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Combining Ability and Genetic Components Analysis Its Trait in Linseed (*L. Usitatissimum L.*)

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Abstract

Ten morphologically diverse parents viz. Padmini, J-23, Parvati, PCL 41-2, PCL-34, PCL-21-2, T-397, PCL-20, PCL-24 and PCL-44 were studied for days to flower, plant height, number of branches per plant, days to maturity, number of seeds per capsule, 1000 seed weight and seed yield per plant. Highly significant differences among all the attributes in both (F1 and F2) generations were most appreciable except number of tillers per plant, number of seeds per and test weight in parents vs F_1s including number of primary branches in parents vs F_2S. Mean value of F_1 hybrids were higher over the parents, similarly the values of F_2 for days to flower and days to maturity was also estimated.

Introduction

Highly significant values of dominance components (H_1 and H_2) always being considerable for acquired traits existence. Additive and non-additive significant gene effects for gea and sea might be highly considerable for days to flower, number of tillers, number of branches, days to maturity alongwith test weight and seed yield. Good general combines in respect of yield were Padmini, T-397, PCL 44 and J-23. Most considerable combinations on the basis of sea effects were J 23/PCL 44, PCL 34, PCL 24 and PCL 24, PCL 44.

Materials and Methods

All the genetically diverse genatypes of Lineseed (Linum ussitatissumum L) engaged to study procured from CSA University of Agri & Tech. Kanpur. The hundred (10 parents + 45 F_1 + 45F_2) lines were grown in plots following the Randomized Block Design with three replications. The observations were recorded on 10 and 20 selected plants in parents F_1S and F_2 populations for yield and its contributing traits.

The estimates of mean, range, genetic components and combining ability were biometrically analysed (Hayman, 1954a, model 1^{st})

Results and Discussion

This breeding programme is to bring about genetic amelioration of the genotypes for high productivity. Inheritance of yield in complex and polygenic in nature which interact with environments and among themselves. Therefore, most of the information regarding the inheritance of yield and its contributing traits were studied. Estimation of genetic parameters (Gardner, 1963) were made upto the mark i.e. genetic components and combining ability. Variance component (Hayman, 1954a) and combing ability analysis (Griffing, 1956b) models were in respect to days to flower, number of tillers, number of branches, number of seeds per capsule, test weight and seed yield per plant.

In linseed (Linum usitatissimum L) the combinations and parents were highly exhibited significantly differences. F_1S and F_2S were also showed the significant differences over the parents (Table-1). The maximum and minimum range of variability among the parents, F_1S and F_2S were appreciable. The genetic components of variation and the related parameters are the important factors to estimate the variation and genetic architecture of population, has a great importance in formulating the efficient breeding programme. In our study, the additive genetic components (D) were highly significant in both (F_1 and F_2) the generations for all the characters (Table 3). The dominance components (H_1 and H_2) estimated the value for all the Traits showing importance of dominant gene effects. It seamed that additive and dominant genes play role in the inheritance of these traits (Singh and Sindhu, 1986; Tiwari et.al., 2006; Nagaich et.al., 2007; Singh et.al.; Singh et.al., 2008 and Jeet et.al., 2009).

Significant positive value of F component indicated that dominant genes were more frequently distributed than recessive genes in the parents (Srivastava et.al. 2009). Similarly the positive and significant values of h^2 indicated that heterogygous genes combination significantly contributed to the overall dominance in positive direction. The component E estimate was positive and non-significant for all the traits indicated less effects of environment on expression.

The ratio of $H_2/4H_1$ was less than the theoretical value (0.25) for all the characters showing symmetrical distribution of favourable and unfavourable genes among the parents. It means the distribution of loei among the parents was not balancing form (Anand et.al. 1972). Number of group of dominant genes (H/H_2) focussed less value than

unity indicated that one major gene group involved in the inheritance as modifiers controlling morphological characters (Anand et.al. 1972).

Nature and magnitude of gene action and selection of suitable parents and their crosses is the prerequisite in order to

propose a systematic and effective breeding programme and utilization of parents and crosses in future sequential breeding programme. As per data (table 4) due to gea and sea were highly significant for all the characters indicating that both additive and non-additive gene effects were involved in the expression of traits (Yadav and Srivastava 2002; Tewari et.al. 2009; Nagaich et.al. 2007 and Jeet et.al. 2009). The higher estimate of σg^2 than σs^2 showed predominance of additive genetic variance only in F1 and F2 generations (Sharma, 1986; Mahto and Rehman 1998) and Nagaich et.al. 2007).

Lower estimated to σq^2 than σs^2 and their ratio ($\sigma g^2/\sigma s^2$) indicated predominate role of non-additive gene action for all the traits (Rao and Singh, 1984; Kumar et.al. 2000; Tewari et.al. 2007; and Pratap et.al. 2009). The average degree of dominance is also of interest to plant breeders (Gardener, 1963). The degree of dominance through combining ability is based on assumptions ($\sigma g^2/\sigma s^2$) indicated genes are directionally distributed among parents (Kempthorne and Curnow, 1961). It dominance variation is in plus and minus direction, they tend to cancel each other.

In this study the performance of PCL 44 Padminig and J-23 were good general combiners for all the traits. The per se performance of parents compared with their gea effects showed as good general combiners is both the generations. The choice of parents in both the generations. The choice of parents on the basis of per se performance may be quite beneficial. The additive effects of parents due to gea are of practical use whereas non-allelic interaction are non-predictable and cannot be easily manipulated.

The specific combining ability estimate may be utilized for heterosis breeding. The desirable sea estimates of crosses were due to involvement of diverse parents (Dang et.al. 1987; Yadava et.al. 2000; Swarnakar et.al. 2005 and Nagaich et.al. 2007). The good cross combinations o the basis of per performance and significant sea effects of J23/T397; PCL 24/PCL 44, and Parvati/PCL 21-2, Parvati/PCL 34, PCL 41-2/PCL 20, PCL 34/PCL 44 and PCL 24/PCL 44 were good specific combiners over the generations.

Table No. 1: Analysis of variance for parents, F1S and F2S for 14 characters in a 10 parents diallel cross of linseed : Mena sum Squares

Source of Variation	d.f.	Days to flower	Plant Height (cm)	Number of tillers/ plant	Number of branches	Days of maturity	Number of seeds/ capsule	1000 seed weigh (g)	Seed yield/ plant (g)	Oil content (%)	Palmite acid (%)	Stearic acid (%)	Oleic acid (%)	Linoleic acid (%)	Linolen acid (%)
Replications	2	0.303	1.030	1.390	0.743	2.363	0.023	0.107	0.006	1.826	0.016	0.006	0.015	0.19	0.102
Treatments	99	127.827**	599.818*	6.752**	159.495**	133.450**	4.645**	4.952**	18.466**	24.777*	0.380	1.385**	29.560**	7.370**	31.093
Parents	9	217.574**	645.130**	10.355**	134.20799	136.252**	6.477**	6.336**	16.031**	28.540	0.542	1.428**	66.974**	5.999**	67.844
F_1S	44	10.7.203**	560.315**	7.460**	166.158**	115.463**	4.039**	4.161**	18.984	23.626**	0.374**	1.411**	24.519**	7.862**	25.829
F_2S	44	126.671**	540.255**	4.554**	132.203**	139.990**	4.130**	3.857**	13.422	23.355	0.343**	1.410**	25.824**	7.443**	26.421
P vs F_1S	1	6.693**	8.940	0.048	476.801**	39.641	0.097	0.152	60.283.**	0.003	1.210**	0.00008	95.727**	2.135**	153.968
P vs F_2S	1	87.919**	674.144	14.012	0.012	417.123**	15.854**	23.363**	3.000**	41.964**	0.963**	0.038**	101.350**	1.376**	152.332
F_1S vs F_2S	1	393.625**	2305.625**	43.200**	1324.457	549.000**	37.037	75.049	248.061**	117.447**	0.038**	0.086**	0.203**	0.222**	0.041
Error	198	0.602	0.716	0.571	0.554	0.662	0.652	0.045	0.071	0.710	0.010	0.003	0.008	0.004	0.013

*** Significant at p = 0.05**

**** Significant at p = 0.01**

Table No. 2 : Mean and Range of 14 characters in parents, F_1S and F_2S of a 10 parents diallel cross in linseed.

Characters	Mean			Range					
	Parents	F1	F2	Parents		F1		F2	
				Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Days to Flower	75.50	74.98	77.39	62.33 (Padmini)	86.67 (PCL-21-2)	60.67 (PCL-24xPCL-44)	84.67 (PCL-34xPCL-20	61.33 (J-23xPCL-44)	87.67 (PCL-41-2xPCL-34)
Plant height (cm)	72.17	72.77	66.93	47.67 (Padmini)	101.67 (Parvati)	44.67 (T-397xPCL-44)	107.00 (Parvati x PCL-41-2)	41.67 (Padmini x T-397)	100.67 (Parvati x PCL-21-2)
Number of tillers/plant	5.60	5.64	4.84	3.33 (Padmini)	9.33 (T-397)	3.33 (Padmini x PCL-41-2)	9.33 (Padmini x PCL-44)	3.00 (Padmini x Parvati)	8.33 (Padmini x J-23
Number of branches/plant	20.93	25.34	20.91	11.0 (Padmini)	32.33 (T-397)	14.00 (J-23x PCL-41-2)	42.33 (Padmini x T-397)	10.33 (J-23 x PCL-21-2)	36.33 (PCL-24 x PCL-44)
Days to maturity	132.97	134.24	137.09	122.67 (Padmini)	143.67 (Parvati)	118.33 (Padmini x PCL-44)	146.33 (PCL-41-2 x PCL-21-2)	123.67 (PCL-34 x PCL-21-2)	149.67 (Parvati x PCL-41-2)

Number of seeds/capsule	7.63	7.57	6.83	5.33 (PCL-21-2)	10.00 (J-23)	5.33 (PCL-41-2 x PCL-21-2)	10.00 (Padmini x J-23)	4.67 (Padmini x PCL-41-2)	9.00 (J-23 x T-397)
1000-seed weight (g)	7.29	7.37	6.32	4.27 (PCL-21-2)	9.20 (J-23)	5.06 (PCL-21-2 x T-397)	10.35 (Padmini x J-23)	4.05 (PCL-21-2xPCL-44)	9.26 (Padmini x PCL 44)
Seed yield/plant (g)	7.20	8.77	6.85	3.30 (PCL-21-2)	11.45 (Padmini)	4.36 (PCL-41-2xPCL-21-2)	14.24 (Padmini x T-397)	3.16 (PCL-41-2x PCL-21-2)	12.37 (Padmini x PCL 24)
Oil content (%)	34.24	34.25	32.93	28.70 (PCL-21-2)	39.18 (Padmini)	26.43 (J-23xPCL-21-2)	40.15 (Padmini x T-397)	26.25 (PCL-21-2xPCL-20)	37.45 (Padmini x PCL 21-2)
Palmitic acid (%)	6.05	6.27	6.25	5.44 (PCL-24)	7.00 (T-397)	5.50 (PCL-41-2 x PCL-20)	7.03 (Padmini x PCL-20)	5.45 (PCL-41-2 x PCL-20)	6.97 (PCL-24 x PCL-44)
Stearic acid (%)	5.06	5.05	5.02	3.88 (Parvati)	3.88 (Parvati)	6.09 (PCL-20xPCL-44)	6.61 (PCL-34xPCL-20)	3.55 (PCL-20x PCL 44)	6.69 (PCL-34xPCL-20
Oleic Acid (%)	30.42	32.39	32.45	22.73 (PCL-24)	38.76 (PCL-41-2)	25.18 (T-397xPCL-20)	38.67 (PCL-41-2xPCL-20)	25.03 (T-397xPCL-20)	38.92 (PCL-41-2xPCL-20)

Linoleic acid (%)	13.47	13.77	13.71	10.57 (PCL-21-2)	15.77 (Parvati)	10.93 (ParvatixPCL-24)	17.64 (ParvatixPCL-34)	11.25 (Padmini x Parvati	17.81 (Parvati x PCL-34)
Linolenic acid(%)	45.01	42.50	42.52	35.54 (PCL-41-2)	52.33 (PCL-24)	36.25 (PCL-41-2xPCL-34)	48.24 (Parvati x PCL-24)	36.39 (PCL-34 x PCL-20)	47.65 (Parvati x PCL-24)

Table 3: Estimates of Genetic Components and Related Parameters for 14 Characters of 10 Parents Diallel Cross In F_1 and F_2 Generations of Linseed

Characters	Gen.	D	H_1	H_2	F	h^2	E	Degree of dominance $(H_1/D)^{0.5}$	$h^2/4H_1$	$\frac{(4DH1)0.5 + F}{(4DH1) - F}$	h^2/H_2	r
Days to flower	F_1	72.30**	73.69**	52.50**	35.57**	0.80	0.22	1.01	0.18	1.64	0.02	-0.457
	SE±	5.93	12.63	10.73	13.69	7.18	1.79					
	F_2	72.35**	116.21**	82.25**	49.85*	11.54	0.18	1.27	0.18	1.75	0.14	-0.147
	SE±	10.07	21.43	18.22	23.23	12.19	3.04					
Plant height (cm)	F_1	314.75**	239.86**	213.47**	19.91	1.07	0.30	0.87	0.22	1.08	0.01	0.585
	SE±	17.75	37.79	32.12	40.96	21.50	5.35					
	F_2	314.84**	235.82**	201.32**	29.57	88.92**	0.20	0.87	0.21	1.11	0.44	0.750

	SE±	14.60	31.08	26.42	33.69	17.68	4.40					
Number of tillers/plant	F_1	3.28**	5.68**	4.94**	1.14	-0.06	0.17	1.32	0.22	1.30	-0.01	0.524
	SE±	0.46	0.98	0.83	1.06	0.56	0.14					
	F_2	3.26**	6.24**	5.17**	3.37**	1.78**	0.19	1.38	0.21	2.19	0.34	0.910
	SE±	0.42	0.90	0.76	0.95	0.51	0.13					
Number of branches/plant	F_1	44.52**	172.20**	155.41**	18.12	62.86**	0.22	1.97	0.23	1.23	0.40	0.008
	SE±	14.06	29.92	25.43	32.43	17.02	4.24					
	F_2	44.58**	144.63**	124.69**	31.93	-0.05	0.15	1.80	0.22	1.50	0.00	0.039
	SE±	14.68	31.26	26.56	33.88	17.78	4.43					
Days of maturity	F_1	45.14**	78.51**	64.63**	7.00	5.13	0.28	1.32	0.21	1.12	0.08	-0.497
	SE±	8.70	18.52	15.74	20.08	10.54	2.62					
	F_2	45.25**	129.73**	115.07**	13.91	55.00**	0.17	1.69	0.22	1.20	0.48	-0.207
	SE±	11.82	25.16	21.38	27.27	14.31	3.56					
Number of Seeds/capsule	F_1	1.87**	2.73**	1.96**	0.89	-0.09	0.29	1.21	0.18	1.49	-0.05	0.254
	SE±	0.22	0.48	0.41	0.52	0.27	0.07					
	F_2	2.03**	5.61**	4.45**	2.32**	2.05**	0.13	1.66	0.20	2.056	0.46	0.699
	SE±	0.46	0.94	0.83	1.06	0.56	0.14					
1000-seed weight (g)	F_1	2.09**	3.61**	3.28**	0.95**	0.01	0.02	1.31	0.23	1.42	0.00	0.453
	SE±	0.19	0.41	0.35	0.45	0.23	0.06					
	F_2	2.10**	4.38**	4.00**	1.37	3.08**	0.02	1.45	0.23	1.58	0.77	0.352

	SE±	0.34	0.73	0.62	0.79	0.41	0.10					
Seed yield/plant (g)	F_1	5.32**	15.77**	12.90**	0.73	7.95**	0.02	1.72	0.20	1.08	0.62	0.645
	SE±	0.88	1.88	1.60	2.04	1.07	0.27					
	F_2	5.30**	13.15**	11.58**	2.87	0.38	0.04	1.58	0.22	1.41	0.03	0.059
	SE±	0.87	1.85	1.57	2.00	1.05	0.26					
Oil Content (%)	F_1	9.48**	21.13**	18.80**	3.94	-0.01	0.03	1.49	0.22	1.32	0.00	0.040
	SE±	1.74	3.71	3.15	4.02	2.11	0.53					
	F_2	9.11**	26.75**	24.95**	6.40	5.39*	0.41	1.71	0.23	1.52	0.22	0.669
	SE±	1.76	3.74	3.18	4.05	2.13	0.53					
Palmitic acid (%)	F_1	0.17**	0.59**	0.43**	0.26**	0.16**	0.01	1.84	0.18	2.40	0.36	-0.239
	SE±	0.03	0.05	0.05	0.06	0.03	0.01					
	F_2	0.18**	0.5**	0.39**	0.27**	0.13**	0.01	1.77	0.18	2.49	0.32	-0.143
	SE±	0.03	0.06	0.05	0.06	0.03	0.01					
Stearic acid	F_1	0.47**	1.52**	1.28**	0.34	0.00	0.00	1.79	0.21	1.51	0.00	0.527
	SE±	0.18	0.38	0.32	0.41	0.21	0.05					
	F_2	0.48**	1.56**	1.28**	0.39	0.00	0.00	1.81	0.20	1.58	0.00	0.529
	SE±	0.16	0.35	0.30	0.38	0.20	0.05					
Oleic acid	F_1	22.32**	32.50**	23.80**	21.70**	12.63**	0.00	1.21	0.18	2.35	0.53	-0.452
	SE±	2.42	5.14	4.37	5.57	2.93	0.73					
	F_2	22.32**	32.49**	24.90**	20.24**	13.38**	0.00	1.21	0.19	2.20	0.54	-0.457

	SE±	2.71	5.77	4.90	6.25	3.28	0.82					
Linoleic acid (%)	F_1	2.00	9.33**	6.64**	2.47	0.28	0.00	2.16	0.18	1.80	0.04	0.423
	SE±	1.19	2.53	2.15	2.75	1.44	0.36					
	F_2	2.00	9.33**	6.90**	2.61	0.18	0.00	2.16	0.18	1.87	0.03	0.443
	SE±	0.90	1.93	1.64	2.09	1.10	0.27					
Linolenic acid (%)	F_1	22.61**	31.33**	21.70**	20.48**	20.32**	0.01	1.18	0.17	2.25	0.94	0.222
	SE±	1.95	4.14	3.52	4.49	2.36	0.59					
	F_2	22.61**	32.30**	22.67**	20.60**	20.11**	0.00	1.20	0.18	2.23	0.89	0.247
	SE±	2.13	4.53	3.85	4.91	2.58	0.64					

*** Significant at p = 0.05**

**** Significant at p = 0.01**

Table No. 4 : Analysis of variance for combining ability for 14 characters in a 10 parents diallel cross in F_1 and F_2 generations of linseed : Mean sum of squares.

Source of variation	Generations	d.f.	Days to flower	Plant height (cm)	Number of tillers/ plant	Number of branches/ plant	Days of Maturity	Number of seeds/ capsule	1000-seed weight (g)
Gca	F_1	9	172.287**	949.630**	8.639**	123.345**	147.015**	5.149**	4.598**
	F_2	9	163.247**	942.587**	3.700**	95.573**	131.677**	2.801**	3.676**
Sca	F_1	45	15.037**	55.767**	1.394**	41.965**	17.605**	0.719**	0.860**
	F_2	45	23.789**	55.566**	1.538**	32.920**	31.468**	1.335**	1.117**
Error	F_1	108	0.219	0.296	0.171	0.218	0.276	0.290	0.021
	F_2	108	0.176	0.199	0.194	0.154	0.169	0.129	0.015
$\delta^2 g$	F_1		14.339	9.111	0.706	10.260	12.228	0.404	0.381
	F_2		13.589	78.532	0.292	7.951	10.959	0.222	0.305
$\delta^2 s$	F_1		14.817	55.471	1.223	41.747	17.329	0.429	0.839
	F_2		23.613	55.367	1.344	32.766	31.299	1.206	1.102
$\delta^2 g/\delta^2 s$	F_1		0.967	1.426	0.577	0.245	0.705	0.941	0.454
	F_2		0.575	1.418	0.217	0.242	0.50	0.184	0.276

$(\delta^2g/\delta^2s)^{0.5}$	F_1		1.017	0.837	1.316	2.017	1.190	1.030	1.483
	F_2		1.318	0.839	2.145	2.030	1.689	2.330	1.900
Gca	F_1	9	20.119**	23.440**	0.191**	1.076**	30.845**	5.424**	36.678**
	F_2	9	12.028**	15.327**	0.188**	1.058**	32.177**	4.515**	36.417**
Sca	F_1	45	3.678**	4.914**	0.128**	0.340**	6.996**	1.893**	6.745**
	F_2	45	3.060**	6.759**	0.117**	0.343**	7.196**	1.933**	6.979**
Error	F_1	108	0.25	0.034	0.005	0.001	0.002	0.002	0.008
	F_2	108	0.043	0.408	0.005	0.001	0.003	0.002	0.002
δ^2g	F_1		1.675	1.950	0.05	0.089	2.570	0.451	3.055
	F_2		0.998	1.243	0.015	0.088	2.681	0.376	3.034
δ^2s	F_1		3.654	4.880	0.123	0.339	6.994	1.891	6.737
	F_2		3.017	6.351	0.112	0.342	7.193	1.931	6.977
δ^2g/δ^2s	F_1		0.458	0.399	0.121	0.262	0.367	0.238	0.453
	F_2		0.330	0.195	0.133	0.257	0.372	0.194	0.434
$(\delta^2g/\delta^2s)^{0.5}$	F_1		1.476	1.581	2.863	1.951	1.649	2.047	1.485
	F_2		1.738	2.260	2.732	1.971	1.637	2.266	1.516

* Significant at p = 0.05

** Significant at p = 0.01

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References

Anonymous, (2013). Annual Progress Report, All India Co-ordinated Research Project on Linseed. Project Co-ordinating Unit (Linseed), CSAUA&T, Kanpur.

Chauhan, M.P., Shadhana, S. and Singh, A.K. (2009). Post-harvest uses of Linseed. J. Hum. Eco., 28 (3): 217-219. Griffing, B. (1956). Concept of general and specific combin-ing ability.Aust. J. Biol. Sci., 9: 463-493.

Hallauer, A.R. and Miranda, J.B. (1981). Quantitative Genet-ics in Maize Breeding, Iowa State University Press Ames, Iowa, USA.

Kaushal, P.K., Srivastava, S.R. and Goswami, U. (1974). Combining ability for oil content in linseed. Indian J. Agric. Sci., 44: 859-862.

Mishra, R.K., Marker, S., Bhatnagar, V. and Mahto, D. (2013). Combining ability and heterosis for seed yield and its component in linseed (Linum usitatissimum L.). Adv. Plant Sci., 2 (1): 44-47.

Neelam, Singh, S.P. and Singh, C.B. (1981). Genetic analy-sis of seed yield and yield contributing characters in linseed using line x tester analysis. Indian J. agric. Sci., 51 (7): 483-488. Panse, V.G. and Sukhatme, P.V. (1985). Statistical methods for Agricultural workers. IInd Ed. I.C.A.r., New Delhi. Rai, M. and Das K. (1974). Combining ability for compo-nents of yield in linseed. Indian J. Genet., 34: 371-375.

Sahu, V., Singh, S.K., Sharma, Amita and Bhati, P.K. (2013). Combining ability analysis for yield and yield traits using 'wa' cytoplasm in rice (Oryza sativa L.). The Bioscan., 8 (3): 871-874.

Simmonds, N.W. (1989). How frequent are superior geno-types in plant breeding populations. Biol. Rev., 64: 341-365.

Sprague, G.F. and Tatum, L.A. (1942). General vs specific combining ability in single cross of corn. Jour. Amer. Soc. Agron., 34: 923-32.

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Formulating Research Designs in Biological Sciences

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Introduction

Science is a systematic investigation of any phenomenon that occurs in nature through observation, identification, description, experimental investigation, and theoretical explanation. The research is simply a method to attain the goals of science and it involves a process of reflective thinking by the researcher. The research in biological sciences has wide implications on the human society since it encompasses numerous interrelated fields from agriculture to zoology to biotechnology, genetic engineering to bioinformatics and so on. Many a biological sciences directly or indirectly affect the lives and living of human beings as well as the environment to which man is intricately related and interdependent. Whether the research is basic or applied, the general steps involved in conduct of any biological research are many and they are required to be systematically undertaken during the course of entire research work.

These steps are given as such.

1. To select the topic, subject, field, and specific problem of the research work.
2. The general survey of the field inorder to understand the problems related to the research work.

3. To search for specific and detailed survey of the pertinent literature and development of bibliography or references related to the problem.
4. To give a plausible definition of the problem to be undertaken during the research study.
5. To determine the various parameters required to be studied to arrive at the solution of the problem.
6. To chose the right methodology to study parameters concerning the problem.
7. To standardize the chosen methodology and testing its suitability for the problem.
8. To design the experiment, field study or survey with appropriate statistical background.
9. The collection of data and relevant information during the conduct of experimental design.
10. The processing, classification, tabulation, presentation, analysis and interpretation of the collected data.
11. To draw appropriate and valid inferences from the data collected in the conduct of experimental design of the research work by applying appropriate statistical methods.
12. To report the research work in the form of an article, paper, thesis, book or any other form of publication.

Hypothesis Formulation

The research generally begins with the identification of the problem by the researcher and subsequently to explain such questions like what, when, why, who and how. Often the explanation is synthesized in the form of a hypothesis. In practice a hypothesis is generally put forth as a solution to the problem or as an explanation for an observed phenomenon. It is a statement making a prediction that an event will occur under the stated and specified conditions. It is observed that a hypothesis should be one that can be tested scientifically by applying some common standard statistical tests and before applying the statistical tests it is required to conduct a well designed and controlled experiment inorder to collect evidence in the

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form of a valid data to support the hypothesis. The data collected from the conduct of experiment are then subjected to statistical analysis which would test the null hypothesis. The result of statistical test of significance calculates the probability for occurrence of null hypothesis. If the probability is very low which means lower than the level of significance, null hypothesis stands rejected. The rejection of null hypothesis leads to suggestion that information collected supports the hypothesis. On the other hand, if the statistical test gives probability of occurrence of null hypothesis equal to or greater than the level of significance the null hypothesis cannot be rejected and in that case the failure to reject null hypothesis leads to the suggestion that the information collected from the experiment is insufficient or inappropriate to draw any valid inference.

Experimental Designs

The beginning of research work pertains to the identification and selection of the topic of the field of study or the problem and a better understanding and definition of the problem which is followed by gathering necessary knowledge of the topic well before the experiment or systematic study. In the conduct of any biological experiment either in the laboratory or field the researcher must lay out all the necessary aspects of the experiment before the commencement of the study. Therefore, the researcher must design the experiment to the minutest detail. The designing varies depending on the specific field of biology such as ecology, cytology, pathology, anatomy, genetics, ethology, taxonomy, microbiology, biotechnology, toxicology, parasitology, immunology and so on. The design as well as conduct of the experiment forms the most crucial part of the research work. The design of the experiment ensures what is to be done and how it is to be done. What are the various requirements in the conduct of study? It is to be kept in mind that the three important basic steps required at the beginning of any biological experiment are aim, plan and procedure.

The aim portrays that the researcher must define and record precisely the objectives of the experiment. In plan, the researcher

should write in detail the strategy to conduct the experiment. The planning of the experiment includes sampling procedure, sample size, mode of treatment, control and collection and data analysis. The procedure is important to work out how to give practical shape to the experiment. It also entails various experimental requirements of tools, equipments and so on inorder to execute the already laid out plan. Moreover, it is given a particular mention that all the practical and operational details expected during the conduct of experiment should be thought of in advance and given proper place in the experimental design.

All the experimental designs require a thorough knowledge of the basic principles of statistics, especially those of inferential statistics like chi square test, t-test, student test, regression, variance, analysis of variance, standard error of deviation, mean, mode and median. If the researcher knows beforehand what statistical test should be applied to the data one can design the experiment accordingly. At the end of the experiment researcher collects all the relevant data from the sample, organizes the data, analyze the data and finally draw the valid inferences. Some of the commonly used experimental designs in the biological sciences are briefly described.

One-Group Design

In one-group design a random sample is collected from the population and its statistics like mean is compared with the population parameter. For example a sample of tall maize plants with two tassels may be collected and examined for the total number of grains. It may be tested whether the mean number of grains present in the sample is significantly different from the mean number of grains present in the maize population.

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One Group Experimental Design

Large Sample vs. Population parameter

Testing the significance of difference between the sample mean and population mean.

Step1 Statement of the problem – Hypothesis

Step2 Null- hypothesis- $H_{\circ}$: $X - \mu = 0$

Step3 Level of Significance: 0.05 or 0.01

Step4 Sampling distribution of sample means Computation of the Standard Error of the Mean either from the population SD (σ) or sample SD (*S*), as

$$\sigma X = \frac{\sigma}{\sqrt{n}}$$

or

$$S X = \frac{S}{\sqrt{n-1}}$$

Step5 Location of the sample statistics in the sampling distribution as

$$Z = \frac{X - \mu}{S X}$$

Step6 Decision regarding the $H_{\circ}$:

If the calculated Z > the table value, reject the $H_{\circ}$

Step7 Inference: Difference between X and μ is significant if $H_{\circ}$ is rejected and not significant if $H_{\circ}$ is failed to be rejected.

Two-Group Design

In a two-group design samples may be obtained from two different populations and their statistics may be used to compare the population parameters for a possible difference or a sample may be randomly divided into two and allotted to 'experimental' and 'control' groups in order to access the possible effect of the treatment to the experiment.

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Two-Group Experimental Design

Step1. Statement of the problem : To test whether there is a significant difference between $\bar{X}1$ and $\bar{X}2$

Step2. Sampling distribution of difference between means, $\bar{X}1 - \bar{X}2$ with a mean of 0, and a SE of difference between means.

$$S_{\bar{X}1 - \bar{X}2} = \sqrt{\frac{S1^2}{N_1 - 1} + \frac{S2^2}{n_2 - 1}}$$

Step 3. Location of the observed difference between means in the sampling distribution in terms of Z score, as

$$Z = \frac{(\bar{X}1 - \bar{X}2) - (\mu_1 - \mu_2)}{S_{\bar{X}1} - S_{\bar{X}2}}$$

Step 4. Decision about H_o: If the Calculated Z < table value of Z, Then, we fail to reject the H_o

Step 5 . Inference

Matched-Pair Data Analysis Design

In this design only one group of sample is used. The data may be collected before and after the experimental treatment or data may be collected after the control treatment and again after the experimental treatment. In such a design each sample unit serves for both control and experimental treatment. Moreover, the pairs of data obtained are also matched and the difference between each pair is obtained and then tested whether the mean difference is significant.

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Matched-Pair Data Analysis Design

Step1 Same subjects yield pairs of data.

(a). Values obtained before and after treatment; (b) Values obtained after control treatment and after experimental treatment; (c)Values obtained at two different periods- now and after a gap of a day, a month, a year, etc.

Step2. Significance of the mean difference (D') is tested using t-test.

Step3 H_0: D' - μ_D =0; n-1 degrees of freedom (*n*= pairs of data); Sampling distribution of mean differences (D' s) with a population mean of $\mu_D = 0$

Step4 Computation:

(i) D= matched difference between *n* pairs of values – if the " after" value is greater than "before " value the difference is shown as + ; if the "after " value is less than the "before" value, the difference is – . This + or – sign should be taken into account while calculating ∑D and (*D* - *D'*) .

(ii) ∑D

(iii) Mean difference: D' = ∑D/*n*

(iv) (D- D'), (D- D')^2 and ∑(*D* - D')^2

(v) SD: $S = \sqrt{\sum(D - D')^2 / n}$

(vi) SE of mean difference: S D' = S/ $\sqrt{n-1}$

Step5 $t = D' - \mu_D / S D'$, this is , t = D-0/S D'.

Step6 Table *t* at specific LS & *n*-1 degrees of freedom (one-tail, if direction specified; two tailed, if not)

Step7 Decision: If calculated *t* > table *t*, reject H_0

Step8 Inference

Multiple-Group Design

This type of experimental designs is based on analysis of variance (ANOVA) since the application of ANOVA would enable a variety of multiple-group designs. Some of the commonly used multiple-group designs are as under:

1. One-way Classification design: Here only one factor is studied at different levels in the experiment. It is a very commonly used

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experimental design wherein two or more groups are compared together.

2. Two-way Classification design: In this experimental design two factors are studied together. It is also known as factorial design. This design works out the effect of two factors operating on the third factor and the first two factors may be in two or more levels.
3. Randomized Block Design: This design implies the arrangement of the experiment in the form of blocks and the assignment of the experimental unit to each block is done randomly. This design is also referred as randomized complete block design and is intended to reduce the random error on account of natural variations.
4. Latin Square Design: If a researcher intends to control the variations in an experiment related to rows and columns in the field LSD is applied.
5. Split-plot Design: This design is useful for two factors, one of which may have to be applied to larger experimental units and the other factor requires smaller areas within larger units.

The results of an experimental design are often measured through the use of some kind of instrument which has a wide range from an ordinary metric scale to digital or much more sophisticated instruments. Whatever instrument may be used in the data measurement the researcher is required to be focused on the accuracy and precision of the measurement values. The accuracy is considered closeness of measured value to the true value. In fact the true value of a measurement is never known and, therefore, the researcher would never be able to know whether the measurement is accurate or not. The accuracy and precision is often dependent on the efficiency of the instruments as well as on the researcher who conducts the experiment. How seriously the researcher conducts the experiment greatly influences the accuracy of the data generated and subsequently the inferences drawn from the analysis and interpretation of the data.

All biological experiments should have appropriate controls. When a sample unit receives a treatment by one of several methods,

it is possible that the effect observed might be due to factors other than the one that the treatment contained. Therefore, it is obligatory on our part to demonstrate that the effect is in fact due to the treatment factor and not due to any others including the method of treatment itself like the handling of the experimental animals, medium in which the treatment factor is prepared. This we can do by incorporating a proper control in the experiment. In general two types of controls are followed in biological science research. They are negative controls and positive controls. In negative controls the factor under testing is removed in the experiment. In positive controls the factor under testing is either completely removed in the experiment or removed in fifty percent of experiment and added in rest of fifty percent so as to determine, and compare and contrast the efficacy of the subject under the research work. The negative and positive controls are also referred to as baseline controls and they are actually opposite to the experimental units with reference to anyone specific condition while all other conditions are the same. It has been seen that normal and healthy plants, animals and microbes may also serve as baseline controls in the experiments. Another type of controls commonly applied in the biological research is the blind controls which are also useful in the conduct of experiments especially when the researcher is expecting the results well before the experiment. Inorder to remove such a bias the researcher may apply blind controls since there is always the possibility of falsifying data since the researcher is already expecting the results prior to the conduct of the experiment. This problem is overcome by subjecting blind controls in the experiment wherein some other person who is unaware of the treatment and results regarding the research work is chosen to gather the result data and evaluation of the results of the treatment. Thus the bias toward an expected result can be eliminated. The researcher may also follow double blind controls in which the person neither knows the results nor the nature of treatment given in the experiment.

Experimental Error

The designing of experiments need to consider the introduction of errors into the research study at the time of conduct of

the experiment. The experimental errors result either on the part of the researcher or the population sample taken to record the observations. The errors may be introduced by the researcher unintentionally during the conduct of the experiment while recording the observations. Sometimes the errors are also introduced through the sample taken for study due to the natural variability already present in the individuals of the population. If the level of errors is significant in such a manner that the selected hypothesis is affected and invalid inferences are drawn from the conduct of the experimental design the researcher is required to replicate the research work by carefully redesigning the experiment.

References

Burkholder, G.J, Cox. K.A, Crawford, L.M & Hitchcock, J (2019).“Research Designs and Methods”. Sage Publications, California, USA.

Cash, Philip, Stankovic, Tino, Storge & Mario. (2016). “Experimental Design Research- Approaches, Perspectives, Applications”. Springer International Publishing, Switzerland.

Creswell, J.W (2013). “Research Designs: Qualitative, Quantitative and Mixed Methods Approaches” (4th Ed.) Sage Publications, California, USA.

Dayarathna, D (2016). Research Design for Beginners (3rd Ed.) –S. Godage and Brothers (Pvt) Ltd.

Kothari, C.R (2014). “Research Methodology”. New Age International Publishers, New Delhi.

Sharma, K.R. (2002). Research Methodology. National Publishing House, Jaipur and New Delhi.

Yin, R.K (2009). “Case Study Research: Designs and Methods” Sage Publications, California, USA.

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Micropropagation in Sugarcane

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Abstract

Plant tissue culture has been opted as the best technology for the production of seeds in sugarcane. Recent trend includes rapid clonal propagation at a faster rate, callus culture to produce somaclonal propagation, disease free plant production by meristem culture, protoplast culture, somatic hybridization, germplasm conservation and genetic transformation. Formulation of specific tissue culture media for culture establishment, multiplication, shooting and rooting is a tough task. Nowadays, new sub-culturing methods also provides better option for rapid multiplication in lesser time period.

Key words: Sugarcane, Micropropagation, Meristem Culture, Genetic Transformation, Subculturing.

Introduction

India is known as the original home of sugar and sugarcane. In global sugar economy, the Indian sugar industry has achieved a number of milestones. It is the second largest producer of sugar in the world. Sugar industry in India is well developed with a consumer base of more than billion of people. This industry is the second largest agro processing industry in India. More than 500 thousand people are directly employed. Including farmers, and their family member, more than 45 million people of the rural population of India depend on sugar

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industry for their livelihood. Its contribution to the Central and State exchequers is of high order. The Indian sugar industry has been accounting for around 1% of GDP of the country in the recent past.

Commercially sugarcane is propagated vegetatively and germination refers to the initiation of growth from present on the planted setts or on the stems of the stools that remain in the soil after harvest of the previous crop. Either whole stalks or stalks cut up in to shorter segments called 'setts' are used as planting material (Willcox *et al*., 2000). After the development of clone/variety, major bottleneck in spreading of a clone or variety is slow propagation rate through conventional method, which takes several years. The most important of which is the non availability of disease free elite stock for seeding and lack of implementation of advance technologies in sugarcane propagation. The most important of which is the non availability of disease free, elite stock for seeding and lack of implementation of advance technologies in sugarcane propagation.

Shaw (1990) reported that micropropagation is being used in several sugar industries, for the development of disease free clones, mostly to facilitate their safe and speedy movement through quarantine. It has now become a valuable alternative to the conventional clonal propagation methods for seed production.

Tissue culture can increase the propagation potential by 20-35 times (Geijskes *et al*., 2003, Snyman *et al*., 2006). In addition, plants can be disease-indexed (Snyman *et al*., 2007) and healthy material multiplied in much less time compared to the conventional vegetative route. Establishment of *in vitro* culture is the first stage in any micropropagation system. Its success depends on choice of explants, varied compositions of nutrients and hormones in culture media, methods of subculturing and also on aseptic environmental conditions. In sugarcane, micropropagation can be performed mainly through three pathways, 1. Axillary shoot formation, 2. Adventitious shoot formation and 3. Somatic embryogenesis.

Despite several benefits of *in vitro* micropropagation technique, it is not gaining popularity upto desired extent due to

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numerous constraints and limitations associated with *in vitro* micropropagation of sugarcane. Numerous studies on sugarcane plant regeneration have been made. Essentially, successful culture and regeneration of plants from protoplasts, cells, callus and various tissue and organs have been achieved in this crop. The *in vitro* experiments on sugarcane were initiated in 1961 at Hawaii. Now a days, at the many places of the world such as Australia, Fiji, Taiwan, Florida, Luciana, Maryland, Philippines, Brazil, France, Shri Lanka and India, scientists are doing experiments for the genetic improvement as well as for the advancements in the production of sugarcane. Production of a large number of identical clones through *in vitro* techniques has been reported by several investigators (Hendre *et al*., 1983; Lee, 1987; Lal and Singh, 1994). Callus culture of sugarcane has been successfully established using shoot apices, young leaves and young inflorescences as the explants on MS medium containing 2, 4-D and coconut milk (Heinz *et al*. 1977; Nadar *et al*. 1978; Bhansali and Singh 1984; Liu 1984). Jadav *et al*. (2001) established a protocol for micropropagation of sugarcane on MS medium supplemented with BAP, NAA and IBA. Sauvaire and Glazy (1978) used axillary bud for micropropagation of sugarcane as it gives shoot on wider range of media. Taylor and Duke (1993) produced *in vitro* plants of over 200 sugarcane cultivars from apical bud on same media (BAP and Kintin). Hendre *et al.* (1983) reported root proliferation on media without any hormone. Chattha *et al.* (2001) reported micropropagation by culturing axillary and apical buds on MS medium with 1.5 mg-1 of BA and GA_3. Almost 2500 seedlings could be generated from one bud within a period of 12 week.

Different varieties have been reported to respond differently regarding regeneration potential and survival rate. It may be due to the variable contents of endogenous hormones in different varieties. George (1993) reported that young tissue had more cytokinin than the old one. Possibly, it is the endogenous cytokinin content that plays role in determining the requirement of cytokinin level in the nutrient

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media for getting optimum number of shoots during micropropagation of sugarcane.

Intensive contamination has been frequently reported despite the use of strong surface sterilization treatments of explants used in tissue culture (Ahloowalia and Meretzki, 1983; Wagih *et al*., 1995). Use of apical meristems as explant for production of virus free plants has been reported in sugarcane by earlier workers (Visessuwan *et al*., 1991, 1999, Victoria *et al*., 1999, Chatenet *et al*., 2001, Fitch *et al*., 2001, Balamuralikrishnan *et al*., 2002, Parmessur *et al*. 2002, Cha-um *et al*. 2006, Zhang *et al*. 2006). Recently, Ramgareeb *et al* (2010) established protocol for rapid proliferation of virus free shoots from infected sugarcane plants and approximately 1,300 shoots were propagated from a single 2 mm meristem in 11 weeks.

Larkin (1982) reported callus cultures which were cultured for 32 months without loss of regeneration ability, while other authors report loss of ability for one-year-old cultures. Ho and Vasil (1983) maintained *S. officinarum* L. cell suspension cultures for a period of two years without loss of morphogenic ability. Unfortunately, some important traits such as resistance to insect pests and to some herbicides, appear to be absent from the genetic pools of sugarcane cultivars (Arencibia *et al*. 1997).

The use of plant transformation methods to introduce resistance genes into plant genomes may have an important impact on sugarcane yields. Arencibia *et al*. (1997) published a report evidencing the generation of the first transgenic sugarcane lines resistant to stem-borer attack. Optimization of the *Agrobacterium* mediated DNA transfer to sugarcane meristems has also been reported (Enriquez-Obregon *et al*. 1997, 1998). The lack of a reproducible methodology for stable transformation of sugarcane has been an important obstacle for its genetic manipulation for several years. In 1992, Bower and Birch successfully recovered transgenic sugarcane plants from cell suspensions and embryogenic calli transformed by particle bombardment (Bower and Birch, 1992).

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Simultaneously, Arencibia *et al.* (1992) developed a procedure for stable transformation of sugarcane by electroporation of meristematic tissues. Later, a method to produce transgenic sugarcane plants by intact cell electroporation was established by the same group (Arencibia *et al*. 1995). The development of herbicide-resistant plants containing the *bar* gene and derived from the commercial variety NCo 310 by biolistic transformation (Gallo-Meagher and Irvine, 1996) has been reported.

Optimization of the *Agrobacterium*-mediated DNA transfer to sugarcane meristems has been reported (Enríquez-Obregón *et al.* 1997, 1998). In 2004 University of Hawaii started a project entitled "Genetic transformation of sugarcane chloroplasts to improve expression and containment of gene encoding human vaccines". Newly developed varieties of sugarcane confer high yield and better sugar recovery.

Malik (1990) reported that yield potential of sugarcane varieties is deteriorating day by day due to segregation, susceptibility to diseases, insects, admixture, changes in adaphic and climatic environment. Moreover, the lack of rapid multiplication procedures has long been a serious problem in sugarcane breeding programs. Old varieties of sugarcane need to be quickly replaced with newly released varieties of sugarcane.

Newly released varieties due to different genetic and physiological nature show different requirements of nutrient media, plant growth regulators and environment for proper development under *in vitro* condition. With the improvement in micropropagation protocol for establishment, multiplication, rooting and hardening, more efficient and cost effective production of plants can be ensured which will help in rapid replacement of old deteriorated varieties of sugarcane with the newly released high yielding cultivars.

There are also some challenges which are faced during *in vitro* micropropagation. These include microbial contamination, phenolics exudation from the explants, shoot vitrification, somaclonal variation, asynchronous shoot development, low survival at green

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house and field levels, high cost of production etc, which need to be reduced. These constraints not only reduce the rate of multiplication under *in vitro* condition but also adversely affect the production capacity of a micropropagation laboratory. This has been a major cause of low adoptability of micropropagation technique in sugarcane at commercial level. Earlier studies have indicated that *in vitro* morphogenetic responses are under the influence of plant growth regulators (hormones) and are cultivar dependant.

The regeneration responses are also highly influenced by various subculturing methods/practices which affect the rate of shoot multiplication. Much work has been done on some of the constraints mentioned above but information on the effect of hormonal manipulations and subculturing practices on the rate of shoot multiplication is scanty.

References

Ahloowalia, B. S. and A. Maretzki. (1983). Plant regeneration via somatic embryogenesis in sugarcane. Plant Cell Rep., 2: 21-25.

Arencibia, A., Molina, P. de la Riva, G. and Selman-Housein, G. (1995). Production of transgenic sugarcane (Saccharum officinarum L.) plants by intact cell electroporation. Plant Cell Reports. 14: 305-309.

Arencibia, A., Molina, P., Gutierrez, C., Fuentes,A., Greenidge, V., Menendez, E, de la Riva, G. and Selman-Housein, G. (1992). Regeneration of transgenic sugarcane (Saccharum officinarum L.) plants from intact meristematic tissue transformed by electroporation. Biotecnología Aplicada .9: 156-165.

Arencibia, A., Vázquez, R., Prieto, D., Téllez, P., Carmona, E., Coego, A., Hernández, L., de la Riva, G. and Selman-Housein, G. (1997). Transgenic sugarcane plants resistant to stem-borer attack. Molecular Breeding. 3: 247-255.

Bhansali, R.R. and Singh K. (1984). Callus and shoot formation from leaf of sugarcane in tissue culture. Phytomorphol., pp: 167-170.

Balamuralikrishnan M., Doraisamy S., Ganapathy T., Viswanathan R. (2002). Combined effect of chemotherapy and meristem culture on sugarcane mosaic virus elimination in sugarcane. Sugar Tech. 4:19-25.

Bower, R. and Birch, R. G. (1992). Transgenic sugarcane plants via microproyectile bombardment. The Plant Journal, 2: 409-416.

Chattha, M.A., Imran, M.I., Abida, A. , Muhammad, I. and Akhtar, A. (2001). Micropropagation of sugarcane (Saccharum sp.) Pakistan Sugar J. 16: 2–6

Chatenet, M., Delage, C., Ripolles, M., Irey, M., Lockhart, B. E. L., Rott, P. (2001). Detection of Sugarcane yellow leaf virus in quarantine and production of virus-free sugarcane by apical meristem culture, J. Plant Disease, 85 : 1177-1180.

Cha-um, Hien, S.N.T. and Kirdmanee, C. (2006). Disease free production of sugar cane varieties (Saccharum officinarum L.) using in-vitro meristem culture., J. Biotechnology, 5 : 443-448.

Enríquez-Obregón, G.A., Vázquez-Padrón, R.I., Prieto-Samsónov, D.L., Pérez, M. and Selman-Housein, G. (1997). Genetic transformation of sugarcane by Agrobacterium tumefaciens using antioxidants compounds. Biotecnología Aplicada. 14: 169-174.

Enríquez-Obregón, G.A., Vázquez-padrón, R.I., Prieto-sansonov, D.L., de la Riva, G.A. and Selman-Housein,G. (1998). Herbicide resistant sugarcane (Saccharum officinarum L.) plants by Agrobacterium-mediated transformation. Planta, 206: 20-27.

Fitch, M.M.M., Lehrer, A.T., Komor, E., Komor, Moore, P.H. (2001). Elimination of Sugarcane yellow leaf virus from infected

sugarcane plants by meristem tip culture visualized by tissue blot immunoassay. Plant Pathology. 50(6): 676–680.

Geijskes R. J., Wang L., Lakshmanan P., McKeon M. G. , Berding N., Swain R. S., Elliott A. R., Grof C. P. L., Jackson J. A. and Smith G. R. (2003). Smartsett™ seedlings : tissue cultured seed plants for the Australian sugar industry. Sugarcane International J. May/ June. pp 13-17.

George, E.F. (1993). Plant Propagation by Tissue Culture, 2nd Ed., p: 246 Exegetics Ltd., Edenton, England

Gallo-Meagher, M. and Irvine, J.M. (1996). Herbicide resistant transgenic sugarcane plants containing the bar gene. Crop Science .36: 1367-1374.

Hendre, R.R., R.S. Iyer, M. Kotwal, S.S. Khuppe and A.F. Mascarenhas. (1983). Rapid multiplication of sugarcane by tissue culture. Sugarcane. 1: 4–9.

Heinz D.J., Krishnamurthi M., Nickel L.G., Maretzki A. (1977). Applied and functional aspects of plant cell, tissue and organ culture. In: Reinert J, Bajaj YPS (eds) Cell tissue and organ culture in sugarcane improvement. Springer-Verlag, New York, pp 3–17.

Ho, W. and Vasil, I.K. (1983). Somatic embryogenesis in sugarcane (Saccharum officinarum L.): Growth and regeneration from embryogenic cell suspension cultures. Annals of Botany. 51:719-726.

Jadhav, A.B., E.R. Vaidya, V.B. Aher and A.M. Pawar. (2001). In vitro multiplication of co–86032 sugarcane (S. officinarum) hybrid .Indian J. Agric. Sci., 71: 113–15.

Lee, T.S.G. (1987). Micropropagation of sugarcane (Saccharum sp.) Plant Cell Tissue and Organ culture, 10: 47–55

Liu, M. C. (1984). Hand book of Plant Cell Culture: Crop species, 2: 572-605. Mc Graw-Hill, New York.

Lal, N. and Singh, H.N. (1994). Rapid clonal multiplication of sugarcane through tissue culture : Plant Tissue Cult., 4 :1-7.

Larkin, P.J. (1982). Sugarcane tissue and protoplast culture. Plant Cell, Tissue and Organ Culture, 1:149-164.

Malik, K.B. and Munir, A. (1990). Sugarcane disease in Pakistan. Pak. Sugar J. 4: 3-10.

Nadar, H.M. Soepraptopo, S., Heinz, D.J. and Ladd, S.L. (1978). Fine structure of sugarcane (Saccharum species) callus and the role of auxin in embryogenesis. Crop Sci. 18: 210-216.

Parmessur, Y., S. Aljanabi, S. Saumtally and A. Dookun-Saumtally. (2002) .Sugarcane yellow leaf virus and sugarcane yellow phytoplasma: elimination by tissue culture. Plant Pathology. 51:561–566

Ramgareeb, S., S.J. Snyman, T. van Antwerpen, R.S. Rutherford. (2010). Elimination of virus and rapid propagation of disease free sugarcane (Saccharum spp. Cultivar NCo376) using apical meristem culture. Plant Cell Tiss & Organ Cult .100:175–181.

Shaw, M.E.A. (1990). Biotechnology in sugarcane agriculture. Proceedings of the Annual National Conference on Science and Technology (Part 2). Scientific Research Council 1990; Kingston; Jamaica: 31-35.

Snyman S. J., Van Antwerpen, T., Ramdeen, V., Meyer, G. M., Richards, J. M. and Rutherford, R. S. (2007). Micropropagation by direct somatic embryogenesis: is disease elimination also a possibility? Proc Int Soc Sug Cane Technol. 26: 943-946.

Snyman, S. J., Meyer, G.M., Richards, J. M., Haricharan, N., Ramgareeb, S. and Hucket, B.I. (2006). Refining the application of direct embryogenesis in sugarcane : effect of the developmental phase of leaf disk ex[plants and the timing of DNA transfer on transformation efficiency. Plant Cell Rep. 25: 1016-1023.

Sauvaire, D. and Galzy, R. (1978). Multiplication vegetative de la canne a sucre (Saccharum sp.) par bouturage in vitro.

ISBN: 978-81-947902-9-7

Comptes Rendus De L' Academic Des Sciences, Ser. 3, 287: 467-470.

Taylor, P.W.J. and Duke, S. (1993). Development of an in vitro culture technique for conservation of Saccharum sp. Plant Cell Tissue & Organ Cult., 34: 217–22.

Victoria, J. I.Guzman. M.L.Graces, F. Jaramillo, A.D. (1999). Pathogen-free seed cane production and its impact on a commercial scale in Colombia. C Singh V.Kumar V. Proceedings of the XXIII ISSCT Congress Organizing Committee. STAI. New Delhi. India. 390-396.

Visessuwan, R., Chiemsombat, P., Naritoom, K. and Surija Chaijakorn, M. (1999). Role of growth regulators in meristem culture and production of virus free sugarcane germplasm. Sugar Tech. 1(3): 82-88.

Wagih, M.E., Gordon, G.H., Ryan, CC and Adkins, S.W. (1995). Development of an Axiliary Bud Culture Technique for Fiji Disease Virus Elimination in Sugarcane. Austr. J. Bot., 43:135-143.

Willcox, T., Garside, A. and Braunack, M. (2000). The sugarcane cropping system. In "Mannual of sugarcane growing", M. Hogarth, P. Allsopp, eds. Bureau of sugar experiment stations, Indooroopilly Australia. pp 127-139.

Zang, M. Q. Rao, G. P. Gaur, R. K. Ruan, M. H. Singh, M. Sharma, S. R.Singh, A.Singh (2006). Sugarcane mosaic virus. In: Characterization, diagnosis and management of plant viruses: (eds) Rao G.P., Khurana P., Lenardon S.L. Industrial crops, Vol. 1. Texas.Studium Press.111-144.

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Studies on Kinetic Parameters of Cu Accumulation by yeast *Saccharomyces cerevisiae*

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Introduction

The rapid development of various industries and discharge of wastes containing metals into the environment causes the environmental pollution. Removal of heavy metals by biosorption has been investigated during last decades. Biological treatment, based on living micro-organisms or plants, offers a reducing level of toxic metals in environmentally acceptable limits. Biosorption is a nondirected physico-chemical interaction between metal and microbial cells. It is beneficial over conventional treatment methods. It is a property of dead biomass, particularly of microbial origin, to retain and concentrate metallic elements from relatively dilute solutions. The mechanism of absorption of the heavy metal ions by the yeast *Saccharomyces cerevisiae* is key interest of the study. Yeast cells are capable of accumulation of various heavy metals. Molecules that participate in binding of metal ions have been identified and found in several species of yeast and other fungi. Yeast being typical eukaryote, has many essential features similar to higher eukaryotes.

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Saccharomyces cerevisiae has been accepted as a model eukaryote in the laboratory. Baker's yeast *S.cerevisiae* has been found to possess two or more substrate specific transport systems for accumulating any single metal ion. They can produce or excrete extracellular polymeric substances such as polysaccharides, glucoprotein, lipopolysaccharide, soluble peptides etc. The adsorbed ions are transported across the membrane by the same mechanism by which metabolically important ions (K, Mg and Na) are accumulated. The metals accumulated by organisms either in large amounts or in traces give active participation in important metabolic activities. Several diseases arise due to heavy metal cations, so it gives direct indication towards interference caused by these pollutants in metabolic activities.

Accumulation of metal ions by yeast largely depends on parameters such as pH, the ratio of the initial metal ion and initial biomass concentration, aerobic conditions, presence of various ligands and competitive metal ions. The accumulated metal ion affects the growth of yeast. Growth characteristics of *S.cerevisiae* were studied in the presence of different concentrations of Cu^{2+} ions. An assessment of metal accumulation, as well as kinetics was performed. The mechanisms of accumulation of Cu^{2+} by the yeast cells were studied. The total mechanism of the bioaccumulation of the heavy metal ions is based on kinetic study of Enzyme-Substrate complex. This will lead us to know the biochemical effects occurring in the living cell by intake of the heavy metal ions.

Growth Characteristics and Determination of Dry mass of *S.cerevisiae*

Growth parameters of *S.cerevisiae* were studied in terms of dry mass measurement in the presence of different concentrations of Cu^{2+} ions. In the presence of 1, 2, 5 and 7µg/ml Cu^{2+} concentrations, Cu^{2+} moderately inhibits the growth of *S.cerevisiae* compared to the biomass growth, obtained under control condition. Total proteins in ng/mg of dry mass decreased with increasing concentration of Cu^{2+} this indicates that proteins may start degenerating. Above 7µg/ml

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concentration of Cu^{2+}, increased growth of yeast was observed, which indicates that some metabolic activities have been initiated leading to an increase in the growth of cells. The most important aspect governing the toxic or stimulating influence of copper on fungal growth is obviously its concentration.

Analysis of Accumulated Copper and it's effect on *S.cerevisiae*

Accumulated Cu^{2+} by *S.cerevisiae* increased significantly with increasing concentration of Cu^{2+}. Increased accumulation of Cu^{2+} in terms of µg/ng of total proteins at lower concentrations (1-7µg/ml of Cu^{2+}), indicate that copper binding proteins may get involve in metabolic reactions. Above 7µg/ml concentration decreased accumulation of Cu^{2+} in µg/ng of total proteins indicates that proteins may involved in metabolic reactions leading to the efflux of accumulated Cu^{2+} ions. Accumulation of Cu^{2+} ions leads to the production of free radicals in tissues. Production of peroxide radicals and interaction with the cell membrane causes cell poisoning.

Copper serves as a coenzyme to many metabolic reactions, in many organisms. It's concentration influences various biomolecules because Copper acts as a cofactor for a number of key proteins. Most of copper is bound to high molecular mass blood components, which shows that proteins are responsible for copper transport. There are different kinds of copper sites in copper containing enzymes which are called active sites. A "normal" copper site is provided by superoxide dismutase (Cu/ZnSOD). The periplasmic Cop-A protein shows conservation of copper binding sites.

Kinetic studies of Cu^{2+} accumulation

Enzyme kinetics is very important for the proper understanding of the rate of biochemical reaction occurring in living cells. An enzymatically controlled reaction depends upon substrate as well as enzyme concentration. The dependence of reaction rate on enzyme concentration is very important as it regulates the cell metabolism. The factor which affects the rate of reaction catalyzed by an enzyme is the concentration of substrate [S]. To study the mechanism of an enzyme-catalyzed reaction it is necessary to

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determine the initial velocity V_0, when substrate (metal) concentration [S] is much greater than the concentration of enzyme (Protein). As [S] increases, V_0 slowly increases and forms [ES] complex. Combination of enzyme with the substrate molecule is a necessary step in enzymatic catalysis. Thus, in any enzymatic catalysis V_{max} is observed when all enzymes are present as [ES] complex. The curve plotted between [S] and V_0 has a shape of rectangular hyperbola, which is general of all enzymes. This has been expressed algebraically by Michaelis-Menten equation, which is as follows:

$$V_0 = \frac{V_{max}[S]}{K_m + [S]}$$

Where, K_m is called as Michaelis-Menten constant. K_m depicts the strength of ES complex or the affinity of an enzyme for the substrate. Practically, accurate values of V_{max} and hence K_m, cannot be determined directly from the substrate saturation curve, as V_{max} is obtained arbitrarily. But it is possible by taking reciprocal of Michaelis-Menten equation, in the form of straight line for the easy determination of V_{max}. This form of the Michaelis-Menten equation is called the Lineweaver-Burk equation. A plot of $1/V_0$ (the reciprocal of initial velocity, determined experimentally) against 1/[S], was drawn to analyse kinetic data using **Lineweaver-Burk equation** equation:

$$\frac{1}{V_0} = \frac{1}{V_{max}} + \left(\frac{K_m}{V_{max}}\right)\frac{1}{[S]}$$

Therefore, the intercept $1/V_{max}$ on the $1/V_0$ axis can be used to find V_{max} and then that value combined with the slope K_m/V_{max} to find the value of K_m. The maximum rate of binding [V_{max}] obtained for Cu^{2+} to the protein molecules is 0.090 µg/ml sec^{-1}. The binding affinity with the protein molecules is shown by $1/K_m$, thus for Cu^{2+} ion obtained value of $1/K_m$ is 0.46. It shows strong binding of Cu^{2+} with targeted protein molecules.

It is now specifically clear that heavy metals when get accumulated by target protein molecules in the cell, these proteins

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may be in need of those heavy metals or are getting associated due to competitive accumulation. When yeast cells were grown in the presence of 10 µg/ml concentration of Cu^{2+} ion, maximum total protein content was observed. De novo synthesis of proteins may help the yeast cells for initiating the efflux of Cu^{2+} accumulated at higher concentration exposure.

References

Aksu Z., Sep. Purif. Technol, 2001, 21, 285–294.

Arzu Y.D., Biochem. Eng. J., 2006, 28,187–195.

Baker A. J. M. and Brooks R. R., Biorecovery, 1989,1, 81-126.

Bahram Sarkarati A.N. and Cokug R., Ferhan Tezca E., Comparative Biochem. and Physiology part c: Pharmacology, Toxicology and Endocrinology, 1999, 122(2),181-190.

Hassett R. and Kosman D.J., J. Biol. Chem., 1995, 270(1),128.

Hossain Md. A., Chemosphere, 2006, 63,171–174.

Mani D. and Mishra S.G., In: Mohan, Ashish (Ed.), Publishing House New Delhi, 1989.

Macaskie L.E., Wates J.M. and Dean A.C.R., Biotechnol. Bioeng. 1987, 30, 57-63.

Verma R. S., Rao T.V.G. and Prasad R., Biochem. Biophys. Acta, 1984, 778, 289-97.

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Importance of Green Chemistry in Science and Technology

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Abstract

Green chemistry is characterised as reduction of the environmental harm in the course of the accompanied of materials and various minimisation and correct disposal of wastes generated throughout completely different chemical processes. The application of green Chemistry begins with recognition that the production, process, use and ultimate disposal of chemical merchandise could cause hurt once performed incorrectly.

Keywords: Green Chemistry, Principle of Green Chemistry, Organic Synthesis, Industrial, Pharmaceutical, Environmental.

Introduction

The term “Green Chemistry” was introduced for first time by Anastas[1,2] in 1991 in an exceedingly special program created by the US Environmental Protection Agency (EPA) so as to stimulate a considerable development in chemistry and chemical technology .Green chemistry is that the utilization of a group of principles that reduces or eliminates the employment or generation of unsafe substances within the style, manufacture and application of chemical products. The green chemistry construct presents a gorgeous technology to chemists, researchers and industrialists for innovative chemistry research and applications. Green chemistry will advance

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environmental property by informing the look of molecules, producing processes and merchandise in ways in which conserve resources, use less energy, eliminate pollution and defend human health.

Food and drink has been created safe to consume, the event of cosmetics has enabled North American country to beautify and admire our appearances and therefore the whole space of prescribed drugs has allowed the event and synthesis of recent cures for diseases and diseases, all as a results of chemistry. However, further chemical developments additionally bring new environmental issues and harmful sudden facet effects that lead to the necessity for 'greener' chemical merchandise.

In the last decade green chemistry and inexperienced engineering have advanced for an excellent sort of analysis and technology fields providing fashionable analysis and sensible applications for a large spectrum of chemical merchandise and technological innovations[3].

Principles of Green Chemistry

Green Chemistry can be comprehensively illustrated as a set of 12 principles, which were proposed by Anastas and Warner[4].These principles include instructions for professional chemists concerning the creation of new substances, new syntheses and new technological processes.

The twelve principles of green chemistry are[5]

Prevention

It is better to prevent waste than to treat or clean up waste after it is formed.

Atom Economy

Synthetic methods should be designed in such some way that every one products participating within the reaction process are included within the final product.

Less Hazardous Chemical Synthesis

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Whenever practicable, synthetic methodologies should be designed to use and generate substances that pose little or no toxicity to human health and therefore the environment.

Designing Safer Chemicals

Chemical products should be design to affect their decide function while minimising the toxicity.

Safer Solvents and Auxilliaries

The solvent chosen for a given reaction must not pollute the environment or be hazardous to human health.

Design for Energy Efficiency

Energy requirements of chemical change should be recognized for their environmental and economic impacts and will be minimized. If possible, synthetic methods should be conducted at ambient temperature and pressure.

Use of Renewable Feedstocks

A raw materials or feedstock should be renewable instead of depleting whenever technically and economically practicable.

Reduce Derivatives

Unnecessary derivatisation (use of blocking groups, protection/ deprotection, and temporary modification of physical/chemical processes) should be minimised or avoided if possible, because such steps require additional reagents and may generate Waste.

Use of Catalyst

It is documented that catalysed increase substantially the chemical reaction rates, without their consumption or insertion in the final product.

Design for Degradation

Chemical products should be designed in order that at the end of their function their breakdown into innocuous degradation products and do not persist in the environment.

Real-time Analysis for Pollution Prevention

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Analytical methodologies need to be further developed to permit for real time, in process monitoring and control before to the formation of hazardous substances.

Inherently Safer Chemistry for Accidental Prevention

Substance and the kind a substance used in a chemical process should be chosen to reduce the potential for chemical accidents, including releases, explosions and fires.

Importance of Green Chemistry

Organic Synthesis

A key aspect of green chemistry is that the involvement of artificial chemistry within the observation of environmental chemistry[6]. Currently the time has arrived for the artificial chemistry those that create chemicals and activities drive chemical processes to become intimately concerned in creating the manufacture, use, and supreme disposal of chemicals as environmentally friendly as potential. Organic synthesis using benign inexperienced solvents like water, supercritical greenhouse emission liquid (CO_2), polyethylene glycol and ferrous solvents. Organic synthesis using phase transfer catalyst and ultrasound has conjointly been studied[7]. Solvents play a very vital role within the chemical and allied industries and millions of tons are used and disposed of each year.

Industrial

Most of the chemicals are made on an industrial scale. The industrial homes adopt synthesis for a specific molecule which should be price effective. Green chemistry incorporating the utilization of inexperienced reagents, inexperienced catalysts, phase transfer catalysis, inexperienced synthesis. There are various examples of productive industrial changes using green chemistry[8].

Eastman attribute greener artificial pathway for its enzymatic esterification[8]. This accelerator method run under gentle conditions minimizes the formation of by-products and save energy, leading to redoubled efficiency.

In green chemistry because of use of non accidental and non dangerous chemical materials industry staff are saved from accidental

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explosion and health damages because of long exposure to risky materials which might be life saving boon for the trade and conjointly for the staff.

Pharmaceutical

Pharmaceutical companies have the capacity to improve the environmental performance by using the knowledge related to green chemistry[9]. Green chemistry is engaged in developing innovative drug deliverance methods which are less toxic and more useful, efficient and could help millions of patients[10], Examples:- (1) Phosphoramidite: solid-phase which is blend of antisense oligonucleotides has been altered to entrain the concepts of green chemistry by discarding the usage and formation of toxic or hazardous materials and recycling the important materials like protecting groups amidites and solid support, thus upgrading the cost-efficiency and atom economy[11]. (2)The formation of Naproxen with chiral metal catalyst containing 2,2'-bis[diphenylphosphino]-1,1'-binaphthyl ligand with fine quantity of product and this was described by Anastas et al[12].

Environmental

Pollution can be defined in various ways. It has been recognised for some time now that most of the pollution is with respect to air, water and soil which are the most essential ingredients for life. Each pollutant that has been introduced in the surrounding has its own health risk profile. Green chemistry has contributed a lot in the cleaning the environment and making our planet a beautiful place to live in. Green chemistry has optimized global mass in order to minimize waste. It has promoted the use and utilization of row materials from renewable sources.

Green Chemistry: Research and Development

Sustainable development and environmental problems are the fore front of public and government concern. Green Chemistry aims not just for safer product, less dangerous consequences to the setting, saving energy and water, however includes broader problems

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which may promote within the finish property development. It is an additional eco-friendly inexperienced different to traditional chemistry practices. The green chemistry movement is an element of a bigger movement ultimately resulting in an inexperienced economy particularly property development.

The speedy development of latest chemical technologies and also the large range of latest chemical product within the last decades turned the attention of environmentalists to remedial actions for the negative impacts (monitoring environmental pollution, reduction of pollutants, recycling, etc).

In the last 250 years chemistry has improved our quality of life, and created thousands of helpful product and materials possible. However this action has return at a price: for the worldwide setting and non-renewable natural resources. Green chemistry and its principle need to alter of these negative impacts and through style, innovation and green processes to restore the planet's sustainable development.

Conclusion

The goal of green chemistry is to make improved, safer and economical surroundings by reducing waste and eliminate the unsafe materials in chemicals. Our future challenges in society, environmental, economic and resources demand for economical and environmental-friendly chemical processes and product. green chemistry addresses such challenges by opening a good and varied research scope so permitting the invention of novel reactions which will maximize the specified product and minimize the waste and by product, further because the design of recent artificial schemes that are inherently, environmentally, and ecologically benign.

References

1. *Anastas P.T., Warner, J. Green Chemistry, Theory and Practice, Oxford University Press, Oxford, 1988.*
2. *Wardencki W., Curylo J., Namiesnic, J. Green Chemistry – Current and Future. Pol. J. Environ. Stud., 2005, 14(4), 389-395.*

3. *Athanasios V., Green Chemistry and Green Engineering, Advances in Chemistry field, www.chem.uoa.gr, July, 2016.*
4. *Ahluwalia, V.K., Kidwai M., New Trends in Green Chemistry, Kluwer Academic Publishers: Dordrecht, 2004.*
5. *"12 Principles of Green Chemistry - American Chemical Society"*, American Chemical Society. *Retrieved 2018-02-16*.
6. *Manahan S.E., Green Chemistry and Ten Commandments of Sustainability 2nd Ed., 2006.*
7. *Ahluwalia V.K., Green Chemistry, A Text book, 2013.*
8. *Office of Pollution Prevention and Toxics; the Presidential Green Chemistry Challenge Awards Programme Summary of 2009 Award Entries and Recipients; US Environmental Protection Agency; Washington DC, EPA 744K 09001, 2009.*
9. *Kim A., Juan C., Peter J.D., Thomas F., Sandra J., Timothy A., Green Chemistry Tools to Influence a Medicinal Chemistry and Research Chemistry Based Organization. Green Chem., 2008, 10:31- 36 53.*
10. *Kirchhoff, Mary, Ryan, Mary Ann., eds. Greener Approaches to Undergraduate Chemistry Experiments. Washington, DC: American Chemical Society, 2002, 54.*
11. *Yogesh S.S., Ravikumar V.T., Anthony N.S., Douglas L.C., Applications of Green Chemistry in the Manufacture of Oligonucleotide Drugs. Pure Appl Chem., 2001, 73:175–180 55.*
12. *Anastas P.T., Lauren B.B., Mary M.K., Tracy C.W., The Role of Catalysis in the Design, Development and Implementation of Green Chemistry, Catalysis Today, 2000, 55:11-22*

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जीवनः जीनों के संयोग से गुणों के प्रयोग तक

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हब्बल और वॉयेजर जैसी अत्याधुनिक तकनीकों से खगोलशास्त्री ब्रह्मांड के अनन्त को टटोलने का सतत् प्रयास कर रहें हैं। ब्रह्मांड के सम्बन्ध में विभिन्न अनुसंधानकर्ताओं के अब तक के अध्ययन का निष्कर्ष यह है कि इसमें कुछ भी स्थायी नहीं है। अरबों वर्षों पूर्व बिग बैंग जैसी घटना से उत्पन्न ब्रह्मांड सतत् परिवर्तनशील है। यहाँ तक कि ब्रह्मांड की उत्पत्ति का यह सिद्धांत भी चिरस्थायी होने का दावा नहीं कर सकता। सूक्ष्म जगत हो अथवा स्थूल जगत, परिवर्तन ब्रह्मांड के हर स्तर पर परिलक्षित होता है। एक ओर जहाँ इलेक्ट्रोन जैसे सबएटोमिक कण अपनी स्थिति में सतत् परिवर्तन करते रहते हैं तो दूसरी ओर आकाशगंगाओं जैसी ब्रह्मांड की विशाल इकाइयों की स्थिति में सतत् परिवर्तन को भी अनुसंधानकर्ताओं ने अवलोकित किया है। परिवर्तन मात्र निर्जीव जगत तक सीमित नही है बल्कि यह सजीव जगत का भी आधारभूत गुण है क्योंकि सजीवों का निर्माण इन निर्जीव पदार्थों के निश्चित संयोजन से ही होता है।

उन्नीसवीं सदी में चार्ल्स डार्विन ने सजीवों के उद्विकास का वैज्ञानिक सिद्धान्त दिया। उनके अनुसार सरल से जटिल जीवों

की उत्पत्ति कईं बाहरी व आन्तरिक कारकों के प्रभाव में हुई है। इनमे सबसे महत्वपूर्ण कारक है आनुवांशिक सामग्री का पुनर्संयोजन, जिसके फलस्वरूप जीवों में जीवन के ब्लूप्रिंट अर्थात जीनोम में एक पीढ़ी से अगली पीढ़ी में निरंतर परिवर्तन होते है। जीनोम में इन परिवर्तनों से जीनों के नये–नये संयोग बनते है। प्रश्न यह उठता है कि जीवन का ब्लूप्रिंट अर्थात जीनोम संयोग का प्रतिफल है तो क्या जीवन भी मात्र संयोग ही है। अन्य जीवों के सम्बन्ध में इसमें कुछ सीमा तक सच्चाई हो सकती है, क्योंकि नैसर्गिक वृत्तियां ही उनके जीवन का आधार होती है। परन्तु मनुष्यों के सम्बन्ध में सच यह है कि जन्म लेना संयोग हो सकता है परंतु जीवन व्यतीत करना संयोग नही है। प्रकृति विज्ञान के नियमों के अनुसार ही कार्य करती है परन्तु प्रकृति की सर्वोत्तम रचना अर्थात मनुष्य भौतिक रूप से इन नियमों से बंधे होकर भी चेतना के स्तर पर रचनात्मकता की स्वतंत्रता रखते हैं। एक ओर हम अन्य जीवों के समान लाखों वर्षों के उद्विकास के फलस्वरूप अर्जित ज्ञान को नैसर्गिक वृत्तियों के रूप में अगली पीढ़ी में आनुवांशिक पदचिह्नों के माध्यम से हस्तान्तरित करते हैं वही दूसरी ओर अन्य जीवों से इतर हम एक पीढ़ी के अनुभव और ज्ञान को अगली पीढ़ी में विभिन्न माध्यमों से हस्तान्तरित कर हमारी अगली पीढ़ी के बौद्धिक विकास का मार्ग भी प्रशस्त करते है। हमारी यही विशेषता हमें अन्य जीवों से विशिष्ट व प्रकृति की सर्वश्रेष्ठ कृति बनाती है। पीढ़ी दर पीढ़ी बौद्धिक विकास के परिणामस्वरूप मानव सभ्यता आज उस स्थिति में पँहुच पाई है जिसे कुछ सौ सालों पहले तक कल्पनाओं में भी स्थान नही मिलता था। परन्तु सभ्यता के विकास का आधार मात्र भौतिक स्थिति में परिवर्तन भर नहीं है बल्कि मानवोचित गुणों की निरंतरता भी होता है। भौतिक उन्नति को जीवन की सफलताओं का पर्याय मानना और भौतिक

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उपलब्धियों को जीवन की सफलता की सीढ़ी मानना मनुष्य जाति के विनाश का आधार बन गया है। अगर जीवन की सफलता की सीढ़ी भौतिक उन्नति ही है तो इस सीढ़ी पर उत्तरोत्तर आरोहण के पश्चात तनाव का स्तर कम होना चाहिए और संतुष्टि तथा आनन्द का स्तर बढ़ना चाहिए, परंतु ऐसा होता नहीं है। भौतिक संसाधनों का संकलन अधिकांशत मानसिक तनाव को जन्म देता है यही कारण है कि मनोवैज्ञानिक कतिपय सांख्यिकीय प्रविधियों के माध्यम से मानसिक तनाव और भौतिक सफलता के मध्य सकारात्मक सहसम्बन्ध स्थापित कर सकते है परन्तु वो मानसिक तनाव और संतुष्टि या आनन्द के मध्य इस प्रकार का कोई भी सम्बन्ध स्थापित नहीं कर पाएंगें।

जैसा कि प्रारम्भ में बताया गया है परिवर्तन ब्रह्मांड का नियम है और इसी नियम के अधीन हम जन्म से मृत्यु तक विभिन्न शारीरिक परिवर्तनों से गुजरते हैं जिनको रोकना या जिनकी दिशा बदलना आधुनिक चिकित्साशास्त्र के वश में नहीं है, क्योंकि शारीरिक परिवर्तन आन्तरिक जैवरासायनिक क्रियाओं का ही परीणाम होते हैं। इसी प्रकार जन्म से मृत्यु तक सतत् मनोवैज्ञानिक परिवर्तन भी होते रहते हैं जिनकी दिशा कई कारकों पर निर्भर करती है। क्योंकि तनाव और संतुष्टि मनोवैज्ञानिक क्षैत्र की विषयवस्तु है अतः इन कारकों को नियंत्रित कर मनोवैज्ञानिक परिवर्तनों को सकारात्मक दिशा दी जा सकती है। मनुष्य में आनुवांशिक सामग्री प्रकृति प्रदत्त वो संयोग है जो हर व्यक्ति को विशिष्टता प्रदान करते हैं परन्तु कोई भी आनुवांशिक संयोग सामान्य मनुष्य में मूल मानव सुलभ गुणों–अवगुणों की एक पीढ़ी से दूसरी पीढ़ी तक सततता में बाधक नहीं होता है। जिस प्रकार काम, क्रोध, लोभ, मोह और अहंकार जैसे मानवीय अवगुण सार्वभौमिक है उसी प्रकार सत्य, सहयोग, परोपकार, करूणा, प्रेम, त्याग जैसे मानवीय गुण भी ना सिर्फ इस ग्रह पर बल्कि ब्रह्मांड

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के हर उस क्षेत्र में प्रासंगिक है जहाँ मनुष्य भौतिक रूप में उपस्थित हो सकता है अथवा कल्पनाओं में विचरण कर सकता है। जीवन की सार्थकता इस पर निर्भर करती है कि हम जीवन में इनका प्रयोग कितना और कहाँ करते हैं, और इसे तय करता है जीवन का उद्देश्य। जीवन की दिशा, उद्देश्य और मार्ग के सम्बन्ध मे विभिन्न भाषाओं के कई विद्वानों ने जीवन सूत्र दिये है जिनमे निहित संदेश रुपी प्रकाश में जीवन यात्रा सार्थक और मानवोचित तरीके के पूर्ण की जा सकती है।

काममय एवायं पुरुष इति।
स यथाकामो भवति तत्क्रतुर्भवति।
यत्क्रतुर्भवति तत्कर्म कुरुते।
यत्कर्म कुरुते तदभिसंपद्यते।।
बृहदारण्यक उपनिषद्

सामान्यतया हम हमारे जीवन की सफलताओं और असफलताओं को भाग्य का प्रतिफल मानते है। भाग्य क्या है? और कैसे बनता है? इसकी व्याख्या कई विद्वानों ने विभिन्न प्रकार से की है। बृहदारण्यक उपनिषद् के इस श्लोक में भाग्य और कामनाओं में सम्बन्ध मिलता है तथा कामनाओं को भाग्य का मूल बताया गया है। कामनाएं जब प्रबल हो जाती है तो संकल्प में परिवर्तित हो जाती है। व्यक्ति संकल्प के अनुसार ही कर्म का रास्ता चुनता है। अंततः कर्म ही होते है जो भाग्य तय करते है। हर कामना भाग्य में परिवर्तित हो यह आवश्यक नही परन्तु हर भाग्य का आधार निःसन्देह कामना ही होता है। कामनाओ की दिशा बदल कर भाग्य को बदला जा सकता है। कामनाएं यदि गलत दिशा में हो तो सही और गलत में भेद करना आवश्यक हो जाता है।

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Be quenched in reasons night
Till weakness turn to might
Till what is dark be light
Till what is wrong be right

-Lewis Caroll

जीवन पथ पर गतिशील रहते हुए हम समय, स्थान और परिस्थितियों के अनुसार विभिन्न प्रतिक्रियाएं और आचरण करते है इनमें से कौन सा आचरण उचित है और कौन सा अनुचित इसमें यदि संशय हो तो लेविस कैरोल का यह जीवन सूत्र मार्गदर्शक हो सकता है। हर मनुष्य में लालच, महत्वकांक्षा और द्वेष जैसी कुछ मानवीय दुर्बलताएँ पायी जाती है। सामान्यतः हम हमारी इन दुर्बलताओं को कमी न मानकर जीवनयापन का माध्यम मान लेते है। महत्वकांक्षाएं मानवीय संम्बन्धों के स्थान पर भौतिक विकास को प्राथमिकता देती है जहाँ मानवीय रिश्ते क्षणिक लाभ की बलि चढ़ जाते हैं। महत्वकांक्षाओं का उद्गम लालच से होता है और परिणति द्वेष के रूप में होती है। यदि मानवीय दुर्बलताओं को विवेक की कसौटी पर परखा जाए तो उचित और अनुचित का पता लगाना सरल हो सकता है।

एकै साधे सब सधै, सब साधे सब जाय।
'रहिमन' मूलहिं सींचिबो, फूलहि फलहि अघाय।।

रहीम

रहीम के इस जीवन सूत्र की कई विद्वानों ने अलग–अलग व्याख्याएं की है परन्तु समय के संदर्भ में देखें तो इसमे एक महत्वपूर्ण संदेश मिलता है। जीवन के लिए समय के तीन आयाम होते है भूतकाल, वर्तमान काल और भविष्य काल। अधिकांशतः हम भविष्य की आशंकाओं से चिंतित रहते हैं अथवा अतीत की कड़वी–मीठी

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स्मृतियों में जीते हैं। समय के इन दो आयामों में हम इतना उलझे होते हैं कि तीसरे आयाम अर्थात वर्तमान के साथ न्याय नहीं कर पाते। हम यह भूल जाते हैं कि यह वर्तमान ही होता है जिसके सापेक्ष समय के बाकी दो आयामों का अस्तित्व होता है। यदि वर्तमान को मात्र वर्तमान पर ही केन्द्रित किया जाए तो समय के बाकी दो आयाम स्वतः ही हमारे पक्ष में होंगें ठीक उसी प्रकार जैसे पौधे के हर भाग को सींचने के बजाय मात्र जड़ों को सीचें तो पौधे के सभी भाग स्वतः ही विकसित हो जाते है। वस्तुतः जीवनकाल का मूल भी वर्तमान काल ही होता है जीसको तात्कालिक आवश्यकताओं के अनुसार श्रेष्ठ पुरूषार्थ के द्वारा सींचा जाना चाहिए।

उम्र भर 'ग़ालिब' यही भूल करता रहा।
धूल चेहरे पर थी और आईना साफ करता रहा।

ग़ालिब

ग़ालिब का यह शेर एक महत्वपूर्ण जीवन सूत्र है जो स्वयं के परिमार्जन का संदेश देता है। स्वयं की कमियों को दूर करने के स्थान पर अन्य लोगों में कमी ढूंढकर दुनिया की नजर में उठकर भी व्यक्ति खुद की दृष्टी में उपर उठ नहीं सकता। अपनी क्षमताओं का सटीक आंकलन करके व्यक्तित्व के सुदृढ़ और दुर्बल पक्षों को पहचानना और वास्तविकताओं को स्वीकार करना सार्थक जीवन के लिए महत्वपूर्ण है। यदि प्रयासों के पश्चात भी सफलता प्राप्त नहीं होती है तो अन्य व्यक्तियों पर दोषारोपण के स्थान पर स्वयं की गलतियों से सीखना और उनको दूर करने पर ध्यान केन्द्रित करना आवश्यक है। इसी प्रकार ग़ालिब का यह शेर प्रयास और परिणाम के सम्बन्ध में भी सटीक है। जीवन मे प्रयास करना ही सफलता की

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गारंटी नहीं है प्रयास सही दिशा मे किये जा रहे है यह भी महत्व रखता है।

$$E= mc^2$$

Albert Einstein

बीसवीं सदी के महान वैज्ञानिक आइंस्टीन का तीन अक्षरों का यह सूत्र भौतिकशास्त्र के समान समाजशास्त्र में भी प्रासंगिक है। इस सूत्र ने ब्रह्मांड को समझने का दृष्टिकोण ही परिवर्तित कर दिया है। इसके अनुसार ब्रह्मांड में ऊर्जा को मैटर अर्थात द्रव्य में और द्रव्य को ऊर्जा में परिवर्तित किया जा सकता है। मुक्त हुई इस ऊर्जा का उपयोग सकारात्मक या नकारात्मक दोनों प्रकार से हो सकता है। जहाँ परमाणु बम के रूप में मुक्त हुई ऊर्जा विनाशकारी है और मानवजाति के अस्तित्व को मिटाने में सक्षम होती है वहीं इस ऊर्जा को विद्युत ऊर्जा मे परिवर्तित कर मानवकल्याण में भी काम किया जा सकता है। इस ऊर्जा का सृजनात्मक या विध्वंसात्मक उपयोग मनुष्य के पर निर्भर करता है और मनुष्य शरीर स्वयं आत्मा नामक ऊर्जा के अधीन कार्य करता है। आत्मा रूपी इसी ऊर्जा को अजर और अमर कहा गया है। यह पूर्णतः हम पर निर्भर करता है कि हम इस अनन्त ऊर्जा का विवेकसम्मत प्रयोग लोककल्याण मे करते हैं अथवा दूसरों से साथ–साथ स्वयं का भी अहित करने में।

सारांशतः पृथ्वी पर जीवन प्रकृति प्रदत्त है जिसको प्रकृति ने करोड़ों वर्षों से सहेज कर रखा है। प्रकृति की सर्वोत्तम कृति होने के पश्चात भी जीवन की परिभाषा में मात्र मनुष्य या कोई एक जीव जाति नही आती। जीवन हर परिस्थिति में अपना मार्ग ढूंढ लेता है। भूगर्भीय समय सारणी और विभिन्न प्रकार के जीवों के जीवाश्मों के अध्ययन के अनुसार प्रकृति ने पृथ्वी पर जीवन के क्षेत्र में असंख्य प्रयोग किये हैं तथा अलग–अलग कालखण्ड मे अलग–अलग प्रकार

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की जीव जातियों को प्रभावी होने का अवसर प्रदान किया है। यही कारण है कि पृथ्वी पर किसी समयखण्ड़ में सूक्ष्म जीव प्रभावी थे तो कभी विशालकाय भयानक डायनासोर। योग्यतम की उत्तरजीविता के नियम के अनुसार प्रकृति ने वर्तमान कालखण्ड में मनुष्य जाति को जीव जगत में सर्वोच्च स्थान तो प्रदान किया है परन्तु इस स्थान पर मनुष्य मानवोचित कर्मों से ही निरंतर बना रह सकता है। प्रकृति प्रदत्त सर्वोच्चता के साथ ही मनुष्यों के कुछ उत्तरदायित्व भी निर्धारित हो जाते है जो हमारे भौतिक विकास और पर्यावरण के मध्य सामंजस्य का आह्वान करते हैं। हमें यह स्मरण रखना होगा कि शरीर अगर मिट्टी से निर्मित है तो निःसन्देह हृदय की मिट्टी सर्वाधिक उपजाऊ होती है। यही कारण है कि इसमें जो कुछ भी बोया जाए उसका पनपना तय है। यह हम पर निर्भर करता है कि हम इसमें मनुष्यता के बीज बोते हैं या पशुता के। जीनोम के किसी भी संयोग में मनुष्य में वो गुण तो बने रहेंगे जो मनुष्यता के लिए आवश्यक हैं यदि हम इन मानवीय गुणों के प्रयोग के स्थान पाशविक व्यवहार करते है तो प्रकृति पृथ्वी पर किसी और को प्रभावी होने का अवसर प्रदान कर सकती है चाहे ये सूक्ष्मदर्शीय रोगजनक जीवाणु हो या सजीव और निर्जीव के बीच की योजक कड़ी, कोरोना वायरस।

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Nano-Scaled Cellulose for Water Remediation

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Abstract

The concentration of heavy toxic metal ions in air, water and soil has increased to an alarming level due to increasing industrialization, urbanization and population explosion. Many of the heavy metals are essential micronutrients, but their higher concentrations are known to produce a variety of toxic effects. High concentration of lead is known to cause behavioural disturbances, kidney damage, anaemia, encephalopathy, cognitive impairment, and damage to the reproductive system. The higher concentration of copper causes damage to the gastrointestinal tract; anorexia and Weakness. The heavy metal ions are non-biodegradable and do not degrade into harmless end products. It is found that in many industries Cu is utilized different applications because of very good electrical and thermal conductivity, ductility and availability. Contamination of drinking water can occur during mining and production processes, where copper ions leak into water streams and are further distributed. In addition to traditional uses, copper can also be used as fungal or plant fertilizers and animal nutrients, which accumulate copper in manure and eventually contaminate the soil,

thus polluting drinking water sources. Potential sources of copper in industrial waste include paper and the fertilizer industry.

Therefore more attention is given to look for the safe and economical methods for their removal. There is an urgent need that all possible inexpensive adsorbents originated from biological, domestic and industrial wastes should be explored and their feasibility for the removal of heavy metal ions should be investigated. The adsorption processes are being widely used for the removal of heavy metal ions from waste streams and industrial effluents since two to three decades.It is certain to happen that new chemicals must be introduced into water systems, including acid and base (pH adjustment), flocculating agents, coagulants, etc., which usually generates new problems. Other conventional methods like ion exchange, membrane technologies, activated carbon adsorption or evaporation are not economical due to substantial energy consumption, especially when treating large amounts of water mixed with heavy metals at low concentration.Nanotechnology holds great potential in advancing water and wastewater treatment to improve treatment efficiency as well as to augment water supply through safe use of unconventional water sources.

Introduction

Adsorption, defines as binding in terms of a physical rather than chemical surface phenomenon. The change in the concentration of the molecule in the upper layer of solid material compared to the bulk phase relative to the surface area of the material is called adsorption. If adsorption occurs and results in the formation of a stable molecular phase at the interface, this can be described as a surface complex. Two general kinds of surface complex exist: inner- and outer-sphere surface complexes. Adsorption is the most common treatment used in conventional clean-up technologies.Bio-adsorption may be simply defined as the removal of substances from solution by biological materials.Adsorption is associated with many benefits such as: availability, high efficiency, cost, environment friendly. The domestic, industrial and biological waste can be used as

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adsorbents.Abundantly available biopolymers have extensively been investigated as adsorbents for the removal of heavy metal ions because of their strong interactions with these metal ions. Sorption is a general term used for adsorption and absorption.

Nanotechnology as a Tool

Recent advancement in nanotechnology offer leapfrogging opportunities to develop next-generation water supply systems. The combination of high strength, chemical inertness, hydrophilic surface chemistry, and high surface area makes nanocellulose a very promising material for high-performance membranes and filters, in order to selectively remove contaminants from industrial and drinking waters. The high mechanical strength and rigidity of nanocelluloseis important in high-pressure, water-treatment applications. Nanocellulose with a high degree of crystallinity is chemically inert in aqueous media,except at very high pH-values.When the size of biosorbents is reduced to nanoscale, high specific surface area and short intraparticle diffusion distance are expected to provide a great advantage for metal ion removal.

Nano-cellulose for Metal Ion Sorption

Cellulose is a large, linear-chain polymer. Cellulose is moderately flexible polysaccharide and has property of twisting and bending in the direction out of the plane owing to its ribbon like shape. The neighbouring cellulose molecules show a strong interaction due to the presence of the hydroxyl (–OH) groups. This peculiar molecular structure of cellulose accounts for its characteristic properties like hydrophilicity, chirality and degradability. Chemical reactivity is largely a function of the high donor reactivity of the OH groups.

Annual production of approximately 3.0 x 10^8 kg of agricultural products is one of the most renewable resources in the world. Cellulose is inexpensive and has many perks, but also has great potential for conversion and ultimately improves its absorption capacity.

Phosphorylated cellulose nanofibrils as cheap and high-quality contentusingfibre sludge stream of paper industry waste.

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These phosphorylated cellulose Nano fibrils were processed on Nano-paper ion-exchangers.The advantage of this method to hold copper ions in the filtration process is that it establishes a continuous process, and as a result, adsorbent material disposal problems are avoided, as backwash operations could be performed easily.The development of an adsorbent into a continuously working nanopaper ion-exchanger represents a step forward in tackling the problem of heavy metal, i.e. copper, accumulation in water resources. Although understanding of mechanisms in terms of biosorption is limited, ion exchange complexation, coordination, adsorption, electrostatic interaction, chelation or micro precipitation, or a combination thereof, can usually be expected.Nanocelluloses with the metal-binding groups are ideal candidates for the treatment of high-volume and low-concentration pollutant water and the use of nanoscaled cellulose for water remediation remains a relatively uncharted area.The four types of nanocelluloses are used i.e.,sludgenanocrystals (CNCSL), bioethanol nanocrystals (CNCBE), phosphorylated cellulose nanocrystals from sludge (phos-CNCSL) and phosphorylated cellulose nanofibers from sludge (phos-CNFSL) for Cu^{2+}. All the adsorbents are isolated from industrial biowastes with zero or even negative cost. The phosphate groups were introduced onto nanocellulose using enzymes as green biocatalysts. Phosphorylated cellulose displayed the capacity to reduce heavy metal concentrations in industry effluent to drinking water level. These technologies provide not only an environmental friendly option for water purification but also unique adsorption efficiency and adsorption rate, owing to the high surface area of the nano particles and tailored functionality due to the presence of carboxyl groups, Sulphate groups and phosphoryl groups on nanocellulose.Cellulose composites, cellulose nanofibrils and nanocrystals show dimensions and lengths from nanometers to micrometers. The excellent mechanical properties are due to their hydrogen bonding crystal assembly. Due to their surface hydroxyl groups, they can be easily modified bynanocarbons, biopolymers o

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nanoparticles to form functional porous media, films, fibers, foams and aerogels.

Researchers have concluded that water quality issues are the biggest challenge humankind faces in the 21st century. Emphasis has been placed on chemical contamination, especially in toxic metals and organic and inorganic pollutants. Innovative processes for treating industrial waste water containing heavy metals often involve technologies for reduction of toxicity in order to meet technology-based treatment standards. Nanotechnology holds great potential in advancing water and wastewater treatment to improve treatment efficiency as well as to augment water supply through safe use of unconventional water sources. Increased demand for effective removal treatments of heavy metals, making the application of adsorption materials such as polymer-functionalized nanocomposites (PFNCs). PFNCs retain the inherent remarkable surface properties of nanoparticles, while the polymeric support materials provide high stability and processability, also explained about nanoparticle-matrix materials are of great interest for metals and metalloids removal. Thanks to the functional groups of the polymeric matrixes that provide specific bindings to target pollutants. The carboxy groups produced on the surface of the nanocellulose can easily be converted into some active substances i.e. esters, ether, acetate, amides. This nanocellulose could be used to form filters to remove waste water impurities. Some studies intended to present an outline on hybrid composites focusing the attention in terms of processing, mechanical, physical, electrical, thermal and dynamic mechanical properties. Hybrid composites are one of the emerging fields in polymer science that triumph attention for application in various sectors ranging from automobile to the building industry. There is a need to recover limited precious and expensive substances which often get lost through the generated wastes and the demand for wastewater reuse have always been the concern of the scientists and engineers. For safer and effective management, wastewaters containing radioactive materials and heavy metals are of particular concern due to their behaviours

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within the environment. Researches explained the suitability of biomaterials for biomedical applications is governed by their physical, mechanical, and biological properties. Of the host of features required for particular biomedical applications, the material must be non-immunogenic and biocompatible.

It is to provide researchers that the evolution of nano-cellulose technology, both as a whole and also divided among the different nanosized particles that are currently the subject of outstanding scientific attention. The global statistics reveals that the moment at which different cellulose nanoparticles technologies achieved a breakthrough, the relative interest received by different nanocellulose particles throughout the years, the companies that have been most interested in this technology, the most prolific inventors, and the patents that have had more influence in further developments. It is expected that the results showing the explosion that nanocellulose technology is experiencing in current days will still bring more research on the topic and contribute to the expansion of nanocellulosics applications.

References

1. *Chauhan, S. Journal of Chem. Pharm.,8(4), 416-420, 2016.*
2. *Gupta, V. K., Gupta, M., Sharma, S. Water research, 35(5), 1125, 2001.*
3. *Wang, J., Chen, C.,Biotechnology advances, 27(2), 195-226, 2009.*
4. *Nayak, B. K., Nanda, A., Bhat, M. A. (Eds.). Integrating biologically-inspired Nanotechnology into medical practice.IGI Global, 2016.*
5. *Crini, G., Lichtfouse, E., Wilson, L. D., Morin-Crini, N., Environmental Chemistry Letters, 17(1), 195-213, 2019.*
6. *Abouzeid, R. E., Khiari, R., El-Wakil, N., Dufresne, A., Biomacromol., 20(2), 573, 2018.*
7. *Crini, G., Lichtfouse, E., Wilson, L. D., Morin-Crini, N., Env. Chem. Lett., 17(1), 195, 2019.*
8. *Shera, S. S., Kulhar, N., Banik, R. M., In Mater. for Biomed. Engg, 339, 2019.*

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9. *Charreau, H., L Foresti, M., Vazquez, A., Recent pat. on nanotech., 7(1), 56, 2013.*
10. *Uth, C., et. Al., Ang. Chem. Int. Ed., 53(46), 12618, 2014.*

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Artificial Intelligence (AI) in The Field of Healthcare Industries

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Abstract

AI now a days is coming up with more effective ways in different field of science technology, Defenses as well as medical field for the welfare of the society.

AI will affect healthcare field as it puts consumers in control of health and well being. Additionally AI increase the ability for healthcare professionals to better understand the day to day patterns and needs of people in the field of health care and with that understanding they are able to provide better feedback , guidance and support for staying healthy also with their systematic data in one touch with an accuracy. AI and robotics are rapidly going to transforming our healthcare system with more accuracy and sufficient knowledge of particular field and related disease to handle properly with all understanding situation between doctor and patients.

Key words

AI-Artificial Intelligence, Healthcare, Technology, Treatment, Medicine, Accuracy, Ubiquitous, Augmentation.

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Introduction

AI is getting increasingly sophisticated at doing work more efficiently, quickly and at lower cost. The potential for both AI and robotics in healthcare is vast. Just like is our everyday lives.AI and robotics are increasingly a part of our healthcare ecosystem.

One of the biggest potential with this AI technology in the field of healthcare sector due to fast results and accuracy in diagnosing the disease more people turning towards this technology. As this is technically more effective to handle as a robotic form to perform surgeries perfectly in operation theaters under supervision of doctors.

There are lots of apps available on net so that individuals can opt any apps for his or her requirement of fitness route with body types and diet schedules. These apps are now a day's boom in the field of healthcare .AI is generally being used to detect disease such as cancer more accurately in their early stage .Due to such apps of AI everyone adopting to keep themselves safe and healthy with the guidance health.

Additionally AI increase the ability for healthcare professionals to better understand the day to day patterns and need to help people they care for and with that understanding they are able to provide better feedback for staying healthy.

AI is generally already being used to detect diseases such as cancer more accurately and in their early stages or early detection of cancer.

Earlier in the field of medicine sometimes delay in providing patients reports due to manually handled they have wait for long hours or days to get their reports from labs also they have suffer lot to get started their line of treatment on or before time that its cure some they have face many difficulties for survive .Now with this technology patients can get their reports on time so that they can avail proper treatments on time to save their life. Even major diseases like cancer can be curable due to early diagnose of symptoms due to AI with in less months. All patients do not have to stay in a hospital for a long

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months for their treatment. In many operations patients can get discharge on same day of surgery too.

There are some wearable AI devices are also available which also indicate about few minutes before if there is any unnecessary changes in heart beats.

AI is the stimulation of human intelligence processes by machine with latest updating especially in our computer system. Some of the applications of AI which includes learning, reasoning and self correction. Other applications of AI which includes expert systems, speech recognition and machine vision.

With the help of AI now doctors and patients are few click away from each other for any help or supports and suggestions over online chats or sharing their reports over phones to their doctors and can get help without wasting their time. Mostly doctors have all records of their patients on computers from there they can excess the data of their particular patients history and can able to prescribe medicine or changes in treatments over phone to their patients.

AI can be dramatically improving the efficiencies of our workplaces and can augment the work human can do. When AI takes over repetitive or dangerous tasks it frees up the human the workforce to do work with the better equipment for tasks that involve creativity and empathy among others.

Technology has placed at the disposal of the healthcare community various potent tools to improve patient care. Virtual reality discuss and apps help ease symptoms of depression and anxiety in older people and patients with mental illness and can also help people with their post operative recovery process.

Now in coming years this technology again going to make a boom in the field of AI as a successful tools in the field of healthcare sectors. In India, we have our own identification number. Known as an Aadhaar card number due to which its more easily to find out person with their diseases history and identification marks as their data were feed online digitally very first time when they visit to hospitals or to visit their doctors .So data of any patients are available on net.

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Another application of AI is making smart phones selfies into powerful diagnostic tools through this device due to continuing the theme of harnessing the power of portable device, experts believe that images taken from smart phones and other consumer grade sources will be an important supplements to clinical quality imaging especially in undeserved population or developing nations.

The quality of cell phone cameras is increasing every year which can able to produce images that are visible for analysis by AI (Artificial Intelligence algorithms). Dermatology and ophthalmology are early beneficiaries of this trend.

The majority of population is equipped with pocket sized, powerful device that have a lot of different sensors are built in it.

This is a great opportunity for all of us. Almost every major player in the industry has started to build AI software and hardware into their devices. That's not a coincidence . Everyday in our digital world this technology increasing day by day with latest updates even software developer generate more than 2.5 million tetra bytes of data. In cell phones the manufactures believe they can use that data with AI to provide much more personalized.

While uses of AI in the field of healthcare its give boost to upcoming more technologies. Which will surely going to make a major changes in the improvement of the patients life of recovery with more efficiency in different departments of health and medicine. Such as Neurology, Cardiology, Gynecology, Urology. With the help of such AI these sectors will going improve more in providing prominent and efficiency in their tests.

Now AI has its new version which is going to take places over real images that is known as virtual images.Through this medium now patients can avail his or her line of treatments during minor disease over virtual images. Where their doctors can examine over internet apps so there is no need to visit their doctors personally. So its again going to make major changes in different ways to support our systems digitally. These systems now coming up with more safety

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and security features to personalize each and every patient can have personal information.

Brain computer interfaces could drastically improve quality of life for patients with AI stokers or locked in syndrome, as well as the 500,000 people worldwide who experience spinal cord injuries every year.

Another development for next generation of radiology tools is also AL reforms in which radiological images obtained by MRI machines CT scanners, and X- rays offer non – invasive visibility into the inner working parts of human body. But many diagnostic processes still rely on physical tissues samples obtained through biopsies , which carry risks including potential for infection.

Artificial intelligence will enable the next generation of radiology tools that are accurate and detailed enough to replace the need for tissues samples in some cases, experts predict.

If we want the imaging to give us information that we presently get from tissues samples, then we are going to have to be able to achieve very close registration. So that the ground truth for any given pixel is known.

AI also help in reducing the burdens of all paper records in the form of Electronic Health Records (EHRs) used by different healthcare departments.

EHRs (Electronic health records) developers are now using AI (Artificial Intelligence) to create more initiatives interfaces and automate some of the routine processes that consume so much of users times. Earlier patients spend more of their time in clinical documentation order entry and sorting through in the process.

Due to AI voice recognition and dictation are helping to improve the clinical documentation process but Natural Language Processing (NLPs) tools might not be going far enough.

Now I think we may need to be even bolder and consider changes like video recording a clinical encounter , almost like police wear body cams and other we can use AI and machine learning index those videos for future information retrievals and also just like in the

home. Now we were using Siri and Alexa ,the future well being virtual assistants to the bed sides for clinicians to used with embedded intelligence for order entry.

AI may also help to the process routine health check- up request from the index, like medications refills and result notifications . It may be also help and guide by its own where it also containing the risk of antibiotics resistance .Which is growing threats to populations around the world as overuses of these critical drugs foster the evolution of superbugs that no longer respond to treatments .Multi drugs resistant organism can wreak havoc in the hospital setting and claim thousands of lives every year.

EHRs (Electronic Health Records) data can help to identify infection patterns and highlight the patients at risk before they began to show symptoms. AI tools are good in accuracy and create faster, more accurate alerts for health care providers ,this tool can live up to the expectation for infection control and antibiotics resistance.

If such AI can't do than that`s really a failure on all our parts. For the hospitals sitting on mountains of EHRs data and not using them to the fullest potentials to industry that`s not creating smarter, faster clinical trial design and for EHRs that are creating these data not to used them that would be failure of such technology.

AI also creating more precise analytics for pathology images which provides one of the most significant sources of diagnostic data for providers across the spectrum of care delivery.70-75% of all decisions in healthcare are based on a pathology results. So the more accurate we get our reports from pathology labs the sooner we get to the right diagnosis, the better we are going to be. That`s what digital pathology and AI has the opportunity to delivers right information about patient disease.

Analytics that can drill down to the pixel level on extremely large digital images can allow providers to identify nuances that may escape the human eyes.

AI can also improve the productivity by identifying features of interest in slides before a human clinician reviews the data.AI can

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screen .through slides and direct us to the right thing to look at so we can excess what`s` important and what`s not. That increases the care in as timely a manner as possible.

Recently the most important exciting development has been checkout which inhibitors , that which block some of the proteins made by some times of immune cells .But still we don't understand all of the diseases biology. This is very complex problem for diseases identity.

We definitely need more patients data .The therapists are relatively new, so not a lots of patients have actually been put on these drugs. So whether we need to integrate data within institution or across multiples institutions is going to be a key factors in terms of augmenting the patient populations to drive the modeling process.

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सामाजिक अनुसंधान की वैज्ञानिक पद्धतियाँ
(राजनीति विज्ञान के विशेष सन्दर्भ में अध्ययन)

इरसाद अली खाँ
सह आचार्य,
राजनीति विज्ञान
राजकीय बाँगड. महाविद्यालय,
डीडवाना, राजस्थान, भारत

"सामाजिक अनुसंधान एक ऐसी वैज्ञानिक योजना है, जिसका उद्देश्य तार्किक तथा क्रमबद्ध विधियों के द्वारा नवीन या प्राचीन तथ्यों को ज्ञात करना और उनकी आवश्यकताओं और अर्न्तसम्बन्धों के कारणों की व्याख्याओं तथा उनको संचालित करने वाले सामाजिक नियमों का विश्लेषण करना है।" – श्रीमती यंग

सारांश

राजनीति विज्ञान की अनेक समस्याओं, नये उत्पन्न प्रश्नों, नवीन ज्ञान, नए घटनाक्रम, प्राक्कल्पनाओं की परीक्षा करना, व्यवस्थित छानबीन करने, तुलना करने, सम्बन्धों को खोजने के उद्देश्य से उपयुक्त पद्धतियों का अनेक परिस्थितियों में प्रयोग कर उसका सारणीकरण करना एवं निष्कर्ष तथा सुझाव देने का प्रयास करना ही अनुसंधान की प्रमुख योजना होती है अर्थात् प्रत्येक अनुसंधान किसी प्रश्न या समस्या को लेकर शुरू किया जाता है। क्यों, क्या, कैसे, कब और कौन शब्दों को यदि हम अनुसंधान के प्राण कहे तो कोई अतिश्योक्ति नहीं होगी। प्रत्येक शोधकार्य में इनका महत्त्व अपरिहार्य है। विशेष रुप से सामाजिक विज्ञानों के ज्ञानकोश में अनुसंधान वस्तुओं, प्रत्ययों तथा संकेतों आदि को कुशलतापूर्वक व्यवस्थित करता है, जिसका उद्देश्य सामान्यीकरण द्वारा

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विज्ञान का विकास, परिमार्जन या सत्यापन हो अर्थात् वह ज्ञान व्यवहार में हो या कला में सहायक ही क्यों न हो।

ऐतिहासिक पृष्ठभूमि

प्राचीन काल से जब से मनुष्य पृथ्वी पर आया तब से लेकर अब तक और आने वाले युगों–युगों तक मनुष्य में कुछ न कुछ नया करने की जिज्ञासा बनी रही है और रहेगी क्योंकि पृथ्वी पर मनुष्य ही सबसे बुद्धिमान जीवों में आता है और बुद्धिमानी को बरकरार रखने के लिए वह सदैव कुछ न कुछ सोचता रहता है तथा कुछ नया करने का प्रयास करता रहता है। जो कुछ इस जगत में है, उसे जानने का भरसक प्रयास मनुष्य करता रहता है। मनुष्य जगत के सम्पूर्ण रहस्यों का पता लगाने का प्रयास करता रहता है। इसके लिए जो प्रयास किसी माध्यम से मनुष्य करता है, उसके लिए वैज्ञानिकों एवं विचारकों ने अलग–अलग नाम दिये है, जैसे – अन्वेषण, गवेषणा, अनुशीलन–परिशीलन, समीक्षा, आलोचना, खोज, अनुसंधान, शोध, समीक्षा, रिसर्च, परिपृच्छा–सिद्धान्त इत्यादि।

अनुसंधान का अभिप्राय

मनुष्य ने अनुसंधान के क्षेत्र में बहुत कार्य किया है। "अनुसंधान" शब्द के मूल में संस्कृत की "धा" धातु विद्यमान है।"धा" धातु का अर्थ धारण करना, रखना आदि होता है। "अनु" उपसर्ग है। जिसका अर्थ है–पीछे लगना, अनुसरण करना, पुनः करना आदि। "धा" धातु से बने "संधान" का अर्थ खोजना, निश्चित करना, लक्ष्य–केन्द्रित होना आदि होता हैं इसे हम इस प्रकार से इसे व्युत्पत्यार्थ को देख लेना चाहिए। जैसे – अनुसंधान शब्द निष्पति "धा" धातु के साथ "अनु" तथा "सम" उपसर्गपूर्वक 'ल्यूट' (अन्)प्रत्यय से होती है। "धा " का अर्थ है, "रखना" स्थिर करना। अतः लक्षणा और व्यंजनागत अर्थ हुआ– दृष्टि को किसी वस्तु अथवा विषय पर रखना या मन को किसी विषय पर केन्द्रित करना और इसी प्रकार अनुसंधान शब्द खोज, सोच–विचार, पूछताछ, परीक्षण इत्यादि रूपों से प्रयुक्त हुआ। जैसे – ''यस्तर्केणानुसन्धते स धर्म वेद नेतरः।"

अनुसंधान शब्द को अंग्रेजी में Research (रिसर्च) कहते हैं। रिसर्च में Re'रि' आवृत्ति का द्योतक है, जबकि Search 'सर्च' खोज का समानार्थी है।

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रिसर्च के कोशगत अर्थ को भी अनुसंधान के स्पष्टीकरण के रुप में देख सकते है, जैसे एक गहन खोज, जो कि सावधानीपूर्वक या श्रम साध्य अन्वेषण किया गया हो, एक ऐसी अध्ययनगत खोज या मूल्यांकन, जो कि विशेषकर समीक्षात्मक और व्यापक अनुसंधान या प्रयोग पर आश्रित हो तथा जिसका उद्देश्य नए तथ्यों का उद्घाटन और उनकी सही व्याख्या करना हो तथा मान्य निष्कर्षों, सिद्धान्तों एवं नियमों का पुनरूद्धार किया गया हो तथा शोध विशेष से प्राप्त निष्कर्षों से एक संयुक्त प्रस्तुतीकरण एक लेख या पुस्तक के रुप में होती है। अनुसंधान (Research) करना बहुत कठिन कार्य होता है क्योंकि शोधार्थी (अनुसंधानकर्त्ता) को जहाँ से वह अपना अनुसंधान चालू करता है वहाँ से लेकर जहाँ तक अनुसंधान का कार्य सम्पूर्ण नहीं हो जाता, वहाँ शोधार्थी को सतर्क, निष्पक्ष रहकर विभिन्न पक्षों का अवलोकन करते हुए सही–सही तथ्यों का संग्रह करना पड़ता है, इसके लिए एक सुनिश्चित एवं सुनियोजित ढंग से उसे कार्य को अंजाम देना होता है तो वह अन्य या अपने मूल्यों को अपनाने या इधर–उधर न भटक जाए इसके लिए एक सुनिश्चित ढंग को शास्त्रीय शैली में हम प्रविधि कहते हैं।

अनुसंधान की पद्धतियाँ

अनुसंधान प्रविधि को कुछ विद्वानों ने लक्ष्य के अनुसार निम्नलिखित तीन बातों को महत्व दिया है जैसे 1. अनुसंधानकर्त्ता का प्रशिक्षण, शोध–प्रवृत्ति एवं प्रयोजन की स्पष्टता होनी चाहिए, 2. अवधारणा का सुचारु निर्धारण हो, 3. आधार सामग्री का संगठन, विश्लेषण, विवेचन एवं प्रस्तुतिकरण सम्बन्धी पद्धतियाँ होनी चाहिए। अनुसंधान की प्रविधियाँ का वर्गीकरण अनेक विद्वानों द्वारा अनेक प्रकार से किया गया है अर्थात् विद्वानों ने क्षेत्र के अनुसार या उद्देश्य या आँकड़ों के आधार पर वर्गीकरण किया है।

अधिकांश विद्वानों ने अनुसंधान को तीन भागों में माना है –

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अनुसंधानों की पद्धतियाँ

ऐतिहासिक अनुसंधान **वर्णनात्मक अथवा सर्वेक्षण अनुसंधान** **प्रयोगात्मक अनुसंधान**

शोधार्थी अपने विषय की अनुरुपता के अनुसार स्वयं यह निर्णय कर सकता है कि वह कौनसी पद्धति को अपने शोध का आधार बनाता है विशेष रुप हम सर्वेक्षण पद्धति, आलोचनात्मक पद्धति, काव्यशास्त्रीय पद्धति, समाजशास्त्रीय पद्धति, भाषा वैज्ञानिक पद्धति, शैली वैज्ञानिक पद्धति, मनोवैज्ञानिक पद्धति, समस्यामूलक पद्धति, तुलनात्मक पद्धति, वर्गीय पद्धति, क्षेत्रीय पद्धति, आगमन–निगमन पद्धति, ऐतिहासिक पद्धति, परम्परागत पद्धति, अन्तर्मुख या मानस पद्धति, दर्शनशास्त्र पद्धति, प्रायोगिक पद्धति, धारणात्मक शैली पद्धति, वैज्ञानिक पद्धति, धार्मिक एवं आध्यात्मिक पद्धति, नीतिशास्त्रीय एवं मानवीय पद्धति, गाँधीय पद्धति, द्वन्द्वात्मक या राजनीतिक अर्थवादी पद्धति, मानववादी पद्धति, आनुभाविक पद्धति इत्यादि।

राजनीति विज्ञान की पद्धतियाँ

राजनीति विज्ञान विषय की पद्धति को विशेष रुप से हम दो भागों में बांट सकते हैं :–

1. परम्परागत (मानकीय) पद्धतियाँ
2. आधुनिक (आनुभाविक) पद्धतियाँ

परम्परागत पद्धतियाँ में विशेष रुप से निम्नलिखित पद्धतियाँ आती है, जैसेः–

1. दर्शनशास्त्रीय पद्धति
2. धार्मिक और आध्यात्मिक पद्धति
3. नीतिशास्त्रीय और मानवीय पद्धति
4. ऐतिहासिक पद्धति
5. मनोवैज्ञानिक पद्धति राजनीतिक अर्थवादी पद्धति
6. मानववादी पद्धति इत्यादि

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आधुनिक पद्धतियाँ में विशेष रुप से निम्नलिखित पद्धतियाँ को ले सकते हैं।

1 . सर्वेक्षण पद्धतियाँ (क) निदर्शन (ख) प्रश्नावाली (ग) अनुसूचियां (घ) साक्षात्कार (ड़) सहभागिता

2 आनुभाविक पद्धतियाँ (क) प्रयोगात्मक (ख) अवलोकन (ग) प्रलेख अध्ययन (घ) अनुरुपण एवं क्रीड़ा (ड़) मापन (च) पैनल (छ) व्यक्तिवृत अध्ययन (ज) अन्तः अनुशासनत्मक (सांख्यिकीय) (ञ) प्रक्षेपण एवं क्रियात्मक पद्धतियाँ इत्यादि।

हम राजनीति विज्ञान में अनुसंधान पद्धति का प्रयोग करने के कारण विशेष रुप से अनुसंधान की परिशुद्धता में वृद्धि करना, औपचारिक प्रशिक्षण प्राप्त करना, अपने क्षेत्र विशेष में घटित नवीन विकासों को समझना, उद्देश्य की प्राप्ति करना, अन्तः अनुशासनात्मक अध्ययन की सहायता से अन्य सामाजिक विज्ञानों की प्रगति को ज्ञात करना, प्राप्त ज्ञान का एकीकरण एवं संग्रहीकरण में सहायता करना, स्वयं के पूर्वग्राहों, आत्मनिष्ठवाद एवं पक्षपात से बचना तथा नवीन मूल्यों के मापने के लिए संशोधित पद्धतियों को तैयार कर प्रस्तावित करना मुख्य है।

अनुसंधान की परिभाषाएँ

साधारणतया वैज्ञानिक पद्धति वह पद्धति होती है, जिसे एक वैज्ञानिक किसी विषय वस्तु के अध्ययन के प्रयोग में लाता है। एनसाइक्लोपिडिया ऑफ ब्रिटेनिका के अनुसार "वैज्ञानिक पद्धति एक सामूहिक पद है, जो उन विभिन्न प्रक्रियाओं के विषयों का उल्लेख करता है, जिनकी सहायता से विज्ञान बनते है, विस्तृत अर्थ में कोई भी अध्ययन पद्धति जिसके द्धारा वैज्ञानिक अथवा निष्पक्ष और व्यवस्थित ज्ञान प्राप्त किया जाता है, एक वैज्ञानिक पद्धति कहलाती है।" जॉर्ज ए.लुण्डबर्ग के अनुसार "सामाजिक वैज्ञानिकों में यह विश्वास दृढ़ हो गया है कि उनके सन्मुख जो समस्याएँ है, उनका हल यदि होता है तो यह सामाजिक घटनाओं के निष्पक्ष एवं व्यवस्थित निरीक्षण, सत्यापन, वर्गीकरण तथा विश्लेषण के द्वारा सम्भव है। इसी दृष्टिकोण के उनके ठोस एवं सफल रुप

को मुख्यतः वैज्ञानिक पद्धति कहा जाता है।" Encyclopaedia of Britannica के अनुसार "वैज्ञानिक पद्धति एक सामूहिक शब्द है, जो उन अनेक प्रक्रियाओं को स्पष्ट करता है, जिनकी सहायता से विज्ञान का निर्माण होता है। व्यापक अर्थों में वैज्ञानिक पद्धति का तात्पर्य अनुसंधान की किसी ऐसी पद्धति से है, जिसके द्वारा निष्पक्ष एवं व्यवस्थित ज्ञान प्राप्त किया जाता है।" ए.वुल्फ के अनुसार ''विस्तृत अर्थों में कोई भी अनुसंधान विधि, जिसके द्वारा विज्ञान का निर्माण एवं विस्तार होता है, वैज्ञानिक पद्धति कही जाती है।"

कार्ल पियर्सन ने अपनी पुस्तक " The Grammar of Science'' के आधार पर प्रमुख विशेषताओं का उल्लेख किया है – 1. वैज्ञानिक पद्धति तथ्यों का वर्गीकरण तथा उनमें पारस्परिक सम्बन्ध एव क्रम का निरीक्षण करना है। 2. वैज्ञानिक पद्धति रचनात्मक कल्पना के द्वारा वैज्ञानिक नियमों की खोज करना है। 3. वैज्ञानिक पद्धति स्वयं किसी विषय की समालोचना करते हुए सामान्य बुद्धि के सभी व्यक्तियों के लिए समान रुप से उपयोगी होना है। कार्ल पियर्सन ने लिखा है कि "वैज्ञानिक पद्धति सभी शाखाओं में केवल एक है वह है सभी विज्ञानों की एकता, अकेले इसकी सामग्री में नहीं। वह व्यक्ति चाहे किसी प्रकार के तथ्यों को वर्गीकृत करता है, जो इनके पारस्परिक सम्बन्धों को देखता है, तथा उनके क्रम का दर्शन करता है, वैज्ञानिक पद्धति का प्रयोग करता है और एक विज्ञान का व्यक्ति है। ये तथ्य मानव सुदूर तारों के वातावरण से सम्बन्धित हो सकते है। ये स्वयं तथ्य नहीं है जो विज्ञान का निर्माण करते है, बल्कि वह पद्धति है जिसके द्वारा इन पर कार्य किया जाता है।"

राजनीति विज्ञान में पद्धतियों की विशेषताएँ

राजनीति विज्ञान में वैज्ञानिक पद्धतियों की प्रमुख लक्षण (विशेषताओं) को हम निम्नांकित बिन्दुओं से व्यक्त कर सकते हैं –

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वस्तुनिष्ठता (Objectivity)

राजनीति विज्ञान में वैज्ञानिक पद्धति व्यक्तिनिष्ठ न होकर वस्तुनिष्ठ होती है तथा इसमें अनुसंधानकर्त्ता के स्वयं के आदर्शों, मूल्यों, इच्छाओं, विचारों, पूर्वधारणाओं, पूर्वाग्राहों के लिए कोई स्थान नहीं होता है परन्तु प्रत्येक अनुसंधानकर्त्ता के साथ कुछ न कुछ मनोवृत्तियाँ, संस्कार, विचार, पूर्वाग्राह एवं दृष्टिकोण जरुर होता है, ऐसी स्थिति में राजनीतिक अनुसंधानकर्त्ता को पूर्ण रुप से वस्तुनिष्ठ हो पाना कठिन होता है, किन्तु वह कितनी सीमा तक वस्तुनिष्ठता का पालन करता है इसका अनुसंधान करने के दौरान ही पता चल पाता है।

तार्किकता (Rationality)

राजनीतिक अनुसंधानकर्त्ता वैज्ञानिक पद्धति का प्रयोग करते समय तार्किक रुप से सशक्त हो। तर्कशास्त्र वैज्ञानिक पद्धति का अभिन्न अंग है। तर्क की प्रक्रिया के तहत हम इसके दो भेद करते है – (अ) निगमन और (ब) आगमन

(अ) निगमन – इसमें आधार वाक्यों से आवश्यक निष्कर्ष निकाले जाते हैं। यदि आधार वाक्य सत्य हो तो निष्कर्ष भी अवश्य सत्य होगा।

(ब) आगमन (Induction)–इसमें दृष्टान्तों के आधार पर सामान्यीकरण (Generalization) अर्थात् कुछ दृष्टान्तों में पाई गई बात को सबके लिए सत्य मानना होता है।

उपकल्पना का निर्माण (Formation fo Hypothesis)

निःसदेह हमें कुछ पाने (खोजने) के लिए हमें उसे ढूँढना होता है और जब हम खोजते है तो हमारे सम्मुख तथ्य स्वयं उपस्थित नहीं होते, अर्थात् तथ्य संकलन के आधार पर बहुधा हमारे मन में धारणा (कल्पना) पहले से होती है, जिसे हम उन कल्पना (प्राक्कल्पना) कहते है। यदि राजनीतिक अनुसंधानकर्त्ता की अच्छी उपकल्पना होती है तो वह अनुभव के रुप में कार्य करती है। सामान्य नियमों या सिद्धान्तों को सदा पूर्ण सत्य के रुप में मानकर उनका उपयोग तो नहीं कर सकते परन्तु कल्पना शक्ति पर यह जरुर निर्भर करेगा की जो इसमें प्राक्कल्पना का निर्माण हुआ, वह ऐसे

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निश्चित रुप में किया जा सकता है, जिससे उसका परीक्षण तक विज्ञान हो सके।

संशयात्मक (Scepticism)

राजनीति विज्ञान में संशय का वैज्ञानिक पद्धति से घनिष्ठ सम्बन्ध है। संशय के पीछे भी दो कारण हो सकते हैं (अ) यह कि अपर्याप्त प्रमाणों पर आधारित हमारे विश्वास सत्य नहीं हो सकते। यदि हमारा विश्वास दृढ हो तो यह भ्रम नहीं होना चाहिए कि वह सत्य भी है। (ब) कोई तथ्य जो प्रकाश मे आया है निरन्तर प्रमाणों पर आधारित है या नहीं। अतः कोई तथा संशय से पूर्णतः परे तो नहीं हैं। इसके तहत केवल सत्य के अधिक निकट ले जाने का प्रयास किया जाता है।

सामान्यता (Generality) – राजनीति विज्ञान में विशेष रुप से सामान्यता वैज्ञानिक पद्धति में तो अभिप्राय रखता है (अ) यह समस्त विषयों में सामान्य है (ब) विषय से सम्बन्धित एक सामान्य सत्य की खोज की विधि भी वैज्ञानिक पद्धति है। इसके तहत जो भी वैज्ञानिक खोज की जावे या नियमों का निर्माण किया जाये वह किसी एक तथ्य पर लागू न होकर सम्पूर्ण वर्ग विशेष पर लागू हो अर्थात् इससे प्राप्त निष्कर्षों को, उस समस्त वर्ग पर लागू किया जाता है।

नियन्त्रण एवं सत्यापनशीलता (Control and Verifiability)

अनुसंधान को प्रत्येक समय अपने अनसंधान को अन्जाम देते समय वैज्ञानिक पद्धति के माध्यम से जाँचने की योजना होनी चाहिए, जिससे वह अपने कार्य की सत्यापन कर सके। नियन्त्रण और सत्यापन के माध्यम से अनुसंधानकर्त्ता अपने चिन्तन व आचरण को वस्तुनिष्ठ बनाता है। जिससे वह अपने खोज को संशय सहित परम सत्य प्राप्त करने का प्रयास कर सके।

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अमूर्तिकरण एवं सिद्धान्त निर्माण (Abstraction and Theory Building)

राजनीति विज्ञान में तथ्यों के ज्ञात होने पर निर्धारक कारकों का अनुसंधान होता है, ये कारक नियमों से नियन्त्रित होते है और नियम अमूर्त होते है, विभिन्न तथ्यों के प्रकाश में आने पर अनेक कारणों तथा अनेक नियमों की खोज होती है, जिससे एक जटिल व्यवस्था और सिद्धान्त का निर्माण होता है।

वैज्ञानिक पद्धति अवलोकन (प्रेक्षण) (Obervation) पर जोर देती है तथा विचारों (मूल्यों) या तथ्यों की वास्तविक परीक्षा करती है। वैज्ञानिक पद्धति ही ऐसे प्रयोग या आदर्श परिस्थितियाँ को तैयार करती है जिनसे उन विचारों को जांचा जा सके। वह क्रमशः ऐसे नये उपकरणों एवं प्रविधियॉ का आविष्कार करती है जिनसे अधिक निश्चित रुप से जांच या अध्ययन के समय वह शोधक को अपने निजी मूल्यों का बहिष्कार करने के लिए बाध्य करती है।

वैज्ञानिक पद्वति के सोपान

राजनीति विज्ञान एवं सामाजिक विज्ञानों में विशेष रुप से वैज्ञानिक पद्धति का प्रयोग किस प्रकार किया जाता है अर्थात् सत्य को जानने के लिए कई अवस्थाओं एवं चरणों से कैसे निकला जाता है? उसका अध्ययन करना भी आवश्यक होता है। इसके तहत अगस्त कॉम्टे ने सकरात्मक पद्धति (Positive Method) के तहत पाँच चरण बताये है –(क) विषय या समस्या का चुनाव, (ख) प्रेक्षण द्वारा प्राप्त होने वाले तथ्यों की जांच करना, (ग) तथ्यों का वर्गीकरण, (घ) तथ्यों की जाँच करना, (ड़) नियमों का प्रतिपादन। जॉन डी.वी ने अपनी पुस्तक "How we think" में चिन्तन का विस्तृत विश्लेषण एवं सकारात्मक अन्वेषण की व्याख्या की है। स्वयं एफ. एन. कार्लेजर ने जान डी.वी कि उपागम के विश्लेषण को अपनी कृति Foundation of Behavioural Research" में वैज्ञानिक पद्धति को निम्नलिखित सोपानो में बांटा गया है –(1) कठिनाइयों एवं समस्या की अनुभूति (Problem obstacte idea) (2) समस्या का स्पष्ट वर्णन (Explanation of problem) (3) उपकल्पनाओं का विकास (Development

of Hypothesis) (4) तार्किक निगमन (Reasoing Deduction), (5)आँकड़ों का संकलन (Collection of Datas) (6) आँकड़ों का निर्वचन (Interpretion of Datas), (7) उपकल्पनाओं के परीक्षण से सम्बन्धित निष्कर्ष (Conclusions of verifiable Hyplotlesis)।

जॉर्ज ए. लुण्डबर्ग ने चार चारण बताये हैं – (क) कार्यकर परिकल्पनाएं (working Hypothesis) (ख) आधार सामग्री का अवलोकन तथा आलेखन (Observation and recording of data) (ग) संकलित आधार–सामग्री का वर्गीकरण व संगठन (Classification and Organization of the data collected)(घ) सामान्यीकरण (Generalization), इन्हीं चरणों, अवस्थाओं को अनेक पद्धतियाँ ने छः या सात में बताया है।

डॉ. एस.एल.वर्मा ने अपनी पुस्तक "राजनीति विज्ञान में अनुसंधान" में वैज्ञानिक पद्धति को व्यापक अनुसंधान प्रक्रिया का ही अपेक्षाकृत छोटा रुप माना है। वर्मा ने अनुसंधान प्रक्रिया को तेरह चरणों में व्यक्त किया है – जैसे – (1) शोध प्रारम्भ कराने वाले बिन्दु, जिज्ञासा, संकट, विषय या समस्या का निर्धारण (2) उसके बाद उस 'समस्या' से सम्बन्धित 'साहित्य' का अध्ययन कि उस पर क्या, कभी, कितनी, कैसे और किस लिये अनुसंधान किया गया है? (3) फिर उस विषय या 'समस्या' के प्रमुख 'अंशों' अंगों या भागों को निश्चित करना (4) यदि संभव और उचित हो तो अपनी ओर से उस 'समस्या' का समाधान सुझाना या प्रस्तावित करना। इस कार्य या सुझाव को 'परिकल्पना' अपकल्पना या प्राक्कल्पना (Hypothesis) कहा जाता है। (5) उसके बाद समस्या का क्षेत्र, सन्दर्भ, पार्श्वदृश्य, परिवेश या पृष्ठभूमि बताना, (6) ताकि 'सूचना' एकत्रित करने के स्रोतों, सूचनादाताओं आदि का अता–पता लगाया जा सके। ये स्रोतों प्राथमिक (मौलिक) या द्वैतीयक हो सकते हैं। (7) सूचना प्राप्त करने के उपकरणों, युक्तियों, उपायों आदि अर्थात् 'प्रविधियाँ' को निर्धारित करना। उनके उपयुक्त या सही होने न होने की लघु स्तर पर जाँच की जा सकती है। (8) इन प्रविधियाँ–प्रश्नवाली, साक्षात्कार आदि का उपयोग करने के परिणाम स्वरुप सूचनाएं, तथ्य या समंक प्राप्त होने लगेंगी, इनको 'संकलित' या एकत्रित

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करने के लिए उस क्षेत्र में सूचना स्त्रोतों के पास जाना पड़ेगा। (9) तथ्यों के संकलन के बाद उनका प्रक्रमण (processing) किया जाता है। प्रक्रमण में संमकों का संपादन (Editing) वर्गीकरण हेतु उनका संकेतन तथा सारणीयन किया जाता है। (10) जब गुण, विशेषता आदि के अनुसार तथ्यों की अनेकानेक सारिणीयाँ बन जाती है तो उनका 'विश्लेषण' या विवेचन या निर्वचन करके उनके मध्य सहसम्बन्धों का पता लगाया जाता है। इससे कार्य कारण सम्बन्धों का ज्ञान होता है, (11) जब यह ज्ञान अनेक वैसी ही समस्याओं पर 'अनुसंधान' करने पर सही सिद्ध होता है तो शोध के उन निष्कर्षा का'सामान्यीकरण' या नियम कहा जाता है। (12) इनके आधार पर पूर्वकथन किया तथा 'सिद्धान्त–निर्माण किया जा सकता है । (13) अनुसंधान का अंतिम कार्य प्रतिवेदन (या रिपोर्ट)लेखन होता है। लघु एवं वृहतशोध प्रबंन्ध उसी कार्य के छोटे – बड़े रुप होते है। वैज्ञानिक पद्धति में प्रायः द्वितीय एवं अंतिम चरण की अनदेखी की जाती है। इसमें प्रथम सात बिन्दु उपागम की प्रकृति के अनुसार क्रियान्वित होते है। शेष छः चरण सभी में प्रायः समान होत है। अर्नल्ड बैख्त ने वैज्ञानिक पद्धति के ग्यारह चरण राजनीति विज्ञान में अनुसंधान में बताये है। इसमें उसने 1,2,3,7,10, तथा 13 की अनेदेखी की है।

अर्नल्ड बैख्त का जोर वैज्ञानिकता पर अधिक है प्रविधियों पर कम। बैख्त द्वारा बताये गये चरण निम्नालिखित है – (1) प्रेक्षण (Observation), (2) वर्णन (Description), (3) (मापन) (Measurement), (4) स्वीकृति या अस्वीकृति (Acceptance or non-acceptance), (5) आगमनात्मक सामान्यीकरण (Inductive Generalization), (6) व्याख्या (Exlanation), (7) तार्किक निगमनात्मक युक्तिकरण (Logical deductive reasoning), (8) जाँच या परीक्षण (Testing), (9)संशोधन (Correction), (10) पूर्णकथन (Prediction), (11) आस्वीकृति (Non Acceptance)।

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निष्कर्ष

प्रसिद्ध विद्वान स्टूअर्ट ने विज्ञान को शोध की पद्धति में निहित माना है, न कि विषय वस्तु में किसी शोध विषय में वैज्ञानिक पद्धति का प्रयोग अति आवश्यक है। अध्ययन के विषय का चयन किया जाता है तथा उसके साथ ही विषय की विशिष्ट परिकल्पना का चयन करते है, जिसके आधार पर सिनापसिस शोधार्थी द्धारा तैयार किया जाता है। इस परिकल्पना से शोध के लिए दिशा निर्धारित हो जाती है। परिकल्पना में शोध करते समय परिवर्तन–परिवर्द्धन के लिए शोधार्थी व्यवस्थित ढंग से तर्कपूर्वक अपने विषय का अनुसंधान करता है। अनसंधान कार्य को करते समय शोधार्थी के सामने जो विषय से सम्बन्धित सामग्री प्राप्त होती है, उसका वह वैज्ञानिक ढंग से परीक्षण करता है तथा उसे सही निष्कर्षों तक पहुंचने के लिए प्रयासरत रहता है। इसमें पश्चात् वैज्ञानिक निरीक्षण, विभाजन तथा तथ्यों की व्याख्या की जाती है, अर्थात् जब हम किसी वस्तु पर विशेष उद्देश्य से दृष्टि डालते है, और बाद से उस का विभाजन करते हुए, पृथक किए हुए तत्त्वों को सप्रमाण व्याख्या किया जाता है, जिसके तहत आन्तरिक रहस्यों को सुगमता एवं सरलता से जाना जात है। शोधार्थी प्राप्त ज्ञान के आधार पर ज्ञान का परिमार्जन किया जाता है और ज्ञान की सीमाएं स्वतः विकसित हो जाती है।

राजनीति विज्ञान में शोधार्थी को अनुसंधान कार्य करते समय विषय का सही निर्वाचन एवं सोच–समझ कर बनाई परिकल्पना का चयन करना चाहिए। इसके लिए शोधार्थी को पूर्ववर्ती अनुसंधानों का गहन ज्ञान प्राप्त करना आवश्यक हो जाता है। शोधार्थी को विषय चुनते समय यह ध्यान रखना चाहिए कि इस अनुसंधान में विश्व, राष्ट्र, समाज एवं मानव जाति एवं अन्य जीवों का हित किस सीमा तक हो सकता है ? इस आधार पर परिकल्पना बनानी चाहिए कि विषय के माध्यम से अन्तनिर्हित सत्य को प्रकाश में लाया जा सके। इसके लिए परिकल्पना के माध्यम में विषय का विभाजन और वर्गीकरण कर उचित तर्क संगत विवेचन करते हुए, प्रमाणों को पुष्ट करते हुए शोध ग्रन्थ को तैयार करें। इन सभी के लिए शोधार्थी को वैज्ञानिक पद्धतियाँ एवं शोध के सम्पूर्ण चरणों, अवस्थाओं का ध्यान में रखते हुए शोध कार्य को जनहित के लिए निष्पादन किया जा सके। इस

प्रकार से हम कह सकते है कि शोध का उद्देश्य, परिकल्पना, अध्ययन की विधि एवं प्राचीन प्रविधि, निर्देशन पद्धति, साहित्य के सर्वेक्षण के कार्य, स्वनिर्मित संरचित साक्षात्कार प्रपत्र, शोध सम्बधित पूर्ण साहित्य का अध्ययन शोध का अध्यायवार विवरण सारांश सांख्यिकी सारणीयन एवं सामान्यीकरण की एक प्रक्रिया है।

सन्दर्भ ग्रंथ सूची

1. *मनुस्मृति 12.106*
2. *डॉ. रामगोपाल शर्मा 'दिनेश'' – "अनुसंधान : स्वरूप एवं प्रविधि," राजस्थान हिन्दी ग्रन्थ अकादमी, जयपुर, प्रथम संस्करण, 1994, पृ. 13*
3. *George Alundberg – 'Social Research", New York, Longmans. Green and Co. 1951- पृ. 1*
4. *Encyclopaedia of Britannica, Vol-xx, 1941, Page – 27*
5. *A wolf – "Essentials of scientific Method, page 15*
6. *Karl Pearson – "The Grammar of Science," London, A&C Black, 1911, पृ. 10–12*
7. *D-Martindale and E-Monachesi, 'Elements of Sociology", New York, Harper and Bros- 1957, Page-24*
8. *John Bynner and keith M. Stribley," Social Research" Principales and Procednres," London,Longman Group, 1979, Page- 4-5*
9. *डॉ. एस.एल वर्मा –"राजनीति विज्ञान में अनुसंधान", राजस्थान हिन्दी ग्रन्थ अकादमी, आठवां संस्करण 2013*
10. *डॉ. आर.एन. त्रिवेदी एवं डॉ डी.पी.शुक्ला – 'रिसर्च मैथोडोलॉजी , कॉलेज बुक डिपो, 83 त्रिपोलिया बाजार, जयपुर*
11. *ए.जी. काछिया – "ई–रिसर्च मेथोडोलॉजी," पैराडाइज पब्लिशर्स, जयपुर –,प्रथम संस्करण, 2013*
12. *बैजनाथ सिंहल – "शोध : स्वरूप एवं मानक व्यावहारिक कार्यविधि," वाणी प्रकाशन, द्वितीय संस्करण 1999*
13. *डॉ. सत्यदेव :– "सामाजिक विज्ञानों की शोध पद्धतियाँ" पृ. 9–12*
14. *F.N. Kerliger – 'Foundation of Behavioural Research,' 1964, Page- 13-16*
15. *John Dewey –'How we think? " page – 108*

ISBN: 978-81-947902-9-7

16. *Arnold Brecht – 'Political theory,' Indian edition, Bombay, The time of India press (1959) 1965, pp- 27-116*
17. *Kenneth D. Boiley – "Methods of Social Research" Free Press New York 1978*
18. *S.L. Verma – 'Research Methodology in Political Science, Jaipur, Rawat 1998-99 – Introdution.*

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Water Pollution Sources and Various Effects on Human Beings

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Introduction

Now a days, the demand of water has increased manifold due to increase in population, and industrial developments. It has its own impact on air, land, sub–surface either directly or indirectly in a phased manner. Rainfall is the only source of water supply both for ground and surface water. The rain water that percolates through soil and stored in the sub–surface is termed as ground water. The rain water is the purest form of water available for our use. When it reaches the earth through the atmosphere, it dissolves all the water soluble gases and salts both from the atmosphere and the earth.

The polluted water may have undesirable colour, odour, taste, turbidity, organic matter contents, harmful chemical contents, toxic and heavy metals, pesticides, oily matters, industrial waste products, radioactivity, high Total Dissolved Solids (TDS), acids, alkalies, domestic sewage content, virus, bacteria, protozoa, rotifers, worms, etc. The organic content may be biodegradable or non-biodegradable. Pollution of surface waters (rivers, lakes, ponds), ground waters, sea water are all harmful for human and animal health. Pollution of the drinking water and that of food chain is by far the most worry-some aspect.

In order to avoid ill effects of water pollution on the human and animal health and agriculture, standards/rules/guidelines have been devised for discharge of effluents from industries and municipalities, quality of drinking water, irrigation water, criteria for

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aquatic life in fresh water by various authorities including central pollution control board (India), World Health Organization (WHO), World Bank, Indian Standard Institution, Indian Council of Medical Research, etc. The implementation of these rules, standards and guidelines, etc is however, wanting. Improperly treated or even untreated industrial and municipal effluents have been continuing to pollute not only surface water sources but also the ground waters. Alarming level of lead (Pb) and arsenic (As) has been found in the sediments as well as waters of Damodar, Safi, Ganga, Adjai rivers in Jharkhand, and West Bengal. High level of contamination by heavy metals, chemicals, organic matter, nitrates, coliforms, human and animal excreta, pesticides, etc is found in various rivers in India including Ganga, Yamuna, Gomti, Ramganga, Hindon, Chambal, Godavari, Krishna, Sabarmati, Subernrekha, Cauvery, etc specially near big cities and industries. Similar is the condition of lakes and ponds near cities.

Many areas have arsenic and fluoride in underground waters. Arsenic in many districts of West Bengal and UP is very high. Fluoride content in underground water of many districts in Tamil Nadu, Orissa, Andhra Pradesh, Gujarat, and Rajasthan and UP is high while it is also high in some places in Jammu & Kashmir, Punjab, Haryana, Delhi, Bihar, Madhya Pradesh, and Maharashtra. The source of fluoride is generally underground rocks. Hexavalent chromium is generally high in surface waters and shallow wells and hand pump waters in areas near tanneries. Pesticides contamination of even ground waters have occurred in some areas due to indiscriminate spraying of pesticides like DDT, Malathion for control of malaria and in some agricultural areas due to excessive use especially that of prohibited pesticides.

Radioactivity may be found in ground waters as well as surface waters. In ground waters it may be due to radioactive material present in underground rocks, while in surface waters it may have been passed on with effluents from uranium mining and milling area, uranium enrichment plants, fuel fabrication units for nuclear reactors, fuel reprocessing plant for spent fuel, etc.

There are numerous ill effects of pollution, each type of pollutants having different effect, on human/animal health and ecology. Plants and agriculture are also badly affected by water pollution. The pollutants enter the plants, fruits, grains, vegetables,

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and fodder, thus entering the food chain ultimately showing ill effects and diseases which may be very serious sometimes. It may also be mentioned that there are adverse effects of air pollution on water quality, water resources, human and animal health, and agriculture. The geo-environmental hazards also have their effects on water quality and land.

Prevention and monitoring of pollution, adequate treatment of waste waters (including sewage) and water conservation are key measures for improving the matters, which have been discussed in subsequent units.

Types and Sources of Pollution

Types of Pollution

Surface waters may have the following types of pollutions:

1. Suspended solids: The inorganic suspended solids blanket the stream bed effecting benthos (flora and fauna at bottom of water) organisms, while the organic solids create sludge banks and decompose causing odours and pathogens.
2. Floating solids including oils, greases: Floating materials obstruct passage of light and aeration which are vital for flora and fauna and self-purification of water.
3. Organic matter: Biological decomposition of waste organic matter in stream depletes dissolved oxygen content of water which may stifle the fish and aquatic life due to lack of oxygen. Unpleasant odour, flavour and taste, result due to lack of dissolved oxygen. Untreated sewage is the biggest pollutant and a cause of pathogens in water.
4. Inorganic dissolved salts: High total dissolved solids (TDS) may interfere with the use of water in industries, municipal supplies and for irrigation purposes. Phosphorus and Nitrogen are plant nutrients which induce algae growth and sometimes create 'Eutrophic' condition when excessive plant and algal growth may kill fishes and water animals.
5. Acid, alkalies, toxic chemicals and heavy metals: Adverse affect on human and animal life and plants.
6. Radioactive materials: Adverse affects on all biological beings.
7. Foam and colour are indicators of contaminations.
8. Microorganisms: Pathogenic bacteria, viruses, etc are health hazards.
9. Thermal pollution: Heat depletes dissolved oxygen in water

adversely affecting fishes. Higher temperature of water also adversely affects its use as coolant in industries.

Ground waters may also have some of the pollutants mentioned in case of surface waters such as heavy metals, high total dissolved solids (TDS), high salinity or sodicity, fluoride, arsenic, nitrates denoting organic pollution, pesticides, radioactivity, bad odours and flavour, colour, pathogens, etc.

Carcinogens in Waste Water

Wastes from certain industries or leakages of certain materials in handling, processing, etc may have substances which can cause cancer in humans or animals. These carcinogenic substances may find their way in waste waters which may pollute the source of waters for general use. Many of the heavy and toxic metals (like nickel, chromium, radioactive substances, certain dyes, inks, resins, fumigants, gasoline additives, nitrophenyl, naphthyamines, benzidine, azo compounds, some of the pesticides like D.D.T. etc are carcinogens. Smoke from combustion of certain organic materials may contain carcinogens which may eventually find their way to pollute waters, besides polluting air.

Prevention from exposure, removal of such compounds or breaking down of such compounds should be attempted.

Pollution by e-waste

India generated about 1050 tonnes of electronic scrap per year as reported in April 2005 which increased to 146,000 tonnes of e-waste per year as reported in May 2007. This would go on increasing year by year. A study by U.S. environmental protection agency shows that e-waste forms about 1% of municipal solid waste in USA. California alone discards 6000 computers daily. They have estimated that about 70% of heavy metals found in the landfills there, come from electronic discards which may contaminate ground waters. When e-waste is incinerated with other wastes it leads to hazardous emission-containing 'Dioxins'. The commonly found metals in e-waste like copper are catalyst for 'Dioxin' formation.

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Sources of Water Pollutants

Effluents and solid wastes from various industries and municipalities, indiscriminate use of toxic chemicals, indiscriminate use of pesticides, insecticides and fungicides, leaching of soils, wastes and rocks are the principal causes of water pollution. Objectionable level of pollution of water due to oils and oily substances may be found mainly in surface waters near the industries using heavy quantities of lubricating oils, greases, and liquid fuels, or refineries, big oil storages, etc. Ground water may also be polluted due to soaking of oil in the ground by indiscriminate disposal of oil sludge. The heaviest polluting source for surface water is sewage from cities.

Effects of Different Water Pollutants

Some of the pollutants like lead (Pb), arsenic (As), mercury (Hg), chromium (Cr) specially hexavalent chromium, nickel (Ni), barium (Ba), cadmium (Cd), cobalt (Co), selenium (Se), vanadium (V), oils and grease, pesticides, etc are very harmful, toxic and poisonous even in ppb (parts per billion) range. There are some minerals which are useful for human and animal health in small doses beyond which these are toxic. Zinc (Zn), copper (Cu), iron (Fe), etc fall into this category. For agriculture, some elements like zinc, copper, manganese (Mn), sulphur (S), iron, boron (B), together with phosphates, nitrates, urea, potassium, etc are useful in prescribed quantities. There are some compounds like cyanides, thiocyanides, phenolic compounds, fluorides, radioactive substances, etc which are harmful for humans as well as animals.

In India, water pollution due to industrial wastes and sewage has been assuming menancing proportions. Large lakes and large stretches of most of the rivers in India have water which is unsafe for drinking purpose. Survey of industrialized zones show that even ground water has become unfit for drinking due to high concentration of toxic metals and chemicals along with bacteriological contamination.

A brief summary of adverse effects of various pollutants on human and animal life and agriculture are indicated in Table -1. It is well known that water borne pathogens cause many diseases. Some common diseases caused by such pathogens are indicated in Table -2.

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Table 1. Effects of Water Pollutants

Sl. No.	Pollutant	Effects
1.	Zinc (Zn)	Zinc is essential element for humans, animal and plants. It is also an important cell component in several metalloenzymes. Infants need 3–5 mg/day, adult males 15 mg/day, pregnant and lactating females 20–25 mg Zn/day. However, heavy doses of Zn salts (165 mg) for 26 days causes vomiting, renal damage, cramps, etc.
2.	Copper (Cu)	Excess of Cu in human body (more than 470 mg) is toxic, may cause hypertension, sporadic fever, uremia, coma. Copper also produces pathological changes in brain tissue. However, Cu is an important cell component in several metalloenzymes. Lack of Cu causes anaemia, growth inhibition and blood circulation problem.
3.	Barium (Ba)	Excess of Ba (more than 100 mg) in human body may cause excessive salivation, colic, vomiting, diarrhoea, tremors*, paralysis of muscles or nervous system, damage to heart and blood vessels.
4.	Iron (Fe)	It is one of the essential mineral for humans and animals. Degree of absorption depends upon solubility and stability of compound. It is a component of blood cells and liveral metalloenzymes. However, more than 10 mg per kg of body weight causes rapid respiration and pulse rates, congestion of blood vessels, hypertension and drowsiness. It increases hazard of pathogenic organisms, as many of them require Fe for their growth.

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5.	Cadmium (Cd)	Cd is very toxic, 50 mg may cause vomiting, diarrhoea, abdominal pains, loss of consciousness. It takes 5–10 years for chronic Cd intoxication. During first phase, discolouration of teeth, loss of sense of smell, mouth dryness occurs. Afterwards it may cause decrease of red blood cells, impairment of bone marrow, lumber pains, disturbance in calcium metabolism, softening of bones, fractures, skeletal deformations, damage of kidney, hypertension, tumor formation, heart disease, impaired reproductive function, genetic mutation, etc.
6.	Mercury (Hg)	Mercury is very toxic. Excess mercury in human body (more than 100 mg) may cause headache, abdominal pain, diarrhoea, destruction of haemoglobin, tremors*, very bad effects on cerebral functions and central nervous system, paralysis, inactivates functional proteins, damage of renal tissues, hyper coagulability of blood, mimamata disease, and even death. It may cause impairment of vision and muscles and even coma. It disturbs reproductive and endocrine system. Also causes insomnia, memory loss, gum inflammation, loosening of teeth, loss of appetite, etc.
7.	Lead (Pb)	More than 400 mg of lead in human body can cause brain damage, vomiting, loss of appetite, convulsions, uncoordinated body movements,
		helplessly amazed state, coma. It is retained in liver, kidney, brain, muscle, soft tissues, bones. Leads to high rate of miscarriages, affects skin, and respiratory system, damages kidney, liver and brain cells. Disturbs endocrine system, causes anaemia, and long term exposure may cause even

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		death.
8.	Arsenic (As)	Poisonous to fishes, animals and humans. Greater than 25 mg of arsenic causes vomiting, diarrhoea, nausea, irritation of nose and throat, abdominal pain, skin eruptions inflammations and even death. It binds globulin of blood haemoglobin in erythrocytes. May cause cancer of skin, lungs and liver, chromosomal aberration and damage, gangrene, loss of hearing, injury to nerve tissue, liver and kidney damage. Minor symptoms of As poisoning, weight loss, hair loss, nausea, depression, fatigue, white lines across toe nails and finger nails.
9.	Vanadium (V)	It is very toxic, may cause paralysis.
10.	Silver (Ag)	Causes pathological change in kidney, liver and may even damage kidney. May cause Argyria (discolouration of skin). Effects mucous membranes and eyes. In high doses, it may be fatal to humans.
11.	Radioactive materials/ metals/substances	These generally cause 'Gene' mutation, ionization of body fluids, chromosomnal mutations and cancers. Destroy body cell tissue, adversely effects reproductive system. When mother is exposed to radiation during pregnancy, it causes severe mental retardation and leukaemia in infants. Radioactive metals like heavy metals are nephrotoxic and damage kidneys.
12.	Fluoride	Excess fluoride intake in body results in progressive crippling scourge (sponging) /fluorosis of bones, teeth. May cause metabolic alternations in soft tissues and their functional mechanism.

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13.	Selenium (Se)	Signs of Se poisoning (more than 4 mg) are fever, nervousness, vomiting, falling of blood pressure, causes damage to liver, kidney and spleen, loss of nails and hair, causes blindness to animals. Cats are most susceptible. It affects enzyme systems and interfere with sulphur metabolism. It can cause growth inhibition, skin discolouration, bad teeth, psychological problem, gastro intestinal problems, but trace amount of Se is protective against poisoning by Hg, Cd, Ag.
14.	Chromium (Cr)	Any chromium compound is toxic but haxavalent Cr greater than 70 mg is very toxic. It causes cancer, anuria, nephritis, gastrointestinal ulceration, perforation in partition of nose. It penetrates cell membrane and badly affects central nervous system. Causes respiratory trouble, lung tumors when inhaled. May cause complications during pregnancy. III Have adverse effects on aquatic life. Trace amount of Cr is essential for normal glucose, protein and fat metabolism and hence it is a essential trace element in diet.
15.	Manganese (Mn)	Mn is essential for mammals but in concentration greater than 100 ppm, is toxic, and causes growth retardation, fever, sexual impotence, muscles fatigue, eye blindness.
16.	Cobalt (Co)	High dose (27 mg or above) can cause paralysis, diarrhoea, low blood pressure, lung irritation, bone defects.
17.	Nickel (Ni)	More than 30 mg may cause changes in muscle, brain, lungs, liver, kidney and can also cause cancer, tremor*, paralysis and even death.

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18.	Boron (B)	Essential for plant growth in traces. Harmful to crops and affects metabolic activities of plants in higher concentration. Affects central nervous system.
19.	Alkalinity and Acidity	Permissible range of pH value if violated may cause health problems to human and animals and loss of productivity in agriculture.
20.	Phosphate and nitrates	Soil nutrient and not toxic in low concentration. Deplete oxygen by excess Algae production-giving bad odour and taste of water and detrimental to aquatic life. They are toxic for human and animal life if concentration is beyond permissible limits. Nitrates also cause cynosis or blue body disease.
21.	Chlorine (Cl)	Destroys plant and aquatic life and is a biocide.
22.	Sulphide	Gives bad odour, toxic to many aquatic organisms and animals.
23.	Salinity	Very bad for soils which retain salinity. Destroys agricultural land.
24.	Oil/Grease /Oil Sludge	Petroleum product in general are very harmful for soils, aquatic life, animal, human and plant life. They are very toxic. Agricultural land may suffer accumulation of oily waste affecting aeration and fertility. Many constituents of oily sludge are even carcinogenic and potent immunotoxicants.
25.	Surfactants and detergents	They are toxic and harmful for aquatic life, animals and humans. Inhibit self-purification of water.
26.	Phenols	Toxic and impart objectionable odour. Also subdue plant growth generally. Some phenols (nitrophenyl etc) are carcinogens.
27.	Cyanides	Cyanide poses a serious health hazard. Apart from acute toxicity and chronic toxicity, it leads to development of iodine deficiency disorders.

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28.	Pesticides/ Insecticides	Highly poisonous for humans and animals. Also they lower seed germination, plays a role in development of Parkinson's disease, destruction of nerve cells in certain regions of brain resulting in loss of dopamine which is used by nerve cells to communicate with brain. Some of these are physical poisons, some are protoplasmic poisons causing liver damage, some are respiratory poisons and some are nerve poisons.
29.	Aluminium (Al)	Toxic specially for brain, sometimes may lead to Alzheimer's disease in humans.

***tremors: Involuntary agitation/viberation/quavering.**

Table-2. Diseases due to Bacterial Pollution of Water

Sl. No.	**Diseases**	**Bacteria I Virus I Protozoa I Worm**
1.	Water borne diseases:	
	Bacterial:	
	Typhoid Cholera Paratyphoid Gastroenteritis Bacterial dysentery	Salmonella typhi Vibrio cholerae Salmonella parayphi Enterotoxigenic Escherichia coli Variety of Escherichia coli
	Viral: Infectious hepatitis Poliomycetis Diarrhoea	Hepatitis—A virus Polio virus Rota-virus, Norwalk agent, other virus Echono-virus, Coxsackie-virus
	Other enteric diseases (Protozoan): Amoebic dysentery Other* intestinal illness	 Ent-amoeba hystolitica Protozoa Glardia sp. and Cryptosporidium sp.
2.	Water-washed diseases: Sabies Trachoma Bacillary dysentery	 Various skin fungus species Trachoma infecting eyes *E. coli**
3.	Water based diseases: Schistosomiasis Guinea worm	 Schistosoma sp. Guinea worm

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4.	Infection through water related insect vectors: Sleeping sickness Malaria	Trypanosoma through tsetse fly Plasmodium through Anaphelis
5.	Infections due to defective sanitation/ polluted water: Hookworms	Hookworms, Ascaris

*Note: It may be mentioned that 'Shiga toxin' is produced by a virulent form of E. Coli bacteria. This toxin can cause ailments ranging from mild intestinal disease to severe kidney complications. The Indian Toxicological Research Institute, Lucknow has confirmed that water of river Ganges has become a home to this virulent form of E. Coli.

References

1. *Trivedi, R.C. (CPCB), "Key Note Address—Water Quality Standards", Int. Conf. on Water Quality Management, Feb. 2003, New Delhi.*
2. *Kant, R., "Remedial Strategy—Drinking Water Pollution", Chemical Engg. World, January 2005.*
3. *"Enviro News", International Society of Env. Botanists (ISEB), NBRI, 3/1998, 1/2000, 4/2001, 7/1998, Lucknow.*
4. *Lucky, T.D. and Venugopal, B., "Metal Toxicity in Mammals", Plenum Press, New York.*
5. *Kudesia, V.P., "Water Pollution—Toxicity of Metals", Pragati Prakashan, Meerut (India).*
6. *Dutta, Venkatesh (TERI), "Bioremedy for Oil Pollution", Science Reporter, April 2002.*
7. *Trivedi, R.C., "Water Quality Management in India", Int. Conf. on Water Quality Management, Feb. 2008, Nagpur.*
8. *Todd, D.K. (1995). Groundwater hydrology. John Wiley and Sons, New York.*
9. *Tatwat, R.K., and C.P.S. Chandel (2007). Characterization of quality and suitability of ground water of Jaipur city for the multipurpose useas. Poll. Res., 26(4), 681–68*
10. *Suryanarayana, K. (1995). Effect of ground water quality on health hazards in parts of Eastern Ghats. Indian J. Environ. Protec., 15(7), 487–500.*

ISBN: 978-81-947902-9-7

11. *Shanthi, V. and N. Gajendran (2009). The Impact of water pollution on the Socio–Ecomomic status of the stakeholders of Ennore Creek, Bay of Bengal (India): Part I. Ind. J. Sci. Technol.2 (3), 66.*
12. *Trivedy, P. and K.C. Mathur (1986). Study of nitrate pollution in ground water of Churu district of western Rajasthan (India).*
13. *Bush, D. and M. Meyer (1982). A case of infertile methemoglobinemia in south Dakota. J. Environ. Health. pp. 310–311*

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Organic Pesticides and Human Health: Need of alternative Strategies for Pest Control in Agriculture

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Abstract

Pesticides are chemical substances which are either used in agriculture, horticulture or in public health programs to protect the plants and their products from diseases, pests, weeds, rodent and human population from vector insect-borne diseases, like dengue fever and malaria. Examples of pesticides include fungicides, insecticides, herbicides, rodenticides, and synthetic plant growth regulators. Most of the pesticides are associated with negative effect on human health and potentially hazardous effect on environmental. Now-a-days the use of such chemical pesticides is increasing in agriculture for increasing food production to meet the demand of rise in global population. Present review aims at highlighting the negative health effects and latest findings regarding the exposure to common classes of chemical pesticides in view of latest developments and researches in sustainable agriculture leading to a drastic reduction in the use of chemical pesticides by the bio-control agents.

Key words: Pesticides, Pests, Insecticides, Herbicides, Fungicides, Bio-control agents

Introduction

Pesticide tainting can be found in the incredible assortments of our regular food items, nourishments, refreshments, water, vegetables, natural products and milk. These pesticides even couldn't

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be totally evacuated by washing and stripping of nourishment things. Pesticides buildups have additionally been detected in human bosom milk tests, and there are worries about pre-birth defects and wellbeing impacts in juveniles. Pesticide buildups stay for long time and cause significant lethal impacts onlife of animalsand furthermore changes their hereditary qualities (Anderssone*t al;* 2014).Pesticides induces disturbances in DNA during fetal development. Disturbances in endocrinefunctions are seen both during and after birth. In little kids the exposure of pesticides is more high and hazardous.Furthermore, the youngsters fall in highly and are more vulnerable (Sabrina *et al;* 2012). Organophosphate and organochlorine pesticides are found to impact acetylcholineestraseenzyme at synaptic nodesin sensory system and may lead toAlzheimer's disease particularly in uncovered individual during their late life (Hayden *et al;* 2010).

Another examination gives that a few herbicides (rotenone and paraquat) upsets the bioenergeticalactivites of mitochondria, oxygen utilization and redox system which also leads to Alzheimer'sdisease (Thany*et al;* 2013). Pesticides like organochlorine, polychlorinated biphenyls, and polybrominated biphenyl ethers are lipophilic and are inserted within lipids of biomembrane. Other pesticides like azole (fungicide) and atrazine impacts by expanding gestational length and disturb the endocrine functioning leading to poor development of genital organs (Rossana*et al;* 2013). Experimental findings indicates that 5 pesticides (bitertanol, propiconazole, cypermethrin, malathion and terbuthylazine) exposure have significant level of endocrine disturbances in human (Wohlfahrt*et al;* 2010). In ananother experiment, it is discovered that introduction of pesticides to mothersduring pregnancy causes different innate irregularities in fetal development (Sabrina *et al;* 2012). This chapter highlights the major harmful impacts and most recent discoveries in regards to negative health effects related with the basic classes of organic pesticides, i.e., organochlorines, organophosphorus, carbamates, triazines, and neonicotinoids.

Organochlorine Pesticides

Organochlorine (OC) pesticides are engineered pesticides generally utilized everywhere throughout the world. The most widely recognized organochlorine class of pesticide is Dichloro-Diphenyl-Trichloroethane (DDT). Uncontrolled utilization of this bug spray has raised numerous natural and human medical problems. It is an

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omnipresent chemical substance, and it is accepted that each living being on Earth has DDT in body stored in the fat. There is likewise proof that DDT and its metabolite p, p-dichlorodiphenyl dichloroethylene (DDE) may have endocrine-upsetting potential and cancer-causing activity. In utero introduction to both DDT and DDE has been related with neurodevelopmental impacts in youngsters. Dieldrin, endosulfan, heptachlor, dicofol, and methoxychlor are some different organochlorines utilized as pesticides.The general class of organochlorine pesticides has been related with endocrine issues, consequences for embryonic development, lipid digestion, and hematological and hepatic modifications. Organochlorine (OC) pesticides are reported to negatively affecting the functioning of thyroid system in a gender-specific pattern the degree of such effects varies among different pesticides (Freire*et al.*, 2013). A recent report from Brazil had indicated thatOrganochlorine pesticides are have anti-androgenic capacity in men and anti-estrogenic effects in women (Freire*et al.*, 2014). Organochlorine pesticide like heptachlor is reported to trigger mitochondria-mediated programmed cell death via lekage of cytochrome-c and impairing the complex III of mitochondrial electron transport chain, thus it acts as a powerful neurotoxicant and possible correlation with the Parkinson's disease in human (Hong *et al.*, 2014). Long duration exposure to many organochlorine based pesticides is reported to impart a potential risk for gallstone in case of humans (Su *et al.*, 2012).

Organophosphorus Pesticides

Organophosphates, which were advanced as an option to organochlorines. The most widely recognized class oforganophosphoruspesticides is glyphosate. This class additionally incorporates other pesticides, for example, malathion, parathion, and dimethoate; of which some are known for their endocrine-disturbing potential. This class of pesticides has been related with impacts on the capacity of cholinesterase enzyme, decline in insulin secretion, interruption of typical cell digestion of proteins, starches and fats, and furthermore with genotoxic impacts and consequences for mitochondrial work, making cell oxidative pressure and other endocrine issues. Glyphosate can show endocrine-disturbing effect, influence human erythrocytes in vitro , and advance cancer-causing nature in mouse skin (Parvez*et al;* 2018). Besides, it is considered to cause outrageous disturbance in shikimate pathway, which is a pathway found in plants and microscopic organisms just as in human

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gut microbes. This interruption may influence the inventory of human living being with fundamental amino acids. Glyphosate-based herbicides, for example, the notable "Gathering," can cause DNA alteration and go about as endocrine disruptors in human cell lines and in rodent testicular cells, cause harms to refined human cutaneous cells, and advance cell passing in the testicular cells of exploratory creatures. There is proof additionally for their conceivable capacity to influence cytoskeleton and intracellular motor proteins.

Carbamate Pesticides

Carbamate pesticides, for example, aldicarb, carbofuran, and ziram, are another class of organic pesticides that have been related with endocrine-upsetting potential, conceivable conceptive issue, and consequences for cell metabolic systems and mitochondrial work. In addition, in vitro investigations have uncovered the capacity of carbamate pesticides to cause cytotoxic and genotoxic impacts in hamster ovarian cells and to instigate apoptosis and rot in human cells, regular executioner cells and furthermore apoptosis in T lymphocytes.

Besides, it has been affirmed that carbaryl, which has a place with the classification of carbamate pesticides, can go about as a ligand for the hepatic aryl hydrocarbon receptor, an interpretation figure included the component of dioxin poisonous quality. There is likewise proof for the capacity of carbamate pesticides to cause neurobehavioral effects,increased chance for dementia and non-Hodgkin's lymphoma.

Triazines

Triazines, for example, atrazine, simazine, and ametryn, are another class of compound pesticides that have been identified with endocrine-upsetting impacts and regenerative harmfulness. Also, it was discovered that there is a conceivable measurable connection between triazine herbicides and bosom malignant growth rate. Atrazine is the well knowntriazines, and it is a generally utilized herbicide that has been related with oxidative pressure, cytotoxicity, and dopaminergic impacts. Besides, the presentation of trial creatures to atrazine has been related with regenerative lethality and deferrals in sexual development.

Neonicotinoid

Neonicotinoid pesticides, for example, imidacloprid, thiacloprid, and guadipyr, are moderately new and furthermore the most widely utilized bug sprays that were advanced for their generally

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safe for non-target life forms. Notwithstanding, there is a lot of proof in actuality; their impact on honey bees is a typical model. There is likewise proof for potential impacts on the endocrine and regenerative frameworks of creatures. Additionally, an ongoing report showed that neonicotinoids can build the outflow of the compound aromatase, which is occupied with bosom malignant growth and furthermore assumes a significant job during formative periods.

Need for pesticide free cleaner and safer agricultural practices

Current farming practices incorporate the wide generation and broad utilization of synthetic pesticides known for their capacity to cause negative wellbeing impacts in people and untamed life and to debase the common habitat. In this way, an earnest vital methodology is required for a decrease in the utilization of agrochemicals and for the execution of feasible practices. Besides, current farming needs to execute naturally friendlier practices that posture less general wellbeing dangers. Changing agrarian practices adjusted to satisfy these criteria is a stage toward the manageability of the horticultural part rather than exactness farming.

Be that as it may, the decrease in the utilization of agrochemicals by applying them just when and where they are fundamental, the spatiotemporal inconstancy of all the dirt and yield variables of a given field must be thought about. This fluctuation incorporates yield, field, soil, and harvest changeability yet in addition factors, for example, wind harm or flooding. Mechanical frameworks, for example, geological data frameworks, worldwide situating frameworks, and different sensors, can be helpful. These innovative frameworks are created by accuracy horticulture which obviously we don't embrace, yet we think about that chose mechanical apparatuses can be utilized to diminish dangers for natural contamination and water contamination and to upgrade financial advantages coming from the decrease in the utilization of compound items.

The decrease in the utilization of pesticides helped by imaginative innovative techniques we firmly accept that may lessen the utilization of compound substances or possibly it can prompt an all out deserting much of the time, for example, on account of urban green regions. The industrialization of agribusiness has brought a progression of issues including monetary, social, and ecological effects that neighborhood populaces can't oversee. Besides, the overproduction of nourishment, send out arranged monocultures, the interest for modest work, and different qualities of industrialization

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have plainly neglected to take care of the issues of craving and hunger. In actuality, unjust nourishment circulation, overexploitation of land and water sources, the abuse of agrochemicals, and the corruption of the regular habitat are a portion of the aftereffects of the prevailing farming model. Nourishment sway advances social, financial, and ecological supportability, for example, through the security of the indigenous populace and the generation of nourishment for dissemination in neighborhood markets, and there is a progressing exertion for its acknowledgment as a fundamental human right.

The prevailing horticultural model has expanded the concoction trouble on indigenous habitat. Also, worldwide agrochemical organizations ingest conventional rural organizations, prompting an industrialized horticulture model and leaving the neighborhood ranchers and little makers to confront the outcomes. Much of the time, these individuals are obliged to embrace naturally disagreeable systems to expand their generation so as to make due in the market, causing increasingly ecological corruption. In any case, because of the way that nourishment sway doesn't really mean sans pesticide, natural nourishment generation, and on the grounds that it doesn't decide pesticide use levels, thus, worldwide eco-accommodating models ought to be actualized. Individuals must be allowed to choose the strategy for creation of their own nourishment, and a significant part of this choice concerns agrochemical items.

Discussion

The excess use and misuse of organic pesticides is contributing hazardous effects to the environment, human health and as well as the ecosystem & community services and functions. Pesticides are being reported to affect so many terrestrial and aquatic species. Life forms in the aquatic ecosystems like as microorganisms, aquatic plants, fish and many aquatic invertebrates, are negatively affected by organic pesticides leading to biomagnification (Frankart*et al.,* 2003; De Lorenzo *et al.*, 2001; Castillo *et al.*, 2006). Pesticides are also linked with the causes of extinctions, loss of safer habitats, behavioral changes and decline in population of several bird species. Prolonged and over use of organic pesticides had resulted into drastic decrease in the number ofbirds like bald eagle, peregrine falcons and sparrow hawk (Mitra*et al.*, 2011).The requirement for insurance against irritations is guaranteed and has its underlying foundations in times long past, when both natural and concoction substances were

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applied as pesticides. From that point forward, various synthetic pesticides have been created, and now worldwide agrochemical organizations, which for the most part control worldwide nourishment generation, apply new compound substances with pesticide properties and actualize biotechnological progresses, therefore separating from customary rural strategies. Moreover, current horticultural practices depend on the wide utilization of substance pesticides that have been related with negative effects on human wellbeing, untamed life, and indigenous habitat.

Our present day agribusiness needs to manage significant challenges, for example, rise in population, nourishment security, wellbeing, dangers from organic pesticides, debasement of the common habitat, and environmental change (Taiz L. 2013). Other than agrarian use pesticides are additionally used in private gardens, along railroads, and in other open zones. In regions where serious monoculture in agribusiness is practished, pesticides are ordinarily utilized strategies for the bug control, yet sadly, with the advantages of organic pesticides, there are connected disbenefits. Excess use of such chemical pesticides compromise the long haul sustenance of normal biological systems by disturbance of predator-prey connections and the loss of biodiversity. Additionally, pesticides can have huge human wellbeing results. Evironmental contamination spread by inordinate utilization of such agrochemicals, has prompted an essentially extensive changes in individuals' mentality towards the utilization of pesticides in the field of farming. Distinctive elective methodologies must be utilized for ecofriendly control plant pathogens and insect herbivores.

Conclusion

The applications of organic pesticides used for the purpose of improvement in agricultural production had affected the human health, it had also altered food chain,food web and ecosystem services adversley.Biocontrol is an Eco inviting and best methods for decreasing or moderating negative health impacts of organic pesticides. In the last three to four decades, a lot of accentuation has been given onbiocontrol specialists like microbial pathogens, and botanicals. Of the different biocontrol procedures, natural control of weeds by plant pathogens has picked up acknowledgment as a down to earth, safe, and ecologically gainful strategy appropriate to agro biological systems. Different abiotic and biotic elicitors have been worked out for creating Systemic Acquired Resistance in plants

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against pathogens. Substance mixes like benzothiadiazole, saliciylic acid, and oxalic acids and biotic elicitors like *Trichodermaharzianum* and *T.viride*can elicitise the plants to safeguard themselves from pathogens (Kumar, D. ,2015).These compounds works by means of activating plant's own immune system.

References

1. *Andersson H, Tago D, Treich N (2014) Pesticides and health: A review of evidence on health effects valuation of risks, and benefit-cost analysis. Toulouse School of economics 24: 203: 295.*
2. *Castillo LE, Martinez E, Ruepert C, Savage C, Gilek M, Pinnock M, Solis E. (2006). Water quality and macroinvertebrate community response following pesticide applications in a banana plantation, Limon, Costa Rica.Science of the Total Environment367: 418–32.*
3. *De Lorenzo ME, Scott GI, Ross PE. (2001).Toxicity of pesticides to aquatic microorganisms: a review. Environmental Toxicology and Chemistry20: 84–98.*
4. *Frankart C, Eullaffroy P, Vernet G. (2003). Comparative effects of four herbicides on non-photochemical fluorescence quenching in Lemna minor.Environmental and Experimental Botany 49: 159–68.*
5. *Freire C, Koifman RJ, Sarcinelli PN, Simoes Rosa AC, Clapauch R, Koifman S. (2013). Long-term exposure to organochlorine pesticides and thyroid status in adults in a heavily contaminated area in Brazil.Environmental Research127: 7–15.*
6. *Freire C, Koifman RJ, Sarcinelli PN, Rosa AC, Clapauch R, Koifman S. (2014). Association between serum levels of organochlorine pesticides and sex hormones in adults living in a heavily contaminated area in Brazil. International Journal of Hygiene and Environmental Health 217(2–3): 370–378.*
7. *Hayden KM, Norton MC, Darcey D, Ostbye T, P Zandi JCS, et al. (2010) Occupational exposure to pesticides increases the risk of incident AD: The cache county study. Neurology 74: 1524-1530.*
8. *Hong S, Hwang J, Kim JY, Shin KS, Kang SJ. (2014). Heptachlor induced nigral dopaminergic neuronal loss and Parkinsonism-like movement deficits in mice. Experimental & Molecular Medicine 46(2): 80*

ISBN: 978-81-947902-9-7
9. *Kumar, D. (2015) Studies on Systemic Acquired Resistance in cauliflower against Sclerotinia stalk rot. Journal of scientific &Technological research.05 (1):69-73.*
10. *Mitra A, Chatterjee C, Mandal FB. (2011). Synthetic Chemical Pesticides and Their Effects on Birds.Research Journal in Environmental Toxicology5: 81–96.*
11. *Parvez S, Gerona RR, Proctor C, Friesen M, Ashby JL, Reiter JL, Lui Z, Winchester PD (2018). Glyphosate exposure in pregnancy and shortened gestational length: a prospective Indiana birth cohort study. Environ Health ;17(1):23.*
12. *Rossana B, Anne M, Vinggaard C, Taxvig J, Boberg E, et al. (2013) Levels of pesticides and their metabolites in wistar rat amniotic fluids and maternal urine upon gestational exposure. Int J Environ Res Public Health 10: 2271-2281.*
13. *Sabrina L, Lidia C, Loreto S, Marina M, Estarlich (2012) Prenatal and postnatal residential usage of insecticides in a multicenter birth cohort in Spain. Science of the Total Environment 273: 445-446.*
14. *Su Y, Dai Y, Lin Y, Gao X, Han Y, Zhao B. (2012). Serum organochlorine pesticide residues and risk of gallstone disease: a case-control study in Xiamen.Annals of Epidemiology 22(8): 592–597.*
15. *Taiz L. (2013) Agriculture, plant physiology, and human population growth: past, present, and future. TheorExp Plant Physiol 25:167–181.*
16. *Thany SH, Reynier P, Lenaers G (2013) Neurotoxicity of pesticides: Its relationship with neurodegenerative diseases. Med Sci 29: 273-8.*
17. *Wohlfahrt VC, Katharina M, Main I, Schmidt M, Malene B, et al. (2010) Lower birth weight and increased body fat at school age in children prenatally exposed to modern pesticides: a prospective study. Environ Health 10: 7*