील अंधश्रद्धेचे स्वरूप आणि परिणाम यावर सारांशाने प्रकाश टाकण्याचा प्रयत्न करीत आहे.

२. अंधश्रदा : स्वरूप व संकल्पना

अंधश्रद्धा या संकल्पनेची संज्ञा आणि स्वरूप विविध विचारवंतांनी स्पष्ट केले आहे. प्रसिद्ध पुरोगामी विचारवंत डॉ. अब्राहाम कोवूर म्हणतात, "प्रामाणिक लोक प्रामाणिक काम करून आपले जीवन जगतात, तर अप्रामाणिक लोक अशा सच्चे काम करणारांना फसवून आपला उदरनिर्वाह करतात. अशा बांडगुळांमध्ये तथाकथित धर्माधिकारी, तपस्वी, अवलिया, संत, महंत, बाबा, ऋषी, स्वामीजी, योगी, भगत, ज्योतिषी, इ. लोक असतात."

अंधश्रद्धेचे स्वरूप स्पष्ट करताना डॉ. नरेंद्र दाभोळकर म्हणतात की, "घडणाऱ्या प्रत्येक घटनेस जानाच्या, अनुभवाच्या साहाय्याने प्रश्न विचारले असता जिचा खरेपणा टिकतो, जिचा कार्यकारणभाव समजतो तिला विश्वास म्हणतात, जिचा खरेपणा टिकत नाही तिला अंधश्रद्धा म्हणतात. प्रत्यक्षात अशी कसोटी घेणे प्रत्येक बाबतीत अवघड असते कारण अंधश्रद्धेचे एक वैशिष्ठ्य असते की, ती बाळगणारी व्यक्ती व समूह तिची चिकित्सा करत नाही व इतरांनी ती केली तर त्यांना ती चालत नाही."

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अखिल भारतीय अंधअखा निर्मूलन समितीचे संस्थापक श्याम मानव यांनीही असे विवेचन केले आहे की, "भूत, मंत्रतंत्र, जादू-टोणा, जारण मारण, देवी अंगात येणे, कौल लावणे, दृष्ट काढणे, चमत्कार बुवाबाजी, फलज्योतिष या सर्वांचा अभ्यास करावा लागला... आमचा देव - धर्माला विरोध नाही पण देवा धर्माच्या नावावर सर्वसामान्य माणसांना लुबाडणाऱ्यांच्या विरुख ही चळवळ आहे."<sup>3</sup>

अशा प्रकारे अंधश्रखेचे स्वरूप व संकल्पना विविध विचारवंतांनी स्पष्ट केली आहे. त्यात सर्वसाधारणपणे समानता आढळते. अंधश्रखेचा संस्कार एका पिढीकडून दुसऱ्या पिढीकडे चालत आलेला असतो. त्यामुळे त्याविरोधात जाण्याचे धाडस समाजात करत नाही मात्र श्रखेबाबत मत - मतांतरे असली तरी अंधश्रखेचे सप्रर्थन कुणीही करू नये असा विचार या विचारवंतांनी मांडला आहे. आणि अंधश्रखेच्या विरोधात मोठी चळवळ उभी केलेली आहे.

3. महिला आणि अंधश्रदा

अंधश्रदा ही सामाजिक समस्या असली तरी महिलांच्या बाबतीत अंधश्रदेचा प्रभाव अधिक दाहक आहे. शतकानुशतके चालत आलेल्या परंपरा, रूढी आणि व्रतवैकल्यांचा पगडा स्त्रीमनावर इतका मोठा आहे की, आजच्या पदवी घेतलेल्या उच्चशिक्षित स्त्रियाही त्यापासून दूर जाण्यास तयार नाहीत. उदा. चांगला नवरा मिळविण्यासाठी हरतालिकेचा उपवास करणे, संकष्टी चतुर्थीला काही न खाता - पिता राहणे, वटसावित्री पौर्णिमेला वडाला सात फेरे मारून दिवसभर उपवास करून सात जन्म हाच पती मिळावा अशी प्रार्थना करणे, आपण अखंड सौभाग्यवती राहणे म्हणजेच नवऱ्याआधी मरण यावे यासाठी मंगळागौरीचे व्रत करणे, संक्रांतीच्या सणाच्या दरम्यान सौभाग्यवती स्त्रियांचे औक्षण करून सौभाग्याचा सन्मान करणे, संतोषीमातेचे व्रत करून मनातील इच्छा - आकांक्षा पूर्ण होतात असे समजणे, पाच गुरुवार उपवास करणे, गर्भातील बाळासाठी गर्भसंस्कार वर्गाला जाणे, मासिक पाळी कालावधीत धार्मिक व विविध कार्यक्रमापासून बाजूला राहणे, टी.व्ही. वरील सिरीयल पाहून 'करवा चोथ' सारखे व्रत करणे, देवाधर्माला - तीर्थ यात्रेला जाऊन नवस बोलणे, बाबा - बुवांच्या सांगण्यावरून हातात - गळ्यात विविध धागे दोरे बांधणे, भूत -भानामतीवर विश्वास ठेवणे, फलज्योतिष - राशिभविष्य या गोष्टींना अतिमहत्व देणे इ. प्रकारच्या बार्बीमध्ये सामान्य स्त्री पूर्णपणे अडकलेली दिसून येते. हिंदुधर्माप्रमाणेच इतर धर्मीय स्त्रियाही अंधश्रदा जपतांना दिसतात. ख्रिस्चन धर्मात ऍडम आणि इव्ह संकल्पना, यहुदी धर्मात स्त्रियांचे कनिष्ठ स्थान, दिगंबर जैनांमधील नाकारलेला मोक्षाचा अधिकार आणि इस्लाम धर्मातील 'तलाक, तोंडावर बुरखा परिधान करणे आदी प्रकार स्त्रियांना माणुसकीचे अधिकार नाकारणारे आणि अंधश्रखेच्या आधारे त्यांचे जीवन व्यापून टाकणारे आहेत. याबाबत डॉक्टर ज्योती लांजेवार यांनी म्हटले आहे, "भारताच्या प्रदीर्घ इतिहासात समानतेचा खरा लढा झालाच नाही. एवढेच नव्हे तर विविधतेतून एकता पाळण्याचे स्वप्न पाहणाऱ्या भारताला नारी विषयक चर्चेसाठी सवडच झाली नाही. हिंदुधर्म हा तर केवळ सनातनी होताच पण त्याबरोबर अनेक बौंख, जैनादि बंडखोर संप्रदायांनी स्त्री समानतेला कसलेच स्थान दिले नाही.... सर्व

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धर्मांमध्ये स्त्री ही पापी नरकद्वार ठरविली होती..... स्त्रियांचे असामान्यत्व पुरुषप्रधान संस्कृतीने नाकारणे व तिला अधिकाधिक दास्यत्वाच्या बंधनात जखडणे असेच प्रयत्न होत गेले." \*

अशा प्रकारे अडकून पडलेल्या स्त्रियांच्या मते मात्र उपरोक्त वर्णन केलेल्या बाबी या अंधश्रखा नव्हेतच त्या जीवनाला अर्थ प्राप्त करून देणाऱ्या श्रद्धाच आहेत असे मानून त्याबाबत अशिमान आणि धन्यता त्या बाळगत असतात. समाजसुधारकांच्या कार्यामुळे आज स्त्रीशिक्षणात वाढ झाली. शिक्षणाच्या प्रसारामुळे समाजात जनजागृती झाली यातून केशवपन, बालविवाह, विधवांचा छळ, सतीप्रथा यासारख्या अमानुष - निर्दय रूढींच्या कचाट्यातून स्त्री मुक्त झाली, मात्र रूढी - परंपरा, धार्मिक व्रतवैकल्ये यातून त्यांची सुटका झालेली नाही किंबहुना स्त्री - म्हणूनच आपले अस्तित्व अबाधित ठेवण्यासाठी, स्वतःचे स्त्रीत्व टिकवण्यासाठी ती यातून सुरु इच्छित नाही असे दिसते. शहरातील परिस्थिती काहीशी बदललेली असली तरी खेड्यात मात्र अजूनही फारसा फरक पडलेला नाही. दारिद्रय, अज्ञान, सामाजिक रूढींचा पगडा आणि अंधविश्वास यांनी स्त्रीजीवन मोठ्या प्रमाणात व्यापून टाकलेले आहे. ग्रामीण, आदिवासी, दलित वर्गातील स्त्रियांचे अंधश्रखेच्या माध्यमातून मोठ्या प्रमाणात सामाजिक, आर्थिक आणि लैगिक शोषण होतांना दिसते.

### ४. अनिष्टप्रथा आणि स्त्रियांचे शोषण

भारतीय समाज व्यवस्थेत अनेक अनिष्ठ रूढी - चालीरीती आजही अस्तित्वात आहेत त्यातील देवदासी, जोगीन, कौमार्य चाचणी, जातीय विवाहबंधने, जैन ब्रहमचर्यव्रत, मुस्लिम बुरखा पखती या व अशा कितीतरी अनिष्ट प्रथांमधून आजही स्त्रियांचे शोषण होतांना दिसते.

देवदासी ही इतकी अमानवी, कूर प्रथा आहे की, भारतात दरवर्षी हजारो मुली या प्रथेतून देवाला वाहिल्या जातात. मुलगा होण्यासाठी नवस बोलून त्याबदल्यात स्वतःची मुलगी देवाला देणे अशी कूर रूढी सामान्यपणे दिसते. महाराष्ट्र आणि कर्नाटक राज्यात ही संख्या सर्वाधिक आहे. महाराष्ट्रात जेजुरीला सोडल्या जाणाऱ्या देवदासींना मुरळी म्हणतात तर आंध्र प्रदेशात जोगतीण म्हणतात. कर्नाटकातील देवदासी भोगंद, अंगद या नावानी ओळखली जाते. देवदासी वयात आली की ती श्रीमत वर्ग, पुजारी यांची भोगदासी बनते. या अनिष्ट प्रथेचे मूळ धर्माशी जोडले गेले. कर्नाटकातील देवदासी मोठ्या संख्येने वेश्या व्यवसायाकडे वळल्या आहेत. प्रसिद्ध साहित्यिक विचारवंत उत्तम कांबळे म्हणतात, "स्वातंत्रोत्तर काळात देवदासी प्रथेविरुद्ध अनेक कायदे होऊनही ही प्रथा बंद होऊ शकली नाही. नग्नप्जा जेथे होते त्याभागातील लोकप्रतिनिधी सुद्धा ही प्रथा बंद करण्यासाठी फारसा प्रयत्न करीत नाही. कारण त्यांचे मतांचे राजकारण आड येते."' एकंदरीत देवदासी प्रथा हा भारतीय समाजव्यवस्थेतील प्रचंड मोठा कलंक आहे. सती प्रथा बंद झाल्याचे समाधान तेंव्हाच मिळेल जेंव्हा देवदासी प्रथा पूर्णतः बंद होईल यासाठी केवळ शासनच नाही तर व्यापक जनजागृतीची आवश्यकता आहे असे वाटते.

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AJANTA - ISSN 2277 - 5730 - IMPACT FACTOR - 6.399 (www.sjifactor.com) कौमार्य चाचणी ही अनिष्ट प्रधा अद्यापही असल्याचे विविध बातम्यांमधून समजते. आदिवासी आणि विशेषतः भटक्या विमुक्त वर्गात ही प्रथा टिकून राहिलेली आहे. लग्न झाल्यानंतर पहिल्या रात्री मुला- मुलीचा शारीरिक संबंध होतांना मुलीची होणारी परीक्षा म्हणजेच कौमार्य चाचणी. यात असे समजले जाते की नवऱ्याबरोबर शरीरसंबंध होतांना नवारीमुलीच्या योनीतुन रक्त आले पाहिजे तरच ती मुलगी कुमारिका अर्थात चारित्र्यवान आहे. रक्त आले नाही तर ती व्यभिचारी समजून तिच्यावर सामाजिक अन्याय, कठोर शिक्षा किंवा प्रसंगी माहेरी पाठवून घटरफोट देणे आदी अमानुष प्रकार अवलंबले जातात. महाराष्ट्र 'अनिस' चे कार्यकर्ते कृष्णा चांदगुडे (नाशिक) यांनी या अनिष्ट प्रथेविरुख प्रचंड मोठी चळवळ उभी केली असून आजपावेतो शेकडो प्रकरणांमध्ये कायदेशीर कारवाई देखील केली आहे.

जैन धर्मातील दीक्षाव्रत ही देखील स्त्रीशोषणाची अनिष्ट प्रथाच आहे. कुमारिका किंवा तरुण मुलगी ब्रहमचर्यव्रत स्वीकारून पुढील आयुष्यात धर्मकार्य करण्यासाठी दीक्षाव्रत घेतात. धार्मिकता आणि टोकाची श्रद्धा असलेल्या सामाजिक परंपरेतून अशा अनेक मुली कमी वयातच संसाराचा त्याग करून 'साध्वी' बनतात. असा निर्णय संबंधित युवती स्वतःच घेते असे दर्शविले जात असले तरी कौटुंबिक व सामाजिक संस्कार व दडपणातूनच ही परंपरा टिकून राहिली आहे. जैनांमधील आर्थिक सुबत्ता आणि उच्च राहणीमान यामुळे या प्रथेविरुद्ध फारसा आवाज कुणीही उठवत नाही असे दिसते.

मुस्लिमांमधील तलाक आणि बुरखा या अनिष्ट प्रथांविरोधात आजवर अनेकदा आवाज उठले, आंदोलने झाली. डॉ. बाबासाहेब आंबेडकर म्हणतात, "नक्कीच हिंदुप्रमाणे मुस्लिमातही सर्व वाईट चाली आहेत आणि काही हिंदुहुन अधिक वाईटही आहेत. अधिकच्या वाईट चालींपैकीं एक म्हणजे बुरखा. रस्त्यावर चालणाऱ्या बुरखाधारी स्त्रिया हे भारतातील एक भीषण आणि गलिच्छ दृश्य आहे." इस्लाम मध्ये तोंडाने तीन वेळा तलाक हा नुसता शब्द उच्चारून भरल्या संसारातून स्त्रियांना रस्त्यावर आणता येते. घटस्फोट दिला म्हणजे लग्न नावाचा करार संपुष्टात आला त्यासाठी नुकसानभरपाईची तरतूद करण्याचे कारण धर्माला वाटत नाही. शाहबानो, इमारना, गुडिया या मुस्लिम स्त्रियांनी धर्ममार्तंड आणि अंतर्गत पुरुषप्रधानतेशी प्रचंड लढा दिला. आज विविध पातळ्यांवर मुस्लिम महिला आंदोलने उभी राहिली आहेत.

### ५. बुवाबाजी आणि स्त्रियांचे शोषण

स्वातंत्रोत्तर कालखंडात शिक्षण आणि विज्ञानाच्या कक्षा रुंदावल्या, शहरे विस्तारली, राहणीमान उंचावले, उत्पन्नात झपाट्याने वृढी झाली मात्र विज्ञाननिष्ठ समाज पाहिजे त्या प्रमाणात निर्माण झाला नाही असे खेदाने म्हणावे लागते. आज बुवाबाजीच्या बाबतीत सुशिक्षित आणि अशिक्षित, ग्रामीण आणि शहरी असा भेदही करता येत नाही इतकी बुवाबाजी समाजाच्या सर्वच थरांमधून आढळते. गाव -पाड्यावरील भगत मांत्रिकांपासून तर शहरी उच्चशिक्षितांमधील हायटेक स्वामी, महाराजांपर्यंत कमी अधिक फरकाने सार्वत्रिक रूप बुवाबाजीने धारण केले आहे. ही सामाजिक समस्या असली तरी पुरुषांच्या तुलनेत

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स्त्रियांमधील बुवाबाजी वेगळी आहे कारण महिलांमध्ये कुमारिका, विधवा, मूल न होणाऱ्या, भूत -भानामती यासारख्या मनोविकृतीत अडकलेल्या, टोकाची श्रद्धा बाळगणाऱ्या महिलांची संख्या लक्षणीय आढळते.

भारतात मागील काही वर्षात अनेक मोठे वलय असलेले बुवा लैंगिक अत्याचार प्रकरणी कारागृहात गेले आहेत. त्यात आसारामबापू, रामरहिमबाबा, पुण्याच्या ५० पेक्षा अधिक स्त्रियांचे लैंगिक शोषण करणारा वाघमारेबाबा, असे कितीतरी आहेत. बाबा - बुवांना समाजात प्रचंड मोठे वलय असल्यामुळे तसेच बाबांकडे पाहतांना बाबा ही एक अलौकिक शक्ती आहे असा पक्का समज असल्याने अंधश्वद्धाळू स्त्रियांमध्ये बाबांच्या दर्शनासाठी, कृपाप्रसादासाठी, अनुग्रहासाठी, आशीर्वादासाठी प्रचंड ओढ असते. अशा बाबा - बुवा, महाराजांनी नुसता स्पर्श केला तरी जन्माचे सार्थक झाले अशी भावना असते. अशा बाबाने सहवास मागितला तर तो नाकारणे अनेक स्त्रियांना शक्य होत नाही. आपले, आपल्या कुटुंबाचे, व्यक्तिगत दुःख, आजार, गरिबी दूर करण्यासाठी व आपल्या मनातील इच्छा पूर्ण होण्यासाठी बाबांना प्रसन्न ठेवले पाहिजे असा ठाम अंधविश्वास अशा स्त्रियांमध्ये निर्माण होतो व त्या बाबा - बुवांच्या लैगिक शोषणाच्या बळी बनतात. प्रा. श्याम मानव म्हणतात, "छायेशिवाय वृक्ष असू शकत नाही तसाच अनेकदा बाबा किंवा बुवा बायांच्या भानगडीशिवाय असूच शकत नाही. हे निखळ सत्य मला बुवाबाजीच्या शोधप्रक्रियेत गवसलं." श्याम मानव व डॉक्टर नरेंद्र दाभोळकर यांनी 'अनिस' चळवळीच्या माध्यमातून शेकडो बाबा - बुवांचा भांडाफोड करून अनेक स्त्रियांना मुक्त केले आहे.

### ६. समारोप

प्रस्तुत विवेचनावरून हे स्पष्ट होते की, भारतीय स्त्री - जीवन अद्यापही अंधश्रद्धच्या छायेतून बाहेर आलेले नाही. सावित्रीचा वारसा घेऊन स्त्री शिक्षणात वाढ झाली, उच्चपदव्या घेऊन ती शिक्षिका , वकील, इंजिनियर, डॉक्टर, न्यायधीश, सनदी अधिकारी अशा पदांवर पोहोचली. अनेक कायदे कानूनांमुळे तिला संरक्षण आणि स्वातंत्र्य मिळाले. ग्रामपंचायतीपासून तर संसदेपर्यंत नेतृत्वाचे आकाश खुले झाल्याने तिचा आवाज उमटू लागला. साहित्य, संगीत, नृत्य, अभिनयाने तिचा गजा-वाजा झाला. 'महिला आता पुरुषांपुढे जाऊ लागल्या' अशी सवंग विधाने जागोजागी कानावर येऊ लागली. मात्र समकालीन समाजरचनेचा सांगोपांग अभ्यास केल्यानंतर उपरोक्त चित्र हे वास्तव नसून आभास असल्याचेच लक्षात येते. मूठभर, उच्चशिक्षित, मध्यमवर्गीय आणि राजकीय कुटुंबातील स्त्रिया सोडल्या तर आजही ग्रामीण आदिवासी, दलित व बहुजनांच्या स्त्रिया अज्ञान आणि अंधश्वदेच्या जोखडातून आणि धर्म - संस्कृती, जात - लिंग भेदाच्या बंधनातून मुक्त झालेली नाही असे दिसते. अंधश्रद्धा ही आजही महिला सक्षमीकरणातील प्रमुख अडथळा आहे हेच यातून अधोरेखित होते.

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## अंधश्रद्धा आणि वर्तमानपत्रांची भूमिका

तारायण बा. पाटील

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#### प्रास्ताविक

ोकशाहीचा चौथा स्तंभ म्हणून वृत्तपत्रे, आकाशवाणी, दूरदर्शन व इतर नवमाध्यमे यांचा तथा पत्रकारितेचा उल्लेख केला जातो. माजव्यवस्थेत सतत परिवर्तन घडवून आणण्याचे काम माध्यमांतूनच चालू असते मात्र ही माध्यमे व त्यावरील बातम्या, मनोरंजन कार्यक्रम, ालिका व चित्रपट यातून हे निकोप वळण दिले जाते का ? विज्ञाननिष्ठ आणि निकोप समाज निर्मितीसाठी योग्य दिशेने प्रयत्व केले जातात ा ? हा अंतर्मुख करणारा प्रश्न आहे. २१ व्या शतकात आपण विज्ञान युगात झेप घेतल्याची घोषणा करतो तरीही ग्रामीण भागापासून तर ठिया शहरातील उच्चभूंपर्यंत सर्वच पातळ्यांवर अंधश्रद्धा कमी अधिक प्रमाणात आहे. शिक्षण व उच्च राहणीमानामुळे अंधश्रद्धा निघून जाईल से वाटत होते मात्र कमी तर झाली नाहीच उलट ती वेगवेगळे रूप बदलून पुन्हा पुन्हा विवेकवादी व विज्ञानवादी विचारांसमोर आव्हाने भी करताना दिसत आहे. अशावेळी वृत्तपत्रांपासून तर दूरदर्शन व नवमाध्यामांनी विज्ञाननिष्ठ समाजनिर्मितीसाठी जनप्रबोधन करण्याची पेक्षा असते. अंधश्रद्धेच्या विरोधात ठाम भूमिका घेण्याची अपेक्षा असते अंधश्रद्धा निर्मूलन आणि वर्तमानपत्रांची भूमिका या दृष्टीने प्रस्तुत ोध निबंधाची मांडणी करीत आहे.

### अंधश्रद्धाः : संकल्पना व स्वरूप

धश्रद्धा हा शब्द उच्चरताच आपल्या डोळ्यासमोर बुवाबाजी, जादूटोणा, भूतपिशाच्च, चमत्कार, भानामती इत्यादी अनिष्ठ बाबी उभ्या हितात. प्रसिद्ध पुरोगामी विचारवंत डॉ. अब्राहाम कोवूर असे म्हणतात. 'प्रामाणिक लोक आपले प्रामाणिक काम करून जीवन जगतात तर प्रामाणिक लोक असे सच्चे काम करणाऱ्या लोकांना फसवून आपला उदरनिर्वाह करतात.'? डॉ. नरेंद्र दाभोळकर अंधश्रद्धेचे स्वरूप स्पष्ट रतांना म्हणतात की, 'घडणाऱ्या घटनेस ज्ञानाच्या अनुभवाच्या सहाय्याने प्रश्न विचारले असता जिचा खरेपणा टिकतो, कार्यकारणभाव मजतो तिला विश्वास म्हणतात व जिचा खरेपणा टिकत नाही तिला अंधश्रद्धा म्हणतात. अंधश्रद्धेचे एक वैशिष्ठ्य असते की, ती बाळगणारी यक्ती व समूह तिची चिकित्सा करीत नाही व इतरांनी केलेली त्यांना चालत नाही.'॰ प्रा. श्याम मानव यांनीही स्पष्ट केले आहे की, अंधश्रद्धा का पिढीकडून दुसऱ्या पिढीकडे चालत आलेला एक असा संस्कार असतो की जो एकाएकी जात नाही व त्याच्या विरोधात जाण्याचे धाडस माजमन करत नाही.'३

थोडक्यात अंधश्रद्धा ही संकल्पना सामाजिक रूढी, परंपरा, अज्ञान व स्वार्थलोपूप वृत्ती, परिश्रम न करता काहीतरी मिळेल ही गेळी आशा, चमत्कारांवर व दैववादावर विश्वास या मानवी प्रवृत्तीवर पोसलेली अपप्रवृत्ती आहे. उपरोक्त तीन विचारवंत तसेच इतरही ानेक विचारवंत सामाजिक कार्यकर्ते व समाजसुधारकांनी, संतांनी निकोप सामाजिक निर्मितीसाठी अंधश्रद्धेवर प्रहार करून जनजागृती ज्ली. वृत्तपत्रे व समाजमाध्यमे यांचेही याबाबत योगदान असून आधुनिक युगात माध्यमांसमोर असलेल्या आव्हानांमध्ये वाढ झालेली आहे.

### अंधश्रद्धा आणि वृत्तपत्रांची भूमिका

ात्तपत्रांचा इतिहास मोठा असून महाराष्ट्रात अव्वल इंग्रजी काळात अनेक वर्तमानपत्रांनी आपले स्थान निश्चित केले. इंग्रजी सत्ताकाळातच रहाराष्ट्रात सामाजिक, शैक्षणिक आणि धार्मिक परिवर्तनाचे वारे वाहू लागले. या बदलत्या वातावरणास तत्कालीन वर्तमानपत्रांनी मोठा तिभार लावल्याचे दिसून येते. ही वृत्तपत्रे व्यावसायिक नव्हती तर अज्ञान अंधारात खितपत पडलेल्या आपल्या देशबांधवांची उन्नती करण्याची जबाबदारी आपलीच आहे अशी त्यांची भावना होती. दर्पण, दिग्दर्शन, प्रभाकर, मुंबई खबर, विचारलहरी, ज्ञानप्रसारक, ार्तमानसंग्रह या प्रारंभीच्या वृत्तपत्रांनी वर्तमान परिस्थिती व बातम्या याबरोबर ज्ञानार्जन व समाजप्रबोधनाचे कार्य हाती घेतले. त्यात ामुख्याने अस्पृश्यता निवारण, स्त्रीशिक्षण, इंग्रजी शिक्षण, उद्योगधंदे, रोजगार, इ. ज्वलंत विषयांवर परखडपणे लेखन करीत होती. ८ जून १८३२ च्या दर्पण या अंकात स्त्रीशिक्षणाबाबतची स्थिती उद्धृत झाली आहे. 'सर्व हिंदुस्थानात येथील राहणाऱ्या लोकांनी स्त्रियांचे मनास वेदेचा संस्कार होण्यासाठी एकही शाळा घातली नाही. सातारचे राजांनी आपले देशातील लोकांस चांगले उदाहरण दाखवले आहे.'\* सामान्य वनता व विशेषकरून मागासलेल्या जातीजमातींमध्ये शिक्षणाचे प्रमाण प्रमाण अत्यल्प होते.

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मराठी वृत्तपत्रशृष्टीची परंपरा उज्वल असून सर्वच वर्तमान पत्रांनी शिक्षणाचा प्रसार, अज्ञान अंधश्रद्धांच्या विरोधात जनजाशृ समाजाला निकोप वळण देण्याचे कार्य केल्याचे दिसून येते. या पार्श्वभूमीवर आजची पत्रकारिता तपासून पाहणे आवश्यक आहे. व घेतला समाजाला निकोप वळण देण्याचे कार्य केल्याचे दिसून येते. या पार्श्वभूमीवर आजची पत्रकारिता तपासून पाहणे आवश्यक आहे. व घेतला ही सामाजिक परिवर्तनाची माध्यमे मनाली जातात हे परिवर्तन योग्य दिशेने घेऊन जाणे आवश्यक आहे. स्वातंत्रोत्तर कालखंडात ईच्या कुं ही सामाजिक परिवर्तनाची माध्यमे मनाली जातात हे परिवर्तन योग्य दिशेने घेऊन जाणे आवश्यक आहे. स्वातंत्रोत्तर कालखंडात ईच्या कुं एपण्याचे कार्य अनेक वृत्तपत्रांनी प्रकर्षाने केलेले आढळून येते. मात्र आजच्या जागतिकारणाच्या युगात सामाजिक ध्येयाने प्रेरिहाप्रकारचे जपण्याचे कार्य अनेक वृत्तपत्रांनी प्रकर्षाने केलेले आढळून येते. मात्र आजच्या जागतिकारणाच्या युगात सामाजिक ध्येयाने प्रेरिहाप्रकारचे जपण्याचे कार्य अनेक वृत्तपत्रांनी प्रकर्षाने केलेले आढळून येते. मात्र आजच्या जागतिकारणाच्या युगात सामाजिक ध्येयाने प्रेरिहाप्रकारचे जपण्याचे कार्य अनेक वृत्तपत्रांनी प्रकर्षाने केलेले आढळून येते. मात्र आजच्या जागतिकारणाच्या युगात सामाजिक ध्येयाने प्रेरिहाप्रकारचे जर्म प्रेरणा मागे पडली आणि तिचे रूपांतर व्यावसायिक व बाजरीकरणात झाले. अशावेळी नेमक्या बातम्या, संपादकीय लेख, होनीतील पढी हळूहळू मागे पड लागली आणि त्याची जागा अगडबंब जाहिराती, मसालेदार बातम्या व लेख, देवधर्माच्या आराधना, फल न्य राशिभविष्य, अफवांची पिके अशा बाबीनी घेतली.

आजची अनेक वर्तमानपत्रे बाबाबुवा, स्वामी, महाराज, सद्गुरू, माँ, माताजी यांना व यांच्या कार्यक्रमांना, सदसंगांना, ख पारायणे, गुरुशिष्य मिलन आशीर्वाद यांना पानेच्या पाने फोटोसह छापून प्रसिद्ध करण्यात धन्यता मनात आहेत. असे करणे म्हण धर्मकार्य करीत आहोत असे त्यांना वाटते. यापेक्षा महत्वाचे म्हणजे बुवाबाजीला माननारा वर्ग खूप मोठा असल्याने जे वर्तमानपत्र रूद्र राहील त्या वर्तमानपत्राला कोणी विचारणार नाही हा वैचारिक दृष्टिकोन जोपासला जातो. ठा, केस

भूतेक वर्तमानपत्रे, साप्ताहिके अंधश्रद्धा पसरविण्यात प्रसिद्ध आहेत. अंधश्रद्धा निर्मूलन समितीचे संस्थापक प्रा. श्याम मा 'श्री' नावाच्या साप्ताहिकाचा भांडाफोड केल्याची हकीगत उल्लेखनीय आहे. 'श्री' नावाच्या साप्ताहिकाने 'आम्हीं छापलेत आत्म्य 'श्री' वावाच्या साप्ताहिकाचा भांडाफोड केल्याची हकीगत उल्लेखनीय आहे. 'श्री' नावाच्या साप्ताहिकाने 'आम्हीं छापलेत आत्म्य अशी बातमी देऊन आत्म्याचे तथाकथित फोटो छापले होते.'५ हे प्रकरण जास्त गाजल्यामुळे मानव यांनी मुंबईत येऊन श्री सा गराने न कार्यालय गाठले व त्यांनी संबंधित फोटोग्राफर शोधून काढत त्याला जाब विचारला. फोटोग्राफरने आपण हे संपादकाच्या मागणीक यला स् दिल्याचे सांगत सादर फोटो ट्रिक फोटोग्राफीच्या एक विशिष्ट तंत्र वापरून तयार केल्याची कबुली दिली. मानव यांनी श्री सा पहि देखात्मा' प्रत्यक्ष दाखविण्याचे आव्हान देऊन १ लाखाचे बक्षीस देखील जाहीर केले परंतु हे कोणतेही आव्हाने त्या साप्ताहिकाने : नाही. पत्रकारिता ही लोकशाहीचा चौथा स्तंभ मनाली जाते मात्र हीच पत्रकारिता अंधश्रद्धेची वाहक म्हणून काम करताना दिसतड प्रमा यातन सिद्ध होते.

'आजचा दिवस असा जाईल' या नावाने जवळपास प्रत्येक वर्तमानपत्रात राशिभविष्य छापले असते. अनेक वाचक तर राग्न्रिकार पाहिल्याशिवाय दुसरे काहीही वाचत नाहीत, त्यात मेष - तब्बेतीची काळजी घ्या, वृषभ - धनलाभ संभवतो, सिंह - मित्रांपासून सालेल्या वृश्चिक - प्रवास घडेल काळजी घ्या अशाप्रकारचे १२ राशींचे राशिभविष्य दररोज येते. यातील जवळपास सर्वच विधाने हे केवळ लेले दै असतात मात्र अंधश्रद्धाळुंची मानसिकताच इतकी विकलांग असते की ते हे राशिभविष्य बरोबर असते अशी घाकटी पिटत असताट प्र सुशिक्षित व उच्चभ्रू लोक राशिभविष्याला अंधश्रद्धा मानत नाहीत. प्रसिद्ध साहित्यिक पु. ल. देशपांडे म्हणतात 'शहरी लोकांच्याअपटात म्हणजे 'Air Condition' अंधश्रद्धा होय. ग्रामीण भागातील अंधश्रद्धा नवस, पशुबळी, भुतेखेते करणीवर विश्वास या असतात तर श. मात्र लोकांच्या अंधश्रद्धा म्हणजे ज्योतिष, वास्तुशास्त्र, रेकी, गर्भसंस्कार धार्मिक कर्मकांड इ. पु.लं. चे हे विज्ञानवादी आणि पुरोगार्ममानप लक्षात घेण्याजोगे असून अशा हायटेक अंधश्रद्धामुळे नवशिक्षित व विद्यार्थी वर्गावरही आपोभाप अंधश्रद्धा व अज्ञान यांचा परिणत्व व भयगंडाच्या व अज्ञानाच्या पातळीवर तर हे विचार रुजायला वेळ लागत नाही.

अगदीच नगण्य अपवाद वगळता जवळपास सर्वच वर्तमानपत्रे दैनिक भविष्य, साप्ताहिक राशिभविष्य छापतात. एक प्रहा एक असा वाचकवर्ग आहे जो राशिभविष्याला प्रथम प्राधान्य देतो. काहीजणांचा दावा असा आहे की आम्ही केवळ मनोरंजन म्हणून हेक्क लागला तर लागला ठोका अशीही अनेकांची भाषा असते. यात बारा राशी व त्यांची 'आजचा दिवस कसा जाईल' याची अतिशय ठे विधाने असतात. उदा. मेष - आज प्रवास घडेल, सिंह- प्रकृतीची काळजी घ्या, वृश्चिक - आदरातिथ्य घडेल, तुळ - दानधर्म करने प<sup>रले</sup> इत्यादि स्वरुपाचे दैनिक भविष्य जे नव्वद टक्के लोकांच्या जीवनात दैनिक जीवनच असते. त्यात भविष्य असे काहीही नसते. प्रवास <sup>ते</sup>साध भाजी- दूध घेण्यासाठी होतोच, प्रकृतीची काळजी सर्वजण घेतात. अशाप्रकारे भविष्य वाचन हा माणसाचा अतिशय आवडता छं जातो. शिवाय मेष राशिच्या शंभरात ९० लोकांचे भविला खोटे ठरले तरी कोणीही त्यांची पडताळणी करण्यास जात नाही किंवा तकार करत नाही. काहीजण मानसिक आधार मिळण्याचा दावा करतात. खरेतर ते स्वतः लाच फसवत असतात.

नाशिक येथून प्रकाशित होणारे अतिशय प्रसिद्ध वर्तमानपत्र म्हणून दैनिक देशदूत चा उल्लेख केला जातो. सिन्नर<sup>कूरारा</sup> उदयोगसमुहाने अंगीकरलेले हे उज्वल समाजकार्य मानले जाते मात्र सध्या प्रबोधन व सामाजिक जवळकीची जाणीव सगळी<sup>कडे प्र</sup>ढवि आहे तसेच दैनिक देशदूत चे झाले की काय ? दैनिक देशदूत अंकाने दर गुरुवारी 'भविष्यवेध' नावाची रंगीत पुरवानी द्याय<sup>चा मोठी</sup>

Dago QA

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श्यक आहे. <sub>वो</sub>ती घेतला आहे. भविष्यवेध मध्ये दर गुरुवारी अनेक राजकीय नेते, नट - नट्या, उद्योजक, प्रसिधा बाबा-बुवा, गायक, वक्ते, संगीतकार कालखंडात ध्रादींच्या कुंडल्या, जन्मवेळ, जन्मराशी, आवडीनिवडी त्यांच्यावर असलेले ग्रहगोलांचे परिणाम, त्यांचा सामन्यांशी जोडलेला संबंध <sup>ध्</sup>येयाने प्रे<sub>रित</sub>ाशाप्रकारचे अतिशय अशास्त्रीय, अवैज्ञानिक, ठोकळछाप लेखन प्रसिद्ध होत असते. उदा. दि. ५ ऑगस्ट २०२१ च्या भविष्यवेध रकीय लेख, <sub>हि</sub>रवानीतील लेखन यातील दोन - तीन विधाने देत आहे.' ध

राधना, फल)

घरातील पलंग कधीच भिंतीला टेकून ठेवू नका तसे केल्यास पती-पत्नीमध्ये दरी निर्माण होते.

न्यायालयाची फाईल देवघरात ठेवल्याने दावा आपल्या बाजूने लागण्यास मदत होते.

सदसंगांना, ह में करणे म्हण वर्तमानपत्र

डॉ. निलेश साबळे यांचेवर सरस्वतीचा वरदहस्त असल्याने त्यांना कमी वयात यशप्राप्ती झाली.

उपरोक्त काही विधाने केवळ उदाहरणादाखल सांगितली असून संपूर्ण चार पानी रंगीत पुरवणीत ज्योतिषशास्त्र, फलज्योतिष व ाधश्रद्धांचा जणु पाऊसच पडलेला असून हे सर्वकाही वाचताना आपण विज्ञानयुगात आहोत की, प्राचीन अश्मयुगात आहोत हे कळत नाही. ात्पर्य वर्तमानपात्रांचा उदय समाजप्रबोधन, समाजकारण व राजकारण यांसाठी झालेला होता. दर्पण, प्रभाकर, इंदूप्रकाश, ज्ञानप्रकाश,

ाराठा, केसरी, सुधारक, बाहेष्कृत भारत, मूककनायक ही मराठी वर्तमानपत्र होती म्हणून छत्रपती शिवाजी महाराजांचे विचार, फुले, शाहु, T. श्याम मा बिडकरांचे विचार सामान्य जनांपर्यंत पोहोचले. देशाच्या स्वातंत्र्याची पहाट फुलली व नवमहाराष्ट्राचे पुरोगामीपण टिकून राहीले. मात्र ालेत आत्म्या ाज वर्तमानपात्रांनी आपला आकार पानांच्या संख्येने वाढवला. छपाई, रंग व गुळगुळीतपणा अतिशय देखणा केला तथापि आपला रंगाने व ऊन श्री साप्त<sub>ाकाराने</sub> समृद्ध झालेल्या वर्तमानपत्रांनी आपला जाज्वल्य विचारांचा इतिहास धुळीस मिळवला व विचारांऐवजी विकारांची पेरणी ा मागणीवरु<sub>ग</sub>रायला सुरुवात केली की काय असे खेदाने म्हणावे लागते. दै. सकाळ, लोकसत्ता व महाराष्ट्र टाईम्स सारख्या वर्तमानपत्रांकडे रसिक वाचक ांनी श्री साप्त<sub>ाद्या</sub>पही आशेने पाहत आहे मात्र अंधश्रद्धा निर्मूलनाच्या कार्यात त्यांनीही बोटचेपी भूमिका घेऊ नये हीच अपेक्षा.

डॉ. नरेंद्र दाभोळकर म्हणतात, 'सर्व आधुनिकता, विज्ञानप्रसार यांना अजिबात न जुमानता अंधश्रद्धांचे विविध प्रकार समाजात प्ताहिकाने स ताना दिसत ≔्वंड प्रमाणात वाढत आहेत. धार्मिक सोहळे आणि कथित बाबा, महाराज, बापू, संत यांचे सत्संग तुफान गर्दी खेचत आहे. या सर्वांचा रतीब

सारमाध्यमे भरभरून घालत आहेत. समाजाचे नेतृत्व करणारा घुरीन वर्ग या सर्वांबाबत लोटांगणवादी भूमिका बाळगत आहे. या सर्वातून वक तर राश्कि प्रकारची निराशा येऊ शकते.'॰ डॉ. दाभोळकरांनी मांडलेली व व्यक्त केलेली भीती मर्यादित अर्थाने बरोबरच असून प्रसारमाध्यमांवर सुरु गंपासून सावसलेल्या बातम्या, जाहीराती यातून व्यक्त होत असलेल्या अनिष्ठ बाबी, मालिकांमधून सुरू असलेले घटना प्रसंग, महापुरुषांचे, नेत्यांचे होत ने हे केवळ क्सलेले दैवतीकरण, रामायण, महाभारत, गणेशा, शक्तीमान, यासारख्या धार्मिक मालिकांमधून दाखविले जाणारे चमत्कार प्रधान प्रसंग व ोटत असताक्वाट प्रयोग, 'रात्रीस खेळ चाले' सारख्या मालिकांमधून वाटवविले जाणारी बुवाबाजी, 'देऊळबंद', 'अलख निरंजन' सारख्या मराठी लोकांच्या चैत्रपटातून बिंबविला जाणारा दैववाद या सर्व बाबी विचारात घेता प्रसारमाध्यमे अंधश्रद्धांचा किती रतीब घालीत आहेत हे सहज लक्षात तितत तर शति. मात्र इतर सर्व प्रसारमाध्यमे व वर्तमानपत्रे यात मुलभूत फरक आहे तो असा की इतर प्रसारमाध्यमांवरील बातमीचा खरेपणा गे पुरोगामीर्तमानपत्रातील बातमीवर बऱ्याचदा तपासून पाहिला जातो. एखादी बाब वर्तमानपत्रात छापली गेली की तरच ती खरी मानली जाते चा परिणागास्तव वर्तमान पत्रांची समाजप्रती असलेली जबाबदारी ही इतरांपेक्षा वेगळी तथा खूपच मोठी आहे. इतरांनी चूक केली तर एकवेळ चालूही गकेल मात्र वर्तमानपत्रांची जबाबदारी मोठी असल्याने त्यांनी करायला नकोच अशी अपेक्षा असते. आपली मोठी जबाबदारी वर्तमानपत्रांनी

त. एक प्रचुन्हा एकदा समजून घेणे आवश्यक आहे.

म्हणून ते नेष्कर्ष तथा समारोप

स्वातंत्रोत्तर कालखंडात शिक्षणाचे जाळे शहरांपासून तर ग्रामीण भागातील खेड्यापाड्यापर्यंत आणि वाड्या-वस्त्यां पर्यंत सर्वदूर म करने फ<sup>र्नस</sup>रले शिक्षणाने समाजात जनजागृती होईल व अज्ञान अंधश्रद्धांचा अंधार दूर होईल व विज्ञान विवेकाचा स्वच्छ प्रकाश पडेल अशी म पर्ण , प्रवास त<sup>प्</sup>रवंसाधारण समजूत होती. महात्मा फुलेंनी 'सारे अनर्थ एका अविद्येने केले' असे म्हंटलेच आहे. मात्र सध्याच्या काळातील शिक्षण आणि , प्रवास त<sup>प्र</sup>वंसाधारण समजूत होती. महात्मा फुलेंनी 'सारे अनर्थ एका अविद्येने केले' असे म्हंटलेच आहे. मात्र सध्याच्या काळातील शिक्षण आणि . अवार ते बडता छंद<sup>े</sup>शिक्षितांच्या जीवनपद्धतीकडे पाहिले तर शिक्षणाने केवळ राहणीमान उंचावले, उत्पन्नात वाढ झाली मात्र मनाच्या गाभाऱ्यातील श्रद्धा -वडता थ्रे ही किंवा <sup>अं</sup>धश्रद्धांचा गोफ तसूभरही कमी झालेला दिसत नाही. ग्रामीण भागात, खेड्यापाड्यात बुवाबाजी, भुताटकी, भानामती, नवस-सायास हे प्रकार चालू आहेत त्यापेक्षा कितीतरी अधिक पटीने शहरी, मध्यम व उच्च वर्गात वास्तुशास्त्र, फलज्योतिष, रेकी, गर्भसंस्कार, स्वामी, सिन्नर<sup>कर</sup>महाराज, माँ, सत्संग, स्वाध्याय यांचे पेव फुटलेले दिसून येते. यातुन शिक्षणाने वैज्ञानिक दृष्टीकोन जोपासला गेला नाही व विवेकविचार सिन्नर<sup>कर</sup> <sub>जनवित्तर</sub> राती अमेच दिसन येते ळीकडे म<sup>ावाढविला</sup> नाही असेच दिसून येते.

ना मोठा

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प्रसारमाध्यमे व विशेषतः वर्तमानपत्रांनी समाजाला निकोप वळण देण्यात मोलाची भूमिका बजावलेली आहे. कोणत्याही प्रकार प्रसारमाध्यमे व विशेषतः वर्तमानपत्रांनी समाजाला निकोप वळण देण्यात मोलाची भूमिका बजावलेली आहे. कोणत्याही प्रकार प्रसारमाध्यमे व विशेषतः वर्तमानपत्रांनी समाजाला निकास प्रकृत के सहात्मा फुले, राजर्षी शाहू व डॉ. बाबासाहे प्रका फायदा डोळ्यासमोर ठेवून वृत्तपत्र सृष्टीची वाटचाल झालेली नाही त्यामुळे महात्मा फुले, राजर्षी शाहू व डॉ. बाबासाहे केवांना दिसला. मात्र आज वाढत्या बाजारीकरणात व जागतिकीकरणात अनेकर्ज फायदा डोळ्यासमोर ठेवून वृत्तपत्र सृष्टीची वाटचाल जालला गए. विचारांचा पुरोगामी महाराष्ट्र आकाराला येतांना दिसला. मात्र आज वाढत्या बाजारीकरणात व जागतिकीकरणात अनेक वर्तमाले राजव्या प्रेवन भांडवलशाही, बुवाबाजी, नफेखोरी व झुंडशाहीपुढे लोटांगण घावरू विचारांचा पुरोगामी महाराष्ट्र आकाराला यताना प्रसणाः पार्टिंग के बुवाबाजी, नफेखोरी व झुंडशाहीपुढे लोटांगण घालतांन अस्तित्व विसरून व जाज्वल्य परंपरा बाजूला ठेवून भांडवलशाही, बुवाबाजी, नफेखोरी व झुंडशाहीपुढे लोटांगण घालतांना कि कि जान्यतीय अपवाद वगळता सगळीकडेच असे निराशाजनक चित्र दिसत आहे जेकर अस्तित्व विसरून व जाज्वल्य परंपरा बाजूला ठपून नाज्य पालन उ अतिशय चिंताजनक बाब आहे. काही सन्माननीय अपवाद वगळता सगळीकडेच असे निराशाजनक चित्र दिसत आहे. हेच अज्ञत के कि र्नाणच गणीचे आदा कर्तव्य आहे अन्यथा लोकशाहीचा चौथा स्तंभ ही कि अतिशय चिंताजनक बाब आहे. काही सन्माननाय अपत्राय राज्य आहे अन्यथा लोकशाहीचा चौथा स्तंभ ही बिरुदावली भू

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# চ্চুনিত মোমামায় (চিত্তুব্বান্ত) চিন্নিয়িমিয়ী

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S. No



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### - प्रा. नारायण बाबुराव पाटील कर्मवीर काकासाहेब वाघ महाविद्यालय, प्रेंपाचराज का जा जिप्तून कि जाणन

पिंपळगाव (ब), ता. निफाड, जि. नाशिक. मोबाईल क्रमांक ९८३४९८१८२९

**d** थागत गौतम बुद्धां चेतत्वज्ञान, आणि महात्मा फुले, राजर्षी शाहू डॉ. बाबासाहेब आंबेडकरां चेसत्यशोधक परिवर्तनवादी विचार घेऊन सर्व सामान्य माणसाला आणि सामान्य कार्यकर्त्याला विचारां ची ऊर्जा ज्यां नी दिली ते महाकवी वामनदादा कर्डक म्हणजे अज्ञान, अंधश्रद्धा, रूढी-परंपरांच्या आणि विषमतेच्या विरोधात रान पेटविणारे लोकशाहीर होते. सत्यशोधक विचारां चा प्रचार व प्रसार करणारे डॉ. बाबासाहेबांच्या स्वातंत्र्य, समता व बंधुता या तत्त्वांचा जागर करून गावागावात जनप्रबोधन करणारे शाहीर वामनदादा म्हणजे स्वातंत्र्योत्तर कालखंडातील फुले- आंबेडकरी चळवळीची पेटलेली मशाल होय आपल्या हजारो गीतां मधून, जलशां मधून त्यां नी डॉ. आंबेडकरांच्या महानिर्वाणानंतर दलित शाहिरीला अधिक प्रवाही ठेवण्याची मौलिक कामगिरी केली. नाशिक जिल्ह्यातील एका लहानशा खेड्यात १९२० साली जन्मलेल्या वामनदादांनी पोटापाण्याचा प्रशन सोडविण्यासाठी आई-वडिलां सह मुंबईची वाट धरली. मुंबईत प्राथमिक शिक्षण अर्ध्यावरच सोडून आलेल्या वामनरावांनी एका गिरणी कामगाराची नोकरी पत्करली. यावेळी मुंबईत त्यांचा आंबेडकरी चळवळीने व विचारांनी प्रेरित अनेक कार्यकर्त्यांचा व विशेषत: शाहीरी जलसेकरांशी परिचय झाला. नाशिक जिल्ह्यातील जलसेकार शाहीर भीमराव कर्डक, शाहीर केरजी घेगडे, शाहीर रामचंद्र सोनवणे यांच्या प्रभावातून कवी वामनदादा कर्डक यांच्यातील शाहिरी ललकार जागी झाली आणि एका मोठ्या शाहिरी परंपरेचा उदय झाला.

### २. शाहिरी रचनेला प्रारंभ

वामनदादांनी १९४२ ला शाहिरी कविता व रचनेला प्रारंभ केलेला दिसून येतो असे असले तरी त्यांची काव्यरचना १९५० नंतर अधिक भरलेली दिसते. डॉ. बाबासाहेब आंबेडकरांचेकार्य आणि त्यांचे चारित्र्य यांचा अधिक प्रभाव त्यांच्या शाहिरीवर पडला. डॉ. आंबेडकरांचे जीवन कार्य हीच दलित मुक्ती तथा परिवर्तनाचे युग आहे हे वामनदादांच्या अनेक रचनांवरून लक्षात येते.

> उद्धरली कोटी कुळे- भीमा तुझ्या जन्मामुळे एक ज्ञानज्योतीने - कडेकोट ज्योती तळपतात तेजाने - तुझ्या धरेवरती उजळे काळोख - मावळे जखडदंड पायातील साखळदंड

लोककवी वामनदादा कर्डक / व्यक्ती आणि वाङमय : 18

झाले गुलाम - मोकळे. कोट्यावधी जनतेच्या जीवनाला नवसंजीवनी देणारा प्रज्ञासूर्य डॉ. बाबासाहेब आंबेडकरांचाज्ञानमार्ग आहे. कोट्यावधी जनतेच्या जीवनाला नवसंजीवनी देणारा प्रज्ञासूर्य डॉ. बाबासाहेब आंबेडकरांचाज्ञानमार्ग आहे. कोट्यावधी जनतेच्या जीवनाला नवसजावना प्रधार करण्डू वामनदादा आपल्या गीतां मधून देतात. उजळे काळोख म्हणजेच अंधारातून - प्रकाशाकडे घेऊन जाणारा आहे हो जा वामनदादा आपल्या गीतां मधून देतात. उजळे काळोख अनेकांच्या जीवनाला प्रकाशमान करणारा डॉ. बाबाम्क वामनदादा आपल्या गीतां मधून देतात. उजळ काळाख प्रकार जीवनाला प्रकाशमान करणारा डॉ. बाबासाहेवांषा साखळदंड मोकळे करणारा असा कृतज्ञतापूर्वक उल्लेख अनेकांच्या जीवनाला प्रकाशमान करणारा डॉ. बाबासाहेवांषा साखळदंड मोकळे करणारा असा कृतज्ञतापूर्वक उल्लेख अनेकांच्या जीवनाला प्रकाशमान करणारा डॉ. बाबासाहेवांषा साखळदंड मोकळे करणारा असा कृतज्ञतापूर्वक उल्लेख जगना का स्वागत करते अशी कर्डकांची श्रव वारसा स्पष्ट करतो. आपली रचना ही भीमपशाने जाणारी आहे ती नव्या युगाचे स्वागत करते अशी कर्डकांची श्रव कारसा स्पष्ट करतो. आपली रचना ही भीमपशाने आहे ही वाणी नव्या परिवर्तनातील जीवनाची कहाणी आक्षे के वारसा स्पष्ट करतो. आपली रचना ही भीमपशान जाणारा जाए जाए जाए जाव करणा परिवर्तनातील जीवनाची कहाणी आले श्रेत करण्या जण्डकाची श्रेत करण्या वाणीला भरते आणले आहे ही वाणी नव्या परिवर्तनातील जीवनाची कहाणी झाली श्रेत करण्यासाठी सिद्ध झाली आहे ह जणूकाही भीमानेच आपल्या वाणीला भरते आणल आठ हो ना में जागर करण्यासाठी सिद्ध झाली आहे हैं। वर्ष मूकपणाने अन्याय, अत्याचार सहन करणारी वाणी व विचारांचा जागर करण्यासाठी सिद्ध झाली आहे हा <sub>फाफान</sub>

विधवा विटंबना ऐकूनिया कानी दया न ये मनी काठोरां च्या 11 १ 11 आया बहिणी लेकी आणि सुना अक्रोशिती जाणा धेनूपरी II २II

गरीब व असह्य माता - भगिनींची काय अवस्था होती हे उपरोक्त रचनेवरून स्पष्ट होते. ३. परंपरा व अंधश्रद्धांनामुठमाती

डॉ. बाबासाहेब आंबेडकरांचीचळवळ आणि स्वातंत्र्य, समता, बंधुता, न्याय ही तत्त्वे समाजमनात रूजू लाख अन्यायाविरोधात संघर्ष करण्यासाठी समाजव्यवस्था ढवळून निधाली. वामनदादां ची लेखणी या परंपरा व अज्ञानअंध्रक्ष विरोधात तळपू लागली. याबाबत सुरेश साबळे लिहितात,"प्रज्ञासूर्य डॉ. बाबासाहेब आंबेडकरांच्या सांस्कृतिक आधार्व पताका आपल्या खांद्यावर घेऊन तेजस्वी लेखणीने आणि कणखर वाणीने बुद्ध, फुले, आंबेडकरी चळवळीचे पाईक लोक - लोकशाहीर वामनदादा कर्डक हे खऱ्या अर्थाने समाजशिक्षक, लोकशिक्षक आणि चळवळी विषयीचे सच्चे भाष्यकार हे गेले आहेत; नव्हे वामनदादा कर्डक हे परिवर्तनवादी फुले, आंबेडकरी चळवळीचे ऊर्जा केंद्र होते." समाजप्रबोधन क लोकजागर करण्यासाठी वामनदादानी समाजातील अनिष्ट रूढींवर सतत आसूड ओढले. ते म्हणतात,

मने मारून जाणे जगू नका श्वानाचे -

मानी मर्द तुम्ही भीमरायाचे

आंबेडकरी जलसा म्हटले की अनिष्ट रूढी - परंपरावर प्रहार करणे आलेच. या अनिष्ट रुढींमध्ये जातीभेद को लिंगभेद या विषमतेविरुद्ध ललकार केला जायचा. सामान्य माणसाचे शिक्षण झाले तरच त्याला सत्याचा व ज्ञानाचा आग दिसेल याची वामनदादा यांना खात्री होती. महात्मा ज्योतिबा फुले, राजर्षी शाहू व डॉ. बाबासाहेब आंबेडकरांचेसलाके पुरोगामी आणि विज्ञानवादी विचारांची ऊर्जा वामनदादांच्या काव्यातून व शाहिरीतून लोकांना मिळत होती. सगक्ष बुवाबाजी, भगतबाजी, मांत्रिक, ज्योतिष व भूत-भानामती हे प्रकार केवळ शिक्षणाच्या अभावातूनच पिढ्यांपिढ्याचल् अहे हे त्यांनी ओळखले होते त्यामुळे समाजाचे मोठ्या प्रमाणावर शोषण केले जात होते. डॉ. बाबासाहेबांनी आपल्या कार्यत्रव चळवळीतून समाजाला ज्ञानाची नवसंजीवनी मिळाली आणि लेखक-विचारवंत कवी लिहिते झाले. वामनदादा म्हणतत,

मी नवी कहाणी, होवून वाणी गाते भिमाची गाणी, मी नवी कहाणी IIधुII मी नव्या युगाचे गाणारी त्या भीम पंथाने जाणारी जावून जगाला मोलाची जीवन इथे मी देणारी \*

जी वाणी हजारो वर्ष मूकपणे अन्याय सहन करत होती तीच वाणी आता आंबेडकरांनी दाखविलेल्या मागति जल नवजीवनाची, नवविचारांची, ललकारी देवून लोकमत जागे करण्यासाठी सिद्ध झाली आहे. यातच नवयुगाची संदर्ग कोल लोककवी वामनदादा कर्डक / व्यक्ती आणि वाङमय : 19

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आहेत. समाजाची निरपेक्षपणे सेवा करण्याचे व्रत वामनदादांनी अंगीकारले. ज्ञानेश्वरांनी समाजासाठी परमेश्वराकडे पसायदान मागितले मात्र वामनदादांनी हेच पसायदान डॉ. बाबासाहेब आंबेडकरांकडेमागितले वामनदादा लिहितात,

"भिकारी होऊन दारी तुझ्या मी दान मागावे दीनांच्या चाकरीसाठी - इथे इमान मागावे उपाशी जीव जे कोटी तयाची भूक भागावी अशासाठी तुझ्याकडे भीमाचे ज्ञान मागावे निवरांना कुठे थारा अशांच्या आसऱ्यासाठी मनाच्या मंदिरी थोडे तयांना स्थान मागावे"'

मानवी जीवन समृद्ध असावे, नितिमान असावे अशी याचना कवी करतो. देशातील भ्रष्टाचार, अन्याय, लोकांचे अज्ञान, अंधश्रद्धा, जातीय सामाजिक विषमता स्त्री - पुरुष भेद या सर्वच विषयांवर वामनदादांची लेखणी लिहितांना दिसते. सत्यशोधक विचारांचे महात्मा फुले व स्त्री शिक्षणाच्या उद्धारकर्त्या सावित्रीबाई यांच्याबद्दल वामनदादा कृतज्ञता व्यक्त करताना म्हणतात,

स्त्री जातीच्या मुक्तीसाठी आले महात्मा फुले गं ...

आले महात्मा फुले - मुलींचे शिक्षण केले खुले गं ... "

वामनदादा कर्डकांच्या शाहिरी काव्य बाबत म्हणता येईल की, वामनदादांनी आपल्या जलशांमधून आंबेडकरी चळवळीने स्वीकारलेल्या सामाजिक व सांस्कृतिक मूल्यांचा प्रभावी प्रचार व प्रसार केला. आपल्या सामाजिक जलशांची निर्मिती करतांना प्रामुख्याने अस्पृश्योद्धार चळवळीला प्राध्यान्य तर दिलेच आणि त्याचबरोबर दलित समाजात वेळोवेळी स्थित्यंतरे याचीही जाणीव करून दिली आहे. डॉ. मधुकर मोकाशी लिहितात की, बाबासाहेबांच्या मानवमुक्तीच्या चळवळीमुळे महाराष्ट्रातील समस्त महार पेटून उठले होते त्यावेळी अनेक घरात चुली पेटत नव्हत्या, परंतु घराघरातून माणसे मात्र पेटून उठली होती. अशा अद्भुत आणि अभूतपूर्व तुफानी वातावरणात आयुष्यभर न विझण्याच्या दुर्दम्य इच्छाशक्तीने हा 'तुफान दिवा' पेटून उठलेला आहे." डॉ. मोकाशी यांनी वामनदादांचा केलेला गौरव तात्कालीन आंबेडकरी चळवळीत असलेले वामनदादा कर्डकांचे एकूण स्थान किती महत्त्वाचे होते हे सहज स्पष्ट होते.

४. चोली के पीछे तेरा अनाज...

आंबेडकरी चळवळीतील कलावंताचे सतत मेळावे भरत असताना एका प्रवासादरम्यान त्या काळात गाजत असलेले गाणे एका हॉटेलात वाजत होते यावर सहज प्रतिक्रिया विचारली असता, त्याचे एक गायक विचारवंत सुरेश साबळे यांना वामनदादांनी उत्तर दिले, "सुनो सुरेश साबळे, डी.आर सुनो, ये गाना लिखने वालो को बोलो चोली के पीछे तेरा अनाज है, और चुनरी के नीचे तेरा जन्मस्थान है ! <sup>6</sup> सर्वांना अचंबित व स्तब्ध करणारी ही प्रतिक्रिया होती. वामनदादांच्या या विचारांवरून काव्य, गीतरचना व शाहिरी गायन यात नैतिक मूल्ये किती महत्त्वाचीअसतात व समाजाला कोणता आदर्श दिला पाहिजे याची आवश्यकता वाटते.

### ५. वामनदादा कर्डक - गीतरचना वैशिष्ट्ये

वामनदादा कर्डकां नी गझल लिहिली, 'तिखट ही मिरची' सारखी लावणी लिहिली सांगाया वेडीला, चल ग हरणे, या सुरुवातीच्या गीतां च्या नं तर वामनदादां नी पुढे केवळ आंबेडकरी समाजाला बाबासाहेबां चे तत्त्वज्ञान सांगणारे, उपदेश करणारी, नव्या समाज निर्मितीच्या प्रेरणा फुलविणारी आंबेडकरी समाजातील अपप्रवृत्तींवर प्रहार करणारी गीते आहेत वामनदादा कर्डक हे प्रतिभावंत आहेत कोणत्याही प्रतिभावंताच्या लेखनामागे काहीतरी प्रेरणा असते, तशी ती वामनदादां च्या गीतामागेही असते ही डॉ. बाबासाहेब आंबेडकर यांच्या जीवनकार्यावर असिम निष्ठा वामनदादांच्या प्रत्येक रचनेत आहे. त्याचबरोबर तथागत गौतम बुद्ध, महात्मा फुले, राजर्षी शाहू या सत्यशोधक व पुरोगामी विचारांच्या महापुरुषांचे युगपुरुषांचे कार्य व विचारप्रेरणा वामनदादांच्या शाहिरीमागे आहे त्यामुळे अनेक अनिष्ट अपप्रवृत्ती परंपरा यांच्या विरोधात वामनदादांची लालकर होती. विचार प्रसारासाठी कलावंतांनी शब्द-सुरांनासाधन म्हणून पाहिले व उपयोजिले. त्यांच्या साध्याचे भान कधी व सुरुन देता त्यात एक पिढीकडून दुसऱ्या पिढीकडे सातत्य टिकवून ठेवल्याचे दिसून येते. "मनोरंजनातून प्रबोधन हेच कलावंताचे ध्येय आणि उद्दिष्ट लोककवी वामनदादा कर्डक / व्यक्ती आणि वाडमय : 20

होते. आंबेडकरी प्रतिष्ठावान लोककवी, गायक शाहिरांनी आपल्या प्रतिभेच्या अभिव्यक्तीसाठी शब्द, सूर आणि स्वि होते. आंबेडकरी प्रतिष्ठावान लोककवी, गायक शाहिराना जागे करण्यासाठी - जागृत करण्यासाठी केला यात आंबेडकरी एखाद्या क्षेपणास्त्रासारखा वापर मृतवत पडलेल्यांना जागे करण्यासाठी - जागृत करण्यासाठी केला यात आंबेडकरी एखाद्या क्षेपणास्त्रासारखा वापर मृतवत पडलेल्यांना जागे करण्यासाठी - जागृत करण्यासाठी केला यात आंबेडकरी के एखाद्या क्षेपणास्त्रासारखा वापर मृतवत पडलेल्यांना जागे करण्यासाठी - जागृत करण्यासाठी केला यात आंबेडकरी प्र एखाद्या क्षेपणास्त्रासारखा वापर मृतवत पडलाखाणा से असे एक संशोधक नरेंद्रकुमार कदम यांनी म्हटले आहे. म्हणून वामन दादा कर्डक यांचे योगदान महत्त्वाचे आहे," असे एक संशोधक नरेंद्रकुमार कदम यांनी म्हटले आहे. तन दादा कर्डक यांचेयोगदान महत्त्वाच आहे, जारा प्रात्तितील अनेक अनिष्ट परंपरा विरोधात रान पेटविषा स्वतःचा संसार आणि सुखाचा त्याग करून समाजातील कर्डक खरोखरच महाकवी ठरले अप्रे स्वतःचा संसार आणि सुखाचा त्यांग करणारे वामनदादा कर्डक खरोखरच महाकवी ठरले असे म्हणता है. आंबेडकरां चेकार्य विचार जनमानसात नेऊन प्रबोधन करणारे वामनदादा कर्डक खरोखरच महाकवी ठरले असे म्हणता है.

६. निष्कर्ष

वरील लेखातील विवेचनावरून काही महत्त्वाचे निष्कर्ष हाती येतात ते खालील प्रमाणे -

वरील लेखातील विवेचनावरून काहा महला महला महला नाशिक व मुंबईत गेले. गरिबीमुळे त्यांना शिक्षा के लोककवी वामनदादा कर्डक यांचे बालपण व शिक्षण नाशिक व मुंबईत गेले. गरिबीमुळे त्यांना शिक्षण के सोडावे लागले व मजुरी करावी लागली.

सोडावे लागले व मजुरी करावा लागला. मुंबईत वामन दादांवर शाहीर भीमराव कर्डक, शाहीर घेगडे, सोनवणे यांच्या शाहिरी काव्याचा व जलशांका 2. पडला व ते आंबेडकरी विचारां नी भारावून गेले.

- पडला व ते आबेडकरा विचाराना माराजूर करेंग तरुणपणीच वामनदादां नी अनेक शाहिरी काव्यरचना केल्या व गावोगावी जलसे सादर करून फुले, शाहू अहे ₹. परिवर्तनवादी विचारांचा प्रसार केला.
- धर्मातील अनिष्ट बाबी, देवधर्म, रूढी परंपरा, अज्ञान व अंधश्रद्धा यावर वामनदादांनी परखड शब्दात हला क ٧. शाहिरी ललकार दिली.
- वामनदादांच्या समग्र काव्यातून डॉ. बाबासाहेब आंबेडकरांच्या विचारांचा, कार्याचा, चळवळीचा गौख 4. दिसतो त्यामुळेच त्यांना भीमशाहिर अशी उपाधी दिली गेली. अनेक विवेचक आंनी त्यांना महाकवी, के असेही संबोधले.
- दलित साहित्यिक, कवी, समीक्षक, लोकसाहित्याचे अभ्यासक, मराठी साहित्याचे संशोधक अशा अनेक क ξ. वामनदादा कर्डक यांच्या कविता, गीते व शाहिरी यांवर अभ्यासपूर्ण विचार मांडले आहेत.
- वामनदादा कर्डक यांच्या शाहिरी कवितेने मराठी साहित्यात व दलित चळवळीत मोलाची भर पडलेले कं 19. समाजात मोठ्या प्रमाणात जनजागृती झालेली आहे.
- वामनदादांच्या शाहिरीने प्रभावित होवून अनेक गायक, कवी, लोककलावंत शाहीर निर्माण झाले त्यमुबेहे 6. साहित्य व लोककलां ना प्रेरणा मिळाली आहे.

### ७. संदर्भ

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- उनि. पृष्ठ १२० 8.
- उनि. पृष्ठ १२२ 4.
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लोककवी ता

9. कदम सुरेंद्रकुमार, वामनदादा कर्डक यांच्या गीतांचा चिकित्सक अभ्यास पीएच.डी संशोधन प्रबंध स्वामी <sup>(मा</sup> तीर्थ विद्यापीठ नांदेड, जून २००७, पृष्ठ ५

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कर्मवीर काकासाहेब वाघ महाविद्यालय, पिंपळगाव (ब), ता. निफाड, जि. नाशिक.

### प्रास्ताविक

'शेतीप्रधान अर्थव्यवस्था' अशी ओळख असलेल्या आपल्या देशाच्या शेती व्यवस्थेत १९६० नंतरच्या हरितक्रांतीने खऱ्या अर्थाने चेहरा-मोहरा बदलायला सुरुवात झालेली दिसून येते. केवळ उपजीविकेचे साधन म्हणून केली जाणारी शेती आधुनिक काळात व्यापार आणि कृषी-उद्योगांचा आधारभूत घटक बनली. सामाजिक जीवनाचा अविभाज्य भाग असलेली ग्रामीण अर्थव्यवस्था व समाजव्यवस्था राजकारणाच्या अर्थात सत्ताकारणाचीही केंद्रबिंदू बनली. आधुनिक काळातील वाढत्या शैक्षणिक सुविधांमुळे व प्रसारमाध्यमांच्या विस्तारामुळे ग्रामीण समाजाला आपल्या अस्मितांची व न्याय हक्कांची जाणीव होऊ लागली. इतरांच्या तुलनेत आपली गळचेपी त्याच्या लक्षात येऊ लागली आणि आत्मभान आलेला वर्ग लेखणीच्या माध्यमातून व्यक्त होऊ लागला. १९८० नंतर या लेखनाने नवे वळण घेतले व ग्रामीण साहित्याच्या रूपाने मराठीत एक मुख्य प्रवाह उदयास आला. ग्रामीण कथा, ग्रामीण कादंबरी व ग्रामीण कवितांच्या रुपाने मराठी ग्रामीण नवलेखक कवींचा प्रचंड मोठा वर्ग उदयास आला. या साहित्यप्रवाहातील अतिशय लोकप्रिय साहित्यप्रकार म्हणून ग्रामीण-कृषी कवितांचा समावेश होतो. ज्येष्ठ साहित्यिक डॉ. द. ता. भोसले म्हणतात, "पाण्यात भिजलेल्या एखाद्या ढेकळासारखा अज्ञान अंधश्वद्धा शोषण आणि दारिद्य यात आजन्म विरत जाणारा आणि दिशाहीन स्वरूपाचे नि:सत्व जीवन जगणारा हा ग्रामीण समाज देहावर पडलेल्या शतकानुशतकांच्या मातीतून वर डोकावून आशावादी नजरेने आणि आत्मविश्वासाने अवतीभवती पाहू लागलेला आहे."<sup>8</sup>

कृषी व ग्रामीण जीवनाचे बदलते समाजवास्तव डॉ. भोसले यांनी आपल्या शब्दांमधून नेमकेपणाने स्पष्ट केले आहे. समकालीन व आधुनिक काळातील स्थित्यंतराचा परिणाम हा एकूण ग्रामीण साहित्य व ग्रामीण कवितेतून प्रतिबिंबित झालेला आहे. प्रस्तुत शोधनिबंधातून त्याचा वेध घेण्याचा प्रयत्न करीत आहे.

१९८० नंतरची ग्रामीण कविता

स्वातंत्र्योत्तर काळात खेड्यांमधून मोठ्या प्रमाणात परिवर्तन झाले. गावगाड्यांनी बद्ध असलेला, एक मेकांच्या सलोख्याने, आधाराने राहाणारा, परस्परांविषयी आत्मीय भावना ठेवणारा गाव बदलला. कालपरत्वे ग्रामीण जीवन बदलले, जीवनाचे स्वरूप बदलले, समाजाची दृष्टी बदलते, त्याचे आचार विचार बदलतात. माणसांच्या - समाजाच्या भौतिक व ऐहिक गरजा बदलतात. या सर्व स्थित्यंतराचा ग्रामीण साहित्यावरही विविध प्रकारे परिणाम झाला. समाजाच्या प्रत्येक क्षेत्रातील स्थित्यंतराचा त्या समाजाच्या, राहणीमानावर, जीवनशैलीवर परिणाम घडत असतो व त्यातून सामाजिक स्थित्यंतर घडत असते. समाजात काही महत्त्वाच्या स्थित्यंतरास कारणीभूत ठरणार्

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घटना घडत असतात. त्या घटनांचा साक्षीदार असणारा संवेदनशील मनाचा कवी गप्प राहणे शक्य घटना घडत असतात. त्या घटना पा सामा मही. तो त्या बदलाची, स्थित्यंतराच्या, निर्माण झालेल्या सामाजिक संघर्षाची शहानिशा करून त्या नाही. तो त्या बदलाचा, ास्थत्यतराज्या, गाँव विद्यानाचे शब्दरूप आपल्या कवितेतून ग्रामीण कवी मांट्र घटनांचे, सामाजिक संघर्षाचे त्यामागील तत्वज्ञानाचे शब्दरूप आपल्या कवितेतून ग्रामीण कवी मांट्र घटनाच, सामााजक संवयाय (पार्मा से क्वाल्यानंतर ग्रामीण कविता मोठ्या प्रमाणावर लिहिली जाडु लागल. ग्रामाण साहत्याया पुछा पुढे येऊ लागली. ही कविता "काव्यगुणात" कमी असली तरी लागला. ( ८००-०९ गएए पा जाणीव नोंद घेण्याजोगी होती.... आशयाभिव्यक्तीचे सर्व संकेत बाजूला तिच्यातून व्यक्त होऊ पाहणारी जाणीव नोंद घेण्याजोगी होती.... ातच्यातून व्यक्त होज गर्हता सम्प्रताल भिडलेले दिसतात असे निरीक्षण डॉ. रवींद्र ठाकूर यांनी नोंदविले सारून हे कवी सरळ जीवनानुभवाला भिडलेले दिसतात असे निरीक्षण डॉ. रवींद्र ठाकूर यांनी नोंदविले आहे. २ ग्रामीण भागातला माणूस वाचू लागला, लिहू लागला त्यातूनच ग्रामीण समाज जीवनाचे, वास्तवाचे चित्रण ग्रामीण कवितेतून येऊ लागले. खेड्यातील नवी पिढी शिक्षणामुळे विचारी वनली तिची अस्मिता, सामाजिक जाणिवा वाढीस लागल्या. त्यामुळे मध्यम वर्गीय शहर स्थित लेखकांनी लिहिलेल्या ग्रामीण साहित्यामध्ये त्यांना उणिवा जाणवू लागल्या हे खऱ्या अर्थाने ग्रामीणतेचे चित्रण नाही, हे त्यांच्या लक्षात येऊ लागले. आपले अनुभव आपणच चित्रित करावेत या अस्मितेतून त्यांनी लेखणी हाती धरली. त्यात खेडयांचे वास्तव चित्रण येऊ लागले. बोलीभाषेचा वापर होऊ लागला. ग्रामीण समाज जीवनाकडे गांभीर्याने बघणारी व बदलत्या समाज जीवनाचे चित्र आपल्या काव्यातन मांडणारी नवी पिढी उदयास आली. यात प्रामुख्याने विठ्ठल वाघ, पुरुषोत्तम पाटील, एकनाथ देशम्ख. प्रभाकर चौधरी, माधव थोरात, नारायण कुलकर्णी, उत्तम कोळगावकर, जगदीश देवपूरकर, राजन गवस, नारायण सुमंत, शशिकांत शिंदे, सूर्यभान चव्हाण, उषा भालेराव, सतीश शिरसाठ, भास्कर बढ़े गोविंद थेटे, मोहन पाटील, इंद्रजित भालेराव, लक्ष्मण महाडिक, प्रकाश होळकर, रावसाहेब कुवर आदी मराठी ग्रामीण कवींनी बदलत्या ग्रामीण समाजजीवनाचे चित्र त्यांनी आपल्या कवितेतून मांडले आहे.

ग्रामीण भाषेच्या वापराविषयी १९८० नंतरच्या काळात नव्या पिढीने सर्व संकेत झुगारले दिसतात. अहिराणी, वऱ्हाडी, कोकणी या बोलीतून अस्सल ग्रामीण बोलीतील कविता जशी येते तमेच सरसकट विधानांचे रूप घेऊन येणारी, अष्टाक्षरी छंदाचा वापर करून यमकबद्ध अभिव्यक्ती करणारी अशी सर्वच रूपे या काळात आढळतात. अनुभव व जाणीव प्रमाण मानून त्यानुसार अभिव्यक्ति विषयांना प्रमाण मानणारी मानसिकता या काळात दिसून येते. १९६० पासून १९९० पर्यंत अनेक क्वी ग्रामीण कविता लिहीत असले तरी ही संख्या निश्चित समाधानकारक नाहीत. यातील नाव घेण्यासाखे दोन-तीनच नावे ग्रामीण कवितेत दिसतात. याविषयी नागनाथ कोत्तापल्ले यांनी खंत व्यक्त केली आहे १९४५ पासून मराठीत जाणीवपूर्वक ग्रामीण साहित्य निर्माण होत आहे. प्रारंभी ग्रामीण जाणिवांची अभिव्यक्ती कवितेतून होती परंतु कविता हा वाडमय प्रकार कमी कलावंतांना जवळचा बाटलेला दिसतो. ग्रामीण जाणिवांची अभिव्यक्ती करणारी किती कविता मराठीत आहे? त्यातही खऱ्या अर्थने वास्तवाला सामोरे जाणारी कविता किती आहे याची मोजदाद केली तर काय चित्र स्पष्ट होईल ते मिळाली नसल्याची खंत कोत्तापल्ले व्यक्त करतात.
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### १९९१ नंतर जागतिकीरणाचे प्रतिबिंब

जागतिकीकरणाची प्रक्रिया असली तरी १९९१ नंतरच्या काळात ग्रामीण भागात त्यामुळे दारिद्रा, बेकारी व बकालपणा वाढला. शहरांना सूज येऊन नागरी समस्या तीव्र झाल्या असल्या तरी दुसऱ्या बाजूने खेडी ओस व भकास होऊन उद्ध्वस्त होऊ लागली आहे. मोबाईल संगणक रस्ते टी.व्ही. च्या वाहिन्या इ. कितीतरी नवीन बाबी खेड्या पर्यंत पोचल्या असल्या तरी 'आर्थिक सुबत्ता' हा जो जागतिकीकरणाचा परिणाम सांगितला जातो, तो खेड्यांपर्यंत पोहोचला नाही. उलट महागाई वजा नापिकी मुळे शेतकऱ्यांना शेती करणे व जगणे अवघड होऊ लागले. त्याचा परिणाम म्हणजे इतिहासात कधीच न झालेले शेतकऱ्यांच्या आत्महत्यांचे सत्र या दशकात वाढलेले आहे. २००६ या एकाच वर्षात विदर्भ व खानदेश येथील एकूण २७८ शेतकऱ्यांनी आत्महत्या केल्या आंकात शब्दबद्ध करताना इंद्रजित भालेराव सारख्या कवी म्हणतो -

'जागतिकीकरणाचा येड्रीनंचा डबा कुणी धुतला निर्मळ गंगेत? निरागस विहार करणाऱ्या नाकात कुणी आणून कुंबला अचानक आंकात'? मात्र ही आकडेवारी व बातम्या वाचूनही समाज व राज्यकर्ते उदासीन आहेत त्यावर भाष्य करताना ते परखडपणे नोंदवतात. पंतप्रधान म्हणाले : 'घेतलेल्या कर्जाचे आणि कुटुंबाचं नियोजन करता येत नाही म्हणून शेतकरी आत्महत्या करतात. शेतकऱ्यांनी विचारलं-देशाचे नियोजन जमलं नाही म्हणून किती पंतप्रधानांनी आतापर्यंत आत्महत्या केली? या आत्महत्यांची कारणमिमांसा करताना अविनाश गायकवाड लिहितात. 'आसुडा ऐवजी आत्महत्या करतो शेतकरी काबीज ज्यांच्या तमाम स्त्रोत, जमीन, पाणी हलत नाही त्यांची जड कातडी!' हे जाड कातडीची लोक कोण आहेत? त्याची जाणीवही या पिढीला झाली आहे. म्हणूनच कवी सुरेश शिंदे नोंदवितात -पाणी खळ्यात पडो की मळ्यात जाते मात्र त्यांच्याच तळ्यात'

किंवा शेतीतील कष्टाचे महाभारत नोंदविताना ते म्हणतात

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'कागदावर काळ करण्या इतकं

सोपं असत काय? मातीला हिरवा करणं जीवाचं वापशावर पेरावा लागतो. तेव्हा उगवतो हिरवा कोंब बाबांनो तुमच्या आकड्यांना आणि अक्षरांना तर माझ्या डिग्रीला बाळवी लागली नसती मग माझ्या बापानं

आत्महत्या का केली असती कारण परंपरा माहीत झाल्याने चक्क कवी आता 'आत्महत्या नको हत्या करायला शिक' असे आवाहन करतो.

अर्थात १९९० नंतरच्या ग्रामीण कवितेत शेतकऱ्यांच्या सृजनावरोबर त्यांचे शोषण, त्यांच्या वेदना, हाल-अपेष्टांबरोबर त्यांच्यावर होणारा अन्याय ही चित्रित झाल्याचे दिसून येतो. षण शेतकऱ्यांच्या समस्यांची पाळेमुळे प्रचलित राजकीय-आर्थिक व्यवस्थेत दडलेली आहे. याची जाणीव या कवींना झालेली आहेत, ती त्यांनी आपल्या कवितेतून व्यक्त केली आहे. आता केवळ जीवनसंघर्ष न्न्हे तर अन्याय-जुलूम यांच्या विरुद्ध लढा या भूमिकेवर हे कबी येऊन ठेपले आहेत त्याची जाणीव सर्वप्रथम अत्यंत ताकदीने विठ्ठल वाघ यांनी आपल्या कवितेतून व्यक्त केली आहे. त्यानंतर इंद्रजित भालेराव हे दुसरे अतिशय महत्त्वाचे नाव आहे. त्याशिवाय नारायण सुमंत, जगदीश कदम, श्रीकांत देशमुख, अनिल पाटील, लक्ष्मण म्हाडिक, सदानंद देशमुख, केशव सखाराम देशमुख, जयराम खेडेकर, एकनाथ कांबळे, रमेश चिल्ले, प्रकाश होळकर, संतोष पवार, बालाजी इंगळे, महेश मोरे, ललित अधाने. पी. विठ्ठल, सुदाम राठोड, विरा राठोड, संदीप जगदाळे ही काही महत्त्वाची नावे या संदर्भात आवर्जून उल्लेख करावी अशी आहेत. त्यापैकी प्रत्येकावर स्वतंत्रपणे लिहीता येईल एवढी ऊर्जा त्यांच्या कवितेत निश्चितच आहे.

### २००० नंतरची दमदार कविता

२००० नंतर लिहिणाऱ्या कवी मध्ये नव्या प्रश्नांना ताकदीने भिडणारे अनेक आशावादी चेहरे दिसतात. श्रीकांत देशमुख, ऐश्वर्या पाटेकर, तुकाराम धांडे, पृथ्वीराज थौर, केशव खटींग, पी. विठ्ठल, कल्पना धुमाळ, विष्णू थोरे, भरत दौडणकर, कैलास दौंड, मोहन कुंभार, विजयकुमार मिठे, विनायक येवले, कैलास सलादे, विनायक पवार, संतोष नारायणकर, अशोक कोळी, बालाजी मदन इंगळे, रवी कोरडे, ललित अधाने, लक्ष्मण बारहाते, ज्ञानेश उगले, गणेश मरकड, नामदेव कोळी, लता शेवाळे, किरण भावसार, सचिन गांगुर्डे, रवींद्र कांगणे, निमंत चांदगुडे, अमृत पेलंग, प्रभाकर शेळके, रावसाहेव जाधव, राजेंद्र उगले, निलेश शेळके, शैलेंद्र चव्हाण, राजेंद्र दिघे, अरुण पवार, रावसाहेब जाधव, ना<sup>गेश</sup>

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शेलार, दत्ता सोनवणे, किरण संधान, संतोष झोमन, सोमनाथ पवार, सोमनाथ फुगट, रवी देवरे, सागर जाधव, विलास माळी, दयाराम हगलाणकर, काशिनाथ वेलदोडे, शिवाजी भालेराव, रूपाली खैरनार, कोमल जगझाप ही नव्या पिढीतील कवी मंडळी महाराष्ट्राच्या कानाकोपऱ्यातून वेगवेगळ्या जाणिवांचे अविष्कार करताना दिसतात. वर दिलेली कवीची यादी आणखी वाढू शकते.

### निष्कर्ष

एकंदरीत ग्रामीण व कृषी जीवनाचे प्रतिबिंब मराठी ग्रामीण कवितेने टिपले आहे हे प्रकर्षाने प्रस्तुत शोधनिबंधातून जाणवते. प्रस्तुत शोधनिबंधातून खालील काही निष्कर्ष हाती येतात.

- १) ग्रामीण साहित्यातील मानवी जीवन हे नागरी जीवनापेक्षा वेगळे आहे. कृषी निगडित समस्या या साहित्याच्या प्रेरणा आहेत.
- २) १९६० नंतर साहित्यात अनेक नवीन प्रवाह आले. ग्रामीण, दलित, जनवादी, स्त्रीवादी, आदिवासी व प्रबोधन साहित्याने मराठी साहित्याच्या कक्षा विस्तारल्या.
- ३) १९८० नंतर ग्रामीण कवितेचे दालन अनेक कवींनी समृद्ध केले. कृषी-जीवनाशी संबंधित नव साहित्यिक वर्गाचा वाटा मोठा राहिला.
- ४) १९९१ नंतरच्या जागतिकीकरणाचा प्रभाव सर्वच घटकांवर झाला. शेतीतील सामाजिक, आर्थिक व तांत्रिक घटकांमध्ये आमूलाग्र बदल झाले. ग्रामीण कवितेत त्याचे प्रतिबिंब पडलेले दिसून येते.
- ५) वाढत्या शहरीकरणाचा, आधुनिकीकरणाचा शेती व शेतकरी यांच्यावर सतत प्रभाव पडत आहे. आज सेझ, प्रकल्पग्रस्तांचे प्रश्न, कर्जबाजारीपणा, बेरोजगारी, कुटुंबाचे विभक्तीकरण, जमिनीचे तुकडीकरण या समस्यांमधून शेतकरी जीवनाच्या समस्यांमध्ये वाढ होत आहे. त्याचे प्रतिबिंब १९९१ नंतरच्या कवितांमधून स्पष्ट जाणवते.
- ६) २००० नंतरच्या उत्तर आधुनिक काळात शेती व शेतकरी जीवनात होत असलेली विविध स्थित्यंतरे व विस्तारलेल्या समस्या आधुनिक कवितेने टिपल्या आहेत. या काळात अनेक नव्या दमाचे ग्रामीण कवी उदयास आलेले दिसतात.

### संदर्भ

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### Infra-red Spectroscopy and Elasticproperties of Ce<sup>3+</sup> Ion Substituted Cu-Zn Ferrite

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### ABSTRACT

 $Cu_{0.5}Zn_{0.5}Ce_xFe_{2-x}O_4$  (x = 0.0, 0.025, 0.05, 0.075, 0.1) ferrite nanoparticles were synthesized by using the solgel auto-combustion approach. The synthesized samples were sintered at 600 degree for 4 hours. Infrared spectra have been completed at room temperature within the wavenumber variety of 300-800 cm<sup>-1</sup>. The IR spectra display principal absorption bands. High-frequency bands 'v<sub>1</sub>' is assigned to the tetrahedral and low-frequency bands 'v<sub>2</sub>' are assigned to the octahedral sites of the complex. The Force consistent for the tetrahedral and octahedral sites changed is study by the usage of IR information. Force constant values is used to calculate the Stiffness constants (C<sub>11</sub> and C<sub>12</sub>). Considering the values of stiffness constants; Elastic moduli consisting of young's modulus, Rigidity modulus, Poisson's ratio, and Debye temperature are calculated.

**KEYWORDS:** Sol-gel method, Ferrites, Infra-red spectroscopy, Elastic property.

### **INTRODUCTION**

Cu-Zn spinel ferrites have wide varietyof application like non-resonant devices, radio frequency circuits, read/write heads for high-speed digital tapes, and microwave devices. <sup>1-2</sup> The small addition of external ions can change the ferrite identity along with their properties.<sup>3</sup> The spinel ferrites properties such as structural, magnetic, and electrical are based on cation distribution of cations in between tetrahedral [A] and octahedral (B) site of spinel structure.<sup>4</sup>Infrared spectroscopy (IR).<sup>5</sup>Structural evaluation gives useful details about the spinel structure. The technique is based upon selective adsorption in the IR.The tetrahedral (A) and octahedral [B] sites of spinel ferrites show absorption bands in the IR spectra split based on cations distribution on them.<sup>6–8</sup>Study of elastic behaviours of ferrites provides the information of interatomic and interionic forces in them. Ferrites are very strong and cannot be deformed under normal conditions.<sup>9-11</sup> Ferrites samples were prepared in several methods. Such as Solid-state reaction<sup>12</sup>. Hydrothermal preparation<sup>13</sup>, Micro emulsion method<sup>14</sup>, Oxalate Precursors method <sup>15</sup>. Now a day, among these various preparation methods of the ferrite nanoparticles, like Sol-gel auto-combustion techniques<sup>16</sup>. The elastic constant is presents nature of the binding forces in the solid. The mechanical strength, fracture toughness and thermal resistance information study by elastic modulus <sup>17</sup>. Study of elastic properties is examined by the synthesis of Cu<sub>0.5</sub>Zn<sub>0.5</sub>Ce<sub>x</sub>Fe<sub>2-x</sub>O<sub>4</sub> (x = 0.0, 0.025, 0.050, 0.075, 0.1) using Sol-gel Auto-Combustion method along with effect of Ce<sup>3+</sup> substituted in prepare ferrites.

### EXPERIMENTAL

Nanocrystalline ferrite powders with compositions of  $Cu_{0.5}Zn_{0.5}Ce_xFe_{2-x}O_4$  (x = 0.0,0.025,0.05,0.075,0.1) were synthesized by Sol-gel Auto-Combustion technique. Shown in the fig.1. The metal nitrates (A.R. grade with 99.8 % purity) Copper Nitrate, Cu NO<sub>3</sub>)<sub>2</sub>6H<sub>2</sub>O, Zinc nitrate (Zn (NO<sub>3</sub>)<sub>2</sub>.6H<sub>2</sub>O), ferric nitrate (Fe(NO<sub>3</sub>)<sub>2</sub>.9H<sub>2</sub>O), Cerium nitrate (Ce(NO<sub>3</sub>)<sub>3</sub>6H<sub>2</sub>O), and citric acid (C<sub>6</sub>H<sub>8</sub>O<sub>7</sub>.H<sub>2</sub>O), were used as starting materials. The reaction was carried out in the air atmosphere without the protection of inert gases. The molar ratio of metal nitrates to citric acid was taken as 1:3. The metal nitrates were dissolved together in a minimum amount of double distilled water to get a clear solution. An aqueous solution of citric acid was mixed with metal nitrates solution, then ammonia solution was slowly added to adjust the pH  $\cong$  7. The mixed solution was kept on to a hot plate with continuous stirring at 90 °C. During evaporation, the solution became viscous and finally formed a viscous brown gel. When finally, all water molecules were removed from the mixture, viscous gel began frothing. After few minutes, the gel automatically ignited and burnt with glowing flints. The decomposition reaction would not stop before the whole citrate complex was consumed. The auto-combustion was then annealed at 600 °C for 4 hrs. The infrared spectra of all the samples were recorded at room temperature in the range 200 cm<sup>-1</sup> to 800 cm<sup>-1</sup> on Perkin Elmer infrared Spectrophotometer.

### Sol-gel Auto-combustion



Fig.1.Schematic diagram for the Sol-gel auto-combustion method.

### **RESULTS AND DISCUSSION**

**Infra-Red Spectroscopy:** NanocrystallineCu<sub>0.5</sub>Zn<sub>0.5</sub>Ce<sub>x</sub>Fe<sub>2-x</sub>O<sub>4</sub> ferrite system is illustrated in Fig. 2. IR spectrum in the range of 200-800 cm<sup>-1</sup>. The investigated absorption band was listed in Table 1. It is observed from Table 1. IR spectrum displayed two absorption bands at562-627 and 362-418 cm<sup>-1</sup> for the spinel ferrites. The better frequency band (v<sub>1</sub>) become due to the stretching vibration of the tetrahedral metallic-oxygen bond and the decrease frequency band (v<sub>2</sub>) changed into because of the octahedral steel-oxygen bond [13]. The band positions for all of the investigated compositions are given in Table 1. The trade inside the lattice constant is chargeable for this shift of the middle frequencies. The increase inside the unit mobile dimensions due to the substitute of Fe<sup>3+</sup> ions via large ionic radius Ce<sup>3+</sup>ions affect the Fe<sup>3+</sup>- O<sup>2-</sup>stretching vibrations and that is a distinguished reason of trade in band positions. The change inside the frequency of the v1 stretching band suggests the choice of Ce<sup>3+</sup>ions to occupy the octahedral sites. The height intensity of frequency bands slightly

changes with growing Ce<sup>3+</sup>substitution. It is understood that the depth ratio is a feature of the trade of dipole moment with the inter-nuclear distance  $(d\mu/dr)$  [14]. This split represents the contribution of the ionic bond Fe-O inside the lattice. Furthermore, it's miles determined from Fig. 2. that the regular mode of vibration of a tetrahedral cluster(v<sub>1</sub>) is higher than that of the octahedral cluster(v<sub>2</sub>), that is attributed to the shorter bond period of tetrahedral cluster and longer bond period of octahedral cluster. Using the analysis of Waldron [5], the force regular K<sub>o</sub> and K<sub>t</sub> were calculated.



Fig 2. Infrared spectra for the series Cu<sub>0.5</sub>Zn<sub>0.5</sub>Ce<sub>x</sub>Fe<sub>2-x</sub>O<sub>4</sub>.

According to Waldron the force constant  $K_t$  and  $K_o$  for respective sites are given by:

$$K_{t} = 7.62 \times M_{1} \times v_{1}^{2} \times 10^{-3}$$
(1)  
$$K_{0} = 10.62 \times \frac{M_{2}}{2} \times v_{2}^{2} \times 10^{-3}$$
(2)

Where,  $K_0$  = pressure regular on octahedral site,  $K_t$  = force regular on tetrahedral web site,  $M_1$  = Molecular weight of tetrahedral web site,  $M_2$  = Molecular weight of octahedral web page,  $v_1$ =Corresponding centre frequency on tetrahedral web page,  $v_2$  = Corresponding middle frequency on octahedral website online. The values of forces are summarized in Table 1. The force constant Kt increasing with the increasing Ce<sup>3+</sup>content whereas  $K_o$  will increase with the increase in Ce<sup>3+.</sup> This variation can be associated with the distinction in ionic radii of Fe<sup>3+</sup> and Ce<sup>3+</sup>ions and their occupancy at A and B web sites. Analysis of IR spectra with crystallographic know-how enables us to decide the Debye temperature and elastic houses. The Debye temperature ( $\theta$ I) of all samples turned into calculated the usage of the wavenumber of IR bands.[14].

$$\theta l = hCVac/k \tag{3}$$

Where,  $h = h/2\pi$ , ok is Boltzmann constant, C is the speed of mild (C =  $3x10^8$  cm/s) and V<sub>av</sub> is the common wave quantity of bands. Variation of Debye temperature with Ce<sup>3+</sup> content material is proven in Fig.3.



Fig.3. Variation of Debye temperature calculated from infrared ( $\theta$ I) and elastic ( $\theta$ <sub>E</sub>)data with Ce<sup>3+</sup> content.

Table No.1: Cu<sub>0.5</sub>Zn<sub>0.5</sub>Ce<sub>x</sub>Fe<sub>2-x</sub>O<sub>4</sub> of (a), (dx), (v<sub>1</sub>and v<sub>2</sub>), (K<sub>0</sub> and K<sub>t</sub>) are Lattice constant, X-ray Density, Band Position, force constant respectively.

C	'a' (Å)	'd <sub>x</sub> ' (g/cm <sup>3</sup> )	<b>Band</b> position		Force constant		
Comp. x			v <sub>1</sub> (cm <sup>-1</sup> )	$\nu_2 (\text{cm}^{-1})$	K <sub>0</sub> x 10 <sup>5</sup> (dyne/cm)	K <sub>t</sub> x 10 <sup>5</sup> (dyne/cm)	
0.0	8.364	5.353	566.41	362.45	0.814	1.404	
0.025	8.373	5.369	570.63	367.92	0.838	1.429	
0.05	8.394	5.371	571.3	395.51	0.968	1.439	
0.075	8.415	5.386	575.17	399.64	0.988	1.467	
0.1	8.421	5.391	627.14	418.34	1.079	1.745	

**Elastic Properties:** The elastic properties had been decided the use of infrared spectroscopy [18-20] These elastic moduli have been calculated the usage of the values of lattice constant 'a', X-ray density 'dx', pore fraction 'f', and force constant 'K'. Values of lattice constant, X-ray density, and pore fraction are listed in Table 1. The average force steady (K) changed into calculated using the subsequent relation:

$$k = kt + ko/2 \tag{4}$$

The bulk modulus of term stiffness constant  $C_{11}$  was calculated using relation [17] Stiffness constant is attributed to interatomic binding between metal ions like Fe, Ce, Zn and Co etc in the present ferrite system.

$$C_{11}. a = K$$
 (5)

Where, a and Kis the lattice constant and average force constant respectively

Stiffness constant (C<sub>12</sub>) = 
$$\frac{\sigma \times Cl \, l}{(l - \sigma)}$$
 (6)

Where, $\sigma$  and ais the Poisson ratio and lattice constant respectively. The  $\sigma = 0.324 \text{ x} 1$  -1.043f is function of pore fraction of Poisson ratio. Table 2. represents the Poisson ratio ranges between 0.273 and 0.264, These values lie inside the range of -1 to 0.5, which conforms with the principle of isotropic elasticity. [13]. Variation of stiffness constants (C<sub>11</sub> and C<sub>12</sub>) as a characteristic of Ce<sup>3+</sup> content material is shown in table.2. It is discovered from Table .2. Both the stiffness steady elevated with a boom in Ce<sup>3+</sup> substitution. The values of Poisson's ratio had been calculated using the relation mentioned somewhere else [17] and the values are offered in Table 2.

Stiffness constant is tormented by elements. The tightness of bonding between the atoms and pressure steady. In the present machine bonds between  $Fe^{3+}$  and  $Ce^{3+}$  atoms are residual bonds and due to this stiffness constant increases with growing  $Ce^{3+}$  content material.

Comp. x	Mean Force constant (K) (K <sub>t</sub> +K <sub>o</sub> )	Pore Fraction	Passion's ratio σ	C <sub>11</sub>	C 12
0.0	1.109	0.138	0.274	132.63	50.057
0.025	1.134	0.144	0.270	135.38	50.073
0.05	1.204	0.148	0.269	143.38	52.761
0.075	1.228	0.157	0.268	145.89	53.413
0.1	1.412	0.162	0.267	167.69	61.081

### Table No.2: Cu<sub>0.5</sub>Zn<sub>0.5</sub>Ce<sub>x</sub>Fe<sub>2-x</sub>O<sub>4</sub> of (K),Pore fraction, σ, (C <sub>11</sub> and C <sub>12</sub>) are Mean force constant, Passion's ratio, Stiffness constant respectively.

These 2 stiffness constants used to calculate elastic constants such as; Young's modulus (E), bulk modulus (K), and modulus of rigidity (G) [14]. The elastic moduli for cubic structure are calculated as follow [18.].

$$(G) = \frac{E}{2(\sigma+1)} \tag{7}$$

The rigidity modulus (G) is calculated using relation 3 and the version is offered in Table 3. It may be found from Table.3. The values of rigidity modulus increased with  $Ce^{3+}$  substitution. B, G, E increases with a growth in both  $Ce^{3+}$ . It indicates that deformation of the solid is easy and the strong has less tendency to spring again to its equilibrium role. The Young's modulus, Bulk modulus, and modulus of rigidity boom with the increasing  $Ce^{3+}$  content. They will increase in elastic moduli may be because of the interatomic binding between diverse atoms in the spinel lattice.[20]. The inter-atomic bonding among the diverse atoms weakens continuously with the addition of  $Ce^{3+}$  content and consequently elastic moduli boom with the increasing  $Ce^{3+}$  content material. In Fe<sup>3+</sup> – Ce<sup>3+</sup> ferrite repulsion among electrons can be multiplied with the increasing  $Ce^{3+}$  content. [14].

The longitudinal elastic wave speed (VL) and transverse (Shear) wave pace (VS) became calculated the usage of the subsequent equations,

Longitudinal velocity 
$$V_L = \left(\frac{C_{11}}{\rho}\right)^{1/2}$$
 (8)  
Transverse (Shear) velocity  $V_S = \left(\frac{G}{\rho}\right)^{1/2}$  (9)

Where, G is tension modulus with correct 0 pore fraction. The values of  $V_1$  and Vs used to calculate imply wave speed (Vm) which used to calculate Debye temperature turned into calculated using system.

Debye temperature 
$$\theta_E = \frac{h}{k} \left[ \frac{3\rho q N_A}{4\Pi M} \right]^{1/3} \times V_m$$
 (10)

Where h, k , M, q and  $V_m$  are planks constant, Boltzmann's constant, molecular weight, number of atoms in the unit formula, and means wave velocity respectively.

$$\frac{3}{V_m^3} = \frac{1}{V_l^3} + \frac{2}{V_s^3}$$
(11)

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By using relation 8, 9, and 11 values of a longitudinal wave, shearing wave, and mean wave velocity are calculated. Table .3 reflects the longitudinal elastic wave velocity is increased whereas transverse (Shear) wave velocity increased with  $Ce^{3+}$  substitution. The wave velocities values of are similar to ferrites value obtained from the UPT method [20]. Table - 3 represents variation of Debye temperature ( $\theta_E$ ). The Debye temperature expanded with  $Ce^{3+}$  substitution. It suggested that lattice vibrations are hindered due to  $Ce^{3+}$  substitution. This may be because the electricity of interatomic bonding increases with concentration supported by way of our effects on the version of elastic moduli [19].

The values of  $V_1/p$  and  $V_s/p$  are calculated through the Anderson equation [21] proven in fig.4. The increases with increasing Ce<sup>3+</sup> ions substitution. [18]. A plot of average sound speed (Vm) against Debye temperature ( $\theta E$ ) is shown in Fig.5. It is interesting to word from the discern that the common sound pace increases linearly with the Debye temperature. This behaviour indicates the direct dating among the common sound speed parameter and the critical Debye temperature [22-23].



Fig.4:  $V_1$ /p and Vs/p in opposition to Ce<sup>3+</sup> ion content.



Fig. 5: Debye temperature  $\theta_E$  in opposition to average sound velocity Vm.

Table No.3.  $Cu_{0.5}Zn_{0.5}Ce_xFe_{2-x}O_4$  of (G), (Y), (B), (V<sub>L</sub>), (V<sub>S</sub>), (V<sub>m</sub>) and ( $\Theta_E$ ) are Rigidity modulus, young modulus, Bulk Modulus, longitudinal elastic wave velocity, transverse (Shear) wavevelocity, mean wave velocity, Debye temperature respectively.

Comp. x	G	Y	В	$V_L$	Vs	Vm	$\Theta_{\rm E}$
0.0	42.29	108.03	80.88	5063.75	3217.84	885.91	668.375
0.025	42.93	109.49	81.23	5078.37	3263.42	920.52	675.348
0.05	45.03	114.73	84.61	5189.47	3360.16	1002.14	695.683
0.075	45.80	116.30	86.13	5192.19	3448.12	1072.80	701.439
0.1	52.73	133.58	95.36	5543.59	3749.15	1369.18	752.291

### CONCLUSION

The  $Ce^{3+}$  substituted  $Cu_{0.5}Zn_{0.5}Ce_xFe2_xO4$ . (x = 0.1,0.075,0.050,0.025,0.0). ferrite nanoparticles have been organized via the usage of the sol-gel auto-combustion approach. The IR spectra confirmed the formation of the spinel shape and gave facts about the distribution of ions between the two sites, tetrahedral (A-site) at (566-627 cm<sup>-1</sup>) and octahedral (B-web site) at (362-418 cm<sup>-1</sup>). The elastic constants increased with the increase in  $Ce^{3+}$  ontent. The elastic moduli and Debye Temperature are found to increase with increasing cerium.

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### A Systematic Review on Growth, Characterization Techniques and Applications of Various Doped Metals in Tartrate System

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### ABSTRACT

For the manufacture of bulk crystals, extensively utilized the solution growth method. Crystal growth technique is critical in the field of microelectronics, laser medicine, optical communication, tomography, and other technologies, particularly those tied to a scientific complex. Doping is a technique for increasing the luminous effectiveness of guest molecules in organic amorphous materials by incorporating dye molecules into the host material. The study of doped organic molecular crystals has been substantial. Tartrate crystals are fascinating, particularly for basic investigation into some of their unusual physical properties. Because tartrates are sparsely soluble in water and dissolve before melting, the gel approach appears to be more promising than the high-temperature crystal formation methods. In the review, many examples of doped metal with a tartrate crystal structure are discussed. The Scanning electron microscope, X-ray analysis, FTIR Thermal analysis (Thermo-gravimetry analysis), PXRD, Atomic Absorption Spectroscopy (AAS) Studies, FT-IR Studies, UV-Vis-NIR Studies, Energy Dispersive X-ray (EDX) analysis, Photoluminescence (PL), and Micro hardness measurement were all used to characterize the crystals. Tartrate crystals have a wide range of uses in science and technology, and in the pharmaceutical business, as discussed in this article.

**KEYWORDS:** doped metal, crystal growth, tartrate crystal, crystal growth, crystal.

### INTRODUCTION

Crystals are in high demand for a various of reasons, including semiconductor physics, engineering, and electrooptic devices. For many years, natural specimens were the only source of extensive, well-formed crystals. Diffusion of molecules of the crystallizing substance in the external environment or distribution of molecules across the surface of crystals can cause crystal development<sup>1</sup>. Crystal formation from liquid and gaseous solutions, pure liquids, and pure gases is only conceivable when the system is supersaturated or supercooled. The creation of the super saturation state, also known as supercooling, is crucial in crystal growth. Another criterion for crystal formation is the creation of a small crystal nucleus and ongoing crystal growth to generate discrete faces <sup>1-6</sup> Crystals can be formed using a variety of processes, including melt growth, vapour growth, solution growth, and solid growth. For the manufacture of bulk crystals, the solution growth method is extensively utilized. The solution growth method classified into four types: hydrothermal growth, gel growth, low-temperature, and high-temperature solution growth. The slow cooling method, solvent evaporation method, and temperature gradient approach are all used to form crystals at low temperatures using water, alcohol, and acetone as solvents. In the gradual cooling approach, The solution temperature is reduced, which involves sealing a saturated solution above the room temperature and suspending a seed crystal in the solution. In contrast to the cooling, in-solvent evaporation causes the solution to loose particles that are bound by weak forces, reducing the volume of the solution. This is the most ancient way of crystal development. The theory behind this procedure is that when the vapour pressure above the solvent rises, the vapour pressure of the solute rises as well, causing the solution to become saturated and crystals to form. In the high-temperature solution growth method, a component of crystallized material is dissolved in solvent and crystallization occurs when the solution becomes critically supersaturated. Crystals develop from an aqueous solution at high temperature and pressure in the hydro thermal growth process. The concentration gradient and temperature difference are the two most important parameters between nutrient and growth media. Calcite, alumina, and antimony are grown using this method. The gel growth method is one of the simplest and most widely used methods because it produces no turbulence and produces a good crystal structure by providing a framework for nucleation. There is no convection in the crystal growth experiment. The crystal growth method yields fewer flaws and a higher degree of perfection. It's a common mechanism for forming crystals in human systems including cholesterol storage and sex hormones. The gel growth method is based on making a solution of two components that

produces a crystalline material through chemical reactions. Crystallization occurs as a result of the chemical processes listed below.

X (From solution) + Gel medium  $\xrightarrow{\text{Atm pressure}}$  X (Crystal)

There are various types of gels like physical gel, which is obtained by a physical method like the cooling process. For example, Gelatin, clay. Chemical reactions like hydrogel, polymerization form chemical gel. E.g. Silica, polyacrylamide  $^{1}$ 

**Importance of crystal growth in future:** Crystal growth technique is critical in microelectronics, laser medicine ,optical communication, tomography, and other technologies, particularly those tied to a scientific complex. Every day, the demand for crystal perfection, structural homogeneity, and defect control grows. Because of the economic pressures, improved yield at optimal performance is necessary, which means that not only the growth techniques but also crystal machining must be optimized and surface preparation must be investigated and optimized scientifically. Crystal growth and epitaxy technology will be particularly essential in the areas of energy conservation and renewable energy. Crystal growth technique is critical for future high-tech applications and is critical for energy conservation and generation. Controlling crystal uniformity and perfection would result in a wide range of materials and applications. For enhanced crystal growth research, applied quantum processes has done in the crystal growth technique <sup>7,8</sup>.

**Doping in crystals:** Classic organic optoelectronic polycene materials, like pentacene and tetracene, are very hard to create high luminescence efficiency crystals for, and crystals of their are rarely used in electroluminescence or lasers. Doping is a technique that incorporates dye molecules into the host material to increase the luminescence effectiveness of guest molecules in organic amorphous materials. To reduce laser absorption loss, doping can shift the emission away from the host's absorption zone. The desired light emission is produced by doped crystals. Since the 1970s, doped organic molecular crystals have been extensively researched and triggered emissions have been observed under a variety of conditions. Because organic condensed states have weak intermolecular contacts and lattice mismatches, it is difficult to Doping an organic crystal, such as an inorganic semiconductor, without affecting crystalline quality. Huan Wang <sup>9</sup> successfully reported the growth of large size, high crystalline quality, and excellent optical properties of tetracene and pentacene-doped trans-1,4-distyrylbenzene (trans-DSB) crystals. Doping results in a higher-quality structure, enhanced crystalline quality, and superior optical characteristics <sup>9-12</sup>. Crystal growth, doping, and heterostructures all influence the light-response range, redox potentials of photoinduced charge carriers, and bulk and surface separation probability of semiconductor photocatalysts. The phase, form, and size of photocatalysts, as well as their surface area and crystallinity, can all be influenced by crystal development. When exposed to solar light, doping, particularly non-metal doping, can considerably modify electronic structure and create heteroatomic surface structures, allowing for high-efficiency photocatalysis. Due to their poor diffusion capacity, most doping procedures result in hetrogeneous dopant distributions in which, the dopant is only disseminated in a subsurface region of relatively limited depth. Doping influences the spectral distribution of dopant-induced electronic states as well as the surface heteroatomic structure, ensuring that photo-induced electrons and holes are powerful enough to facilitate surface charge-carrier transfer for subsequent photoreactions under solar illumination <sup>13</sup>.

**Tartrate crystals:** Tartrate crystals are enthralling, especially for basic research into some of their remarkable physical characteristics. Some of these crystals are ferroelectric, while others are piezoelectric, and several have been used to control laser output. Because tartrates are sparsely soluble in water and dissolve before melting, the gel approach appears to be more promising than the high-temperature crystal formation methods. Crystal growth in a variety of materials, including calcium tartrate and lead tartrate, has been documented Temperature behavior of yttrium and samarium tartrates produced on the gel was also investigated. <sup>14–16</sup>. Jethva HO et al <sup>14</sup> investigated the formation and characterization of lead tartrate crystals grown on silica gel and characterised using Fourier transform infrared spectroscopy and XRD. Because tartaric acid contains two hydroxyls and two carbonyl groups, monovalent, divalent, and trivalent metal ions, as well as phosphoruscontaining moieties, can be quickly integrated. Tartrate molecules' properties can benefit transducers, linear and nonlinear mechanical devices alike. Sodium tartrate dihydrate is a common primary reference for water Lanthanides produce a series of compounds whose properties change content assessment methods. predictably as the atomic number of the lanthanide increases. The gel approach has a lot of appeal when it comes to synthetic crystallization of materials that have low water solubility, break down before melting, and do not evaporate or sublime when heated. Several researchers have used the gel technique to create single crystal and polycrystalline materials of great interest in solid state science and technology. In vitro, copper

tartrate has been shown to increase luteinizing hormone production. Clomitrol is a drug that contains a specific type of copper and is used to supplement the mineral complex that regulates testosterone. Prior to dehydration, iron tartrate complex ions for renal tissues serve as crucial contrast blocks. Iron tartrate also used as photo activator in the oxidative deteriotion of white wine caused by light. Copper tartrate is used as catalyst in carbon fibre floret <sup>17–19</sup>.

**Role of gel medium in crystal growth:** The most straightforward method is to use the gel to create crystals. This method can be used to make crystals of sparingly soluble compounds that dissolve at low temperatures. Surprisingly, in gel growth, the gel functions as a three-dimensional crucible, supporting the crystals, providing nutrients for growth via its porous medium, and encouraging growth without exerting significant force. Some parameters must be considered when growing crystals in a gel-like environment, such as the pH of the gel, density, gelling solution, and reactant concentration. At room temperature, perfect quality crystals can be created by selecting the proper parameters. Some authors suggest that a gel droplet be placed in a glass slide, protected by a glass cover slide, and placed over a petri dish with the reactive solution to diffuse into the gel, which is essential for the formation of microcrystals  $^{20-22}$ . Numerous studies on calcium tartrate crystals, both pure and doped, have been conducted. The use of gel in crystal growth provides a porous physically conducive medium for nucleation and growth through a constant supply of nutrients from the porous network of gel, and it also participates in the chemical reaction that forms the crystal nucleation  $^{20}$ .

### Examples of growth of different doped metals with different tartrate crystals

 $Co^{2^+}$  doped copper tartrate single crystals: Pradeepkumar<sup>23</sup> investigated the growth of Co<sup>2+</sup> doped copper tartrate single crystal under various environmental conditions. They also investigated various properties such as optical and thermal properties. The diffusion method and crystals grown in silica gel medium were used to create these Cobalt doped Copper Tartrate (CoCT). Tartaric acid, Sodium Meta Silicate, copper chloride, and cobalt chloride are the chemicals used in the crystal growth process. For this Silica gel was prepared by the addition tartaric acid of 1 M with the combination of sodium metasilicate solution. The pH of solution adjusted to 5. The prepared gel was about to be transferred to the test tubes and undergone continuous observation for 24 hrs. Aqueous solution 0.5M cobalt chloride and 1M copper chloride was added into the test tube containing gel without disturbing the gel. The Co<sup>2+</sup> and Cu<sup>2+</sup> ions diffuse slowly through the gel thin pores, reacting with the tartrate ions and forming solitary crystals. These crystals were analysed by different methods like the scanning electron microscope, X-ray analysis, and Thermal analysis. The research conducted by the researchers was concluded that, due to the super saturation in the crystals, it was observed that reduction of nucleation rate was more in laser exposed crystals than other light exposed materials at room temperature. Scanning electron microscopy was done for the surface morphology of the crystals. Thermogravimetry analysis was done to analyze the percent loss and decomposition temperature of grown crystals are supported by the analysis.

**Magnesium doped copper tartrate (MgCT):** Pradeepkumar KV <sup>24</sup> created Magnesium doped copper tartrate (MgCT) during crystal growth, which was formed in a gel medium at room temperature with the help of single diffusion process and exposed to various radiations such as lasers semiconductor and compact fluorescent lamps (CFL). To make sodium metasilicate crystals, 1 M tartaric acid was used. To avoid the formation of local ion concentrations, which would result in the formation of an early gel, both materials were mixed and constantly stirred. The gel pH was adjusted to 5 before being transferred to the test tubes. After four days, the gel hardened. Aqueous solutions of 1 M copper chloride and 0.5M magnesium chloride were slowly added over hard gel-containing test tubes. These tubes were then allowed to be exposed to various light rays. The irradiation was done with a semiconductor laser (635nm) and a 9W compact fluorescent lamp (CFL). The internal reagents reacts with the supernatant solution which permeates the gel substrate and resulting in the formation of copper tartrate crystals doped with magnesium. They discovered that when no irradiation media are present during the daily growth phase It is observed that in comparison to other forms of light radiation the nucleation rate in the laser medium decreases . while the size, number, and purity of the crystals increase. After one month the developed crystals were collected The crystals shape and surface properties were investigated <sup>26</sup>.

 $Cu^{2+}$  and  $Zn^{2+}$  doped L Tartaric acid- Nicotinamide (LTN): crystals of pure,  $Cu^{2+}$  and  $Zn^{2+}$  doped L-tartaric acid Nicotinamide (LTN) organic nonlinear optical material developed by Gulam Mohammed M <sup>27</sup>. The slow evaporation method was used to create this formulation at room temperature. LTN salt was made from equimolar concentrations of 1-tartaric acid and nicotinamide in a solution. Nicotinamide was mixed with distilled water before being combined with 1- tartaric acid. The saturated solution was created at room temperature. After 30 days, the crystals were extracted. This method is used to create  $Cu^{2+}$  and  $Zn^{2+}$  doped

crystals with a mole percentage of 5%. High-quality non-linear optical (NLO) crystals have a significant NLO coefficient, are transparent in the UV range, and are easy to produce in massive dimensions. For NLO applications, various organic molecules are designed. These molecules have a chiral structure and a large dipole moment, as well as hydrogen bonding between them. LTN's crystal structure is an organic-organic complex with an advantage over inorganic compounds in terms of optical non-linearity. The surface morphology of LTN crystals grown had been studied. To detect functional groups, FTIR technology was used. The effect of dopant metals on the physical properties of crystals was investigated using various methods such as ESR, thermal, dielectric, and photoconductivity <sup>27</sup>.

**Calcium doped cadmium tartrate crystals:** The development and characterization pure and calcium doped cadmium tartrate crystals were examined by Bachhav SK <sup>25</sup>. The crystals were generated using silica gel, and the controlled diffusion method was developed for this purpose. To achieve the desired pH of the mixture. After the solution had been fixed for 48 hours, a pipette was used to apply a 1 M cadmium solution to the gel; at this point, the gel should not be disturbed. Ions diffusion into the gel occurs and interacts with the reactants on the inside. At room temperature, the test tubes were placed, the crystals were taken from the test tube after a month, cleaned and prepared for further analysis.

The XRD pattern reveals that of the crystals formed are of crystalline nature and validates the unit cell parameter value with published value. By chemical analysis presence of cadmium and calcium metal is identified and the energy gap of pure doped obtained to be 4.2 ev and 5.63ev respectively <sup>25</sup>.

**Copper-doped iron tartrate crystals:** Mathivanan V <sup>28</sup> created crystals of pure and copper-doped iron tartrate. During crystal growth sillica gel was used Crystals were grown by the diffusion method. The crystallization was carried out with the help of 0.5 M sodium metasilicate and 0.5 M tartaric acid. Both solutions were combined, and the pH was set to 4.5. The mixture is then transferred to test tubes and allowed to sit for 24 hours. The pH had a significant impact on how it worked. If the pH is higher, the gel will set faster than if it is lower. To avoid gel breaking, an aqueous iron sulphate solution was carefully poured into the tubes containing gel. Similarly, for copper doping, an aqueous solution of ferrous sulphate and copper sulphate was slowly poured into the gel-containing tube. Due to the diffusion of ions through the upper surface of the gel, interacts with inner reactants. <sup>28</sup>.

**Characterization of the metal-doped crystals:** There are different methods for the characterization of the doped metal crystals which includes scanning electron microscope, X-ray analysis, FTIR Thermal analysis (Thermogravimetry analysis), PXRD, Atomic Absorption Spectroscopy (AAS) Studies, FT-IR Studies, UV-Vis-NIR Studies, Photoluminescence (PL), Energy Dispersive X-ray (EDX) analysis, and microhardness measurement.

**Scanning electron microscopy:** To examine the crystals surface morphology Scanning electron microscopy (SEM) is used. It employs a stream of energetic electrons at the crystal surface to generate a variety of signals or any solid surface. These signals are produced by electron sample interactions and provide information on the crystal surface shape. Materials chemical composition, crystalline structure, and orientation are also provided. Two-dimensional images can be obtained. SEM can also analyze the selected point location on the specimen <sup>29</sup>.

**X-ray Analysis:** This technique is used to examine the three-dimensional structures of crystals. This method can be used to distinguish between atom types. This method can be used to identify and locate an individual atom deep within a molecule. This method can also be used to identify large compounds such as proteins. The structure can be viewed from any angle, and relative positions can be calculated precisely. This method is inspired by the dispersion of electrons in atoms. Diffraction intensity can be used to calculate electron density, which can then be used to generate three-dimensional atom structures <sup>30</sup>.

**Fourier transform infrared (FTIR) spectroscopy:** The vibrational spectra of metal tartrate crystals have been determined by many authors. This method is used to calculate the physical properties of solids, liquids, and gases. In this method, IR wavelengths are used to observe chemical bonds that connect atoms. These bonds can vibrate at frequencies that correspond to infrared wave-length light. FTIR is primarily used to identify carbon-containing organic compounds. It's commonly used in polymer characterization, forensic analysis, and pharmaceutical analysis<sup>31</sup>. In the study of The Cu<sup>2+</sup> and Zn<sup>2+</sup> doped L-tartaric acid nicotinamide (LTN) crystals, OH vibrations of the alcoholic and COOH groups of tartaric acid are shown to overlap with the NH vibrations of nicotinamide. Comparison of the doped crystals and udoped crystals can reveal the results of zinc doped and copper doped crystals<sup>27</sup>.

**Energy Dispersive X-ray (EDX):** Elements are analyzed using this procedure , which is associated with electron microscopy and involve the production of specific X-rays which identify the presence of elements in crystals. This method is also used in various biomedical fields. This technique is capable of providing both semi-qualitative as well as semi-quantitative analysis. EDX is a critical tool for detecting nanoparticles, particularly those used in therapeutic efficacy and some chemotherapeutic agents. Lead, nickel cadmium, copper, chromium, and zinc are examples of heavy metals<sup>32</sup>. The presence of cobalt in the lattices of copper tartrate crystals was confirmed by EDX <sup>23</sup> in the study of  $Co^{2+}$  doped copper tartrate single crystals.

**Photoluminescence (PL):** It is the spontaneous emission of light from a material when it is excited optically. It is used for a variety of material parameters. It is a highly selective and sensitive method of characterization that characterizes electrically. It can determine the surface structure, interface, and impurity levels of a molecule. It is a time-efficient and quick method <sup>33</sup>.

**Micro hardness measurement:** The Micro hardness study was determined by employing the Vickers micro hardness tester. The load of it can vary from 10 to 25gms. The presence of dopants that are used in crystallization slightly modifies the hardness of crystals. Hence by this study hardness of the material can be determined<sup>27</sup>

**Applications:** The metal tartrate compound is used in a variety of scientific and technological applications, including ferroelectric applications of calcium tartrate. Single calcium tartrate crystals were formed on silica gel. These crystals ferroelectricity was determined using hysteresis loop measurements at 123°C, the Curie temperature<sup>34</sup>. in the piezoelectric application, Cadmium tartrate is utilized <sup>35</sup>. , several tartrate composites which includes mixed and pure form of tartrate are superior due to their medical, industrial, and pharmaceutical applications. Na-Cr tartrate injections, for example, improve the transplanted sarcomas the susceptibility to the effects of X-rays, as well as the various ferrous tartrate compounds calciphylaxis reaction to avoid anaemia in animals. , and in the production of champagne manganese tartrate crystals are used. Manganese tartrate is used in the production of chemical temperature indicators. in ammonium units Strontium tartrate is used. Zinc tartrate is used as a metal protection powder <sup>36</sup>.

Nonlinear optical and spectral properties of divalent metal ion tartrates make them ideal for use in transducers. Calcium tartrate's dielectric, ferroelectric, thermal, and optical properties make the metal complexes useful in a variety of fields. Tartrates are commonly used to treat cognitive deficits caused by diabetes, cancer treatment with tartrate ions, and herpes treatment. In the treatment of renal disorders, iron tartrate complexes are used as contrast agents. Several compounds are used as hair conditioner additives and skin tanning agents<sup>36</sup>. Cadmium enhanced, because copper tartrate is transparent to visible light, it can be used in a variety of applications that need crystalline perfection and optical transparency. These crystals act as an insulator and are necessary for the creation of optoelectronic device materials. These can be used to make copper-clad laminates for PCBs and have a variety of uses in the electronic industry <sup>36</sup>.

### CONCLUSION

There is a high demand for high-quality crystals in today's world, which have applications in science and technology. Many crystal formation processes exist, According to materials nature and qualities. Because of its simplicity, the gel growth approach, which is based on the controlled diffusion method, is regarded as an excellent method among all crystal growth techniques. Single crystals of tartrate exhibit a wide range of fascinating properties, including ferroelectric, dielectric, optical, and other properties, and some of the crystals have applications in nonlinear optical systems. A literature review of various examples of doped metal with distinct tartrate crystal systems was conducted and included in the provided review in understand to have a better grasping of the influence of doping on the tartrate crystal system. Several crystal characterisation methods have been described, each of which describes the surface.

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# १७. सावरकर यांचे हिंदू राष्ट्रवादाचा संबंधी विचार

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### प्रस्तावना

राष्ट्रवाद ही आंतरराष्ट्रीय राजकारणातील अतिशय महत्त्वपूर्ण विचारप्रणाली आहेत. आधुनिक काळात राष्ट्र आणि राष्ट्र भूमी यांना आदर्श मानून त्यावर श्रद्धा व निष्ठा ठेवल्यास आणि राष्ट्रासाठी व्यक्तीला आपल्या सर्वस्वाचा त्याग करण्यास शिकवणारी विचारसरणी म्हणून राष्ट्रवादी विचाराकडे पाहिले जाते. राष्ट्रवाद या विचारसरणीचा प्रभाव जगभर प्रसिद्ध झालेला दिसून येतो. म्हणून राष्ट्रवादाला आधुनिक युगाचा धर्म असेही म्हटले जाते. भारताने आंतरराष्ट्रीय क्रिकेट मॅच जिंकली या बातमीने आज भारतातील सर्व जण रस्त्यावरून आनंद व्यक्त करताना दिसतात. प्रत्येक भारतीयास आनंद देणारी ही वातमी असते. वस्तुतः आपल्यापैकी कित्येक भारतीयाने ही मॅच खेळली नसते. तसेच प्रत्येक भारतीयांनी ही मॅच जिंकलेली ही नसते. तरीही आपल्या प्रत्येकास आनंद होण्याचे कारण काय तर भारतीय खेळाडूंबरोबर भारतीय लोकांचे राष्ट्र या संकल्पनेच्या माध्यमातून घट्ट नाते जोडलेले असते त्यामुळे आपणास आनंद होत असतो. राष्ट्राचा अभिमान मानवी मनात निर्माण होणारी प्रवळ भावना आहेत याच भावनेमुळे व्यक्तिगत त्याग, शौर्य, स्वाभिमान, औदार्य, वंधूभाव इत्यादी सत्प्रवृत्ती विकसित होत गेल्याचे दिसून येते. आपल्या राष्ट्रासाठी हसत-हसत स्वतःचा त्याग करणाऱ्या अनेक व्यक्ती आपल्या भारतामध्ये होऊन गेल्या. भारतात भगतसिंग आणि त्यांचे सहकारी यांचे उदाहरण देता येईल. परंतु यामध्ये एक धोका हा राष्ट्र अभिमानाचा अतिरेक झाल्यास तो दोष वनतो. अशा अतिरेकातूनच हिटलर आणि मुसोलिनी सारखे उदयाला आले. व त्यांनी शिकविलेल्या अतिरेकी राष्ट्रवादातून जगाला दुसरा महायुद्धाला सामोरे जावे लागले.थोडक्यात राष्ट्रवाद ही एक सामाजिक पर्यावरणात अविष्कार होणारी देशातील समाज घटकांची एकतेची भावना किंवा मानसिक स्थिती आहे. राष्ट्रीयता किंवा राष्ट्रवाद ही एक मानवाची मानसिक अवस्था आहे. या अवस्थेत आपल्या देशातील समूहाचे सुख-दुःख स्वतःचे मानले जाते तसेच समाजावर आलेले संकट आपले संकट समजले

जाते त्यामुळे व्यक्ती सुखी होताना दिसतो.

### अभ्यासाचा उद्देश

- राष्ट्रवादाचा अर्थ समजून घेणे. 1.
- हिंदू कोण? याचा अभ्यास करणे. 2.
- सावरकरांचे हिंदू राष्ट्र वादा संबंधीचे तत्वज्ञान अभ्यासणे. 3.

### परिकल्पना

- राष्ट्रवाद भारतीय स्वातंत्र्य लढ्यातील महत्त्वाची प्रेरणा होती. 1.
- भारतीय स्वातंत्र्य लढ्यातील सर्व नेते राष्ट्रवादी विचारधारेचे होते. भारतीय स्वातंत्र्यलढ्यात जहाल आणि मवाळ असे दोन गट निर्माण झाले होते. 2.
- 3.

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### अभ्यास पद्धती

सदर विषयाचे संशोधन करण्यासाठी ऐतिहासिक संशोधन पद्धतीचा स्वीकार करण्यात येणार असून त्यामार्क द्वितीय तथ्य सामग्री द्वारे माहिती गोळा केली जाईल. उदाहरणार्थ विविध लेखकांनी लिहिलेल्या पुस्तकांमधून मक संशोधन माहिती तथ्य शोधले जाणार असून त्या आधारावर संशोधन पूर्ण केले जाईल.

### राष्टवाद अर्थ

राष्ट्रवाद म्हणजे राष्ट्र राष्ट्राभिमान आणि राष्ट्रीय उत्कर्ष या कल्पनांचा पुरस्कार करणारा भावनिक विचार होईल. हान्स कोहन या विचारवंताने म्हटले आहे की राष्ट्रवाद ही मानसिक अवस्था असून राष्ट्रवादाने भरवलेला जण <sub>ममूह</sub> म्हणजे राष्टक होय. ब्रिटिश विचारवंतांच्या मते एकात्म समाज जेव्हा राजकीय स्वातंत्र्यासाठी चळवळ किंवा संघर्ष करते तेव्हा तो समाज राष्ट्रवादी असतो. स्वातंत्र्यपूर्व काळात भारतीय समाज एकात्म होण्यासाठी प्रयत्नशील झाला त्यामुळे भारतीय समाजात देशाच्या स्वातंत्र्याची भावना रुजवली त्यासाठी प्रयत्न करावा अशी प्रेरणा उत्पन्न केली. अशाप्रकारे भारत देशात राष्ट्रवाद जन्माला आला. परंतु राष्ट्रवादाची ही एकच बाजू झाली. दुसऱ्या वाजूने समाजाच्या उत्कर्षांच विचार समाविष्ट झालेला असतो. राजकीय आर्थिक शैक्षणिक संस्कृती इत्यादी विविध क्षेत्रातील समाजाचा उत्कर्प हा राष्ट्रवादी भावनेत समाविष्ट होतो. म्हणूनच स्वातंत्र्यपूर्व काळात भारतातील नेते देशाचे राजकीय, आर्थिक सामाजिक, शैक्षणिक, सांस्कृतिक विकासाचे स्वरूप रेखाटत होते. ते चित्र भारतीय समाजापुढे घेऊन त्या दिशेने समाजाला गतिमान करत होते. समाजाच्या सर्वांगीण विकासाच्या कल्पनाही वेगवेगळ्या असतात. त्या दृष्टीने झालेले वेगवेगळ्या देशातील प्रयत वेगवेगळे आहेत.

सावरकर हिंदुत्वाचे प्रभावी प्रवक्ते आहेत. हिंदुत्व हा विचार त्यांच्याकरिता अतिशय श्रद्धेचा होता. हिंदूंचे श्रेष आणि वैभव हा त्यांचा मानविंदू होता. राष्ट्रीय काँग्रेसच्या स्थापनेनंतर हिंदूंमधील जागृतीला प्रारंभ झाला. शेकडो वर्ष सुप्त अवस्थेत पडलेल्या हिंदुधर्माच्या नवीन जीवनाला सुरुवात झाली. परंतु पुढील काळात राष्ट्रीय काँग्रेसच्या प्रवाहात मुसलमानांना सामील करून घेण्याच्या उद्दिष्टांनी काँग्रेसच्या नेतृत्वाने मुस्लीम संतुष्टी करणाची नीती स्वीकारली. हिंद् संघटनाना हिंदूंचे हित हा विचार तुच्छ मानला जाऊ लागला. हिंदूंचे विचार करणे स्वातंत्र्य आड येणारी बाब ठरू लागली.

हिंदू राष्ट्रवादाची एक प्रतिक्रिया या स्वरूपात मुस्लिम राष्ट्रवादाची स्थापना झाली. हिंदू राष्ट्रवादा<sup>व्या</sup> रक्षणाकरिता स्थापन झालेल्या हिंदू महासभेच्या अध्यक्षपदी सावरकर सतत सात वर्षे होते. त्यांनी या काळात मां<sup>डलेले</sup> विचार हिंदुत्वाचे प्रकट चिंतन ठरले. सावरकर हे प्रखर हिंदू नेते होते. हिंदू संस्कृती हिंदू सभ्यता ही त्यांना कशाही<sup>पेक्षा ही</sup> महत्त्वाची होती. त्यांचे तत्वज्ञान त्यांचे राजकीय विचार हे हिंदुत्व या एका संकल्पनेभोवती फिरतात. त्यांनी हिंदूवी व्याख्या केली आहेत. त्या आधारावर हिंदुत्वाची संकल्पना स्पष्ट केली. 'हिंदुत्व' या प्रसिद्ध पुस्तकात सावर<sup>करांती</sup> हिंदुत्वाचा विचार विस्तृतपणे मांडला. हे पुस्तक 1923 मध्ये प्रकाशित झाले यावरची टाचणे त्यांनी अंद<sup>मातात</sup> जन्मठेपेची शिक्षा भोगत असताना तयार केली. खरे म्हणजे त्यांनी तोंडात वाचणे काढली हे म्हणणे सयुक्तिक नाही <sup>कारण</sup> त्याठिकाणी त्यांच्याजवळ लिखाणाचे कोणतेही साहित्य उपलब्ध नव्हते. त्यांनी तुरुंगाच्या भिंतीवर खिळ्याच्या <sup>च्या</sup> साह्याने सर्व मजकूर लिहून काढला तो पाठ केला आणि मुक्त ते नंतर तो पूर्ण लिहून प्रकाशित केला.

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हिंदुत्वाचा विचार मांडताना हिंदू कोण? हे सावरकरांनी स्पष्ट केले आहेत त्यांनी हिंदूंची केलेली व्याख्या प्रसिद्ध <sub>जहेत ती</sub> व्याख्या पुढीलप्रमाणे

आ सिंधू सिंधू पर्यंता यश भारत भूमिका

षितृभू पुण्य भू शैव स व हिंदू रिती स्मृत

जो सिंधू नदीपासून समुद्र पावेतो पसरलेल्या भारत वर्षास आपली मातृभूमी पूर्वजांची भूमी तसेच पुण्यभूमी समजतो तो हिंदु होय.

<sub>सम्बन</sub> <sub>हिंदू बद्दल</sub> बरील प्रकारे जाज्वल्य विचार मांडणारे सावरकर हिंदुत्वाची काही वैशिष्ट्ये किंवा लक्षणे सांगतात. ती पुढील प्रमाण

- जी व्यक्ती सिंधू नदी पासून ते ब्रह्मपुत्र नदी पर्यंत आणि हिमालयापासून ते कन्याकुमारी पर्यंतचा प्रदेश हा एक 1. आहे असे मानून त्यावर निस्सीम प्रेम करते.
- वैदिक काळापासून हिंदुस्तानात राहणाऱ्या जाती-जमातीच्या वंशातील असावी याला कारण आहे प्राचीन 2. काळापासून या भूमीवर निवास केल्याने येथील हिंदूत काही वैशिष्ट्ये निर्माण झाली आहेत. विशेष म्हणजे ती इतर वंशा पेक्षा अगदी भिन्न आहे. उदाहरण जर्मनी चीन इत्यादी.
- ती त्या व्यक्तींची पुण्यभूमी सुद्धा असावी. पुण्यभूमी म्हणजे त्या व्यक्तीचा धर्म हिंदुस्थानातच निर्माण व 3. विकसित झालेला असावा. तसेच त्या धर्मातील सर्वात पवित्र स्थान हिंदुस्थानातच असावे.

त्या व्यक्तीला हिंदू संस्कृतीबद्दल प्रेम आणि अभिमान असावा.

सावरकर म्हणतात की हिंदू तो की जो कोणत्याही विचारधारेचा तत्त्वप्रणालीचा किंवा सामाजिक व्यवस्थेचा इतकेच नव्हे तर परंपरावादी किंवा प्रगतिवादी जरी असला तरी त्याचे हिंदुत्व वदलत नाही. कारण हिंदुत्व ज्यामुळे निश्चित होते तो घटक म्हणजे हिंदू रक्त होय. अशा प्रकारे सावरकरांनी समान भूप्रदेश एकच धर्म आणि संस्कृती या चार गोष्टी हिंदू राष्ट्रवादा करिता आवश्यक मानला आहे. विशेष म्हणजे सावरकरांना भारतीय राष्ट्रवाद ही संकल्पना मान्य नव्हती. त्यांच्या मते त्यातून फक्त प्रादेशिक एकतेची भावनात प्रगट होते आणि एका विशिष्ट घटकातून निर्माण होणारे राष्ट्र फार काळ टिकू शकत नाही.

सावरकरांच्या मते हिंदूंची संस्कृती आणि त्यांचे वांग्मय जगातील इतर कोणत्याही मागे टाकले नाही. ते म्हणतात की हिंदू सभ्यता शतकानुशतके जिवंत आहेत टीकून आहे. या मधल्या काळात बाकी सभ्यता उदयाला आल्या आणि नाश पावल्या. हिंदू त्यांची वर्ष शतकांनी मोजत नाही तर युग आणि कल्प अशी त्यांची गणना आहे. सावरकर इतके सांगून हिंदूंना आव्हान करता की भारताच्या उज्वल भविष्य करिता अथक परिश्रम करा कारण इतिहासात ते राष्ट्र विजेते <sup>म्हणून</sup> राहिले पाहिजेत गुलाम म्हणून नाही. सावरकरांच्या दृष्टीने हिंदूं करिता तीन कसोट्या महत्त्वाच्या ठरतात. एक राष्ट्र, दोन जाती, तीन संस्कृती, राष्ट्र याचा अर्थ संबंधित व्यक्तीने प्रादेशिक एकात्मता आणि भौगोलिक मान्यता यांचा <sup>यापर के</sup>ला पाहिजे. या भौगोलिक सीमांच्या रक्षणाकरिता त्याने वाटेल तो त्याग केला पाहिजे. त्यांची प्रदेशा बाहेर ओढ <sup>नको जा</sup>नीचा अर्थ सावरकर यांचे रक्त हिंदू असा करतात. वेगळ्या शब्दात सांगायचे तर ज्यांचे पूर्वज हिंदू पाहिजेत <sup>तिमरी</sup> गोष्ट म्हणजे व्यक्तीची प्राचीन भारतीय संस्कृतीच्या श्रेष्ठतेवर आणि सभ्यता श्रद्धा पाहिजे ती गर्वाची वात होणे आवश्यक आहे.

### मुसलमान आणि ख्रिश्चन

हिंदू शिवाय या देशात अनेक धर्माचे लोक राहत असतात त्यांचे काय ते कोण हिंदूंची व्याख्या करताता सावरकरांनी म्हटले आहे की सिंधू सिंधू भारत भूमी ही ज्यांची पितृभूमी आणि पुण्यभूमीही आहे तो हिंदू. त्यांच्या को मुसलमान आणि ख्रिश्चन आदी अल्पसंख्यांक इथे राहतात ज्यांना या संस्कृतीचा अभिमान वाटत नाही किंवा भारतीय पूर्वजांचे रक्त वाहत नाही ते हिंदुत्वाच्या धारेत येऊ शकत नाही. याचा अर्थ स्पष्ट आहे सावरकर ख्रिश्चन आणि मुसलमानांना हिंदुत्वात सामावून घेत नाही. त्यांचे म्हणणे स्पष्ट होते की मुसलमानांची पवित्र ठिकाणे भारतावाहेर आहेत. मक्का मदिना हज करिता ते दुसऱ्या देशात जातात ते भारताला आपला देश मानत नाही. इथे त्यांचा निवास आहे परंतु धार्मिक आधारावर त्यांना भारत आपला वाटत नाही. ही त्यांची पुण्यभुमी नाही हाच विचार त्यांनी ख़िश्चनांच्या वावतीत ठेवला आहेत.

### हिंदुत्व आणि हिंदू धर्म

सावरकरांनी हिंदुत्व आणि हिंदू धर्म यात फरक केला आहे. त्यांची हिंदुत्वाची कल्पना हिंदू धर्माहून अधिक व्यापक आहे. हिंदू धर्म हा हिंदुत्वाचा एक घटक मानता येईल हिंदू धर्माचा संबंध मृत्यूनंतरच्या अवस्थेशी आहेत. परपेश्वर सृष्टी यांच्याशी निगडित आहेत त्यांच्या मते हिंदू धर्म हा सर्वात प्राचीन धर्म आहेत आणि म्हणून तो परंपरा आदींनी समढ आहे. हा धर्म अतिशय बुद्धिप्रामाण्यवादी आहेत हा धर्म गतिमान आहेत तो इतर धर्मांना स्वतात समाविष्ट करू शक्तो. जगातील अनेक पंथांनी त्यापासून प्रेरणा घेतली आहेत. अशाप्रकारे हिंदुत्वाची कल्पना हिंदू धर्मावर अधिक व्यापक आहे. सामाजिक आर्थिक आणि राजकीय अंगांचा समावेश हिंदुत्वात सावरकरांनी केला आहेत. राष्ट्रवादाला जवळचे आहे कर हिंदू धर्म राजकारणापेक्षा नैतिकतेला जवळचा ठरतो.

### हिंदू राष्ट्रा वादाची कल्पना

सावरकरांचे पूर्ण राजकीय विचार हिंदू राष्ट्र भोवती गुरफटले होते. एका बळकट हिंदू राष्ट्राचे त्यांचे स्वप्न होते. हिंदुत्वाची परिणती राष्ट्रीयत्व हिंदू हिंदूंना करणारे अडथळे नष्ट होतात. हिंदुत्व व हिंदु राष्ट्रात कोणाचा समावेश होतो जैन, शीख ,आर्य बौद्ध यांचा समावेश होतो. भारत हीच त्यांची पुण्य भूमि आणि पितृभूमी आहे. सावरकर अशा सर्वांता एकच म्हणून एक प्रवळ हिंदुराष्ट्र बनव इच्छित होते. राष्ट्रीयत्वाची आपली कल्पना स्पष्ट करताना सावरकर म्हणतात की राष्ट्रीयत्व करिता एका देशात राहणाऱ्या लोकसंख्या व्यतिरिक्त त्यांच्यात भाषा जातीय सांस्कृतिक आणि आर्थिक एकता असण्याची नितांत गरज आहे. जातीय आणि ऐतिहासिक ऐक्याचा अभाव असेल राष्ट्रीयत्वाची भावना जागृत होऊ शकणार नाही तिचा विकास होऊ शकणार नाही. सावरकर स्पष्ट घोषणा करतात की भारतीय राष्ट्र ही गोष्ट कधीही अस्तित्वात नव्हती आणि नसणार. सदैव हिंदू राष्ट्रच राहिले आहे आणि राहणार आहे. हिंदू मुसलमान आणि ख्रिश्च<sup>न यांना</sup> एकत्र आणून एक राष्ट्र निर्माण होऊ शकणार नाही कारण त्यांच्यात जातीय धार्मिक आणि ऐतिहासिक ऐक्या<sup>जा</sup> प्रामुख्याने अभाव आढळतो.

सावरकरांची हिंदु राष्ट्राची कल्पना उदात्त विचारावर आधारित आहेत. त्यांची राष्ट्र कल्पना चार आधा<sup>रावर</sup> स्थिर आहेत चार लक्षणे ते स्पष्ट करतात पहिली गोष्ट म्हणजे हा एक देश आहे दुसरे संस्कृती तिसरे संस्कृत भाषा <sup>आणि</sup> चौथे लक्षण समान इतिहास आणि परंपरा सावरकरांच्या मते भूमी निष्ठा आणि धर्मनिष्ठा असेल तरच निर्माण होते. हिं राष्ट्राची कल्पना मांडताना काही गोष्टी अधिक स्पष्ट केले आहे. हिंदुना इथे राहण्याचा विशेष अधिकार आहे हिंदू भा<sup>रताला</sup> मातृभूमीच्या स्वरूपात मानतात ते भारताच्या सांस्कृतिक वारसा वर प्रेम करतात. काश्मीरपासून कन्याकुमारीप<sup>र्यत</sup> पसरलेल्या मातृभूमी पितृभूमी आणि पुण्यभूमी आहे. अर्थातच ती भावना मुसलमानांची अमू शकणार नाही त्यांची

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प्<sup>एयभू</sup>मि आणि पितृभूमी अरब आहे. त्या ठिकाणी त्यांचे पैगंबर जन्माला आले त्यांच्याशी त्यांच्या भावनिक संबंध गहणार.

साबरकर असे म्हणतात की हिंदूंना प्रदेश बाह्य आत्मीयता नाही याउलट स्थिती मुसलमानांची आहे. ते मोठ्या <sub>प्रमाणात</sub> इथे अल्पसंख्यांक आहेत त्यांच्या निष्ठा प्रदेश बाह्य आहे. ते हज बाहेर देशात जातात आमच्या देव-देवतांची त्यांची कुठलीही भावनिक आत्मीयता नाही. त्यांना भारतापेक्षा हजरत मोहम्मद यांच्याबद्दल अधिक आदर आहे. त्यात्म उ माबरकरांनी हिंदुत्व किंवा हिंदू राष्ट्र विषयीचे विचार इतक्या प्रभावीषणे मांडले ते खोडून काढण्याचे साहस कुणालाच साने झाले नाही. सावरकरांचा हिंदू राष्ट्रवाद ज्वलंत स्वरूपाचा आहेत. त्याकरिता कोणतीच तडजोड त्यांनी स्वीकारली नाही अमे जरी असले तरी अल्पसंख्यांक विषयी त्यांच्या मनात सहिष्णुता होती. धर्म सहिष्णुता आणि धर्मनिरपेक्ष तत्त्वाचा <sub>त्यांनी</sub> अंगीकार केला होता. सावरकर मुसलमानांचे शत्रू नव्हते ही बाब लक्षात घेतली पाहिजेत. परंतु स्वातंत्र्य संपादन <sub>करता</sub>ना मुसलमानांचा अनुनय करणे त्यांना पसंत नव्हते. स्वातंत्र्य प्राप्त झाले की मुसलमानांच्या मागण्यांचा विचार करता येईल असे सांगून सावरकर स्पष्ट करतात की त्यांच्या अवास्तव मागण्या मान्य केल्या जाणार नाही.

मावरकर म्हणतात मुसलमानांची पुण्यभूमी नसल्याने त्यांना या देशाबद्दल काहीच वाटत नाही आपलेपणा ताही. हिंदूंची गोष्टच वेगळी आहे त्यांची पितृभूमी आणि पुण्यभूमी एकच असल्याने भारताचे स्वातंत्र्य आणि स्वराज्य हेच त्यांचे ध्येय आहेत. सावरकरांच्या मते हिंदू संघटित असतील तरच हे साध्य होईल. स्वातंत्र्य संपादनासाठी मुसलमानांची मदत घेण्याची गरज नाही. सावरकरांचे म्हणणे होते की तशीच वेळ आल्याम ब्रिटिशांशी हिंदू एकट्यानेच टक्कर देऊन स्वातंत्र्य मिळतील यासाठी कोणी सहकार्य केले तर ते स्वीकारण्याची त्यांची भूमिका आहे सावरकरांचे यासंबंधी तील उदगार इतिहास प्रसिद्ध आहेत. ते म्हणतात की तुम्ही आला तर तुमच्या सह न आल्यास तुमच्याशिवाय आणि विरोध केला तर तुम्हाला विरोध करून हिंदू आपल्या राष्ट्रीय स्वातंत्र्याकरिता झघडतील.

### सावरकरांच्या हिंदुराष्ट्र या कल्पनेवर टीका

### 1. संकुचित स्वरुपाची कल्पना

सावरकरांच्या हिंदुराष्ट्र या कल्पनेला भरपूर प्रतिसाद मिळालेला नाही किंवा हिंदुत्वाची कल्पना सर्वत्र लोकप्रिय होऊ शकली असेही म्हणता येणार नाही. टीकाकारांच्या मते हिंदुराष्ट्र संकल्पना आता अतिशय संकुचित स्वरूपाची झाली आहेत तीच कल्पना आपण गृहीत धरली तर मुस्लिम ख्रिश्चन व पारशी इत्यादी अल्पसंख्यकांना राष्ट्रीय प्रवाहाच्या वाहेर राहावे लागेल शेकडो वर्षापासून या सर्वच धर्मियांनी भारताच्या संस्कृतीत कीर्तीत् आणि इतर क्षेत्रातही मोलाची भर घातली आहेत. मूठभर गट सोडले तर हे सर्व लोक भारतात बेमालूमपणे मिसळून गेले आहेत त्यामुळे ही कल्पना कालवाह्य स्वरूपाची वाटते.

### 2. खडक व तडजोड विरोधी कल्पना

असेही म्हटले जाते की सावरकरांची हिंदू राष्ट्र ही कल्पना अतिशय खडक परीदुडू व तडजोड न स्वीकारणारी कल्पना आहेत. मुस्लिमांच्या विरोधातून की अधिकच कठोर बनली. काँग्रेसने सर्वधर्मसमभावाचे तत्व स्वीकारले होते <sup>मूलनः</sup> सावरकर हे मुस्लिम बिरोधी नव्हते त्यांचे काही सहकारी तर मुस्लीम होते. परंतु त्यांना असे दिसू लागले की <sup>सकीने</sup> धर्मांतरण केले जाते त्यामुळे भविष्यात त्यांना मुस्लिमांच्या लोकसंख्यावाढीचे भय दिसले मुस्लिमांना द्विभार्या <sup>विवाहची</sup> परवानगी आहे. त्यामुळे तर ही लोकसंख्या खूपच वाढेल या सर्वांसाठी त्यांनी हिंदू राष्ट्राची कल्पना मांडली असली तरी ती मूळ प्रश्नाचे उत्तर कधीच नव्हते.

### 3. भारत एकात्म समाज नाही

सावरकर म्हणतात की भारत हा एकात्म समाज आहे पण प्रत्यक्षात तसे नाही भारतात प्रादेशिक निष्ठा आहे. प्रादेशिक भाषांबद्दल दुराभिमान आहे इतर भाषांबद्दल द्वेष आहे हिंदी बद्दल सर्वांना प्रेम नाही संस्कृत सर्वांना समज<sub>त</sub> नाही याशिवाय जाती पंथ वंश इत्यादी अनेक घटकांनी भारतीय समाज विघटीत झालेला असताना भारत हा एकाव समाज आहे हे सावरकरांचे विधान तर्काला आणि वस्तुस्थिती ला धरून नाही असे म्हटले जाते.

### 4. वांशिक एकता नाही

सावरकर असेही म्हणतात की भारतात वांशिक एकता आहे पण प्रत्यक्षात तसे नाही. जुन्या काळी असलेल्या अनेक वर्षांनी हिंदूंची वांशिक शुद्धता नष्ट केली आहे. त्यामुळे वंशिका आधारावर हिंदू राष्ट्र ही कल्पना मांडता येणार नाही.

### 5. सांस्कृतिक एकता नाही

हिंदू धर्मीयांमध्ये सांस्कृतिक दृष्ट्या एकता नाही भाषा चालीरीती रहाणे वागणी या सर्व बाबतीत देशात सर्वत्र भिन्नता आढळून येते. त्यामुळे असे म्हणता येईल की सांस्कृतिक दृष्ट्या सुद्धा भारतीय हिंदु मध्ये एकवाक्यता नाही त्यातून हिंदू राष्ट्रवाद कसा निर्माण होणार.

### 6. हिंदुत्व हेच भिन्नभिन्न आहे

हिंदू या कल्पनेवाबत हिंदू मध्येच एकवाक्यता नाही. हिंदू महासभा, राष्ट्रीय स्वयंसेवक संघ, आर्य समाज, भाजप, शिवसेना या सर्वांमध्ये हिंदू या संकल्पनेबद्दल वेगवेगळ्या अर्थच्छटा आहे. हिंदू हे स्वतंत्र एकात्म राष्ट्र व्हाक्याचे असेल तर या सर्व गटांनी एका हिंदुत्वात विलीन व्हायला काय हरकत आहे असे घडत नाही. हिंदू समाजात अशी फूट असल्यास हिंदू राष्ट्राची कल्पना कशी काय प्रत्यक्षात येणार हा प्रश्न आहे.

सावरकरांचे मते आपण मांडलेल्या हिंदू राष्ट्रवादाच्या कल्पनेवर टीका होणार याची कल्पना सावरकरांना होती. भारत राष्ट्राच्या विघटनकारी स्वभावात हीदेखील त्यांना पूर्ण कल्पना होती. या संपूर्ण टीकेला उत्तर देताना सावरकर अमे म्हणतात की भारताचा विशाल भूप्रदेश भारतीय नक्कीच एकता निर्माण करू शकेल. उत्तरेला बद्रीनाथ दक्षिणेला रामेश्वर पूर्वेला जगन्नाथपुरी आणि पश्चिमेला द्वारका या जुन्या पूर्व काळातील धर्म संस्थान चा भारतीय हिंदूंना चांगला परिवय आहेत. पवित्र नद्या सरोवरे धर्मपीठे ही देशभर पसरलेली असून ती हिंदूंमध्ये संपूर्णपणे ऐक्य निर्माण करू शकतात. त्यामुळे काही बाबतीत भिन्नता असली तरी त्यांना एकत्र बांधून ठेवणारे घटक फार मोठ्या प्रमाणावर आहे. या मर्वातून हिंदू समाज हा राष्ट्र स्वरूप झाला असेल असे म्हणता येईल अर्थात सावरकरांनी पुण्य भूमी आणि पितृभूमी या दोत संकल्पना स्पष्ट केल्यामुळे आज व्यावहारिकदृष्ट्या त्यांनी हिंदू राष्ट्राची कल्पना मान्य होण्यासारखी आहे मावर<sup>कर हे</sup> प्रखर राष्ट्रभक्त होते.

### मूल्यमापन

देशभक्त सावरकर यांनी हिंदू राष्ट्रवाद या विषयावर आपले बहुमोल असे विचार व्यक्त केलेले दिसू<sup>न ग्रेतात.</sup> त्यांनी हिंदू राष्ट्रवादाची जी कल्पना केली आहे त्यामध्ये मातृभूमी पितृभूमी पुण्यभूमी या आधारावर मांडलेले आहे<sup>त. धरा</sup> हिंदू कोण याविषयी त्यांनी आपले विचार व्यक्त केलेले दिसून येतात. हिंदू कोणाला म्हणावे हिंदू विषयक विचा<sup>र त्यांनी</sup> व्यक्त केलेले आहेत. सावरकरांनी हिंदू राष्ट्रवादाची संकल्पना त्यांच्या राजकीय विचारात अतिशय महत्त्वाची <sup>संकल्पना</sup> आहेत. हिंदू राष्ट्र निर्माण व्हावे ही त्यांची मनोमन इच्छा होती. हिंदू राष्ट्रवाद संकल्पना मांडत असताना त्यांनी मुस<sup>लमान</sup>

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# VOLUME - N. ISSUE - I - NOVEMBER - APRIL - 2021-22

ULUME X. ISSUE - ISSN 2319 - 8508 - IMPACT FACTOR - 6.571 (www.sjifactor.com) GALANT GALANT द्वाविषयी द्वेषाची भावना नव्हती त्याच प्रमाणे अल्पसंख्यक समुदाय यांनादेखील भारतात सामावून घ्यावे. द्वाव्याविषयी द्वेषाची भावना नव्हती त्याच प्रमाणे अल्पसंख्यक समुदाय यांनादेखील भारतात सामावून घ्यावे. <sub>बोंब्याविषयी क्या प्रमान भारतात मामावून घ्यावे.</sub> <sub>बोंब्याविषयी हिंदू</sub> राष्ट्रवाद या संकल्पनेवर अनेक प्रकारे टीका होत असली तरी त्यांनी मांडलेली हिंदू राष्ट्रवादाची <sub>वीवरकरोंच्या १९</sub>४ <sub>वीवरकरोंच्या १९</sub>४ <sub>वीवरकरों</sub>ची अतिशय व्यापक असून या देशात जन्मलेल्या नागरिकांची पुण्यभूमी व पितृभूमी या आधारावर ही संकल्पना <sub>वीवर्णना ही</sub> अतिशय व्यापक असून या देशात जन्मलेल्या नागरिकांची पुण्यभूमी व पितृभूमी या आधारावर ही संकल्पना हो<sup>हल्पना ही आप प्र</sup> हो<sup>हल्पना ही आप प्र</sub> यो आधारावर ही संकल्पना <sub>होंडतेली</sub> असल्यामुळे जैन बौद्ध पारसी सिख हा सर्व धर्म समुदाय भारतीय भूमीतील असल्यामुळे त्यांची सुद्धा मातृभूमी</sup> <sub>प्रोडतेली असर भाउ</sub> <sub>प्रोडतेली असर भाउ</sub> <sub>प्रोडतेली असर भाउ</sub> म<sub>ाउ</sub>ने वाकीचे धर्म मिळवून सर्वांची ती विकृष्मी व पुण्यभुमी असल्यामुळे हिंदू राष्ट्र वनण्यास अजिबात हरकत नाही अशी त्या पाठीमागची त्यांची प्रामाणिक इच्छा होती.

### संदर्भ साहित्य

- डॉ शंकर चव्हाण. राजकीय विचार प्रणाली. प्रशांत पब्लिकेशन जळगाव 1.
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- क दि बोराळकर, भारतीय राजकीय विचारवंत. पिंपळापुरे अंड कं पब्लिशर्स नागपूर 3.
- प्रा श्रीकांत वि देशपांडे, भारतीय राजकीय विचारवंत श्री मंगेश प्रकाशन नागपूर 4.
- डॉ विलास आघाव व सुखनंदन ढाले, प्रा रमेश शेवाळे भारतीय राजकीय विचारवंत चिन्मय प्रकाशन 5.
- डॉ वा वा पाटील, आधुनिक भारतीय राजकीय विचारवंत. प्रशांत पब्लिकेशन जळगाव 6.
- डॉ दिलीप सिंह निकुंभ भारतीय राजकीय विचारवंत प्रशांत पब्लिकेशन जळगाव 7.

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# Women's Participation In Freedom Movement Of India

Mr. Prashant Vasant Ransure

Assistant Professor in History ,MVP Samaj's Art's Commerce and Science College, Tryambakeshwar

Soon after India got independence, the intellectualsconstrued India's freedom struggle from difference points of view. In the colonial India some scholar-leaders like LalaLajpatRai, Bat Gangadhai Tilak, A.C. Majumdar, Pattabhi Sitaramaya1, SurenderNathBanarjee, C.F. Andrews, etc. had come with their writings and later on supplemented by others such as B.R. Nanda, Bisheswar Prasad, AmleshTripathi, Tara Chand, NilkhantShastri, R. C. Majumdar etc. Their works throw light on the nationalist historiography of freedom struggle of India. As propounder of the nationalist approach," these scholars and leaders came out with an effective conception that the modern historical struggle in India developed as a unified and collective opposition based on national feelings as a whole against the British colonial rule.

The nationalist historiography was developed by the English educated class which was the product of new educational institutions emerged during the second half of 19th century. The educated middle class played an important role in the creations of several organisations which instilled the national sentiments in India. The nationalist school, however, has been criticised with an argument that it uncritically emphasised the glories of the past. Besides, it also overlooked the role of various social groups in the freedom movement.<sup>2</sup>Moreover the unavoidable aspect of women's participation in the movement has also been left without addressed. Both of the schools viz. the Cambridge and nationalist share similar view points at least on two aspects. One that the Indian elite led the people in the struggle and the second one is that the aspect of women's participation in this long lasting struggle is almost missing in both of the historiography.3 It seems that their interest rested somewhere else otherwise such a vast account of women organisations which were involved in nationalist policies from the middle of 19th century and sufficiently addressed women issues would have certainly be examined in their discourse in regard to women's contribution. Further, there were many instances that shed adequate light on the participation of women in the national movement by various types of their activities, 4 be it their passive role as mothers, sister and wives or active participation through Gandhian Constructive Programme or overt revolutionary activities against colonial rule.

The present work aims at understanding the contribution of all sections of women towards the freedom struggle of India in accordance with the nationalist approach.

Women in Pre-Gandhian Movement:-

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From the beginning of Indian National congress, its membership was open to women. Allan Octavian Hume even went ahead asking all shades of opinion never to forget that unless the elevation of the female clement of the nation proceeded (with an equal place) with their work, all their Labour for the politicalempowerment of the country would prove futile. For the first time, ten women who attended the fourth session of the Congress at Bombay in 1889 A.D. were also from Bombay and Calcutta. Among them, the prominent women were SwarnaKumari Devi, sister of RabinderNath Tagore, and Pandita Ramabai, an Arya Samajist of Poona.º The former being an progressive woman had already started SakhiSamitiin 1886 A.D. to foster among Indian women an active and enlightened interest in the welfare of the country whereas the latter one had the honor of being the first women to speak from the congress platform where she also proposed a vote of thanks to the President, PherozeshahMahta.

Sarla Devi Chaudhurani, daughter of SwamaKumari, who was to take an active participation, in the nationalist movement in the years to compose a song urging the people to different provinces of the country to join the freedom struggle. The proceedings of the 1902 A.D. session of the Congress at

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Abmodulated commenced with the singing of the National Anthem by Lody VidyagauiNitkanth and Abarcubhai contained. The decision for the partition of Bengal was approved by the government on the visiter ShandaMehta. The decision for the partition of Bengal was approved by the government on for usier Sharearth first time spurred the common people including women interpolitical action from a poly of the short SOO women held a meeting at fanikbard out. po July. Pour extension interpolitical action It was any written to note that about 500 women held a meeting at JaniKhandi village, district of Mursidabad, any written the partition. In September 1905 A.D. when Rabin Levin and the partition of Mursidabad, to protest against the partition. In September 1905 A.D. when RabinderNath Tagore annianced his plan for observing RakhiBandhan on the "partition day" Le. 16 October, women's actively trok part plan to very number. Similarly, women also observed "non-cooking day" as suggested by Romendra samiler Trivedi who asked them to be part of political movement without overlooking household. Thereafter, the notion of boycotting of British goods in general and foreign cloths made in Manchester and other British centers in particular as propounded by a revolutionary Shyamji Krishna Vernus who also published the same idea in his own Journal Indian Sociologist in October 1905A.D. Not only this, he even laid importance that economic refuse as a fake weapon of a weak and unarined nation against a powerful armed foreign government, the natives would commit no evils. The movement, in the way, started with boycott of foreign and was soon widened to with boycott of person using British goods. As a consequent, Swaraj, Swadeshi and National Education became the degans of the nationalists. Sister Nivedita who was also a great source of inspiration to many youngmen and women visited the court in 1907 A.D. to stand surety for release at BhupendraNathDutt, youngest brother of Swami Vivekanand, who was arrested for sedition as editor of Jugantar.

The Punjabi women did not lag behind in making their contribution during the national movement. Smt. Sushila Devi of Sialkot was the first lady who delivered a series of lectures in which she enticized the governmental policies. Smt. Purani, a prominent Arya Samajist of Hissar, toured vatious districts of Punjab for the advocacy of the cause of Swadeshi. Another woman Har Devi (wife of Roshan Lai, Barrister of Lahore) was a social worker and editor of a Hindi magazine. The Bharat Shopping to be rank of the political workers. She not only took the accountability of arranging meetings for revolutionaries but also of fund collection for their multiple activities. The involvement of women in Swadeshimovement was also affirmed by Mrs. Ramsay Macdonald who visited India at that time. The women entered into agitational politics only after the First World War, This was made possible only by a new woman's organisations and the recruitment of women to existing political organisation. The entry of Mrs. Annie Besant to Indian politics in 1914 A.D., her elevation to President-Ship of Congress and Women's India Associationenhanced the process of bringing women into national politics. Her activities were seen as threat to the government and she was asked to leave the country.

Sarojini Naidu, being the first Indian woman to make politics her full time accupation, was infact, drawn into the vortex of politics by Gopal KrishanGokhle whom she considered her Gara. It was on his encouragement that she had joined congress. On December 1951A.D. she attended congress session at Bombay as a UnitedProvinces delegate whereat she supported a resolution of selfgovernment. Further, as a member of Home Rule League she led a deputation of women to England consisting of Annie Besant, Mrs. HerabaiArdesher Tata and Miss MthanArdeshir Tata, Edwin Montagu as members.<sup>9</sup>They presented a memorandum to the British Government, asking for voting for women rights.

### Women in Gandhian Movement:-

Gandhi's arrival in India was a turning point in India's struggle for freedom. After a conditional support given to Muslims in Khilafarmovement, he brought them to Congress, as an instrumental, for Hindu-Muslim unity. The Satyagrahmovement for first time was launched by him on 6th April 1919 A.D. The passing of the oppressiveRowtan Bills by the British Government which amed at prohibiting public protest and suspending civil liberties were, in fast, responsible for the launching of Non-CooperationMovement. The movement was based on six points namelyn) boycon

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of law court by lawyers and to set up populartribunals for administering justice; (ii) boycott of schooland cellege owned or aided by the government, and theestablishment, of national educational institutions; (iii)boycott of elections; (iv) smender of honours and titles (v)Boycott of British goods and encouragement of Swadeshi; and (vi) a temperance campaign to wean addicts from liquor. He invited the women to join Non- Cooperation Movement. Addressing public meetings in different parts of the country, he also appealed to women to donate their jewellery for the collection of Tilak Swaraj Fund. In his speeches he compared the British rule to Ravana-rajya and said that as Sitadid not cooperate with Rauana, so the Indian people must not cooperate with the Rakshasi-Sarkar.<sup>10</sup>

The year 1930 A.D. witnessed the altogether changed perspective of women in two ways in the history of freedom struggle of India. Firstly, they marked their successful and decisive leadership along with the changing concept of "Women uplift" to "equal right" with that of men and secondly they joined the movement in a massive participation. The launching of civil disobedience movement under the ideology and leadership of Gandhiji was to be primarily carried out without participation of women in it. The women of the country in general and within Congress took it embarrassing. It happened so as they had already reached to such a level of awakening in regard to the right of equality through the continuous efforts made by some prominent and dynamic women leaders," in the foregoing decade, like Annie Besant, Sarojini Naidu, Kamla Devi Chattopadhyaya, Basanti Devi, Unnila Devi, Rameshwari Nehru, HemprabhaMajumdar and Bee Amman, etc.

It is significant to note that at the beginning of Civil | Disobedience Movement, Gandhi did not allow women to join it. He was of the opinion that the participation of women might be considered weakness. But the women who were already charged with the new concept of equal rights arose to the resentment. Margaret Cousin even addressed through a letter of their protest to Gandhi. In these stirring critical days of India's destiny, there should be no watertight compartments of service. Further, women even went ahead while demanding that "no conference, no Congress or commission dealing with the welfare of India should be held without the presence on them of their kind. While leaving Sabarmati on March 12, 1930 A.D., he did not include any woman in the group of marchers of the satyagrah as already determined. The women at his Ashram were disappointed as he took only four or five with him as he had replied there would be time enough for that.KhurshedBehn, granddaughter of DadabhaiNaoroji, wrote an angry letter to Gandhi asking him why he was not allowing women to jointhe DandiMarch. Mridula Sarabhai, and then a student of Gujarat Vidyapeeth, even ignoring the instruction of Gandhi jumped into the struggle, despite Principal Kaka Kalelkar's order not to do so. Consequently, both these young women were arrested at Ahmedabad. After the arrest of Gandhiji and Abbas Tyabji in Salt Satyagraha, Sarojini Naidu assumed the leadership at Dharsana, the scene for the mass breaking of the salt laws.12

On returning to India after attending Round Table Conference in London Gandhi was again arrested on 4 January, 1932 A.D. He was confined in Poona Jail, while setting aside Gandhi-Irwia Pact by Lord Willingdon who had joined as successor of Lord Irwin. The reception committee of Congress was also declared unlawful by the government. Sarojini Naidu, a true Gandhian, again shouldered the responsibility to respond against the attitude of British Government. In fact, it demand her duty to perform on becoming as acting President of Congress in the same year. She not only made a call to hold the session of the Congress in order to start the movement again, but she was arrested on 20th October 1932 A.D. and later, 13 she was sentenced to one year's imprisonment for her activities against the British government.

Kamla Devi contined to prepare students and youth by addressing their meetings and conferences. She, being Vice Chairman of the Bombay Youth League, presided over the students' conference at Lahore in October 1931 A.D. Whilespeaking on such occasion, she condemned the education system. She said, "It is a frame that ill fits us for it is cast in a sinister mould us in slow deliberate manner." Besides salt satyagraha, the other programme, were also taken up by activity

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wenten followers of Gandhiji. The credit of picketing in Bombay broadly goes to the Des sorikaSanghwhich was formed by Hansa Mehta and others. Their picketing was so effective that the government had to declare it illegal. The acknowledgment to some other equally important women freedom fighter whose contribution in no way was less important also needs to be made in this regard. Out of them were JaishriRaiji, Hansa Mehta, Perin Captain, Sofia Somjee, LilavatiMunshi, Manibhen Patel and Khurshedbhen who prominently participated in Civil Disobedience Movement.<sup>14</sup>

ArunaAsaf Ali also informs about the activities of Des SevikaSanghof Bombay which was quite decisive not onlyin creating favorable opinion among the masses but alsopicketing in different ways. Two women organisations viz. 'All India Women Conference the local branch and the Hindustan Seva Dal were quite active in Madras region during the civil disobedience movement. Besides, the VanarSena, which was originally started in Bombay by ShriJohri from among Youth League Leaders, also did not lag behind in multi-playing its rank and file in the same context. DurgabaiDesmukh was another eminent woman the southern regions where she accelerated her activities during the Salt Satyagraha as she was already active in politics since 1921A.D. when she was merely a child. Campaign for salt satyagrahain Bengal was mainly led by LatikaGhosal under the banner of MahilaRashtryaSanghfounded by herself with the help of Subhash Chandra Bose.15

The most important issue of women was their suffrage taken up by Women's Indian Association (WIA) founded in Madras in 1917 A.D. by three theosophist women namely Annie Besant, Dorothy Jinarajadasa and Margaret Cousins. Besides opening of new branches in other cities, their Theosophical Society took a lead in forming the new associations for the well-being of their lot. The establishment of the All India women's Conference in 1927 A.D. as non-political organisation showed at most interest in promoting educational opportunities, <sup>16</sup> for women and improving their position through the social and legal reforms. They first of all were interested in the question of women's right to vote and were largely responsible for organizing the Suffragette movement

Furthermore, the hardship faced by the women participants during their underground activities and the degree of silent sacrifice of those who faced extremely inhuman treatment, rape and, even loosing of their children left no iota of doubt that making a sacrifice for national cause was no monopoly of the men. So their participation on the equal footing is, undoubtedly, praiseworthy in all the movements started under the official leadership of the Indian National Congress. References:-

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## Acid-base Modified Biosorbent for Heavy Metal Removal - A Review

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### ABSTRACT

The heavy metals Cu, Cd, Ni, Cr, Pb, As and Bi removal by modified low cost adsorbents were reviewed in the current article. The present study focuses on enhancement of adsorption of metal by acid-base modification of low cost adsorbent. An acid modification were carried out by H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>, H<sub>3</sub>PO<sub>4</sub>, citric acid and tartaric acid while base modification were carried out by NaOH, K<sub>2</sub>CO<sub>3</sub> and KOH. The review represents various parameters such as activation agent of adsorbent by acid-base, type of adsorbent, characterization methods viz. SEM, EDS, FTIR, BET and maximum adsorption capacity of heavy metals. Adsorption method is found superior for removal of pollutant from waste water than any other conventional method. The adsorption of metal on adsorbent surface occurred by physical sorption, chemical sorption, complexation, ion exchange and through pore diffusion process. Agricultural waste adsorbents are found good alternative due its negligible cost, easy availability and maximum adsorption capacity.

**KEYWORDS:** Heavy metals; Adsorbent; Acid-base treatment; SEM; BET

### INTRODUCTION

Heavy metals are major toxic pollutants specially found in waste water discharges from different industries. The process of metal extraction from ore such as mining, roasting, pulverizing, refining greatly contributes the heavy metal accumulation into the waste water while the fertilizer industry, tanneries, pesticides, batteries, electroplating and paper industries also introduces heavy metal into the environment<sup>1</sup>. Heavy metals such as Cadmium (Cd), Chromium (Cr), Copper (Cu), Cobalt (Co), Lead (Pb), Zinc (Zn), Arsenic (As) Vanadium (V) and Nickel (Ni) shows adverse effect on animals as well as aquatic life<sup>2</sup>. The effluent of industrial waste containing large amount of toxic heavy metals without prior treatment causes hazardous effect to aquatic life. Many of the heavy metals are non-biodegradable and hence accumulate in the food chain which reduces the human life<sup>3</sup>. Cadmium (Cd) is carcinogenic and responsible for Itai-Itai disease, anemia, dyspnea, Chromium causes lungs tumor and allergic dermatitis, Copper (Cu) gives liver illness, diarrhea, headache, Mercury affects on kidney, nervousness, unconsciousness, Nickel (Ni) causes anaphylaxis and damages red blood cells, lead (Pb) affects on appetite loss, kidney failure, high blood pressure, anemia and Zinc (Zn) causes restlessness and metal fume fever<sup>4</sup>.

Nowdays numerous techniques are available for the removal of heavy metals such as precipitation, oxidation, reduction, ultrafiltration, reverse osmosis, electro dialysis and ion exchangers<sup>5</sup>. Due to increase in processing cost, low efficiency, low sensitivity, all these techniques have certain limitations for heavy metal removal from waste water. Adsorption is an advantageous technique over the all of these methods due to low cost and greater removal efficiency of metal from waste water<sup>6</sup>. An activated carbon adsorbent used for heavy metal removal shows greater removal efficiency and easy operating process but due to its high cost it have some limitation. The adsorbent prepared from fly ash, sludge, industrial waste, zeolites and agricultural waste has great significance for heavy metal removal <sup>7-8</sup>.

In the current review article, the surface modification for various low cost adsorbents by acid-base treatment is explored. The absorption efficiency of adsorbent can be enhanced by activation viz. physical method and

chemical method<sup>9</sup>. The present work summarizes the effect of modification of various adsorbents by treatment with sulphuric acid, hydrochloric acid, nitric acid, tartaric acid, phosphoric acid while with base sodium hydroxide, potassium hydroxide, potassium carbonate and calcium hydroxide.



Figure 1. Activation of adsorbent by various Acid-Base treatment

**Modification of adsorbent by acid treatment:** The removal of Cu from agricultural waste adsorbent like bagasse on activation with citric acid was investigated by Meenal Gupta et al.<sup>10</sup>. Sulphuric acid treatment for various adsorbents namely areca catechu <sup>11</sup>, Cynodon Dactylon <sup>12</sup>, Henna leaves <sup>13</sup>, Cashew nut<sup>14</sup> were carried out and found maximum adsorption capacity for Cu 1.33 mg/g, 90.35 mg/g, 3.65 mg/g and 406.6 mg/g respectively. An azadirechta indica leaf <sup>26</sup> on phosphoric acid treatment shows higher adsorption capacity 110.9 mg/g for Cr removal while Macadamia activated carbon<sup>15</sup> on treatment with sulphuric acid, phosphoric acid and nitric acid shows 25.75 mg/g, 25.43 mg/g and 38.59 mg/g respectively. Sorghum bicolor <sup>19</sup> and Cassava peel <sup>28</sup> adsorbents on sulphuric acid modification for Cr shows maximum adsorption capacity 25.64 mg/g and 10.07 mg/g respectively. The adsorption efficiency of toxic metal Cd was investigated by sulphuric acid treated cashew nut shell <sup>14</sup>, phosphoric acid treated azadirechta indica leaf <sup>26</sup> and sulphuric acid modified cassava peel <sup>28</sup>. Lapsi seed stone <sup>21</sup> on activation with mixture of sulphuric acid-nitric acid shows maximum adsorption capacity 69.49 mg/g for Ni ion while Sorghum bicolor <sup>19</sup>, Doam seed coat <sup>20</sup> on sulphuric acid treatment has adsorption capacity 47.62 mg/g and 13.51 mg/g respectively.

Ponnusamy Senthil Kumar et al.<sup>14</sup> studied on removal of Zn by using low cost adsorbent Cashew nut shell. The prepared adsorbent was characterized by FTIR and SEM. The maximum adsorption capacity was found 455.7 mg/g while the Palm midrib <sup>23</sup> on citric acid and tartaric acid treatment and azadirechta indica<sup>26</sup> on phosphoric acid treatment shows 5.72 mg/g and 133.3 mg/g respectively. Sartape Ashish et al. explored the use of coconut shell adsorbent <sup>22</sup> on activation with sulphuric acid for the removal of Bi and the activated adsorbent was characterised by FTIR, SEM and BET surface area analyser. The amount of removal of Pb were investigated on sulphuric acid activated maize tassel <sup>25</sup>, phosphoric acid treated azadirechta indica leaf <sup>26</sup>, nitric acid activated baggasse, palm pit, saw dust <sup>27</sup>, sulphuric acid treated cassava peel <sup>28</sup>. An elemental analysis and Boehm method were applied to characterise the prepared adsorbent.



Figure 2. Heavy metal adsorption capacity between 0.078 to 47.62 mg/g by different acid treated adsorbents



Figure 3. Heavy metal adsorption capacity between 69.49 to 456.3 mg/g by different acid treated adsorbents

Heavy metal	Adsorbent	Modifying agent	Characterizations	Maximum adsorption	Ref
				capacity mg/g	
Cu	Baggasse	Citric acid	FTIR, SEM	5.35	10
Cu	Areca catechu shell	H <sub>2</sub> SO <sub>4</sub>	FTIR, SEM	1.33	11
Cu	Cynodon Dactylon	$H_2SO_4$	FTIR, XRD, SEM	90.35	12
Cu	Henna Leaves	$H_2SO_4$		3.65	13
Cr	Henna Leaves	$H_2SO_4$		0.078	13
Cu	Cashew nut shell	$H_2SO_4$	FTIR, SEM	406.6	14
Cd	Cashew nut shell	H <sub>2</sub> SO <sub>4</sub>	FTIR, SEM	436.7	14
Zn	Cashew nut shell	$H_2SO_4$	FTIR, SEM	455.7	14
Ni	Cashew nut shell	$H_2SO_4$	FTIR, SEM	456.3	14
Cr	Macadamia activated carbon	H <sub>2</sub> SO <sub>4</sub>	FTIR, TGA, EDAX, BET	25.75	15
Cr	Macadamia activated carbon	H <sub>3</sub> PO <sub>4</sub>	FTIR, TGA, EDAX, BET	25.43	15
Cr	Macadamia activated carbon	HNO <sub>3</sub>	FTIR, TGA, EDAX, BET	38.59	15
Cr	Activated carbon	HNO <sub>3</sub>	EAS, Boehm method	13.74	16
Cr	Olive stone	$H_2SO_4$	FTIR	71	17
Ni	Oil palm	H <sub>3</sub> PO <sub>4</sub>		19.6	18
Cr	Sorghum bicolor	$H_2SO_4$	BET, FTIR	25.64	19
Ni	Sorghum bicolor	$H_2SO_4$	BET, FTIR	47.62	19
Ni	Doum seed coat	H <sub>3</sub> PO <sub>4</sub>	FTIR,	13.51	20
Ni	Lapsi seed stone	H <sub>2</sub> SO <sub>4</sub>	FTIR, Boehm method	28.25	21
Ni	Lapsi seed stone	H <sub>2</sub> SO <sub>4</sub> and HNO <sub>3</sub>	FTIR, Boehm method	69.49	21

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Bi	Coconut shell	$H_2SO_4$	SEM, FTIR, BET	250	22
Zn	Palm midrib	Citric acid and tartaric acid	SEM	5.72	23
Cu	Palm	$H_3PO_4$	FTIR, BET	21.23	24
Pb	Maize Tassel	$H_2SO_4$	XRD, FTIR	37.31	25
Pb	Azadirechta indica leaf	H <sub>3</sub> PO <sub>4</sub>	BET	205.6	26
Cu	Azadirechta indica leaf	H <sub>3</sub> PO <sub>4</sub>	BET	185.8	26
Cd	Azadirechta indica leaf	H <sub>3</sub> PO <sub>4</sub>	BET	154.5	26
Zn	Azadirechta indica leaf	H <sub>3</sub> PO <sub>4</sub>	BET	133.3	26
Ni	Azadirechta indica leaf	H <sub>3</sub> PO <sub>4</sub>	BET	120.6	26
Cr	Azadirechta indica leaf	H <sub>3</sub> PO <sub>4</sub>	BET	110.9	26
Pb	Baggasse	HNO <sub>3</sub>	Element analysis, Boehm method,	13.7	27
Pb	Palm pit	HNO <sub>3</sub>	Element analysis, Boehm method	15.20	27
Pb	Sawdust	HNO <sub>3</sub>	Element analysis, Boehm method	17.5	27
Pb	Cassava peel	H <sub>2</sub> SO <sub>4</sub>	Nitroperchloric digestion method, FAAS	24	28
Cd	Cassava peel	H <sub>2</sub> SO <sub>4</sub>	Nitroperchloric digestion method, FAAS	7.05	28
Cr	Cassava peel	$H_2SO_4$	Nitroperchloric digestion method, FAAS	10.07	28

**Modification of adsorbents by base treatment:** Bagasse <sup>10</sup>, green vegetable waste <sup>29</sup>, rice husk <sup>30</sup> and orange peel <sup>31</sup> have been used as adsorbent for removal of Cu from its solution. Green vegetable waste was modified by potassium hydroxide while other adsorbents were modified with sodium hydroxide. The author carried out the FTIR, SEM, EDS, TGA and BET characterization for the activated biosorbent material. Green vegetable waste biosorbent shows higher adsorption capacity 75 mg/g in comparison with other adsorbent. The removal of Cd by sodium hydroxide treated biosorbent such as sawdust, wheat straw, corn stalk <sup>32</sup> and rice husk <sup>33</sup> shows adsorption capacity 40.78, 38.75, 30.40, 8.50 mg/g respectively. Rice husk <sup>33</sup> on modification with potassium hydroxide and calcium hydroxide changes adsorption capacity 8.24 mg/g and 10.46 mg/g respectively.



Figure 4. Heavy metal adsorption capacity between 2.06 to 101.01 mg/g by different base treated adsorbents.

S. Erdogan et al. utilised potassium carbonate treated apricot <sup>34</sup> adsorbent for the removal of Ni ion. The prepared biosorbent was characterised by BET and FAAS and shows maximum adsorption capacity 101.01 mg/g. The study of adsorption of Cr by potassium hydroxide activated sawdust, corn straw and corncob <sup>35</sup> were carried out by Shujauddin Khushk et al. The higher adsorption capacity 59.23 mg/g was observed by bamboo waste <sup>36</sup> while corncob shows minimum adsorption capacity 29.46 mg/g. The sawdust and corn straw shows maximum adsorption capacity 34.07 mg/g and 30.15 mg/g respectively. Francisco Jose Alguacil et al. explored the use of cluster stalk <sup>37</sup> on potassium hydroxide activation for Pb ion adsorption.

The poisonous Hg metal adsorption has been investigated by Zhiyuan Liu et al. by rice husk <sup>38</sup> adsorbent on activation with potassium hydroxide. The material was characterised by SEM, FTIR, BET and XPS. The maximum amount of Hg removal by rice husk was found 55.87 mg/g. The seaweed <sup>39</sup> is used as low cost adsorbent on modification with potassium hydroxide and found 12.3 mg/g of maximum adsorption capacity for Vanadium removal.

Heavy metal	Adsorbent	Modifying agent	Characterization	Maximum adsorption	Ref.
		C		capacity mg/g	
Cu	Baggasse	NaOH	FTIR,SEM	2.06	10
Cu	Green vegetable waste	КОН	SEM, TGA, DSC, FTIR	75	29
Cu	Rice husk	NaOH	FTIR, SEM, EDX	48.84	30
Cu	Orange peel	NaOH	FTIR, SEM, BET	50.25	31
Cd	Sawdust	NaOH	FTIR, SEM, BET, XRD	40.78	32
Cd	Wheat straw	NaOH	FTIR, SEM, BET, XRD	38.75	32
Cd	Corn stalk	NaOH	FTIR, SEM, BET, XRD	30.40	32

1 able 2. Biosorption of neavy metals by base treated low cost adsorber	Table	2.]	Biosorpt	tion of	f heavy	metals	bv b	ase t	reated	low	cost	adsorber
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Cd	Rice husk	NaOH	FTIR	8.50	33
Cd	Rice husk	КОН	FTIR	8.24	33
Cd	Rice husk	Ca(OH) <sub>2</sub>	FTIR	10.46	33
Ni	apricot	K <sub>2</sub> CO <sub>3</sub>	BET, FAAS	101.01	34
Cr	sawdust	КОН	SEM, BET, FTIR	34.07	35
Cr	Corn straw	КОН	SEM, BET, FTIR	30.15	35
Cr	corncob	КОН	SEM, BET, FTIR	29.46	35
Cr	Bamboo waste	КОН	FTIR	59.23	36
Pb	Cluster stalk	КОН	FTIR, BET	58	37
Hg	Rice husk	КОН	SEM, FTIR, BET, XPS	55.87	38
V	seaweed	КОН	SEM, EDS, FTIR, BET, XPS	12.3	39

From the literature review it is observed that many researchers applied the acid and base activation method to activate the adsorbent. S. Abdic et al. (2018) studied on the heavy metal removal by modified and unmodified tangerine peel adsorbent <sup>40</sup>. The author reported that 40% of adsorption efficiency enhanced by adsorbent modification. The sulphuric acid is most commonly used acid activating agent for activation of adsorbents. An acid and base activation method is simple, effective, time saving and economical than any other chemical method. The activation of functional group on adsorbent surface found successful and which is identified by adsorbent characterization.

## CONCLUSION

In the current review, the biosorption of heavy metal on acid-base treated adsorbents have been studied. Agricultural waste material used as low cost adsorbent for heavy metal removal was found highly efficient and environmental healthy. It was observed that the modified adsorbent by acid-base chemical treatment shows better adsorption efficiency than non-modified adsorbents. An acid-base treatment has been most widely used for surface modification because of its specific impact on surface to adsorb target pollutant. Due to surface modification, the increase in pore volume and pore size generates more active sites for adsorption which is characterized by BET surface area analysis. A new functional group binding sites are formed due to activation which results into more uptake of metal ion from solution. The researcher were studied the presence of different functional groups on adsorbent surface and characterized by FTIR while the surface morphology were studied by SEM analysis. The amount of adsorption of metal ion depends on various factors such as adsorbent dose, pH of the solution, temperature, modifying method and nature of adsorbent. These type of modified adsorbent is helpful for industrial waste water treatment and will used to reduce the environmental pollution.

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## Exploration of biomass waste as low cost adsorbents for removal of methylene blue dye: A review

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#### ABSTRACT

Biomass waste, which is abundantly available has been studied as low cost biosorbent for dye sequestration from waste water. The present review reports on recent development for remediation of methylene blue dye by agricultural waste and fruit peel waste material. The aim of this study was to revise latest literature in the field of dye adsorption and discuss the dye adsorption capacity of different types of adsorbents. The activated carbon prepared from several types of biomass waste material enhances the adsorption efficiency after modification. The variety of activating agents, method of activation, characterization of biosorbent material like SEM, EDAX, BET surface area and FTIR analysis has been explored in the present review. The dye adsorption factors such as effect of pH, agitation time, temperature, adsorbate and adsorbent dose were discussed. The detailed investigation on applicability of isotherm model, kinetic model and thermodynamic parameters has also been presented. The adsorption kinetics and adsorption isotherm model focus on selectivity of adsorbent. Adsorption mechanism, Influence of pH<sub>pzc</sub> and comparative study of biomass waste adsorbent with other adsorbents have been carried out. The use of biomass waste adsorbents is economically feasible, environmental healthy and found to have outstanding removal capacity of dyes.

#### 1. Introduction

Dyes are organic aromatic compound having complex structure and soluble in water. Every year dye industry produces  $7 \times 10^5$  tons of dyes compound [1]. The industrial effluent contains huge amount of hazardous dyes and it is discarded into the environmental water resources. The presence of even lower amount of dye in water produces colour and which is very harmful to the aquatic life. These dyes prevents the penetration of sunlight into water and disturb the photosynthesis process of aquatic plants, alternately disturb the aquatic life [2]. An approximately 2% dyes from the total present dyes enter into the stream of water through different pathways and pollutes the fresh water. Due to complex structure of dyes, it is difficult to remove it by using chemical reagents and oxidizing agents [3] (see Figs. 1–4).

Most of the dyes are toxic, carcinogenic and cannot be degraded by simple biodegradation technique [4]. Methylene blue is used in great extent in textile industry for colouring the paper, cotton, silk and wool [5]. Different industries like paper, plastic, rubber, leather, textile, cosmetics, food and pharmaceuticals uses large amount of dyes for colouring the material [6].

The traditional methods used for removal of dyes from waste water are physical method, chemical method and biological methods. The physical and chemical methods include precipitation, filtration, flocculation-coagulation and reverse osmosis. The organic chemical compounds converted into mineral material by oxidation process. Chemical method needs specific instruments and chemicals for removal of dyes. It again produces some by-products which create pollution due to its disposal problem. Biological method has limitations for complete removal of dyes. Adsorption is found to be most promising technique for the removal of dyes. The advantage of adsorption techniques are economically feasible, easy handling, availability of adsorbent and better efficiency [7]. Adsorption by low cost adsorbent found most effective for larger scale than other techniques. Activated carbon which is commercially available is a good adsorbent but it increases the cost of

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dye removal. Nowadays, activated carbon prepared from biowaste, agricultural waste, household waste, industrial waste, clay and minerals found to be most effective adsorbents. These waste materials have disposal problems and do not have as such any appreciable economic value and thus such materials are explored for the removal of dyes from industrial effluent. From environment point of view, low cost adsorbents are ecofriendly, abundant, inexpensive and efficient for dye removal [8].

In recent years, a several type of materials such as agricultural waste, egg shell, coffee waste, nanoparticles, composite material, industrial waste, clay, fly ash and red mud are used for dye removal. Methylene blue has several toxic effects on human body. It causes serotonin toxicity, dizziness, precordial pain and bladder irritation. The researchers carried out the work on methylene blue dye adsorption by pomegranate peel [9], chitosan lignin [10], dragon fruit peel [11], fava bean peel [12], cashew nut shell [13], H<sub>3</sub>PO<sub>4</sub> activated pomegranate peel [14], coconut leaves [15] and bagasse [16]. A review on methylene blue dye removal by bio-waste material were carried out by A Farhadi et al. [17] and Hamad Noori Hamad and Syazwami Idras [18]. This review summarises the data for methylene blue dye removal by various adsorbents and these cumulative data is advantageous in future research in adsorption.

#### 2. Adsorption mechanism

The amount of dye adsorption depends on the type of adsorption mechanism and interaction between dye and sorbent surface. Ali H. Jawad et al. [19] has investigated surface mechanistic study of MB dye on KOH activated biomass waste. The dye molecule and adsorbent surface has several number of interactions through the functional groups present on surface. The MB dye cations was electrostatically attracted

## Factors affecting on adsorption

- pH
- Adsorbent dose
- Initial dye concentration
- Contact time
- Particle size
- Temperature

Fig. 2. Factors affecting on adsorption.

towards negatively charged groups on biomass surface. Adsorption mechanism on orange peel surface for methylene blue dye molecule was reported by Stephanie Giraldo et al. [20]. For mechanism study the author carried out adsorbent surface characteristic study with FTIR spectra and concluded that different type of interactions. The  $\pi$ - $\pi$  interaction, hydrogen bonding and electrostatic interactions between adsorbent surface and MB dye molecule were stated.

Ali H. Jawad and Ahmed Saudi Abdulhameed [21] studied MB dye



Fig. 1. Different methods of adsorbent activation.

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adsorption on bamboo chip biosorbent. The authors reported the involvement of hydrogen bonding interactions between adsorbent surface and MB dye. The  $\pi$ - $\pi$  interaction was occurred between aromatic ring of MB dye and adsorbent functional groups. Jacob J. Salazar-Rabago et al. [22] studied the effect of operating conditions on biosorption mechanism of dye on white pine sawdust. It was noted that, biosorption mechanism was both reversible (electrostatic attraction) and irreversible nature (chemisorption). Along with this, proton exchange mechanism from adsorbent surface with MB<sup>+</sup> ion was observed and considered as negligible when compared with other mechanism.

The sulphuric acid treated coconut shell on FTIR analysis confirms the presence of carbon, hydrogen and carbonyl group [23]. It was reported that, the SO<sub>3</sub> group after sulphuric acid treatment shows electrostatic attraction with dye molecule. The adsorption process was enhanced due to different types of interactions between dye and functional groups present on adsorbent surface. The adsorption and mechanism study of MB dye by rice straw was carried out by Ali H. Jawad et al. [24]. The  $\pi$  orbital of aromatic group of MB dye molecule interacts with lone pair of electrons on oxygen of adsorbent surface. The surface hydrogen are available for hydrogen bonding with nitrogen atom of dye molecule.

#### 3. Agricultural waste

Agricultural waste produced in massive amount and some of them are toxic when exposed in environment for longer time. These waste material shows better adsorption efficiency of dyes after proper treatment. The use of agricultural waste material as low cost adsorbents is promising not only due to its low cost but also due to its high efficiency of dye removal, easy handling, availability and it also resolves the disposal problem of waste material. Agricultural waste material contains high amount of carbon which on modification converts into activated carbon [25]. Due to activation of low cost adsorbent and little processing, the sorbent efficiency enhances with minimum processing cost [26]. Overall the low cost adsorbents found most superior than commercially available activated carbon. Table 1 represents the use of numerous agricultural waste materials as a low cost adsorbents reported by various researchers in their published research work.

Effectiveness of ZnCl<sub>2</sub> activated corn husk was tested by Khodie et al. [6] for the effective removal of methylene blue dye from aqueous solution. The material prepared from raw corn husk was impregnated with concentrated solution of ZnCl<sub>2</sub> in the ratio 1:1 with corn husk powder and then dried in oven at 1100C. After washing with water followed by alkali treatment to achieve neutral pH, the material was used for adsorption study. A several batch experiments were carried out to



Fig. 3. Adsorption capacity of different adsorbents in the range (i) 4.52–47.62 mg/g (ii) 51.55–166.6 mg/g (iii) 205.4–515.46 mg/g and (iv) 1000–1923 mg/g.

investigate the effect of adsorbent dose, dye concentration, pH, contact time, particle size, agitation speed and temperature for the removal of dye. The number of sorption site increased with increasing adsorbent dose and results into maximum amount of adsorption of dye. Due to increase in shaking speed, all binding sites were available for biosorption and results in quicker adsorption of dye. The authors analyzed isotherm data using Freundlich isotherm and Langmuir isotherm. B. H. Hammed and A.A. Ahmad [27] investigated the use of garlic peel as a biosorbent. The batch experiments were carried out at the concentration of 25–200 mg/l between the pH 4–12. The adsorption capacity of dye increased with increasing time at temperature 30 °C. Garlic peel was obtained from local market, then washed, boiled with water, filtered and dried in oven at 60 °C for 24 h. After drying, the material was crushed, sieved and used as adsorbent for MB removal. The resultant material was characterized by the techniques like BET, SEM and FTIR. The total pore volume was found 1.12  $m^2/g$  with surface area 0.561  $m^2/g$ . In FTIR analysis the peak at 3567 cm<sup>-1</sup> indicated the attached -OH group. Diffusion rate of dye molecule across the external boundary level increased with rise in temperature. The temperature factor was found to have profound effect on rate of adsorption, amount of adsorbed dve increased from 82.64 mg/g to 142.86 mg/g with increased in temperature from 30 °C to 50 °C.

Ranxiao Tang et al. [28] explored walnut shell as an economical and environmental friendly adsorbent for removal of methylene blue dye. Different parameters were studied for removal of methylene blue. The optimized conditions for dye removal were: contact time 60 min, particle size 80 mesh, adsorbate concentration 20 mg/l, pH 6–11 and adsorbent dose 1.25 g gave 97.1% of dye removal. A smaller particle has larger surface area and gives more active sites shown by BET characterization. The amount of adsorption increased with change in the pH value of the solution due to change in electrostatic forces between walnut shell particles and methylene blue dye. The maximum adsorption 98.7–99.5% was observed in alkaline medium between the pH 6–11.

Ali H. Jawad et al. [29] used  $H_3PO_4$  activated coconut leaves as boisorbent for methylene blue removal. The maximum dye adsorption value for modified coconut leaves adsorbent was found 250 mg/g. The parameter used for these studies were adsorbent dose 2 g, pH 5.6 and temperature 30 °C. BET analysis provides surface area 631.6 m<sup>2</sup>/g, average pore size 36.5 A<sup>0</sup> with iodine number 829.2 mg/g.

Ficus carica bast has been studied as an adsorbent by Deepak Pathania and group [30]. Plant leaves, seeds, fruits and bark of ficus

carica bast are considered as waste product. The author collected this waste material and prepared adsorbents by carrying various treatment on it. The collected material was sorted, washed, dried, and given acid treatment and further dried in oven at 150 °C for 24 h. The author found that maximum adsorption of MB occurred at pH 7.8, contact time 80 min having adsorbent dose 0.5 g/100 ml of dye concentration 0.05 g/100 ml. Langmuir, Freundlich and Tempkin isotherm model were studied for batch experiments. The equilibrium data well fitted by Langmuir isotherm than Freundlich isotherm and adsorption phenomenon obeyed pseudo-second order kinetic model.

Tiwari D. P. et al. [31] investigated acid and aldehyde modified activated carbon obtained from neem bark and potato peel. The aldehyde treatment was given to neem bark and potato peel for the removal of colour of raw material while acid treatment was given for activation of carbon adsorbent. Potato peel was soaked in 6% formaldehyde and neem bark in 37% formaldehyde overnight followed by washing with water and NaHCO<sub>3</sub>. The prepared activated carbon was characterized by SEM and FTIR to know about the structural and morphological properties of adsorbent surface. The H2SO4 treated potato peel showed 75-100% removal of methylene blue while treated neem bark removed 98% methylene blue. The equilibrium data were studied using Langmuir, Freundlich and Tempkin isotherm model. Acid treated potato peel and formaldehyde treated neem bark fits for the Langmuir isotherm due to monolayer adsorption while formaldehyde treated potato peel and acid treated neem bark well fitted with Tempkin isotherm model. Acid treated neem bark showed maximum adsorption 1000 mg/g of methylene blue than other studied adsorbent. The authors also studied the pseudo-first order and pseudo-second order kinetic model and it was observed that pseudo-second order kinetic model was well fitted for adsorption study.

Md. Tamez Uddin et al. [32] utilized mango leaf powder as a low cost adsorbent and explored different parameters like effect of contact time, adsorbent dose, solution temperature and dye concentration for removal of methylene blue dye. The dried mango leaves were grinded, washed and dried in oven at 105 °C for 24 h. The resultant material was characterized with SEM, BET and FTIR. The frequencies observed in FTIR indicated that mango leaf powder contained –OH and –COOH functional groups. The availability of pores and surface morphology of adsorbent was studied with the aid of SEM technique before and after the adsorption of dye. BET surface area characterization point up the total pore volume was less than 184 diameters. The author reported that pH of the dye solution has an important role in adsorption because it



Fig. 4. Adsorption capacity of different fruit peel adsorbents in the range (i) 17.54–200 mg/g (ii) 218.5–1263 mg/g.

#### Table 1

Agricultural wastes used as low cost adso	orbents for MB removal
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Adsorbents	рН	Temp (°C)	Contact time (minute)	Maximum adsorption (mg/g)	Reference
Corn husk	4	25	80	462.96	[6]
Garlic peel	6-	30	210	82.64	[27]
P	12				[]
Walnut shell	6	25	120	51.55	[28]
Coconut leaves	56	30	60	250	[20]
Ficus carica hast	7.8	30	80	47.62	[30]
Potato peel (acid	12	25	30	40	[31]
treated)	12	20	50	10	[01]
Potato peel (formaldehyde treated)	8	25	30	47.62	[31]
Neem bark (acid Treated)	2	25	30	1000	[31]
Neem bark (formaldehyde treated)	4	25	30	90	[31]
Mango leaf powder	7- 10	25	120	156	[32]
Pea shell	5.86	25	180	246.91	[33]
Rice husk	7	25	_	25.46	[34]
Wheat straw	, 10	25	_	205.4	[35]
(phytic acid modified)					
Wheat straw (SDS modified)	8	30	120	126.60	[36]
Wheat straw	8	30	120	55.00	[36]
Sugarcane bagasse	5	-	30	84.74	[38]
Sugarcane bagasse (CaCl <sub>2</sub> treated)	5	-	30	35.21	[38]
Bagasse (tartaric acid treated)	9	30	35	59.88	[39]
Peanut shell (Sulphuric acid treated)	10	23-75	30	1250	[40]
Coconut leaves	8	50	90	87.72	[41]
Coconut coir dust	6	30	20	29.50	[42]
Walnut shell	8	30	_	33.63	[43]
Tamarind pod shell	6	-	80	60.11	[44]
Date stone (sulphuric acid treated)	5.57	50	60	515.46	[45]
Rice straw	6	35	120	32.60	[46]
Rice straw (Citric acid modified)	6	35	120	62.90	[46]
Corn cob	7.6	30	-	417.1	[47]
Corn husk	6.2	-	15	30.33	[48]
Corn cob (citric acid treated)	6	20	120	214.5	[49]
Cashew nut	10	30	60	5.311	[51]
Onion skin (cold plasma treated)	10	30	150	250	[52]
Onion skin (formaldehyde treated)	10	30	150	166.6	[52]
Onion membrane	7.1	20	60	1923	[53]
Soyabean dreg	9	45	120	1273.51	[54]
Acacia wood	7	30	180	210.21	[55]

influence the surface charge and degree of the ionization of the material. The amount of adsorption increased with increasing pH value. At higher pH value, the negatively charged surface site of adsorbent attracts the cation of methylene blue molecule. The maximum amount of adsorption of dye was found in the pH 7–10.

Pea shell (*Pisum Sativum*) has been investigated as adsorbent for methylene blue removal by Gecgel et al. [33]. They prepared activated carbon from pea shell, the material obtained from pea shell was further activated with ZnCl<sub>2</sub> before its utilization. During removal of methylene blue various parameters were tested like effect of contact time, initial concentration of dye, concentration of adsorbent, temperature, solution

pH and contact time. It has been observed that, the percentage of dye removal increased with increased in contact time till the equilibrium time achieved. The rise in temperature from 25 °C to 55 °C, the percentage of removal of methylene blue dye increased. Maximum dye removal was found at temperature 55 °C (99.85%) for the initial dye concentration of 100 mg/l. The rate of diffusion of dye across the surface and internal pores of the adsorbent particles increased due to rise in temperature. The equilibrium data well fitted with Langmuir isotherm model showed maximum adsorption 246.91 mg/g. Adsorption kinetics were studied by kinetic model pseudo first order and pseudo second order. The calculated  $q_e$  value well fitted with experimental  $q_e$  value and proved to be a pseudo second order kinetic model.

Many researchers proved rice husk as a good alternative low cost adsorbent for removal of methylene blue dye. The easy availability, negligible cost, resolves its disposal problem and maximum adsorption capacity of dye attracts the use of rice husk as an adsorbents. Jude Ofei Quansah et al. [34] explored nascent rice husk for cationic dye removal. The author compared the dye adsorption capacity of thermally activated rice husk at temperature 75 °C, 100 °C, 300 °C, 500 °C and 700 °C. The lower temperature (75 °C) for rice husk activation was found superior for dye adsorption. The kinetic studies shows that 17.10 mg/g and 18.19 mg/g dye adsorption capacity for pseudo first order and pseudo second order model respectively. The Langmuir model demonstrates maximum dye uptake 25.46 mg/g at pH 7 with temperature 25 °C.

Application of phytic acid modified wheat straw as adsorbent for removal of methylene blue was tested by Hui You et al. [35]. Wheat straw was modified with phytic acid by esterification process. The dried powder of wheat straw was immersed in DMF and ultrasonically dispersed for 30 min. Mixture was stirred at 60 °C for 3 h by adding phytic acid and urea. The resultant solution after cooling was filtered and washed several times with water, ethanol and finally dried the modified wheat husk powder at 60 °C for 24 h. In the SEM characterization, it was observed that modified wheat straw has rough surface and its specific surface area was increased, which is useful for maximum dye adsorption. The author studied the adsorption kinetics by pseudo first order, pseudo second order and Elovich model. It was found that pseudo second order was most suitable than other kinetic models. Maximum adsorption was found 205.4 mg/g at 25 °C. Desorption study reported that adsorbent can be reused for dye removal. Langmuir adsorption isotherm model best fitted for this study.

Ebrahimian Pirbazari et al. [36] investigated that, wheat straw on modification by surfactants enhances the adsorption ability. Sodium dodecyl sulfate solution was treated with wheat straw with continuous shaking at 180 rpm for 3 h at 30 °C. The solution was filtered, washed and dried the modified adsorbent in oven at 80 °C for 24 h. Due to exothermic nature of adsorption process, the methylene blue adsorption decreases with increased in temperature. Modified wheat straw showed 126 mg/g and unmodified wheat straw adsorbed 55 mg/g methylene blue at temperature 30 °C.

Banerjee et al. [37] improved the adsorption capacity of wheat straw by modified it with 1% perchloric acid. It was observed that dye removal efficiency depends on the change in pH value. As temperature is increased from 30 °C to 100 °C, the efficiency of adsorption found to be decreased. The adsorption of methylene blue increased from 79.80% to 93.4% by increasing the adsorbent dose by 10 g/l to 25 g/l.

Efficiency of sugarcane bagasse modified with CaCl<sub>2</sub>/NaOH was investigated by Utomo et al. [38] for adsorption of dye. Sugarcane bagasse is obtained as agricultural by-product in huge amount and available easily with negligible cost. The disposal problem can be resolved by using large amount of bagasse for adsorption study. Modification of bagasse was carried out on treatment with CaCl<sub>2</sub> which removed the lignin contained from bagasse. The material was characterized by FTIR and XRD to determine the present functional group. Dye removal efficiency were found for treated bagasse 10.90 mg/g and untreated bagasse 11.42 mg/g for 11.217 mg/l initial concentration of methylene blue. Langmuir adsorption isotherm model well fitted with removal capacity 84.74 mg/g for untreated bagasse and 35.21 mg/g for CaCl<sub>2</sub> treated bagasse. The dye removal capacity of NaOH treated sugarcane bagasse was found to be very high.

Bagasse on treatment with tartaric acid explore their potential for the removal of methylene blue from aqueous solution reported by Ling Wei Low et al. [39]. Adsorbent material was characterized by SEM before and after the treatment with tartaric acid. Initially the surface of adsorbent was smooth with a few tiny pores while after modification it becomes uneven with a few pores. The amount of adsorption increased with increase in dye concentration with optimum pH 9. However, the adsorption phenomenon found to be temperature dependent. The amount of adsorption at 30 °C and 50 °C were found to be 59.88 mg/g and 69.93 mg/g respectively.

Md. Tariqul Islam et al. [40] reported that peanut shell improved its adsorption capacity on refluxing with sulphuric acid. A 5 g of Peanut shell were refluxed with 40 ml conc.  $H_2SO_4$  for an hour and then cooled, filtered, washed with distilled water, dried and used for batch experiments. The simulation studies for the effect of initial dye concentration, pH, contact time and temperature were studied. Stronger electrostatic interaction between methylene blue and adsorbent can be achieved due to change in pH from acidic to alkaline. It was found that change in pH from 3.5 to 10 increased the adsorption capacity of adsorbent from 500 mg/g to 810 mg/g. The maximum adsorption capacity of 1250 mg/g was found for an initial dye concentration at 1500 ppm and pH.

10. Langmuir and Freundlich adsorption isotherm were studied to investigate the interaction between adsorbent and adsorbate, Langmuir model was best fitted for these studies. Adsorption kinetics followed pseudo second order kinetic model. The author also studied column adsorption by using 2 g adsorbent with 105 g sea sand packed in column and reported 100% removal efficiency for 36 L of 20 ppm of methylene blue solution at pH 7.

Coconut leaves powder on microwave induced NaOH activation was studied for adsorption of methylene blue dye [41]. The 10 g of coconut leaves impregnated with 40 ml NaOH solution (50%) in the ratio of 1:4. The impregnated mixture was kept in oven 110 °C for 24 h. The prepared material was acid washed and oven dried for batch experiment study. The author investigated different parameters such as adsorbent dose (0.2–1.50 g/l), dye concentration 100 mg/l, contact time (15–90 min), temperature (298–323 K) and pH (3–8). The author reported 99.37% colour removal and 98.27% COD reduction with 87.72 mg/g dye uptake capacity.

Etim U. J. et al. [42] investigated the use of coconut coir dust without any physical and chemical modification for methylene blue dye removal by batch experiment study. The author studied the various parameter like adsorbent dose (0.05–0.2 g), different initial dye concentration, pH (2–10) and contact time (0–35 min). The mechanism and nature of adsorption was studied by Langmuir, Freundlich and Tempkin adsorption isotherm. In a kinetic study, the experimental data well matches with pseudo second order kinetic model with correlation coefficient ( $R^2 = 1$ ). The maximum adsorption was observed for methylene blue dye by coconut coir dust adsorbent was 29.50 mg/g.

An experimental investigation of MB adsorption by response surface methodology through statistical optimization on walnut shell was carried out by Mohammad Kashif Uddin and Abu Nasar [43]. The adsorbent material was characterized by XRD, BET surface area analysis, SEM, FTIR and Thermogravimetric analysis. Adsorption capacity increased from 4.713 mg/g to 18.192 mg/g by increasing the dye concentration 50–200 mg/l. Through the isotherm study it was observed that adsorption process was endothermic and spontaneous in nature. The optimum conditions for better adsorption were adsorbent dose 0.5 g, dye concentration 50 mg/l, pH 8 and temperature 30 °C. The author also carried out desorption study by using 0.1 N HCl and found complete desorption of Methylene blue dye.

N. Ahalya et al. [44] studied various parameters of adsorption on tamarind pod shells for methylene blue dye adsorption. The presence of –COOH, –OH, C–O and C=O groups on adsorbent surface was detected

by FTIR frequencies 2924, 3430, 1030 and 1654 cm<sup>-1</sup> respectively. An element detection of tamarind pod shell adsorbent were carried out and found 46.01% carbon and 6.14% hydrogen with 0.94% of nitrogen. The equilibrium time required for 50 and 100 ppm solution was 70 and 80 min respectively. A total 60.11 mg/g maximum adsorption of methylene blue was found out by tamarind pod shells.

Waste date stone has great potential sorption value due to change in physicochemical characteristics after modification with chemicals. A date stone has lignocelluloses biomass, abundant availability and negligible economic value. Date stone adsorption capacity was improved by modified with 2 N H<sub>2</sub>SO<sub>4</sub> solution as reported by Noureddine El Messaoudi et al. [45]. The lignocelluloses biomass adsorbent on treatment with H<sub>2</sub>SO<sub>4</sub> activates the functional adsorption sites and increases binding capacity for adsorbate particle. An acid treated adsorbent material was characterized by FTIR, SEM and thermogravimetric analysis (TGA). SEM analysis shown that acid treated adsorbent has microporous and irregular structure than untreated adsorbent. TGA was studied in the temperature range 25 °C-600 °C with heating rate 10 °C/min for thermal stability of adsorbent. FTIR frequencies depicts that adsorbent have bonded -OSO3 group after modification with acid. During the experiment, methylene blue concentration increased from 100 mg/l to 300 mg/l resulted into increased in amount of adsorption from 98.07 to 280.37 mg/g at contact time 60 min. Langmuir isotherm model was found to be most satisfactory having 515.46 mg/g maximum adsorption capacity. The author tested desorption study and noted that 95.38% of methylene blue desorption was obtained with 0.1 N HNO<sub>3</sub>.

Adsorption efficiency of rice straw improved by treating with acidalkali was investigated by Nady A. Fathy et al. [46]. The raw rice straw were treated with citric acid and EDTA separately and dried at 50 °C. In physicochemical analysis bulk density, moisture, iodine number, slurry pH were studied. Adsorption study was carried out by using 20–200 mg/l methylene blue solution (25 ml), adsorbent dose 0.15 g, pH 6 with contact time 2 h. The effect of pH on adsorption rate was studied in the pH range 2–10 and amount of adsorption increased by changing the pH from acid to alkaline. The untreated and citric acid treated rice straw showed maximum adsorption 32.60 mg/g and 62.90 mg/g respectively. Recycling and reusable ability of adsorbent were studied by desorption study which was carried out by treating used adsorbent with 0.1 M HCl and 0.1 M NaOH. A complete removal of methylene blue was observed on treating with 0.1 M HCl.

Hee Jeong Choi et al. [47] studied on agricultural biosorbent corncob for removal of MB. Hauser ratio and porosity analysis showed that corncob has good ability of adsorbent due to number of pores on surface. The corncob adsorbent material was prepared by drying at 70 °C for 72 h and cutted in 0.5 cm thickness and stored in desiccator. Batch studies were carried out by investigating the parameters such as effect of pH, initial MB dye concentration, corncob dosage and temperature. The pH of the solution was adjusted by using the solution HCl or NaOH in between the pH 2 to 10 and effect of temperature was studied in between 10 °C to 30 °C. The elemental analysis of corncob were carried out and showed 57.81% C, 5.41% H, 0.83% N, 0.03% S and analysis of physical properties includes 1.42% moisture, 17.41% volatile matter. 3.23 as h content, 37.63% fixed carbon and 83.51% porosity. The surface characterization carried out by SEM analysis and it showed that corncob surface was very irregular and porous in nature. The surface of corncob was found multiple layers of thin films which adsorb larger amount of dye. The amount of removal of MB in 3 h was found 82.46%, 86.79%, 96.01 and 98.62% at MB concentration 0.02 g/l, 0.01 g/l, 0.005 g/l and 0.0025 g/l respectively. The removal percentage of MB was decreased by increase in initial MB concentration from 0.02 g/l to 0.005 g/l. The effect of pH was observed by maintain pH value at 2,4,6,8 and 10 and removal of MB dye was 11.47%, 38.46%, 99.74%, 99.89% and 99.90 respectively. The maximum adsorption observed at higher pH value due to electrostatic interaction. As the pH increase, the removal rate also increased because of increased in anions in the aqueous solution. The maximum adsorption was found 417.1 mg/g.

Chemically modified cellulose waste prepared from corn cob waste was studied by Jin Yaniqiao et al. [49]. Corn cob waste was treated with citric acid via esterification and used as biosorbent for removal of MB dye. The corncob residue was washed with distilled water and then dried at 60 °C for 24 h. The dried material was filtered to 120–500 mesh size. The powdered residue material was pretreated with 0.1 mol/l NaOH for 2 h and then washed with water to remove excess base. The residue material was treated with 0.6 mol/l citric acid at the ratio 1:10 (w/v) for 1 h and then dry it overnight at 60 °C, then temperature increased up to 120 °C for 3 h. The resultant material was filtered with hot distilled water under vacuum, dried and used it for batch experiment study. Characterization of biosorbent material was carried out by FTIR and XRD study. In XRD study it was observed that the crystallinity of corn waste material is not affected after modification. The biosorbent capacity and removal rate decreased from 124.9 to 121.0 mg/g and 99.95%–96.7% respectively by increasing the temperature from 20 °C to 60 °C which proved that biosorption process was exothermic and favors at low temperature. The adsorption occurred very rapidly in first 10 min and then adsorb slowly, it is due to the more availability of surface function sites at initial stage of adsorption. The maximum MB adsorption 214.5 mg/g was found at the MB concentration 800 mg/l.

Cashew nutshell, a novel adsorbent for removal of MB dye was investigated by Ramlingam Subramanium et al. [50]. The author used the activated carbon prepared from cashew nut and studied different process variable viz. pH, initial dye concentration, adsorbent dose and contact time. The authors carried out several operations for activation of carbon. Initially the material was sieved and dried, then carbonization was carried out at 7000C under N2 atmosphere. The resultant material was soaked in KOH with ratio 1:1 and dehydrated at 105 °C for overnight followed by pyrolysis in stainless steel vertical tubular reactor. The material was activated by placing it in a tube furnace under high purity nitrogen at 850 °C for 2 h. The resultant activated product was cooled to room temperature and washed with deionized water. Finally the acid treatment was given followed by washing with hot distilled water. BET surface area 984 m<sup>2</sup>/g, average pore diameter 2.52 nm and pore volume 0.552 cm<sup>2</sup>/g was found in surface characterization of activated biosorbent. The increase in initial MB dye concentration, the driving force increases and also enhanced the interaction between adsorbent surface and MB dye, which ultimately affects the greater adsorption rate. The author used response surface methodology (RSM) to design the experiment, optimize the variable and model the process.

P. Senthil Kumar et al. [51] studied on removal of MB by cashew nut shell in order to explore their potential use as a biosorbent for MB removal. The characterization of biosorbent was carried out by FTIR, BET and SEM. The BET surface area, average pore diameter, pore volume and bulk density were found  $395 \text{ m}^2/\text{g}$ , 5.89 nm, 0.4732 cm<sup>2</sup>/g and 0.415 g/cm<sup>2</sup> respectively. The author studied the effect of pH on adsorption rate and it was concluded that adsorption of MB increases with increased in solution pH. At lower pH, the adsorption sites are occupied by H<sup>+</sup> ions and hence less adsorption occurred while at higher pH the negative ion increased which increases the adsorption through electrostatic attraction. The optimum temperature 30 °C was found for maximum adsorption. The decreased in adsorption from 98.18 to 90.79% was observed by increased in temperature from 30 °C to 60 °C. Thermodynamic parameters such as enthalpy, entropy and free energy change were determined. The Gibbs free energy value found negative which indicated adsorption is feasible and spontaneous. The negative value of enthalpy change indicates exothermic nature and entropy value suggested the randomness at the surface. Langmuir adsorption isotherm best fitted to the experimental values as compared to Freundlich, Tempkin and Dubinin-Radushkevich isotherm model. The pseudo second order kinetic model well fitted than pseudo first order and elovich kinetic model. The maximum adsorption of MB dye was found 5.311 mg/g at pH 10 within contact time 60 min.

An onion skin treated with cold plasma and formaldehyde was investigated for removal of MB dye by Cafer Saka et al. [52]. Onion skin are disposed into the environment in massive amount which causes health issues to the community. The onion skin were collected, dried and removed the adhere impurities. The skins were boiled for 3 h to remove colored material and dried in oven for 24 h at 85 °C. The dried material was sieved and treated with Nitrogen plasma for 30 min. The cold plasma treated material was used for batch experiment study. The author also studied the formaldehyde treated onion skin for adsorption. Formaldehyde (1%) with onion skin in the ratio 1:5 at room temperature for 24 h. The resultant material was filtered with water for several time to remove formaldehyde and dried in oven at 80 °C for 24 h. The prepared biosorbent material were sieved and used for adsorption study. FTIR study were carried out in between 4000 and 400 cm<sup>-1</sup>. Lower adsorption found at acidic pH and it goes on increasing with increased in pH from 2.5 to 10. The cold plasma treated onion skin increased in dye removal from 12.692 mg/g to 120.26 mg/g by increased in dye concentration from 10 to 100 mg/l while the formaldehyde treated onion skin adsorbent showed increased in dye removal from 14.268 to 118.35 mg/g. The author studied pseudo first order and pseudo second order kinetic model and found that pseudo first order kinetic model described best for the uptake of methylene blue. The cold plasma treated onion skin showed maximum adsorption 250 mg/g while formaldehyde treated onion skin showed maximum adsorption 166.67 mg/g.

Somaneh Saber-Samandari and Jalil Heydaripour [53] studied on onion membrane as a biosorbent for MB dye. The maximum adsorption was found 1.055 g/g in first hour with efficiency 84.45% while in 8 h it was 1.202 g/g with efficiency 96.20%. The biosorbent material was characterized by FTIR and SEM. It was found that onion membrane has –COOH and –OH anionic groups which shows electrostatic attraction towards positive charge and hydrogen of MB dye molecule. The author studied three kinetic models such as pseudo first order, pseudo second order and intraparticle diffusion model. Langmuir and Freundlich isotherm model were also studied and found that the Freundlich model well-matched with experimental data. Adsorption process was found exothermic and spontaneous by thermodynamic study.

Mohamad Firdaus Mohamad Yusop et al. [55] explored the physicochemical activation process by KOH treatment to the acacia wood for methylene blue dye adsorption. Due to physicochemical treatment, mesopore surface area increased from 268.40 m<sup>2</sup>/g of raw char to 689.77 m<sup>2</sup>/g of activated acacia wood carbon. The average pore volume and total pore volume of activated material was found 2.78 nm and 0.5350 cm<sup>2</sup>/g respectively. An elemental analysis of material showed 78.60% Carbon, 7.20% Hydrogen, 0.01% Sulphur and 14.19% of Nitrogen and Oxygen. By increasing temperature from 30 °C to 60 °C the adsorption of methylene blue reduced from 210.21 to 179.85 mg/g. Adsorption capacity increased from 256.41 to 279.33 mg/g at pH 8 to 10 respectively. In a thermodynamic study, enthalpy change ( $\Delta H^0$ ) and entropy change ( $\Delta S^0$ ) values were determined as -44.32 kJ/mol and -0.16 kJ/mol respectively.

#### 4. Influence of surface area

The BET surface area, pore diameter and pore volume of phosphoric acid activated corn cob carbon powder was studied by Ali H. Jawad et al. [56]. The observed BET surface area was 415.2  $m^2/g$ , pore diameter 3.35 nm, volume in pores 95.4  $cm^2/g$  and total volume in pores 0.35  $cm^2/g$ . Ahmad Saud Abdulhameed et al. [57] studied the effect of activation of carbon and increase in surface area of adsorbent prepared from biomass green waste. The adsorbent material on activation changes the textural property. The enhancement in surface property such as pore volume from 0.202  $cm^2/g$  to 280.2  $cm^2/g$ , total pore volume 0.007  $cm^2/g$  to 0.762  $cm^2/g$  and BET surface area 1.14  $m^2/g$  to 1245.6  $m^2/g$  for raw adsorbent to activated adsorbent respectively. The obtained data indicates that sample was mesoporous in nature. The corn cob was activated with sulphuric acid and used for methylene blue dye adsorption studied by Ali H. Jawad et al. [58]. The mean pore diameter and BET surface area was found 11.534 nm and 1.653  $m^2/g$  respectively.

Mondira Bardhan et al. [59] worked on betel nut husk carbon activated with sodium hydroxide for MB dye removal. The textural property was studied with BET surface area analysis. The obtained pore diameter 3.533 nm depicts mesoporous properties. The author reported that BET surface area  $81.73 \text{ m}^2/\text{g}$  was found longer in comparison with areca husk. The activated adsorbent showed maximum adsorption capacity 381.6 mg/g at temperature 30 °C. The acid treated rubber leaf shows maximum adsorption capacity 263.2 mg/g reported by Ali H Jawad et al. [60]. Due to acid activation with high concentration of sulphuric acid, the decrease in surface area was observed, alternatively increase in sulphur and oxygen content on adsorbent surface. The BET surface area and total pore volume for activated carbon of rubber leaf were found 1.65 m<sup>2</sup>/g and 0.00342 cm<sup>2</sup>/g respectively.

#### 5. Fruit peel waste

Fruits contain noteworthy ingredients which are useful to maintain good health. Day by day demand of fruits goes on increasing due to rise in population and health issues. During the fruit processing, 20–30% materials are discarded as waste. The fruit waste includes seed, peel and pomace which contain dietary fibers, carotenoids, polyphenols and other fibers [61]. The use of proper fruits in diet reduces the risk of diseases such as cancer and cardiovascular diseases [62]. Fruit seeds can be preserved and used but fruit peels are generally of no use and discarded as waste. Different organic and inorganic pollutants were successfully removed by using fruit peel biosorption process. Fruit peel based adsorbents are explored for the removal of methylene blue dye [63], the various fruit peels used are summarized in Table 2.

Ali H. Jawad et al. [64] investigated mango peel as an adsorbent for removal of methylene blue dye from its aqueous solution. Mango fruit found to be one of the most consumable fruit in the entire world. The 35% to 60% mass from the mango fruit considered to be the byproduct and discarded as a waste material into the environment. The mango peel contained carotenoids, vitamin E, vitamin C, polyphenols, lactic acid and dietary fibers. The author utilized sulphuric acid to activate and modify the mango peel waste. At first, the mango peels were collected from local fruit juice center and then washed with water. Afterwards, dried in oven at 105  $^{\circ}$ C for 24 h for removal of moisture content. The material was grinded, sieved and treated with acid in proportion of 1 g powder with 1 ml sulphuric acid. Activated material was examined to ash content, moisture content and micropore content. Surface morphology was characterized by SEM-EDAX. The change in surface topography of the

adsorbent indicated that, reduction in pore structure and the surface became smoother after adsorption. In FTIR spectra study, shifting in frequency before and after adsorption of methylene blue dye proved the methylene blue interaction with functional groups of activated mango peel adsorbents. Adsorption kinetics were studied by using pseudo first order and pseudo second order kinetic model. Maximum adsorption by pseudo first order and pseudo second order were found 241.94 mg/g and 256.41 mg/g respectively. It was found that pseudo second order kinetic model is well fitted to the adsorption kinetics. In adsorption thermodynamic study, the entropy change positive value indicated that adsorption process was endothermic and follows chemisorption mechanism through strong forces of attraction. The author reported that maximum adsorption capacity for sulphuric acid treated mango peel was found 277.8 mg/g. Methylene blue adsorption by HPO treated and activated orange peel has been investigated by Maria Emilia Fernandez et al. [65]. For activation of carbon content within orange peel, the powdered material with diameter 500–1000  $\mu$ m was treated with 50% H<sub>3</sub>PO<sub>4</sub>. Elemental analysis of untreated orange peel showed 43% Carbon, 5.9% Hydrogen, 50.2% Oxygen while treated orange peel material showed 82% Carbon, 2.5% Hydrogen, 14% Oxygen and 0.9% Nitrogen. Batch and continuous experiments were carried out for adsorption study. For continuous adsorption experiment, acid activated orange peel powdered material was packed into the column having internal diameter 1.6 cm, height 36 cm and diameter of particles used in between 105 and 250 µm. Adsorption capacity found 0.131 mmol/g by using pseudo second order kinetic model at pH 7, initial concentration 0.21 mmol/g and adsorbent dose 0.29 mmol/100 ml. By using Langmuir adsorption isotherm 1.00 mmol/g adsorption capacity was achieved.

Lina B. L. Lim et al. [66] utilized breadnut peel as adsorbent for its ability to remove methylene blue dye. Artocarpus camansi commonly known as breadnut belongs to Artocarpus of the Moraceae family. Breadnut peels are inedible, having no economic value and thus discarded as waste. The author studied different experimental parameters such as effect of pH, contact time and adsorbent dose. The prepared and dried breadnut peel powder was characterized for element content in which 41.1% carbon was found by elemental analysis. In general characterization, the adsorbent contain 21% fiber which is beneficial for adsorption of dye molecule. SEM characterization point up that, after methylene blue treatment, roughness of adsorbent surface was changed and reduced in number of pores due to packing with methylene blue molecules. The author noted that, high removal efficiency of dye molecule was due to fibrous and porous surface of adsorbent. The calculated specific surface area 1519 m<sup>2</sup> g<sup>-1</sup> was found to be higher than

#### Table 2

Various fruit peel waste used as low cost adsorbents.

Fruit peel adsor	bents Ac	ctivating agent		pН		Temp (	°C)	Contac	Time (min)	Max. Adsorption (mg/g)	Ref.
Mango	Sul	ılphuric		5.6		30		60		277.8	64
	Ac	cid									
Breadnut	-			6		25		60		409	66
Banana	H <sub>2</sub>	$_2SO_4$		11		30		1440		250	67
Banana	Ca	arbonization		6.3–6.9		25		150		1263	68
Pomegrana te	-			7		30		150		36.36	69
Pomegrana te	-			11		30		30		102.25	70
Citrus	-			6.4		24		-		185.83	71
Citrus	Cal	alcium alginate		6.4		24		-		964.54	71
Citrus Lanatus	Zn	nCl <sub>2</sub>		5.45		25		-		231.48	72
Citrus Lanatus	H <sub>2</sub>	$_2SO_4$		5.6		30		0-300		200	73
Kendu	An	mmonium carbona	te	6		25		100		144.9	75
Pomelo	_			10		30		180		81.71	76
Pomelo	Citric acid		10		30		180		199.29		76
Pomelo	-		10		30		150		218.5		77
Pumpkin	Beetroot Extract		7		50		180		198.15		78
Bean	Microwave induced	d KOH	9		25		30		45.45		79
Acron	Microwave induced	d KOH	9		25		30		17.54		79
Dragon	-		4.7		20-25		60		640		81
Apple	-		6		20		360		107.52		82
Durian	NaOH		-		-		-		235.80		83
Orange	Carbonization		6		30		180		476		85
Banana	Carbonization		8		30		180		390		85

other relevant adsorbents. The equilibrium time found 60 min to achieve maximum adsorption and further increased in time does not show any more adsorption. Spontaneous biosorption process was studied by using energy and entropy factors. At temperature 25 °C Gibbs free energy change -6.25 kJ mol<sup>-1</sup> indicated that adsorption process was exothermic and spontaneous. The author also reported that increased in temperature, negative value of  $\Delta G^0$  increases, which proved that adsorption occurred at lower temperature and maximum adsorption capacity  $q_{max}$  decreased with increased in temperature. The maximum adsorption 409 mg/g was found at temperature 25 °C.

Banana peel is the most wasted peel among the other fruit peels. It contains cellulose, lignin, starch, protein and hemicelluloses but these peels have no economic value and considered to be waste material. However, preparation of activated carbon from banana peel as an adsorbent found to be most attractive alternative for commercial activated carbon. Ali H. Jawad et al. [67] reported the acid treated banana peel as adsorbent for methylene blue removal. Raw banana peels were washed, dried, grinded, sieved and impregnated with concentrated H2<sub>s</sub>O<sub>4</sub> for activation purpose. Elemental analysis showed Carbon 55.54%, Oxygen 37.95% and Hydrogen 4.24%. Due to activation by sulphuric acid, the SO<sub>3</sub> group bonded on adsorbent surface group which creates negative charge on surface for maximum adsorption. It has been reported that, the amount of adsorption depends on initial dye concentration, as the initial concentration increased from 10 mg/l to 300 mg/l, then removal of methylene blue increased from 16.63 to 259.70 mg/g. Higher methylene blue concentration creates large driving force which determines more probability of collision between adsorbent and methylene blue molecule. From the calculated data of adsorption isotherm, author noted that Langmuir isotherm model best fitted with larger R<sup>2</sup> value (0.990) than Freundlich (0.703) and Tempkin model (0.922). The monolayer and homogeneous adsorption occurred on the surface of adsorbent. Batch experiment study were carried out between the pH 3-12, contact time 0-1440 min, methylene blue concentration 10–300 mg/l and adsorbent dose 0.02–0.30 g. At temperature 30  $^{\circ}$ C, the maximum adsorption capacity 250 mg/g was found in batch experiment study. Adsorption was spontaneous and endothermic in nature. The adsorption efficiency of banana peel has been improved by carbonization process at temperature 500–750 °C reported by Jian Feng Ma et al. [68]. Pyrolysis of volatile matter occurred during carbonization which changes the original surface morphology. A numerous micropores formed on the surface and a high surface area 1950 m<sup>2</sup> g<sup>-1</sup> was found. The pore volume was 1.071 cm<sup>2</sup>g<sup>-1</sup> while 0.869 cm<sup>3</sup>g<sup>-1</sup> micropore volume observed. According to adsorption kinetic study, 87-95% adsorption was found in the first 10 min due to the high driving force on methylene blue molecule for migration towards adsorbent surface. The maximum uptake of methylene blue 1263 mg/g was observed which is higher than any treated and activated banana peel for methylene blue dye.

Fuat Guzel et al. [69] reported pomegranate peel as an adsorbent with adsorption capacity of 36.36 mg/g for removal of methylene blue. Punica granatum commonly known as pomegranate is found to be most popular and nutritional fruit. Pomegranate peel becomes thick and hard carries 5-15% of total weight. A huge amount of pomegranate peel discarded as waste from fruit juice industry. The authors prepared fine powder from the peel by washing, grinding, sieving and drying methods. The resultant material was studied without any further physical or chemical treatment. The batch experiments were carried out at different pH values between 2 and 12 with proper addition of 0.1 M NaOH or 0.1 M HCl solution. The amount of adsorption increased from 5.36 to 20.68 mg/g with increase in pH from 2 to 7. This is due to decrease in electrostatic repulsion between the positively charged surface and methylene blue molecule. The pH 7 was found to be suitable for better adsorption. Equilibrium time 150 min was found but initial adsorption occurred very rapidly within first 60 min and then adsorption capacity became slower. The variation in biosorbent dose from 0.1 g/l to 1 g/l enhances the methylene blue removal from 38.6 to 94.0%. The author

studied the effect of salt ionic strength on removal of methylene blue dye and reported that adsorption decreased by increased in NaCl salt concentration. The salt cations occupied the surface of adsorbent rather than methylene blue. Furthermore, author worked on desorption study of dye from adsorbent surface. They utilized HCl, HNO<sub>3</sub>, CH<sub>3</sub>COOH, H<sub>3</sub>PO<sub>4</sub> Citric acid and water as desorbing agents. The desorption efficiency with various materials were found as with citric acid 78.25%, HCl 57.81%, HNO<sub>3</sub> 55.73%, H<sub>3</sub>PO<sub>4</sub> 68.64% and with water 3.29%. Citric acid showed maximum desorption of methylene blue while water showed minimum desorption. It was due to more binding cites of carboxyl group in citric acid molecule.

An investigation on pomegranate peel was carried out by Nur Dini Daud et al. [70] to evaluate the removal efficiency for methylene blue dye from its aqueous solution. They found the adsorption capacity 102.25 mg/g and dye removal percentage 99.8%. The batch experiments were carried out with pH 11, adsorbent dose 1.0 g, contact time 120 min, dye concentration 10 mg/l and temperature 30 °C.

Application of citrus peel encapsulated with calcium alginate and unmodified citrus peel as ecofriendly and effective biosorbent for removal of methylene blue was reported by Amina Aichour et al. [71]. Fine fractions of citrus peel were prepared by washing, crushing, sieving and drying. One fraction of the prepared material was added into 2% sodium alginate and stirred for 10 h. Then added into 4% calcium chloride to form beads, it was washed repeatedly to remove excess sodium chloride and dried. The author studied both batch and continuous adsorption methods. Plastic column with diameter 1.9 cm and length 20 cm was used in continuous method. Several parameters such as adsorbent flow rate, effect of bed height, and effect of initial concentration of dye were studied. The total amount adsorbed, effluent volume, adsorption at equilibrium and amount of dye spent in the column were determined by using breakthrough curve. The batch study showed that 93% of methylene blue was removed by using calcium alginate encapsulated citrus peel. The high correlation coefficient (R<sup>2</sup>) showed Langmuir model well fitted and proved monolayer adsorption. The maximum amount of methylene blue adsorbed was 185.83 mg/g on citrus peel and 964.54 mg/g over encapsulated citrus peel. For an initial concentration of methylene blue 200 mg/l with flow rate 2 ml/min and bed height 3.5 cm, the amount of methylene blue obtained 93.6% having bed capacity of 31.45 mg/g. Thomson and Yoon-Nelson model best fitted by the breakthrough curves.

Activated carbon prepared from citrullus lanatus rind was found efficient for the removal of methylene blue reported by Osman Umer et al. [72]. The rind of citrullus lanatus commonly known as watermelon considered to be waste and no economic value. On treatment with chemicals and carbonization process, the rind produced highly efficient activated carbon. The watermelon rind were collected, washed and cleaned with distilled water, cutted into small pieces, dried in sunlight for 2 days and then crushed and sieved (50 mesh). The dried powder impregnated with ZnCl<sub>2</sub> in the ratio of 2:1 with refluxing condition for an hour. The resultant material was dried for 24 h at 105 °C in an incubator. Then carbonization was carried out in furnace at 700 °C for 60 min. For removal of chloride and zinc compound from the surface of adsorbent, it was treated with 0.1 N HCl followed by hot water, dried in incubator at 105 °C and used for adsorption study. Thermal behavior of the prepared material during the carbonization and activation was studied by using thermogravimetric analysis. The carbon content analysis of raw material and treated material found to be 38.57% and 60.42% of respectively. Effect of temperature on adsorption of methylene blue was found to be significant. The amount of methylene blue adsorbed was 231.48, 243.90, 244.50 and 259.74 mg/g at temperature 25 °C, 35 °C, 45 °C and 55 °C respectively. The author utilized Langmuir, Freundlich, Tempkin and Dubinin-Radushkevich model to explain adsorption mechanism. The correlation coefficient value from Langmuir isotherm was found to be closer to 1, suggested that the Langmuir model best fitted for adsorption study. Pseudo-first order, pseudo second order and Elovich model were examined for kinetic study. The correlation

coefficient value was in the range of 0.995–1.000 proved to be the best fitted pseudo second order kinetic model. Thermodynamic study revealed that adsorption was endothermic in nature, spontaneous and feasible.

Ali H. Jawad et al. [73] used sulphuric acid for activation of citrus lanatus rind. One step chemical activation by sulphuric acid at temperature 110 °C for 24 h was used for activation to adsorbent material. The effect of different system variables such as contact time, pH, initial dye concentration and adsorbent dose were studied in batch experiments. Elemental analysis of adsorbent material showed 41.06% carbon, 52.25% oxygen, 5.12% hydrogen and 1.57% nitrogen. Adsorption capacity increased at equilibrium from 60 mg/g to 300 mg/g with increased in methylene blue concentration from 50 to 400 mg/l. The increased in amount of adsorption was observed due to increase in collision rate between methylene blue molecule and adsorbent surface. The calculated and measured quantity of adsorbed value in pseudo second order kinetic model was closer than the values obtained from pseudo first order model, indicated that pseudo second order kinetic model satisfied the adsorption kinetics. The author reported that the adsorption mechanism on the adsorbent surface was occurred due to electrostatic attraction between positively charged methylene blue molecule and negatively charged functional group on adsorbent surface and also due to the hydrogen bonding and  $\pi$ -  $\pi$  stacking interaction between surface framework of adsorbent and aromatic rings of methylene blue molecule. The maximum adsorption capacity 200 mg/g at 30 °C was found and well described by Langmuir isotherm model.

Similarly, batch and fixed bed column studies were carried out on watermelon rind by Lakshmipathy and N. C. Sarada [74]. Batch studies were performed with different parameters like adsorbent dose, pH, contact time and initial dye concentration while fixed bed column studies were carried out with parameters such as bed height, flow rate and initial inlet concentration. Thomas and Yoon- Nelson and Adams-Bohart model were studying for analyzing the breakthrough curve. Glass column having length 15 cm with diameter 1 cm packed by adsorbent material was used for fixed bed column adsorption process. The physicochemical characteristics of watermelon rind showed 61.47% carbon and 30.31% oxygen. By increasing the temperature 30 °C–50 °C, the amount of adsorption changed from 44.5 to 46.1 mg/g, shows no appreciable change in adsorption with increase in temperature.

Sumanta Sahu et al. [75] investigated the use of kendu fruit peel as low cost adsorbent for the removal of methylene blue. Kendu is popular fruit belongs to Ebenaceae family known to be coromandel ebony. In order to improve the adsorption efficiency the chemical treatment was done by ammonium carbonate followed by carbonization to the biosorbent material. The washed, dried fruit peel powder carbonized in furnace at 400 °C for 2 h. The carbonized biomaterial was modified by mixing 20 g powder with 250 ml 0.05 M ammonium carbonate and then stirred it for 24 h on magnetic stirrer. The resultant material was filtered, dried in oven at 100  $^\circ$ C for 2 h and then in muffle furnace at 400  $^\circ$ C for 2 h. The prepared material was known to be modified biosorbent and used for batch experiment study. Biosorbent material was characterized by SEM, FESEM and FTIR. The surface area and pore size were calculated from BET and BJH method respectively. Thermogravimetric analysis was performed to study thermal stability of material. The pore volume and specific surface area were determined by using Quantachrome model. The SEM micrographs showed that modified biosorbent material surface was fully porous with different sizes. The modified biosorbent surface area 249 m<sup>2 g-1</sup>, pore volume 0.133 cm<sup>3</sup>g<sup>-1</sup> and pore size 3.09 nm were found from BET characterization. The author noted that temperature has no effect on adsorption capacity. The maximum adsorption of 144.9 mg/g was found for the batch study. The adsorption energy value (E) 10.42 KJmol-1 indicated that it was chemical adsorption.

Pomelo is largest fruit from citrus belongs to Rutaceae family. Approximately 15% weight out of the fruit is discarded as peel waste. Pomelo peel was found to be attractive biosorbent for dye removal from its aqueous solution. Yimei Ren et al. [76] studied pomelo peel as an adsorbent and improved its removal efficiency by modifying with citrate. The grinded small particles (60-80 mesh) were prepared from pomelo peel by washing, grinding and drying at 60 °C. 5 g Pomelo peel powder and 150 ml citric acid (0.6 mol/l) was stirred at room temperature, filtered, dried at 55 °C for 20 h and then heated for 90 min at 120 °C. After cooling the mixture was filtered and added into 100 ml NaOH solution (0.1 mol/l), material was washed with hot water (70 °C) and dried in oven for 24 h at 60 °C. The increased in adsorption was found with increased in initial concentration of methylene blue. The maximum adsorption occurred within first 30 min and then adsorption equilibrium achieved after 3 h. Removal rate of methylene blue increased from 46.22% to 90.51% and adsorption capacity increased from 38.52 mg/g to 75.43 mg/g with increased in pH 2.57 to 4.1. The author reported that below the pH 5.3, the surface of adsorbent was positively charged, which decreased the electrostatic attraction between adsorbent surface and methylene blue molecule. The pH value more than 5.3 makes the surface negatively charged and increased in electrostatic attraction which ultimately increased in adsorption capacity. The correlation coefficient value of pseudo second order model was found to be higher than pseudo first order model. The adsorption capacity value of calculated and experimental analysis found closer which indicated that pseudo second order kinetic model well fitted than pseudo first order kinetic model. From thermodynamic study it was observed that increased in temperature has no effect on adsorption. Negative value of  $\Delta H^0$  indicated that adsorption process was exothermic. The increased in  $\Delta G^0$  with rise in temperature proved that maximum adsorption occurred at lower temperature. From the obtained values it was concluded that, adsorption process was exothermic, spontaneous and entropy decreased process.

The internal interaction relationship during adsorption process was studied by Van Phuc Dinh et al. [77] using pomelo peel adsorbent. Computer simulation by ab initio model was applied to simulate the IR spectra of pomelo peel biosorbent material. The combination of FTIR measurement with ab initio model was found to be effective to understand the adsorption mechanism. By using such combination author concluded that methylene blue adsorption on biosorbent took place due to electrostatic attraction and hydrogen bonding. The author studied four kinetic model such as pseudo first order, pseudo second order, intraparticle diffusion and Elovich model having correlation coefficient value 0.6183, 0.9282, 0.8422 and 0.9671 respectively. From the calculated values it was indicated that adsorption kinetics followed pseudo second order kinetic model. To estimate adsorption, the author utilized five adsorption isotherm models such as Langmuir, Freundlich, Tempkin, Sips and Dubinin-Radushkevich. The Langmuir isotherm model well fitted with maximum adsorption capacity 218.5 mg/g.

Jamshaid Rashid et al. [78] utilized pumpkin peel by modifying with beetroot extract as novel adsorbent for decolorization of aqueous solution of methylene blue. Beetroot extract was selected due to presence of its natural antioxidant activity and explored a greener approach towards the waste water treatment. The collected pumpkin peels were washed, dried in sunlight for 30 days, then in oven dried at 100 °C for 18 h, finally grinded and sieved. The carbonization treatment was given to the peel at various temperature 250, 350, 450 and 550 °C for 1 h in muffle furnace and prepared material was known to be activated carbon namely AC250, AC350, AC450 and AC550 respectively. Then all these activated carbon were tested for adsorption capacity of methylene blue. It was observed that AC<sub>250</sub> found to be most efficient adsorbent than other carbonized activated carbon. For further activation, AC<sub>250</sub> was treated with oxalic acid, nitric acid and citric acid. SEM images of beetroot extract activated carbon material showed that adsorbent surface contained high pore volume, different sizes of pores and well distributed pore structure, which facilitates higher adsorption than acid treated activated carbon. FTIR spectra showed that AC<sub>250</sub> has varieties of functional group than AC<sub>350</sub>, AC<sub>450</sub> and AC<sub>550</sub>. Adsorption capacity enhanced from 147.5 mg/g to 198.15 mg/g by increased in temperature 30 °C-50 °C. The temperature dependent adsorption process was found

to be endothermic in nature. The author studied in recycling of adsorbent and it was found that adsorption efficiency reduced from 198.15 mg/g to 149.12 mg/g after third cycle. Total 12% reduction in adsorption efficiency was observed due to the blockage of micropore on adsorbents. Methylene blue adsorption decreased with rise in carbonization temperature from 250 °C to 550 °C ( $AC_{250}$  to  $AC_{550}$ ) of an adsorbent due to sintering effect which destroyed the pore wall. Extent of adsorption was found to depend on methylene blue concentration and it was observed that increased in methylene blue concentration, the adsorption capacity increased. The highest adsorption capacity was found 198.15 mg/g at methylene blue concentration 200 mg/l.

Microwave induced KOH chemical activation for bean peel and acron peel was investigated by Ibtissem Kahoul et al. [79] and applied for removal of methylene blue dye from aqueous solution. Been peel and acron peel were cutted, washed, dried and crushed to fine powder. They were carbonized at temperature 623 °C and 923 °C respectively in oven for 1 h. The produced biochar were impregnated with KOH solution in the ratio 1:1. The microwave activation to biosorbent were carried out in microwave oven with microwave power 800 W, irradiation time 7 min with stirring speed 600 rpm. The produced material was further washed with 0.1 M HCl and then with water to achieve neutral pH and finally dried in oven at 60 °C for 12 h. The author investigated thermogravimetry and it was observed that, been peel loses its mass in four stages while mass of acron peel drops in three stages. The weight loss was observed due to release of adsorbent water and decomposition of cellulose, hemicelluloses and lignin. Calculated qe value was found in good agreement with experimental qe value and higher coefficient value proved that adsorption process followed pseudo second order kinetics. Bean peel and acron peel showed maximum adsorption capacity 45.45 mg/g and 17.54 mg/g respectively at pH 9.

M. F. Abdullah et al. [80] investigated dragon fruit peel as a biosorbent for decolorisation of methylene blue aqueous solution. The dragon fruit peel extracted pectin was polymerized with acrylic acid to produced hydrogel by using gamma and microwave radiation. In the first step the dried powder of dragon fruit peel was treated with acid at pH 1.5 and 3.5 and stirred the solution for 120 min at 70 °C. An isopropanol solution (85%) was mixed into the pectin solution in the proportion of 1:2 and coagulated at room temperature for 24 h. The formed precipitate was filtered, centrifuged, rewashed with isopropanol and dried it for 24 h at 37  $^\circ\text{C}.$  In the second step, 1% pectin solution was mixed with acrylic acid at different ratio (1:4), (2:3), (3:2), and (4:1) by adding 5% N-N' bisacrylamide for crosslinking. The resultant material was stirred for 2 h at room temperature. The solution were taken in Petri dish with parafilm covering and exposed to gamma radiation. Similar process was performed and additionally 5% sodium persulphate was added as initiator and resultant mixture was radiated to microwave radiation at different doses. The prepared hydrogel material was used as biosorbent for methylene blue removal from aqueous solution. Gamma ray radiated hydrogel adsorbent showed 45% of methylene blue removal while microwave radiated hydrogel adsorbent showed 35% removal of methylene blue from 20 mg/l initial dye concentration at pH 8. According to adsorption kinetics, the correlation coefficient value by pseudo first order model for gamma and microwave radiated hydrogel adsorbents were found 0.9979 and 0.9933 respectively which was very closer to 1 while by pseudo second order kinetic model the value were 0.9811 and 0.8667 respectively. The author claimed that adsorption kinetics followed pseudo first order kinetic model.

Priyantha et al. [81] also utilized dragon fruit skin for removal of methylene blue and studied effect of different parameters such as pH, contact time and initial dye concentration. The dragon fruit skin was oven dried at 88 °C, blended and sieved to obtained smaller particles. The equilibrium was reached within 1 h and initial adsorption was occurred very rapidly. The adsorption process was described by using three kinetic models such as Lagergren first order, pseudo-second order and Weber–Morris intraparticle diffusion order model. It was observed that adsorption kinetics followed pseudo second order model which indicated the chemisorption nature in which exchange of electrons occurred between methylene blue molecule and biosorbent functional groups. Langmuir model well fitted with high correlation coefficient value 0.972. Maximum adsorption 640 mg/g was observed by dragon fruit peel adsorbent.

Adsorption of methylene blue onto biosorbent prepared from apple peel was investigated by I. Enniva and A. Jourani [82]. Dried apple peel were grounded, sieved and preserved for adsorption studies. The resultant material was characterized by adsorption spectra. The author noted that functional groups OH, C=O, C-O and C-O-C were disappeared after adsorption of methylene blue. Adsorption is found to be optimum between the pH range 3-6. Adsorption process was found to be slightly temperature dependent. By increased in temperature from 10 to 40 °C, the adsorption capacity was decreased from 9.08 to 8.56 mg/g. It was showed that adsorption process was exothermic in nature. The author also studied thermodynamic parameters such as Gibbs free energy ( $\Delta G^0$ ), change in enthalpy ( $\Delta H^0$ ) and change in entropy ( $\Delta S^0$ ). All the three factors were showed negative value which indicated that adsorption process was spontaneous, feasible and exothermic in nature. Furthermore, the data obtained from Langmuir, Freundlich and Tempkin isotherm model, the adsorption capacity was found to be 107.52 mg/g showed that Langmuir adsorption isotherm best fitted than other isotherm models.

Durian peel, an fruit peel waste available abundantly was studied as low cost adsorbent for removal of methylene blue dye by Nguyen Thi Thoung et al. [83]. Only 40% part of fruit is edible while remaining part is discarded as a waste. The collected durian peels were extensively washed with distilled water to remove any dirt and adhering particles, then cutted, dried at 80 °C for 48 h and grounded. The powdered material treated with 0.01 M NaOH, isopropanol and repeatedly washed with distilled water to maintained pH 6-7, then oven dried at 80 °C for 12 h and used for fixed bed column adsorption study. Fixed bed column adsorption method was studied with three factors such as bed height, flow rate and initial concentration of methylene blue dye. For column study, a plastic column was used with diameter 2 cm and height 15 cm. Specific amount of durian peel powder (3.5g) was packed into the column with average packed density 322 g/cm<sup>2</sup>. Methylene blue with varied concentration was allowed to flow down through the column bed during adsorption study. Flow rate changed from 5 to 20 ml/min with different bed height 2, 4 and 6 cm. The amount of adsorption was found to depend upon initial methylene blue concentration. It was observed that with increased in methylene blue concentration from 200 ppm to 600 ppm, increased in adsorption amount from 196.60 mg/g to 235.80 mg/g. Adsorption occurred faster by increased in flow rate. The adsorption capacity was found 110.96, 196.60 and 201.95 mg/g with increased in flow rate 5, 10 and 20 ml/min respectively. The author found that, increased in bed height by 2, 4 and 6 cm, the adsorption capacity increased to 166.15, 196.60 and 242.09 mg/g respectively. Dye molecule diffuse completely on adsorbent surface due to longer breakthrough time. The author also studied adsorption through batch experiment and it was found that initial methylene blue concentration 50, 100, 200 and 400 ppm showed adsorption capacity 23.84, 43.17, 74.12 and 102.59 mg/g respectively. Fixed bed column adsorption is found to be superior on batch experiments.

Erny Haslina Abd Latib et al. [84] studied  $H_2O_2$  treated and carbonized durian peel for sequestration of methylene blue dye. The activation of durian shell was carried out by physical and chemical activation process. Dried powder of durian peel was immersed in 100 ml  $H_2O_2$  solution. Then it was filtered, washed to maintained pH 6–7. Afterwards, dried overnight at 80 °C and then carbonized in tube furnace. The sample was characterized using Field Emission Scanning Electron Microscopy (FESEM) and elemental analyzer. The percentage of carbon in activated biomass was found 62.58%. Effect of adsorbent mass on adsorption capacity was compared with treated and untreated durian shell. The removal efficiency for untreated shell increased from 62%, 85% and 86% for adsorbent dose 0.2g, 0.4 g, and 0.6 g respectively while for the same biomass, treated shell showed removal efficiency 35%, 96% and 95% respectively. The author reported the maximum removal efficiency for methylene blue was 99% by using 0.6 M  $\rm H_2O_2$  treated durian peel.

A comparative study on banana peel and orange peel prepared biochar was carried out by Amin M. T. et al. [85]. The collected material was washed, dried, grinded and then pyrolised in a box furnace for 3 h at 800 °C. The biochar material was characterized by using SEM, EDX, and FTIR spectra. The biochar produced having particle size less than 75  $\mu$ m was used for adsorption study. The surface area of orange peel and banana peel decreased from 90% to 83% and from 80% to 73% respectively by increased in the initial methylene blue concentration 50-150 mg/l. This was observed due to larger surface area, active functional groups and more adsorption sites in orange peel adsorbent as compared to banana peel adsorbent. The author studied initial rate of adsorption by second order kinetic model and it was observed that, with increased in initial concentration from 50 to 150 mg/l adsorption increased from 12 to 31 mg/g and 10–42 mg/g respectively for banana peel and orange peel. Effect of pH and effect of adsorbent dose were investigated through batch experiments. Result showed that removal efficiency increased to 30% for banana peel adsorbent and 15% for orange peel adsorbent by changing the pH value 2 to 8 and 2 to 6 respectively. The change in adsorbent dose of an orange peel from 0.1 to 0.4 g and banana peel from 0.1 to 0.5 g, the adsorption capacity increased from 350 to 500 mg/g and 250-390 mg/g respectively. For adsorption isotherm study, six isotherm models were studied such as Langmuir, Freundlich, Tempkin, Dubinin-Radushkevich (D-R), Harkin-Jura (H-J) and Hasley model. A high correlation coefficient value and closer agreement to the experimental values indicated that Langmuir isotherm model is well fitted. The adsorption capacity of sorbent banana peel and orange peel increased from 390 to 430 mg/g and 476-526 mg/g respectively with increased in temperature from 30 °C to 60 °C. Total 7% increase in removal indicated that adsorption was endothermic in nature. Negative value of Gibbs free energy suggested the non-spontaneous nature of adsorption of dye on adsorbent.

#### 6. Influence of pH<sub>pzc</sub>

Orange peel biochar by acid activation shows MB adsorption 208.3 mg/g was investigated by Jawad Ali H. et al. [86]. The point of zero charge analysis was carried out by authors and found that  $pH_{pzc}$  for orange peel biochar was 4.80. The point of zero charge for physically and chemically modified coffee husk were evaluated at pH 4.35 and pH 6.95 respectively by T. P. Krishna Murthy and B-S.Gowrishankar [87]. The maximum methylene blue dye adsorption efficiency achieved at pH greater than  $pH_{pzc}$ . At alkaline pH, the surface of adsorbent becomes negatively charged and creates attractive force to the cations of methylene blue dye. The chemically treated coffee husk adsorbent shows higher dye uptake capacity (199.73 mg/g) than physically treated material (129.43 mg/g) at pH 7.9 and 7.6 respectively.

Watermelon rinds prepared from biosorbent shows  $pH_{pzc}$  at 4.3 [88]. Below the  $pH_{pzc}$  anion adsorption was more favourable while above the  $pH_{pzc}$  cation adsorption was more suitable. The ZnCl<sub>2</sub> treated edible fungus residue studied for influence of point of zero charge by Hongyan Li et al. [89]. The evaluated  $pH_{pzc}$  value for prepared adsorbent material was found at pH 6.93. The  $pH_{pzc}$  value was determined through solid addition method using pH meter for pomegranate peel by Ali H. Jawad et al. [90]. The maximum dye adsorption was found 200 mg/g and pH at point of zero charge was 5.4 which indicate acidic surface of biosorbent. The adsorption of methylene blue dye was increased up to pH 5 and after that no further increase in dye adsorption. At very acidic pH, the amount of adsorption was lower due to higher concentration of H<sup>+</sup>. Syringa vulgaris leaves investigated by Giannin Mosoarca et al. [91] got dye adsorption capacity 188.2 mg/g at pH > pHpzc (5.77).

Ramlah Abd Rashid et al. [92] was explored coconut leaves for MB dye remediation. The adsorption capacity was 151.5 mg/g with

adsorbent dose 0.02–0.25 g and pH 3–11. The point of zero charge was estimated for adsorbent surface and found at pH 4.2. The carbonized coconut leaves on KOH activation was investigated by Ramlah Abd Rashid et al. [93]. The authors studied the effect of pH in the range 3–11 for the amount of dye adsorption. The point of zero charge for prepared adsorbent was obtained at pH 4.2.

#### 7. Comparative study with other adsorbents

The zeolite activated carbon composite on sodium hydroxide treated palm oil was explored for MB dye adsorption by W. A. Khanday et al. [94]. The composite was prepared in two steps, the NaOH fusion with palm oil was carried out in first step by heating at temperature 800 °C for 90 min. The hydrothermal treatment then processed by mixing material with kaoline in the ratio 1:0.2 and heated at 100 °C for 8 h in autoclave. The prepared composite material was characterized by XRD, scanning electron microscopy, BET surface area analysis and FTIR. The larger BET surface area 615.406 m<sup>2</sup>/g with pore diameter 3.048 nm was evaluated for composite biosorbent. The adsorption of dye was found temperature dependent and increased the amount of adsorption 143.47 mg/g, 199.6 mg/g and 185.71 mg/g with temperature 30 °C, 40 °C and 50 °C respectively.

Md Azharal Islam et al. [95] utilized sodium hydroxide activated rattan hydrochar for MB dye sequestration. The collected mass was hydrothermally carbonized to prepare activated carbon. The morphological and textural properties of biosorbent surface was examined. Due to carbonization and activation of prepared carbon material, the surface area increased to  $1135 \text{ m}^2/\text{g}$  with pore size distribution  $35.5 \text{ A}^0$ . Authors studied the different adsorption variables such as dye concentration 25 mg/l, temperature 30 °C, contact time 8 h and pH 7 which shows 96% of MB removal efficiency. The Langmuir isotherm show the best fitted isotherm with maximum adsorption capacity 359 mg/g.

Karanj fruit hulls activated carbon on KOH activation produced large surface area and found efficient biosorbent for methylene blue removal reported by Md. Azharul Islam et al. [96]. The author carried out detailed study of adsorption isotherm, kinetic modelling, thermodynamic property and adsorption mechanism. The adsorption process such as monolayer, multilayer, dye-adsorbent interaction were evaluated by studying the langmuir, freundlich and tempkin isotherm model respectively. The MB dye uptake capacity through Langmuir isotherm model were 154.8 mg/g, 203.4 mg/g and 239.4 mg/g at temperature 30 °C, 40 °C and 50 °C respectively. The experimental thermodynamic parameter value denotes that dye adsorption was favourable at higher temperature. The authors carried out the comparative study with apricot stones, coffee grounds, peach stone which has lesser dye uptake capacity than karanj fruit hull activated carbon.

F. Marrakchi et al. [97] worked on MB removal by chitosan flakes with NaOH treatment. The activated carbon material was prepared from chitosan and NaOH with different impregnation ratio such as 1:1, 2:1, 3:1 and 4:1. The impreganated samples were treated under N<sub>2</sub> flow at 800 °C. The available functional groups, pore size, pore diameter, surface morphology were studied by using FTIR, BET surface area and SEM analysis. The FTIR spectra clearly depicts the presence of –OH, C–H, N–H, C–O, C–N functional groups on the surface of sorbent material. Due to sodium hydroxide impregnation with applied temperature 800 °C, there was change in surface chemistry and shifting of peaks at different frequencies. The influence of MB initial concentration was evaluated with concentration 25–400 mg/l with contact time 60–120 min. The authors demonstrated the adsorption mechanism by using Weber-Morris and Boyd model. The maximum dye uptake 143.53 mg/g with solution pH 11 evaluated by Langmuir adsorption isotherm.

W A Khanday et al. [98] utilized phosphoric acid treated chitin for removal of cephalexin antibiotic having adsorption capacity 245.13 mg/g. Low rank coal, a waste material converted into activated carbon with greater dye removal efficiency was explored for MB dye adsorption by Ali H Jawad et al. [99]. Due to KOH activation, the sorbent material increased the surface area from 1.23  $m^2/g$  to 1094.3  $m^2/g$ . The enhancement in surface area was responsible for higher percentage of MB dye uptake. The author studied the influence of adsorbent dose, dye concentration, contact time and solution pH to investigate the adsorption properties. The maximum removal of MB dye low rank coal adsorbent was found 491.7 mg/g. The regression coefficient value  $(R^2)$ for langmuir, freundlich and tempkin model were found 0.99, 0.93 and 0.97 respectively indicates adsorption system follows langmuir model. The author has carried out comparative study with several adsorbent and concluded that selantik coal shows more dye adsorption capacity than other adsorbents. S N Surip et al. [100] used sulphuric acid activated Merit Kapit Coal for decolorisation of MB dye. The coal material was impregnated with H<sub>2</sub>SO<sub>4</sub> and dried in oven at 110 °C for 24 h. The elemental analysis shows 48.78% C, 22.35% N, 3.26% H and 25.61% O. The acid treated coal has low surface area (0.59  $m^2/g$ ) with pore diameter 16.4 nm. Box-Behnken design was used to optimized decolorisation and COD reduction of methylene blue dye. The optimum obtained results were 78.5% decolorisation and 63.3% COD reduction. The freundlich model shows best regression coefficient ( $R^2 = 0.99$ ) than langmuir model ( $R^2 = 0.87$ ) but maximum dye uptake capacity of langmuir (421.1 mg/g) was greater than freundlich model (123.7 mg/g).

Merit Kapit coal on activation with KOH used for MB dye sequestration was investigated by Ali H Jawad [101]. However, change in surface area 332.61 m<sup>2</sup>/g of raw adsorbent to 1100.18 m<sup>2</sup>/g of KOH treated adsorbent material. In the adsorption isotherm study, langmuir model shows 200 mg/g MB dye uptake by KOH activated adsorbent.

#### 8. Conclusion

The aim this research work is to compile and present the data of various low cost adsorbents for removal of methylene blue dye. Many researcher modified the adsorbent by various physical and chemical treatments and found superior improvement in dye adsorption. Agricultural waste and fruit peel waste materials are readily available with negligible cost and show greater dye adsorption capacity. The amount of adsorption depends on various parameters viz. Dye concentration, adsorbent dose, contact time, solution pH and temperature. The maximum amount of dye adsorbed at higher quantity of adsorbent dose. The adsorbent prepared from agricultural waste shows the same amount of dye removal efficiency as like activated carbon.

Agricultural waste adsorbents found outstanding dye removal efficiency and promising result with minimum processing cost is advantageous and good alternative as adsorbent in adsorption technology for industrial waste water treatment. Many of the low cost adsorbent can be recycle and reuse. All the researcher used batch experiments for adsorption study therefore again further study and experiments need to be performed for larger scale so this can be used in industry for commercial level.

#### Declaration of competing interest

The author declare no conflict of interest.

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## 'उत्थानगुंफा'तून प्रतिबिंबित झालेले आंबेडकरी तत्वज्ञान डॉ.उषा सोरते

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कविता ही कवीचा सहजोत्स्फुर्त भावनांचा उद्गार असते. परंतु या भूमिकेबरोबरच दलित कवी एक वेगळी भूमिका,एक वेगळी प्रेरणा घेवून कविता लेखन करतांना दिसतात.ती भूमिका मानवमुक्तीची आहे.जोपर्यंत कवितेमध्ये मानवमुक्तीची भूमिका आणि मनुष्यत्वाला जोपासणारा विचार येत नाही, तोपर्यंत कवितेत जिवंतपणा आल्यासारखा वाटत नाही. कारण दलित साहित्याची पर्यायाने दलित कविताची प्रेरणा आंबेडकरवाद आहे. दलित साहित्य हे माणसांवर होणाऱ्या अन्याय-अत्याचाराच्या प्रतिक्रियेतून जन्माला आलेले साहित्य आहे. त्यामुळे दलित साहित्य हे व्यक्तीचे न राहता समष्टीचे झालेले दिसून येते. त्यातील अनुभव एका व्यक्तीचा नसतो,तर तो समूहाचा,समाजाचा प्रातिनिधिक अनुभव असतो. म्हणून दलित साहित्य व्यक्तिगत नसते. यशवंत मनोहर यांची कविता ही अशाच स्वरुपाची आहे.

नामदेव ढसाळनंतरच्या दलित कवितेला तिच्या कलात्मक संवेच व सक्षम पातळीवर आणून तिला आपले स्वत्वरूप आणि एक विद्रोही व्यक्तिमत्व ज्या थोड्यांनी प्राप्त करून दिले, त्या कवींमध्ये डॉ. यशवंत मनोहरांना अग्रक्रम द्यावा लागतो.

यशवंत मनोहरांनी आपल्या भूमिकेशी ठाम राहून आपला लेखन प्रवास सुरु ठेवला आहे.'माझे दुःख मीच वाहून नेईन' या सत्यावर श्रद्धा ठेवून त्यांनी आपली वाटचाल चालू ठेवलीआहे. या वाटचालीत त्यांनी बुद्ध,फुले,आंबेडकर या क्रांतिकारक प्रतिभावंतांनी दाखवलेल्या वाटेनेच वाटचाल केलेली दिसून येते. त्याचे प्रत्यंतर त्यांच्या सर्वच काव्यसंग्रहातून येते. यशवंत मनोहरांची कविता म्हणजे आंबेडकरवादी साहित्याचा सर्वोच्च मानबिंदू ठराव्यात अशा स्वरूपाच्या आहेत.

यशवंत मनोहर यांचा 'उत्थानगुंफा' (१९७७) हा पहिला काव्यसंग्रह होय. त्यानंतर डॉ. बाबासाहेब आंबेडकर:एक चिंतन काव्य, मूर्तिभंजन, जीवनायण, प्रतीक्षायन, अग्नीचा आदिबंध, स्वप्नसंहिता असा त्यांचा काव्यप्रवास आहे. यशवंत मनोहरांच्या 'उत्थानगुंफा' या काव्यसंग्रहाच्या संदर्भात रा.ग.जाधव म्हणतात, त्यांच्या या 'उत्थानगुंफे'ने मराठीमध्ये पहिला प्रथम सर्वकष विद्रोहाचा रौद्रसुंदर युरोपिया साकार केला.

यशवंत मनोहरांनी 'उत्थानगुंफा' या काव्यसंग्रहात क्रांतीला जन्म देणाऱ्या सर्व महान व्यक्तीला, शक्तींना आपल्या कवितेची प्रेरणा म्हणून स्वीकारले आहे. त्यात भगवान बुद्ध, चार्वाक, महात्मा ज्योतीबा फुले, कार्ल मार्क्स यांनाही ते आपल्या कवितेची प्रेरणा मानतात.

डॉ.बाबासाहेब आंबेडकरांच्या तत्वज्ञानाच्या भरभक्कम आधारावर यशवंत मनोहरांच्या'उत्थानगुंफा'मधील कवितेची उभारणी झालेली आहे. या आंबेडकरीवादाने त्यांच्या कवितेला एक भक्कम तात्विक पाया प्राप्त करून दिलेला आहे. अर्थात त्यांची कविता आंबेडकरांच्या तात्विक विचारांचे वहन करणारी कविता आहे. म्हणून ती विचार कविता आहे. त्यातल्या त्यात ती तात्विक विचार कविता आहे.



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डॉ.आंबेडकर म्हणजे विद्रोह, दलित जीवनाचे भाष्यकार होय. त्यांच्या रुपाने गावकुसाबाहेरील अंधाराला सारणारे स्वयंभू तेजोवलय उदयाला आले होते. त्यांच्या रूपाने दलित जीवनात जणू काही क्रांतीसुर्यच प्रगटला होता. म्हणून यशवंत मनोहर म्हणतात-

आणि माझ्याही कवितेच्या मनगटातून आता

सूर्य उगवू लागला आहे

सर्वहारा क्षितिजांच्या पिंड प्रदेशात

## प्रखरता पेरू लागला आहे.

परंपरेने जखडलेल्या, गोंधळलेल्या, चक्रव्युहात सापडलेल्या दलित माणसाला त्या संभ्रमातून बाहेर काढण्याचा, लढण्याचा मार्ग डॉ. आंबेडकरांनी दिला. आंबेडकरांनी माणसातले 'माणूसपण' हे सर्वश्रेष्ठ मूल्य मानले आणि माणसातली अस्मिता जागवली. म्हणून कवी म्हणतात.-

> तेव्हापासून प्रेते चर्चा करतात त्या मुलुखात पाल्हाळिक येथील सनातन अंधारावर थुंकून गेलेल्या एका प्रचंड विद्रोही सूर्याची नित्य

डॉ. आंबेडकरांचे लेखन हे दलित साहित्याचे विचारधन आहे. दलित साहित्याची प्रेरणा आहे. दलित कविता डॉ.आंबेडकरांच्या तत्वज्ञानाच्या काव्यात्म आविष्कारातून जन्माला आलेली आहे. डॉ. आंबेडकर म्हणाले होते, तत्परतेने सावध होवून जीवन व संस्कृती विषयक मूल्ये साहित्यकारांची जोपासली पाहिजेत. ती सतेज बनवली पाहिजेत. साहित्यिकांनी दलित, उपेक्षितांच्या व्यथा-वेदना समजावून घेवून त्यांना आपल्या साहित्याद्वारा सर्वांपर्यंत पोहोचवले पाहिजे. इतकेच नाही तर त्या दलित उपेक्षितांचे जीवन त्यांनी आपल्या साहित्याद्वारा उन्नत केले पाहिजे. अशाप्रकारची बाबासाहेबांची साहित्यिकांना शिकवण होती.

कवी यशवंत मनोहरांची कविता याच ध्यासातून जन्माला आलेली आहे. ते म्हणतात-

त्यांच्यासाठी ही कविता ज्यांना इथे ठाव नाही गाव नाही नाव नाही

ज्यांची दुनिया अजून जन्मली नाही इथे

आणि भविष्यालाही माहित नाही ज्यांचे युग

हे माझे शब्द प्रकाशाची स्तोत्रे गाणारे झाडे होवोत

या कवितेतून यशवंत मनोहरांची काव्यविषयक भूमिका सहजपणे कळते. त्यांच्या कवितांमध्ये आंबेडकरी तत्वज्ञान प्रतिबिंबित झालेले दिसून येते. आंबेडकरांच्या प्रेरणेतूनच त्यांच्या मनात विचारक्रांती झालेली आहे. आपल्या या क्रांतिसन्मुख साहित्याची प्रेरणा डॉ. आंबेडकरांच्या विचारात आणि शिकवणुकीत आहे असे ते मानतात.

यशवंत मनोहरांची कविता जीवनातील विविध पैलूंवर प्रकाश टाकत असली तरी दलित जीवनातील दुःख हाच तिचा मूळ गाभा आहे, केंद्र आहे. दलित जीवनातील व्यथा, वेदना करणे हाच त्यांच्या कवितेचा विषय आहे. पण त्यांची कविता नैराश्यवादी किंवा दुबळी झालेली दिसत नाही. ती आशावादी आहे. दलितांच्या वेदनांनी पेटून उठणारी आहे. दलित जीवनातील व्यथा, वेदना, अन्याय, अत्याचार पाहून ती प्रस्थापित समाजव्यवस्था नाकारते. त्याविरुध्द विद्रोह करते. क्रांतीतूनच समाजपरिवर्तन घडणार आहे, हा विश्वास तिच्यामध्ये आहे. म्हणूनच ती क्रांतिप्रवण बनते. ती दलित समाजाचे प्रतिनिधित्व करते. तिला सामाजिक जाणिवेचे सतत भान असल्याचे दिसते.

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यशवंत मनोहरांनी आपल्या कवितांमधून जीवनाच्या दाहक अनुभवांचे चित्रण प्रभावीपणे व वेगवेगळ्या प्रतिमांच्या माध्यमातून केलेले आहे. त्यांच्या कवितेतील जीवनानुभव कवीचे एकट्याचे नाहीत तर ते दलित समुहाचे अनुभव आहेत. परंपरेने ज्यांना अधिकार नाकारले, ज्यांच्यावर सतत अन्याय अत्याचार केले, ज्यांचे भूत-भविष्य-वर्तमान या प्रस्थापित समाजव्यवस्थेने उद्ध्वस्त केले,ज्यांची गती हरवली होती, अशांचे समाजवास्तव मनोहरांनी आपल्या कवितेतून चित्रित केले आहे. या प्रस्थापित समाजात दलितांचे जगणे पशुतुल्य होते, ज्यांच्या सावलीचा ही विटाळ मानला गेला. त्याने धर्मशास्त्रातील तत्वज्ञान ऐकू नये याची काळजी घेतली गेली, होणाऱ्या अन्यायाविरुद्ध आवाज उठवला तर त्याची जीभ छाटली जात होती. अशाप्रकारचे जीवन या समाजाने दलितांना जगण्यास भाग पाडले होते. म्हणूनच कवी म्हणतात-

> इथेच जन्मले माझे हतभागी पूर्वज अस्तित्वाची निर्वात अंतराळे घेऊन आणि शेणाच्या पाट्याप्रमाणे जन्म वाहत गेले इथूनच इथेच कैद झाली त्यांची शोषित वाणी

यशवंत मनोहरांच्या कवितेतून ज्यांचे अस्तित्व निर्वात झाले, ज्यांना शोषणा विरुद्ध आवाज उठवता आला नाही, अशा दलितांचे दुःखमय जीवन पाहून कवीचा जीव या भूमीने दिलेल्या शापामुळे जळतो आहे. वेदांच्या आधी आणि त्यानंतरच्या शतकांमध्ये निर्माण केलेल्या या विषमताधिष्टीत जातीव्यवस्थेने दलितांवर एक प्रकारचे पांगळेपण लादले. ईश्वर, आभाळ, भूमी, दिशा ही सारी या प्रस्थापितांचीच मक्तेदारी बनली. म्हणूनच त्यांनी दलितांना अज्ञान, दुःखरुपी काळोखात जीवन जगण्यास भाग पडले. त्यांची स्वप्ने साकार होवू दिली नाही. त्यांच्यापर्यंत ज्ञानरूपी प्रकाश पोहचू दिला नाही. प्रस्थापितांनी दलितांवर केलेल्या अन्यायाविरुद्ध दलित वर्ग पेटून उठला तर त्यांचा विद्रोह दडपून टाकण्यासाठी प्रस्थापितांनी दलितांवर अत्याचार केले. त्यांचे जगणे मुष्किल केले. हे दाहक समाजवास्तव यशवंत मनोहरांच्या कवितांमधून आलेले आहे. ते म्हणतात-

तुझ्या गळ्यातील गाडग्याने आणि कमरेच्या फांदीने मी शरमिंदा आहे मारुती

अजून तुझ्या प्राक्तनांचा विटाळ संपला नाही दुःखपुत्र

तुझे प्रत्येकच क्षितीज अध्यात्माचे विष देवून मारले होते

आणि ओवीशिवाय पिठाशिवाय फिरवीत आलास फुटके जाते

यशवंत मनोहरांच्या कवितेतून दलितांच्या जीवनात दैववादाच्या नावाखाली जे बहिष्कृत जिणे जगणे भाग पाडले, त्यांची स्वप्ने, त्यांच्या आशा मारून टाकल्या. या भूमीत जन्म घेतल्याने आपली फसवणूक झाली असे कवी येते सांगतो. या मतलबी दुनियेत आपली होणारी फसवणूक कवी कोणाला तरी सांगू पाहतो. पण त्यांची भाषाच कवीला येत नाही हे असंवादित्व कवीला अस्वस्थ करते. म्हणून कवी पुन्हा एकदा बहिष्कृत जीवन वाट्याला आलेल्या या समाज जीवनात पुन्हा एकदा ज्ञानरूप दिवा लावण्याची विनंती डॉ. बाबासाहेब आंबेडकर या युगप्रवर्तकास करतात. दलित समाज पुन्हा अंधःकारच्या गर्तेत लोटला जात आहे, हे पाहून कवी या युगप्रवर्तकास आवाहन करतो. दलितांचे अनाथपण दूर करण्यासाठी कवी स्वतःला डॉ. आंबेडकरांकडे शक्ती मागतो. त्याचवेळी तो निश्चय करतो की, सभोवतालच्या बेवारस दुःखाला मी माझा शब्द देऊन जाईन. म्हणूनच कवी म्हणतो-

शब्दांची पूजा करीत नाही मी माणसांसाठी आरती गातो

ज्यांच्या गावात सूर्य नाही त्यांच्या हातात उजेड देतो

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यशवंत मनोहरांची कविता ही मूल्य संघर्षाची कविता आहे. त्यांनी समाजातील समदुःखी माणसांशी बांधिलकी साधलेली आहे. त्याचप्रमाणे त्यांची कविता समाज जीवनात नवपरिवर्तन घडवू पाहते. पण ते कोणत्याही प्रकारची मानसिक गुलामगिरी स्वीकारण्यास ते तयार नाही. मानवतेच्या नावाने आवाहन करणार्या या कवीच्या हाती आग, माथी आग, मनात लाव्हा व लेखणीत विद्रोह आहे. म्हणूनच ते दलितांना क्रांतीसाठी आवाहन करतात.

यशवंत मनोहरांच्या कवितेतून दलित जीवनाचे सर्वांगिण चित्रण येते. अपमानित, उपेक्षित, जीवन जगलेल्या या दलितांना आयुष्यभर दुःख, दैन्य, दारिद्र्य भोगावे लागले. त्यामुळे डॉ.भालचंद्र फडके आपल्या 'दलित साहित्यःवेदना आणि विद्रोह' या ग्रंथात म्हणतात,दलित साहित्य हे 'मानवत्वाची प्रतिष्ठा'या महान मूल्यावर श्रद्धा असलेले साहित्य आहे.दलित साहित्यातून शतकानुशतके माणुसकीचे हक्क नाकारलेल्या जातीजमातीच्या वेदना आलेल्या आहेत.आजवर सोसलेल्या छळातून या दलित समाजाला एक दृष्टी आली आहे. ती म्हणजे 'मी माणूस आहे, मला माणुसकीचे हक्क मिळाले पाहिजे'.म्हणून हा समाज क्रांतिप्रवण बनला आहे. त्यामुळेच यशवंत मनोहरांच्या 'उत्थानगुंफा' या काव्यसंग्रहातील कवितांमधून येणारी वेदना-विद्रोह-नकार समजून घेतला पाहिजे.

अतिशुद्राने भूकबळी राहिले पाहिजे, बेघर,अज्ञानी, मुके, आंधळे, बहिरे राहिले पाहिजे.ही हिंदू धर्माची वर्णव्यवस्था,संस्कृती, धर्मनीती आहे. हीच वैचारिकता,मानसिकता आणि सामाजिकता आहे. हिंदू धर्म याच तत्वाने समाजात जातीभेद करतो.म्हणून कवी म्हणतो-

> अस्तित्वाचा कापूस काढणारी ही एकेक क्रूर धनुकली परमेश्वराच्या लाडक्या पोरांनो

## इथे जीव लागत नाही, इथे जीव जगत नाही

धर्माच्या नावाने आपण प्रयत्नपूर्वक फसवले जात आहोत ही जाणीव वेदना घेवून येते.तेंव्हा कवी स्वतःवर आणि आपली फसवणूक करणाऱ्यावरही चिडतो.संस्कृतीने दलित समाजाची पदोपदी अडवणूक केली आहे. अशावेळी आपल्या मनातील वेदना घेवून कवी घायाळ मानाने आक्रोशत एकटाच भटकतो आहे. या संस्कृतीने आपल्याला माणूस म्हणून जगू दिलेले नाही,ह्या संस्कृतीच्या तुरुंगात 'जगणे'हे जगणे नसून तगमगणेआहे.आपले श्वास या संस्कृतीने दिलेली भिक आहे, ही वेदना कवीला अस्वस्थ करते.

> भिक म्हणून वाढलेले श्वास घेतले उदासवाणे संस्कृतीभर तगमगलो तुरुंगवाणे आणि कितीही घासला परीस तरी लोखंडाचे नाही झाले सोने

यशवंत मनोहर आपल्या कवितेतून दलितांच्या पोरकेपणाचे दुःख,त्यांचे एकाकीपण व्यक्त करतांना दिसतात.प्रस्थापितांनी दलित समाजाला कायमच तिरस्कृत, बहिष्कृत जीवन जगण्यास भाग पाडले.या चंद्रसूर्याच्या दुनियेत त्यांचा कोणी स्वीकार केला नाही.त्यांची ही वेदना समजून घ्यावी लागते. मनोहरांची कविता हे धगधगते वास्तव घेवून येते. त्यांच्या शब्दाशब्दातून ज्वालाग्राही मन डोकावत असते.या मनात एकेक आठवण, संवेदना ज्वालामुखीचे रूप घेवून उकलत बाहेर येते.ज्या समाजव्यवस्थेने त्यांना नाकारले, ते नाकारलेले जगणे त्यांनी जागून पाहिले आहे. ते विष त्यांनी पुन्हा पुन्हा पचवले आहे.देशातील संस्कृती, इतिहास उज्वल असला तरी मनूच्या पाईकांनीठभारलेल्या या



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समाजरुपी वास्तूचा इतिहास मात्र आठवण्यासारखा नाही. त्यातील प्रत्येक आठवण दलित समाजाला दंश करणारी आहे.वेदना देणारी आहे. म्हणून कवीला सारे आयुष्यच गुदमरलेले,कोंडलेले वाटते.

यशवंत मनोहरांची कविता ही परिवर्तनवादी व्यक्तिमत्वाची कविता आहे. विद्रोहाचे धगधगते रूप घेवून ही कविता येते. समाजपरिवर्तन हे तिचे ध्येय आहे. या विषमतावादीसमाजरचनेची पाने गळून पडावीत, ही व्यवस्था उद्ध्वस्त व्हावी असे कवीला वाटते. यासाठी ते क्रांतीला आवाहन करतात. क्रांतीतून हे सारे घडणार आहे,असा त्यांना विश्वास वाटतो.म्हणूनच ते 'आपल्या पुढची अटळ युद्धभूमी मान्य आहे. आणि तिथे प्रथमच प्रस्थापितांची संस्कृती, अध्यात्मआणि मंदिरे जमीनदोस्त होणार आहे'असा विश्वास व्यक्त करतात.एकंदरीत हे सारेच उलथून टाकायचे आहे.त्यासाठी विद्रोहाची आवश्यकता आहे. सर्वकष क्रांतीतूनच नवसमाज निर्माण होणार आहे,असा विश्वास ते व्यक्त करतात.

यशवंत मनोहरांची कविता ही संतापातून,चिडीतून, दुःखभोगातून जन्माला आलेली आहे.तसेच ती मानव मुक्तीच्या लढ्यातून जन्माला आलेली आहे.त्यामुळे तिच्यात बंडखोरी आहे.ही बंडखोरी त्यांच्या कवितेतून विद्रोहाचे रूप घेते.हा विद्रोह ठाम नकार घेवून आलेला आहे.ज्यांच्या गावात सूर्य नाही,त्यांच्या हातात उजेड देण्याची भूमिका घेणारी ही कविता आहे.प्रस्थापितांना ती नकार देते.त्यांच्या परंपरागत उत्तरांना आव्हान देते.म्हणूनच कवी म्हणतात ,'जातांना मुक्याने जाणार नाही,या पसार्याला शाप देवून जाईन'पुढे ते म्हणतात,'येतांनाउत्तरे घेवून आलो होतो, जातांना प्रश्न घेवून निघून जाईन'. असे ते आव्हान देतांना दिसतात.

यशवंत मनोहरांनी आपल्या कवितेला मुक्तीलढ्याचे साधन म्हणून राबविले.दुःखितांचे आसवे पुसणारी ही कविता वाचून संस्कृतीचे ठेकेदार त्यांना कवी म्हणून गौरवणार नाही.आपली उपेक्षा केली जाईल याची कवीला जाणीव आहे.पण प्रस्थापितांच्या गटाला कवी नाकारतो आहे.त्याचा अनुभव हाच त्याच्या कवितेचा विषय आहे.

यशवंत मनोहरांची कविता हीआंबेडकरी विचारांचे, तत्वज्ञानाचे वाहक बनली आहे.देव,दैववाद,कर्मविपाक,धर्म,संस्कृती नाकारण्याचे सामर्थ्य आंबेडकरी विचारांनीच दलितांना दिले.कवीने मनुप्रणित समाजव्यवस्था नाकारून तिच्या जागी नवसमाज निर्माण करायची आहे, की जिच्यात विषमता नसेल,समताधिष्टीत समाजरचनेचे स्वप्न कवी पाहतो आहे.तो वैदिक परंपरेची,हिंदू धर्माची जुनी मूल्यव्यवस्था झुगारत असतांना त्याला नवी मूल्ये रुजवायची आहे.'मानव्याच्या प्रतिष्ठा' साठी त्याला समाजक्रांती हवी आहे.

यशवंत मनोहरांची कविता ही विद्रोहाचा उच्चांक गाठणारी कविता आहे. ती विद्रोहाचा प्रखर आशय घेवून येत असतांना दलितांच्या, वंचितांच्या,शोषकांच्या मनात शोषणाविरुद्ध,अन्यायाविरुद्ध पेटून उठण्याची वृत्ती निर्माण करण्याची भूमिका घेतांना दिसते.ही कविता होरपळलेल्या,हरपलेल्या जीवनात बहरआणण्याचे स्वप्ने पाहणारी,मानुषी मूल्यांना महान मानणारी आहे.या कवितेने आंबेडकरी विचारांना,दलित जाणीवेला काव्यात्म रूप दिलेले आहे.साठोत्तरी काव्यप्रवाहाच्या रूपाने एक महान संस्कृती मूल्ये दिले आहे. समता,स्वतंत्र्यता, बंधुता या मूल्यांबरोबरचप्रज्ञा,शील,मैत्रीभाव या मूल्यांची एक महान संस्कृती या कवितेने प्रदान केलेली आहे. त्याचप्रमाणे ही तत्वनिष्ठा जीवनात गतिमान करण्यास ही कविता शिकवते.ही तत्वनिष्ठा एक महान संस्कृती बनून यशवंत मनोहरांच्या कवितेतून येतांना दिसते.त्यामुळे विसाव्या शतकातील एक श्रेष्ठ कविता म्हणून यशवंत मनोहरांच्या 'उत्थानगुंफा'मधील कवितांचे स्थान अव्वल दर्जाचे आहे, हे मान्य करावे लागते.



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दादासाहेब बिडकर कला, विज्ञान आणि वाणिज्य महाविद्यालय, पेठ, जि. नाशिक - ४२२२०८

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> परिसंवाद प्रमुख डॉ. आर. बी. टोचे प्राचार्य

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Peer Reviewed Refereed JournalISSN : 2278 - 5639Global Online Electronic International Interdisciplinary Research Journal (GOEHRJ)[Bi-Monthly]Volume - XISpecial Issue - IJanuary - February 2022

नाशिक शहराच्या विशेप संदर्भात स्थानिक इतिहास लेखनाची आवश्यकता

डॉ. एम. आर. थोरात कला, विज्ञान, व वाणिज्य महाविद्यालय, ओझर (मिग) जि. नाशिक

नाशिकला प्राचीन ते आधुनिक काळातील मोठा इतिहास लाभलेला आहे. त्यामुळे स्थानिक इतिहासाचा वेगवेगळ्या परीप्रेक्षातून अभ्यास करणे शक्य आहे. आज नाशिकवाबत अनेक अंगांनी अभ्यास केला जात असला तरी काही घटक दुर्लक्षित राहिले तर काही घटकांबांबत संखोल अभ्यास होणे आवश्यक आहे. प्रामुख्याने भारतीय स्वातंत्र्य चळवळीत नाशिककरांचे मोठे योगदान असून स्वातंत्र्य प्राप्तीनंतर शहराची वाढ व विकास झपाट्याने घडून आला आहे. त्या अनुषंगाने नाशिकच्या इतिहासलेखनाच्या आवश्यकतेचा आढावा सदर शोधनिबंधातून घेण्यात आला आहे. उद्देश :-

- भारतीय स्वातंत्र्य चळवळीत नाशिकचे योगदान या विषयाचे स्थानिक इतिहास लेखनातील महत्त्व अधोरेखित करणे.
- नाशिक शहराच्या स्थानिक इतिहास लेखनाची आवश्यकता प्रकट करणे. संशोधनपद्धती :- ऐतिहासिक संशोधनपद्धती.

इतिहास लेखनामध्ये व्यक्ति, समाज, स्थल् व काल या चार-घंटकांना अतिशय महत्वाचे स्थान आहे.'या घटकांच्या आधारे मानवी जीवनाच्या विकासाच्या टप्प्यांचा अभ्यास केला जातो. (इति + ह + आस) इतिहास या संस्कृत शब्दाचा अर्थ 'असे घडले, अशा प्रकारे घडले' सर्वसाधारणपणे इतिहास म्हणजे भूतकाळातील माहितीचा शोध पेवून जे घडले त्याचे जसेच्या तसे वर्णन तर्कशुद्ध व अर्थपूर्णरित्या करणे होय.'ग.ह. खरे यांच्या मते गतकालीन स्थित्यंतराचे यथास्थितज्ञान म्हणजे इतिहास होय. सदाशिव आठवले यांच्या मते इतिहास म्हणजे बदल, इतिहास म्हणजे स्थित्यंतर होय.'या व्याख्यावरून गतकालीन मानवी जीवनातील स्थित्यंतरांचे इतिहासातील महत्त्व समजते.

स्थानिक इतिहास ही एक इतिहाची महत्त्वाची शाखा होय. स्थानिक परिसराचा अथवा एखाद्या गावाचा सूक्ष्म पातळीवरील अभ्यास या अंतर्गत केला जातो. स्थानिक इतिहासाच्या अभ्यासामुळे राष्ट्राच्या इतिहासातही मोलाची भर पडते. याचा अर्थ राष्ट्रीय स्तरावरील इतिहास लेखनास स्थानिक इतिहास लेखन पूरक ठरते.स्थानिक इतिहास लेखनासाठी प्रत्येक गाव ऐतिहासिकदृष्ट्या महत्त्वाचे आहे.प्रथम गावचे इतिहासलेखन, तालुक्याच्या स्थलाचे इतिहासलेखन अशी मांडणी केल्यास प्रादेशिक व राष्ट्रीय इतिहासामध्ये भर घालता येईल.' सर्वसाधारणपणे स्थानिक इतिहास म्हणजे स्थानिक इतिहासकाराने, स्थानिकांसाठी, स्थानिक इतिहासाचा, स्थानिक उपलब्ध संदर्भ साधनांच्या

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भदतीने घेतलेला शोध आणि बोध होय. तर अरुण टिकेकर यांनी स्थानिक इतिहास याऐवजी स्थानीय इतिहास हो राब्द अधिक समर्पक मानला. त्यांच्या मते स्थानीय इतिहास हा एक प्रकारे सामाजिक इतिहास असतो. राहराजा क प्रभागाचा इतिहास सामाजिक बदलांचा इतिहास असतो. त्यामुळे तो आंतरविद्याशाखीय असतो. एखाद्या राहराजा प्रभागाचा इतिहास सामाजिक बदलांचा इतिहास असतो. त्यामुळे तो आंतरविद्याशाखीय असतो. एखाद्या राहराजा चाटचालीत अनेक प्रकारचे बदल होत असतात. कपड्यांच्या बदलत्या पद्यिन्स, पादत्राणे, घरे, वाहने, खाद्य सक्त केशभूषा, विविध क्षेत्रातील अभिरुचीत झालेले बदल इ. घटकांचा स्थानीय इतिहास लेखनात समावेश होतो. प्रानुष्ठाने केशभूषा, विविध क्षेत्रातील अभिरुचीत झालेले बदल इ. घटकांचा स्थानीय इतिहास लेखनात समावेश होतो. प्रानुष्ठाने केशभूषा, विविध क्षेत्रातील अभिरुचीत झालेले बदल इ. घटकांचा स्थानीय इतिहास लेखनात समावेश होतो. प्रानुष्ठाने वा ल्याख्याच्या आधारे नाशिक शहराच्या विस्तारात मोठी वाढ झाली आहे. त्यातून सामाजिक, सांस्कृतिक, रौक्षणिक, नागरीकरणाच्या प्रक्रियेत नाशिक शहराच्या विस्तारात मोठी वाढ झाली आहे. त्यातून सामाजिक, सांस्कृतिक, रौक्षणिक, आधिक इ. स्वरूपाचे अनेक वदल येथे घडून आले. तसेच नाशिककरोंचा भारतीय स्वातंत्र्य चळवळीतही मोठा सहभाग राहिला आहे. हे सर्व घटक नाशिकच्या स्थानिक इतिहासलेखनाचे महत्त्व अधोरेखित करतात. त्याचा आदाज पहिला आहे. हे सर्व घटक नाशिकच्या स्थानिक इतिहासलेखनाचे महत्त्व

## ऐतिहासिक घटक :

एखाद्या गावाचे ऐतिहासिक महत्त्व, गावाच्या इतिहासाची प्राचीनता व परंपरा, गावाच्या नावाची व्युत्पत्ती, गावाज्ञं संबंधित पुराणकथा, दंतकथा, लोक समजुती इ. चा अभ्यास यामध्ये करता येतो. नाशिकच्या प्राचीन इतिहासाचे महत १९५२ साली येथे सापडलेल्या अश्मयुगीन हत्यारे, उपकरणे व अवशेषांवरून समजून येते. सातवाहन काळात गोवर्धन व नाशिक परिसर भरभराटीस होता. या काळातील अनेक घडामोडींची साक्ष देणांऱ्या प्राचीन बौद्ध लेणी तसेच ११-१२ व्या नाशिक परिसर भरभराटीस होता. या काळातील अनेक घडामोडींची साक्ष देणांऱ्या प्राचीन बौद्ध लेणी तसेच ११-१२ व्या गातिकातील जैन लेणीक्षी येथे आहेत. तर पेश्वेकालीन नाशिकच्या वैभुवांची साक्ष देणारी अनेक हिंदू धर्मीय मंदि, गोदावरी नदीतील कुंडे, पाट, वाडे, इ. वास्तु आजही उभ्या.आहेत.त्याचा उपयोग स्थानिक इतिहास लेखनासाठी होव् शकतो.

भारतीय स्वातंत्र्य चळवळ व नाशिक :

नाशिकच्या दृष्टीने भारतीय स्वातंत्र्य चळवळीतील घटनांचे स्वतंत्ररीत्था सूक्ष्म पातळीवर अध्ययन करणे शस्य आहे. प्रामुख्याने ब्रिटिशकालीन प्रशासकीय, सार्वजनिक, शेक्षणिक, धार्मिक, निवासी चास्तुयेथे आहेत. 'तसेच स्वातंत्र चळवळीच्या अनुषंगाने समकालीन वृत्तपत्रांचे योगदान, विविध सामाजिक संस्था, अभिनन भारत संघटना, नाशिक मधील क्रातिकरकांचे कार्य, लो. टिळक, स्वा. सावरकर, म. मांधीचा नाशिकच्या स्वातंत्र्य चळवळीवरील प्रभव, असहकार, सविनय कायदेभंग, चले जाव चळवळीत नाशिकने योगदान''इ, घटकांचा स्थानिक इतिहासलेखनाच्या दृष्टीने अधिक सखोल अभ्यास करणे आवश्यक उसते.

## भौगोलिक घटक :

स्थानिक इतिहासात डोंगर, दऱ्याखोऱ्या, नद्या, पर्यावरण, जमीन, पाऊस, कुषी च खनिज उत्पादन<sup>14</sup>हे भौगोलि<sup>क</sup>

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अवन्त्रे नवदनित सामवित्र प्रचन, सर्ग, सर्ग, वित्तनितन कटन, तृहुत ताला, तान्तनिक तंत्र्या, तान्तनिक इन को पोक्सभी सारमाल हु, भरम्बाच स्वन्ताव भाषांचा आगते " तानिकच्या तीवतम तीवनत तीकल्यन तात्र हा बात मत्व्याचा हाती. १९८१ हे २०४१ राज्यात त्यांनिक तोकतंत्र्या मार्वीणा के देश व राज्याच्या तृत्वदेव जीवल हात " शिहाल्य सामविक बीक्सादील सचिव स्वात्राच हा भटन सामगीन्दुर इमारा इस्ता, तर्वन त्यांत्रभ्यासंग्रान्त स्वान-प्रतिकमध्ये सुरस्ता संपुत्त सुदुह पदारी व्यक्तिमात होती, त्यांत कात्र होत त्यांत स्वत्य त्यांत्रभ्यासंग्रान्त स्वान-प्रतिकमध्ये सुरस्ता संपुत्त सुदुह पदारी व्यक्तिमात होती, त्यांत कात्र होत त्यांत सुद्र रहतांत कात्र्य, सान्ती, त्य स्वान-प्रतिकमध्ये सुरस्ता संपुत्त सुदुह पदारी व्यक्तिमात होती, त्यांत कात्र होत त्यांत सुद्र रहतांत कात्र्य, सान्ती, त्य स्वान-प्रतिकमध्य प्रायदिन नाहे सुद्रत्यांत्र सिंत् तायांत. त्यांव त्यांत्रांच्या सान्त्याक्त रहील्ल, तुव सान्ता कार्त संपत्त्र सामयात्रां सांत्र संस्कृतांत्रसंद झाली. " स्वत्याय पुत्रद्वनी यदि संस्कृती ते चार्ट,काल्कृतीका सान्त् संपत्र्वाच्या सामयात्रीन स्वान्त्र संस्त्र प्रायत्त किंत्र पदाते ने पद्यित पदाती, कीन्द्र्यात्व काल कार्य सिन्त सार्वन्द सामयात्रां स्वान्त स्वान्त्र होताल तीवत सत्यांची सात्र्याच्या साहे.

अवकात प्राणुकाने गावलीत मंदि, सर्वाद, विज्ञान, पर्व इ प्रार्वताल्वाळे सरावा, वम, स्वाव, क्रेंस, साम, या. अनुवर्धाच्य कार्व, सर्वाव, ताट्व, विज्ञानत, शिल्पारुल, वमातने, वमातन, इ वानीपा कमानेक तंतरा. विक्र स्वार प्राणुकाने संदरापे स्वार व दोसंबोर समूत येथे निर्मान पालिक किनी तंत नावतात. विक्रम कुल्लास कर्ल्य कि व कार्व लग्न करून फेलार प्रमुख पालिक व वाल्कृतिक स्वान येथे वर्गन तीती. व्यातन्यतार्थ प्रविधानूत वाल्कृतिक कार्व कार्व्य कार्यून फेलार प्रमुख पालिक व वाल्कृतिक स्वान येथे वर्गन तीती. व्यातन्यतार्थ प्रविधानूत वालकृतिक कार्व कार्य्य कार्यून फेलार प्रमुख पालिक व वाल्कृतिक स्वान येथे वर्गन तीती. व्यातन्यतार्थ प्राणिक्त कार्यूल कार्य्यक कार्य्य कार्य्य कार्य्य कार्य्य येथे आहेत. उदा १९९२ प्रायुत्वी प्रांत व्याव्यावयालयात्र, २८२० कार्यूल्य कार्य्यक कार्य्यक, लोकजित्यादी प्रारम ६ वाल्य कार्युतिक प्रालकृतिक प्रालकृतिक प्रांत विक्राण्य पुराव प्रांत तीत. त्यांच वार्य्यात्र कार्य्यक कार्य्यकालय, लोकजित्यादी प्रारम ६ वाल्य कार्यिक प्रालकृतिक प्रालकृतिक विक्राण्या पुराव प्रांत तीत. लोज, वार्य्यालय कार्यक्राव्य कार्य्यालय, लोकजित्यादी प्रारम ६ वाल्य कार्यात्र वर्ष प्रालकृतिक प्रालक्ताल प्रांत त्यांच कार्य, कार्य, कार्य्य कार्यक्राव्य कार्य्यालय, लोकजित्यादी प्रायंत ६ वाल्य कार्यातिक प्रालकृतिक प्रांत वीक्राण्या पाय प्रांत तीत. लोज कार्य

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कुसुनासव, सोकरुवी वायसराय कडंड, बागुम्ब माणूल, प्र. वसंत कानेटकर आदी साहित्यिकांची मोटी पत्तर साल लभली आहे. बोर महापुरुषांचे अनेक पुतळे व स्मारक बेचे आहेत. गणेशोत्सव सावरी करणारी अनेक बुनी मंडवे तंत रायाकलेल्या क्रीडा संस्थानी स्थानिक लोकवीआचा रता उंचावत ठेवला आहे.'' असा विविध वैशिष्टवांनी झंखू असलेल्या सडीक सहराचा स्थानिक इतिहास धार्थिक व सांस्कृतिक दृष्टीनेही स्वतंत्र्यणे लेखन करणे शस्य आहे. आधिक घटक :

एकावा सवास्या अधिंक विकासना अनेकपटक काणीभूत असतात. त्यामध्ये प्रमुख्यानेभौनेलिक स्थि तोर्थछेवाचे विकास, स्वेटर, ऐजितलिक पार्डभूमों, स्थानिक प्रमासन इ बावींचा यात अंतर्भाव असतो. नागिक हे त्व मुख्य तीर्थछेव असल्पनेत्व्वेटक व भविसंचा सबल कायम्प्य सहित्योंने अनेक व्यवसायांना चालना मिठाली. ज़्र्री क्षे कांचा फिडडेची भांडो बनकित्याच मोठा उद्योग होता,वेधीत भांड्याना देगोमरातून मोठी मागणी सहिती. यांग्रिव विमकाम, विडी उद्योग, तेत व भाव लिरगे, मॉ मिल्स, सराफ व्यवसाय, जिटिंग प्रेस इ. पटक स्थानिक आर्थिक बीक्सच वेकिष्ट्ये सहितो. १९६२ मध्ये ओवोलिक वहाहतीची स्थारना झाल्पाने पूरक व्यवसाय व उद्योगांना चल्ल सेक्सच केंग्रेव बाह,केवान नानरोसग, व्यन्सांर चठवळो, दट्यावट्या व संगर्क साधनात वाढ, सेव क्षेत्रच विकास, बंधीत बाह,केवान नानरोसग, व्यन्सांर चठवळो, दट्यावट्या व संगर्क साधनात वाढ, सेव क्षेत्रच विकास, बंध व प्रालस्था, उन्सने व बाहरांची वाढ इ. अनेक बाबी शहरात पडून आल्पा. एकूपच नाशिक प्रत्ये आर्थेकदूट्या इंटिंडन लेखन सम्योग्रन्य आहे.

य पटकात परंतरेक व पार्निक गिकण् पदले, रौक्षणिक संस्थांच्रों वाढ, विकास व योगदान, विद्यापंठ, केंद्रेय शाळा, महानगर पालिका शिकण व्यवस्था, विरोध शिक्षण देनात्त्यां संस्था, अनौपचारिक शिक्षण व्यवस्था, संशोधन व प्रशिक्ष्य स्तरा, वसतिज्ञे, महिलांचे शिक्ष्ण, विद्यार्थी संघटना अशा विविध बाबींच्च्ये समावेश होतो. प्रमुख्यने नाशिकच्चा शैक्षणिक विकासात्स्वातंत्र्यपूर्व काट्यपासून कार्यरत मराटा विद्या प्रसारक समाज नाशिक, गोडले एत्युकेशन सोसावटी वासह नाशिकरत्नुकेशन सोसावटी, नाशिक शिक्षण प्रसारक मंडळ, म. गांधी विद्या मंदिर इ संस्थानं महत्त्वाचे दोगदम दिले तसेक स्वकांच्या आधारेहो नाशिकचा सैनिकी स्कूलसह धार्मिक शिक्षणाची परंतरां घरणम लाभलां आहे. अशा विविध सैक्षणेक पटकांच्या आधारेहो नाशिकचा शैक्षणिक इतिहास लिहिणे समय आहे राजकीय व प्रशासकीय पटक :-

कोगत्याही शहराच्या याद व विकासात स्थामिक राजकारण व प्रशासनाची भूमिका महत्त्वाची राते. त्याकृष्टे साम्रिकच्या विकासात स्वातंत्र्यपूर्वकाट्यपासून नगरपालिकेची भूमिका महत्त्वाची राहिली.स्वातंत्र्यानंतर शहरात्य सान्रेंकरणत मोठी वाढ होत.१९८२ पासून नाग्निक महानगरपालिका अस्तित्वात आली एकूणव स्वातंत्र्यपूर्व काट्यपासूनच्या प्रयासनाचा अभ्यास स्थानिक इतिहास लेखनातून करता येईल.

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नाशिकच्या रथानिक अप्रश्नार 🖙 अशा प्रचनरे रथानिक इतित्वम लेखन सन्दीय इतिहासलेखनास पूरक आहे. इतिहासातील चंचित्त घटनवर्च इतिहासलेखन चत्रणे व्यावश्यक्रवादे, प्रारताच्या स्वातंत्र्य चळवळीतही नाशिवल्कसंचा मोठा सहभाग असून त्याचे अभिक सूत्रम पातन्त्रीवर होग्वन करण्यास वाच असल्याचे लगात थेते. स्वातंत्र्योत्तर काठात तर वाशिक शास्राच्या लोकजीवनात आमूलाम बदल पहून आल्याचे लक्षात मेतात. त्यामुळे नाशिकचा स्थानिक इतिहास सामाजिक, शैक्षणिक, आर्थिक, सांस्कृतिक इ. जंगांनी लेखन करण्यास चाव आहे.

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## **Problems & Challenges of Rural Marketing in Indian Economy**

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## Introduction:-

This is right time for the Indian economy to develop its rural market and consumer sector. Indian rural markets posses' enormous demand as it has high level of the demographic dividend which leads to create huge demand base. India is recognizes as country of the villages as two - thirds of Indian people is still living in the rural areas. India has second ranking in terms of the population. This population is 17% of the world's total population. The objectives of the rural management lies in the to organize

The basic objectives of rural management is to organize, develop and utilize the available resources at efficient and optimal level in order to increase the productivity of the resources in such way that benefit of this process is reaches to the entire rural population. Rural management also helps to improve the standard of living of the rural population through increasing income level, generation of employment opportunities and providing basic amenities. Since independence, the Government has brought various schemes to enhance the life of the rural people. Upgrading rural market is one way to improve access to Marketing opportunities can be generated through the up gradation of the rural market. In order to get rid of the British rule rural people has contributed at the immense level through participating in the independent movement .But since the independent rural people has not got the attention of the government as like urban. India is agriculture based economy though the agriculture constitutes the 15% of the national income but 55% population of the country is engaged in the agriculture sector for its livelihood and this segment of the economy has remained the undeveloped and huge urban and rural gap has created in terms of the income, standard of living .It indicates that people are engaged with this sector has been neglected by the government. After the implementation of the structural adjustment programme which recognized as LPG polity has changed the dimensions of the economy through the foreign direct investment and opening of external sector to the world market .This new economic policy of the government has brought development at some extent but rural market has not been improved at the satisfactory level.

Youth who are educated, have access to technology and have openness to change. Also rural markets have acquired significance, as the overall growth of economy has resulted into substantial increase in the purchasing power of the rural communities. A survey by India's premier economic research entity, National Council for Applied Economic Research (NCAER)indicates that rise in rural incomes is keeping pace with the rise in urban incomes. The rural middle class is growing at 12 per cent, close to the urban middle class which is growing at 13 percent.

## Key Words:-

Rural Marketing, Indian corporate, rural population, Indian economy, Agriculture



## Rural marketing Definition and concept:-

"Rural marketing is the process of marketing in rural areas. It includes the adoption of various marketing strategies and policies in rural market with a view to convert the needs and wants of rural people into demand."

In recent years rural markets has been receiving the significance as the Indian economy has been growing by 7% average after the adoption of the globalization policy which crested the demand for industrial goods and service sector .This has increased the purchasing power of the rural consumer through expansion of the industrial and service sector. Rural sector has been creating demand for the industrial sector as implementation of the green revolution programme.As urban or industrial area is growing, rural marketing terms has been emerged But often, rural marketing is confused with agricultural marketing –the latter denotes marketing of produce of the rural areas to the urban consumers or industrial consumers, whereas rural marketing involves delivering manufactured or processed inputs or services to rural producers or consumers

## Indian economy post independence:-

The Indian economy was growing below its potential as explore the signs of the stagnation like situation as 47% population of the country were living below the poverty line at the time of sixties and seventies Indian economy was growng by 3.5% which is called the Hindu rate of growth . According to the World Bank a third of the global poor people are residing in India. At the time of independence 72% of the work force was employed in agriculture and it contributed to nearly 50% of the national income.

The space of the Industrialization was at a very low level with only 2% of the work force was employed in industries. In addition to this rate of investment were very low which couldn't develop the rural area through the provision of employment to the rural population As result of the low agriculture output, little industrialization, low figure of national income, high poverty and unemployment has led to the lower economic development. After the independence from colonial rule in 1947, the process of rebuilding the economy has been initiated through the formulation of the various schemes.

First five year plan for the development of Indian economy came into implementation in 1952. These Five Year Plans was focused on the needs of the infrastructure. In the process of the building basic infrastructure priority were given to the rural sector which means this sector received the attention but industrial sector had been developed at the higher pace and rural sector didn't get the development. The GDP growth rate for the 2008-09 periods has been 6.7%. Despite improvement in many areas it is true that poverty, unemployment and illiteracy are major stumbling blocks to the nation's development. Before competing with China to become the biggest and most powerful economy, we have to realize that there are many problems within the country which need to be tackled first. Benefits of the economic reforms were remained limited to urban centers whereas the condition rural areas have become undeveloped and inequality in the rural and urban areas over the development indicators has been exacerbated. Bridging of this gap has become imperative in such way that rural area shouldn't lagged behind to the urban area in the process of the development.

The asset of the country is lies in the youth population of the country which has become very passionate for the government jobs and high salary. But reality is government can't absorb this total youth population into government jobs as it has certain limitations .Indian government need to frame such unique policy which will provide employment to the youth and generation of



employment in the private sector has become important. The Gross Domestic Product (GDP) at factor cost, which was 2.3 % in 1951-52 reached 6.5 in the financial year2011-2012 Trade liberalization, financial liberalization, tax reforms and opening up to foreign investments were some of the important steps, which helped Indian economy to gain momentum. The Economic Liberalization introduced by Man Mohan Singh in 1991, then Finance Minister in the government of P V Marimba Rao, proved to be the stepping-stone for Indian economic reform movements.

## Rural marketing in modern India:-

"Rural Marketing is defined as a function that manages all activities involved in assessing, stimulating and converting the purchasing power of rural consumers into an effective demand for specific products & services and moving these products & services to the people in rural areas to create satisfaction and a better standard of living and thereby achieving organizational goals" This process should be come up with the target of elimination of the socio-economic disparities between the rural and urban customers.

This system consist on the transactions of urban marketers who sell their goods and services in rural areas, like pesticides, fertilizers, seeds, FMCG products, tractors, bicycles, consumer durables, etc.Rural to Urban (R 2 U): Transactions in this category basically covers under the agricultural marketing where a rural producer seeks to sell his produce in an urban market, like seeds, fruits and vegetables, milk and related products, forest produce, spices, etc.URBAN RURAL, RURAL RURAL, URBAN RURAL, Rural to Rural (R 2 R):This includes the activities that take place between two villages in close proximity to each other, like agricultural tools, handicrafts and bullock carts, dress materials, etc.

## Problems in rural marketing:-

Though rural sector has achieved progress in terms of the infrastructure but compare with the urban part of the country former sector has stayed behind in the development. The growth rate Indian economy has achieved so far has not remained inclusive which indicates that fruits of the growth have not reached to the rural sector at the satisfactory level. Many problems have been still to tackle to the government in order to development of the rural sector.

## **Transportation:**

Transportation plays a crucial role in the development process through the movement of the goods from one place to another. Quality of the transportation in the country has not improved its efficient level and which posses the many shortcomings .The current transportation facility has achieved success in the urban areas but rural India has stayed behind and the state of the transportation infrastructure in India has been remained poor in the rural area, some villages in country has not yet connected to the urban market at proper level. In the monsoon period, quality of the roads deteriorates which leads to creation of problematic situation to the people living in the rural sector. So, quality of the roads needs to be improve in order to the facilitation of the needs of the rural people

## **Communication:**

Marketing communication in rural markets suffers from a variety of constraints. The literacy rate among the rural consumers is very low. Print media, therefore, have limited scope in the rural context. Apart from low levels of literacy, the tradition-bound nature of rural people, their cultural barriers and their overall economic backwardness add to the difficulties of the



communication task. Post, telegraph, and telephones are the main components of the communication infrastructure. These facilities are extremely inadequate in the rural parts of our country. In rural areas, the literacy percentage is still low, compared to urban areas. In India, there are 18 recognized languages. All these languages and many dialects are spoken in rural areas. English and Hindi are not understood by many people. Due to these problems, rural consumers, unlike urban consumers do not have exposure to new products.

## Availability of appropriate media:

All organized media in the country reach towards only to the 30% rural population of the country the radio network, in theory, covers 90 per cent. But, actual listenership is much less. TV has become very popular medium of the communication in the rural areas as all the news and various programmes is attained through this medium It is estimated that TV covers 20 per cent of the rural population. But, the actual viewer ship is meager. The cinema, however, is a good medium for rural communication. But, these opportunities are very low in rural areas.

## Warehousing:

This is one of the most important factor in the rural marketing which is necessary in the process of production and consumption of agriculture products, commodities .The number warehouse in the rural areas are available in the lower number against of its actual demand. Some problems lies in this regard as central warehousing corporation and State Corporation which constitutes the major part of the public warehousing has not delivered its service in terms of the increase numbers in the rural areas and it has not extended their network to the rural parts of the country .Lack of this adequate facility farmers has to sell their produce in the market at the prevailing price which is remains below the production cost.

## Village structure in India:

In our country, the village structure posses the diversity in terms of the Cast, religion, land holding etc. It is estimated that 60 per cent of the villages are in the population group of below 1,000. This nature of the villages affects to the development of the village society.

## Inadequate banking and credit facilities:

In rural markets, distribution has become less because of the less banking and credit facilities. The rural area need huge provision of the banking services in order to send remittances, investment in the agriculture sector which will increase backward and forward linkages in the rural sector. Due to the lower availability of the banks many people rural has not attached to the banking sector and eventually can't save their money in the banks As result of this financial inclusion haven't taken place in at the highest level in the rural sector. Due to this speed of the rural marketing is stayed limited in the village level and it has aggravated the gap of development in the rural and urban sector over the availability of the banking sector.

## **Branding:**

Branding of the product contributes in the selling of the product at large level. Day by day national brands are becoming popular for purchasing of the goods but at the rural level local brands can play major role to improve the rural marketing. As the prices of the established brands remains high to the poor village people but local brands can be reaching to the rural areas by the efficient way. Due to the lower income purchasing power of the people who are engaged in the agriculture sector and other unorganized sector has the low purchasing power. Local



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## QUALITY ENHANCEMENT OF HIGHER EDUCATIONTHROUGH GOOGLE SERVICES

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## **INTRODUCTION:**

Google is mainly known as a search engine in whole world. It provides the data whatever needed. Now a day Google provides the various services rather than only a search engine and e-mail facility. Google was founded in 1998 by Larry page and Sergey Brin while pursuing Ph.D. at Stanford University in California. Together they own near about 14 percent of its shares and control over 56 percent of the stockholder voting power through super voting stock. They incorporated Google as a privately held company on September 4, 1998, in California. Google was then reincorporated in Delaware on October 22, 2002. An initial public offering (IPO) took place on August 19, 2004, and Google moved to its headquarters in Mountain View, California, nicknamed the Googolplex. In August 2015, Google announced plans to reorganize its various interests as a conglomerate called Alphabet Inc. Google is Alphabet's leading subsidiary and will continue to be the umbrella company for Alphabet's Internet interests. Sundar Pichai was appointed CEO of Google, replacing Larry Page who became the CEO of Alphabet.

The company's rapid growth since incorporation has triggered a chain of products, acquisitions, and partnerships beyond Google's core search engine (Google Search). It offers services designed for work and productivity (Google Docs, Google Sheets, and Google Slides), email (Gmail, G-suite), scheduling and time management (Google Calendar), cloud storage (Google Drive), instant messaging and video chat (Duo, Hangouts), language translation (Google Translate), mapping and navigation (Google Maps, Waze, Google Earth, Street View), video sharing (YouTube), note-taking (Google Keep), education (Google classroom), and photo organizing and editing (Google Photos) etc. The company leads the development of the Android mobile operating system, the Google Chrome web browser, and Chrome OS, a lightweight operating system based on the Chrome browser. Google has moved increasingly into hardware; from 2010 to 2015, it partnered with major electronics manufacturers in the production of its Nexus devices, and it released multiple hardware products in October 2016, including the Google Pixel smartphone, Google Home smart speaker, Google Wi-Fi mesh wireless router, and Google Daydream virtual reality headset. Google has also experimented with becoming an Internet carrier (Google Fiber, Google Fi, and Google Station).

Google.com is the most visited website in the world. Several other Google services also figure in the top 100 most visited websites, including YouTube and Blogger. Google was the most valuable brand in the world as of 2017, but has received significant criticism involving issues such as privacy concerns, tax avoidance, antitrust, censorship, and search neutrality. Google's mission statement is "to organize the world's information and make it universally accessible and useful". The company's unofficial slogan "Don't be evil" was removed from the company's code of conduct around May 2018, but reinstated by July 31, 2018.

The Google services are too much important in all the sectors of economy due to usefulness of various utility services provides by the google. Hence it is very useful in the higher education sector also. This article tried to find out the uses of various services provided by google in Higher education sector. Also try to explain that how we can use various google services in teachinglearning process.

## **OBJECTIVES OF THE STUDY:**

- 1. To study the background of Google services.
- 2. To Study the various services provides by Google.
- 3. To Study the role of various google services in higher education.

## **ROLE OF GOOGLE SERVICES IN HIGHER EDUCATION:**

Now a day Google provides various useful services. These as follows...

- 1. Google search: A search engine is a web-based tool that enables users to locate information on the World Wide Web. The information gathered by the spiders is used to create a searchable index of the Web. There are three commonly known types of search engines that have been identified during various research projects navigational, informational and transactional. Google uses automated programs called spiders or crawlers, just like most search engines, to help generate its search results. Google has large index of keywords that help a determine search results. Google uses a trademarked algorithm called PageRank, which assigns each Web page a relevancy score. Google search is a very important tool for higher education. Google search has the answer for every question arise in higher education. It can gives the explanation of every concept related to education. Students and teacher can find the explanation, examples, samples, case studies, images, books, references, audios, videos, news, reports, stats, etc. The information gets from google search increase the knowledge of the teachers and students.
- 2. G-mail: Gmail is a service provide by google in the form of an account for receiving and sending e-mails. Users can access Gmail on the web and using third-party programs that synchronize email content through POP or IMAP protocols. Gmail started as a limited beta release on April 1,

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2004. At the time of start, Gmail had an initial storage capacity offer of one gigabyte per user, a significantly higher amount than competitors offered at the time. Today, the service comes with 15 gigabytes of storage. Users can receive emails up to 50 megabytes in size, including attachments, while they can send emails up to 25 megabytes. In order to send larger files, users can insert files from Google Drive into the message. By 2018, Gmail had 1.5 billion active users worldwide. Most of the Gmail users are comes from education and IT sector. The Gmail service is a free service provided by Google. People from the education sector can use google as a tool of information transfer. They can send and receive various documents, books, presentations, which can improve the knowledge of the teachers and students.

- **3.** G-suite: G-Suite is a suite of cloud computing, productivity and collaboration tool, software and products developed by Google Cloud, first launched on August 28, 2006 as Google Apps for Your Domain. G-Suite comprises Gmail, Hangouts, Calendar, and Currents for communication, Drive for storage, Docs, Sheets, Slides, Keep, Forms, and Sites for productivity and collaboration and depending on the plan, an Admin panel and Vault for managing users and the services. It also includes the digital interactive whiteboard Jamboard and the app development platform App Maker. While these services are free to use for consumers. G Suite adds enterprise features such as custom email addresses at a domain(@yourcompany.com), option for unlimited cloud storage (depending on plan and number of members), additional administrative tools and advanced settings, as well as 24/7 phone and email support. Being based in Google's data centers, data and information is saved instantly and then synchronized to other data centers for backup purposes. Unlike the free, consumer-facing services, G Suite users do not see advertisements while using the services, and information and data in G Suite accounts do not get used for advertisement purposes. Furthermore, G Suite administrators can fine-tune security and privacy settings. As of January 2017, G Suite had 4 million paying businesses, and 70 million G Suite for Education users. Educational institutions can used it for institutional domain to using various services provides by the G-suite. Any institution can register to the G-suite and access the services of the E-mail with institutional domain.
- **4. Google Drive:** Google Drive is a file storage and management service, launched on April 24, 2012. The official announcement labeled Drive as "a place where you can generate, share, pool resources, and keep all of your substance". With Google Drive, users can upload any type of file to the cloud, share them with others, and access them from any computer, tablet, or Smartphone. Users can sync files between their device and the cloud with apps for Microsoft Windows and Apple macOS computers, and Android and iOS smartphones and tablets. As part of G Suite, Google Drive comes with additional features designed for business use, including.

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Either 30GB, 1TB per user, or unlimited storage, depending on the plan Advanced admin controls, depending on the plan Audit and reporting insights for Drive content and sharing, depending on the plan. Educational institute can store and share the data among teachers, staffs and students. It can help to increase speed of data transfer, and improve the knowledge sharing among students.

- 5. Google Docs, Google Sheets and Google Slides: Google Docs, Google Sheets and Google Slides are respectively a word processor, a spreadsheet and a presentation program. The three programs originate from company procurements in 2006 and are today unified into Google Drive. They all work as collective software that permit users to view and edit documents, spreadsheets and presentations together in real-time through a web browser or mobile device. Changes are saved automatically, with a modification history keeping track of variations. There is also the competency to set user permission levels to designate who can view, comment or edit the document as well as permissions to download the particular document. Google Forms, meanwhile, is a tool that permits collecting information from users via a personalized survey or quiz. The information is then collected and automatically connected to a spreadsheet. The spreadsheet is populated with the survey and quiz responses. In June 2014, Google introduced Office support in Google Docs, Sheets, and Slides without the need for file alteration. Writing for TechCrunch, Frederic Lardinois wrote that "Google is clearly positioning its apps as a more affordable resolutions for companies that need to sometimes edit Office files". As part of G Suite, Google Docs and Slides come with additional features designed for business use, containing unlimited modification history. G Suite also has gathered a strong following in education, with over 70 million users by 2017.
- **6. Google Form:** Google Forms is a survey application. Forms features all of the association and sharing features found in Docs, Sheets, and Slides. It can also be used to create quizzes, including some specialized functions that are of use in educational settings. Institutions can use google forms for online practice exams, collect feedback from students, parents, teachers, and other staffs about syllabus, teaching methods, college campus, and overall development of the institution. It's also helpful to collect the staff information.
- 7. Google Sites: Google Sites is a creation tool that allows multiple people to create and edit websites, without requiring coding knowledge or other web design skills. It was introduced in February 2008 in an effort to help customers "quickly collect a variety of information in one place including videos, calendars, presentations, attachments and text and easily share it for viewing or editing with a small group, their entire organization, or the world.

- 8. Google Calendar: Google Calendar is an online calendar intended to help keep track of time and schedules. It was launched in April 2006, and participates with Gmail for users to easily add events from email messages straight to the calendar. As part of G Suite, Google Calendar comes with additional features designed for business use, including.
  - Smart scheduling of meetings, where the service finds available times and appropriate locations based on colleagues' schedules
  - ✓ Public calendars for consumers to understand a business forthcoming events.
  - ✓ Calendar combination with Google Sites.
  - ✓ Easy immigration from Exchange, Outlook or iCal, or from .ics and .csv files.
  - ✓ Capacity to realize what meeting rooms and joint resources are available
- **9. Google Hangouts:** When Google Apps for Your Domain was launched in 2006, Google Talk was used for communication. This was later replaced in May 2013 by Google Hangouts, a messaging facility that includes technology from diverse communication services Google had developed. Hangouts supports text, voice and video discussions (video up to 25 participants), and is cross-platform on the web, Android and iOS. In July 2014, Google declared that Hangouts would be covered under the same 99.9% uptime guarantee that Gmail and Google Drive have, as well as 24/7 phone and email care. As part of G Suite, Google Hangouts originates with additional features designed for business use, including:
  - Participants can share their screens.
  - The screen automatically focuses on the person who is speaking, and "intelligent muting" avoids background noise.
  - Businesses can host Hangouts on Air; public live streams that are automatically saved to the business' YouTube account
  - Integration with Google Calendar for one-click start of a Hangouts conversation at the beginning of a meeting
  - Custom controls for admins, including limiting access, turning chat history off, and the ability to refuse participants for privacy
  - Custom status messages.

Google Hangouts Meet is a standards-based Video Conferencing application, using exclusive protocols for video, audio and data transcoding. Google have partnered with Pexip to offer interoperability between the Google protocol and standards-based SIP/H.323 protocols to allow communications between Hangouts Meet and other Video Conferencing tools and software.

- **10. Google Current:** Google Currents, formerly Google+ for G Suite, is used to let team members "engage and communicate" at "a deeper level", with a stream containing posts, comments and Communities based on common areas. It makes it easy for anyone to discuss and share ideas, no matter their team, level or location. It features Collections that make it easy to group posts by topic, in order for users to show what they know and follow what matters most. As part of G Suite, Google Currents comes with additional features designed for business use, including improved privacy controls and limited communities. A current is a adapted successor of Google+, which was shut down for consumers and brands on April 2, 2019.
- **11. Google Keep:** Google Keep is a note-taking service with a variety of tools for notes, including text, lists, voice, and images. Google Keep became part of G Suite in February 2017, and as part of G Suite, Google Keep comes with additional features designed for business use, including. Integration with Google Docs to easily access Keep notes while on Docs on the web.
- **12. Google Vault:** Google Vault and archiving and electronic discovery service entirely available to G Suite customers, was announced on March 28, 2012. Vault gives users an easy to use and cost effective explanation for managing information critical to your business and preserving important data, with Google affirming that it can decrease the costs of process, regulatory investigation and compliance actions by saving and managing Gmail messages and chat logs with the ability to search and manage data based on filters, such as terms, dates, senders, recipients and labels. An update in June 2014 let Vault customers search, preview, copy, and export files in Google Drive.
- **13. Jamboard:** In October 2016, Google announced Jamboard, the first hardware product designed for G Suite. Jamboard is a digital interactive whiteboard that enables collaborative meetings and brainstorming. The Jamboard is connected to the cloud, and enables people in different locations to work together in real-time through multiple Jamboards or connected remotely through a smartphone companion app. The Jamboard recognizes different touch inputs, such as using a stylus to sketch or eraser to start over, and does not need batteries or pairing. The Jamboard is a 55-inch 4K display with a built-in HD camera, speakers and Wi-Fi.
- 14. Google Classroom: Google Classroom is a free association tool for teachers and students. Teachers can create an online classroom, invite students to the class then create and distribute assignments. Within the Google Classroom students and teachers can have discussions about the assignments and teachers can check the student's progress. Schools must register for a free Google Apps for Education account to use Classroom. Under the Classroom app, students and teachers have access to features that are not found in personal Google accounts. For example, in Forms, teachers can put images to questions or as multiple choice answers. Inbox by Gmail has

Classroom messages grouped in Inbox, making it easy for teachers and students to catch important updates and highlights. Also, the Classroom tool allows teachers to organize the class stream by adding topics to posts, and teachers and students can filter the stream for exact topics. Google classroom can change the classical system of classes and make it innovative teachinglearning process.

## **CONCLUSION:**

Google are launching various new services which is very useful to the education sector. Google services enhance the quality of teaching and learning process. The teaching and learning process became more easy and interesting in this modern era. Students can learn the various things with example, videos, images, diagrams, tables, current data and news with the help of various services provides by Google. Teachers and institutions can also increase their quality, knowledge and ability to teach with the help of various Google services. If the institutions encourage their students, teachers and non-teaching staff to efficient use of the google services, the quality of all the stakeholders of the institution will increase rapidly.

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					सहाय्यक प्राध्य	गपक (अर्थशास्त्र)
					एम.व्ही.पी. समाजाचे कर	ला, विज्ञान आणि
					वाणिज्य महाविद्याल	ज्य, ओझर (मिग)
					ता. निफाड, जि. ना	शिक ४२२२०६.

## गोषवारा

थेट परदेशी गुंतवणूक धोरणात सुधारणा, गुंतवणुकीची सुविधा आणि व्यवसाय सुलभता या आघाडीवर सरकारने केलेल्या उपाययोजनांमुळे देशात थेट परदेशी गुंतवणुकीचा प्रवाह वाढला आहे. भारताच्या थेट परकीय गुंतवणुकीमधील खालील कल जागतिक गुंतवणूकदारांमध्ये गुंतवणुकीसाठी <mark>भारत हा प्राधान्य देश असल्याचे समर्थन करतो. मागील</mark> ०६ वर्षांच्या कालावधीसाठी (२०१४–१५ ते २०१९–२०) एकूण एफडी<mark>आय ओघ ५५ टक्क्याने वाढला म्हणजेच २००८–</mark>१४ मधील २३१.३७ अ<mark>ब्</mark>ज अमेरिकन डॉलर्स वरुन २०१४–२० मध्ये ३५८.२९ अब्ज डॉलरवर गेला. भारतात २०२०–२१ मध्ये ८००९२ दशलक्ष अमेरिकन डॉलर इतकी विदेशी गुंतवणूक झालेली असून २०२०–२१ मध्ये ४३९५५ दशलक्ष अमेरिकन डॉलर इतकी सर्वाधिक निव्वळ वि<mark>दे</mark>शी गुंतवणूक झाल्याचे दिसून येते. , भारतात २०१८ ते डिसेंबर २०२० या कालावधीत संगणक सॉफ्टवेअर, हार्डवेअर क्षेत्रात अनुक्रमे ६.४२ दशलक्ष डॉलर, ७.६७ दशलक्ष डॉलर, २४.३९ दशलक्ष डॉलर इतकी गुंतवणूक झाल्याचे दिसते. कोव्हिड—१९ चा परिणाम जगातील सर्वच देशांवर झाल्याने अर्थव्यवस्थेला <mark>आ</mark>र्थिक संकटांचा सामना करावा लागला. जगातील अनेक विकसित देशांचा जीडीपी उणे झालेला असून त्यास विकसनशील व अ<mark>विकसित देशही सुटलेले नाहीत. जगातील अनेक कंपन्यांनी चीनमध्ये गुंतवणूक व उ</mark>त्पादन सुरु केले होते परंतु कोव्हिड—१९ चा पहिला रुग्ण <mark>चीनमध्ये सापडल्याने व चीनवर कोव्हिड पसरवल्याचा आरोप</mark> झाल्याने <mark>अ</mark>नेक विदेशी कंपन्यांचे प्रंचड आर्थिक नुकसान झाल<mark>्या</mark>ने अनेक <mark>कंपन्यांनी आपली गुंतवणूक चीन मधून भारतात करण्यास</mark> सुरुवात <mark>के</mark>ली. गेल्या २६ महिन्यात म्हणजेच एप्रिल—मे २०२१ पर्यंत भारतात १,३४,९६६ दशलक्ष डॉलर इतकी गुंतवणूक झालेली दिसून येते. विकसनशील भारतात होणाऱ्या विदेशी गुंतवणुकीमुळे वि<mark>का</mark>साला चालना मिळण्यास सुरुवात होईल आणि</mark> विकसनशील भारत विकसित भारत होण्यास यामुळे मदत होईल. प्रस्तुत शोधनिबंधामध्ये दुय्यम तथ्य संकलन पद्धतीचा वापर केला असून विदेशी गुंतवणूक संकल्पनेचा आढावा घेणे. भारतीय कोव्हिड—१९ चा विदेशी गुंतवणुकीवर झालेल्या परिणामांचा आढावा घेणे. या उद्दिष्टांच्या आधारे भारतातील विदेशी गुंतवणुकीवर कोव्हिड—१९ <mark>चा झालेला परिणामां</mark>चा सविस्तर आढावा घेतलेला आहे.

महत्त्वाचे शब्द (Keywords) : विदेशी गुंतवणूक, कोव्हिड-१९, एफडीआय, डॉर्लर्स, भांडवल इ.

प्रस्तावना

भारितात कोव्हिड म्हणजेच कोरोनाचा पहिला रुग्ण मार्च

२०२० मध्ये सापडला आणि भारतीय अर्थव्यवस्थेची आर्थिक गती मंदावण्यास सुरुवात झाली. भारत हा जगातील सर्वात मोठी बाजारपेठ असणारा विकसनशील देश म्हणून ओळखला जातो. कोरोनाचा पहिला फटका चीनला बसल्याने आणि कोरोनाचा निर्माता म्हणून संशयाने चीनकडेच पाहिले जात असल्याने तेथे असणाऱ्या अनेक विदेशी कंपन्यांना प्रचंड आर्थिक नुकसान सोसावे लागल्याने अनेक कंपन्यांनी आपली कार्यालये, उद्योग भारतामध्ये स्थलांतरीत करुन विदेशी गुंतवणूक करु लागलेले दिसून येते.थेट परकीय गुंतवणूक (एफडीआय) हा आर्थिक विकासाचा प्रमुख चालक आहे आणि भारताच्या आर्थिक विकासाचा प्रमुख चालक आहे आणि भारताच्या आर्थिक विकासासाठी बिगर—कर्ज वित्तपुरवठ्यचा महत्त्वपूर्ण स्रोत आहे. सक्षम आणि गुंतवणूकदारांना अनुकूल थेट परकीय गुंतवणूक धोरण लागू करण्याचा सरकारचा प्रयत्न आहे. थेट परकीय गुंतवणूक धोरण अधिक गुंतवणूकस्नेही बनवणे आणि देशातील गुंतवणूकीच्या ओघाला बाधा आणणारे

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धोरण अडथळे दूर करणे हा यामागील हेतू आहे. गेल्या सहा वर्षांत या दिशेने उचललेल्या पावलांना फळ मिळाले आहे, देशात थेट परदेशी गुंतवणुकीचा ओघ कायम वाढत थेट परदेशी गुंतवणुकीचे उदारीकरण आहे. आणि सरलीकरणाच्या मार्गावर वाटचाल सुरू ठेवून सरकारने विविध क्षेत्रांत थेट परदेशी गुंतवणूक सुधारणा केल्या आहेत. थेट परदेशी गुंतवणूक धोरणात सुधारणा, गुंतवणुकीची सुविधा आणि व्यवसाय सुलभता या आघाडीवर सरकारने केलेल्या उपाययोजनांमुळे देशात थेट परदेशी गुंतवणुकीचा प्रवाह वाढला आहे. भारताच्या थेट परकीय गुंतवणुकीमधील खालील कल जागतिक गुंतवणूकदारांमध्ये गुंतवणुकीसाठी भारत हा प्राधान्य देश असल्याचे समर्थन करतो. मागील ०६ वर्षांच्या कालावधीसाठी (२०१४-१५ ते २०१९-२०) एकूण एफडीआय ओघ ५५ टक्क्याने वाढला म्हणजेच २००८–१४ मधील २३१.३७ अब्ज अमेरिकन डॉलर्स वरुन २०१४–२० मध्ये ३५८.२९ अब्ज डॉलरवर गेला. एफडीआय इक्विटीचा ओघ देखील ५७ टक्क्यांनी वाढून २००८-१४ मधील १६०.४६ अब्ज डॉलर्सवरून २५२.४२ अब्ज डॉलर्स वर (२०१४–२०) गेलेला दिसतो. आर्थिक वर्ष २०२०-२१ (एप्रिल ते ऑगस्ट २०२०) एप्रिल ते ऑगस्ट २०२० या काळात एकूण ३५.७३ अब्ज अमेरिकन डॉलरची एफडीआय ओघ प्राप्त झाला. आर्थिक वर्षातील पहिल्या पाच महिन्यांमधील ही सर्वोच्च पातळी असून २०१९–२० च्या पहिल्या पाच महिन्यांमधील (३१.६० अब्ज अमेरिकन डॉलर्स) तुलनेत १३ टक्के जास्त आहे. २०२०–२१ (एप्रिल ते ऑगस्ट २०२०) आर्थिक वर्षात एफडीआय इक्विटी ओघ २७.१० अब्ज डॉलर्स आहे. आर्थिक वर्षातील पहिल्या पाच महिन्यांमधील ही सर्वोच्च पातळी असून २०१९–२०च्या पहिल्या पाच महिन्यांमधील (२३.३५ अब्ज डॉलर्स) च्या तुलनेत १६ टक्क अधिक असल्याचे दिसते.?

## विदेशी गुंतवणूक म्हणजे काय?

''परकीय देशातील व्यक्ती, परकीय देशातील संस्था, बहुराष्ट्रीय कंपन्या, आणि सरकार यांनी परकीय चलनाच्या स्वरुपात यंत्रसामुग्री, तंत्रज्ञान या स्वरुपाचे भांडवल भारतामध्ये आणले तर त्याला विदेशी गुंतवणूक असे म्हणतात.''

## अभ्यासाची उद्दिष्टे

- १) विदेशी गुतवणूक संकल्पनेचा आढावा घेणे.
- २) भारतातील विदेशी गुंतवणुकीवर कोव्हिड—१९ चा झालेल्या परिणामांचा आढावा घेणे.

## संशोधन पद्धती

प्रस्तुत संशोधनासाठी दुय्यम तथ्य संकलन पद्धतीचा वापर करण्यात आला असून संशोधनामध्ये पुस्तके, ऑनलाईन वृत्तपत्रे, संकेतस्थळे इत्यादीचा वापर संशोधन व्यवस्थित होण्यासाठी केला आहे.

## विदेशी गुंतवणूक संकल्पना

थेट परकीय गुंतवणूक म्हणजे दोन विविध देशांतर्गत कंपन्यांना एकमेकांच्या देशात गुंतवणूक करण्याची मुभा. अशा प्रकारच्या गुंतवणूकीमुळे दोन्ही कंपन्यांना एकमेकांच्या देशात काही ठराविक टक्के रक्कम गुंतवण्याची संधी मिळते. देशात परकीय भांडवल मोठ्या प्रमाणात गुंतवल्यामुळे देशाच्या अर्थव्यवस्थेलाही चांगला फायदा होतो. सर्वसाधारणपणे परकीय गुंतवणुकीसाठी कोणत्याही कंपनीला दुसऱ्या कंपनीचे १० टक्के शेअर्स खरेदी करावे लागतात. मात्र एखाद्या कंपनीने ५१ टक्के शेअर्स खरेदी केल्यास दुसऱ्या कंपनीची ओनर कंपनी म्हणून ओळखली जाऊ शकते. भारतात रिटेल क्षेत्राचा व्याप फार मोठा आहे. देशाच्या अर्थव्यवस्थेत रिटेल क्षेत्राचा वाटा हा अंदाजे १५ टक्के आहे. त्याशिवाय देशाच्या अर्थव्यवस्थेत रिटेल क्षेत्राच्या माध्यमातून सरकारच्या कोट्यात दरवर्षी २५० कोटी डॉलर्स परकीय चलन येते. विदेशातील कंपन्या जशा अनेक देशात भांडवल गुंतवतात तशाच भारतातल्या अनेक कंपन्यांनीदेखील विदेशातील अनेक देशांत भांडवलाची गुंतवणूक केलेली आहे. अफ्रिका, चीन, इंग्लंडच काय थेट अमेरिकेतही आपल्या देशातील अनेक कंपन्यांची गुंतवणूक आहे. विदेशी कंपन्यांना आपला पैसा गुंतवायचा असेल तर आपल्या सरकारची परवानगी घ्यावी लागते. अशी परवानगी घेऊन अनेक विदेशी कंपन्या यापूर्वीच भारतात आलेल्या आहेत. फॉरेन डायरेक्ट इन्व्हेसमेंट (एफडीआय) म्हणजे, विदेशाची थेट गुंतवणूक होय. देशात तीन प्रकारच्या कंपन्या असतात. निखळ देशी भांडवल असलेल्या कंपन्या, देशी भांडवलासोबत विदेशी भांडवल वापरणाऱ्या कंपन्या व केवळ विदेशी भांडवल असणाऱ्या कंपन्या. सरकारने विदेशी कंपन्यांना निम्यापेक्षा अधिक गुंतवणुकीला परवानगी

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दिली. संयुक्त भांडवल गुंतवणुकीच्या अनेक कंपन्या आहेत. नोकिया किंवा कोकाकोला ही थेट गुंतवणुकीची उदाहरणे आहेत.<sup>३</sup>

## भारतातील विदेशी गुंतवणुकीतील परिणामाचा आढावा

भारतीय अर्थव्यवस्था २०२०-२१ मध्ये साथीच्या रोगाने उद्ध्वस्त झाली होती, परंतु थेट विदेशी गुंतवणुकीचा (एफडीआय) प्रवाह विक्रमी उच्चांकावर होता. जुलै ते सप्टेंबर तिमाहीत भारताला एकूण २८.१ अब्ज डॉलर्स आणि मागील एप्रिल ते जून तिमाहीत ११.५ अब्ज डॉलर्सची एफडीआय प्राप्त झाली आणि आर्थिक वर्षाच्या पहिल्या सहामाहीत एकूण ३९.६ अब्ज डॉलर्सची थेट परकीय गुंतवणूक वाढली. या<mark>तील ३० अब्ज डॉलर्स</mark> इक्विटी एफडीआय प्रवाहाच्या स्वरूपाचे होते किंवा मुळात परदेशी कंपन्यांनी भारतीय कंपन्यांमध्ये इक्विटी स्टेक्ससाठी केलेली गुंतवणूक तर उर्वरित पैसे गुंतवणूक कमाई किंवा नफा म्हणून पुन्हा व्यवस<mark>ा</mark>यात वळवले गेले. डिपार्टमेंट ऑफ प्रमोशन फॉर इंडस्ट्री <mark>अँड इंटरनल ट्रेड (DPIIT)</mark> आकडेवारीनुस<mark>ा</mark>र 🔄 २०<mark>२०—२१</mark> कडील च्या पहिल्या सहामाहीत यापैकी बहु<mark>ते</mark>क इक्<mark>विटी एफडीआयचा प्रवाह</mark> संगणक सॉफ्टवेअर सेगमेंटमध्ये होता आणि रिलायन्स इंडस्ट्रीजची उपकंपनी जिओ प्लॅटफॉर्ममधील गुंतवणुकीमुळे लि. FDI मध्ये तीव्र वाढ<mark>ं</mark> आणि चालू आर्थिक वर्षात GDP मध्ये संकुचित होण्यामुळे FDI मध्ये जीडीपीची टक्केवारी मागील वर्षांच्या पातळीला ओलांडू शकते. ही पातळी गेल्या पाच वर्षांमध्ये स्थिर राहिली आहे. संगणक श्रेणीला देशातील सर्व सॉफ्टवेअरच्या इक्विटी एफडीआयमध्ये ५८ टक्के १७.५ अब्ज डॉलर्स प्राप्त झाले. त्यानंतर सेवा क्षेत्राला २.२ अब्ज डॉलर्सपेक्षा जास्त कालावधीत एफडीआयचे सुमारे ०८ टक्के प्राप्त झाले. ट्रेडिंग, ऑटोमोबाईल, इन्फ्रास्ट्रक्चर, हॉटेल आणि पर्यटन आणि टेलिकॉम सारख्या इतर क्षेत्रांमध्ये मागील वर्षांच्या तुलनेत लक्षणीय परदेशी गुंतवणूक अजून दिसून आली नाही. यापैकी काही क्षेत्रे साथीच्या आजारामुळे आणि नंतरचे लॉकडाऊन आणि शारीरिक संपर्क आवश्यक असलेल्या क्षेत्रांवर घातलेल्या निर्बंधांमुळे सर्वात जास्त प्रभावित झाले. जिओ प्लॅटफॉर्ममध्ये भरीव गुंतवणूक केल्यानंतर सप्टेंबर तिमाहीत तंत्रज्ञान कंपन्यांमध्ये गुंतवणूक शिगेला पोहोचली. फेसबुक, सिल्व्हर लेक, व्हिस्टा इक्विटी भागीदार आणि

इतर कंपन्यांनी या कालावधीत देशात १५ अब्ज डॉलर्स किंवा एकूण एफडीआय इक्विटी प्रवाहाच्या ५० टक्क्यांपेक्षा जास्त गुंतवणुकीची घोषणा केली. आकडेवारीनुसार गुजरात राज्याला सर्वात जास्त परकीय गुंतवणूक प्राप्त झाली आणि त्यानंतर महाराष्ट्राने प्रामुख्याने जिओ प्लॅटफॉर्ममध्ये गुंतवणूक केली. २०१७–१८ आणि २०१८–१९ मध्ये तुलनेने अल्प नोंदवल्यानंतर भारतात विदेशी गंतवणक वाढ २०१८--२०१९ मध्ये ६२ अब्ज डॉलर्स आणि २०१७--१८ मध्ये ६०.९ अब्ज डॉलर्स वरुन २०१९–२० मध्ये ७४ अब्ज डॉलरवर पोहोचली आहे. कोव्हिडनंतर एफडीआय आणि एफपीआय प्रवाह सातत्याने वाढत आहेत. <mark>भारताबद्दल गुंतवणूकदारांची भा</mark>वना बरीच सकारात्मक आहे. <mark>पुढे जाऊन, संरक्षण क्षेत्र खुले</mark> झाल्यामुळे, पुढील काही <mark>वर्षांमध्ये या क्षेत्रात भरी</mark>व विदेशी गुंतवणूक होऊ शकते. <mark>भारतात येणाऱ्या एफडीआय</mark>ची एकू<mark>ण</mark> देशांतर्गत उत्पादनाची <mark>टक्केवारी म्हणून गणना के</mark>ली असता २०१९–२० मध्ये <mark>संपलेल्या गेल्या पाच वर्षांमध्ये २.</mark>३–२.६ टक्क्यांच्या <mark>आसपास स्थिर आहे. तथापि</mark>, कोव्हिड—१९ महामारीमुळे <mark>नाममात्र जीडीपीमध्ये घट झाल्यामुळे</mark> तसेच एफडीआय <mark>प्रवाहात तीव्र वाढ झाल्यामुळे</mark> व जि<mark>ओ</mark>मधील गुंतवणुकीमुळे जीडीपीची टक्केवारी जीडीपीच्या ०३ टक्क्यांपेक्षा अधिक असेल म्हणून हे बदलू शकते. एप्रिल–सप्टेंबर या कालावधीत. सहामाही जीडीपीची टक्केवारी म्हणून <mark>एफडीआयचा प्रवाह ३.५</mark> टक्के होता. आर्थिक वर्षाच्या दुसऱ्या सहामाहीत अर्थव्यवस्थेचा विस्तार होत असल्याने ही संख्या कमी होऊ शकते. एफडीआय हे देशाच्या <mark>जागतिकीकरणाच्या पातळीचे</mark> सूचक आहे. जीडीपीची टक्केवारी म्हणून एफडीआय स्थिर राहिली आहे, याचा अर्थ असा की गेल्या काही वर्षांत देशाचे जागतिकीकरण झाले नाही. पण एक लक्षात ठेवायला हवे की, गेल्या पाच वर्षांतही अशी वेळ आली आहे जेव्हा देशांनी जगभरातून आत पाहिले आहे आणि जागतिकीकरणविरोधी भावना समोर आल्या आहेत.\*

## भारतातील निव्वळ विदेशी गुंतवणुकीनिहाय वर्गवारी

भारतातील विदेशी गुंतवणुकीत २०१० ते २०२०—२१ मध्ये किती टक्के वाढ/घट झाली याविषयी माहिती तक्ता १.१ मध्ये दिली आहे.

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VOL-	VIII ISSUE-	VIII AU	GUST	2021	PEER RE\ e-JOURI	/IEW IM NAL	1PACT FACTOR 7.149	ISSN 2349-638x
त	क्ता १.१. भारतात	1ील निव्वळ वर्गीकरण	विदेशी गुंतव	णुकीनुसार	परिण दिसन	ाम झालेला न 1 येते	।सल्याने विदेशी	गुंतवणूक वाढलेली
अ. नं.	वर्ष	गुंतवणूक अमेरिक	दशलक्ष न डॉलर	वाढ/ घट	भारत	ातील विदेशी गुं भारतातील	<b>तवणुकीच्या ओर्घा</b> विदेशी गुंतवणुकीत	<b>नेहाय वर्गवारी</b> 1 कोव्हिड—१९ पूर्वी
०१	२०१०–११	११३	રુ૦૫		व न्	ांतर काय बद	ल झाला याविष	यी माहिती जाणून
०२	२०११–१२	२२०	००६	१०७१०	घेण्या	साठी २०१०	–११ ते २०२	१०–२१ याकाळात
০২	२०१२–१३	१९८	८१९	- २१८७ भारतातील विदेशी गंतवणकीच्या ओघाविषयी माहिती तक्ता				
०४	२०१३–१४	२१८	१६४	१७४५	१.२	मध्ये दिली आहे		
οų	२०१४–१५	३२१	६२८	११०६४	ेतक	ता १.२. भारतात	े नील विदेशी गंतवप	गकीच्या ओघानसार
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११	२०२०—२१	४३९	९५५	९४२	०२	२०११–१२	३९१७७	-२४२०
१२	२०२१–२२*	११९	९८९	-३२०५७	०३	२०१२—१३	४६७१०	७५३३
				स्रोत :	०४	२०१३–१४	२६३८५	–२०३२५
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		S	*एप्रिल-मे	२०२१–२२	०६	२०१५–१६	३१८९१	<i>—४१६७१</i>

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तक्ता १.१ वरुन असे दिसते की, भारतातील निव्वळ विदेशी गुंतवणुकी<mark>विषयी विश्लेषण केले असता</mark> भारतात २०२०–२१ मध्ये ४३९५५ दशलक्ष अमेरिकन डॉलर इतकी सर्वाधिक निव्व<mark>ळ</mark> विदेशी गुंतवणूक झाल्याचे दिसून येते. त्याखालोखाल २०१<mark>९</mark>–२० मध्ये ४३०१३ दशलक्ष अमेरिकन डॉलर इतकी विदेशी गुंतवणूक झाली तर २०१५–१६ मध्ये ३६०२१ दशलक्ष अमेरिकन डॉलर इतकी विदेशी गुंतवणूक झालेली असून एप्रिल—मे २०२१—२२ या दोन महिन्याच्या कालावधीत ११९८९ दशलक्ष अमेरिकन डॉलर इतकी विदेशी गुंतवणूक झाल्याचे दिसते. यावरुन असे स्पष्ट होते की, २०१९–२०, २०२०–२१ व एप्रिल—मे २०२१—२२ या कालावधीत भारतात झालेल्या विदेशी गुंतवणुकीचे प्रमाण लक्षणिय असल्याचे दिसून येते. तसेच चीन मध्ये असणाऱ्या अनेक कंपन्या व त्यांची कार्यालये कोव्हिड–१९ मुळे बंद असल्याने त्यांच्या उत्पादन व उत्पन्नामध्ये घट झाल्याने त्यांनी आशिया खंडात चीन शेजारी असणाऱ्या व जगातील सर्वात मोठी बाजारपेठ असणाऱ्या भारतात विदेशी गुंतवणूक केलेली दिसते. तसेच भारतात कोव्हिड–१९ च्या पहिल्या लाटेचा खूप मोठा

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\*एप्रिल—मे २०२१—२२

तक्ता १.२ वरुन असे दिसते की, भारतातील २०१०--११ ते २०२०--२१ याकाळात विदेशी गुंतवणुकीच्या ओघाविषयी विश्लेषण केले असता एप्रिल-मे २०२१--२२ या दोन महिन्याच्या कालावधीत भारतात १०४५७ दशलक्ष अमेरिकन डॉलर इतकी विदेशी गुंतवणूक झाल्याचे दिसून येते. त्याखालोखाल २०२०--२१ मध्ये ८००९२ दशलक्ष अमेरिकन डॉलर इतकी विदेशी गुंतवणूक तर २०१९--२० या कालावधीत ४४४१७ दशलक्ष अमेरिकन डॉलर इतकी विदेशी गुंतवणूक झालेली असून २०१३--१४ मध्ये सर्वात कमी म्हणजेच २६३८५ दशलक्ष

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## Aayushi International Interdisciplinary Research Journal (AIIRJ)

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अमेरिकन डॉलर इतकी विदेशी गुंतवणूक झालेली दिसते. याचाच अर्थ, भारतात कोव्हिड—१९ च्या कालावधीत म्हणजेच २०१९—२० ते एप्रिल—मे २०२१—२२ या कालावधीत १,३४,९६६ दशलक्ष अमेरिकन डॉलर इतकी विदेशी गुंतवणूक झाल्याचे स्पष्ट होते.

## क्षेत्रनिहाय विदेशी गुंतवणुकीनिहाय वर्गवारी

भारतातील एप्रिल २०१८ ते डिसेंबर २०२० च्या कालावधीत क्षेत्रनिहाय किती दशलक्ष डॉलर विदेशी गुंतवणूक झाली याविषयी माहिती तक्ता १.३ मध्ये दिली आहे.

अ. नं.	क्षेत्र	२०१८— १९ एप्रिल— मार्च	२०१९—२० एप्रिल— मार्च	२०२०—२१ एप्रिल— डिसेंबर
०१	सेवा क्षेत्र	९.१६	७.८५	३.८६
०२	संगणक सॉफ्टवेअर, हार्डवेअर	Ę.82	७.६७	२४.३९
०३	दूरसंचार	२.६७	૪.૪५	०.३५
०४	व्यापार	<mark>४</mark> .४६	४.५७	२.१४
οų	बांधकाम विकास	०.२१	०.६१	०.२७
०६	वाहन उद्योग	२.६२	२.८२	9.89
७७	बांधकाम पायाभूत उपक्रम	२.२६	२.०	૭.૧૫
०८	रसायन	8.96	8.0	०.७३
०९	औषधे व फार्मास्युटिकल्स	०.२६	૦ .ધર્	१.२५
१०	हॉटेल व पर्यटन	<u>۶</u> .0	2.98	०.३२

तक्ता १.३. क्षेत्रनिहाय विदेशी गुंतवणुकीनुसार वर्गीकरण

स्रोत : https://investmentmonitor.ai

तक्ता १.३ वरुन असे दिसते की, भारतात एप्रिल २०१८ ते डिसेंबर २०२० या काळात झालेल्या विदेशी गुंतवणुकीविषयी विश्लेषण केले असता २०१८ ते डिसेंबर २०२० या कालावधीत संगणक सॉफ्टवेअर, हार्डवेअर क्षेत्रात अनुक्रमे ६.४२ दशलक्ष डॉलर, ७.६७ दशलक्ष डॉलर, २४.३९ दशलक्ष डॉलर इतकी गुंतवणूक झाल्याचे दिसते. त्याखालोखाल सेवा क्षेत्रात अनुक्रमे ९.१६ दशलक्ष डॉलर, ७.८५ दशलक्ष डॉलर, ३.८६ दशलक्ष डॉलर इतकी तर बांधकाम पायाभूत उपक्रम क्षेत्रात अनुक्रमे २.२६ दशलक्ष डॉलर, २.० दशलक्ष डॉलर, ७.१५ दशलक्ष डॉलर इतकी विदेशी गुंतवणूक झाली. तसेच व्यापार क्षेत्रात अनुक्रमे ४.४६ दशलक्ष डॉलर, ४.५७दशलक्ष डॉलर, २. १४ दशलक्ष डॉलर इतकी गुंतवणूक झालेली आहे. तसेच बांधकाम विकास क्षेत्रात सर्वात कमी म्हणजेच अनुक्रमे ०. २१ दशलक्ष डॉलर, ०.६१ दशलक्ष डॉलर, ०.२७ दशलक्ष डॉलर इतकी विदेशी गुंतवणूक झाल्याचे दिसून येते. यावरुन असे स्पष्ट होते की, कोव्हिड-१९ च्या काळात संगणक सॉफ्टवेअर, हार्डवेअर क्षेत्रात झालेल्या विदेशी गुंतवणुकीचे प्रमाण लक्षणिय असल्याचे दिसते. यामागचे कारण जाणून घेतले असता भारतात सर्वत्र लागू झालेला लॉकडाऊनमुळे सर्व कामे संगणक व सॉफ्टवेअर, हार्डवेअर इत्यादीच्या माध्यमातून होऊ लागल्याने संगणक सॉफ्टवेअर, हार्डवेअर ची मागणी वाढल्याने विदेशी गुंतवणुकीतही वाढ झाल्याचे स्पष्ट होते.

## सारांश

कोव्हिड—१९ चा परिणाम जगातील सर्वच देशांवर <mark>झाल्याने अर्थव्यवस्थेला आ</mark>र्थिक संक<mark>टांचा सामना करावा</mark> लागला, जगातील अनेक विकसित देशांचा जीडीपी उणे झालेला असन त्यास विकसनशील व अविकसित देशही <mark>सुटलेले नाहीत. जगा</mark>तील अनेक कंपन्यांनी चीनमध्ये <mark>गुंतवणूक व उत्पा</mark>दन सुरु केले होते परंतु कोव्हिड—१९ चा पहिला रुग्ण चीनमध्ये सापडल्याने व चीनवर कोव्हिड े-पसरवल्याचा आरोप झाल्याने अनेक विदेशी कंपन्यांचे प्रंचड आर्थिक नुकसान झाल्याने अनेक कंपन्यांनी आपली गुंतवणूक चीन मधून भारतात करण्यास सुरुवात केली. भारत सरकारने विदेशी गुंतवणुकीला प्रोत्साहन देत अनेक नियम व अटी शिथिल केल्याने विदेशी गुंतवणुकीचा प्रंचड ओघ भारताकडे सुरु झाला यास दुसरे कारण म्हणजे जगातील प्रचंड मोठी बाजारपेठ भारत हे होय. गेल्या २६ महिन्यात म्हणजेच एप्रिल-मे २०२१ पर्यंत भारतात १,३४,९६६ दशलक्ष डॉलर इतकी गुंतवणूक झालेली दिसून येते. विकसनशील भारतात होणाऱ्या विदेशी गुंतवणुकीमुळे विकासाला चालना मिळण्यास सुरुवात होईल आणि विकसनशील भारत विकसित भारत होण्यास यामुळे मदत होईल परंतु ही वाढ टिकवून ठेवण्याची जबाबदारी व इच्छाशक्ती सरकारने टिकवून ठेवल्यास जागतिक उत्पादन

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