

BIO-DATA

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| 7. EDUCATIONAL QUALIFICATIONS | |

Exam. Passed	Year of passing	Percentage / Division	University	Subjects
Matric (High School)	1966	63.1 Ist	Punjab Univ. Chandigarh	Phy. Chem. Math. Eng. S.S. Pbi. Hd
Pre-university	1967	64.4 Ist	Punjab Univ. Chandigarh	Phy. Chem. Math. Eng.
BSc.	1970	62.9 Ist	Punjabi Univ. Patiala	Phy. Chem. Math. Eng
MSc.	1972	66.7 Ist	Roorkee Univ. Roorkee	Chemistry
Ph.D	1976		Roorkee Univ. Roorkee	Chemistry
International Diploma	1992	Grade 1.0	Trondheim Univ. Norway	Paper Technology

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| 8. SPECIALIZATION | PULP BLEACHING/ ENVIRONMENTALSCIENCE |
| 9. TEACHING / RESEARCH EXPERIENCE | 38 years |

Employer	Post held	Period of Employment		Nature of Duty / work
		from	to	
IIT Roorkee	Professor	29.4.04	date	Teaching/Research
Roorkee University	Associate Professor	9.4.96	28.4.04	Teaching/Research
Roorkee University	Reader / Sl.Gr.Lecturer	24.9.89	8.4.96	Teaching/Research
Roorkee University	Lecturer	24.1.79	23.9.89	Teaching/Research
CSIR (Chem. Deptt UOR)	Pool Officer	24.2.77	23.1.79	Teaching/Research
Govt. College for Women Amritsar	Lecturer	18.9.76	17.2.77	Teaching
CSIR (Chem. Deptt UOR)	JRF	15.12.72	14.12.75	Research

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| 10. STUDENTS GUIDED FOR Ph.D DEGREE | 14 |
| 11. RESEARCH PAPERS PUBLISHED | 40 |
| 12. SPONSORED RESEARCH/ CONSULTANCY PROJECTS HANDLED | 12 |
| 13. PRIZES / MEDALS | |

1. Khosla Research Silver Medal 1998 awarded to research paper "Gas chromatographic determination of pollutants in the chlorination and caustic extraction stage effluent from the bleaching of a bamboo pulp" Talanta, 44,1911-1918 (1997)
2. Khosla Research Commendation Certificate 1997 awarded to research paper "Gas chromatographic analysis of chlorophenolic, resin and fatty acids in effluents from bleaching processes of agricultural residues." Intern. J. Enviorn. Anal. Chem. 64,289-300 (1996)

Annexure-I

Significant contribution during the last 10 years

Among the various production processes, bleaching process is considered to generate a high pollution load. About 65% BOD and 90% of color load comes from bleaching section. The waste water has been shown to be toxic. Studies have also shown that toxicity is due to the presence of chlorinated organic compounds e.g. chlorinated phenolics, chlorinated and non chlorinated acids. Further studies have also shown that quite a number of chlorinated compounds namely tri and tetra chloro guaiacols, tri, tetra & penta chlorophenols which contribute substantially to effluent toxicity do not get removed by conventional effluent treatment which essentially remove suspended solids and BOD, COD reduction is modest and colour reduction nil.

During the last 25 years intense research effort has been made to identify these toxic compounds. All studies to date have been on soft woods and to some extent on hard woods. No data is available for Indian hard woods or agroresidues, which is the main raw material for Indian paper industry

Laboratory studies have been carried out to identify and estimate the various chlorinated toxic compounds like chlorinated derivatives of phenols, guaiacols, catechols, vanilins, syringaldehydes, chlorinated fatty and resin acids, unsaturated fatty and resin acids in the chlorination and extraction stage effluents generated from various raw materials like bagasse, wheat straw, bamboo, kahi grass, eucalyptus, mixed wood (pine + eucalyptus+ small amount of bamboo). The concentration of various compounds identified has also been compared with the reported $^{96}\text{LC}_{50}$ values to know whether the concentration exceeds the toxic limits. This study was supported by Council of Scientific and Industrial Research (CSIR).

Laboratory studies have also been performed to study the formation of various chlorophenolic compounds as a function of chlorination conditions as well as modification in bleaching conditions like splitting of chlorination stage, partial/complete replacement of C by D, replacement of H by D and use of oxygen delignification stage. The effect of these changes on the pulp properties and environmental loads has also been studied. This study has been supported by UP Council of Science and Technology (UPCST)

About a decade back one more highly toxic compound 2378 tetra chloro dibenzo dioxin (2378 TCDD) commonly called dioxin was detected in the fish samples from a American river into which paper mill effluent was discharged. This particular discovery created panic among the government and paper industry as this compound is highly toxic, mutagenic, and carcinogenic and is not easily degraded in the environment. This led to start of systematic studies on dioxin to estimate the levels, understand the generation and ways for its removal or reducing its formation. Studies revealed that this compound is formed during pulp chlorination. Bleaching sequences were changed to ECF (elemental chlorine free) and TCF (total chlorine free) to minimize or stop the formation of dioxin. Studies further confirmed the presence of dioxins in paper samples of common use (tissue, paper plates, butter paper, printing papers) effluents, sludge and soil etc. Another compound 2378 tetra chloro dibenzo furan (2378 TCDF), comparatively less toxic has also been identified.

In India paper industry still continue to use chlorine and hypo chlorite for pulp bleaching. Hence the waste water and paper samples are likely to contain two highly toxic compounds 2378 TCDD and 2378 TCDF. A study was planned to estimate these two compounds in chlorination and extraction stage effluents, paper mill effluents and paper samples of common use. Some studies

have also been carried out by changing the bleaching sequences with a view to reduce the formation of these two toxic dioxins. This study has been supported by Ministry of Environment & Forests, New Delhi.

Among the various options to reduce the formation of chlorinated organics in bleaching effluent is enzymatic pre bleaching. This has been implemented in developed countries. It gives about 15-25% reduction in bleach chemical charge and AOX. Studies have been performed to look at the behavior of Indian raw materials towards enzymatic pre bleaching so that the same can be adopted by Indian mills also. The economic analysis has also been done.

In order to get information on the action of enzymes on pulps, some mechanistic studies have been initiated. The studies are aimed at analyzing the reaction products and correlating the same with the strength properties. Studies have been planned to look at the presence of hydrolyzed xylan and lignin in effluents, pentose and lignin contents in pulps, presence of hemi cellulose-lignin linkage. Role of primary & secondary fines and participation of surface/cell wall xylan or both in the enzymatic action has also been investigated.

The other option to reduce the formation of chlorinated organics and AOX is to in for ECF bleaching. Oxygen delignification and replacement of chlorine and hypochlorite by chlorine dioxide has also been investigated. Some preliminary studies have also been performed using ozone as a delignifying agent i.e. TCF sequence like OZP have also been performed.

Some studies have also been performed on the use of lignin as adsorbent for the removal of cationic and non-ionic surfactants from their aqueous solutions.

Annexure-ii

SHORT TERM COURSES

As a resource person for Industry Sponsored Human Resource Development Short Term Programs

1. Phoenix Pulp & Paper Mills, Thailand.
2. Ballarpur Industries, Yamunanagar.
3. Hindustan Newsprint Ltd., Kottayam.
4. Federation of Paper Trader Association of India.
5. Environment Management in Pulp & Paper Industry organized for Indian Paper Industry
6. Star Paper Mills Saharanpur
7. Tamil Nadu Newsprints and Paper Ltd Kottayam

Annexure-iii

DETAILS OF Ph.D. THESIS SUPERVISED.

S No	Title of the thesis	Name of student	Year of award	Co-Supervisor
1	Ion-exchange studies with some titanium compounds and their membranes	Surender Kumar	1984	-----
2	Colloidal and surface properties of lignin from Eucalyptus wood	A. K. Jindal	1984	W. U. Malik
3	Adsorption studies of some surface active agents on lignin	Anuja Gupta	1993	A. K. Jindal
4	Identification of pollutants from CE stages during pulp bleaching	Chhaya Sharma	1994	N. J. Rao
5	Identification and removal of pollutants from CE stages in bleaching of a mixed wood pulp	Sushanta Mahanty	1994	N. J. Rao
6	Corrosion Investigations on construction materials of Bleach Plant Washers	Raghuvir Singh	1996	A.K. Singh
7	Studies on the environmental aspects of enzymatic pre bleaching of agroresidues pulps	Shobit Kumar Mathur	2004	N. J. Rao
8	Estimation of chlorophenols in effluent formed under different conditions of bleaching	Sinni Jacob	2005	-----
9	Persulphate prebleaching of chemical pulps	Rachna Malhotra	2007	N. J. Rao
10	Lignin as an adsorbent for the removal of dyes from wastewater	Alka Jain	2007	-----
11	Studies on the generation of chlorophenolics formed during bleaching of chemical pulps	Divya Prakash	2007	N. J. Rao
14	Study and evaluation of electrolysis as a treatment option for non-sulfur black liquor	H.R.Ghatak	2010 Thesis submitted	P.P.Kundu

DETAILS OF Ph.D. THESIS continuing

S No	Title of the thesis	Name of student	Co-Supervisor
1	Studies on the reduction of environmental load by using enzymes during the bleaching of chemical pulp	Shiv Kumar	Chhaya Sharma
2	Formation and removal of chlorinated organics from pulp bleaching effluents	Praveen Kumar	N.K.Bhardwaj
3	Studies on the treatment and recycling of pulp and paper mill wastewater	Rajni Sharma	Chhaya Sharma
4	Removal of toxic compounds from paper mill waste water.	Ashutosh kumar Choudhary	Chhaya Sharma

Annexure-iv

DETAILS OF SPONSORED/ CONSULTANCY PROJECTS HANDLED

S. No	Title of the project	Sponsor/ Funding Agency	Amount in lacs	Duration	PI./Co-PI
COMPLETED					
1	Laboratory Studies on the removal of pollutants from bleach plant effluents of pulp paper industry.	CSIR	6.16	April,1988-March, 1992	PI
2	Study of Steel Corrosion in aqueous media	DST	4.89	April,1986-Sept.,1989	Co-PI
3	Pollution Control: Studies on black liquor - A paper industry waste.	UPDOE	8.47	Feb., 1988-Jan., 1991	Co-PI
4	Chemical Recovery Systems for agroresidue based small pulp & paper mills.	UNEP	\$ 0.05	Dec., 1989-June, 1991	Co-PI
5	Material Evaluation in Environmental friendly bleach media of paper industry.	MHRD	9.22	Nov.,1993 - Nov., 1996	Co-PI
6	Study of Dioxins and Furans present in Indian Environment.	MOEF	6.49	Jan.,1994-June.,1997	PI
7	A Low Pollution Bleaching Process for Chemical Pulps	AICTE	8.00	April,1998-March,2001	PI
8	A study on Generation of Chloro-organics formed during Bleaching of Pulp	UPCST	3.26	April,2000-March,2003	PI
9	Improved Environment Management in Bleach plant through Biobleaching	MOEF	9.51	April,2000-Dec,2004	Co-PI
10	Xylanase prebleaching- reaction products and effect on paper properties	DST	13.89	April,2002-March 2006	PI
11	FIST funding in the area of pulp bleaching	DST	60.00	April,2004-March,2009	PI
CONTINUING					
1	Monitoring and removal of toxic compounds from Indian paper mill waste waters	MOEF	9.45	Sept.2008-Sept.2011	PI

Annexure-v

LIST OF PUBLICATIONS

1. Studies with stannic molybdate membranes.
J. Colloid and Interface Sci., 47, 1-5 (1974).
2. Ion-exchange properties of chromium ferrocyanide.
J. Inorg. Nucl. Chem., 38, 342-343 (1976).
3. Ion-exchange behaviour of pyridinium tungstoarsenate.
Talanta, 23, 323-325 (1976).
4. Tungstoarsenates as ion-selective membranes for cesium and thallium (I) ions.
J. Electroanal. Chem., 72, 111-116 (1976)
5. Studies on the ion-exchange behaviour of chromium ferrocyanide
J. Radioanal. Chem., 36, 469-477 (1977).
6. Synthesis and ion-exchange properties of cerium (IV) molybdate
J. Radioanal. Chem., 40, 7-15 (1977).
7. Viscometric studies of clay-dye suspension. Viscosity variations of H-Bentonite-Anionic(dye (Solochrome Fast Navy 2 RS and (Solochrome Black WDFA) suspensions.
Indian J. of Chem., 16A, 688-691 (1978).
8. Chromatographic separation of pyridinium tungstoarsenate impregnated ion-exchange papers.
J. Radioanal. Chem., 53, 49-57 (1979).
9. Electrochemical properties of zirconyl tungstate membrane
J. Electroanal. Chem., 110, 181-203 (1980).
10. Studies with some inorganic ion-exchange membranes: part I- Functional properties and permeability of chromium ferrocyanide and cerium (IV) molybdate membranes Indian
J. of Chem., 22A, 395-398 (1983).
11. Studies on the selective separation of rubidium on a titanium(IV) tungstoarsenate column. Analyst,
109, 151-153 (1984)
12. Selective determination of rubidium ions by a solid membrane electrode
J. Electroanal. Chem., 161, 345-354 (1984).
13. Inter molecular attractive forces at oil / 0.05% lignosulphonate of Eucalyptus teriticornis water interface.
J. Ind. Chem. Soc., 61 813-814 (1984).
14. Studies on some inorganic ion-exchange membranes: part II- Fixed charge density and permselectivity of chromium ferrocyanide and cerium (IV) molybdate membranes
Indian J. of Chem., 23A, 1021-1025 (1984).
15. Studies on the sorption of some metal ions on titanium arsenate and titanium tungstoarsenate gels using radioactive tracers
J. Radioanal. Chem., 90, 255 (1985).
16. Studies with inorganic ion-exchange membrane exhibiting selectivity for Pb (II) ions
Talanta, 33, 717-720 (1986).
17. Toxic effluents from pulp and paper mills
IPPTA convention Issue, Annual General Meeting & Seminar 9-10, April 1987 pp 202-229.
18. A study of steel corrosion in bleaching environment of pulp and paper industry
10th International congress on metallic corrosion (Madras) Vol. III, Nov. 7-11, 1987. pp 2519-2528.
19. Utilisation of lime sludge as filler grade pigment
IPPTA 1(3), 1-3 Sept. (1989).
20. Corrosivity of environment and material performance in bleach plant washers
Tappi, 73(1), 67-71 (1990).

21. Gas chromatographic analysis of chlorophenolic, resin and fatty acids in effluents from bleaching processes of agricultural residues
Intern. J. Environ. Anal. Chem. 64, 289-300 (1996).
22. Gas chromatographic analysis of chlorophenolic, resin and fatty acids in chlorination and caustic extraction stage effluent from kahi grass
Analyst, 121, 1963-67 (1996).
23. Gas chromatographic determination of pollutants in the chlorination and caustic extraction stage effluent from the bleaching of a bamboo pulp
Talanta, 44, 1911-1918 (1997).
24. Determination of 2378 TCDD and 2378 TCDF in bleaching effluents and paper products
Presented at National Symposium on Environment and Toxicology at New Delhi Dec. 29-31, 1997
25. Adsorption of cationic surfactants on lignin.
Annali De Chimica 89, 453-461 (1999).
26. Determination of pollutants in kraft bleaching effluents from the eucalyptus pulp
Analytical Sciences 15, 1115-1121 (1999).
27. Determination of chlorophenolics in effluents from bleaching processes of rice straw pulp.
J. Environ. Monit. 1, 569-572 (1999)
28. Minimising the formation of 2378 TCDD and 2378 TCDF in bleaching effluents-a laboratory Study.
IPPTA Con. Issue 49-60 (1999)
29. Application of commercial xylanases in bleaching-a review
IPPTA Vol.13 (1), 13-24 March 2001
30. Xylanase prebleaching of wheat straw and Sarkanda soda pulps
IPPTA Vol. 14(2), 45-52 June 2002
31. Development of bleaching process through statistical experimental design
IPPTA Vol. 15(2), 39-46 April 2003
32. Xylanase prebleaching of agroresidue pulps
Paprex India 2003, 87-104
33. Reduction of pollution load in bleaching effluents of paper mills using oxygen delignification
Nature Environment and Pollution Technology Vol 2(1), 57-62, 2003
34. Action of xylanase pre bleaching on wheat straw and oxygen delignified wheat straw soda
Pulps - probable mechanisms
Appita Annual Conference-2005 (ISWFPC) pp631-638
35. Xylanase prebleaching of chemical pulps
IPPTA Vol.17.No 4, 35-47 October 2005
36. Reduction of effluent COD and colour by using flocculants and adsorbent
Paper Technology Vol 48 No 2, 23-30 March 2007
37. Gas chromatography analysis of resin and fatty acids from laboratory generated bleach plant effluents
China Pulp and Paper 26(5) 29-33 May 2007
38. Detection of chlorophenolic Compounds in Bleaching effluents of Chemical Pulps
China Pulp and Paper 27(5) 35-40 May 2008
39. Electrode processes in black liquor electrolysis and their significance for hydrogen production
Intl Journal of Hydrogen Energy 33(12), 2904-13 June (2008)
40. Thermochemical comparison of lignin separated by electrolysis and acid precipitation from soda black liquor of agricultural residues
Thermochimica Acta 502(1-2), 85-89 April (2010)