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X-RAY POWDER DIFFRACTION PATTERN OF THE COMPLEX OF S_4N_3Cl WITH Zn (II)

S. S. Yadav* & S. P. S. Jadon**

ABSTRACT

From the X-Ray powder diffraction pattern of the complex of S_4N_3Cl with Zn (II), synthesized by refluxing both in DMF and formulated as S_4N_3Cl. ZnO, $Sin^2\theta$, hkl, d, d_{hkl} axial ratios a_o b_o & c_o and axial angels α, β & γ have been calculated suggesting that the complex possesses triclinic geometry.

Key Words : *Diffraction Pattern, Triclinic geometry, Bands, Coordination*

Introduction :

S_4N_4 used as semiconductor and for film coating, therefore it is used as raw material for the present study.

Preparation of S_4N_4 :

S_4N_4 was synthesised by Jolly and Geohring's methods[1]

$$6\,SCl_2 + 16\,NH_3 \xrightarrow{CCl_4} S_4N_4 + 12\,NH_4Cl + 2S$$

Preparation of S_4N_3Cl :

$$S_4N_4 + CH_3COCl \rightarrow S_4N_3Cl + CH_3CNO$$

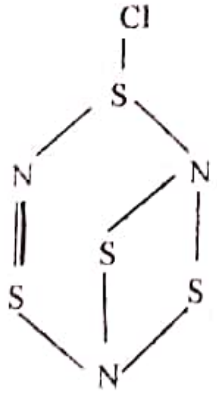

Fig. 1 Structure of S_4N_3Cl

Results & Discussion :

Determination of Molecular Composition

The molecular weight of the S_4N_3Cl ZnO complex 289.64 found the supported by the prominent mass line at m/z 289 in its mass spectra (Tab. 1) other mass lines in the mass pattern are on account of the other fragments as mention in (Tab. 1) Cause by the FAB Fragmentation of the complex.

N--S-->M, 617.2cm^{-1} for S-N free, 696.3 cm^{-1} due to S-N ring, in the range of 1434.9 to 2056.0 cm^{-1} for N-S-Cl bands are observed in the I. R. spectrum of the complex, S_1 (Fig -2. Table-2). The other peaks at in higher region 2185.2-3500 cm^{-1} are according to δ-S-N bands. The appearance of two S-coordinated and two, N-coordinated bands of S_4N_3Cl ring suggest that it has quadridentatedly linked to Zinc Oxide with the sp^3 hybrization in Zinc atom. Due to the coordination S_4N_3Cl ring may be either stretched or distorted, but the presence of δ—S-N bands express the distortion of the ring during the complex formation. The coordination of S_4N_3Cl ring with ZnO may be shown on next page :

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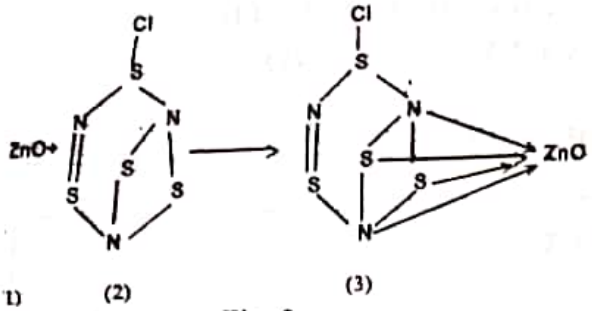

Fig. 2

The appearance of distorted S-N bands indicate that ring has distorted or stretched during the complex formation[2]. The coordination of the S_4N_3Cl ring with ZnO is also support by the higher values of free constant (Table 2) determined for δ—S-N band.

I. R. Spectral Studies :-

$$\bar{\upsilon} = 5.3 \times 10^{-12} \ K/\mu$$

Electronic Spectral Analysis :-

$$f = 4.32 \times 10^{-9} \times \varepsilon_m \times \Delta\upsilon_{1/2}$$

$$Nc = 2.52 \times 10^{19} \times e^{-\Delta Eg/KT}$$

X-Ray Powder Diffraction Pattern :-

$$a_0 = \sqrt{\frac{n^2\lambda^2}{4q}}$$

$$\cos\phi = hh'+kk'+ll' / \sqrt{(h^2+k^2+l^2) \times (h'^2+k'^2+l'^2)}$$

&

$$\frac{a_0}{b_0} = \frac{\sin\phi_1}{\sin\phi_2} \quad , \quad \frac{c_0}{b_0} = \frac{\sin\phi_3}{\sin\phi_4}$$

Table -1 Mass Data of the Complex S_4N_3Cl ZnO

S.No.	M/Z Ratio	Band Assignment
1.	107	3Cl
2.	136	2 (S - Cl)
3.	154	$(N - S - N)_2$ - Cl
4.	170	$(S_4N_3^+)$
5.	191	(S_4N_2Cl)
6.	207	(S_4N_3Cl)
7.	228	(S_3N_2Cl) - (S - Cl)
8.	249	$(S_4N_3 - Zn)$ - (M - 2)
9.	267	$(S_4N_3Cl - Zn^{++})$ (M - 2)
10.	279	(S_5N_6Cl)
11.	281	$S_4N_3Cl - S_2N$
12.	289	S_4N_3Cl - ZnO (M + 2)
13.	307	$S_5N_4Cl_3$
14.	325	$(S_4N_2Cl - ZnO)$ - Cl (M + 2)
15.	345	$(S_3N_3Cl - ZnO - S_2N_2$
16.	370	$(S_4N_4Cl - ZnO - (N - S - Cl)$
17.	414	$(S_4N_4Cl - ZnO - (S_2N_2Cl)$
18.	455	$(S_4N_3Cl - ZnO) - (S_4N_4^+)$
19.	485	$(S_4N_3Cl \rightarrow Zn - Cl) - (S - N - Zn - Cl)$

Table -1 (Cont. .....)

S.No.	M/Z Ratio	Band Assignment
20.	510	$(S_4N_3\,Cl \rightarrow Zn - Cl) - ZnO - S_3N$ (M - 3)
21.	572	$(S_4N_3\,Cl - ZnO)_2$
22.	582	$(S_4N_3\,Cl \rightarrow Zn - Cl) - ZnO\,(S - N) - (S - Cl)_2$ (M - 2)
23.	610	$(S_4N_3\,Cl - ZnO)_2 - Cl$
24.	646	$(S_4N_3\,Cl \rightarrow Zn - Cl)_2$
25.	661	$(S_4N_3 - Cl)_3 - (S - N)$
26.	706	$(S_4N_3\,Cl - ZnO)_2 - Cl - (N_2 - S - Cl)$
27.	763	$(S_4N_3\,Cl)_3 - S_2N) - (S - Cl)$
28.	799	$(S_4N_3\,Cl - ZnO)_2 - S_4N_2Cl$
29.	813	$(S_4N_3\,Cl - ZnO)_2 - S_4N_3Cl_2$
30.	852	$(S_4N_3\,Cl - ZnO)_2 - S_4N_3Cl_3$
31.	860	$(S_4N_3\,Cl - ZnO)_3$ (M + 1)
32.	895	$(S_4N_3Cl - ZnO)_3 - Cl$
33.	928	$(S_4N_3Cl - ZnO)_3 - (S - Cl)$
34.	962	$(S_4N_3Cl - ZnO)_3\,Cl - (S - Cl)$
35.	1010	$(S_4N_3Cl - ZnO)_3\,ZnO - (S - Cl)$
36.	1077	$(S_4N_3Cl - ZnO)_3\,ZnO - (S - Cl)_2$

Table -2, I. R. Spectrum data of the Complex - S_4N_3Cl ZnO

S. No.	Vibrations cm^{-1} (υ)	% of Trans-mittance	Assignment of Bands	Force Constant ($Kx10^5$) dyne/cm^2
1.	418.5 (S)	18.796	S - Cl	1.742
2.	430.1 (S)	43.003	S - Cl	1.839
3.	441.7 (S)	39.351	N - S -> M	1.123
4.	538.1 (S)	27.762	N - S -> M	1.667
5.	617.2 (b-s)	16.742	S - N free	2.193

6,	696.3 (b - s)	23.127	S - N ring	2.791
7.	987.5 (S)	27.650	S - N -> M	5.613
8.	1072.3 (b - d)	14.802	S - N -> M	6.619
9.	1434.9 (S)	21.439	N - S - C1	9.309
10.	1629.7 (b -d)	36.110	N - S - C1	12.008
11.	2056.0 (S)	78.121	N - S - C1	19.112
12.	2185.2 (S)	77.278	δ - S - N	27.488
13.	2356.9 (S)	83.805	δ - S - N	31.977
14.	2617.2 (W)	96.711	δ - S - N	39.430
15.	2987.5 - (b) 3512.1	24.002-20.496	δ - S - N	51.378-71.005

Table -3 X. R. D. Pattern of the Complex - $S_4N_3Cl.ZnO$

S. No.	Intensity I / I_0	2θ (°)	$Sin^2\theta$	$(h^2+k^2+l^2) \times Q$	hkl	d (Å) (Observed)	d_{hkl} (Å)
1.	59.04	20.40	0.0314	0.0314 x (1)	100	4.353684	4.353684
2.	45.92	22.79	0.0390	0.0390 x (1)	100	3.902508	3.902508
3.	99.19	26.47	0.0525	0.0525 x (l)	100	3.367431	3.367431
4.	52.72	28.56	0.0609	0.0305 x (2)	110	3.125605	2.210470
5.	51.35	29.25	0.0638	0.0319 x (2)	110	3.052751	2.158947
6.	47.89	30,65	0.0699	0.0395 x (2)	101	2.917089	2.063005
7.	34.01	33.79	0.0845	0.0423 x (2)	110	2.653255	1.876418
8.	22.32	38.96	0.1112	0.0371 x (3)	111	2.311931	1.334834
9.	21.70	41.74	0.1270	0.0318 x (4)	200	2.163834	1.081917
10.	55.02	44.03	0.1406	0.0352 x (4)	200	2.056528	1.028264
11.	20.83	46.77	0.1576	0.0316 x (5)	210	1.942379	0.868685
12.	56.51	52.09	0.1928	0.0322 x (6)	211	1.755708	0.716651
13.	22.27	54.53	0.2099	0.0349 x (6)	211	1.682838	0.686873
14.	20.36	70.65	0.3344	0.0335 x (10)	310	1.333272	0.421655

Table -4 Axial Distances & Axial Angles of the Complex - $S_4N_3Cl.ZnO$

S.No.	a_0(Å)	b_0(Å)	c_0(Å)	α(Å)	β(Å)	γ(Å)
1.	4.346918	3.601732	2.020483	125.305	140.600	94.096
2.	3;900443	3.231795	1.812958	125.305	140.600	94.096
3.	3.361759	2.785457	1.562573	125.305	140.600	94.096
4.	4.410587	3.654486	2.050077	91.809	121.050	147.140
5.	4.312717	3.573394	2.004586	91.809	121.050	147.140
6.	3.875679	3.211276	1.801448	91.809	121.050	147.140
7.	3.745209	3.103173	1.740804	91.809	121.050	147.140
8.	3.999073	3.313517	1.858802	140.599	85.904	133.496
9.	4.319492	3.579007	2.007736	120.737	100.795	138.466
10.	8.211168	6.803539	3.816619	120.737	100.795	138.466
11.	8.666280	7.180632	4.028159	144.250	76.842	138.466
12.	8.585158	7.113416	3.990453	119.348	102.137	136.941
13.	8.246384	6.832718	3.832988	119.348	102.137	136.941
14.	12.625401	10.461046	5.868391	123.685	97.151	143.193

Experimental:

Electronic Spectral Analysis :

The UV Spectrum of the complex recording in the range of 200-800 nm has to bands out of which the former assignment at 207.2 nm (48262.54 cm^{-1}) equivalent to 5.98 eV energy is due to the ionic environment for the charge transfer transition[3]. While the latter band at 288.8 nm (34620.03 cm^{-1}) equivalent 4.29 eV energy is due to the covalent bond in the S_4N_3 ring. This is also supported by the values of frequency ratio υ_1/υ_2 0.7175 < 2 and oscillator strength '*f*' of the order of 10^{-5} for the spin allowed Lapporte forbidden transition i.e. for covalency in the complex.[4] The low value of band gap energy Δ Eg = 0.8453 (eV) and high value of conductivity electron 2.515 x 10^3 infers the good conductivity of the complex. The results show that Zn^{2+} ion has linked quadridentatedly to S_4N_3Cl.

X-Ray Analysis :-

The X-Ray powder diffraction spectrum of the complex was recorded in the 2 θ range 10^o to 90^o and from the XRD pattern the value of $\sin^2\theta$, miller indices, hkl and inter planer distance 'd' were calculated (tab. 3) and resembles to the theoretical work[5-6]. The values of axial ratios and axial angles were calculated by the using formulas given on page no. 2

The value of the axial ratios and axial angles (Tab. 4) founds are according to the triclinic geometry of the complex.

Conclusions :

The complex of S_4N_3Cl synthesized with ZnO is formulated as S_4N_3Cl ZnO on the basis of its analytical data and its mass spectrum. The formation of the complex is also supported by the bands found in its IR spectrum suggesting quadridentated coordination of N-atom S_4N_3 ring to Zn^{2+} ions. Above opinion is also held by the U.V. spectrum analysis. The XRD investigations suggested the triclinic geometry of the complex.

Acknowledgement :

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ROLE OF OPTIMIZATION TECHNIQUES IN CONTROL FOR OXYGEN DEPLETION IN AN AQUATIC SYSTEM

Dr. Shubhnesh Kumar Goyal*

ABSTRACT

Oxygen is required to support aquatic life and maintain water quality; it is the most important dissolved gas in water. A small amount of oxygen, up to ten molecules of oxygen per million of water, is actually dissolved in water. Fish and other aquatic creature breathe Dissolved oxygen (DO) and without sufficient oxygen mortality will occur. In this work we give the Mathematical Model for the interaction between oxygen transport and oxygen use up by contaminants in polluted water bodies and derive the optimal control for the resulting coupled system .We also examine the existence of the solution and then state the optimality conditions. Further the Optimization Techniques is to be discussed to obtain a feasible solution of the Mathematical model.

Key Words : Optimal control, oxygen transport, water pollution, optimization techniques

INTRODUCTION

What's in a glass, a sink, a river full of water...A refreshing drink.....A cleansing wash.....an invigorating swim....A home for plants, insects, fish, birds and mammals. It all depends on water quality.

We tend to think of water in terms of a particular purpose. Is the quality of the water good enough for the use, we want to make of it? Water fit for one use may be unfit for another. We may for instance, trust the quality of lake water enough to swim in it but not enough to drink it. Along the same line, drinking water can be used for irrigation may not meet drinking water standards. It is the quality of the water which determines its uses.

Scientists, on the other hand, are interested in other aspects of water quality. To them quality is determined by the kinds and amounts of substances dissolved and suspended in the water and what those substances do to inhabitants of the ecosystem.

It is the concentrations of these substances that determines the water quality and its suitability for particular purposes [1].

It is easy to dispose of waste by dumping it into a river or lake. In large or small amounts dumped intentionally or accidentally, it may carried away by the current, but will never disappear. It will reappear downstream, sometimes in changed form, or just diluted. Freshwater bodies have a great ability to breakdown some waste materials, but not in the quantities discarded by today's society. This overload that result is called pollution, eventually

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puts the ecosystem out of balance.

Sometimes nature itself can produce these imbalances. In some studies, the natural composition of the water make it unfit for certain uses.

But most often our waterways are being polluted by municipal, agricultural and industrial wastes, including many toxic synthetic chemicals which can't be broken down at all by natural processes. Even in tiny amounts, some of these substances can cause serious harm.

Many causes of pollution including sewage & fertilizers contain nutrients such as nitrates and phosphates. In excess levels nutrients over stimulate the growth of aquatic plants and algae. Excessive growth of these types of organisms consequently clogs our waterways used up dissolved oxygen as they decompose and blocked light to deeper waters. This, in turn, proves very harmful to aquatic organisms as it affects the respiration ability of fish and other invertebrates that resides in water [2].

Oxygen is required to support aquatic life and maintain water quality; it is the most important gas in water. Water in equilibrium with air at 25 degree centigrade's contains 8.3 mg per liters of dissolved oxygen. Although water molecules contain oxygen atoms, this oxygen is what is needed by aquatic organisms living in natural waters. A small amount of oxygen, up to ten molecules of oxygen per million of water, is actually dissolved in water. Fish and other creature breathe dissolved oxygen and without sufficient oxygen mortality will occur.

Dissolved Oxygen (DO) concentrations are affected by a number of factors. Higher DO is produced by turbulent actions such as waves, which makes air and water. Lower water temperature also allows for retentions of higher DO concentration. Low DO level tends to occur more often in warmer, slow moving waters. In general low DO level occurs during the warmest summer months & particularly during low period.

Water depth is also a factor, in deep slow moving waters DO concentrations may be high near the surface due to wind action and plant photosynthesis, but may be entirely depleted (anoxic) at the bottom [2].

Oxygen consuming wastes include decomposing organic matter or chemicals that reduce DO in the water. Raw domestic wastewater contains high concentrations of oxygen consuming wastes that need to be removed before it can be discharged into a waterway. Maintaining a sufficient level of DO in water is critical to most form of aquatic life.

Microorganisms such as bacteria are responsible for decomposing of organic waste. When organic matter such as dead plants, leaves clippings, manure sewage, or even food waste is present in the water supply, the bacteria will begin the process of breaking down this waste . When this happens, much of the available DO is consumed by aerobic bacteria, robbing other aquatic organism of the oxygen they need to live.

The first part of this work studies the mathematical models which can be used to stimulate the interaction of pollutants with oxygen in aquatic media.

Results & Discussion

Interactive Transport Models : Water pollution is caused by wastewater discharges into rivers, lakes, ponds etc. containing organic substances or excessive heat from both domestic or

industrials origin. Apart from urban areas, chemical, food and paper industries are among the most important sources of pollution.

An organic pollutant, such as human and animal fecal wastes, is thoroughly mixed in the water of a river which is moving downstream at a constant velocity 'c'. The concentration ρ of the pollutant in the river is homogeneous in all direction except that of the downstream on, which we take to be from left to right along the x-axis. The river is thereby modeled by an advective on in one dimension. Diffusive effects due to river turbulence and irregularities in its contours as it meanders downstream are all ignored. However, the pollutant is allowed to decay in the water due to bacterial action, which gradually decomposes it [3].

Let 'k' be the rate at which the pollutant density is degraded. We assume it to be proportional to the density itself:

$$k(x, t) = -\mu\rho(x, t),$$

Where 'μ' is a prortionality constant that measure the efficiency of bacterial action. Since an advective model appropriate, the equation then is:

$$\frac{\partial}{\partial t}\rho(x,t) = -c\frac{\partial}{\partial x}\rho(x,t) - \mu\rho(x,t) \quad \text{.....[1]}$$

The bacterial decomposition of the pollutant requires an uptake of DO in the water. As the pollutant is degraded, oxygen is used up. Let $\delta(x, t)$ be the density of DO in the river. Its maximum value, which depends on temperature, is δ_m. we assume it to be a known fixed quantity. The rate at which the oxygen dissipated is the same as that of the pollutant decay and is proportional to the pollutant concentration.

$$k_1(x, t) = -\mu\rho(x,t)$$

There is a source term due to the fact that the river surface, in contact with air above, draws oxygen in form the atmosphere by the process as Re-oxygenation. This happens at a rate proportional to the difference the saturation level δ_m and the actual δ Thus:

$$k_2(x,t) = \mu_1[\delta_m - \delta(x,t)]$$

Thus the oxygen ow equation is given as:

$$\frac{\partial}{\partial t}\delta(x, t) = -c\frac{\partial}{\partial x}\delta(x, t) - \mu\rho(x,t) + \mu_1[\delta_m - \delta(x,t)] \quad \text{.....[2]}$$

Thus our coupled system is:

$$\frac{\partial}{\partial t}\rho(x, t) = -c\frac{\partial}{\partial x}\rho(x, t) - \mu\rho(x,t)$$

$$\frac{\partial}{\partial t}\delta(x, t) = -c\frac{\partial}{\partial x}\delta(x, t) - \mu\rho(x,t) + \mu_1[\delta_m - \delta(x, t)] \quad \text{.....[3]}$$

The optimal control problem :

We state the optimal control problem. We look for a $(\rho, \delta, \upsilon) \in H^1(\Omega) \times H^1(\Omega)\ H^1(\Omega) \times U$ Such that the cost functional:

$$J(\rho,\upsilon) = \frac{1}{2}\int_Q |\rho - \rho_d|^2\, dxdt + \frac{\xi}{2}\|\upsilon_1\|_{L^2(\Sigma)} + \frac{\zeta}{2}\|\upsilon_2\|_{L^2(\Sigma)} \quad \text{.....[4]}$$

is minimized subject to the constraints –

$$\begin{aligned}
&(\rho, \varphi_1) + \alpha_1[\rho,\varphi_1] = (\upsilon_1, \varphi_1) && \forall\varphi_1 \in H^1(\Omega), \upsilon_1 \in L^2(\Sigma)\\
&\rho(x, 0) = \rho_0 && \text{in } \Omega\\
&-\frac{\partial}{\partial n}\rho(x, t) = \upsilon_1 && \text{on } \Sigma\\
&(\delta, \varphi) + \alpha_2[\delta,\varphi_2] = (\upsilon_2,\varphi_2) && \forall\varphi_2 \in H^1(\Omega), \upsilon_2 \in L^2(\Sigma)\\
&\delta(x, 0) = \delta_0 && \text{in } \Omega\\
&-\frac{\partial}{\partial n}\delta(x, t) = \upsilon_2 && \text{on } \Sigma
\end{aligned} \quad \text{.....[5]}$$

The control space 'U' is a closed convex subset of

$$L^2(\Sigma) \times L^2(\Sigma).\upsilon = \{\upsilon_1,\upsilon_2\}$$

is the control and the corresponding state $\rho = \rho(\upsilon_1)$ and $\delta = (\upsilon)^2$ is the solution of [5] above. $\rho_d \in L^2(Q)$ is a target state that we would like to obtain by controlling ρ and $\xi, \xi > 0$.

Let υ_{ad} the admissible space of control, be defined as:

υ_{ad}= $\{(\rho,\delta,\upsilon)\in H^1(\Omega)\times U: J(\rho,\upsilon)<\infty\}$ [5] are satisfied.

.....[6]

Then $(\bar{\rho}, \bar{\upsilon})\in U_{ad}$ is called an optimal solution if there exist $\epsilon>0$ such that-

$J(\bar{\rho}, \bar{\upsilon}) \le J(\rho,\upsilon) \quad \forall(\rho,\upsilon)\in U_{ad}$

.....[7]

Satisfying

$\|\bar{\rho}-\rho\|_{H^1(\Omega)}\|\bar{\upsilon}_2-\upsilon_2\|_{L^2(\Sigma)}\|\bar{\upsilon}_2-\upsilon_2\|_{L^2(\Sigma)}<\epsilon$

.....[8]

If, for optimal solution $(\rho, \upsilon)\in U_{ad}$ inequalities [7] and [8] holds true with $\epsilon = \infty$ then we say that $(\bar{\rho}, \bar{\upsilon})$ is the global minimum. The optimal control problem can now be formulated as a constrainted minimization in Hilbert Space :

$\min_{(\rho, \upsilon)\in Uad} J(\rho,\upsilon)$ .....[9]

The second part of this work, is to be discussed some optimization techniques to obtain a feasible solution of the mathematical model, result of the first part.

Some investigators have described some of the proposed groundwater management models as optimal control problems. They classified the system variables as control variables and state variables. In optimal control problem formulations, the control variables govern the evolution of the system from one stage to the next and the state variables describe the behavior of the system at any stage. The optimal control problems involve a number of stages where each stage evolves from the previous stage in a prescribed manner. The problem is to find a set of control or design variables such that the total objective function i.e. performance index over the total number of stages is minimized subject to certain constrained on the state and control variable [8].

In optimal control problem the response equations constitute the core of the problem. The response equations explicitly show the dependence of the state variables of the possible planning design or operational decisions. In groundwater planning and management applications, the response equations are obtained by transformation of the system's governing partial differential equations using either the finite element technique or the finite difference technique. The optimal control problem formulations allow the possibilities of the joint parameter identification and management, and simultaneous state variable prediction and resource management.

Willis and Newman (1977) [4-5] formulated a dynamic management model as a problem in optimal control. The problem was solved by using the mathematical programming technique. The management problem consisted of a nonlinear concave objective function and linear convex constrained. The solution algorithm of Tui (1965) [6] was used to solve the optimization problem. This algorithm linearised the objective function with Tailor's series expansion about an initial feasible decision vector, and solve linear sub problem to obtain a new basis.

Dynamic programming (DP) techniques are also used to solve multistage decision problems. In the DP a multistage decision problem is decomposed into a sequence of single stage problem. Individual single stage problem s may be solved by any method of optimization. The advantage of using the DP technique is that it can deal with discrete variables, nonconvex, non-continuous and non-differentiable function. It can also take into account stochastic variability by a simple modification of the deterministic procedure. It requires the separability and monotonicity of the objective function. A detailed of various DP approaches used in water resources management is given by Yakowitz (1982) [7].

The existence of optimal solution : We now show the existence of an optimal solution :

Theorem : There exists a unique optimal solution $(\bar{\rho}, \bar{\upsilon})$ of [9].

Proof : The set U_{ad} is nonempty, thus we may choose a minimizing sequence $(\rho(\upsilon^n_1), \upsilon^n)$ in U_{ad} such that $\lim_{n\to\infty} J(\rho^n,\upsilon^n)=\inf_{(\rho,\upsilon)\in U_{ad}} J(\rho,\upsilon)$

Set $\rho(\upsilon^n_1) = \rho^n$. By definition of U_{ad}, we have

$$(\rho^n,\varphi_1) + \alpha_1[\rho^n,\varphi_1] = (\upsilon_1{}^n\varphi_1) \qquad \forall\varphi_1\in H^1(\Omega)$$
$$(\delta^n,\varphi_2) + \alpha_2[\delta^n,\varphi_2] = (\upsilon_1{}^n\varphi_2) \qquad \forall\varphi_2\in H^1(\Omega)$$

$$\frac{\partial}{\partial n}\rho^n(x,t)=\upsilon_1 \quad \frac{\partial}{\partial n}\delta^n(x,t)=\upsilon_2 \text{On}(\Sigma) \quad \ldots\ldots[10]$$

By virtue of the term $\xi\|\upsilon_1\|^2 L^2(\Sigma)$ and $\xi\|\upsilon_2\|^2 L^2(\Sigma)$ in (4) and form (6), we see that $\|\upsilon^n_1\|_{L^2(\Sigma)}$ and $\|\upsilon^n_2\|_{L^2(\Sigma)}$ are uniformly bounded. Also from (2) and (3) we have that the sequences $\|\rho^n\|_{H(\Omega)}$ and $\|\delta\|^n_{H(\Omega)}$ are uniformly bounded since the embedding from $H^1(\Omega)\to\to L^2(\Omega)$ is compact and using a compactness and lemma, it follows that we may extract a subsequence, denoted again by ρ^n,δ^n and υ^n such that

$$\upsilon^n_1\to\bar{\upsilon}_1 \text{ and } \upsilon^n_2\to\bar{\upsilon}_2 \text{ in } L^2(\Sigma)$$
$$\rho^n\to\bar{\rho} \text{ and } \delta^n\to\bar{\delta} \text{ in } L^2[O,T:H^1(\Omega)]$$
$$\frac{d\rho^n}{dt}\to\frac{d\bar{\rho}}{dt} \text{ and } \frac{d\delta^n}{dt}\to\frac{d\bar{\delta}}{dt} \text{ in } L^2[O,T:H^1(\Omega)]$$
$$\rho^n\to\bar{\rho} \text{ and } \delta^n\to\bar{\delta} \text{ in } L^2(\Omega)$$

Since $J(\rho, \upsilon)$ is lower semi continuous, we may conclude that $(\hat{\rho}, \hat{\upsilon})$ is an

$$J(\hat{\rho}, \hat{\upsilon}) = \inf J(\rho, \upsilon)$$

optimal solution i.e., $(\rho, \upsilon)\in U_{ad}$

CONCLUSION

We have discuss herein the optimal control problem for oxygen depletion in an aquatic system as the problem of constrained minimization in Hilbert Space and the coupled contaminated transport problem with optimal conditions. We have also discussed the existence of optimal solution based on standard technique. Further the approach of optimization is discuss. In the subsequent work , we shall discuss the optimal feasible solution of this Mathematical Model /problem.

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175 MeV Au^{+13} ION IRRADIATION INDUCED STRUCTURAL & MORPHOLOGICAL MODIFICATIONS IN ZINC OXIDE THIN FILMS

Devendra Singh[1*], Aditya Sharma[1-2], Mayora Varshney[1], Shailendra Kumar[3] & K. D.Verma[1]

ABSTRACT :

Thin films of ZnO were deposited, on Si substrates, using the RF-sputtering technique and irradiated by the 175 MeV Au^{+13} beams. The structural changes were investigated by x-ray diffraction (XRD) measurements. The particle size found to increase with the increasing ion fluence up to 1×10^{12} ion/cm^2. At highest irradiation fluence of 5×10^{12} ion/cm^2 the average particle size decreases. The Raman spectroscopy measurements were performed to understand the local phonon mode of the samples. The surface morphology of the as-deposited and irradiated thin films is measured by the Atomic Force Microscopy (AFM).

Key Words : Thin films, XRD, AFM, and Raman.

INTRODUCTION :

Zinc oxide is the material which having the wide energy band gap of 3.37 eV with large exciton binding energy (60 meV) [1-2]. There are very few reports are available in which pristine ZnO's properties are tailored by inducing defects or by annealing the samples [3-4] ions (ranging from few KeV to hundreds of MeV) pass through a material, loss their energy and material gains energy which leads to generation of various defects. These defects help to modify materials physical/chemical properties. In the present study, we report the effect of 175 MeV Au ion irradiation on structural and morphological properties of pristine ZnO thin film deposited on Si substrate.

EXPERIMENTAL DETAIL :

ZnO thin films were deposited on Si substrate using RF-sputtering technique. The ZnO thin films were irradiated with 175 MeV Au^{13+} ions beams with three different fluences. The structural study on un-irradiated and irradiated samples was done by (θ-2θ) XRD using Brooker D8 advanced diffractometer with Cu Kα radiation (λ = 1.540 Å). The Raman scattering measurements were performed using In-Via Raman microscope. Surface morphology was studied by AFM using digital Nanoscope IIIa SPM, in tapping mode.

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Result and discussion :

Structural properties of ZnO films were studied by XRD (θ-2θ) measurements (Fig. 1).

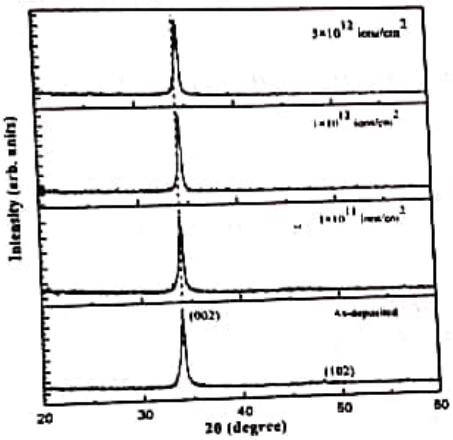

Figure 1. XRD patterns of as-deposited and irradiated ZnO thin films.

Figure 1 shows the typical XRD pattern of pristine and 175MeV Au $^{+13}$ ion irradiated ZnO thin films. It is clearly visible from the figure that pristine ZnO film has (002) and (102) plane of ZnO, having hexagonal structure (JCPDS# 702205). After the irradiated the intensity of (002) peak is decreases whereas (102) peak is almost vanished in irradiated films. With the irradiation position of (002) peak is shifted towards higher 20 angle side and FWHM of the (002) peak of film is continuously decreases up to the irradiation fluence of 1 x 10^{12} ion/cm^2. At the highest fluence i.e. 5 x 10^{12} ion/cm^2 the FWHM of (Xf) peak is again increased. The average particle size, lattice parameters, and strain produced in the films are calculated (see table 1). Thus XRD results conclude that with increasing irradiation fluence the grain growth takes place and strain releases. Whereas, at highest fluence of irradiation (i.e. 5 x 10^{12} ion/cm^2), the average panicle size is decreases, and hence strain increase, which is due to the formation of large number of irradiation induced defects in the film. At highest fluence the decrease in crystallites size may arise due to the sputtering of atoms by SHI irradiation.

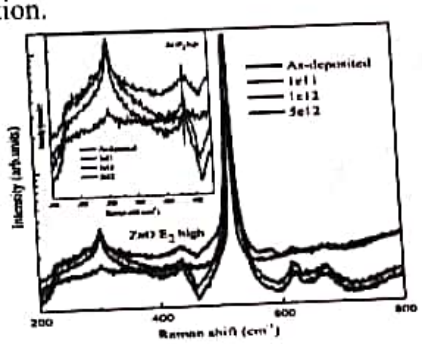

Figure 2. Raman spectra of ZnO films

Figure 2 shows the Raman spectra of as-deposited and irradiated ZnO thin films and reflect typical features of ZnO. At the fluence of 1 x 10^{12} ion/cm^2 the FWHM of the E_2 high mode is constantly increase and the intensity of the peak is diminished. Such features indicate the creation of large density of deep level effects like oxygen vacancies and grain growth as evidenced in XRD measurements. Fig. 3 shows the two dimensional (2D) images of (a) as-deposited, (b) 1 x10^{11} ion/cm^2, (c) 1 x 10^{12} ion/cm^2 and (d) 5 x 10^{12} ion/cm^2 irradiated ZnO thin films, respectively. It is clear from the Fig. 3(a) that, as-deposited ZnO thin film, show a few randomly distributed nano-structures, having different size and shape, on the film surface. From the morphology of the irradiated films (Fig. 3(b), (c) and (d)), it is observed that irradiation with 175 MeV Au ions lead to modify the surface nano-structures. Our AFM results strengthened the grain growth on increasing the irradiation fluence up to 1 x 10^{12}

ion/cm^2 and decrease in the particle size at the irradiation fluence 5 x 10^{12} ion/cm^2 thus supports our XRD and Raman measurements.

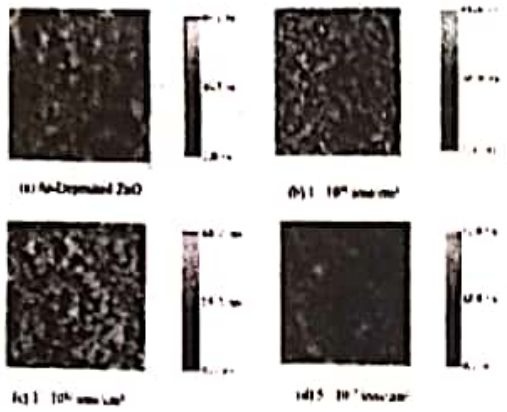

Figure 3. AFM images of ZnO films

CONCLUSIONS

Well crystalline ZnO thin films on Si substrate were deposited by RF-sputtering technique and irradiated with 175 MeV Au^{+13} ion beam. The XRD results revels that at low irradiation fluences, up to 1 x 10^{12} ion/cm^2, ZnO thin films release the strain and show irradiation induced grain growth.

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Table 1

Sample name	Particle size (nm)	Lattice Parameter 'a' (Å)	Lattice Constant 'c' (Å)	c/a ratio	Strain (%)
As-deposited	16.756	3.185	5.2664	1.6535	0.1177
1 x 10^{11} ions/cm^2	17.698	3.185	5.2665	1.6535	0.0988
1 x 10^{12} ions/cm^2	21.502	3.185	5.236	1.6439	0.0802
5 x 10^{12} ions/cm^2	17.902	3.185	5.231	1.6423	0.0959

ASSESSMENT OF COMPARATIVE PENETRABILITY OF TRANSFERSOMES AT DIFFERENT PH

Neha Varshney* & Harendra K. Gaur**

ABSTRACT

There are many types of vesicular systems available for transdermal drug delivery which comes under the range of nanotechnology. Transfersome® is one of the names of vesicle of them which have several advantages over the other biodegradable nanoparticles and therefore used for transdermal drug delivery. Transfersomes® can deform and pass through narrow constriction (from 5-10 times less than their own diameter) without measurable loss. This present study was taken to synthesize the biodegradable nanoparticles (Transfersomes®) and check the effect of pH on the stability of Transfersomes® by their penetrability. The penetrability of Transfersomes® is directly proportional to pressure. And the factor affecting rigidity is pH. The hydration of molecules in the vesicles will lead to aggregation.

Keywords-*Transfersomes®, transdermal drug delivery, nanotechnology, biodegradable nanoparticles.*

Introduction : Vesicles are basically colloidal particles having a water filled core surrounded by a wall of lipids and surfactants (amphiphiles) arranged in bilayer. Vesicular systems for transdermal delivery of drugs are gaining importance recently owing to their ability to act as a means of sustained release of drugs, ability to target organs for drug delivery, biodegradability, and lack of toxicity, and most importantly it provides patients convenience. One strategy to modulate skin permeability is through the use of vesicles loaded with active agents (Benson et al 2006 & Elsayed *et al* 2007). The origin of liposome can be traced back to the contribution of Bangham *et al* in the mid-1960s. Recently, it became evident that, in most cases, classic liposomes are of little or no value as carriers for transdermal drug delivery as they do not deeply penetrate skin, but rather remain confined to upper layers of the stratum corneum. Whether niosomes have advantages over liposomes beyond their economy and chemical stability remains to be determined. In 1997 Touitou *et al* developed ethosomes, new soft vesicular carriers mainly consisting of phospholipids and ethanol. Their name was chosen to emphasize the presence of high concentrations of ethanol (20 - 45%). It has been shown that the physico-chemical characteristics of ethosomes allow this vesicular carrier to transport active substances more efficaciously through the SC into the deeper layers of the skin than conventional liposomes. Over the last two decades, intensive research led to the introduction and development, of a new class of lipid vesicles, the highly deformable (elastic or ultra flexible) Transfersomes®. The concept and term of these elastic vesicles was introduced first by Ceve G 1992. Transfersomes® were developed in order to take the advantages of phospholipids vesicles as transdermal drug carrier. Flexibility of Transfersomes® membrane is achieved by mixing

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suitable surface-active components in the proper ratio. (Cevc G *et al* 1991). Transfersomes® can deform and pass through narrow constriction (from 5-10 times less than their own diameter) without measurable loss. pH of medium is one of the main factors of them, because entrapment 'efficiency of Transfersomes® greatly depends on the pH of medium.

Materials & Method : For the size characterization of Transfersomes®, we use following chemicals i.e. Soybeanphos phatidylcholine **(SPC)** Nattermann Phospholipids (Rhone-Poulenc Rorer, Cologne, Germany). Used as bilayer former, **tween80** (Merck) used as surfactant, ethanol (Merck) used as a solvent and **phosphate buffer** of pH 6.5, 7.0 and 7.5 (50mM) used as hydrating medium (Cevc G *et al* 1995, 98).

Process of Preparation of Transfersomes®

Step 1- We calculated 10 wt % of SPC (Molecular Weight =800, as basic bilayer former) and Tween 80 (Molecular weight 1310) as surfactant for molar ratio 3 : 1.

Step 2- SPC was vortexed in ethanol and when it was completely dissolved, we added Tween 80 and vortexed the mixture till it had completely dissolved.

Step 3- 50mM phosphate buffer of pH (6.5, 7.0, and 7.5) was added as hydrating medium.

Step 4- The suspension was then subjected to three cycles of freeze & thawing for preparing equal size nanoparticles.

Step 5- The resulting suspension was then passed through the extruder fitted with 20 nm. pore size filter membrane at pressure 0.1 Mpa, and time interval 60 sec.

Step 6- The flow rate value (mg/sec)=Weight of filtrate for a specific time interval / Time Internal.

Step 7- The penetrability value = Av Flow (mg/sec) / Pressure (MPa) x Area of Filter (cm^2)

Results and Discussion : The penetrability of Transfersomes® is directly proportional to pressure. Greater the pressure, the larger the force to deform vesicles and allow them to pass through 20 nm filter. Similarly, beyond optimum pH, the vesicles tends to aggregate. Thereby, decreasing the deformability and the efficiency to pass through small pores like 20 nm decreases. However the force applied also depends on the deformability. The rigid the vesicle, the larger force is required to pass the material across. One of the factors affecting rigidity is pH. The hydration of molecules in the vesicles will lead to aggregation.

This figure shows the penetrability of Transfersomes® at pH 7.5 and the applied pressure is 0.1 MPa. The penetrability of Transfer somes® is decreases from passage 1 to passage 2.

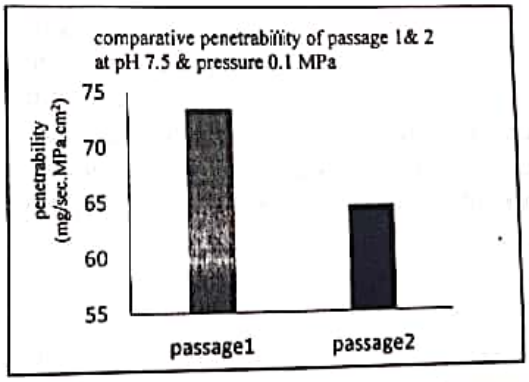

Fig-1 depicts the comparative penetrability of passage 1 and 2 of Transfersomes® at pH-7.5 and applied pressure is O.lMPa.

This figure also shows the penetrability of Transfersomes® at pH 7.0 and the applied pressure is O.lMPa. The penetrability of Transfersomes® is also decreases from passage 1 to passage 2.

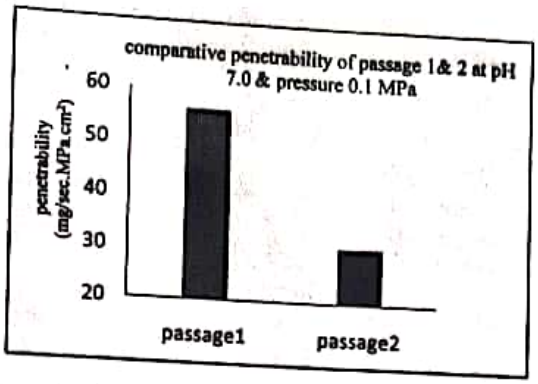

Fig-2 Depicts the comparative penetrability of passage 1 and 2 of Transfersomes® at pH-7.0 and applied pressure is O.lMPa.

Thus elevating the absorbance values as well as lowering the penetrability figure 3 demonstrates-

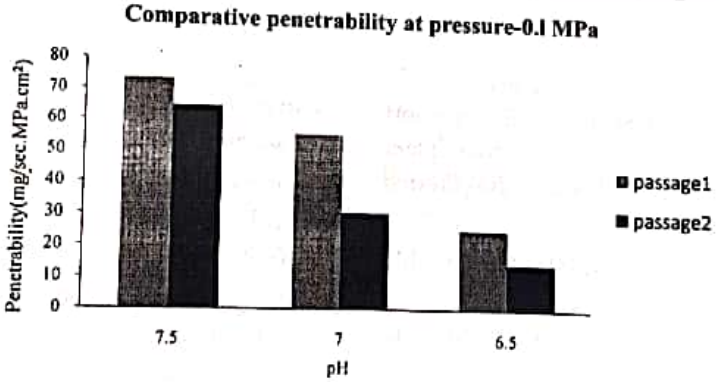

Fig-3 depicts the comparative penetrability of Transfersomes® at pH-7.5 & 7.0 and applied pressure is 0.1 MPa.

Figure 1a shows that the penetrability of Transfersomes® decreases from high pH to low pH thereby demonstrating the increase in rigidity. Increase in rigidity implies that flexibility of vesicles is reduced. Thus, the efficiency to transport therapeutical molecules will be decreased.

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EXOTIC GRASSES OF VARANASI DIVISION

Dr. Mayank Srivastava

ABSTRACT

The present study revels that exotic grasses were introduced in this region both adventiously and intentionally for purpose of food, fodder, forage, fiber, oil, medicine, and ornamental, afforstation, manuring, soil conservation and their economical or horticulture value. The present study deals with 47 species of exotic grasses. The family Poaceae have been arranged according to Clayton and Renvoize's (1986) classification. Data such as common / local name, native country, possible time of introduction as well as possible flowering and fruiting period, economic uses, chromosome number and dichotomous key has also been given.

INTRODUCTION

The family Poaceae is the largest family of flowering plants and most widely distributed and is in greater abundance than any other group of flowering plants.It may be 620 genera (Hutchinson, 1959) and about 10,000 species in the world (Hubbard, 1954). About 240 genera are represented in India (Bor, 1960), in his book "Grasses of Burma, Ceylon, India & Pakistan". Recent researcher (Moulik,1997) including exploration, critical identification and revision during last two decades have resulted in discovery of many new taxa and new records and in changes in nomenclature on account of varied altitudinal, edaphic and climatic conditionals the flora of India is very rich, varied and colorful. The floristic wealth of India is extremely rich in diversity and endemism. It is estimated that India has an approximately 45,000 plant species, of which about 15,000 are vascular plants (Angiosperm and Gymnosperms). Jain and sastry (1980) have also recorded a high percentage of endemism in monocotyledons.

During the last two million yeas, the flora in the world has undergone phenomenal changes, largely as a response to the climate and environmental alterations. This has resulted in the migrations of plant species from one reason to another and also in local extinctions and speciation, showing finally distribution of plant diversity (Pain, 1999). Although the great natural barriers (mountain, ranges, sea and deserts) have protected the indigenous flora, but the land mass connection have provided migratory routes too many to foreign elements.

Varanasi has a rich exotic flora which forms a dominant part of the land scape. Many exotic grasses got acclimatised or established in the original flora of the area and now constitute important elements of the original flora. On account of their wide distribution and occurrence in wild stage.

In recent years a large number of publications on the floristic of our country-including regional and local floras have appeared but exotics in the Indian floras have not received. The exotics form quite a good percentage of our flora today. However, only a few scattered publications are available in Indian context. The exotics have been introduced to boost the economy and help providing additional plant resources for food,

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fodder, fibre, drugs etc. the new intrants have considerable impact on the flora and some of the elements particularly obnoxious weeds, have created health hazards besides adversely upsetting the ecological balance.

A good number of exotic glass were introduced into India by Mughal emperors, Missionary Botanists, European officials and plant explorers. In India, only few workers, viz. Pandey & Farmer (1994), Srivastava and Oommachan (1994), Matthew (1969) have reported exotic plants (both dicotyledons and Monocotyledons). In District.

Uttar Pradesh, Many workers have been made taxonomic and floristic studies of the grasses on district lavel. Rajagopal and Panigrahi (1965, 1966, 1967), Bose and Pandey (1969) have mentioned a total of 89 species as introduced and cultivated in Allahabad. Sharma and Pandey (1984) reported 458 exotic species in "Exotic Flora of Allahabad District" in which only 8 genera and 9 species of family Poaceae are exotics.

From perusal of the literature it is clear that the exotic studies on the grasses in Uttar Pradesh is meagre. During critical botanical exploration of Varansi from 2003 to 2005, the author have been reported 35 genera and 49 species of exotic grasses Varanasi District.

Results & Discussion :

KEY TO THE SUBFAMILIES

1a. Culms woody; leaves dimorphic, of the main culms with short deciduous blades, rarely bladeless, of the branches with a well-developed blade and petiole between sheath and blade ---------- **2. Bambusoideae**

1b. Culms not woody; leaves not dimorphic with developed blade and without pseudo-petiole between sheath and blade :

2a. Tall reeds; spikelets with usually tow or more fertile awnless, florets or if with one fertile floret then sterile floret above it; rachilla joints or lemma with long silky hairs ---------- **1. Arundinoideae**

2b. Small herb; spikelets with one fertile awned floret; rachilla joints or lemma not hairy:

3a. Spikelets arising in open or contracted or spike like panicles less often in racemose or spike; ovary hairy or glabrous; caryopsis longitudinally graved with the linear hilum ---------- **5. Pooideae**

3b. Spikelets not as a above; ovary glabrous; caryopsis not as above :

4a. Leaves narrow; inflorescense effuse or spiciform, digitate or racemosely arranged in spikes; spikelets 1 to many flowered , breaking up at maturity above more or less persistent glumes; glumes awned or awnless; caryopsis usually with an adhering or free pericarp ---------- **3. Chloroidoieae**

4b. Leaves broad; inflorescence panicle or diffuse, subdigitate racemes; spike lets 1 or 2 flowered, breaking up at maturity from the pedicles; glumes awn less; caryopsis with free pericarp ---------- **4. Panicoideae**

1. SUB FAMILY - ARUNDINOIDEAE
KEY TO THE TRIBES

la.	Spikelets 1- flowered; arranged in short effuse or contracted panicle; lemmas 3- awned ----------	**1. Aristideae**
Ib.	Spikelets 2 to- flowered; arranged in long diffuse or lax plumose panicle; lemma 1-awned ----------	**2. Arundineae**

1. TRIBE ARISTIDEAE
1-*Aristiida* L.

Aristiida adscensionis Linn. S. PI. ed .1: 82.1753 ; Hook. f. Fl. Brit. Ind. 7: 224.1896; Bor, Grass. Bur, Cey, Ind. Pak. 407.t 43.1960; Moulik, Grass. Bamb Ind.2;423.1997.

It is also known as Motti-burri, longi-kussal; law lamp & lampro & introduced from north africa in 1930 (Ridley). In Madagascar an ointment consisting of lard & the for itch & ring worm,

Flowering & Fruiting : August - December

Chromosome Number: 2n = 20.

2.TRIBE- ARUNDINEAE
KEY TO THE GENERA

1a.	Panicle brown; lodicules oblanceolate; wavy at apex ----------	**2. *Phragmites***
1b.	Panicle white; lodicules obovate, wavy not at apex ----------	**1. *Arundo***

1. *A rundo* L.

Arundo donax L. Sp.Pl. ed.1 : 81.1753; Hook. f. Fl. Brit. Ind. 7:302.1896; Bor, Grass. Bur. Cey. Ind. Pak. 413.t.44.1960; Moulik, Grass. Bamb. Ind. 2:430. 1997

It's common name is doka & introduced from Tropical Africa. The rhizomes are much used in decoction as an emollient & diuretic. They are said to be stimulate the menstrual discharge & diminish the secretion of milk.

Flowering & Fruiting : August - November.

Chromosome Number : 2n = 100, 110.

2. *Phragmites* Trin

Phragmites karka (Retz.) Trin-ex Steud. Nom. Bot. ed. 2, 2 : 324. 1841; Hook. f. Fl. Brit. Ind. 7:304. 1896; Bor, Grass. Bur. Cey. Ind. Pak. 416.1960; Moulik; Grass. Bamb. Ind. 2 : 433.1997.

It is also known as nainarakula nar, narkul, nulanara and narkat introduced from temperate region.

Ayurvedists describe the plant as sweets acrid, cooling, ophrodisiac, useful in bilious-ness, urinary troubles, vaginal and uterina complaints, erysipelas & disease of heart th root is regarded as cooling & diuretic b Chinese. The culms is used for making mats & nuts.

Flowering & Fruiting : September-Novembe

Chromosome number : 2n = 36.

2. SUB FAMILY- BAM BUSOI DEAE

1. TRIBE -ORYZEAE

i. Orvza L

Oryza saliva L. Sp. PI. 333.1753; Hook.f .Fl. Brt. Ind.70072.1896; Bor, Grass. Bur. Cey. Ind. Pak. 605. 1960; Moulik, Grass. Bamb. Ind. 2: 48.1997

It is commonly known as chaval, dhan, & introduced from East Indies. Ayurveda describes the rice grain as acrid, sweet, oleaginous, tonic, aphrodisiac fattening diuretic usefuM in biliousness. lt is best food in all dysenteric complaints certain varieties of specially prepared grains are used medicinally in China and Malaya .Rice water is a cooling and nourishing drink in fevrile disease and inflammatory conditions of intestine.

Flowering & Fruiting : August - November.

Chromosome number : 2n=24.

3- SUB FAMILY- CHLOROIDOIDEAE

KEY TO THE TRIBES

la.	Spikelets 1 to many flowered, slightly Compressed; glumes herbaceous; lateral nerves of lemmas close to the margin & hairy; palea narrowly wingled on keels----------	**1. Cynodonteae**
b.	Spikelets 2 to many flowered; strongly compressed, glumes membranous or coriaceous; lateral nerves of lemma distant to margin & glabrous; palea occasionally winged on keels ----------	**2. Eragrostideae**

1—TRIBE-CYNODONTEAE

KEYTOTHEGENERA

la.	Upper glume with rows of stout hooked spines along the nerves ----------	**4. *Tragus***
1b.	Upper glume not as above :	
	2a. Spikelets awned :	
	3a. Lodicules wavy at apex; caryopsis fusiform, trigonous ----------	**1. *Chloris***
	3b. Lodicules absent; caryopsis terete, cylindric ----------	**3. *Perotis***
	2b. Spikelets awnless ----------	**2. *Cynodon***

1. *Chloris* Sw.

KEY TO THE SPECIES

la.	Culm 75 cm long; lower glume 1.0mm long, awned; empty lemmas awned ----------	**1. *C. barbata***

1b. Culm 1.5m long; lower glume 1.5mm long; awnless; empty lemmas awnless——————— 2. *C. gayana*

1. ***Chloris barbata*** Sw. Fl. Ind. Occ. 1: 200. 1797; Hook. f. Fl. Brit. Ind. 7: 292. 1896; Bor, Grass. Bur. Cey. Ind. Pak. 465. 1960; Moulik, Grass. Bamb. Ind .2: 563.1997.

It was introduced from Tropical America in 1897 or early part of 19th century in India before 1769.

Flowering & Fruiting : August - January.

Chromosome number : 2n = 40

2. ***C. gayana*** Kunth Rev. Gram. 1:89 .293 .t. 58 .1829;Hook. Fl. Brit. Ind .7:292.1896.

It was introduced from North America, Australia, & Hawaiian Island in 19th century.

Flowering & Fruiting : March-December.

Chromosome number : 2n = 40

2. *Cynodon* Rich

Cynodon dactylon L. Pers. Syn. Pl. 1:85. 1805; Hook, f. Fl. Brit. Ind. 7:280.1896; Bor, Grass. Bur. Cey. Ind. Pak. 496.1960; Moulik, Grass. Bamb. Ind. 2:566.1997.

It is also known as dub, durba, Bermuda grass, bahama grass & introduced from Europe .A decoction of root is chiefly used as diuretic in south India. The cold infusion of the root often stops bleeding from piles. The roots crushed & mixed with curds are a deccan remedy for chronic gleet. The expressed juice of plant, however is a popular astringent commonly used as an application to fresh cut and wound given internally in cases of chronic diarrhea & dysentery.

Flowering & Fruiting : March-October

Chromosome number : 2n = 40

3. *Perotis* Ait

Perotis India (L) ketz. Rev. Gen. Pl. 2:787.1989; Hook. f. Fl. Brit. Ind. 7:98.1896; Bor Grass. Bur. Cey. Ind. Pak. 611. 1960; Moulik, Grass. Bamb. Ind. 1:504.1997.

It is also known as Kuras and introduced from tropical Africa.

Flowering & Fruiting : October - November.

4.*Tragus* Scop.

Tragus roxburgii Panigrahi in Kew Bull. 29 (3):496.1794; Hook. f. Fl. Brit. Ind. 7:97.1896; Bor Grass. Bur. Cey. Ind. Pak. 691. 1960; Moulik, Grass. Bamb. Ind. 2: 506.1997.

It is commonly known as Barchente and introduce from South - East Asia & East Africa.

Flowering & Fruiting: July - September

2. TRIBE - ERAGROSTIDEAE
KEY TO THE GENERA

1a.	Inflorescence a solitary or 2 to many digitate or subditate Spike	**1. Dactyloctenium**
1b.	Inflorescence panicle :	
2a.	Nerves on the lemma hairy; lemmas often lobed or toothed	**2. Diplachne**
2b.	Nerves on the lemma glabrous; lemmas entire never lobed or toothed	**3. Eragrostis**

1. *Dactyloctenium* Willd
KEY TO THE SPECIES

1a.	Caryopsis 1.0mm long, reniform	***1D. aegyptium***
1b.	Caryopsis 0.5 mm long, ovate	***2D. sindicum***

1. Dactyloctenium aegyptium (L.)P. Beauv. Ess. Agrost. Expl. Pl.15.1812; Bor, Grass Bur. Cey Ind. Pak. 489.t.54.1960; Moulik. Grass. Bamb. Ind. 2:585.1997.

It is commonly known as Makra, gandhi anchi, manchi & introduced from panatropical areas. Parched grains useful in pains after child birth. Decoction of seeds usefull in pain of kidney region.

Flowering & Fruiting : August - November.
Chromosome number : 2n=48.

2. D.sindicum Boiss. Diagh. ser. 2, fasc. 4:131.1859; Bor Grass. Bur. Cey. Ind. Pak. 489. 1960; Moulik, Grass. Bamb. Ind. 2:587.1997.

It native of hotter parts of middle East.
Flowering & Fruiting : September-January.

2. *Diplachne* P. Beauv.

Diplachne fusca (L.) P. Beauv.ex Roem & Schult. Syst.Veg. 2:615.1817; Hook. f. Fl. Brit. Ind. 7:329. 1896; Bor, Grass. Bur. Cey. Ind. Pak. 492. 1960.

It is commonly called as shotigandar & introduced from Tropical & South-Africa.
Flowering & Fruiting : January- April.
Chromosome number : 2n = 40.

3. Eragrostis Wolf

KEY TO THE SPECIES

1a. Ligule membranous :

2a. Panicle 30 cm long, lax; caryopsis polished ---------- *1. E. atrovirens*

2b. Panicle 15cm long, contracted, caryopsis not as above:

3a. Lodicules oblanceolate; caryopsis spindle shaped ---------- *4. E.tef*

3b. Lodicules absent; caryopsis elliptic, subglobose ---------- *3. E. curvula*

1b. Ligule hairy :

4a. Anther yellow-brown; ovary ovate ---------- *2. E. cilianensis*

4b. Anther deep-pink; ovary elliptic ---------- *5. E. tenella*

1. Eragrostis atrovirens (Desf) Trin. Ex. Steud. Nom. Bot. ed. 2(1) : 562. 1840; Bor, Grass. Bur. Cey. Ind. Pak. 503.1960; Moulik Grass. Bamb. Ind . 2:597.1997.

It introduced from North - West Africa.

Flowering & Fruiting: September-March.

Chromosome number: 2n = 40.

2. *E.cilianensis* (All.) Vignolo - Lutani in Malpighia 18:386.1904; Bor, Grass. Bur. Cey. Ind. Pak. 503.1960; Moulik Grass. Bamb. Ind. 2:598.1997.

It was introduced from Central America.

Flowering & Fruiting : September-November

Chromosome number: 2n = 20.

3. *E.Curvula* (Schard) Nees, Fl. Afr. Aust . 397.1841; Bor Grass. Bur. Cey. Ind. Pak. 507.1960; Moulik, Grass. Bamb Ind. 2:602.1997.

It is also known as weeping-love grass and introduced from South Africa in early in the present centaury.

Flowering & Fruiting : February-April.

Chromosome number: 2n = 80.

4. *E.tef* (Zucc.) Trotter in Bull. Soc. Bot. Ital. 62.1918; Bor, Grass. Bur. Cey. Ind. Pak.513.1960; Moulik, Grass. Bamb. Ind. 2:608.1997.

It was introduced from Ethiopia.

Flowering & Fruiting : August-December.

Chromosome number : 2n = 40

5. *E.tenella* (L.) P. Beauv. ex Roem & Schult; Syst.Veg.2:576.1817; Hook. f. Fl. B rit. Ind.7:315.1896; Bor. Grass Bur. Cey. Ind. Pak. 513.1960; Moulik, Grass. Bamb. Ind. 2:608.1997.

It was introduced from Arabia.

Flowering & Fruiting : July-October.

4- SUB FAMILY - PANICOIDEAE KEY TO THE TRIBES

1a. Spikelets often paired ; both gumes as long as the spikelets ; upper lemma hyaline or membranous & usually awned ---------- **1. Andropogoneac**

1b. Spikelets solitary or paired lower glumes usually smaller, upper glumes as long as the spikelets; upper lemma papery to very tough & rigid & usually awnless ---------- **2. Paniceae**

TRIBE-ANDROPOGONEAE
KEY TO THE GENERA

la. Inflorescence a true or false panicle :

2a. Aromatic grasses; panicles interrupted by spathes- **1. *Cymbopogon***

2b. Grasses not aromatic; panicles not interrupted by spathes

3a. Panicles densely silky villous & effuse **5. *Saccharum***

3b. Panicles not silky villous & diffuse :

4a. Branches of panicles whorled; lower glume muricate or spinulose ---------- **8. *Vetiveria***

4b. Branches of panicles verticillate or alternate; lower glume not muricate or spinulose ---------- **7. *Sorghum***

1b. Inflorescence a solitary, digitate or sub digitate racemes:

5a. Racemes fascicled; lower glume of sessile spikelets orbicular, cartilaginous, pitted—————— **2. *Hackelochloa***

5b. Racemes not fascicled; lower glume of sessile spikelet not as above:

6a. Spikelets unisexual; male and female conspicuously dissimilar ---------- **9. *Zea***

6b. Spikelets perfect and similar:

7a. Racemes spatheolate; pedicel rounded at tip— **3. *Iseilema***

7b. Racemes not spatheolate; pedicel not rounded at tip:

8a. Spikelets terete stout; joints rounded on back -- **4. *Rottboelia***

8b. Spikelets oblong; joints densely hairy on two angles ---------- **6. *Sehima***

l. Cymbopogan Spring

Cymbopogan martlnii (Roxb.) Wats, in Atkins. Gaz.N.W. Pror. Ind. 392.1882; Bor, Grass. Bur. Cey. Ind. Pak. 129.1960; Moulik, Grass. Bamb. Ind. 1.215.1997.

It is native of Afro- Asian. A fragrant oil called "Rosha oil" is obtained from it and is used in lumbago, blandness and skin disease; it is taken internally in bilious complaints.

Flowering & Fruiting : September-February

Chromosome number: *24=40.*

3. *Iseilema Anderss*

Iseilema laxum R. Br. Prodr. 205. 1810; Hook. f.Fl. Brit Ind. 7:218. 1896; Bor. Grass. Bur. Cey. Ind. Pak. 188.1960; Moulik, Grass. Bamb. Ind. 1: 226.1997.

It was introduced from Tropical America.

Flowering &Fruiting : October - November.

Chromosome number: 2n = 8.

2. *Hackelochloa* O. Ktze

Hackelochloa granularis O. Ktze.Rev. Gen. PI. 2.776.1891; Bor, Grass. Bur. Cey. Ind. Pak. 159.1960; Moulik, Grass. Bamb. Ind. 1.193.1997.

It is also known as trinpali & native of pan tropical country. Plant with other ingredients used in curing enlarged spleen and liver.

Flowering & Fruiting: July - November.

4. *Rottboellia* L.f.

Rottboellia cochinchinensis (Lour.) W.D. Clayton in Kew Bull. 35:817. 1981; Moulik, Grass. Bamb. Ind. 1: 199.1997.R. exaltata Linn T. Supp. PI. 114. 1781; Hook. f. Fl. Brit. Ind.7: 156.1896; Bor, Grass. Bur. Cey. Ind. Pak. 206.t.l3.1960.

It was introduced from Tropical Asia & Africa.

Flowering & Fruiting : August-November.

Chromosome number : 2n=20.

5. *Saccharum Linn.*

KEY TO THE SPECIES

1a. Anther pale yellow; style solitary; caryopsis oblong, cylindric ——— **1. *S. officinarum***

1b. Anther purple; style bifid; caryopsis lanceolate, subglobose ——— **2. *S. spontaneum***

1. ***Saccharum officinarum*** Linn. Sp. P1.54. 1753; Hook. f. Ind. 7:118. 1896; Bor, Grass. Bur. Cey. Ind. Pak. 212.1960; Moulik, Grass. Bamb. Ind. 1:32.1997.

It is also known as Ganna, nobel cane and introduced from Africa. Ayurveda describes the sugarcane as sweet, oleagenous, diuretic, tonic, cooling and aphrodisiac. The roots are used as a cooling and diuretic medicine; and stem is useful as a remedy for caught.

Flowering & Fruiting : January-April

2. ***S. sponfaneum*** LMar\t.Alt. 183. 1771; Hook. f. Fl. Brit. Ind.7:l 18.1896; Bor, Grass. Bur. Cey. Ind. Pak. 214.1960; Moulik, Grass. Bamb. Ind. 1: 322.1997.

It is also known as Kans and introduced from pan tropical country. It's dried stem is used for basket & hut making. Root extraction is taken to kill intestinal worms and also relieving for fever and body ache.

Flowering & Fruiting : September-December.

Chromosome number: 2n = 128..

6. *Sehima Forrsk*

Sehima nervosum (Rott 1.) Stapf.in Prain, Fl.Trop. Afr.9: 36.1917; Bor, Grass. Bur. Cey. Ind. Pak.218.1960; Moulik, Grass. Bamb. Ind. 1.300.1997.

It was introduced from South-East Asia.

Flowering & Fruiting : October-December.

7. *Sorghum Moench.*

KEY TO THE SPECIES

1a. Ligule membranous : lodicules 2-horned, nerveless ---------- ***1. S. halepense***

1b. Ligule oblique, a tuft row of hairs; lodicules without horned, many nerved ---------- ***2. S. vulgare***

1. ***Sorghum halepense*** (L.) Pers. Syn. Pl. 1: 101.1805; Bor, Grass. Bur. Cey. Ind. Pak. 222. 1960; Moulik, Grass. Bamb. Ind. 1: 249. 1997. *Andropogon halepensis* L. Brot. Fl. Lusit. 1 : 84.1804; Hook. F. Fl. Brit. Ind.7 : 182. 1896.

It is also known as Boru, baru means grass and introduced from tropical America probably.

Flowering & Fruiting : October - December.

2. ***S. vulgare*** Pers. Syn. 1 : 101. 1805. Andropogon sorghum Brot. Fl. Lusit. 1:88. 1804; Hook.f.Fl. Brit. Ind .7: 183. 1896.

It is also known as Jowar and Introduced from Arabia in ancient time. According to Ayurveda writers the grain is cooling and aphrodisiac, improving both appetite & relish for food. It is useful in the treatment of general disorders, diseases of blood, piles, ulcers, tumors.

Flowering & Fruiting: August-November

8. *Vetiveria* Lem. Lisanc

Vetiveria zizanioides [L.] Nash in Small. Fl. South-east U.S.67.1903; Bur. Cey. Ind. Pak. 258.1960; Moulik, Grass. Bamb. Ind. 1.256.1997. *Andropogon squarrosus* Hook. f. Fl. Brit. Ind 7:765.1896.

It is also known as khas-khas, bala, balah, bena, ganrar and panni, has been introduced into the new world. Roots are used in fan and mats for sweets smelling infusion of roots is used of cure snake, fever and scorpion tring. Ayurvedists describes the roots as bitter, cooling, stomachic, astringent and an antidote to poisons. They recommend its use in burning sensations, bilious fevers, fout breath, thirst, strangura Ulcer & Disease of blood the root as cooling to the brain. Bitter & soporific. An infusion of the root is given as febrifuge and powder or in bilious complaints. Juice is given as tonic and immunity improve to women after delivery. Dried stem is used for making brooms.

Flowering & Fruiting : August - November.

Chromosome number : 2n = 20

9. *ZEA* L.

Zea mays L. Sp. PI. 971. 1753; Bor, Grass. Bur. Cey. Ind. Pak. 270. 1960.

It is also know as makka, bhutta, corn and maize and introduced form central America. The grain is nutritive demulcent, emollient, diluents, and absorbent. It's alkaline solution, is prepared from the burnt cobs and is given in lithiasis . The grain is much used as a valuable article of diet for invalids & children's.

Flowering & Fruiting: July September.

2. TRIBE - PANICEAE
KEY TO THE GENERA

1a. Spikelets with bristles :
- 2a. Bristles persistent; upper lemma transversely rugose——— **8. *Setaria***
- 2b. Bristles deciduous; upper lemma smooth——— **6. *Pennisetum***

1b. Spikelets without bristles :
- 3a. Leaf-blade linear; ligules absent——— **3. *Echinochloa***
- 3b. Leaf-blade linear to ovate ligule present:
  - 4a. Lower glume very reduced or absent:
    - 5a. Spikelets solitary, piano- convex, orbicular; upper lemma crustaceous, with narrow inrolled margins—— **5. *Paspalum***
    - 5b. Spikelets binate, ovate, lanceolate; upper lemma thin cartilagenous with flat hyaline margins——— **2. *Digitaria***
  - 4b. Lower glume well developed :
    - 6a. Spikelets with long Silky hair & muronate——— **1. *Rhynchelytrum***
    - 6b. Spikelets without silky hairs & not mucronate :
      - 7a. Panicle effuse; upper glume as long as the spikelets——— **4. *Panicum***
      - 7b. Panicle contracted; upper glume shorter than the spikelets :
        - 8a. Lower glume turned away from the axis or spikelets——— **9. *Urochloa***
        - 8b. Lower glume turned towards the axis or spikelets——— **1. *Brachiaria***

1. *Brachiaria (Trin.)* Crises
KEY TO THE SPECIES

1a. Middle lemma & middle palea present; stigmatic hairs in 2- rows— **1. *B. brizantha***

1b. Middle lemma & middle palea absent; stigmatic hairs simple:
- 2a. Rachis triquetrous; spikelets crowded; stigma brown——— **2. *B. mutica***
- 2b. Rachis flat; spikelets distant; stigma purple——— **3. *B. ramose***

l. ***Brachiaria brizantha*** (Hochst ex Rich.) Stapfm Prain, Fl. Trop. Afr. 9:531. 1919; Bor, Grass.Bur. Cey .Ind. Pak.281.1960; Moulik, Grass Bamb. Ind.75.1997.

It has been introduced in the early 19th Century From Tropical Africa as a fodder grass. (Bor, 1960).

Flowering & Fruiting July- September.

Chromosome number : 2n = 54.

2. ***B.tnutica***_ Forssk. Stapf. in Prain, Fl. Trop. Afr. 9:526.1919; Bor, Grass. Bur. Cey. Ind. Pak. 284. 1960; Moulik, Grass. Bamb. Ind. 1:77.1997. Panicum muticum Forssk. Fl. Aegypt. 20.1775; Hook. f. Fl. Brit. Ind. 7:34. 1896.

2. *Digitaria* Heist. Ez. Fabrious

Digitaria ciliaris (Retz.) Koel. Descr. Gram. 27:1802, Moulik, Grass, Bamb. Ind. 1:90, 1991. D. adscendens (Kunth) Henr. Blumea 1:92. 1834; Bor. Grass. Bur. Cey. Ind. Pak. 298. 1960.

It has been introduced from temperate and warm region of earth.

Flowering & Fruiting : August-November.

Chromosome number : 2n = 54.

3. *Echinochloa* P. Beauv.

Echinochloa cruspavonis (H.B.K.) Schult. Syst. Veg.2. Marit. 269. 1824; Bor,Grass.Bur. Cey. Ind. Pak. 310.1960; Moulik, Grass. Bamb. Ind. 1.99.1997.

It has been introduced from Tropical South America & Africa.

Flowering & Fruiting : September - November.

It has been introduced from South America and West Africa.

Flowering & Fruiting : November - March.

Chromosome number : 2n = 36.

3. ***B. ramosa*** **(L.)** Stapf in Prain, Fl. Trop Afr. 9:542. 1919; Bor, Grass. Bur. Cey, Ind. Pak. 284, 1960, Moulik, Grass, Bamb, Ind. 1:78, 1997, Panicum ramosum L.Mant. Pi. 1:29. 1767; Hook. f. Fl. Brit. Ind. 7:36, 1896.

It's also known as chapar, chapsura and has been introduced from tropical old world.

Flowering &Fruiting : July - October.

Chromosome Number : 2n = 28.

4. *Panicum* Linn.

Panicum maximum Jacq. Collect. Bot. 1:76. 1786; Hook. f. Fl. Brit. Ind. 7 : 49.1896; Bor, Grass. Bur. Cey. Ind. Pak. 327.t37.1960; Moulik, Grass. Bamb. Ind. 1:119.1997.

It is also known as ginighaus and introduced from America about in 1,800. This grass is considered one of the best horse - fodders, but it may cause fatal colic if given in too large a quantity or when wet.

Flowering & Fruiting : September - January.

Chromosome number : 2n = 48.

5. *Paspalum* Linn.

Paspalum dilatation Poir in Lam. Encycl. Meth. Bot. 5:35. 1804; Bor, Grass. Bur. Cey. Ind. Pak .338.1960; Moulik, Grass. Bamb. Ind. 129.1997.

It is also known as dallis grass, and introduced from south America and Brazil.

Flowering & Fruiting : June - August.

Chromosome number: 2n=40.

6. *Pennisetum* L.C.Rich
KEY TO THE SPECIES

1a. Spike 25cm long; lower glume present; anther yellow; caryopsis slaty —— **2. *P. typhoides***

1b. Spike 15cm. Long; lower glume absent; anther purple; caryopsis whitish black —— **1. *P. purpureum***

1. *Pennisetum purpureum* Schum. Besker. Guin . PI 44. 1827; Bor, Grass. Bur. Cey. Ind. Pak. 348. 1960; Moulik; Grass. Bamb. Ind. 1:140. 1997.

It has been introduced from tropical Africa.

Flowering & fruiting : September -November.

Chromosome number : 2n = 28.

2. *P. typhoides* (Burm.) Staf. & C. E. Hubb. in Kew. Bull. 271.1933; Bor, Grass. Bur. Cey. Ind. Pak. 350. 1960; Moulik, Grass. Bamb. Ind. 1:142.1997.

It is also known as Baja, Bare and introduced from Tropical Africa about 2000 years ago .It is useful in diseases of heart; it improve the appetite for food & the relish of it.

Flowering & Fruiting : September- October

Chromosome number 2n= 14.

7. *Rhynchelytrum* Nees

Rhynchelytrum repens (Willd.) C. E. Hubb. in Kew. Bull.1934: 110. 1934; Bor, Grass. Bur. Cey. Ind. Pak.335. 1960; Moulik, Grass. Bamb. Ind.l:148.1997.

It has been introduced from Tropical South Africa.

Flowering & Fruiting : March - August

Chromosome number 2n = 36.

8. *Setaria* P.Beauv.
KEY TO THE SPECIES

1a. Bristles antrorsely scabrid; lodicules hyaline :
2a. Lodicules wavy at apex; ovary ovate; caryopsis greenish-black — **1. *S. glauca***
2b. Lodicules 2-horned at apex; ovary elliptic-oblong; caryopsis light yellow —— **2. *S. italicci***

1b. Bristles retrorsely scabrid; lodicules membranous —— **3. *S. verticillata***

1. *Setana glauca* (L) P. Beauv. Ess. Ind. Pak. 360.1960. Moulik, Grass. Agrost. 51.169, 1812; Hook, f.fl. Brit. Bamb. Ind. 1:153. 1997. Ind. 7:78.1896, Bor, Grass. Bur. Cey.

2. *S. italica* (L.)P. Beauv. Ess. Agrost. 51.170.1812, Hook. f. Fl. Brit. Ind. 7:68. 1896; Bor, Grass. Bur. Cey. Ind. 362.1960. Moulik, Grass. Bamb. Ind. 1: 155.1997.

It is also known as kagun, rala, kakun, bhadli, kang and introduced from Japan & China. The plant is sweet and acrid, fattening, aphrodisiac and sedative to the gravid ulcer. It is useful in dispelling burning sensations and healing fractures. The grains are useful in rheumatism, burning.

Flowering & Fruiting : July - October.

Chromosome number : 2n = 18.

3. S. vertidllata (L.) P. Beauv. Ess. Agrost 51. 178. 1813; Hook. f. Fl. Brit. Ind. 7: 80. 1896; Bor, Grass. Bur Cey. Ind. Pak. 362. 1960; Moulik, Grass. Bamb. Ind. 1: 159. 1997.

It is also known as lapti, chirchira, bardani, chilaya and introduced from Astro - Asia.

Flowering & Fruiting : August - October.

Chromosome number : 2n = 18.

9. *Urochloa* P. Beauv.

Urochloa panicoides (L.) P. Beauv. Ess. Agrost. 52. 1812; Bor, Grass. Bur. Cey. Ind. Pak. 372.1960; Moulik, Grass. Bamb.Ind. 1:169.1997.

It is also known as kuri, kuriya & introduced from Tropical Africa.

Flowering & Fruiting: July- December.

Chromosome number: 2n =36.

5. SUBFAMILY - POOIDEAE

KEY TO THE TRIBES

Ia.	Lemmas membranous or coriaceous; lodicules glabrous; ovary glabrous	**2. Poeae**
Ib.	Lemmas coriaceous; lodicules hairy; ovary hairy :	
2a.	Glumes as long as the spikelets; lemma awned form the tip	**3. Triticeae**
2b.	Glumes as long as or longer than the lowest floret & enclosing the spikelets; lemmas awnless or awned from the back	**1. Aveneae**

1. TRIBE - AVENEAE

KEY TO THE GENERA

Ia.	Spikelets 3 - flowered; awnless	**2. *Phalaris***
Ib.	Spikelets 1-2 flowered; awned :	
2a.	Glumes awnless; lemmas awned from the back; ovary hairy; caryopsis hairy	**1. *Avena***
2b.	Glumes awned; lemmas awned from the apex; ovary glabrous; caryopsis glabrous	**3. *Polypogon***

1. *Avena* L.

Avena sativa L. Sp. PL ed. 1:79.1753; Hook. f. Fl. Brit. Ind.7:275.1896; Bor, Grass. Bur. Cey. Ind. Pak. 434. 1960; Moulik, Grass Bamb Ind. 2: 440. 1997.

It is also known as jayee, oats & introduced from Europe. The meal of oats boiled with vinegar and applied takes away freckles and spots in face & other part of body. The seeds are used as an emollient refrigerant and diuretic. Tincture made from oats useful in fatigue nervous exhaustion, sleeplessness and sexual weak.

Flowering & Fruiting : November - March.

Chromosome number : 2n = 42 .

2. *Phalaris* L.

Phalaris minor Retz. Obs. Bot. 3:8.1783; Hook. f. Fl. Brit. Ind. 7: 221 .1896; Bor, Grass. Bur. Cey. Ind. Pak. 616. 1960; Moulik, Grass. Bamb. Ind.1: 471. 1997.

It has been introduced from Baluchistan.

Flowering & Fruiting : January - March.

Chromosome number : 2n = 28

3. *Polypogon* Desf

Polypogon monspeliensis (L.) Desf. Fl. Atlant 1:67.1798; Hook. F.Fl. Brit. Ind. 7:245. 1896; Bor, Grass. Bur. Cey. Ind. Pak. 403. 1960; Molik, Grass. Bamb. Ind. 2 : 415. 1997.

It is also known as chiripy, bafra and introduced from Temperate part Asia Africa & Europe (Bor 1960).

Flowering & Fruiting: January- March.

Chromosome number: 2n=28.

2- TRIBE-POEAE

KEY TO THE GENERA

1a. Inflorescence a spike; lemmas aristate or awned ———— **1. *Lolium***

1b. Inflorescence a panicle; lemmas not awned ———— **2. *Poa***

1. *Lolium* L.

Lolium temulentum L. SP. P1 .83.1753 Hook. f Fl. Brit. Ind.7: 364.1896; Bor, Grass. Bur. Cey. Ind. Pak. 546. 1960; Moulik, Grass. Bamb. Ind. 2:524. 1997.

It is also known as machni & introduced from North Africa & South Europe. The Seed or grains were used medicinally by the ancient Greeks & Romans. It is still recommended as a sedative poultice for curing spots on skin

Flowering & Fruiting : December-May.

Chromosome number : 2n = 14.

2. *Poa* L.

Poa annua Linn SP.P1. 68.1753 Hook. f Fl. Brit. Ind.7: 345.1896;Bor, Grass. Bur. Cey. Ind. Pak. 555. 1960; Moulik, Grass. Bamb. Ind. 2:529. 1997.

It is also known as annual blue grass and introduction from south America.

Flowering & Fruiting : July - September.

Chromosome number : 2n = 28.

3. TRIBE - TRITICEAE
KEY TO THE GENERA

la.	Ligule hairy at apex; auricle well developed; spikelet 1-flowered; lodiculeas hairy at apex ————	1. *Hordeum*
1b.	Ligule lacerate uricle well developed; spikelet 1-flowered; lodiculeas hairy at apex————	2. *Triticum*

1. *Hordeum* L.

Hordeum vulgare L Sp. PL 84.1753; Hook. f. Fl. Brit. Ind. 7:373. 1896; Bor, Grass. Bur. Cey. Ind. Pak. 677.1960; Moulik, Grass. Bur. Cay. Ind. 2. 494. 1997.

It is also know as jau, jav, jawa & introduced from temperate region. It is used in treatment of bronchitis. The ashes of leaf are employed in the formation of cooling sherbets.

Flowering & Fruiting : January - April.

Chromosome number: 2n = 28.

2. *Triticum* L.

Triticum aestivum L. Sp. Pl. 85.1753; Bor, Grass. Bur. Cey. Ind. Pak. 1960; Moulik, Grass. Bamb. Ind. 2. 496 19973. T. vulgar Vill. Hook. f. Fl. Brit. Ind. 7:367. 1896.

It is also know as gehun, giun & introduced from Mediterranean region. It is used as cooling, oleaginous, tonic, aphrodisiac, laxative, and fattening improving appetite and relish for food.

Flowering & Fruiting January - April.

Chromosome number : 2n=28.

Conclusions :

The study of flowering plants reveals that exotic grasses were introduced the purpose of food, fodder, forage, fibre, oil, medicine and ornamental afforstation, manuring, soil conservation and their economical or horticulture value. The exotics form quite a good percentage of our flora today. The division of Varanasi also has a rich exotic flora land scape & found many important plants which is use to said purpose.

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Format For Research Paper

Nine Steps for Writing a Research Paper in Science. To actually writing the paper, you need to develop a strong topic idea, find relevant research organize your information. You can simplify the process by following some very simple steps.

1. **Choose a topic :** The first step in researching your paper is to choose a topic.
2. **Confirmation of Topic :** Find intriguing references for further exploration and to get a general overview of your chosen topic.
3. **Reference Collection :** Some articles are available in full-text online, while others will need to be accessed in your Library's academic journal collection.
4. **Reference List :** Make a preliminary list of all of the articles, online information, books and other primary sources that you might possibly use in your final paper. At this point, include every single source that you might possibly use. As you begin honing in on your topic and narrowing the focus of your paper, you can start eliminating some of the resources that do not quite fit in with your thesis or supporting information.
5. **Write the Outline of research paper:** Writing a good outline can make the writing process much easier, so do not skip this important step. Start by creating a rough outline that includes the following steps :

   i. **Abstract :** Difference between summary and Abstract: Abstract is the brief of summary. The abstract needs to be set up in a special way, starting with an introduction, a short part about what you are writing about in Journal, then the general information (What you have discovered in your analysis), and then you finish off with a short conclusion to your subject. A summary is just a short version of whatever is written above in your article. Abstract is written in the beginning of the article whereas summary is written at the end of the article.

   ii. **Introduction :** Here the basic concept of all the independent and dependent variables listed in the title of the project is discussed with the help of references collected so far. Then the lacuna in the concerned previous studies is written on the basis of which statement of the problem is cited. Statement of the problem is followed by the Objectives and Hypothesis framed and Limitations of the present Study.

   iii. **Methodology :** Methodology includes the subjects selected for the study, their inclusion in the Experimental Design, the tools used for measuring the dependent variables and the process of administering the tools for collecting data.

P. T. O.

iv. **Result :** Presentation of results in the form of figures (polygon/histograms)

a. Summarization of results in the form of central tendencies, variance etc.

b. Analysis of results in the form of analysis of variance, t-tests and coefficient of correlations.

v. Discussion of Results in the light of other studies by including sub-sections related to each argument, idea or category.

vi. Conclusion of results in the form of possible answers for the postulates derived from each hypotheses.

6. **Write a First Draft :** Once you've drafted a well-organized and through outline, it is time to write the first draft of your paper. Before drafting, keep other research articles with you to assimilate their draft. In your mind before writing your first draft. Include all of your references. It is always easier to include your references first rather that to search and hunt for each individual reference after the paper is completed.

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