



The University of Delhi The Innovation Projects Report 2012-2013



Innovation Projects Desk
Office of Dean, Academic Activities and Projects,
University of Delhi, Delhi-110007

DELHI UNIVERSITY INNOVATION PROJECTS REPORT 2012-13

The Antardhvani cultural festival showcases 113 Innovation Projects funded by the University of Delhi in 2012. The findings are open to peer review and public interaction. After the successful progress of the projects, fresh proposals have been invited for the next round. This report presents an overview of the work accomplished by the research teams till February 2013. The listing is alphabetical by the name of the College.

The Concept: The Innovation Projects were conceptualized by the Vice Chancellor against the background of opportunities and limitations reported in undergraduate colleges of the University of Delhi. While teachers often said they wished for research opportunity, the students were often seeking interdisciplinary exposure. Given a curriculum which was bounded by a discipline based syllabus and strict timetables for lectures, the teachers and students did not have the time, or the grants, to consider new ways of learning.

The scheme, 'Innovation Projects in Colleges' invited proposals in January 2012 that were 'designed...to enhance learning experience through student participation'. They were to be conducted by teams of 3 teachers and 10 students from at least 2 departments and to call in a Mentor from outside the institution. The scheme was structured to encourage and support hands-on research by college teachers and students.

Entries & Grants : The response was enthusiastic. The University received 146 entries from 51 colleges, several of them submitting multiple projects to be conducted by interdepartmental teams. The University selected 113 Innovation Projects for giving a grant support of up to Rs. 10 lakhs each, subject to periodic review. The projects were formally launched on 15 May 2012 after a meeting with the Vice Chancellor of over 300 teachers who had signed up with successful proposals. An Innovation Desk was set up for at the office of Dean Academics for regular interaction on issues arising from the implementation of the programme.

Reports and achievements: Quarterly reports were received on 14 August and sent for review to senior faculty. On 12 October 2012 five parallel meetings were held for project groups so that progress could be monitored carefully and experience gained from each other. This meeting was attended by faculty and students and by this time, substantial achievement was noted in some projects. Half yearly reports were submitted around 20 November 2012 and assessed by an expert committee. Several projects had demonstrated the viability of the innovations. It is clear that the purpose for which the Innovation Project scheme had been launched, which was to generate excitement in trying out ideas and carrying them through by means of practical output, was being fulfilled. The outcome of the projects may build

prototypes for problem-solving in the community. We are glad to report that about 14 projects have received media attention, and 4 are considering patent filing.

Attention in Media: Most projects conducted field trips, seminars and workshops. The hands on approach showed results in public and drew attention to real life problems of shelter, water & air pollution, urban transport, nutrition, preservation of history and culture, weekly markets and such others. Newspapers have periodically carried reports and one book has been published.

Committees: Review meetings have been held throughout the year. Thanks are due to Vice Chancellor, Registrar, Finance Officer for administrative measures. For academic assessments, thanks to Prof. S.C. Bhatla, Dean Science, Prof, Ajay Kumar, Prof. Girishwar Misra, Prof. M.M. Chaturvedi as Deans Research, and Dr. Sangit Ragi, Dy. Dean Academics. Ms. Mukta Dutt, Information Executive, has efficiently handled the Innovation Projects Desk.

Prof. Malashri Lal, Dean Academics

List of Projects (Colleges in Alphabetical order)

S.No	College	Subject	Project Title	Code
1.	Acharya Narendra Dev College	Electronics Physics Biomedical Sc.	Glucose detection – A Biosensing approach	ANDC - 101
2.	Acharya Narendra Dev College	Physics Physics Computer Sc.	CO ₂ Gas Sensing - an ICT based investigation for pollution control	ANDC - 102
3.	Acharya Narendra Dev College	Electronics Electronics Chemistry	Mobile phone as a real time sensor based undergraduate laboratory	ANDC – 103
4.	Acharya Narendra Dev College	Chemistry Chemistry Biomedical Sc.	Survey-based study to identify the health hazards associated with occupational exposure of textile dyes used by dyers to color the fabrics	ANDC – 104
5.	Acharya Narendra Dev College	Zoology Zoology Chemistry	Exploring useful bacteria from soil	ANDC – 105
6.	Acharya Narendra Dev College	Botany Botany Biomedical Sc.	Recording and analysis of Locomotory behaviour among birds	ANDC - 106
7.	Aditi Mahavidyalaya	English Commerce Commerce Commerce	Bridging the gap from Corporate to Common: building an umbilical cord relationship	AM - 101
8.	Aditi Mahavidyalaya	Social Work English B.El.Ed	Locating women in the context of partition: An account of lived experiences and unheard voices	AM - 102
9.	Atma Ram Sanatan Dharma College	Chemistry Chemistry Biology	Study the factors responsible for food adulteration, detection of adulteration and biological effects of adulterants on the health of consumer.	ARSD - 101
10.	Bhaskaracharya College of Applied Sciences	Instrumentation Electronics Chemistry	Study of Rise in Consumption of the Mobile phones/Electronic Gadgets in Delhi region and Material Analysis projecting potential Electronic waste and their impact on environment	BCAS - 101
11.	Bhaskaracharya College of Applied Sciences	Food Technology Microbiology Biomedical Science	Studies to assess the quality of fruits and vegetables with respect to microbial load and the remedial measures for their control	BCAS – 102
12.	Bhaskaracharya College of Applied Sciences	Food Technology Polymers Sc. Biomedical Sc.	Development of Cost-Effective Nutritious Multi Cereal Bar and It's Sustainable Packaging Using Nano-Biopolymer	BCAS – 103

13.	Bhaskaracharya College of Applied Sciences	Polymer Science Physics Food Technology	Development and study of alternate packaging materials from agro wastes and its application in food packaging	BCAS – 104
14.	Bhaskaracharya College of Applied Sciences	Chemistry Electronics Physics	Determine the Speciation of some Selected Heavy Metals from E-wastes and their Impact on Ground Water	BCAS - 105
15.	Bhim Rao Ambedkar College	Applied Psychology Applied Psychology Social Work	Growing Under the Shadow of Mass Media: Explorations into Family Lives and Psycho-Social Well-Being	BRAC - 101
16.	Bharti College	English English Hindi	Challenges and Opportunities for School Girls in Delhi and Rajasthan: Gender Discrimination, Sexual Harassment, Wash (Water, Sanitation and Hygiene) and its Impact and Language, Communication Skill and Socio-Culture Behavioral Patterns	BW– 101
17.	Cluster Innovation Centre	Physics Mathematics Electronics & Computer Sci.	24 x 7 water supply in villages and small towns of India	CIC - 101
18.	Cluster Innovation Centre	Physics Mathematics Electronics & Computer Sci.	Solution for road management from modeling and simulation of traffic flow on selected roads of Delhi	CIC – 102
19.	Cluster Innovation Centre	Physics Mathematics Physics	IT model for parking space management: optimal and efficient parking-retrieval of vehicles	CIC – 103
20.	College of Vocational Studies	English Commerce Economics	Impact of Socio-Economic-culture profile of students on Academic Performance	CVS – 101
21.	Daulat Ram College	Biochemistry Chemistry Chemistry	Metal Scavengers based on Functionalized Silica Gels and Microorganisms: Greener and Sustainable Approach for Treatment of Soil and Water	DR – 101
22..	Deshbandhu College	Zoology Zoology Botany	Effect of plant extracts on the midgut microbial flora of Aedes aegyptii	DB - 101

23.	Deshbandhu College	Chemistry Chemistry Physics	Qualitative analysis of water and gaseous pollutants from different zones of NCR region and designing some tools and techniques to eradicate them by using absorption and adsorption techniques involving biodegradable materials	DB - 102
24.	Deen Dayal Upadhyaya College	Chemistry Chemistry Botany	Studies on water pollution of River Yamuna in Delhi	DDU – 101
25.	Deen Dayal Upadhyaya	Physical Education Business Studies Physics & Elect.	A study of Physio-Neuro-Psychological Aspects of Archers in Indian Perspective	DDU – 102
26.	Delhi College of Arts & Commerce	English Computer Sc. Political Science	A study of Stress Levels and Stress Sources Among Undergraduate Students of University of Delhi	DCAC – 101
27.	Delhi College of Arts & Commerce	English History English	Symphonies of Life in Nature and Environment: Folksongs of Punjab and Jammu and Kashmir	DCAC - 102
28.	Dyal Singh College	Chemistry Chemistry Zoology	Synthesis and Characterization of Ionic Liquids for their use in Chromatographic Separation of Amino Acids and Sugars	DS – 101
29.	Dyal Singh College	Chemistry Botany Chemistry	Understanding the mechanism of action of Prime Ayurvedic Plant drugs by undertaking a first principal quantum mechanical study of the structure-property relationship and activity of the various chemical ingredients of these plants and undertaking In-Campus-Plantation aimed at understanding entrepreneurial activities in this area	DS – 102
30.	Dyal Singh College	Chemistry Chemistry Physics Physics	Chemistry Learning: Eco-Friendly and Inquiry-model based experimental chemistry with inherent safety aspects	DS – 103
31.	Dyal Singh College	Zoology Computer Science Zoology	Development of Zoology E-Museum for courses of University of Delhi	DS – 104
32.	Gargi College	Physics Chemistry Microbiology	Synthesis and Characterization of Novel nanomaterials using green methods for anti-microbial applications	GC – 101
33.	Gargi College	Zoology Physics Physics	To Device a cost effective set up for Cell Identification, Characterization and Separation	GC – 102
34.	Gargi College	English Elementary Edu. Hindi	Daastan-e-Nisvan (Stories of Women)	GC – 103

		Hindi Political Science		
35.	Hansraj College	Hindi Sanskrit Hindi	राष्ट्रीय राजधानी क्षेत्र में दृष्टिबाधितों से संबन्धित संस्थाओं एवं संस्थानों की उपलब्धियां एवं चुनौतियाँ	HR – 101
36.	Hindu College	Chemistry Chemistry Zoology	Green Approach for the Extraction of Hazardous Heavy Metal ions and Dyes from Waste water using Synthetic and Natural Wastes	HC – 101
37.	Hindu College	Botany Botany Chemistry	Isolation and characterization of metal corrosion inducing bacteria from the polluted water and development of inhibitors of Microbial Induced Corrosion (MIC)	HC – 102
38.	Hindu College	Mathematics Chemistry Physics	Innovation Projects for Learning Science-Design, Spread and Documentation	HC – 103
39.	Hindu College	Physics Physics Chemistry Chemistry Chemistry	Development of Thin Films/ Nano materials for their Electronic and Biomedical Applications	HC – 104
40.	Indraprastha College for Women	Sanskrit Psychology Sanskrit	To Prepare a Glossary of Technical Terms in Yoga Philosophy	IP – 101
41.	Institute of Home Economics	Communication & Extension Microbiology Food & Nutrition	Ensuring Access to Safe Street Food	IHE – 101
42.	Institute of Home Economics	Fabric & Apparel Science Microbiology Microbiology	Isolation and identification of pigment producing fungi for using as textiles dyes	IHE – 102
43.	Jesus & Mary College	Mathematics Sociology Mathematics	Solid Waste Management	JMC – 101
44.	Jesus & Mary College	History History	Preserving our Common Heritage – The Monuments of Delhi	JMC – 102
45.	Jesus & Mary College	Economics Economics Commerce	Street Vendors: Service Providers or Traffic Hazards	JMC – 103
46.	Jesus & Mary College	English English Education English	Delhi – The city as text	JMC – 104
47.	Jesus & Mary College	Commerce Commerce	Understanding the lives of the working poor in Delhi	JMC – 105

		Political Science		
48.	Jesus & Mary College	Sociology Sociology History	Beyond Relocation: Experiences from the Urban Fringes	JMC – 106
49.	Jesus & Mary College	Education Educaton Education	A cultural and contextual understanding of resilience and the role of voluntary organizations in its development: a study of marginalized urban girls in Delhi	JMC – 107
50.	Kalindi College	Physics Physics	Conversion of mechanical energy to electrical energy on metro tracks	KC – 101
51.	Keshav Mahavidyalaya	Physics Computer Science Physics	Design and development of a low cost computerized laser Raman spectrometer indigenously for DU student laboratories.	KM - 101
52.	Kirori Mal College	Physics Physics Mathematics	Study on Quark Gluon Plasma (QGP) and Neutrino Physics	KMC – 101
53.	Kirori Mal College	Chemistry Chemistry Botany	Phytoremediation of Lead and Zinc polluted soils using Helianthus plant species: A new green technology	KMC – 102
54.	Kirori Mal College	Chemistry Chemistry Geography	Understanding the Chemical Metamorphosis caused due to Industrial Pollution in the Shiwalik region of the Himalayan Belt	KMC – 103
55.	Kirori Mal College	Physics Physics Zoology	Novel Strategies involving Nanomaterials/ Nanocomposites and Biosorption for Removal of toxic metals from water	KMC – 104
56.	Kirori Mal College	Geography Mathematics Statistics	Mapping the Spatial Topology of two sub- glacier basins of NW Himalayan for multi class change detection using MODIS, Landsat and IRS data	KMC – 105
57.	Kirori Mal College	Botany Botany Zoology	To assess the mutagenic potentials of some commonly encountered environmental pollutants and therapeutic agents	KMC – 106
58.	Kirori Mal College	Botany Botany Chemistry	A comparative study of phytoremediation of stagnant water by free floating plants and making it potable with the use of various plant sources	KMC – 107
59.	Kirori Mal College	Chemistry Chemistry Physics	Analysis of Heavy metal content in soils and plants present near the road side and suggest the plants to be grown in and around Delhi - NCR	KMC – 108
60.	Kirori Mal College	Statistics Geography Economics	Public funds and private responsibilities: An analysis of Cash Transfers as a viable alternative to PDS	KMC – 109
61.	Lady Irwin College	Resource Mang. & Design Application Fabric & Apparel Science	Multi-Criteria Framework for Sustainability Design Audit	LI - 101
62.	Lady Irwin	Resource	Generating Energy Consciousness among Rural	LI – 102

	College	Mang. & Design Application Development Communication & Extension	Household	
63.	Lady Shri Ram College for Women	Commerce Commerce Commerce Statistics	The Study of Corporate Social Responsibility Practices of MNCs in India	LSR - 101
64.	Lady Shri Ram College	Psychology Elementary Edu. Political Science	The Imprisoned Dove: Transcending Conflict and Building Cultures of Peace	LSR – 102
65.	Mata Sundri College for Women	Commerce Commerce Philosophy	Working conditions of BPO employees: Social and Ethical dimensions	MSC – 101
66.	Maitreyi College	Chemistry Physics Chemistry	Study of Surface Tension in the action of soaps, detergents, germicides, cosmetics and in the field of pharmaceuticals	MT - 101
67.	Maitreyi College	Biology Physics Physics	Biocompatibility of Nanomaterials	MTC - 102
68.	Maharaja Agrasen College	Business Eco. Electronics Electronics Business Eco.	Measuring Environmental Footprint of University of Delhi and Transforming it into a Zero-Impact University	MAC - 101
69.	Maharaja Agrasen College	Electronics Electronics Electronics Business Eco.	Redefining Curriculum: Integrating ICT for Innovation Eco-System	MAC - 102
70.	Miranda House	Geography Geography Sociology	Inheriting Land, Endangering The Girl Child: Interrogating Land Productivity, Property Rights and Family Planning in Western Uttar Pradesh and Punjab	MH – 101
71.	Miranda House	Botany Botany Chemistry Botany	Computational Modelling of Phyto regulatory Profile of some Nanoparticles	MH – 102
72.	Miranda House	Sociology Economics Geography	Miles on the Yamuna Team-A	MH - 103
73.	Miranda House	Physics Physics Chemistry Botany	Miles on the Yamuna Team-B	MH - 104
74.	Motilal Nehru College	History Commerce	Mining in National Capital Region: A Soio-economic and Environmental Study	MNC - 101

		Physics		
75.	Rajdhani College	Physics and Elect. Mathematics Physics & Elect.	Study on the crucial changes in the Earth's atmospheric system during solar maxima phase using interdisciplinary approach	RD – 101
76.	Ramjas College	Chemistry Zoology Zoology	<i>In vitro</i> effect of medicinal plant extracts against human fungal pathogen <i>Candida albicans</i>	RC - 101
77.	Ram Lal Anand College	History Commerce Economics	Deconstructing farmers' suicide, unraveling paradoxes: whispers from below	RLA – 101
78.	Ram Lal Anand College	Microbiology Geology Microbiology	Delineation of Groundwater Potential and potable quality in and around South Campus (University of Delhi) ridge area	RLA – 102
79.	Satyawati College (Eve.)	Economics English Hindi Hindi Economics	An Exploration of the Issues and Concerns of College-Going Young Adults through interactive Theatre Activities	ST (E) – 101
80.	Satyawati College (Eve.)	Political Science Economics Commerce	Emerging Gram Panchayat Leadership in Rajasthan: A comparative study of Banswada (ST), Ganganagar (SC) and Alwar (Gen) Distt.	ST (E) – 102
81.	Shyam Lal College	History Hindi Economics	साप्ताहिक बाजार : रोज का संघर्ष (खुली अर्थव्यवस्था में साप्ताहिक बाजारो का सामाजिक – सांस्कृतिक – आर्थिक और मनोवैज्ञानिक अध्ययन एवं उसकी प्रासंगिकता	SLC - 101
82.	Shyam Lal College (Eve.)	Political Science Political Science Hindi	Forest Protection by Tribal Women's: An Efforts by Jamuna Tuddu	SLC(E) – 101
83.	Shyam Lal College (Eve.)	Hindi Commerce English	उपभोग संस्कृति, बाजार और बचपन	SLC(E) – 102
84.	Shyama Prasad Mukherjee College	History Hindi Commerce	Gendering Dalit migration and its Socio-Cultural Impact	SPM – 101
85.	Shyama Prasad Mukherjee College	Geography Education Economics	An Exploratory Study of Environmental Awareness and Consumer Behaviour towards Eco-Friendly Household Products	SPM – 102
86.	Shyama Prasad Mukherjee College	B.El.Ed Psychology Maths	A Study of Students Absenteeism in Primary School in Delhi and NCR	SPM – 103
87.	Shaheed Bhagat	Geography	Problems and Development of Slums: Students'	SBS (E) – 101

	Singh (Eve.)	Economics English	Perspective	
88.	Shivaji College	Physics Sociology Sociology	University Social Networking Site for D.U. Community	SWC – 101
89.	Shaheed Rajguru College of Applied Sciences for Women	Chemistry Food Technology Instrumentation	An Assessment of consumers' exposure to pesticide in conventional vegetables and vegetables sol with the 'organic' tag in Delhi NCR region, India	SRCA – 101
90.	Shaheed Sukhdev College of Business Studies	Finance Operational Res. Computer Sc.	Investor sentiment in the Indian Financial Market: An empirical study	SSCB – 101
91.	Sri Guru Nanak Dev Khalsa College	English Commerce English	Youth Empowerment – What is means to youth and its Implications for Educational Institutions	SGND – 101
92.	Sri Guru Tegh Bahadur Khalsa College	Electronics Electronics Chemistry	Role of nano-crystals in energy harvesting and biomedical applications	SGTB – 101
93.	Sri Guru Tegh Bahadur Khalsa College	Hindi Political Science Mathematics	Conceptualizing Women Sports in the context of Sports Economics and Marketing of Professional Sports in India: Performance Study of Gender based athletes in respect of their Advertising & Promotion Value	SGTB – 102
94.	Sri Guru Tegh Bahadur Khalsa College	Zoology Chemistry Chemistry	Fluorescent Powder Compositions for Developing Latent Fingerprint	SGTB – 103
95.	Shri Ram College of Commerce	Political Science Economics Commerce	Aahaar	SRCC - 101
96.	Sri Aurobindo College	Commerce Commerce Chemistry	Green Banking & Sustainable Development, the need of today	SAC – 101
97.	Sri Aurobindo College	Commerce English Chemistry	Environmental Crisis - Green Economic Solution	SAC – 102
98.	Sri Aurobindo College (Evening)	Psychology Psychology Physical Edu.	Strengthening Psychological capital for sports person	SAC (E) – 101

99.	Sri Venkateswara College	Biochemistry Botany Botany Chemistry	Survey of Tree Species in Delhi Region and Screening of Selected Medicinal Plants for Anti-Cancer Activity	SVC – 101
100.	Sri Venkateswara College	Botany Botany Botany Zoology	Screening of Cyanobacteria for Antimicrobial activity and Explore its Biosynthesis regulated by Heterochromatin	SVC – 102
101.	Sri Venkateswara College	Botany Biochemistry Botany Chemistry Zoology	Comparative Anti-oxidant Profiling of Various Indian Rice Cultivars in Response to Salinity Stress	SVC – 103
102.	Sri Venkateswara College	Biochemistry Biochemistry Biochemistry Statistics Biochemistry	Screening of Indian population for possible polymorphisms in candidate genes of extracellular matrix proteins that could lead to Disc degeneration leading to herniation	SVC – 104
103.	Sri Venkateswara College	Biochemistry Biochemistry Economics Bio-Chemistry Statistics Biochemistry Bio-Chemistry	To study the nutritional and socio-economic viability of consuming Olive oil versus Ground nut oil in the Indian context	SVC – 105
104.	Sri Venkateswara College	Biochemistry Biochemistry Biochemistry Chemistry Chemistry Biochemistry	Purification and characterization of Cytochrome P450 from liver for the study of P450 interaction with anticancer drug molecules	SVC – 106
105.	Sri Venkateswara College	Zoology Zoology BioChemistry Zoology	An easy identification of few pathogenic gamma/epsilon proteobacteria by exploring the internal features of their 16S r RNA	SVC – 107
106.	St. Stephen's College	Chemistry Chemistry Physics	Molecular Design, Synthesis, Characterization and Applications of Macrocyclic Compounds	SSC – 101
107.	St. Stephen's College	Chemistry Chemistry Mathematics Chemistry	Development of new reagents for detection of anions in water	SSC – 102
108.	St. Stephen's	Physics	Suggested Areas of improvement in the Shelters for the	SSC – 103

	College	History Physics	homeless in Delhi	
109.	St. Stephen's College	Physics Physics Economics	On the Energy, Light Characteristics and Economic Feasibility of LED luminaries	SSC – 104
110.	St. Stephen's College	Physics Computer Science Physics	Blood Flow Artifacts in Magnetic Resonance Imaging: Cause and Control	SSC – 105
111.	St. Stephen's College	Chemistry Chemistry Physics	Devices based on Photomicro lithography and Nano Carbon Materials	SSC – 106
112.	Vivekananda College	Food Technology Food Technology Hindi	Assessing and Improving the Quality of Fat used in College Canteens	VC – 101
113.	Zakir Husain Delhi College	Physics Chemistry English Physics	Feasibility studies to improve quality of living and development of low cost efficient techniques to purify potable water in villages: Case study with reference to villages of Ajmer (Rajasthan)	ZH – 101

ACHARYA NARENDRA DEV COLLEGE

Project Title: "Glucose Detection – a biosensing approach"

Project Code: ANDC – 101



a)
a) Low-cost Glucometer



b)
b) Students immobilizing protein and enzymes on Zinc Oxide

1. Objective (150 words):

Oxidation of glucose is known to be the major source of cellular energy in human body. Glucose acts as the major carbohydrate present in the peripheral blood besides finding importance as a metabolic intermediate. Glucose determinations assume importance mainly to aid in the diagnosis and treatment of lifestyle disease; diabetes mellitus. Higher concentrations of blood glucose levels indicate existence of pancreatitis, pituitary or thyroid dysfunction, renal failure and even liver disease.

The primary objective of the work at Acharya Narendra Dev College has been the hands-on development of glucose oxidase based blood glucose concentration sensing material by the students. Specifically, immobilization of glucose oxidase on an identified matrix for stability and reproducibility has been the endeavour. The matrix based on relevant metal oxide would be identified by systematically working out the iso-electric point (IEP) factors followed by immobilization of bio-molecules. The entire process would be bereft of any hazardous chemical treatment.

2. Final Findings (300 words):

The students scanned literature and identified zinc oxide (ZnO) to be an ideal semiconducting metal oxide for making up the matrix since it possesses a high iso-electric point (IEP) factor of 9.5 and which is expected to support the low IEP of glucose oxidase (GOX). Further, well known biocompatibility of ZnO has been reported to be an added advantage. In the present study, initially to determine the binding capacity of protein and determination of optimized conditions Bovine Serum Albumin (BSA) was used as the model protein. In experiments, BSA was dissolved in 50 mM Phosphate buffer (PB) at pH 7.2 and incubated with 50 mg ZnO. Post incubation at room temperature for 20 minutes the slurry was centrifuged. Protein content of supernatant was determined by Folin – Lowry method which gave indication of unbound protein. The amount of protein binding on the ZnO matrix was estimated by subtracting the amount left in the supernatant from the total and measured average was found to be approximately 573.33 ug bound / 50 mg of ZnO matrix.

Further, binding of a model enzyme with the ZnO matrix and enzymatic activity of immobilized enzyme onto the matrix was undertaken. Horse Radish Peroxidase (HRP) was taken in PB as used above but at varying pH conditions (5.6, 7.2, 8.0) to investigate the effects of pH on binding. Results obtained indicate that buffer with pH of 7.2 is optimal for binding of HRP with ZnO matrix and any further increase or decrease leads to a fall in the binding capability. The bound enzyme was also found to be catalytically active. In the next set of experiments binding of

Glucose Oxidase (GOX) with ZnO was undertaken. 50 mM PB at pH 7.2 was taken as solution in which binding was performed. Glucose Oxidase was found to bind with the matrix with the retention of catalytic activity.

3. Learning for Students (200 words):

The multi-disciplinary nature of the project ensured that students from all three different streams learnt to appreciate others' field of study and develop skills to tackle the life-style problem of diabetes. Students of life science learnt skill sets required in a physical science laboratory and vice-versa for physical science students. They have become conscious of the burgeoning problem of rapid spread of diabetes having scanned literature and journals accessed through scientific databases of Scopus and ScienceDirect available through University of Delhi's wi-fi internet. Hands-on experiments performed in the laboratory coupled with handling of hazardous chemicals have made appreciate team-work while inculcating good laboratory practices. Another tangible benefit for students has been time management vis-à-vis regular classes and maturity as a responsible individual who is tuned to the needs of the society. The advanced level equipment operated as part of the project has made students equipped with technical dexterity that may prove very useful when they find employment in the industry. While learning to procure different chemicals and even distinguishing the same chemical of different grades for specific use has emboldened the students to perceive study in a new light that is beyond the classroom. A paradigm shift is clearly discernible in the way the trained students attempt a problem and adopt a scientific approach. Introduction to free and open softwares besides the dedicated ones for instrument control has introduced the students to the concept of multi-tasking. The students participated and had paper presentation in the following workshops/ seminars: 1. Glucose Detection- a biosensing approach, Animesh Kar, Gunjan, Harsh Bishen, Raj Keshri, Deepak Kumar, Rajender, Durgesh Kumar, Kapil Joshi, Dikshant hans, Rajesh Choudhary, Arijit Chowdhuri, Amit Garg , National Conference On Redefining Science Teaching: Future of Education, 7-9th March, 2013, University of Delhi, South Campus, New Delhi – 110 021
2. Paper presentation in seminar held at GARGI college under GC-102 project on "To Device a cost effective set up for Cell Identification, Characterization and Separation" on 21st April 2013.

4. Benefits to College (100 words):

The college has become richer in the scientific sense through the establishment of advanced laboratories fully furnished with modern instruments, which are expected to find usage for further research and for teaching under the upcoming FYUP. The faculty involved in the project has been able to establish a comfort zone wherein they have come together to perform as a team to achieve goals in multi-disciplinary fields. Students in the college have been exposed to frontier areas of science where cutting edge research is going on and are trained to take up research as viable career option.

5. Benefits to Society (100 words):

The project has empowered the students to assimilate knowledge and develop skills for the benefit of the society by making them informed persons who can pursue goals for its betterment. The trained students with their scientific temper are geared to join the crusade against the onslaught of lifestyle diseases and make the society aware of their pitfalls. Post, graduation studies the students with their training and hands-on skills will be at an advantage to find top ranking jobs and would make responsible CEOs and COOs who believe in giving it back to the society. Thus the Indian society would be lucky to get future citizens who are interested in making it a better place.

6. Further Plans (100 words):

With the advanced laboratories developed during the course of the project it is felt that the project can be taken forward to realize some key applications. A few of the immediate applications are enumerated as follows:

- o Develop a blood glucose measurement prototype strip compatible with the low cost glucometer developed.
- o Increase the shelf-life of the strip from a few weeks to months

- o Reduce the cost of the blood glucose measurement strip
- o Rapidly transfer the technology of blood glucose measurement strip to a company for commercialization.

ACHARYA NARENDRA DEV COLLEGE

Project Title: “CO₂ Gas Sensing – an ICT based investigation for pollution control”

Project Code: ANDC – 102



a) Figaro CO₂ sensor b) Vernier CO₂ sensor with data acquisition module
c) Gas Sensing Test Rig (GSTR) for simulation of controlled environmental conditions

1. Objective (150 words):

CO₂ is recognized as a significant workplace hazard. It poses a threat to life through asphyxiation when it displaces the oxygen in air down to dangerously low levels. Inhalation of elevated concentrations of CO₂ can adversely affect the respiratory, cardiovascular and central nervous systems in humans. Hence, need of the hour is to accurately measure level of CO₂ in the ambient environment. The aim of this project is to use commercially available gas sensors for CO₂ detection in the immediate environment and understand the mechanism of its detection, data acquisition and recording of the acquired data.

Students in the project have been trained in the measurement of real-time CO₂ gas concentration levels in the immediate vicinity as well as in a controlled environment (Gas Sensing Test Rig). They have acquired skills in hands-on operation of the sensor and acquire CO₂ data by interfacing the sensor to a computer. Investigation of critical issues related to selectivity, sensitivity, response speed, and aging have been undertaken.

2. Final Findings (300 words):

The students investigated CO₂ gas level concentrations in Delhi (plain) and in places located at higher reaches including Sat Tal, Chanfi, Naukuchiya Tal and Pangot (mountains) with the idea to correlate the effect of spread of human habitat to the existing CO₂ concentrations in the immediate vicinity. The acquired data indicates a direct correlation between the density of human population and the measured concentration of CO₂ gas. Specifically, in all locations situated in the mountains (besides Delhi) the CO₂ level was found to increase with increasing human density i.e. more popular the spot, higher the CO₂ level. Interestingly at Pangot and Chanfi (less touristy) with small hamlets and more green cover, the commercial CO₂ sensor could only measure just base level CO₂ concentrations indicating that it had reached its lower limit.

In another experiment the students measured CO₂ exhaling characteristics of a human being who is initially at rest and works up a light exercise after some time before relaxing once again. It is noted that the response of the CO₂ sensor (rise and fall in the CO₂ concentration level) typically follows the pattern of exercise regimen of the human being. Upon examining the variation of output CO₂ concentration levels of a human being, pre- and post-exercise, it is seen that there is an accentuated difference in the initial CO₂ concentration value for the person pre and post exercise and that the concentration level progressively moves to a saturation value. Further if the same person uses mint (chewing gum) during exercise then the CO₂ sensor returns a flat value.

This Indicates that the CO₂ detection characteristics of the sensor, somehow gets inhibited in the presence of mint. A simple variation of position of the sensor affects the CO₂ detection characteristics and it is observed that concentration of CO₂ measured varies inversely as a function of distance.

3. Learning for Students (200 words):

In this multi-disciplinary project the first tangible benefit for students has been teamwork and hands-on learning beyond the classroom on a real life problem affecting the world at large. Students have learnt to access databases like Scopus and Science Direct, study scientific journals and scan literature for relevant information using the University of Delhi powered wi-fi internet available in college. They have gained advanced skills through hands-on usage of

advanced instruments and imbibed good laboratory practices thus turning them into useful manpower. They have learnt to implement different softwares on computers and have become skilled in their use for scientific applications including graph plotting, data acquisition, data conditioning etc. Sight visits to different areas in the country for data collection has made them aware of different customs besides varying environment affecting the acquired data and limitations of the sensor. They have developed a keen sense of responsibility towards preserving the environment and awareness to reduce carbon footprint in whichever way possible. Having developed a logical bent of mind and scientific temper the students have learnt how to manage disappointments and values of hard work over long duration of time. They have become adept at time management besides developing dexterity at interacting with people coming from diverse backgrounds. Finally, having worked in the project for the last year the Students have changed into well-rounded personalities overcoming their initial shy nature. The students also participated in the following conferences/seminars a) Ms. Sandal Azhar and Mr. Priyank presented a poster in the National Conference on Redefining Science Teaching: Future of Education held at University of Delhi South Campus, 7 – 9 March 2013.

b) Ms. Sandal Azhar and Ms. Priya Kashyap won third prize in the poster competition during the Seminar on "Optical fiber based probes" organized by Gargi College on 12th April 2013.

4. Benefits to College (100 words):

Through the project students have acquired hands-on skills in advanced research grade equipments/instruments. The college has been able to establish state-of-the-art laboratories adding to the established infrastructure, wherein students can perform some of the experiments included under the FYUP programme. Due to multi-disciplinary nature of the project faculty members from different departments have put in more time, effort and imagination which has helped in advancing their knowledge base and which is expected to help in solving complex societal problems. Project investigators have been successful in contributing a paper in the 27th National Conference on Plasma Science and Technology (Plasma 2012) during 10 – 13th December 2012 at Pondicherry University, wherein funding under the DU innovation project has been duly acknowledged.

5. Benefits to Society (100 words):

Students have matured into responsible citizens having developed scientific temper. They have cultivated a sense of responsibility towards protecting the fragile environment and awareness of problems caused by CO₂ emissions has inspired them to adopt techniques that reduce the carbon footprint in small but definite measures. They have instilled the values of hard work and gained useful hands-on training in advanced technology instruments. It is envisaged that the society is definitely going to get more responsible citizens in the future who are willing to take informed decisions and thus make a positive difference to its well-being.

6. Further Plans (100 words):

It is envisaged that the established infrastructure and advance level instruments procured can be utilized further to take the work forward. Some of the immediate applications are enumerated as follows:

- Build an array of gas sensors for measuring gas response characteristics in a gas mixture
- Investigate gas sensing characteristics in a gas mixture.
- Acquire data of gas sensing characteristics
- Generation of finger prints for individual gases in a combination of gases
- Use statistical distribution concept of principal component analysis for recognizing gas mixtures

Media coverage of the ANDC – 102 project in Dainik Bhaskar newspaper (NCR edition) dated 10th August 2012.

बंद कार में दम घुटने से अब नहीं होगी किसी की मौत

विद्यार्थी अक्सर मोटो दौड़ कोर्सों के एअर-सिस्टम तैयार करते हैं। इस सेवा, कारों में इन्फ्लेटर के तैयार करने की बजाय तुरंत सहायता

Advt. No. | 10/11/2017

आज बंद कार में दम घुटने से नहीं होगी मौत। इस प्रकार की घटनाओं का खतरा घटने का विश्व विख्यात विज्ञानविद्वानों के द्वारा न सिर्फ विज्ञान का 'नया विचार' तैयार करा जा रहा है, बल्कि बंद कार में अक्सर होने वाली ही घटनाओं को दम घुटने और अक्सर आम बंधुओं को



ऐसे काम करता है सेसर

अक्सर मोटो दौड़ कोर्सों के बीच विद्यार्थी हैं, जिनका काम है, दुर्घटना घटने और दुर्घटना घटने से बंधुओं को अक्सर तैयार करने के लिए बंधुओं को बंधुओं को अक्सर

अक्सर इन्फ्लेटर के साथ एक विद्यार्थी, मोटो के अंदर होने और उसके दौरान ही घटनाओं में अक्सर होने से बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर

कैसे है उपयोगी, क्यों पड़ी जरूरत

विज्ञान का एक ही जो तैयार मोटो है उसी दौरान बंधुओं की है। इस तरह से अक्सर इन्फ्लेटर बंधुओं को तैयार करने के लिए बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर

कममत में सस्ता य यूजर फ्रेंडली

मोटर को अक्सर तैयार करने के लिए बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर

मोटर को बंधुओं के बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर

अक्सर तैयार करने के लिए बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर तैयार करने के लिए बंधुओं को अक्सर

ACHARYA NARENDRA DEV COLLEGE

Project Title: Mobile Phone as a real time sensor based undergraduate laboratory

Project Code: ANDC-103



Students integrating a tablet to a computer using data acquisition card through LabVIEW in the project laboratory

1. Objective (150 words):

The primary objective of the work was to develop experiments by integrating mobile phones/tablet to various types of already available sensors in the college like gas sensors (O₂ and CO₂), pH sensor, ion selective electrodes, conductivity sensor, colorimeter, charge sensors, current sensors, light sensors, magnetic field sensors, drop counters, dissolved oxygen sensors etc. using a low cost USB based data acquisition device and develop applications running using web services. Development of a remote lab as well as automation of all sciencebased experiments is the main focus. The web applications can be downloaded from the internet on different type of mobile devices and afterwards can be used for conducting the sensor based experiments i.e. to convert mobile phone into a mobile laboratory.

2. Final Findings (300 words):

As per the initial and essential requirements of the project, students were trained in LabVIEW, its programming features like creating, saving, replacing and reusing VIs (virtual instruments), looping techniques, use of case and event structure for conditional programming, creating local and global variables for better controls, various tools it provide for handling any kind of data. Use of Clusters and Sub VIs was very much significant in making the VI much more compact and saving us a lot of terminal space. A decent amount of time was spent in the detailed study of graphical representation of our acquired data, learning Functions palette that provided us with functions for a variety of graphical representations and in different dimensions.

Interfacing of Data Acquisition Devices such as USB 6008 and sensorDAQ with sensors using LabVIEW

One of the key components of the project was students' need to understand the basic interfacing principles along with the details of various data acquisition devices for use in any applications. Students learnt about these principles with LabVIEW applications developed using USB 6008, sensorDAQ and myDAQ. Following topics were covered through Hands-on sessions:

a) Sampling Rate and Nyquist Criterion

- Aliasing
- Example – Nyquist.VI, Aliasing.VI, waveform chart and freq.VI

b) Quantization Error

- Example– Quantization.VI, Linearity Check.VI

c) Resolution from Range and Number of Bits

d) Data Acquisition Structures Functions & locations

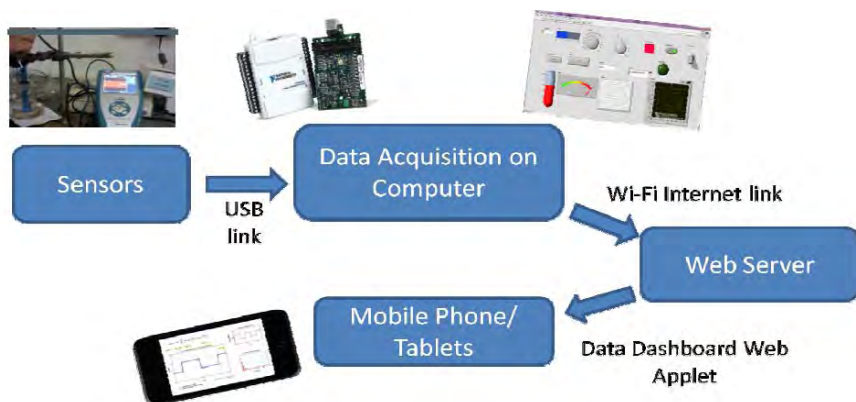
- Timing
- Triggering
- Buffering

e) Data Acquisition through Measurement and Automation Explorer(MAX)

- Single Shot Acquisition of a single channel using MAX
- Software timing functions and time functions
- Multi-channel acquisition using MAX
- Multiple Samples of a single or multiple channels using MAX

- Timing
- Triggering – Digital and analog using MAX

Students developed various VIs interfacing various sensors like light sensor, rotary sensors etc. using sensorDAQ and USB 6008 and myDAQ. They developed software program (VI) for two way exchange of data through USB of mobile phone/tablet. They successfully calibrated and interfaced sensors with PC through DAQ devices and established PC to mobile phone/tablet link through server. The block diagram of the development is as shown:



Chemistry group also worked on some of the key physical chemistry experiments to convert the current conventional chemistry laboratory into an automated Chemistry laboratory based on sensors and data acquisition devices. Some of the key experiments which were published and presented in various conferences are as under:

1. Determination of isoelectric point of an amino acid as model experiment (not reported using sensors). Classically this was done by titrating an acidified solution of the amino acid with NaOH solution pH metrically, thus Redefining Chemistry Experiment using Sensors. pH sensor was coupled with DAQ that collected the pH values at every addition. Use of drop counter reduces the efforts of noting no. of drops as well as improved on the accuracy. Student visualized the plot runtime and can see the result instantly on LabQuest or Logger Pro. With provisions of electronic data exported to Excel for analysis.

2. Another experiment on construction of binary phase diagram of the naphthalenebenzoic acid system as a model experiment using temperature probe and data collection and analysis software was successfully conducted and reported.

3. Learning for Students (200 words):

Students got exposure of research tools & methodology during the project. They learnt the state of the art technological practices followed worldwide like learning LabVIEW: tool used for virtual instrumentation, familiarity with sensors, their calibration and interfacing with PC through DAQ devices, developing automated experiments at school and undergraduate level, understanding and establishing PC to mobile phone link through web server, learning integration of USB based data acquisition interface like SensorDAQ, USB 6008, myDAQ etc. with the computer. Students learnt to work in an interdisciplinary team. The students participated and had papers publication/presentation in the following workshops/ seminars:

Publications

1. Changing students perspective towards Science using sensors and data acquisition systems, Dhruv Dosad, Prabhav Pushkar, Amit Garg, Reena Sharma, Vishal Dhingra, International Journal of Electronic and Electrical engineering, Volume 5, Number 2, Page no. 111-114, 2012

2. Automating Physical Chemistry Laboratory using sensors and data acquisition systems, Rambir, Sachin Kumar, Amita, Pankaj Khanna, Amit Garg, Vishal Dhingra CRSSI, BHU 15th CRSI National Symposium in Chemistry (NSC-15), 1st -3rd February 2013, Banaras Hindu University

3. Mobile Phone as a real time sensor based undergraduate laboratory, Amit Verma, Dhruv Dosad, Hemant Adhikari, Rakhi Bisht, Prabhav Pushkar, Kamal Kishore, Sandeep Yadav, Sachin Kumar, Rambir, Amita, Amit Garg, Vishal

Dhingra , Pankaj Khanna, National Conference On Redefining Science teaching: Future of Education, 7th -9th March, 2013, University of Delhi, South Campus, New Delhi-21

4. Integrating Electronics in transforming Chemistry laboratory an enthralling experience for students, Sachin Kumar, Rambir, Amita, Pankaj Khanna, Amit Garg, Vishal Dhingra, Academic Congress: nabling the Young: Redefining Education, September 6th - 7th , 2012, University of Delhi

Awards

1. Paper presentation in seminar held at GARGI College under GC-102 project on “To Device a cost effective set up for Cell Identification, Characterization and Separation” on 21st April 2013. The jury members duly appreciated and rewarded the work and students won 3rd prize among 8 projects displayed there.

Participation in National and International conferences

1. International conference on Recent Trends in Electrical and Electronic Communication Engineering” (RTEECE – 2012), 29th – 30th September 2012, JNU, New Delhi

2. CRSSI, BHU 15th CRSI National Symposium in Chemistry (NSC-15), 1st -3rd February 2013, Banaras Hindu University

3. National Conference On Redefining Science Teaching: Future of Education, 7th -9th March, 2013, University of Delhi, South Campus, New Delhi – 110 021

4. Academic Congress: Enabling the Young: Redefining Education, 6th - 7th September, 2012, University of Delhi
The participation provided them an opportunity for exchange of ideas to some of the leading experts from Academia, Industry as well as Scientists.

Conducting Workshops in various Schools as resource persons

The students after getting initial training on use of LabQuest(a data acquisition device) and various sensors have conducted workshops in various schools of Delhi. The list of schools covered is as under:

1. Birla Vidya Niketan School, Pushpa Vihar

2. Modern School Brakhamba Road

3. Heritage School, Rohini

4. Apeejay School, Pitampura

5. Gyan Bharti School, Saket

6. Chinmaya Vidyalaya, Vasant Vihar

This activity had two fold benefits to these undergraduate students. It led to improving them academically by becoming resource persons for these workshops and handling a group of around 40 students in each session as well as helping them in personality development. It has been an enthralling experience to students.

Membership International Academic Society SPIE, USA

After getting involved in the project, students understood the meaning of real time research at undergraduate level have gone ahead to become the student members of one of the well know international society in photonics SPIE, USA.

4. Benefits to College (100 words):

The project has been a boon to the college in the sense that it has further rejuvenated the practice of promoting undergraduate research followed for a long time. The funding for the project has led to procurement of many sophisticated equipments that otherwise is very difficult from the normal funding. These facilities will further prop up the research environment in the college. The students have learnt the time optimization i.e. their regular studies with their project work. Also, by seeing the students of this project working on the state of art technology and their participation in various national and international conferences, it has motivated their peers to take up these challenges.

5. Benefits to Society (100 words):

Over the last decade, we have observed a great decline in the interest of students in pursuing science across the country. They do not pursue a career in science. The project was a model to showcase how the present situation can be changed. Students working in this project now understand the meaning of real research and what it means to practice science. Undergraduate students of different disciplines in the college had been imparted training not only to automate various experiments using computer interfaced sensors but also how to work in an interdisciplinary

environment with a focus on promoting research at the undergraduate level. They have been exposed to real, cutting edge technology enabling them to take well informed decisions about their career. The workshops conducted during the project have led to a strong school university interface. The exposure and expertise the students of the project gained were shared by them with their counterparts at various schools of Delhi. Furthermore, the college students were able to articulate their research work into scientific communication. The students learnt much more than they would have in a normal class, thanks to the benefits of learning by doing made possible under the aegis of this project.

6. Further Plans (100 words):

The project was based on proprietary software of National Instruments, LabVIEW. Being paid costly software, it sometimes become detrimental in wide spread adoption of the newly developed experiments across the University/schools. Therefore, to overcome this disadvantage and to have its wider adoption and tailoring as per need for maximum use by undergraduates from other colleges, we propose to develop a low cost computer controlled science laboratory that utilizes both hardware and software tools which are open source based. This new approach will help colleges /schools to convert their stereotype science laboratories into technology based laboratories in which experiments can be tailored as per the educational needs, experiments that will be flexible, reliable and inexpensive. The areas where the scope of the project can be further extended are:

- Develop more automated experiments at school and undergraduate level and thus make them more economical & time saving and do effective utilization of resources.
- Design more appropriate hardware interfaces for different experiments and integrate them with systems developed in the project.
- Acquaint students about these automation techniques and create new interesting experiments for better learning. Conduct workshops at various places like colleges of University of Delhi, schools in Delhi etc. acquainting the stake holders about the developed system.

ACHARYA NARENDRA DEV COLLEGE

Project Title: Survey-based study to identify the health hazards associated with occupational exposure of textile dyes used by dyers to color the fabrics

Project Code: ANDC 104



Picture 1: Our group with the Mentor and the dyers at work...

1. Objective (150 words):

Occupational health and safety cover for this unorganized sector can well be said as non-existent. This encouraged us to take up the task of identifying the health problems faced by these dyers sitting in almost each corner of the market, but go unnoticed and unattended. There is relatively lack of statistical data at the national level available on accidents and occupational diseases in this segment. The objectives of this survey were:

1. To assess and evaluate the awareness about occupational health problems.
2. To identify suspected cases (gender based) of work-related symptoms of skin-itching, contact dermatitis, irritation of eyes, headache, hearing disability, asthma, etc. from various local dye units existing in Delhi and NCR.
3. To assess the amount of dyes actually adsorbed on the fiber compared to the quantity used by the dyer for each dyeing.

The project was designed so that a science student especially from chemistry/ biomedical science background can assess the impact of the chemicals on the common man working far away from labs. The project also aimed at creating the environment awareness among students and thus in society.

2. Final Findings (300 words):

Our team interviewed more than 160 dyers and it was observed that the dyes and chemicals used in textile finishing are very harmful to the health of the dyer. People exposed to these dyes are found to suffer from skin irritation, skin rashes, scaling, often on the hands and fore arms (in some cases loss of sensation), and also on nose and eyes. Some dyers have developed a shortterm allergy to certain dyes. Exposure to even small amounts of these dyes like *Indian Pink* leads to severe coughing. Dyers are commonly using *Hypo* and *Bleach*, to clean dyes from their hands. Common bleach contains *sodium hypochlorite* which causes moderate mucosal irritation, the extent of which depends on concentration and duration of contact. In case of severe exposure, permanent pulmonary damage can occur leading to chemical irritant induced type of asthma (respiratory sensitization), an unusual breathlessness. Bleach is harsh on skin and nails. The skin

of hands of these dyers has become dry and patchy. Almost every dyer has accepted that the sensitivity of their hands towards hot and cold feeling is lost. Many have accepted that they can't feel the sensation of a crawling insect on their hands. *Hypo (sodium thiosulphate)* though less severe than bleach, causes dermatitis, eye irritation leading to redness and continuous pain in eyes on long-term exposure. In our survey, dyers admitted that they have developed small patches on skin. Some dyers have reported that they become sensitized straightaway and some after years of exposure to these reactive dyes. The dyers have informed us that the symptoms of sensitization usually get better when they are away from work over a weekend or a holiday. One cannot rule out that these symptoms may be exaggerated for other reasons also, but the effect of dyes cannot be ruled out at all. When asked why most of the dyers are not following the simplest safety precaution of wearing hand gloves, the common reason that came out is the discomfort with gloves

while handling hot dye solutions. Some dyers though very less in number have admitted that they have experienced memory reduction over years but they are reluctant to correlate it to the use of dyes. Almost every dyer adopts a common household remedy for cleaning his internal system after being exposed to dyes throughout the day. They as a regular practice eat jaggery in the evening.

According to them it cleans their throat and takes all dye particles inhaled during the day. This survey has revealed a striking fact about the profession- the dyers whether literate or illiterate, know that they are dealing with chemicals that may harm them. They may not exactly know what could be the ill effects, but they certainly know that they are harmed in the long term. They do take measures from their side but are reluctant to admit it publicly out of a fear of losing their profession.

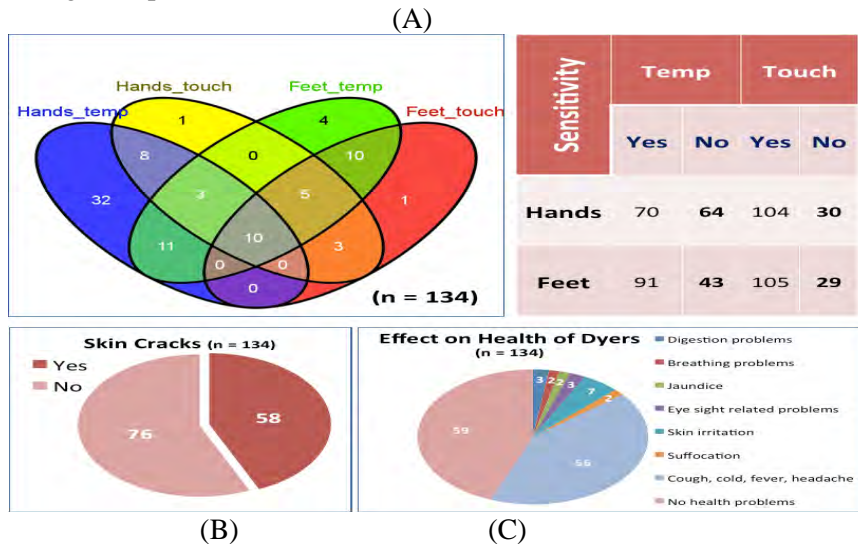


Figure 1: A. Venn diagram showing the sensitivity of hands and feet of the dyers for temperature (Hands_temp and Feet_temp respectively) and touch (Hands_touch and Feet_touch respectively) (n = 134).

B. Pie diagram showing the proportion of the dyers (n = 134) with skin cracks.

C. Pie diagram showing different types of health problems in the dyers (n = 134).

After doing the survey it was recognized that the dyer would not be at the risk if he takes the right precautions. To reduce the above mentioned symptoms following suggestions given to the dyers:

1. Work as cleanly as possible, to protect yourself and others in the vicinity.
2. Get more and more information about the chemicals you use and how to handle them safely.
3. Wash your hands thoroughly before eating, drinking or smoking. Do not eat, drink or smoke in the area where these chemicals are used.
4. Wear the personal protective equipment like chemical-resistant gloves, apron, work boots to stop liquids spilling inside, eye protection (preferably a visor which extends and tapers under chin and report any defects as early as possible.
5. Inform your doctor that you work with dyes and chemicals if you suffer ill health and seek medical advise.

3. Learning for Students (200 words):

This project has been a great learning experience for undergraduate students involved. They have learned the basis of a project designing and its implementation, collection of data and then summarizing the results in a coherent way. They have learnt how to plan a project, what methodology they should follow to achieve the set goals and how to analyze whether they are following a right research direction or not. Students were also involved in purchasing of equipment's required in this project along with mentors. They have learned what specifications to look for in equipment and how to do a market survey for knowing the best brand available at best price. For this survey-based project, they have used a self prepared questionnaire through exhaustive discussions with the mentors to collect the data. To check the completeness of this questionnaire, they have done pilot studies. With the result of pilot studies they learnt how to enrich questionnaire for final data collection. During the course of this study, students are have also

learnt methods of determining physiological parameters, dealing with human subjects considering socio-ethical issues and statistical analyses including sampling, data generation, presentation and interpretation. Through interviews they developed the better communication skills, team spirit, constructive criticism for the team members, refining their own art of interviewing and improving the data quality.

They have stepped beyond the college premises, to see the real world as a classroom, enriching their knowledge not only about how their subject of undergraduate studies is correlated to the real life, but also about human survival in challenging circumstances.

4. Benefits to College (100 words):

The college has definitely been benefited by this project as students enrolled in this project have reached the local dyers all over Delhi and NCR. The students have interviewed not only the dyers but also interacted with the shopkeepers sitting nearby. This way the people get to know that the undergraduate students of Acharya Narendra Dev College affiliated to University of Delhi are researching on a topic beneficial for the society. The research findings of this project are being compiled in the form of a research paper that will be communicated to a peer reviewed journal soon. A research publication by undergraduate students will earn laurels for the College also. Infrastructure generated through funding from this project will be utilized for training more number of undergraduate students.

5. Benefits to Society (100 words):

The small-unorganized sections of the society generally go unnoticed in form of any occupational health hazards associated with their professions. The research findings of this project clearly indicate the casual approach of dyers in dealing with dyes. The dyer, most often illiterate or just primary educated is unaware about the level of harm these dyes can pose to them. During interaction with dyers, students have conveyed to them the need for adopting safer occupational practices and keeping a watch on the effects of dyes on their bodies. Through the interactive sessions during interviews, the dyers felt inclusive, attended and cared. This research has also brought to notice the amount of dye thrown everyday into common drains and thus calls for a deeper and safer solution for disposal of dyes after use.

6. Further Plans (100 words):

The research findings of this project are being compiled in the form of a research paper that will be communicated to a peer reviewed journal soon. Since this project involved interaction with dyers in Delhi and NCR, the same may be extended to other regions of the country.

ACHARYA NARENDRA DEV COLLEGE

Project Title: Exploring useful bacteria from soil

Project Code: ANDC-105

Soil sample collection sites



Sugar Plant, Dhanaura, U.P



Teerthan Valley, H.P

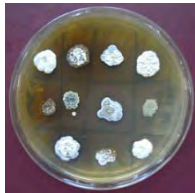


Yamuna Bank, Delhi



Diversity Park, Sarai Kale Khan, Delhi

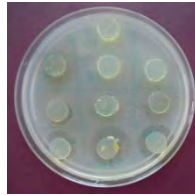
Purified colonies



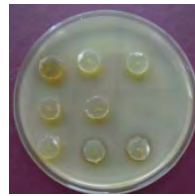
Primary screening of isolates for antimicrobial activity



Activity against *Candida albicans*



Activity against *Bacillus cereus*



Activity against *Escherichia coli*

Secondary screening

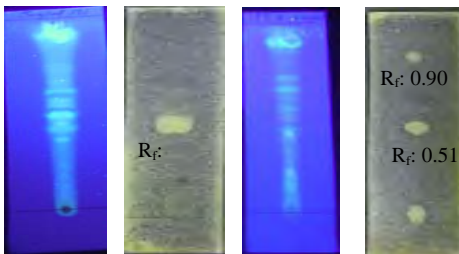


Activity of isolate 51 methanol extract against *Candida albicans*



Activity of isolate 173 methanol extract against *Fusarium oxysporum*

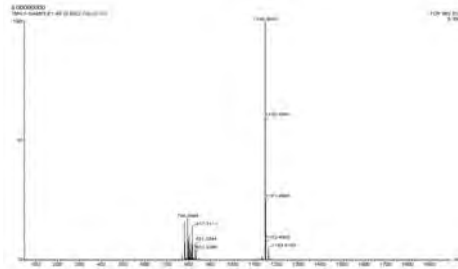
Thin layer chromatography and Bioautography



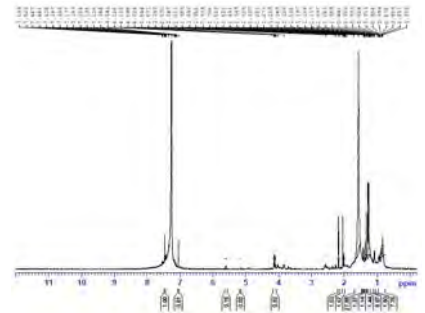
TLC profile and bioactive fraction of isolate 196

TLC profile and bioactive fractions of isolate 51

Mass Spectrometry of bioactive fraction of isolate 196



NMR Spectroscopy of bioactive fraction of isolate



1. Objectives (150 words):

- a) Isolation of bacteria from different ecological habitats and their storage
- i) Collected soil samples.
- ii) Prepared serial dilutions.
- iii) Plated on media.
- iv) Purified and stored isolates.

b) Antimicrobial analyses of isolates

Primary Screening

- i) Cut out agar plugs from culture plates and placed on sensitive strain seeded plates.
- ii) Inhibition zones around plugs indicated antimicrobial compound production.

Secondary screening

A Extraction of antimicrobial compounds

- i) Added solvent to culture agar pieces.
- ii) Kept on shaker.
- iii) Separated organic phase.
- iv) Evaporated organic solvent and obtained extract powder.

B Agar well method

- i) Bored wells in sensitive strain seeded plates and loaded with different extract concentrations.
- ii) Measured inhibition zone diameters and compared with control antibiotics.

c) Extraction and identification of bioactive fraction by Thin Layer Chromatography and UV-Vis Spectrophotometry.

- i) Separated extract fractions by TLC.
- ii) Identified bioactive fractions by bioautography.
- iii) Characterized compounds by spectroscopic methods.

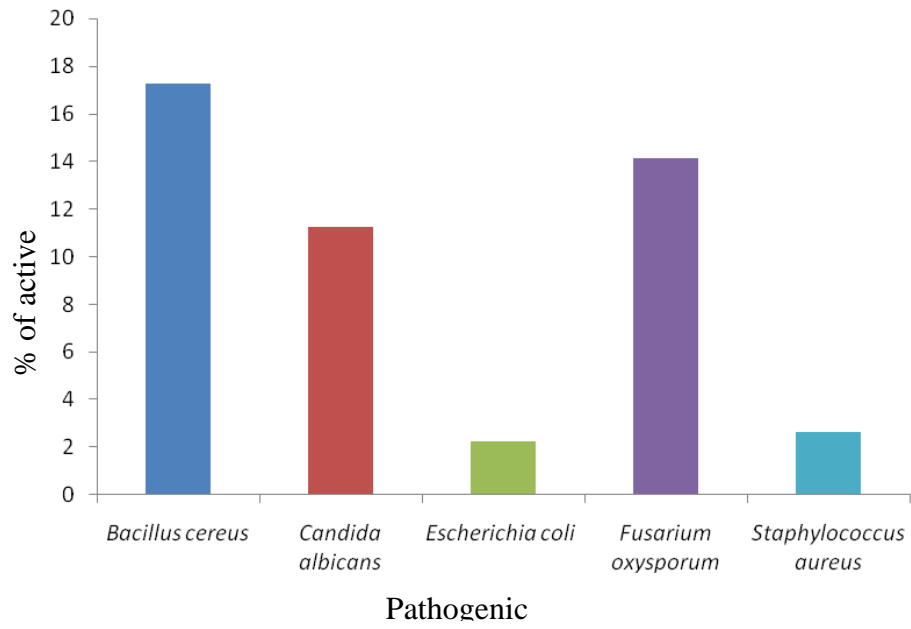
2. Final Findings (300 words for text only):

Bacterial colonies were isolated from soil samples collected from diverse ecological habitats including agricultural, industrial, landfill sites, river/lake sediments, diversity park, sea/beach sediments and forest sites. Amongst these, agricultural samples from Dhanaura (U.P) gave the largest yield of actinomycete colonies. Among various media tested for bacterial isolation, arginine glycerol medium gave the maximum yield of actinomycetes. Isolates were tested for antimicrobial activity against five pathogens. Maximum number of isolates showed activity against *Bacillus cereus* (17.28%) followed by *Fusarium oxysporum* (14.11%), *Candida albicans* (11.26%), *Staphylococcus aureus* (2.65%) and *Escherichia coli* (2.24%) (Graph 1). Some isolates were active against more than one pathogen.

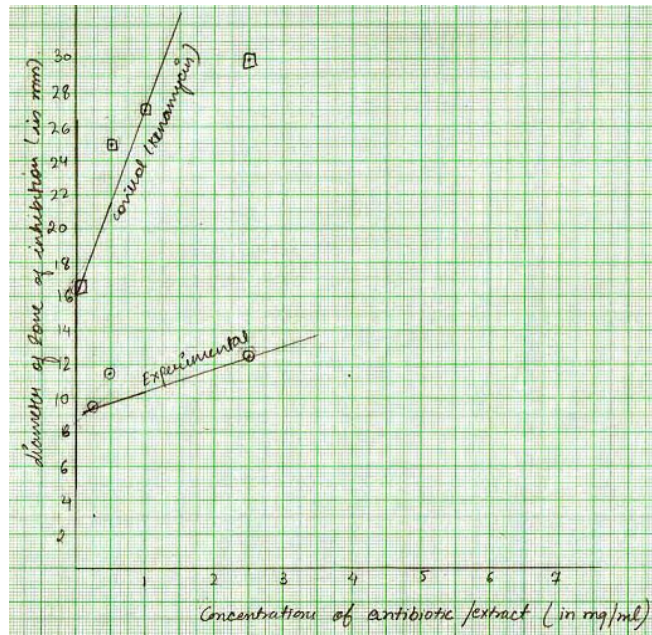
Isolates 196, 51 and 173 were shortlisted for further analyses on basis of their high activity during primary screening (Table 1). Bioactive compounds were extracted from media plates using solvents of variable polarity. Activity of extracts was quantified by agar well method and compared with that of control antibiotics (Graphs 2, 3, 4).

Isolates selected for secondary screening	Activity against pathogen
196	<i>Bacillus cereus</i>
212	<i>Staphylococcus aureus</i>
51	<i>Candida albicans, Bacillus cereus, Fusarium oxysporum</i>
22	<i>Escherichia coli</i>
173	<i>Fusarium oxysporum</i>

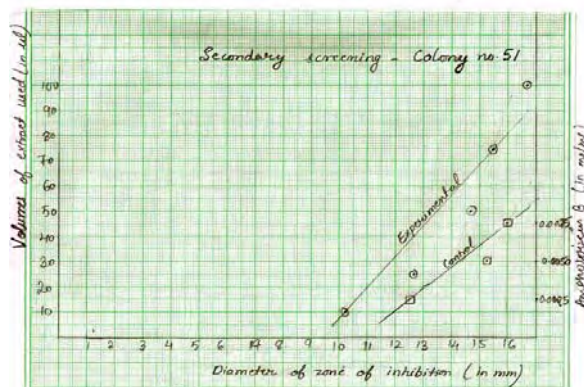
Table 1: Potent strains selected for secondary screening



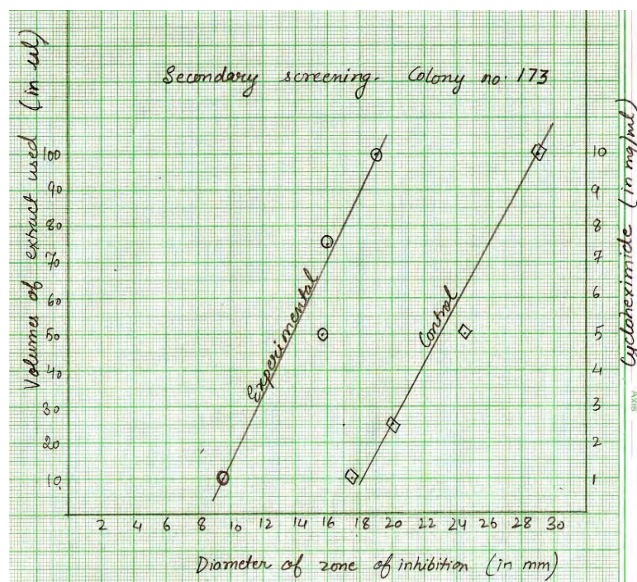
Graph 1: % of isolates active against different pathogens



Graph 2: Comparative activity of ethyl acetate extract of isolate no. 196 and kanamycin against *Bacillus cereus*



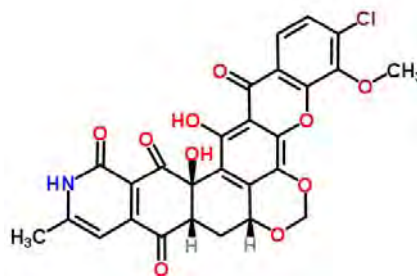
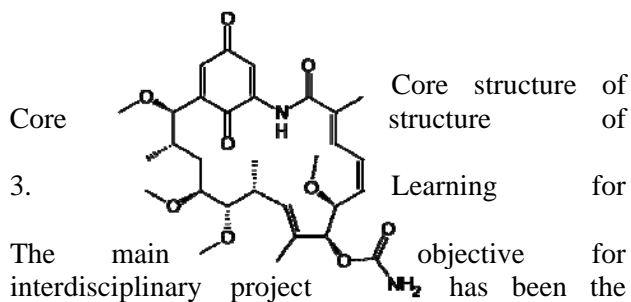
Graph 3: Comparative activity of methanolic



Graph 4: Comparative activity of methanolic extract of isolate no. 173 and cycloheximide against

Actual bioactive fractions were determined by bioautography. Ethyl acetate extracts of isolates 196 (R_f : 0.48) and 173 (R_f : 0.90), showed a single bioactive fraction active against *Bacillus cereus* and *Fusarium oxysporum*, respectively. Single bioactive fraction from 51 methanolic extract (R_f : 0.62) showed activity against both *Candida albicans* and *Fusarium oxysporum* indicating its broad spectrum antimicrobial activities. Two bioactive fractions were present in 51 ethyl acetate extract (R_f : 0.90, 0.51) active against *Bacillus cereus*. Bioactive compounds were purified by TLC and subjected to structure elucidation using mass spectrometry and nuclear magnetic resonance.

Ethyl acetate extracts from isolates 196 and 51 active against *Bacillus cereus* possessed similar ESI-MS and NMR spectra, indicating similar compounds and showed structural similarity to Herbimycin, a benzoquinone ansamycin compound. On the other hand methanolic extract of isolate 51 active against *Candida albicans* and *Fusarium oxysporum* showed structure similarity to Xantholipin, a xanthone group antibiotic.



Herbimycin
Xantholipin

Students (200 words):

pursuing this use of Microbiology,

Ecology and Chemistry techniques in an integrated manner to achieve goals of project. Ten students involved in this project from Zoology and Chemistry departments. Students had gone out in the field in groups to collect samples, learnt the ability to plan and execute experiments, to correlate information given in literature to the techniques adopted in the project work. The students have become proficient in preparation of culture media, isolation of bacteria from soil samples, purification and preservation of colonies, screening of isolates for antimicrobial activities, extraction of bioactive compounds and their quantification during secondary screening, thin layer chromatography, bioautography, mass spectrometry and NMR spectroscopy.

This project was a good opportunity for undergraduate students to have an exposure of research and to participate in the following conferences.

i) Mega multidimensional event of Delhi University, Antardhwani, February 22-24, 2013.

ii) National Conference on "Redefining Science teaching: Future of education" held at South Campus, Delhi University, March 7-9, 2013. Presented paper entitled "Screening of soil actinomycetes for antimicrobial compounds" and won a cash prize of Rs. 1,000/-.

Each student received financial assistance in the form of monthly stipend of Rs. 1,000/-during the entire duration of the project.

4. Benefits to College (100 words):

- i) Student participants applied interdisciplinary techniques for achieving goals of the project. They learnt the ability to plan and execute experiments, to correlate information given in literature to the techniques adopted in the project work.
- ii) This project was a good opportunity for undergraduate students to have an exposure of research at an early stage of their career as they actively participated and presented their work in various academic conferences.
- iii) Project data is in the process of being converted into research papers for publication in peer reviewed journals.
- iv) There has been an improvement in college infrastructure on the basis of funds of innovation project.

5. Benefits to Society (100 words):

The project has led to selection of a group of bacteria with appreciable antimicrobial potential. These can be tapped by high throughput industrial screening for identification of their antibacterial, antifungal, anticancer and antitumor properties. Patents can be filed for those commercially important microbes that would be taken over and developed by the industry. Some commercial antimicrobial compounds may be isolated and characterized on the basis of this study. The work will also provide a novel gene pool that can be further improved by genetic engineering to enhance its desirable traits.

Students working in this project were benefited academically as well as financially.

6. Further Plans (100 words):

Chemical analyses of antimicrobial compounds will lead to discovery of novel compounds or analogues of existing ones. Antibiotic producing strains can further be subjected to strain improvement and combinatorial biosynthesis for production of more effective analogues or hybrid bioactive molecules. Biosynthetic gene clusters i.e. Non-ribosomal peptide synthetases (NRPS) and Polyketide synthetases (PKS) responsible for production of antimicrobial compounds in strains will be identified. Phylogenetic studies can be performed on the basis of NRPS and PKS gene sequences to determine relatedness of strains. Strains having potential for synthesis of novel compounds can be taxonomically characterized by genotypic, phenotypic and chemotypic studies.

ACHARYA NARENDRA DEV COLLEGE

Project Title: Recording and analysis of locomotory behavior among birds

Project Code: ANDC 106



Team members at Bio-diversity Park, Delhi

1. Objective (150 words):

Birds are feathered, winged, bipedal, endothermic, egg-laying, vertebrate animals. Bird species not only look unique, they also have unique ways of acting, moving, sitting, and flying. The most basic aspect of its behavior is posture, or how a bird presents itself. The present study was conducted with the following objectives:

- I. To visit in and around Delhi NCR in different seasons to observe and identify the birds, and thus recognize the diversity of the avian population.
- II. To video record the visible motor actions and also utilize similar videos available on the internet (Youtube).
- III. To specifically profile the visible motor actions of birds and analyze the behavioral complexities to throw light on the cognitive gap between the stimulus and response.
- IV. Group the birds within the taxa on the basis of the range of motor actions.
- V. Upload the videos of motor actions on CUBE, a website from Homi Bhabha Centre for Science Education, TIFR Mumbai.
- VI. To establish possible correlations between the motor actions of a species with their cognitive behavior on the one hand and the anatomical aspects of central nervous system on the other.
- VII. Comparison of motor profiles of closely related bird species using the recorded data in order to establish their taxonomic relations on the basis of motor action flexibility.

2. Final Findings (300 words):

In all about 150 birds were identified and their motor actions were recorded. Apart from this some recordings were downloaded from the Youtube website.

The recordings were then grouped on the basis of taxonomic classification. The motor actions were defined as hopping, walking, preening, climbing, walking sideways and backward etc. The taxonomic groups were then further categorized on the basis of the range of motor actions. The observations are being attached as a spreadsheet in ANNEXURE – I.

For preliminary analysis of the recorded data, families of birds under four orders: Columbiformes, Ciconiformes, Pelicaniformes and Passeriformes were chosen (Annexure 1). Simple visible motor actions and behaviors frequently displayed by birds were taken into consideration. Motor actions displayed together (a set of different motor actions happening together under natural condition in an individual bird) in a given bird were termed as engaged motor actions. Following is the Summary of the findings made so far:

1. Apart from flying, walking (alternate lifting and advancing of legs in the direction of motion) is the most common locomotory action among birds of above mentioned four orders.
2. Doves and Pigeons (Columbidae) showed an engagement between two motor actions i.e. thrusting their head (head bobbling) in the forward direction while walking in the same direction.
3. While most of the birds could walk in the forward direction, only few birds were commonly observed (crows, pigeons, house sparrow etc. see annexure 1) walking sideways and in backward directions indicating more freedom of motor action and planning and execution of appropriate type of motor activity for a given type of stimulus.
4. Only birds belonging to the order Passeriformes could be observed to hop.
5. Members belonging to same family and also closely related ones (eg. Columbidae) showed differences in the overall motor action profile.
6. Birds belonging to the order Ciconiformes (water birds: egrets and storks) were mostly found less active and showed few types of motor actions as compared to those birds which spend most of their life on trees and ground (mynas, sparrows, crows etc).
7. For egrets and storks walking was found to be the most common method of locomotion other than flying.
8. Families Columbidae, Sturnidae, Corvidae showed more diverse types of motor activities.
9. Jungle babblers (Timaliidae) were mostly observed using hopping method for their locomotion.

3. Learning for Students (200 words):

The opportunity to do a scientific project has contributed richly to the students. The students have learnt:

- a. Scientific approach to problems based on hypothesis.
- b. Learning to survey literature with respect to the given problem.
- c. Trained the students to think and analyze observations logically and independently.
- d. Handling photographic and videography equipments.
- e. Recording videos of living organisms without disturbing the organism and without getting noticed.
- f. Editing and improving pictures and videos to improve the quality.
- g. Observing birds and identifying them in the field using standard field guides.
- h. Classification of birds and bird movement.
- i. The distribution of motor actions among birds is varied and very specific with respect to the kind of habitats that the bird occupies.
- j. Observation and analysis of recorded videos and drawing scientific inferences from them.
- k. Sharing and uploading the scientific data on CUBE for discussion with larger scientific community.
- l. Learnt to present their data in the form of posters and power point presentation in front of scientific community.
- m. Discuss the various aspects of their work with experts and looking at the problem from different viewpoints.
- n. Ability to appreciate nature and its biodiversity.
- o. Students have learnt to correlate the specificity of birds to particular habitats.
- p. The observations and analysis of motor actions have shown that every bird is equipped with specific behavioral pattern which gives it an edge for survival in its habitat conditions

4. Benefits to College (100 words):

The college has, through these innovation projects, been able to inculcate a scientific temperament in the students. It has provided an opportunity to motivate the undergraduate students to take up scientific research as a carrier. The present project has shown that simple day to day observations can be used to draw meaningful scientific conclusions. More and more students of the College are now inspired to do such scientific studies. The project has also enabled the College to acquire a few equipments which will enable the students in future to do such scientific studies.

5. Benefits to Society (100 words):

The present study highlights:

- a. Scientific research and meaningful conclusions can be drawn from simple field observations.

- b. The study of organisms in their natural habitats reiterates the importance of both the organism and its habitat.
- c. Such behavioral studies may help in planning and execution of conservation work of animals
Thus these studies are important to create awareness and scientific temperament in the society. It helps to bring about a sense of appreciation of nature and organisms in all its myriad forms.

6. Further Plans (100 words):

The students involved in the project are in the process of preparing a paper from the data collected and the same will be communicated in a peer reviewed journal, very shortly.

Similar studies will be conducted on other organisms with the help of existing equipment to understand the biology of behavior.

ADITI MAHAVIDYALAYA

Project Title : Bridging the gap from Corporate to Common : Building an umbilical cord relationship

Project Code : AM-101



Final Seminar Held on 16th April, 2013

1. Objective (150 words) :

Bridging the gap – from Corporate to Common

Building an umbilical cord relationship

Disseminating management/tax/communication skills through audio visual aids to employees/students in govt. Setups in and around the college.

The aim is to spread awareness in and around the college on sensitive issues like gender discrimination, stress management, communication skills, investment management and e-learning. The prime objective is to use the college, which is the only institute of higher learning in the areas as the nodal point for disseminating knowledge in the above areas. The target group that is intended to gain from the above initiative are since most of these are government setups in a rural area exposure to such areas is minimal and much needed. Hence the topic Bridging the gap – from corporate to common.

2. Final Findings (300 words) :

Having spent a year researching the given topic, analysing the findings of the research has not only been interesting but also startling. Though a lot of gender bias was expected in the rural belt yet some of the observations and findings were unexpected. Stress, specially hidden stress amongst SOS mothers was an eye-opener for the target group itself. The greatest benefits seemed to be reaped in. The area of e-learning which has been a big no-no in this area. The practical training sessions in the college Computer Lab. helped to overcome the hesitation to large extent. The students of the college gave the most overwhelming response to the communication skills workshops. The sessions on investment management came across as a welcome break for the employees in government setups as well as college students. The statistical analysis can be summed up as under :

1. 67.3% respondents faced discrimination at workplace, 67.1% have been ridiculed by opposite sex and 62.4% feel women at higher position can't take decisions – thus highlighting significance of gender sensitization workshops.

2. 65.3% students feels lonely sometimes and 25.7% students feel depressed very often. 71.9% professionals face stress usually in organizations and 71.2% feel they are able to handle stress only to a limited extent.
3. 61.5% access internet daily but only 7.5% knew about common keyboard shortcuts and only 52.7% knew about customization of settings, thus showing importance of workshop.
4. 92% feel contents of communication workshops were relevant and 32.4% feel overall content-worth worth of workshop was 'Excellent'.
5. 86.9% have not attended any workshop on e-filing before, 75.7% don't know about Demat account and now, 92.6% feel they would be able to describe what e-filing is.

3. Learning for Students (200 words) :

The 9 students interns who worked tirelessly round the year reaped the greatest advantage from this project. This group of Commerce students were exposed to research areas that would otherwise never enter the domain of commerce. They enhanced their knowledge in diverse areas like Gender Sensitization, Stress Management, Communication Skills, etc. Not only this, at an undergraduate level, they got to understand the nuances of a detailed Research Project. All the planning, preparation and presentation that was a pre-requisite of the smooth functioning of this project became a cake walk for them towards the end. Interactions with eminent resource persons helped to groom their personalities. The preparation of questionnaires and feedback forms was a novice task for them is also a learning experience which they did with a lot of enthusiasm. The spirit of team dynamics was also engrained in their working and the importance of meeting deadlines. The compilation of data, statistically analysing it and reporting the findings were among the other things that they learnt. Stock taking of all material/equipments purchased was also done by these young researchers. Over all, an exposure of Research of this magnitude has been an enriching experience and a wonderful grooming journey for undergraduate students.

4. Benefits to College (100 words):

The college benefitted immensely from the project as the students were the greatest beneficiaries on the yearlong series of workshops and lectures conducted on diverse topics. They were exposed to the expert views of eminent resource person with expertise in specific areas. The day long event entitled "Being Innovative" held on 12th February, 2013 offered a platform to these young minds to showcase their talents in a variety of competitions. Over 350 students participated in T-shirts painting, Investment Quiz, PPT Competition, Poster Making, Article Writing, Notice Board Decoration, etc. on topics like Stress Management, Gender Sensitization, Investment Management, Communication Skills and e-learning. Besides, the college also gained from the visits by eminent speakers all the year through.

5. Benefits of Society (100 works) :

The achievement of the project can be gauged from the fact that over 50 workshops were conducted over the year for diverse target groups. The nearby govt. schools which otherwise have little exposure to such events were the greatest beneficiaries. The employees of DSIIDC gained immensely from their hands on experience of working computers probably for the first time. However, the biggest benefit went to Delhi Police Personnals from 14 police stations participated in the gender sensitization and communication enhancement workshops that were organized at Bawana and DC Office Ashok Vihar Training Centre. The SOS Village family also expressed their heartfelt thanks for the stress management workshops for the mothers and lecture series for the children of SOS. The students of the college too benefitted from these sessions.

The team has identified the great need of educating the boys of govt. schools and gender discrimination prevalent in rural society. Practical sessions on e-filing of returns by the Commerce Dept. are also planned.

6. Further Plans (100 words) :

The team intends to carry this work forward with funding from other sources like UGC. The newer dimensions that can enrich this work have already been planned. The team aims to be associated with WDC to organize similar trainings for different target groups. Another area, where there is a lot of scope in the rural setup like Bawana is to use the college as a nodal point for disseminating e-learning. The team is also looking at targeting the stress issues at work place and also the growing levels of stress amongst students.

ADITI COLLEGE

Project Title: Locating women in the context of partition: An account of lived experiences and unheard voices

Project Code: AM102



Voicing the unheard

1. Objective (150 words):

- (i) To understand the prevalent familial and gender relations in the context of pre/ during and post partition: It is an attempt to understand the family dynamics, family structure and patterns, family relations and socialization patterns.
- (ii) To collect lived experiences of partition and present life sketches of women: The sociological experiences of the women who were active and passive victims have their own individual memories. Their experiences of a social event may throw a very different light altogether. This study is also an attempt to see their present life situations.
- (iii) To study the socio-cultural and emotional issues of women who lived/ experienced partition: This study is an attempt to understand and analyze the socio-cultural and emotional difficulties and issues faced/experienced by the women of different castes, classes, religions, communities and countries.
- (iv) To locate women in totality in the context of partition: Totality means the varied experiences of women folk. It is an attempt to understand women across cultures and their social, cultural, emotional and physical experiences.

2. Final Findings (300 words):

Those were tragic times when self and saving one's own life became more important than saving their own children. Women were the 'missing' women, they are the 'missing women' now, what has changed? They had no say in what men did then and they have no say now. The onus of the family honor is/ was on girls/ women. Their life was burdened under patriarchal notions. They lived a life of hardships and suffered, which would have been very difficult considering that they originally came from rich families. They were confined to their homes and did not have any freedom of mobility. The two communities lived in harmony before the partition. It was after the partition that the riots started and there was a lot of violence and bloodshed. As one of the survivors said "*Kaumaan kharab nahin hundiyaan, kharaab te loki hunde ne.*" ("Communities are not bad, people are bad"). Those belonging to affluent families were in a position to send their women folk and their valuables to India, even by air. Those, who did not have the means, suffered the most.

Violence was meted out to women at the time of partition and later on during rehabilitation and resettlement. This skewed sample relates partition with the violence at various levels such as (a) individual: where they were expected and forced to be silent (mentally, emotionally and physically) (b) familial: where women were told to commit suicide or were killed to maintain the honor of the family, they were shifted to safer places much earlier (c) class: lower class women had a journey full of pain, trauma, suffering, brutality, and discrimination (d) communal: being a member of the other/rival community they were tortured, molested, raped, mutilated, abducted and were even forced to change their religion at times, to marry their rapists (Christian women were safe from these suffering because it is said that riots took place between Hindus and Muslims) (e) national: they were forcibly recovered and were told to abandon their children, forced to marry again with the native man. Brutality of men towards women at the time of partition was

a mob reaction and most of them didn't even know the reason for such behavior. We can conclude here that women experienced partition in a different way which is full of pain, trauma and sufferings.

3. Learning for Students (200 words):

It was a challenge to engage the students to understand the context and the situation of women prevalent during/pre/post partition. Rigorous training and extensive reading provided them to clarify their prejudices and myths related to partition. The evidence based exploration helped them to differentiate between myths and facts. Students were able to develop their perspective in an interdisciplinary manner.

Various skills like reading, writing, communication (interaction, questioning, probing and interviewing), rapport building, observation, data handling, analyzing, self reflection, participation, socio-personal experience sharing presentation, administrative, organization and managerial were learnt.

The students learnt gadget handling through videography, photography, voice recording, data operation and data transferring.

The students developed the sensitivity towards the elderly women and their issues. Their interaction with the survivors equipped them to handle the emotions in difficult situations.

They learnt to explore their own lives, their families and the people related to them. They developed more sensitivity towards women related issues.

The inquisitiveness prompted them to explore the holistic aspect of the historical context and its connectivity with the generations.

They learnt to differentiate between primary and secondary data.

They learnt to value diversity in social structure while working with diverse communities. They also learnt to value individuality and confidentiality.

Field visits, exhibition and participation in various forums (workshops, seminars, press conference, and DU fest) helped them to gain confidence.

Reference reading, research reviews, Data collection and analysis enhanced their critical thinking.

4. Benefits to College (100 words):

Research team represented the college at various forums within Delhi and other states of India. The research work was published in various news papers. The study brought recognition to the college nationally and internationally. College has benefitted through networking with other institutes, agencies and Individuals which will work as resource pools for the future endeavours. This ethnographic qualitative research study will be a reference material for students and the faculties. The documentary "Adhkhule Panne" (collection of oral testimonies of survivors) made during the project is an asset of the college. All the gadgets (laptop, cameras, voice recorders etc.), books and reference materials are the updated resources in the college can be utilized and referred.

5. Benefits to Society (100 words):

This project has given voice to silence. Numbers of survivors were unheard within the family before the commencement of the project. This project worked as "catharsis" for the respondents. The family members extended appreciation and thanks to the research team as they revealed that their family ties have become stronger through this intervention.

An innovative research piece had been produced for general and academic reading. It is an additional work for women studies which has provided a perspective to see the women in totality and as complete being. A song has been written and composed by Shri Madhav Pandey 'Nirmal' citing women's struggle.

A team of ten young researchers have been trained to work with sensitivity in the area of conflict issues.

Voicing the unheard has signified the worth of survivors' experiences in the present context.

The report, documentary film, recorded narratives and pictures can be a part of archives. Recommendations and suggestions provided in this study could be considered for future studies and research work.

6. Further Plans (100 words):

Team is planning to have a formal release of the documentary film "Adhkhule Panne" along with a panel discussion.

Research articles and book will be published.

The research presentation will be done in academic forums.

Compilation of narratives will be done.

Due to paucity of time the women survivors (active or passive) within the country and outside i.e. Britain, Australia, Ireland, New Zealand, Pakistan and Bangladesh were not interviewed. The team will further like to extend the work if opportunities and resources are provided

ATMA RAM SANATAN DHARMA COLLEGE

Project Title: Study the factors responsible for food adulteration, detection of adulteration and biological effect of adulterant on the health of consumer.

Project Code: ARSD-101



1. Objective:

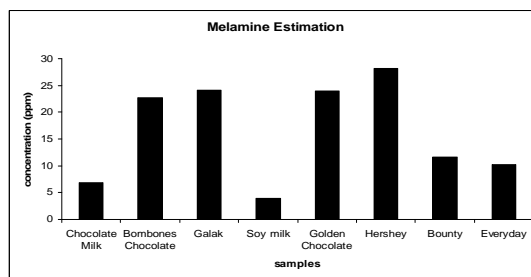
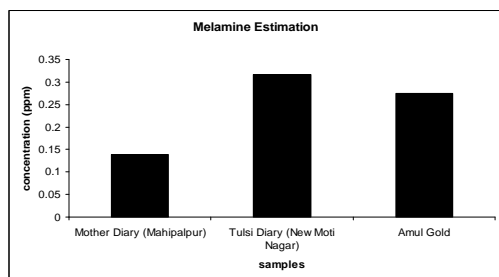
- Sampling of food items like spices, pulses, dairy products, oil and beverages from manufacturers, whole sellers, retailers and grey market to ascertain the point of adulteration which can occur during harvesting, storage, processing, transportation or distribution.
- Identification of factors (intentional or unintentional) which lead to adulteration.
- Check the adulteration of various food items using available methods and develop new methods which are easier and cost-effective.
- Ascertain the biological effects of the adulterants on the health of the consumer.

2. Final Findings :

Results of our survey through a questionnaire pointed to the fact that common people are not much aware of the food adulteration in their daily meal. On the basis of their feedback we found that people do face adulteration but are unable to recognize the adulterant. They do not have a tool or a technique by which they can detect adulteration and protect themselves from the ill effects which may not be directly observed by them. Thus keeping in mind this necessity we have developed a 'Kitchen Kit' with the help of household materials and chemicals (like nail paint remover, petrol, lemon juice, washing soda etc.) so that people can detect some adulterants easily at home without the help of any professional laboratory. Using this easily assembled kit they can save themselves from the adulterated material. Details of the kit have been given in the half yearly report.

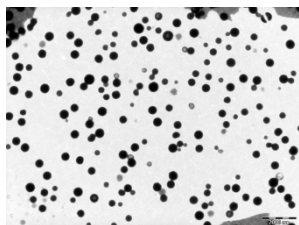
To ascertain the reasons of adulteration, regions of intense adulteration in Delhi and NCR region, samples of spices and pulses, milk and dairy products, oil and beverages, sweet and confectionaries were collected from various zones of Delhi and NCR. Local as well as branded ones were subjected to testing with this Kitchen Kit. The results are incorporated in the previous report. Adulteration in green vegetables was found generally to be a dye called Malachite Green which is applied for improving the colour and texture of vegetables like spinach, peas, parmal, ladyfinger etc. Exact verification was done with a paper chromatography technique. It was detected only in 2 out of 100 samples tested.

An emerging adulterant called Melamine was also tested in milk and packed foods like milk powders, chocolates, protein diets etc using an advanced technique of ELISA. Some of the important results are presented on the graph.



Liquid milk samples (branded or unbranded) were found contaminated with a very small quantity of Melamine to the order of 0.3 mg/L or less even on repeated testing. Such a small quantity of melamine can creep into the samples from the packaging materials and need not come from intentional adulteration. However the imported samples of some chocolate milk, soy milk, nutrition bars and chocolates were found to contain a comparatively higher level of melamine to the order of 25 mg/kg of sample. This could be due to seepage from the packaging material or intentional addition of this substance to raise the apparent protein content of the food material. Such contaminations could be harmful and have been reported recently in other countries. But the findings have to be correlated with some other testing methods like HPLC or mass spectroscopy before we make any claims on the quality of the tested food materials and this can be a part of our future endeavors.

Presence of melamine can also be visibly detected by Gold nano-particles. As gold is an expensive metal we envisaged the use of Copper nano-particles for such detection. For this purpose Copper nano-particles were prepared in the laboratory at a very high yield of 60% and were characterized by Spectroscopy and Transmission Electron Microscopy. The results are as follows.



TEM micrograph for the for the nano- sized copper (II) nitrate using CTAB as surfactant

Figure reveals that nanoparticles were indeed synthesized, are spherical in shape and their size as determined by Dynamic Light Scattering is in the range of 200-210 nm. Such particles can then be used for the visible detection of melamine and is part of our future plans.

3. Learning for Students :

Students learnt the process of sampling and presentation of the resulting data when they collected the locally made and branded food items from various zones of Delhi and NCR. They learnt to prepare a questionnaire for survey and to extract meaningful information from that myriad data. They understood the importance of a literature survey before the start and in the process of a meaningful research; as a result they came across some established tests for detecting the adulterants and physico-chemical properties of adulterants and the food items.

Due to this exercise they were able to shortlist a number of physical and chemical tests for detecting adulterants and also improvise/modify them to be performed at home using household chemicals. The tests were then actually performed at home by students to understand and solve the problems which would be faced by anyone using such a Kit at home.

Students learnt an advanced technique called ELISA (Enzyme Linked Immuno Sorbent Assay) for the detection of an adulterant called Melamine in food items. They learnt to prepare an ELISA plate using the concerned kit and operate the ELISA reader. They also learnt to synthesize nano-particles using some easily available chemicals like CTAB, butanol and iso-octane in the college laboratory. This knowledge would be helpful in their future endeavors in

academia or industry and for this work we would like to acknowledge Dr. Subhash Mohapatra Ph.D, PDF one of faculty member of ARSD College.

Students visited two Central Food Technological Research Institute (CFTRI) one in Indirapuram (Uttar Pradesh) and other in Mysore (Karnataka). In Mysore CFTRI they have participated in a 3-day training program in 'Food Adulteration and its Detection Techniques' under the able guidance of its head Dr. Alok K. Srivastava. They learnt various food safety and standards act requirements and detect adulteration in sweets, food grains, spices, fats, oils, (pesticide and heavy metal contamination) in packaged drinking water by the well-trained staff of the institute. They also learnt about microbiological contamination in food, genetically modified foods and emerging techniques for their detection.

In the process they were able to understand the functioning of various analytical instruments like Atomic absorption spectrophotometer, High performance liquid chromatography, Gas chromatography and Nuclear magnetic resonance in the detection of various adulterants in food items. The students were provided with the participation certificates and applauded for their curiosity and existing knowledge of the food adulteration.

4. Benefits to College :

A one day workshop was organized in the college to spread awareness on adulteration. It was attended by students, teaching faculty and members of non teaching staff. All the participants showed high interest and willingness to know the technique and methods of detection of adulteration using 'Kitchen Kit'. This kit uses household chemicals like toilet cleaner as hydrochloric acid, lemon as citric acid, vinegar as acetic acid, nail paint remover as acetone etc. The tests were demonstrated to the participants and their queries were addressed. Pamphlets enlisting these tests in a concise format were distributed to the audience so that they can introduce them to their kin and try them at home. ELISA reader bought for the detection of Melamine can be used in the practical of undergraduate courses for various colorimetric and spectroscopic studies further research work. One of the good quality centrifuge machine is also bought for the college which can also be used for academic and research purposes in future.

5. Benefits to Society :

Our questionnaire was circulated among the housewives in various localities to develop awareness about various edible and consumable adulterants. We have also demonstrated the various tests at the Innovation Plaza in 'Antardhwani 2013' to a large number of people from various factions of society. This helped us in achieving our objective of spreading awareness about food adulteration. Our Demonstration was also telecast by DELHI AAJ TAK in their news bulletin. We were able to equip the common man with a tool or a technique in the form of demonstrations and pamphlets of 'Kitchen Kit' by which they can detect adulterations at home and protect themselves from their ill effects. This would ensure them a safer and healthier food. We have uploaded a video in YOUTUBE which shows the usage of this 'Kitchen Kit' so that people can easily access and get alerted about various adulterations and their easy detections.

6. Further Plans :

To spread the 'Kitchen-Kit' among the society at grass root level our main target is to educate the students at school level. If we do educate one student then he/she shall educate his/her family about the adulteration. By these type of demonstrations in schools we will be able to cover a major segment of society. But due to time shortage and summer vacations in the schools we were unable to give demonstrations at school level. If we get chance in future we will spread awareness among the society.

Further we want to make the masses aware of an emerging adulterant called Melamine, so that they do not become victim of its hazardous effects. The method employed by our team in the concluded project namely ELISA is costly, we plan to develop a simpler and economical method for its testing so that one day it becomes a part of our 'Kitchen Kit'. We plan to develop some nanoparticles which can also detect Melamine effectively. We like to extend our awareness campaign and testing to other new adulterants like Acrylamide, Diethylene Glycol, Nitrosamine etc to save the society from their harmful effects.

BHASKARACHARYA COLLEGE OF APPLIED SCIENCES

Project Title: Study of Rise in Consumption of the Mobile phones/Electronic Gadgets in Delhi region and Material Analysis projecting potential Electronic Waste and their impact on Environment
Project Code: BCAS-101



Fastest growing contributor to municipal waste globally. E- WASTE

1. Objective (150 words):

India as a fast growing telecom market has the second largest number of telecom subscribers in the world. India's 630 million telecom subscribers indicate a strong economic growth which has fueled the consumption and buying of new electronic products. This has resulted into accumulation of electronic waste (E-waste) at an incredible rate. The E-waste generation estimated from mobiles in our country is 1,700 tonnes. The objective of this project has three major parts

- a) Field survey of consumption of mobile phones
- b) Material analysis of metals being used in various electronic gadgets
- c) Environmental aspects of E-waste disposal.

a) Field survey to collect data based on sample statistics of non-probability; convenience samples using random sampling was adopted to study various patterns like

i. Awareness of Environmental hazards due to e-waste in various age groups

ii. Usage of mobile phone in various age groups among men and women

ii. Frequency of change in cell phones in various age groups

iii. Attitude towards recycling of unused electronic products.

iv. Cost of the mobile phone being used by the subject.

v. Branded or local make mobile phones being used.

vi. Mobile use based on Gender/age group.

vii. Awareness among the subjects regarding health/medical side effects over prolonged use of mobiles.

viii. Awareness of Electronic waste generation and its impact on environment because of its recycling in organized/unorganized sector.

b) Material analysis of metals being used in various electronic gadgets will aim at identifying

some of the recoverable metals so as to project an estimate of reusable metals in quality/local products. The selected metals in this study are Pb, As, Cd, Cu, Zn and Al in quality/local products.

c) Identifying some of the various toxic /heavy metals present in e-waste dumping sites within Delhi of which are a major concern and threat to the environment and are inherently employed in almost all electronic consumables.

2. Final Findings (300 words):

a) As mobile phones are the fastest growing electronic consumables in our country, the project attempts to study the consumption pattern, mind set and awareness of the people about e-waste generated from mobile phones, from different sections of the society in Delhi region. A survey was conducted on nearly thousand respondents to collect data based on sample statistics of non-probability; convenience samples using random sampling. The subjects for the survey were chosen from the geographical boundaries of the Capital. The areas selected were those lying near corners or on diagonals of squares of 20 kilometer perimeter from Google maps. The selected areas were from North Delhi, South Delhi, East Delhi and West Delhi. A detailed entry of the data sheets, each having 25 questions was carried out. Preliminary analysis of these data was carried out using SPSS statistical analysis tool. Some of the findings from the survey are as follows:

Out of 994 respondents, 922 gave information on their Occupation as given below:

Table I

Occupation	Frequency	Percent %
Professional	359	38.9
Homemaker	157	17.0
Student	268	29.1
Business	138	15.0
Total	922	100.0

38.9% of the respondents who informed about their occupation were professionals, 29% students, 17% Homemaker and 15% from Business background.

Out of 994; 987 respondents informed about their gender. 71.83% were male respondents and 28.17% were female.

Out of 994; 972 respondents informed about their age as given below:

Table II

Age	Frequency	Percent %
Less than 18	20	2.1
Between 18 and 25	403	41.5
Between 26 and 35	245	25.2
Between 36 and 50	204	21.0
Above 50	100	10.3
Total	972	100

977 respondents out of 994 informed about their educational Background. Maximum number of respondents (37.56%) was graduates.

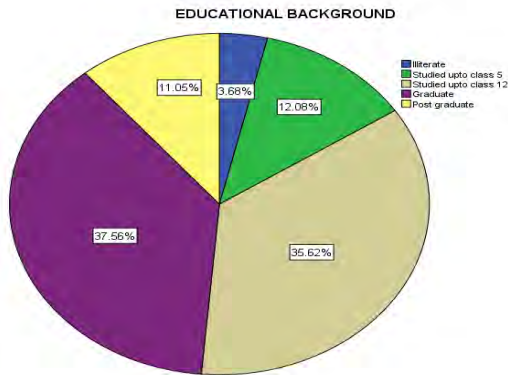


Table III: Awareness of Environmental Hazards of e-waste in various geographical boundaries of Delhi

Regions of Delhi	Percentage of aware	Percentage of Not aware/doubtful
South	16.74	83.26
North	25.34	74.66
East	23.08	76.92
West		

Table IV: Awareness of Environmental Hazards of e-waste on Gender Basis

Gender	Percentage of aware	Percentage of Not aware/doubtful
Male	69.46	30.54
Female	29.64	70.36

Table V: Awareness of Environmental hazards about to e-waste in various age groups

Age group	Percentage of aware	Percentage of Not aware/doubtful
Up to 25yrs	48.9	51.81
26 to 35yrs	18.78	81.22
36 to 50yrs	81.33	81.67
Above 50yrs		

Table VI: Usage of mobile phone by age of 18 among Men and women

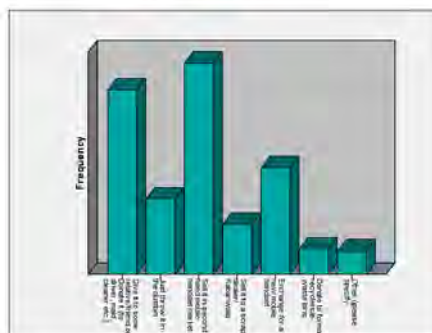
Gender	Usage of mobile by age of 18	Usage of mobile after age of 18
Male	38.50	61.50
Female	31.29	68.71

9. Comparison of respondents inclined towards giving away their cell phones for second hand use to others

Preferred way of disposal of old cell phones to give away to friends/helpers/drivers



Way of disposal of used mobile



Preference of the respondents towards disposing off their used mobile phones

b) This project also looks at the potential presence of some of the heavy metals in mobile phones of different makes and quality. Mobile phones of three types- named as L (local), Standard Brand 1 and Standard Brand 2 were taken as samples. These phones were dismantled and their PCB boards were separated from the rest of the cell phones as shown in Figure 1. These phones were weighed using an analytical balance. Metals to be studied were extracted using the standard extraction method called APHA (American Public Health Association), 1980.

The metals under study in the mobile samples labelled as L (local), Standard Brand 1 and Standard Brand 2 were Lead, Arsenic, Cadmium, Copper, Zinc and Aluminium. It was observed that the local sample gave out very less fumes in comparison to the branded samples 1 and 2 which gave out copious brown fumes on digestion with nitric acid. The clarity of solution prepared for these samples was in following order: Standard Brand 1 > Standard Brand 2 > L. The concentration of the above mentioned metals were studied using Inductively Coupled Plasma -Optical Emission Spectrometry (ICP-OES) of the following make:

Company : Perkin Elmer
 Model No. : Optima 8000

Detection Limit : 0.1ppb to 100ppm. The detection of metals was carried out at FICCI Research and Analysis Centre (FRAC).The percentage of various metals in the three samples is given below in Table IV.

Table VII: Metal concentration in the various mobile samples under study

Sample: Local

S.No.	Metals	Result (in ppm)	Percentage (approx.)
1.	Lead	2540	77
2.	Arsenic	Not Detected	0
3.	Cadmium	Not Detected	0
4.	Copper	37.12	1.9
5.	Zinc	1.23	0.8
6.	Aluminium	596	21.3

Sample: Brand 1

S.No.	Metals	Result (in ppm)	Percentage (approx.)
1.	Lead	272	42
2.	Arsenic	Not Detected	0
3.	Cadmium	Not Detected	0
4.	Copper	36.45	5.6
5.	Zinc	1.8	0.4
6.	Aluminium	330	52

Sample: Brand 2

S.No.	Metals	Result (in ppm)	Percentage (approx.)
1.	Lead	18.90	17.5
2.	Arsenic	Not Detected	0

3.	Cadmium	Not Detected	0
4.	Copper	68.06	5
5.	Zinc	12.82	3
6.	Aluminium	282.2	74.5

It has been stated that the presence of the elements detected in mobile phones in this paper; are present in electronic components as follows:

1. Lead , copper, Zinc, Aluminium (in bulk)
2. Cadmium (in small amounts)
3. Arsenic (in trace amount)

The results observed by the Project Team also found that the above elements were present in the same measure in our samples. However, the concentration of lead in the three samples can be compared as follows: Local> Brand 2> Brand 1. These observations are important keeping in mind that the presence of these metals even in small trace in the environment due to improper

disposal tends to bio-accumulate in the food chain through soil and their carcinogenic properties can be very harmful. c) Various toxic /heavy metals are inherently employed in almost all electronic consumables. Their present in e-waste dumping sites within Delhi is a major concern and threat to the environment. The soil samples were collected from various e-waste dumping locations. The metals under study in the soil samples were Lead, Arsenic, Cadmium, Copper, Zinc and Aluminium. The concentration of the above mentioned metals were studied using Inductively Coupled Plasma -Optical Emission Spectrometry (ICP-OES).

Table VIII: Metal concentration in the various soil samples under study

Sample: Nehru Place

S.No.	Metals (mg/kg)	Result
1.	Lead	23.8
2.	Arsenic	Not Detected
3.	Cadmium	Not Detected
4.	Copper	44.2
5.	Zinc	Not detected
6.	Aluminium	223.0

Sample: Mundka

S.No.	Metals(mg/kg)	Result
1.	Lead	9.0
2.	Arsenic	Not Detected
3.	Cadmium	Not Detected
4.	Copper	7.0
5.	Zinc	Not detected
6.	Aluminium	692.2

Sample: Naraina

Metals(mg/kg)	Result Sample			
	B	C	D	E
Lead	2.6	3.4	5.2	0.8
Arsenic	N.D	N.D	N.D	N.D
Cadmium	N.D	N.D	N.D	N.D
Copper	37.6	27.0	8.0	8.0
Zinc	N.D	N.D	N.D	N.D

Aluminium	173.0	856.0	942.4	723
-----------	-------	-------	-------	-----

N.D = Not Detected

3. Learning for Students (200 words):

Students were an integral part of the research project and contributed towards the following with dedication, sincerity and best of their aptitude and ability:

- a) The survey conducted across the length and breadth of Delhi to study the consumption pattern, mind set and awareness of the people about e-waste generated from mobile phones, from different sections of the society in Delhi region on nearly thousand respondents was a great learning experience for the students.
- b) The sample preparation for finding the presence of heavy metals in the PCB boards of mobile phones of three types- named as L (local), Standard Brand 1 and Standard Brand 2 using the standard extraction method called APHA (American Public Health Association), 1980 was carried out by the students.
- c) The soil samples from some of the e-waste dumping sites in Delhi i.e. Naraina, Nehru place, Mundka were collected by the students.
- d) Sample preparation for finding the presence of heavy metals in soil was carried out by the students.
- e) Feeding of data in Excel format and extracting it on SPSS software was carried out by the students.
- f) Students and Principal Investigators also visited a formal recycling unit Earth Sense Recycle Private Limited, Manesar and experienced the working of various equipments like Dust Extraction Setup, safe removal of harmful gases from AC and Refrigerators, Baling process, Degaussing machine etc.

4. Benefits to College (100 words):

1. College was benefitted with the equipment/glassware/Plastic ware purchase with the funding provided by the ongoing project. Equipment and Consumables worth Rs. 198319.75/- and laptop/projector worth Rs. 6500/ were purchased.

2. College also got recognition in the public media because of the one of a kind study carried out under this project. The study carried out under the project revealed some noteworthy survey findings reported in the newspapers given below:

- a) The project still under study has very interesting results showing the consumption pattern of mobile phones in Delhi and the awareness of the Delhi people about e-waste which have been reported in the press in Dainik Bhaskar on 14 March 2013.
- b) The project also triggered the organization of a National level Conference on the

diverse and complex problem of e-waste management. The Conference titled NATIONAL CONFERENCE ON E-WASTE SUSTAINABILITY: NEEDS AND SOLUTIONS FOR ITS MANAGEMENT was held on March 7 - 8, 2013 at Bhaskaracharya College of Applied Sciences located at Dwarka. The Conference was organized in joint collaboration with GIZ-IGEP (Indo-German Environment Partnership). The National Conference organized has been reported in the press in The Pioneer on 8 March 2013.

c) The Conference was also reported in Dainik Jagran on 9 March 2013. The clippings of the press reports and the brochure of the Conference with the mail/ report.

5. Benefits to Society (100 words):

Information technology has become a part of everyday life for people from a vast cross section of social structure. This has resulted in to electrical and electronic equipment becoming the fastest contributor to the municipal waste across the globe.

Mobiles have become an integral part of our life. However, given the toxicity of the components involved in its manufacturing, it is important to sensitize the society about how to reduce, reuse and recycle mobiles and other electronic components for prevention of environmental pollution as well as efficient utilization of resources.

Undertaking this project, helped us understand the consumption pattern of mobile phones among the different sections

of the society, material analysis of metals being used in the mobiles phones and also the environmental aspect of E-waste disposal. With more than 91% population in NCR region using mobiles, it is of utmost social importance to research and study the various aspects; social, environmental and scientific, of mobiles /electronic gadgets so as to understand its influence on our environment.

6. Further Plans (100 words)

Principal Investigators of the project are very keen on pursuing other chemical/ physiological/ consumption pattern of mobiles phones/e-waste. To study one of these various aspects, a project titled “Assessment of Brominated Flame Retardants in Mobile phones/Electronic Gadgets, their consumption Pattern in North India Region and Carbon Foot Prints from Electronic Waste” has been submitted to University of Delhi.

BHASKARACHARYA COLLEGE OF APPLIED SCIENCES

Project Title: Studies to assess the quality of fruits and vegetables with respect to microbial load and remedial measures for their control

Project Code: BCAS-102



When you know Better, you do Better.

Educational material design by BCAS-102 displayed at SAFAL Booth.

1. Objectives:

Fruits and vegetables are unique foods since they are often consumed raw or with minimal preparation. To date, there have been no effective interventions strategies developed which can completely eliminate food safety risks associated with consumption of uncooked produce. Therefore, preventing contamination with human pathogens, dangerous levels of chemical residues, or physical contaminants is the only way to assure these foods are wholesome and safe for human consumption.

The safety and quality of fresh produce requires implementation of a risk-based management system approach through all stages of production, distribution, storage, transportation and marketing of food products in the complete food chain. The entire chain is not under the control of only retailers but a range of stakeholders and therefore cannot be handled by retailers alone but needs a coordinated approach. Keeping in mind the gap areas, these were the objectives for our project.

1. To assess the prevalent food safety practices of the food handlers in the various retail outlets in Delhi.
2. To enumerate the microbial load on the selected fruits and vegetables samples from major retail outlets in West Delhi.
3. To isolate and identify the common micro-organisms present on their surface using microbiological, biochemical and PCR techniques.
4. To find remedial measures to reduce the surface microbial load which are simple and cost effective.

2. Findings of the Project:

I. FOOD SAFETY PRACTISES SURVEY

N=1000 Food Handlers

n= 100 Retail Outlets

The statistical findings of the survey revealed that the attitudes and practices of the food handlers need more attention on the implementation level. 92% of the outlets had a code of hygienic practices each but there was a lack of proper training about the food safety and hygiene among the workers. Only 57% of retail outlets were washing their fresh produce (fruits and vegetables) before selling and remaining even lacked wash water facilities. All the retail outlets (100%) were following grading and sorting and even FIFO but correct knowledge of storage temperatures for different perishable commodities was not known to workers at ground level in 62% of the outlets. It was strongly felt that foodservice employees in these retail outlets require basic yet informative training about the food safety aspects. Keeping this in mind, various training and educational materials were designed for creating awareness about food safety among food handlers and consumers under the "Food Safety Education Initiative (FSEI)-When you know better, you do better".

II. ENUMERATION OF THE MICROBIAL LOAD

Fruits and Vegetable Samples Tested	Range of Detected Microbial Load (c.f.u /gm)
Beans	$1.29 \times 10^3 - 2.6 \times 10^8$
Bottle Gourd	$1.55 \times 10^4 - 1.94 \times 10^{10}$
Carrot	$1.97 \times 10^6 - 3.46 \times 10^7$
Cauliflower	TLTC - 2.08×10^{12}
Cucumber	$1.31 \times 10^4 - 2.88 \times 10^{13}$
Ladyfinger	$1.18 \times 10^4 - 1.33 \times 10^4$
Papaya	$1.2 \times 10^7 - 1.8 \times 10^8$
Pear	TLTC - 2.95×10^{13}
Spinach	$1.19 \times 10^4 - 5.01 \times 10^{15}$
Tomato	TLTC- 1.09×10^6
Brinjal	TLTC - 1.41×10^4
Apple	TLTC- 6.68×10^3
	*TLTC= Too Less To Count

A total of sixty one samples (Apple, Pear, Papaya, Tomato, Bottle gourd, Cucumber, Brinjal, Ladyfinger, Carrot, Cauliflower, French beans and Spinach) were analyzed for their surface microbial load.

Majority of samples were found to be contaminated but the level of contamination was variable. Apples showed least level of contamination which may be attributed to the wax coating on their surface. Spinach showed the

highest level of contamination which may be due to its proximity to the ground. Even the food safety practices of the food handlers affected the microbial load; the outlets scoring high on the hygienic practices had a comparative low microbial load. The samples lifted in winter had a lower count than those in summer months.

III. IDENTIFICATION OF ISOLATED MICROBES

Microbiological, biochemical characteristics and PCR analysis formed the basis of the identification of the type of micro flora associated with the fruits and vegetable samples. Members of family Enterobacteriaceae such as *E.coli*, *Shigella*, *Salmonella* and others like *Pseudomonas*, *Bacillus* were identified.

IV. IDENTIFICATION OF MICRO-ORGANISMS PRESENT ON THE SURFACE OF FRUITS AND VEGETABLES BY IN-HOUSE DEVELOPED POLYMERASE CHAIN REACTION (PCR)

Isolation of DNA from bacteria.

Bacterial strains of *Salmonella* MTCC98 and *E. coli* JM109 were procured from Microbiology Department, Patel Chest Institute as reference cultures. The DNA was isolated from different micro-organisms by using the phenol-chloroform method. The purity of the DNA was checked by agarose gel electrophoresis, and PCR was carried out by using the isolated DNA.

Design of PCR primers from Salmonella and E. coli

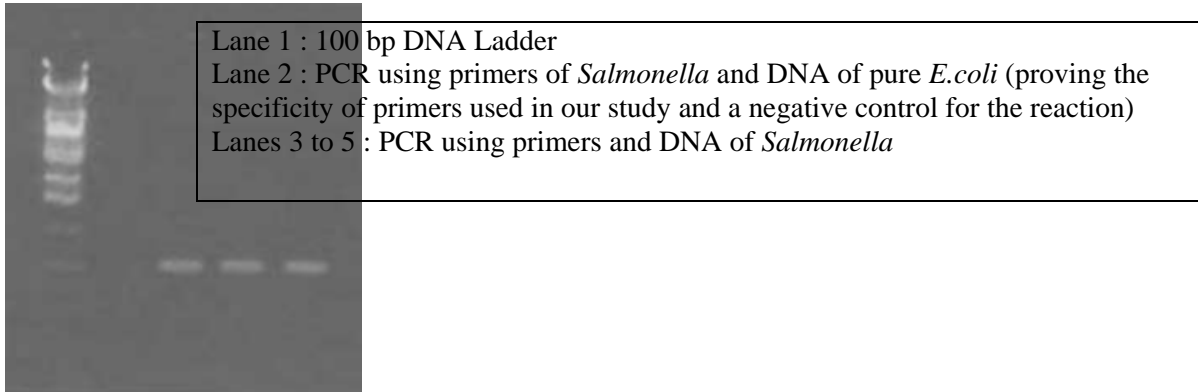
Sequence of the whole genome of *E.coli* O157, *Salmonella enterica* and *Shigella boydii* were retrieved from NCBI Database. The unique genes of these 3 pathogens were identified by using BLAST database (<http://www.ncbi.nlm.nih.gov/BLAST>) which checks the similarities between the different organisms. These unique genes were used for primer designing. Primer designing were done by using PICK PRIMERS from <http://www.ncbi.nlm.nih.gov>.

PCR based detection of pathogens

Using specific primers (as given above) ,PCR was carried out on DNA isolated from different micro-organisms using a thermal cycler (Eppendorf India ltd.). Similarly we have been able to standardize the PCR conditions for the other two organisms using pure cultures. Table below shows the said results in details.

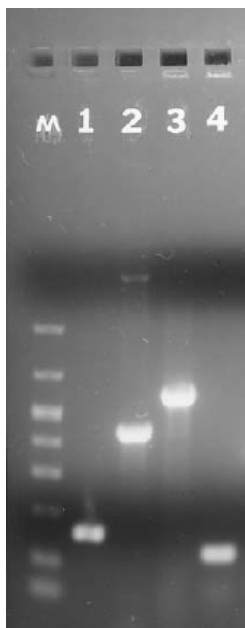
PCR to amplify signature sequences of *E. coli* (Standardization of PCR reaction)

PCR was carried out with three pairs of primers specific for *Escherichia coli* : Eco A1/A2, Eco B1/B2, Eco C1/C2 . Primer set Eco A1/A2 and C1/C2 are species specific primers designed from unique sequence of *E. coli* O157:H7 and the primer pair was specific for genus specific amplification of *E.coli*. Standardization of PCR was carried out at different annealing temperatures, primer concentration and Mg²⁺ ion concentrations and using the pure isolated DNA. Out of the three sets and different standardization conditions performed, set EcoA1/A2 was found to be most appropriate for further analysis, as this pair was specific for only the pathogenic strain of *E. coli* and was highly sensitive. The primer pair set Eco B1/B2 were proved to be genus specific.



PCR to amplify signature sequences of *Salmonella* showing 275 bp product

Separate PCR were performed for the three food pathogens using DNA isolated from pure bacterial cultures. The PCR products obtained were run on a single agarose gel. Figure below shows the three PCR results together:



Lane M: 100 bp DNA ladder
 Lane 1 : PCR to amplify *Salmonella* (275 bp PCR product)
 Lane 2 : PCR to amplify *E. coli* O157:H7 (482 bp PCR product)
 Lane 3 : PCR to amplify *Shigella* (610 bp PCR product)
 Lane 4 : PCR using primer set specific for all *E.coli* strains EcoB1/B2

Therefore, in the present study we have been able to standardize the three PCR reactions using DNA from pure cultures and have been able to identify non-pathogenic *E. coli*, *Salmonella* and *Shigella* on the surface of fresh produce.

Table : PCR sensitivity (minimum Cell numbers in the assay for positive PCR results)

Organism Name	Name and the protein product of the Unique gene	PCR product Size	Sensitivity (cells)
<i>Escherichia coli</i> O157:H7	<i>yaaA</i> gene : Predicted transporter	482 bp	20 cells
<i>Salmonella</i> spp.	<i>invA</i> gene; possible secretory protein involved in virulence	275 bp	80 cells
<i>Shigella</i> spp.	<i>ipah</i> gene; invasion plasmid antigen	610 bp	9 x 10 ⁴ cells

The developed PCR based detection kit provides a rapid, sensitive, specific, and cost-effective method for food pathogen detection. Food companies around the world already rely on various PCR based and real-time PCR assays for food pathogen detection. But these are quiet expensive to be purchased. The In-house developed PCR assays provide a futuristic method for rapid detection of these pathogens. Once standardized for use at a large scale, the method would be extremely useful to food companies in India as well.

V.EFFICACY OF THE ANTIMICROBIAL DIPS

The three antimicrobial dips in varying concentration and dip time were tested for their efficacy in reducing the surface micro flora. Aim was to find a cost effective and simple method at home level for the consumers as an intervention to reduce the microbial risks associated with the fresh produce. Various organic acids were tried as these are regarded as GRAS and permitted by law for use in foods. The antimicrobial dip A was found to be effective at

1% concentration and 2 minutes dip time. It reduced the microbial load in the range of 76% to 90% in all the samples tested. Antimicrobial activity was also studied. The team intends to file for its patent.

OTHER ACTIVITIES UNDERTAKEN DURING THE PROJECT

1. Paper presentation in the International Conference and Exhibition on Food Processing & Technology held at Hyderabad from 22nd to 24th November 2012.

Evaluation of food safety practices in the retail outlets of west Delhi (India).
Shalini Sehgal, R.K. Khandal, Uma Chaudhry and Purnima Anand
J Food Process Technol/S1: 2157-7110-S1.007-6/Special Issue 2012

Rapid detection and characterization of pathogens present on fresh produce: A paradigm shift from culture plate to molecular biology.

Uma Chaudhry, R. K. Khandal, Shalini Sehgal and Purnima Anand
J Food Process Technol/S1: 2157-7110-S1.007-001/Special Issue 2012

2. Poster presentation in the National conference for “Redefining Science Teaching: Future of Education” organized by Acharya NarendraDev College, Delhi University on 9th March 2013
Microbial Hazards Associated With the Vegetables Sold in Retail Market

Shalini Sehgal , Purnima Anand and Manjusha ,N.

3. Standard Operating Protocols (SOPs)for Identification of Food Pathogens in the form of virtual lab which can be used by others undertaking such projects were designed.
4. Seminar on “Changing Paradigm in Food Safety” on 5th July 2013 was organized by the team BCAS-102. The speakers were Dr. R. K. Khandal,Vice Chancellor, UP Technical University, Lucknow ,Ms. P. Alli Rani-CEO, FHEL ,Concor , India and Mr.Rakesh Mehra, HEAD, IQF Operations, SAFAL
5. A workshop on the Use of Statistical Tools in Biological Research was also successfully organised.
6. Exhibition of the training and educational material under the Food Safety Education Initiative.

3. Learning of Students:

1. The study conducted has provided an opportunity for the students of B.Sc. (H) Food Technology/Microbiology/Biomedical Science to develop their skills to carryout objective research on the topics of common interest and social relevance. The major impact of this project for the students was to get an opportunity to have an exposure to a multi-disciplinary research subject.
2. The project has helped them broaden their knowledge base of the complete innovation cycle where the outcome of research is not just for basic and theoretical aspects but also for the practical and applied uses.
3. The students have learnt how to plan and perform experiments beyond the structured course curriculum .They have understood collection of reference of literature, development of questionnaire, conduction of survey and its analysis.
4. They also developed skills in various microbiological and molecular biology techniques. Three hands on workshops were organized in the initial stages of the project so that they learnt sampling, preparation of

media and reagents, dilutions, plating, PCR, primer designing, running the PCR and gel electrophoresis. They also learnt the basic bioinformatics tools and statistical analysis of data.

5. The students have honed their communication skills by fruitful interaction with teachers, researchers, and academicians during ANTARDHAWANI-2013. They participated in poster presentations and also organized the final project seminar in the college. These all activities also helped them to develop their organizational skills.
6. The students also interacted with professionals at retail outlets during sampling, survey and training which provided them an insight into the functioning of Indian Food Retail Sector.
7. Development of training material also taught the role of pedagogy in teaching and also more conversant with the use of Hindi in technical writing.

4. Benefits to College:

1. Genesis of research at undergraduate level
This project provided an opportunity to both teachers and students to do research work at undergraduate level, learning of various new techniques and research methodology. The interdisciplinary nature of the project resulted in fruitful interaction between all the three departments and understanding the concept of team work.
2. Visibility of the College and University of Delhi
This project also enhanced the visibility of our college as well as University of Delhi in the Food Retail Sector as around thousand workers and hundred outlets were interviewed and surveyed respectively.
3. Infrastructural addition
The college also benefitted with the addition of some equipments in the departments.
4. Academia – Industry Interface
The project provided this opportunity as various industry people were consulted during the course of this study and some visited college during the final seminar presentation.

5. Benefits to Society:

1. The survey data of the project will serve as a reference guide for various stakeholders i.e. regulators, policy makers, consumers etc. This could turn out to be a targeted document for drawing plans and strategies to achieve the desired standards of food safety in the country, once published in reputed journals as no such surveys have conducted until now.
2. “Fruit-N-Vegi Wash” – A cost effective antimicrobial dip which can be used by the consumers at their home level to wash their vegetables and fruits before consumption(applying for patent).
3. A complete training set comprising of 14 posters (seven in hindi and seven in English), leaflets , booklets were designed to help food handlers understand that the basic techniques of hand washing, hygiene, temperature control, proper storage play an important role in maintaining the supply of safe food. (enclosed). This training kit was used at various outlets to train the workers at the outlets and also being mailed to the corporate offices of Indian Retail Sector for wider circulation at National level.
4. Beginning of Food Safety Education Initiative (FSEI) by an academic institute for consumer and food workers awareness on food safety.

6. Further Plans:

1. Such studies can be conducted all over the cities and data generated will be very useful as no such database is currently available for both microbiological and chemical contaminants in fresh produce.
2. In-house polymerase chain reaction (PCR) method for the detection of *Escherichia coli* has been developed and is being evaluated for the detection of this organism and other related pathogens present on fresh produce.
3. Toxicity studies of “Fruit-N-Vegi Wash” need to be undertaken .
4. Strengthening of the Food Safety Education Initiative (FSEI) by the support of University of Delhi as it is required at all levels of food sector –both organized and unorganized. This initiative must include food safety awareness for consumers and school children as Food Safety is a way of life which should be inculcated at younger age.

BHASKARACHARYA COLLEGE OF APPLIED SCIENCES

Project Title: Development of Cost-Effective Nutritious Multi Cereal Bar and its Sustainable Packaging Using Nano-Biopolymer

Project Code: BCAS-103



Nutrition Bar and Its Packaging Material

1. Objectives of the Study:

1. To develop cost-effective Nutritious Multi-Cereal Bar to curb the problem of malnutrition in India.
2. To develop and characterize a cost-effective nano biopolymer film to make it suitable for food packaging.
3. To study the changes in chemical and sensory attributes in order to assess the Shelf- stability of in-house biofilm packaged bar.
4. To conduct health and environmental awareness camps in government schools and slums areas.

2. Final Findings :

Five bars with the ingredients in different forms and proportions, using different methods of cooking, different flavor, texture, appearance and nutritive value were formulated keeping in mind the standards that were decided.

Sensory evaluation of all bars was done by a panel of 20 semi trained judges. Their nutrient content was estimated using nutritive value of Indian foods, ICMR publication. On the basis of sensory evaluation, cost and nutritive estimation, one bar was selected as the final bar on which further tests, studies and improvements are being carried out.

The testing of this bar for proteins, fats, carbohydrates, total ash, vitamin A and vitamin C ,texture using standard procedures was done. Peroxide value, fat, acidity , moisture were also tested for a period of three months. Water activity of bar was also determined for a period of three months at 0,7,15,30,60,and 90 days period. Finally bar was found tasty, healthy, nutritious. Cost of the bar was very less as compared to other bars available in market. Shelf life of bar is more than three months both at ambient as well as at 37 degree Celsius.

For packaging the nutrition bar, nine biofilms based on starch and PVA have been developed with varying compositions. Based on their mechanical properties the film with 50:50 starch and PVA have been selected for the project. The film was further added with many active food grade reagents to make it water insoluble, food safe and anti microbial in nature. Nanofillers have been also incorporated in the film at 1%, 2% and 3% loading. The mechanical properties were enhanced but the incorporation of clay made it brittle in nature. Hence, the nanoclay filled composite of the film was not chosen for the final work. The unfilled film were further tested for mechanical properties, antimicrobial properties, WVTR and permeability in air. The mechanical properties are very high, permeability is almost nil in air. The film absorbs water but insoluble in water. The film has antimicrobial properties.

3. Learning for Students :

The DU Innovative projects are one of a kind. It is unheard of any other university to fund such research projects for their students to help them develop their skill sets. Students are really grateful to the University of Delhi for giving them such an opportunity.

Students explored, learnt and developed product. The project was a great platform for students to explore their minds, learn from their experiences and develop personally as well as professionally. Being the students of applied sciences, it is necessary for them to have a practical knowledge of all that they study in their classrooms. In this project that is exactly what they achieved.

Managing studies and this project together wasn't a burden at all; instead it taught them multitasking and time management. Apart from developing product, they had Nourish Organics factory visits, attended three international conferences and workshops, won best poster award, published paper in journal and conducted awareness campaigns. We are sure that at some point of time in their life they would benefit from their experiences.

4. Benefits to College:

1. College students got exposure to new research area at an undergraduate level and also to the field which is not their field of study. They were trained to integrate their knowledge with their peers of different streams. The students worked in the team and learnt to collaborate which is the need of the day.
2. Two patents were submitted from this project.
3. Teachers got funds to carry out research work. Infrastructure was build up for the college. Even teachers also learnt to collaborate with each other and mentor who is an expert in this field.
4. It gave an excellent platform and financial assistance for the students and the teachers to visit industries and attend and participate in different conference

5. Benefits to Society:

The project was proposed keeping in mind the problem of malnutrition in India. The nutrition bar developed during this project will benefit the low income groups of our society as the bar developed is very cheap. It can be incorporated into mid day meal for school children and various other government schemes and curb malnutrition.

The bar is rich in macro and micro nutrients; it is tasty and very cost effective which makes it the bar for the common man.

The packaging of the bar has been done using biodegradable packaging material made from starch. This is aimed as a solution of plastic pollution, a problem that not only our country but every other country faces. Moreover the packaging is very cheap and based on bio resource. The final packaging film is food compatible too.

Possible End-users

- Low Income group of the society especially malnourished children.
- Pregnant and lactating women.
- Teenagers.
- Packaging Industry.
- Ministry of Health and family welfare.
- Department of Environment.

6. Further Plans:

We have applied for patent both for bar and film. Our plan is to incorporate this bar in mid day meal scheme so that nutritious and safe food can be provided to malnourished and poor children at very low cost. In future also we want to make handy, healthy ,nutritious and inexpensive ready to eat food products in environment friendly packaging material from waste products or from cheap easily available material. So that these type of food products can be used/ distributed at the time of need like during flood, drought, war etc. In future, we can also export these type of products.

The packaging film is environment and food safe. The packaging film may be used for this nutrition bar as well as for packaging of other materials. This film may be also combined with other packaging films to create a multi layer packaging material.

BHASKARACHARYA COLLEGE OF APPLIED SCIENCES

Project Title: Development and study of Alternate Packaging Materials from Agro Wastes and its Application in Food Packaging

Project Code: BCAS-104



Agro waste based packaging material for market eggs

1. Objective of the study:

The development of alternate packaging material from renewable resources is the focus of this study. *Packaging* is defined as a socio-scientific discipline which operates in society to ensure delivery of goods to ultimate consumer in the best condition intended for their use. The packaging material must have good barrier properties, thermal and mechanical properties. It is advantageous and equally important for the packaging material to be ecofriendly. Most of the packaging materials used at present are bio non-degradable in nature. These non biodegradable materials generate large amount of toxic substances, which are harmful to the biosphere. All these factors have contributed in generating a huge ecological imbalance. The society has now awoken to realize the consequences of this ecological imbalance and is gradually shifting towards environmental friendly materials. Keeping various environmental and other issues in mind and the present day need, we decided to work on the problem which could directly serve the society and bring awareness on certain issues. Thus, the proposed work aims to develop hard and flexible material film using agro wastes like rice husk, sugar cane bagasse etc, optimize the film properties and explore the suitability of the film as packaging material for food products. The study would also assess the shelf life of the food products using the developed packaging materials.

2. Final Findings:

1. Initially the material film that we developed degraded with time. Also it was rough. The gelatin coating over the material eliminated this problem. The new film was then flexible, hard, strong and showed swelling behavior of 5%. It was also reversible after heating in an oven after 30 minutes at 120 °C. The developed film had property to absorb metal ions from surrounding (liquid) solution. The film was characterized by measuring the absorbance of metal ion by UV spectroscopy. This particular property added a new dimension to our work. The flexible film developed was robust in nature. The parameters like strength, permeability and stretching ability were found satisfactory. Further, the material was solution casted for making packaging material for marketed eggs.
2. The data of internal and external quality parameters of market eggs (using commercial paperboard packaging) was studied and showed better quality of eggs at refrigerated temperature in comparison to room temperature. The air cell size and weight loss was less in refrigerated storage.
3. The paraffin coated rice husk based packaging material showed better barrier properties and had reduced moisture and CO₂ losses in comparison to pure rice husk based packaging material. It had better pH of yolk and albumen. The studies were carried out at room temperature conditions from December to July. The results indicate suitability of the paraffin coated rice husk based packaging material as an alternate to the conventional packaging materials.

4. The Focaccia bread was standardized (formulation) with respect to taste, specially the spice and herb mixture with reference to local Indian palate. We propose to improve the texture in future and also develop a suitable bio-degradable packaging material film.
5. We are also working on to use our packaging material for liquid items. Due to paucity of time, the findings could not be completed but initial results indicate the suitability of our packaging material for liquid items.

3. Learning for students:

1. The opportunity was very well used by students to develop logical thinking, experimental expertise and ability to draw scientific conclusions. It has also helped them to gain confidence and improve their holistic education.
2. The exposure to attend conferences gave them opportunity to hear some highly intellectual as well as informative lectures. This helped them to expand their knowledge base and could get glimpse of the various research activities and programmes.
3. The presentations trained them to plan, organize and deliver the data in systematic manner. They developed scientific writing skills, learnt literature survey and the importance of citations and references.
4. They realized the relevance and importance of the objective of the study. They understood vast applications of agro wastes. They could appreciate the interdisciplinary aspects in sectors academic, economic, resource management, employment etc .

4. Benefits to College:

1. The funding of the projects under Innovation Scheme is a big motivator for teachers and students. Such schemes help to create an academic friendly environment where exchange of ideas and thoughts take freely. It infuses fresh energy in the academic community.
2. It created an environment where the importance of interdisciplinary approach was realized by faculty as well as by students themselves. The innovative thinking was very much evident during the cultural festival “*Antardhvani*”.
3. The initiative and support of the University was commendable. The other Universities are also realizing the importance of academic growth by encouraging the college faculty and students.
4. The unique concept of research under the Innovation Scheme was highly appreciated in various conferences that we attended. The students were highly motivated in conferences while competing with the post graduate and full time research students in academic events.
5. The publications/ patents will definitely lift the prestige of the University and Colleges.
6. The research at undergraduate levels, will also attract students in colleges from foreign nations. This would help in the academic growth of the University and will spread the popularity further.
7. The continuous research activities would also help in enhancing the prestige of the University. It will help faculty members to continuously update their knowledge and skills.
8. The funding received under the project scheme has also helped the colleges to equip their laboratories with some modern instruments and softwares. This will provide an opportunity to enhance the learning skills of all.
9. The avenues for higher promotions will open up in colleges.

5. Benefits to Society:

1. The study was undertaken with an objective to assess the suitability of agro waste generated in industries in developing a packaging material. The success work can help the society in many ways:
2. It is a beginning towards developing the ecofriendly waste management.
3. Eco and Environment friendly approach will be in consonance with current needs to preserve and improve quality of biosphere.
4. It will reduce dependency on non-renewable resources. It will help in preserving our diminishing natural

resources.

5. It may encourage small time entrepreneurship.

6. Further Plan:

We propose to further investigate certain unique characteristics, properties and behavior using agro wastes like :

1. Separation of cellulose and silica from agro-wastes.
2. Water purification using the residual form of agro-wastes.
3. Development of different types of packaging materials for different food items.

BHASKARACHARYA COLLEGE FOR APPLIED SCIENCES

Project Title: Determine the speciation of some selected Heavy Metals from E-wastes and their impact on Ground water

Project Code: BCAS-105



Students working in laboratory.

Introduction

E-waste is any refuse created by discarded electronic devices and components or substances involved in their manufacture or use. The disposal of electronics is a growing problem because the electronic equipment contains hazardous substances like Pb, Cd, Cu and As as metals and COD, DO, alkalinity, chloride ions etc. as non metals. In a personal computer, for example, there may be lead in the cathode ray tube (CRT) & in soldering, mercury in switches and cobalt in steel components, among other equally toxic substances. Metals like Pb, Cd, As, Cu and As, non-metals sulphate, nitrate and phosphate etc. in the soil due to e-scrap dumped on or under the grounds and their mixing with ground water. Above mentioned elements i. e. metals have been selected for the present study because these are the important component of many electronics devices like mobiles, televisions and computers etc.

Sources of Metals in Electronic Equipments

Metals	Sources
Arsenic	Diodes, Microwaves ovens, LEDs, Solar Cells, Semiconductor Diodes etc.
Cadmium	Batteries, Solder alloys, Circuit Boards, Monitors, CRTs etc.
Copper	Conducting cables, Copper ribbons, coils, circuitry, etc.
Lead	Lead rechargeable batteries, solar panels, transistors, Lithium batteries, PVC etc.

These metals are common constituents of environmental pollutants in soil and water. These metals are more likely to affect the water quality parameters depending on the nature of their different chemical forms, distribution pattern, etc. For physio-chemical characterization, ground water is chosen from the sites within 1-2 Kilometer periphery of the dumping ground. The important physio-chemical parameters which have a bearing on speciation like pH, EC, Alkalinity, DO and COD etc determined using standard method (APHA)..

Impact of these metals on humans

Lead: A neurotoxin that affects the kidneys and the reproductive system and mental development in children. High quantities can be fatal. Mechanical breaking of CRTs and removing solder from microchips release lead as powder and fumes.

Cadmium: A carcinogen, long-term exposure causes severe pain in the joints and spine known as Itai-itai disease. It affects the kidneys and softens bones. Cadmium is released into the environment as powder while crushing and milling of plastics, CRTs and circuit boards. Cadmium may be released with dust, entering surface water and groundwater.

Arsenic: Arsenic is a poisonous metallic element which is present in dust and soluble substances. Chronic exposure to arsenic can lead to various diseases of the skin and decrease nerve conduction velocity. Chronic exposure to arsenic can also cause lung cancer and can often be fatal.

Copper: Acute symptoms of copper poisoning by ingestion include vomiting, hematemesis i. e. vomiting of blood, hypotension, melena i. e. black "tarry" feces, coma, jaundice and gastrointestinal distress. Individuals with glucose-6-phosphate deficiency may be at increased risk of hematologic effects of copper⁷. Hemolytic anemia resulting from the treatment of burns with copper compounds is infrequent. Chronic (long-term) effects of copper exposure can damage the liver and kidneys.

Materials and Methods

Sample collection: Different E-waste sample, soil and water have been collected from various places like Mundka, Seelampur, Geeta Colony, Noida Industrial Area, Khora Colony and Mayapuri industrial area for metal and non – metal analysis. The soil and water will be used for the preparation of laboratory leachates through the fabricated Lysimeter.

Leachate formation: Leachate has been prepared by using the Lysimeter in the laboratory. The Lysimeter is made up of perper sheet about 4 feet height and 6 inch wide. For the formation of Leachates, granules, sand and soil have been collected from the E-waste storage site. These E-wastes substances were first digested with concentrated HCl solution to remove the organic matter as well as the other impurities. The water sample collected from the site has been run through this Lysimeter at very slow rate and the Leachates have been collected from the Lysimeter. These Leachates were be preserved for metal and non metal analysis (total concentration and the speciation of the metals).

Extraction of metals from E-waste: The collected E-waste has been grinded properly and then this was subjected for acid digestion. The materials will be digested with HNO₃ over a hot plate to the lowest possible volume, while continuing heating and adding conc. HNO₃ as necessary until digestion is complete (light colored clear solution). Then it was diluted with double distilled water to remove the residue from the sample. Then this sample was mixed with the collected water sample and reserved for the formation of Leachate.

Non-metal and metal analysis: For non metals, alkalinity, chloride, phosphate, sulphate and nitrate experiments are being done. ¹

Result and Discussion

The Results of the different samples of ground water and soil collected from the different area of Delhi are reported in ppm through Leachate formation.

Mundka

Sr. No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
1	36.32	4.46	61.27	7.41	92	0.98	478
2	38.11	4.92	63.54	6.23	87	0.91	463

3	39.23	5.03	68.63	5.91	82	0.84	447
---	-------	------	-------	------	----	------	-----

Noida

Sr. No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
1	39.32	4.80	70.05	6.23	98	0.81	485
2	40.05	5.15	72.52	5.75	89	0.71	479
3	41.15	5.89	74.52	5.55	76	0.69	461

Kamaruddin Nagar

Sr No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
1	30.80	3.93	58.17	7.02	88	0.82	452
2	28.37	4.08	59.95	6.86	73	0.74	436
3	24.42	4.22	62.72	6.44	66	0.64	409

Geeta Colony

Sr. No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
1	27.38	3.84	52.28	7.73	94	0.78	442
2	29.21	3.44	54.10	6.05	91	0.72	431
3	31.61	3.12	56.73	5.68	88	0.63	428

Shastri Park

Sr. No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
1	33.21	4.27	60.07	7.49	90	0.92	461
2	29.74	4.12	62.28	7.33	84	0.85	453
3	28.98	3.98	63.12	7.18	79	0.81	444

Seelampur

Sr. No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
---------	-------------------------------	-------------------------------	-----------------	------------------------------	-----	----	-----

1	26.92	3.61	48.87	7.21	91	0.71	433
2	26.07	3.53	50.21	6.98	87	0.64	425
3	25.86	3.47	51.94	6.81	82	0.57	410

Mayapuri

Sr. No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
1	27.13	3.42	46.85	6.92	82	0.65	427
2	26.85	3.36	48.21	6.46	77	0.54	421
3	26.22	3.25	49.56	6.02	72	0.47	418

Water

Sample 1

Sr No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
1	27.21	3.19	58.29	5.31	111.00	1.76	421.0
2	29.37	4.24	63.91	4.83	108.00	1.84	418.0
3	30.44	4.54	64.79	3.72	102.00	1.92	428.0

Sample 2

Sr No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
1	21.08	2.09	52.39	4.91	107.0	1.52	408
2	20.71	2.68	58.75	4.27	98.0	1.67	397
3	19.24	3.02	61.25	3.98	96.0	1.71	389

Sample 3

Sr No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
1	19.91	2.01	49.23	4.21	103	1.41	396
2	19.07	2.48	51.72	4.03	97	1.48	382
3	18.87	2.76	59.13	3.94	92	1.53	377

Sample 4

Sr No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
1	26.82	2.14	55.18	5.12	109	1.57	419
2	24.38	2.97	57.93	4.98	101	1.69	412
3	23.12	3.01	59.26	4.81	98	1.74	408

Sample 5

Sr No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
1	18.76	1.98	46.23	4.18	101	1.47	382
2	18.23	1.83	49.79	4.11	97	1.53	367
3	17.92	1.74	51.32	4.02	92	1.58	352

Sample 6

Sr No.	SO ₄ ²⁻	PO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	COD	DO	Alk
1	19.32	2.12	52.32	4.22	102	1.52	387
2	18.91	1.93	56.12	4.18	99	1.59	373
3	18.42	1.81	58.42	4.09	78	1.62	369

Results of the test for metals

Kamruddin Nagar:

S.No.	Parameters	Results	Test Method
1.	Lead (as Pb) ,mg/l	0.25	IS:3025 (P-41)
2.	Arsenic (as As), mg/l	Not Detected	IS:3025 (P-47)
3.	Cadmium (as Cd) ,mg/l	Not Detected	IS:3025 (P-37)
4.	Copper (as Cu) ,mg/l	1.84	IS:3025 (P-42)

Sample Description:

Mundka(Leachate):

S.No.	Parameters	Results	Test Method
1.	Lead (as Pb) ,mg/l	0.17	IS:3025 (P-41)
2.	Arsenic (as As), mg/l	Not Detected	IS:3025 (P-47)
3.	Cadmium (as Cd) ,mg/l	Not Detected	IS:3025 (P-37)
4.	Copper (as Cu) ,mg/l	0.61	IS:3025 (P-42)

Sample Description:

Kamruddin Nagar:

S.No.	Parameters	Results	Test Method
1.	Lead (as Pb) ,mg/l	0.22	IS:3025 (P-41)
2.	Arsenic (as As), mg/l	Not Detected	IS:3025 (P-47)
3.	Cadmium (as Cd) ,mg/l	Not Detected	IS:3025 (P-37)
4.	Copper (as Cu) ,mg/l	2.24	IS:3025 (P-42)

Sample Description:

E-Waste Digestive:

S.No.	Parameters	Results	Test Method
1.	Lead (as Pb) ,mg/l	0.25	IS:3025 (P-41)
2.	Arsenic (as As), mg/l	Not Detected	IS:3025 (P-47)
3.	Cadmium (as Cd) ,mg/l	0.65	IS:3025 (P-37)
4.	Copper (as Cu) ,mg/l	0.85	IS:3025 (P-42)

The behaviour of lead in natural water as well as in the leachates is combination of precipitation equilibrium and the complex formation ability with the organic and inorganic ligands. The degree of speciation and their mobility of lead depends on the physiochemical state of the complex formed.

From the experimental result it is found that lead is less in the leachate of mundikka sample where the sulphate concentration is higher. It may be concluded that sulphate ion has the complexing ability with lead which in turn influences the concentration of lead in the samples.

In aquatic environmental copper can exist in three broad categories particularly in the form of particulate, colloidal and soluble. The speciation of copper in natural and in leachate is determined by the physiochemical and hydrodynamic characteristics and biological state of water. Copper forms complexes with the ions like carbonate, nitrate, sulphate, chloride etc. Copper interacts strongly with sulphur forming relatively stable insoluble sulphides. It may be the reason for the higher concentration of copper in the sample kamruddin nagar site than the mundikka samples.

The arsenic metal is extremely rare in the environment and it combines strongly with sulfur from the experimental result. It was found that arsenic concentration is very low and is not detected through the experiment.

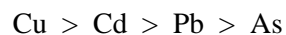
Cadmium is an amphoteric and sulphophilic element. It undergoes multiple hydrolysis at different pH values in the environment. Cadmium(+2) is present totally as the divalent species up to pH 8 in the absence of any precipitating anion such as phosphate and sulfides. Since in the experimental result it is found that phosphate and sulfides are present in the significant level. In addition to the chloride has the major role in the speciation of cadmium as chlorides are more selective than the other agents in their interaction with cadmium. It may be the reason for the low concentration of the cadmium in the leachate.

Conclusion

From the data observed and analyzing after experiments in laboratory shows that ground water near the e-waste dumping sites has high concentration of chlorine and other salts. These chemicals may affect human life in many ways. Workers and residents near the dumping sites who drink the ground water with concentration of these chemicals are highly vulnerable of adverse effect on their health. The results of the above experiments performed in the laboratory are according to our expectations.

Our project is totally based on the experiments, so all results depend on the experimental data and observations. We have finished visiting e-waste sites and have collected all the data required to carry out the proposed experiments. Many chemical analyses have already been performed while the instrument-based experiments are remaining to be performed. We are progressing according to the original hypothesis of our project and although many experiments are remaining to be carried out, the initial results are very encouraging.

It may be concluded that the concentration of the heavy metals in leachate are in the order as follows,



Copper and cadmium species contribute the more deleterious effect on the receiving water body. More precaution should be taken for the attenuation of the metals like Copper and Cadmium.

References

1. Eugene W. Rice, Rodger B. Baird, Andrew D. Eaton and Lenore S. Clesceri, Standard Methods for the Examination of Water and Wastewater (APHA, New York Washington, 22nd edition)
2. Goyer RA, Lead toxicity: From overt to subclinical to subtle health effects, *Environ, Health Perspect* 86, 177, 1990
3. Goyer RA, Results of lead research: Prenatal exposure and neurological consequences, *Environ, Health Perspect*, 104, 1050, 1996
4. www.waterdirectoriate.asn.au/maillinglist/index.php
5. Klimisch HJ, Lung deposition: deposition, clearance and renal accumulation of inhaled cadmium chloride, *Toxicology*, 84, 103, 1993
6. Hostynek JJ, Hinz RS, Lorenz RS, Metals and skin: *Crit Rev Toxicol*, 123, 171, 1999
7. http://en.wikipedia.org/wiki/Copper_toxicity - cite_note-Casarett-2
8. www.who.int/water_sanitation_health/dwq/chemicals/sulfate.pdf
9. www.epa.ie/

BHIM RAO AMBEDKAR COLLEGE

Project Title: Growing Under The Shadow of Mass – Media Explorations into Family Lives and Psycho Social Well – Being

Project Code: BRAC 101



National Seminar Photo, Tripurari Sharan Director General Doordarshan

1. Objective (150 words):

Empowering the student participant learn the skills of appreciating social. Reality with a

- a. Research and critical orientation.
- b. (b) Understanding the way media is created and modalities of its functioning.
- c. (c) Exploring the patterns of use and exposures to mass-media in urban families
- d. From different social back-grounds and examining its relationship with psychosocial
- e. well-being.
- f. (d) Understanding the media map impact on our psycho-social well-being.
- g. (e) Understanding Mass Media impact across different generations and Exploring Gender
- h. differences

2. Final Findings (300 words):

- a. Mass-media influence on behavior of people has acquired large share as compared to other mediums. Mass Media messages are conveyed through Television, Computer, Mobile phone, Film, Newspapers, radio and social networking sites to a large number of population. Exposure, Access or attention to media messages are important of source of shaping attitude, interest, emotional and cultural expression in more determining ways than our previous times. Mass - Media message impact has shown that audience responses to media content of pleasure, pain, anger, violence is not the same across the population. That means media messages are polysemic that each media message or text is capable of being interpreted in a variety of ways. Media not only represents social reality it creates its own social reality. Media propagated reality acquires a dominant part but it is not monopolistic. Detailed analysis and critical analysis is ignored at the cost of media prioritizing agenda and cultivation of life styles close to fictional reality rather than factual. Media messages try to dramatize events with a mix of narrative, public appeal, popular taste, and mass consumption and so on. Decoding dynamics of media messages produced and received reveal a variable pattern of effect on the basis of direct experience. Mass-media has led to powerful impact on the young generation in

terms of shaping the expectations, desires and emotions due to their excess use and dependence on mass media. Life styles are chosen primarily by selecting those on offer through media. Continuous flow of information has also led to a stage of conditioning of our minds to rely on media information for finding solutions to our problems. Media also serves use and gratification purpose by providing escape from the normal routine, surrogate member of a community like face-book, help us confirm our sense of identity, satisfying a feeling of surveillance- feeling of what is going on.

- b. One important reason why people engage in media messages is intertextuality that is they may read one text in relation to others. There have been significant differences in media use pattern on the dimensions of age, gender and economic status. It would be erroneous to assume mass media users as an undifferentiated mass. Social location, literacy and media awareness, gender and age adopt different source of discursive resources for decoding media messages. It is prudent not to make generalization about media audience about their patterns of receptivity. Even in the same house hold variable pattern of media interaction can be found. Mass media tends to produce homogenization of products, services, life-style, art and culture providing numerous guidance implicit and explicit and tries to foster new identities to its viewers when people are engulfed by information to such extent that distinction between reality and hyper reality is blurred. Life styles are chosen primarily by selecting those on offer through media. Traditional systems are facing threat of extinction owing to large influx of new information. Mere research survey of manifest opinions of people will not be close to the reality of media people interaction outcome. The nature of representation in the media of women, youth and children also reflects a particular display of certain attribute like intimacy and emotion, custodians of future. It was discovered through this project that members of marginalized communities' representation is strongly skewed. The representations of marginalized groups are done mostly for token roles. Rising rate of juvenile crimes can be attributed to amplification spiral. Social circumstances are excluded in the reporting of juvenile crimes leading to a stage of moral panic. Deviant minority of pedophiles or stranger danger is accorded undue attention than it deserves and other actual and serious issues of road accidents, malnutrition, epidemic and other such problems are not accorded due importance which constitutes vast majority of child deaths. Concepts of deviancy and morality are used rather simplistically, with little concern for the context of social inequalities in which they operate. In the prime time shows old and marginal are excluded. Double standards of ageing are reflected by media in which women are required to match the youthful ideal all their lives but men are not. Disabled persons are represented as loss of one's humanity, as an emblem of social evil, as an object of fun or pity, stereotypical portrayal of image. The representation of disabled is portrayal not as a person or an individual but on the basis of classification. One strong area that emerged through mass media research is the depiction of sexuality in media. Mass - media depicts sexual behaviors on the screen which is very harmful to adolescents and youths who are susceptible to media influence as they are blank sheets on which mass media can script its story well. Inaccurate image of sex leads to unrealistic expectations, frustrations and dissatisfaction among adolescents and youth. Such expectations of fantasy and frustration can be minimized with help of effective media literacy. Mass media as a credible medium is also received with great skepticism due to twisted representation and attaching more importance to the fictional aspects and conjectural realms. However many good things like myths around gender and work class supremacy corruption in high places sporting talent in the rural areas have come to the fore due to exposure by the media. The context of television viewing has changed over time all the family together watching television but internet and mobile phones still operate within parameters of home within home. There are also differential patterns of programmes choice youth hard tough, old age spiritual and religious, women soft and fictional with many exceptions in each category. Children's in particular have been found to be vulnerable to hypodermic effects of media messages. But this assumption can't be generalized and children even at the age of 8 to 10 reported well developed media literacy. People appearing in advertisements were described as ugly, stupid, and some of the children were particularly cynical about free gifts. Some children also reported strong disenchantment of particular news stories being repeated for long periods. Mass media deal in symbols and their representations lead to construction

of dreams, desires and expectations but fail prescribe the roadmap to achieve those expectations in real life situation in equitable fashion. The overall psychosocial wellbeing can improve with impetus on educational role of mass media. Vast majority of our agricultural population can improve their yield with help of spread of scientific methods in the farming. Current predominance of co modification and profit motive a major objective of welfare is being largely ignored. Government controlled mass media organizations are engaged in developmental initiatives but it lacks popularity among the common mass due to less effective propaganda strategy adopted by them. We also need good government initiative have mass media research institutions. Even our syllabi content should provide adequate attention to mass media from primary to higher education level. There is a trend of flash mob that have emerged recently but they aggregate for a cause for momentary period and vanish and their agenda is also vanished. In Indian context several protests have been organized through the help of networking sites and some of them resulted in decision making at the government level. But grassroot change at the level of internalizing those conducts in the lives of people has not happened as increase in crime against women has been reported by the media. Similarly altruistic behavior pattern in the community life of individualistic urban context has been witnessing a moral nadir. If more researches are conducted awakening the awareness of youth and adolescents psychosocial wellbeing can improve at individual and community level. Even concept of wellbeing has acquired business model in which major implicit objective is profit earning and welfare is just the part of advertisement slogan. Hospitals and hospitality sector have also fallen prey to this business model of earning more and more profit and it is very often reported that big names seek tax exemption benefits for serving the poor and destitute but they rarely follow such policy. Simply putting the blame game on an individual or or an institution will not solve the challenging task of achieving wellbeing at holistic levels. We require more such researches to find effective solutions for the psychosocial wellbeing. Participation of young researchers reduces the general bias of being expert and brings quality dimension to the quest for exploring reality.

3. Learning for Students (200 words):

- a. This research work provided a platform to our students for their all round personality development. It offered them opportunity to enhance their psychological capital, social skills, academic skills, research orientation, team spirit, and respect for teachers gaining celebrity status in the college. In course of time they became effective decision makers. They learned to make the best of difficult situations time using e-mails to the teachers and moral encouragement by the teachers made them feel better for the rest for the day. During their visits to academic congress, Bangalore conference and many other conferences I received responses all positive emotional expressions and not a single negative comment. I was swamped with e-mails and text messages expressing highest level of things from their gratitude journal. There was a hunger to do more and do better which was manifested in Antardhwani. They developed research orientation were truly able to understand and build meaningful systems of reality negotiations. This work reoriented the focus of their thinking in pursuit of meaningful experiences. Finding a full-fledged experiment. In fact mindful approach emerged through this project revealed the power of positive emotions in them. Normally of love, work and play became integral part of their life activity during these months despite the horror and uncertainty of contemporary times effective pedagogy can bring desired positive traits of creativity, curiosity, open mindedness, love of learning will to accomplish goals in the face of opposition persisting in course of action despite obstacles, speaking the truth and presenting oneself in a genuine way. Their social intelligence improved beyond imagination and knowing what to do to fit in diverse social situation became a part of their natural habit. Organizing group activities to get things done and ensuring that they happen became a regular part of their daily-routine. They covered a wide experience, interacted with the very important person from bureaucratic realm, academic domain and they matured from rote learning to appreciation of charts, nature and everyday experiences.

4. Benefits to College (100 words):

- a. Institutional authority and legitimacy is encouraged by fair decision making and sensitive treatment to the group members. Innovative group became a favorable social identity in the college. The group members started getting contingencies within the internal and external environment of this university and outside. Innovative team became a potential status investment by the university. College pride got a multidimensional boost with the participation and contribution of innovative team at university and national level. The paradox and myth created around the elite institutions was minimized with our students' performance and interaction at a wider spectrum. Our college students did a meaningful and unorthodox research in mass media which is still most important but paid least research attention. Our students created a record of presentin technical papers in three national and one international conference. In fact Bhim rao Ambedkar College made its mark in the IIM Bangalore conference dinner of Naop with special applaud from the members present. Our innovative national seminar was inaugurated by director general Doordarshan and joint secretary ministry of rural development was guest of honor and Dean prof Anand prakash delivered a scintillating keynote address. Editor in chief live india, editor india tv, consulting editor sidharth mishra, ips officer ashwini chand currently with cbi, prof from jamia university, Dean amity university, dean I p university, Faculty members from Christ university banglore, deputy dean dr sangeet ragi, deputy dean dr neeraj tyagi , world bank adviser sanjeev roy and many other dignitaries took part in this seminar. Even a Harvard university free lance journalist shreya delivered her talk in this seminar. This whole seminar was telecast live on doordarshan for 2hrs and at least ten other channels telecasted the seminar on the same day. This was also reported by national dailies. Our college got the documentary of this research on you tube and a regular update of its activities carried out are reported on its blog totally managed by students. In fact our college acquired a prime importance in the academia and research community with this kind of innovative research.

5. Benefits to Society (100 words):

- a. Researchers have revealed that total revenue going in media industry and more than fifty percent of this is owned by four top companies that include Time warner, Walt Disney, News Corporation, Viacom and Bettelsmann. The logic of profit and capitalism is the dominant aspect of mass-media contents the poor and powerless are easily ignored from its priority area. Television being a powerful medium present's information and entertainment called infotainment. We are in the midst of a digital maelstrom which is reshaping our internal and external choice and in this process our traditional ways are facing extinction. Control and ownership of media plays an important role in the determination of outcomes of media.
- b. Time consumed watching television and spending time has increased at a rapid pace. How far this excessive dependence has affected our psychosocial health, Growth of happiness index. Harmony in the family values, lack of critical research orientation, gender sensitivity, intergenerational reciprocation, growth of altruism, national integration is a question to ponder with. Media determinism that emphasizes the technological power as a key driver of social change needs to be introspected?
- c. New forms of media such as instant messaging, social networking, facebook communication, twitter are setting complex challenges of relationships and behavioral adjustments at micro and macro level. In order to establish changes in the actual domain you have to manage and balance the war that goes on in the virtual domain.
- d. Any amount of change cannot see the light of the day unless you have effective media mechanism to produce those images in the percptrial realm of the people at large. Mass-media messages analysis is not a matter of choice instead it is necessity to analyze its impact to make these processes productive

or counterproductive as this will not allow you to remain in equilibrium. It is of great concern that researches in mass media allow the opportunity for its audience to have an informed choice before assimilating its contents as good or bad. Media literacy has become more important than academic literacy with its immense power to enter into our personal and public activities domain without our permission. Wellbeing of a person is largely dependent upon understanding and ignorance of the society at large. How many hours of our man power is lost watching limitless flow of information and images from mass s media needs to be analyzed in best possible terms . There are also certain advantages that can be achieved through educational programmes and health entertainment. Health care systems can gain enormous advantage with help pf mass media and research in this area can help the society. Many negative social practices of casteism, communalism, gender violence, child labor, honor killings can be overcome with help of mass media awareness programmes. Benefits to the society are too many from research in such a contemporary area.

6. Further Plans (100 words):

I intend to continue the research work on more specific area of mass media. The same students can be given opportunities to hone their skills in this research initiative. Large number of samples can be collected over a long period of time. Some other questionnaire may be developed and employed upon the samples. We can also bring out a quality book authored with help of these young researchers. These findings can be published in an international journal and we can bring out “An Innovative Documentary” on this subject.

BHARATI COLLEGE

Project Title: Challenges and Opportunities for School Girls in Delhi and Rajasthan: Gender , Sexual Harassment, WASH (Water, Sanitation and Hygiene) and it's Impact on Language, Communication Skill and Socio-Cultural Behavioral Patterns

Project Code: BW-101



1.Objective (150 words):

The study aims to study the challenges and opportunities to school girls in Delhi and Rajasthan. The availability clean drinking water, hand wash facilities, wash rooms in school and hygiene education in classrooms, particularly the girls who reach puberty, the location of girl wash rooms in schools, closeness of wash rooms from home or in the home have direct bearing on girls and increase participation in education.

The impact of gender discrimination, sexual harassment and WASH can be understood as communication skills is hampered, followed by a social isolation, irregular food habits, detachments from regular schedules etc. Therefore, the objectives are:

To study the geographic location, profile, infrastructural facilities of water, sanitation and hygiene in the schools of Delhi and Rajasthan

2. To study the patterns and factors of gender and sexual harassment of school girls.
3. To examine impact on language, communication and socio-cultural behavioral patterns.
4. To examine the preventive policies of gender- sexual harassment and measures of girl education of state and society.

2. Final Findings (300 words):

1. The information breaks the near one sided image of schools of urban areas where wash room or common room is perceived as an integral part, but in rural areas wash rooms either do not exist or are in pathetic condition and totally insecure condition.
2. There is urgent need of sensitization of boys towards the problems faced by girls to increase GER of girls
3. Due to harassment, girl students do not eat properly, stay alone, avoid mixing with peoples, disenchantment in day to day activities, getting irritated on small issues, isolation, avoiding school, classroom or meeting neighbors or any person or a place which used to be part of regular activity
4. The case of Rajasthan in many government schools the structure of the toilets doesn't exist at all. The girls are forced to go in open for toilet which makes them vulnerable to humiliation, embarrassment and exploitation.. The case of Delhi clearly reflects that the girl students do not face the harassment as far as wash room is concerned. At the same time, the need of cleanliness in the wash room has been emphasized.
5. The location of ladies wash rooms (if existing at all) is very isolated, far away, without lights, without doors, without cleanliness and horrifying, abusive languages on the doors, the bolts are broken, unfriendly structure and appearance of wash rooms.
6. In the case of Rajasthan, the insecurity level is so high that 99% girls do not want to come to schools during menstruation. In the case of Delhi, the girls do come to schools during menstruation, but the sufferings of menstruation is not taken as it is still considered as an individual problem

7. The sample study of Rajasthan shows that awareness about sexual harassment and gender discrimination is almost zero, rather the percentage of eve teasing (inside and outside school) is very high. In the case of Delhi, the awareness of sexual harassment and gender discrimination is very high and 84% girls feel confident to inform the parents about the sexual harassment, in case they face.
8. There is an urgent need to socialize and sensitize boys at every stage.
9. The data's/information shows that the government schemes and policies offer opportunities to girls, if articulated as per the challenges of rural and urban areas.

3. Learning for Students (200 words):

The Innovation Project is a landmark scheme to provide new ways of participating in evolving mechanisms of knowledge productions and it offers a sense of belonging in students for participating in research process. For the first time, the students have been given opportunities to get associated with teachers in a manner where the collaboration of teachers and young minds starts new traditions of knowledge production.

Infact, for the first time, students were given chance to present their work and the magnanimity can be understood from the fact that at the same time more than 1500 students were presenting to the people under the same roof.

The students have submitted the following: "When we visited Rajasthan, it was truly an awakening experience for all of us. We were saddened by the fact that so many girls who wanted to study were not being given any opportunity to do so.

We are now trained with the basic procedures of interviewing, questioning and analyzing and interpreting as we were a part of the process of forming the questionnaires for about 600 students (senior and primary) whom we interviewed. We learnt the tactics of approaching intimate topics such as sexual harassment and gender discrimination. The ways of surveying, thorough research of the topic and then preparing analyzed questions from that, like open, closed questions or direct or indirect aspects of questions and equally subjective and objective questions as well. The basis of what is taught in M.Phil.

It's been only 6 months with this project in hand and we already feel like new people. To sum up, this was truly an enlightening experience and has given us a rich sense of commitment to dedicate ourselves to the services of nation by lifting up the truly unprivileged and we thank our professors and the University Heartily for this Opportunity."

4. Benefits to College (100 words):

The Innovation Project initiates a new tradition of situating the colleges as the centre of knowledge production. Obviously, the colleges contribute a lot in the process of knowledge dissemination, and at the same time, the enormous energy and contemporary experiences of students provide an opportunity to include the contemporary perceptions and conceptualization of various phenomena in the knowledge production. Till date, the research activity through project work was limited to the teachers only, and within this framework the participation was very marginal.

The innovation project provides an opportunity to ensure that observations of young mind become part of knowledge system. Further, it helps in the expansion of culture of research work at the college level. Since, the project provides opportunities to the researchers to decide the area of project on its own; therefore, it helps the teachers to engage in their area study in innovative way.

5. Benefits to Society (100 words):

The innovation projects are very helpful to the societies as it engages the young minds and students to deal and understand the contemporary challenges faced by the society. The essence of knowledge production is always linked to the creation of knowledge system which liberates the societies from historical bondages and helps the society to rise above the hierarchical patterns. Infact, the contemporary societies are facing a number of challenges where the development of science and technology cannot be used for the development of social capital. Therefore, the knowledge system created by the innovation will definitely help in the creation of social capital. This projects will definitely help in the articulation of policies of state by situating the ground realities faced by the girl students as the epicenter of framing the policies.

6. Further Plans (100 words):

The innovation has definitely created new ways for understanding the challenges faced by the girl students. We are definitely focused to carry on the research on new dimensions of the challenges and our efforts will be directed to understand the micro-level patterns of socio-cultural behavior of girls students so as to create an awareness in the society. Our approach will be to create the scientific patterns to formulate preventive measure in order to ensure larger participation of girls in the schools.

CLUSTER INNOVATION CENTRE

Project Title: DUCIC27X7 WS 1.0: Automated Project Proposal Development Tool for Rapid implementation of 24X7 Water Supply Systems in Small Towns and Villages of India

Project Code: CIC 101



DUCIC24X7 WS 1.0

1. Objective (150 words):

The project “*DUCIC27X7 WS 1.0: Automated Project Proposal Development Tool for Rapid Implementation of 24X7 Water Supply Systems in Small Towns and Villages of India*” aims at developing a public domain software module that will automatically generate the project proposal for implementation of a 24X7 water supply system in any small town or village. The generated proposal, starting from input parameters related to the population, geographical layout, payment capacity, consumption etc., will contain all details of the water distribution network, cost of the proposed project, tender document and a commercially viable tariff structure. The proposed software module will incorporate spatial position analysis, mathematical model for pipe network and tariff structure, optimal path analysis and analysis of relationship between topology and pipeline network.

2. Final Findings (300 words):

The primary output of the project is a software module that generates a project proposal for implementation of small to medium sized public 24X7 water supply system. The main findings of the work are:

Shuffled Complex Evolution (SCE) proved to be a powerful optimization algorithm to solve water distribution network optimization problems.

Cross subsidy can be used to generate optimal tariff slab structure for efficient recovery of the project cost.

The optimized network design module resulted in minimization of construction costs and maximization of reliability of final solution subject to constraints such as proper pressure level at demand node and fire flow compliances.

IPython was used to integrate code snippets written in FORTRAN, OpenEV, Java, PCRASTER and to generate PDF report.

GUI for the software module is developed in wxPython and PyQt.

Any village or town that is willing to provide population data can avail of this cheap method of making assessment for project cost and tariff structure for switching to a 24x7 water supply system.

3. Learning for Students (200 words):

The students have benefitted from the project by learning a variety of subject concepts/ working methodologies and thorough understanding of the software development life cycle. The key skills acquired by the students during project phase are:

Familiarity with GIS desktop application like ArcGIS and QGIS.

Developing complex mathematical models and algorithms.

Geoprocessing, Spatial DBMS, data mining techniques

Software development, testing and licensing procedure

Conducting field survey, handling of GPS and post processing techniques.

Economics of 24x7 water supply.
Automated project proposal

4. Benefits to College (100 words):

The developed software module will greatly assist in implementation of 24X7 water supply system in small towns and villages thereby enhancing the efficiency in management of resources. Certain aspects of the project were closely related to the curriculum of the member students. The student's knowledge of the paper "*Amazing world of probability and statistics*" helped in forming questionnaire and organization of the collected survey data; "*Data modeling and design*" in developing the database of all the civil and tariff related data acquired and "*Information Organization and Art of Problem Solving*", "*Discretizes and understanding real life situation through mathematical lens*" in gaining the algorithmic perspective for optimizing the distribution network and designing the tariff structure. The output of the project is in line with the mandate of CIC and will help the centre in establishing link with society and industry by providing consultancy in resource management, planning and implementation.

Working for the project provided the member students a great platform to learn and implement diverse concepts like GIS, tariff optimization, civil engineering, Database development and management, automated project proposal generation etc. The experience of software development, testing, interaction with public and professionals, huge number of presentations helped in development of professional, technical and communicational skills which would benefit them in their future career.

5. Benefits to Society (100 words):

India is rapidly urbanizing. An essential component of a good urban infrastructure – a proper water supply system – is absent in most of the villages and small towns of India. As we organize our society better by adopting technology, it is only a matter of time that most of the villages and towns will explore the possibility of moving to a 24x7 water supply system.

First step for establishing a 24x7 water supply system is to generate a network, optimize tariff structure and to approximate the initial investment required. This 24x7 water supply software will be extremely handy for such a transition by villages and towns who do not have financial resources to hire expensive consultants. The software generates an automated project proposal for the rapid implementation of the 24x7 water supply system including the cost structure, pipeline network and tariff structure.

This module takes basic information like GPS data of the area, field survey, population (from census data), as input and takes into account the growing population and consequently their growing needs for water. The software thereby helps in the organized development of urban infrastructure and efficient water resource management. This in turn replaces the system of investing huge amounts on consultants for initial planning as concerned authorities can now access this open source software for the same.

6. Further Plans (100 words):

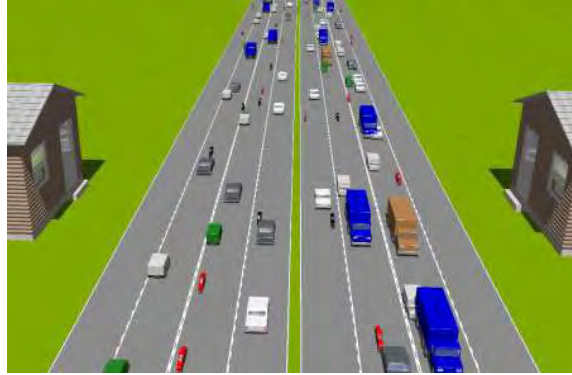
The project team further aims at testing the software by debugging it under vivid environments, and removing errors if any. The software will also be tested in its real-time implementation scenario with the data of some small towns and villages locally so that accuracy of the module could be further improved. At present the user interface is for more of a technical audience. Hence, interface of the module needs to be more user-friendly for which some more work is required. The final aim is to fully automate the procedure thereby reducing the user effort and manual input requirements. When both types of testing would be done, the executable of the software will be made Open Source for every user.

We also aim to approach city authorities, NGOs, Sarpanch of villages, MLAs who are willing to implement 24x7 water supply systems in their areas. We hope to take up some such turnkey projects where we will conduct the survey and provide the authorities a cost estimation of the planned project and user friendly commercially viable tariff structure.

CLUSTER INNOVATION CENTRE

Project Title: SOLUTIONS FOR ROAD MANAGEMENT FROM MODELING AND SIMULATION OF TRAFFIC FLOW ON SELECTED ROADS OF DELHI

Project Code: CIC-102



1. Objective (150 words):

This project aimed to develop a mathematical model for real time simulation of traffic flow of some selected Delhi Roads. Model parameters and rules of vehicular movement were to be determined from the study of synchronous recording of traffic inflow and outflow on selected roads. Statistically, the simulation aimed to correctly predict the out flux of vehicles observed for each segment. After achieving a confidence level, the model was to be used to simulate new traffic flow scenarios on the same road segment by changing road dividers, flyovers, traffic restrictions etc. Origin of specific jams or clustering was to be studied through computer simulation and solutions obtained by testing new layout of the same region or by redesigning the traffic lights.

The methodology planned were

- Mathematical modeling of vehicular traffic flow
- Stochastic modeling
- Image analysis for quantifying vehicular flow density
- Traffic lighting system
- Flyover planning
- Restricted traffic flow for smooth traffic flow

2. Final Findings (300 words):

The following has been achieved:

- Simulation of traffic flow using MATLAB for a ring-road segment that includes two intersections around the "Vishwavidyalaya" metro station.
- Using MATLAB, simulation of vehicular acceleration and deceleration on a ring road frame near south campus has been simulated in MATLAB and visualized in POVRAY.
- Visualization of MATLAB simulation results using the three dimensional ray tracing software PovRay. This is done by generating frames and placing vehicles in them. Each captured frame is then saved in PNG format. Movies were made from these sequential PNG images using separate software.
- A Java applet has been developed to simulate the traffic along major road segments around the University of Delhi, North Campus. In this simulation minimum distance between the vehicles was maintained, acceleration/deceleration rules were applied and vehicles made to stop-go at traffic junctions depending on the traffic light there.
- A traffic light system has been developed to have dynamic synchronization of traffic light with the density of vehicles on different roads of the junction. The algorithm needs to control the traffic light by comparing the traffic

flux and traffic density from different directions, and accordingly switch the traffic signal at different frequency at different times.

f) A model has been developed to simulate public transport along a road segment passing through agatpur village and optimal bus-timing has been determined through simulation. At this frequency the bus service is to become economical while the public will have least waiting time.

3. Learning for Students (200 words):

The students learned a number of new techniques, tools and research methods that includes

- a) Mathematical modeling of traffic flow using MATLAB, JAVA
- b) Field survey techniques, analysis of video data
- c) Image visualization using POV-Ray, MATLAB
- d) Computer simulation of optimal bus route and timings
- e) Stochastic modeling and statistical averaging
- f) Mathematical modeling based on empirical data

The students, for the first time, dealt with a real life problem of this magnitude and tried to solve them using mathematical modeling, computer simulation and matching simulation data with empirical observations. They also learned probabilistic simulation techniques.

4. Benefits to College (100 words):

A traffic modeling and simulation undergraduate research group has evolved out of this project activities. The centre could have recording systems for traffic and high power computers for simulation and graphics. An IT innovation lab has been established out of the equipments and software purchased from this project.

5. Benefits to Society (100 words):

Traffic congestion is one of the biggest impediments in the economic activities of Delhi and in other major cities of India. In spite of well planned and well laid out roads, increase in the vehicular density and lack of traffic discipline often create localized clustering and jams. Flyovers, BRT corridors and synchronous traffic lighting systems are hardly effective. This project work showed that some of these planning can get vital input from computer modeling and simulation. Specific traffic flow scenarios can first be tested on computer models before committing large investment. Public transport routes and timing can be optimally designed through computer simulation. Automated traffic light system that adapts to accumulation of vehicles on one of the roads could also be designed through computer simulation.

6. Further Plans (100 words):

The following activities are planned in future

- a) Incorporating the physics of vehicular motion into the existing simulation model.
- b) Finding the reason behind the discrepancy between simulation and empirical data
- c) More careful data collection of a DTC bus route for testing bus route model
- d) Graphics simulation of traffic flow using MATLAB graphics tools
- e) A new model for BRT

CLUSTER INNOVATION CENTRE

Project Title: IT Model for Parking Space Management: Optimal and Efficient Parking-Retrieval of vehicles

Project Code: CIC-103



1. Objective (150 words):

The project envisages exploring the possibility of installing efficient and optimal solutions that address the parking problems of the city.

The scope of the project is to analyse various options like multi-level parking, valet parking and parking in saturated residential colonies. Through surveys held across Delhi, it was found that most of the residential colonies lack appropriate infrastructure to accommodate the vehicles. For such saturated colonies, a multi-level car parking model has been suggested. Also, in order to increase the efficiency of valet parking systems, an android application has been designed which can be used by the valet to make optimal use of available parking space. Apart from this, simulation of unorganised car parking lots have been created using MATLAB®

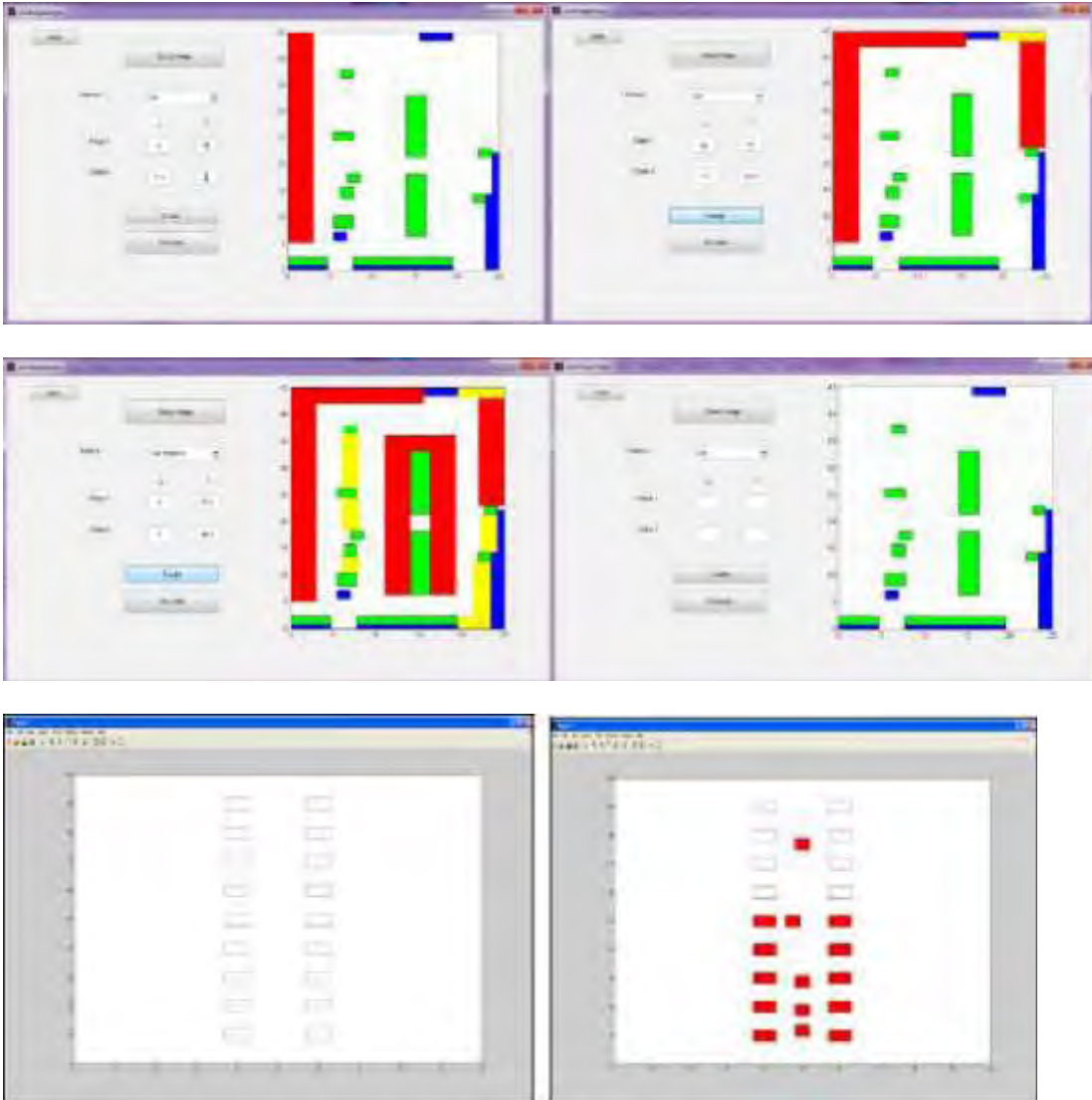
2. Final Findings (300 words):

Delhi University Parking Lot

Delhi University parking lot, near the Rugby Sevens Stadium was chosen to examine the parking pattern and the possibility of coming up with an optimized solution. People randomly park their cars which causes problem for others as it becomes difficult for them to retrieve their cars. So in order to solve this problem, we plan to come up with a solution which will give an optimized solution for parking the vehicles. A team of students measured every part of the lot using a measuring tape and drew a sketch of the area on a graph paper. The final graph, with near precise measurements, was then plotted using grids. MATLAB®



Simulation of this parking lot further organizes it for Bus parking, Car parking and 2-wheeler parking.



Entry-Exit Visualization

Automated Multi-Level Parking for Saturated Residential Enclaves Most of the old residential enclaves have been built with considering every household will need one car space / in some places one scooter. Over the years the numbers of cars owned by residents have increased tremendously. As a result the extra cars had no extra space to park. Hence out of no option cars started occupying the road space of the colonies. This makes these enclaves extremely vulnerable to disasters. The blocked road also affects entry/ exit of vehicles to the enclaves.

Android Application for Parking Lots

The app is a tool that shall help make parking and retrieval of cars from valet parking lots much easier. The valet can simply ask the car owner for how much time he plans to park the car there, enters the value on his app, and tap the slot on the screen where the car has been parked. As time passes, the color of the particular slot on his parking lot map darkens. Having done this for each car that enters the lot, the valet can, by just a glance on his screen, estimate which cars are due to be out in some time, and which cars still have a lot of time to go. This not only facilitates and increases the efficiency of parking new cars as they come, but also eliminates errors due to human memory when allotting new slots to cars.

3. Learning for Students (200 words):

This project was a great learning experience for the students involved. It enabled them to explore and practice techniques which were beyond their regular coursework. They learned to create real time simulations in Matlab ® using probabilistic variables, in order to determine the average time in which a parking lot fills. Few students learned to create *Android* applications for tablets and implementing real time algorithms, which they developed themselves for managing valet parking in smarter way. Some learned to create and render customized 3D models in *Blender* which was used to design multilevel parking for residential areas. They also witnessed the working of an automated multilevel parking lots at Sarojini Nagar and Baba Khark Singh Mark, from the inside. The students learned to recreate the layouts of existing parking lots using manual measurements. They also learned to analyze those layouts using top view photography and video recordings. They explored techniques to combine images from different cameras to get the complete view of parking lots. Students also understood the present scenario of the parking lots visited and collecting data of them by interviewing the users and the employees designated there. Few students also created real life models of parking lots surveyed. They also learned great management skills by making posters, setting up stalls and explaining their work to the general public, during *Antardhwani-the annual cultural fest of University of Delhi*.

4. Benefits to College (100 words):

Via this project, the college got access to research professors, students with special knowledge, and keen work ethic along with college funds which created for a powerful resource. With the funds assigned, the Centre could purchase all the necessary equipment that helped us realize this project. The Centre benefited in terms of expertise and knowledge gained. Faculty could often assign us more complex, authentic problems to groups of honed students than they could to individuals. This made for a more focused peer group working together with the relevant researchers. An IT innovation lab could be established using these funds for further such research. A research group with competence in parking modeling has also evolved out of this activities.

5. Benefits to Society (100 words):

With the rising population and correspondingly, the number of vehicles, more intelligent ways need to be devised to combat the parking problems. Besides the problem of space for cars moving on the road, greater is the problem of space for a parked vehicle. The suggested Multi-Level design for the parking system would provide a great relief to the society with a number of advantages such as optimal utilization of space, security, lower maintenance and operational cost. It would become very comfortable for the driver as he does not have to maneuver his car through the entire parking lot looking for a place to park, nor does he have to attend the car when it is being parked, thus saving a lot of time. The developed android application for the residential and single-level parking systems would be very beneficial for the unorganized parking lots, as it could be used for synchronous real time tracking of the parked vehicles within the parking area and compute the most efficient entry-parking exit scheme for each vehicle. It would help in reducing the chaos and using the existing space in the most efficient manner.

6. Further Plans (100 words):

A very relevant and massive theme such as ‘parking problems of a city’ definitely involves a lot of scope. Some of the future proposals that the students plan to take up are listed below:

1. The team proposes to sync a live-image capturing Quadcopter with special surveillance software that would help authorities to ensure the security and organization of their parking lot.
2. Research on RFID technology, which the team had initially proposed is still in progress. The team would like to implement the technology in a simulated parking lot to ensure the feasibility of use of this technology in actual parking lots.
3. Parking problems in residential colonies require immediate attention. Our team shall endeavor to optimise the available parking space of a residential colony in New Delhi, India. This can be done by allotting fixed positions to cars belonging to the inmates of various houses of the colony. Such measures, undoubtedly, would require cooperation from the Residential Welfare Associations (RWAs) of the colony.

4. The Android application developed for single-level parking lots needs to be developed further for final commercial utilization.

Not just Delhi, but it seems that every city in the world requires appropriate solutions to address their massive parking problems. Developing such solutions requires various skills and expertise which can only be acquired over time.

COLLEGE OF VOCATIONAL STUDIES

Project Title: IMPACT OF SOCIO_ECONOMIC-CULTURAL PROFILE OF STUDENTS ON ACADEMIC PERFORMANCE

Project Code: CVS101



SEMINAR: THE GRAND FINALE

1. Objective:

Students of Delhi University come from diversified socio-economic-cultural (SEC) backgrounds that originate from differences in family income, caste and class, urban and rural areas, type of schooling, parental education and attitude towards education.

- The study ascertains the relationship between academic performance of students in the College of Vocational Studies (CVS) and their socio-economic-cultural positioning in society. Socio-economic status (SES) includes family income of the student, occupation and education of the father and mother. Socio-cultural factors refer to gender, category, religion, rural or urban location and familial attitude towards education.
- The project examines the direction and strength of the relationship between academic performance and attendance. Attendance is a good proxy of psychological, motivational and socio-economic factors and hence is expected to significantly influence academic performance. The study examines the effect of social category as a mediating variable that impacts this relationship.
- The project studies the relationship between English proficiency and Academic performance of undergraduate students.

2. Final Findings:

The study is based on secondary data of the entire student population of CVS as well as primary data on a sample of 514 students from CVS comprising honours and vocational courses drawn from 3rd and 2nd year (4th semester).

- For honours courses the category (Gen., OBC, SC/ST) of the student is a significant variable that impacts the academic performance, besides their class X performance and attendance in college. The adjusted R^2 increases substantially from the first (28%) to the second University exam (44%), denoting a stronger relationship as the level of difficulty increases in the course. A startling finding is the significant influence of class X (and not class XII) results in determining college performance. We can presume that the class X result is a good proxy for the Intelligent Quotient of the student.
- In the vocational courses, it was found that the class X result, attendance, school category (government and others) and rural-urban background explains 35% of the variation in academic performance in the First University exam. Factors such as gender, religion, mother's education, and family income are also significant in explaining some amount of variation in college examination results. The findings suggest a need for a sustained teaching intervention that compensates the low SEC student for his basic class X result disadvantage. Only then can it be said that a low SEC student has equal access to higher education.

- The correlation of (0.56) was found between percentage of attendance and percentage of marks for the entire First year (2011-12) students of CVS. However, a very high rate (35%-47%) of absenteeism (lower than 66.6% attendance) was found among students. Therefore it can be concluded that the overall academic performance in the college can be significantly improved by bringing students to class.
- The correlation of (0.41) was found between English proficiency test scores and final marks conducted on 110 students from CVS.

3. Learning for Students:

The Innovation project has been a great learning experience for the students. Having been a part of a research project and coming from varied disciplines, they were initiated into the basics of conducting research. They engaged themselves in reading beyond their curriculum and interpreting, analysing and assessing research studies from all over the world.

They learnt technical skills like preparing questionnaires, data collection, data entry and making Google spread sheets. They also learnt to analyse data using multiple statistical tools with the help of Microsoft Excel and Stata software.

Participating in the Academic Congress and making presentations in seminars motivated them to write lucidly, compete and excel, going on to win prizes as well.

Organizational, interpersonal, social, interactive, presentation and teamwork skills are what they learnt while managing the stall at 'Antardhwani'. The whole experience of the festival and being a part of the university along with all the other Innovation project teams was one of learning and confidence building.

Overall, students have gained a broader vision and approach towards their future goals and this experience has imparted a tremendous sense of confidence in them. Time management and meeting deadlines has inculcated a deep sense of discipline in them.

Last but not the least, interacting with Prof. B K Khadria of JNU, a brilliant academician was an enriching experience.

4. Benefits to College :

The innovation project has been successful in enhancing the academic environment of the college. It has created interest and aspiration among students towards research.

It has created social capital among the student body, a bond with the institution that has so far been the preserve of cultural and sports activity students. In fact, students are now vying with each other for inclusion in other such Innovation projects in the college.

As a faculty member, the project has shown the feasibility of combining research with teaching as an on-going activity and led to academic enrichment and growth of faculty members.

5. Benefits to Society:

The project has analysed the academic and social environment of an educational institution of higher learning at a micro level. The findings highlight the factors which will help in making higher education truly accessible to low SES students. The study reinforces the role of education in ensuring upward social mobility. Implementation of suggestions made would integrate the low SES students with the larger body of diverse students and ultimately society. Facilitating academic success of low SES students will lead to an egalitarian society that is essential for the progress and development of the country.

6. Further Plans :

Based on our findings, we plan to start a process of integrating the socially and economically weaker students with other students to make teaching more equitable.

In order to do that and develop a sense of belonging among students to a particular course and college we plan to set up a book and film club, organise talks on social awareness, hold interactive workshops, counseling sessions, start support groups and English proficiency remedial classes so that the amalgamation of students is easier.

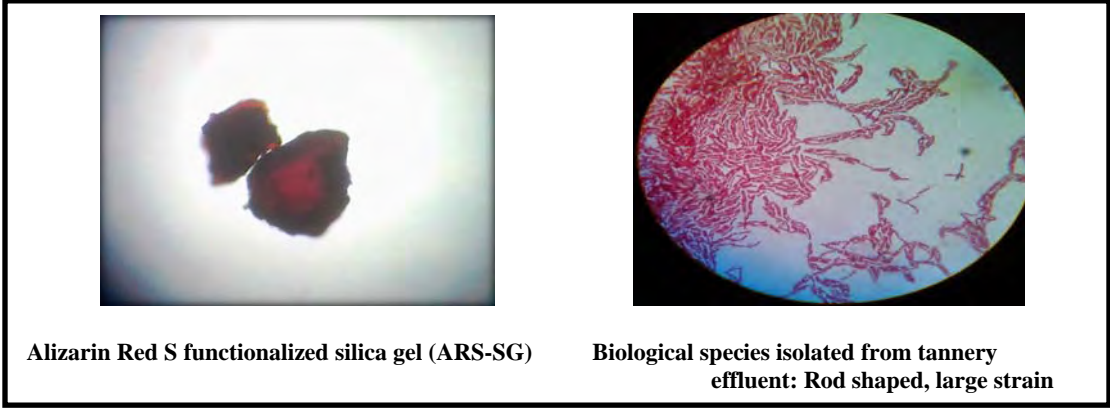
This would bring about a radical change in the mind-set of the students and teachers and help improve the academic environment of the college.

We plan to publish research papers and extend this pioneering study to other DU colleges.

DAULAT RAM COLLEGE

Project Title: Metal scavengers based on functionalized silica gels and microorganisms: Greener and sustainable approach for treatment of contaminated soil and water

Project Code: DR-101



1. Objective (150 words):

The objective was to design and synthesize highly specific, efficient and recyclable metal scavengers.

2. Final Findings (300 words):

Results of functionalized gel preparations:

The immobilization of Alizarin Red S on APSG (aminopropyl silica gel) has been successfully performed. The alizarin red S functionalized silica gel has been successfully characterized. The columns required for carrying out analytical studies have also been designed and employed. The analytical studies have indicated that the resin is selective towards iron and cobalt at different pH values.

Results of metal ion analysis of water and soil near Agra Tannery:

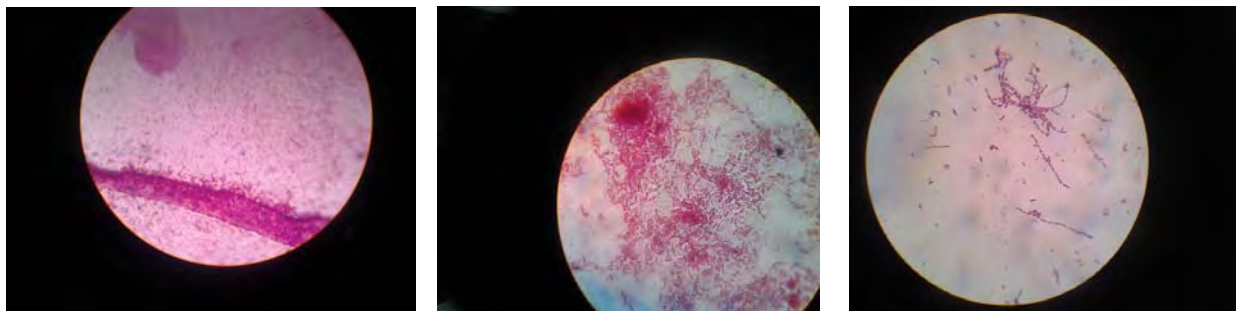
The digested samples from the Agra tannery were analyzed using atomic absorption spectrometer. The results are tabulated as under:

S.No.	Details of sample	Concentration of chromium in ppm
1	Yamuna river sample at Belaganj, Agra	Not detectable (traces of cadmium were found)
2	Sample near the chemical treatment vats	13.53 per gram of the sample
3	Sample from the washing area (of the skins)	155.24 per gram of the sample

Results of Microbe analysis of soil and water from and around Agra Tannery:

Using classical techniques of isolation and analysis (Grams staining) of various samples of bacteria and other microorganisms the following results were obtained-

Yamuna River soil and water (in Agra)



Results from soil and water obtained from Tannery-

3. Learning for Students (200 words):

As a part of their literature survey prior to the laboratory work students learnt that metal contamination is a widespread malaise of certain industrial complexes at various parts of India. Particularly contaminating are the tanning, dyeing, battery manufacturing and thermometer manufacturing industries. This awareness will be an important contribution to their sensitization of environmental pollution and remediation. The students have got an on field experience of tanning industry (from their visit to tanning industry in Agra) where they have seen chromium being discarded at high concentrations in water bodies. They have also learnt to interpret data from techniques like Infrared spectroscopy, thermogravimetry, elemental analysis, atomic absorption spectrophotometer and various microbiological techniques. Further their participation at International workshop of chemistry for sustainable future gave the students an immense exposure to world renowned leaders in Green Chemistry, their work and future prospects.

4. Benefits to College (100 words):

The innovation project reflected an encouraging environment for the students of Chemistry as well as other science streams who were further motivated to work towards maintaining greener methods in laboratory practices. The college has largely benefited from the provision of grant which enabled the faculty for further improvisation of infrastructure and modern techniques. Also, the fellowship given to the students under the project was a source of immense inspiration for other students who aspire to work under further new projects and ideas.

5. Benefits to Society (100 words):

As our sincere commitment to the environment, these metal scavengers will be of large benefit in cleaning the environment from heavy metal ions which are off late becoming a great threat to the surroundings. This can promote further interest of students in working towards cleaning the environment and add to their learning experiences. Being Chemistry and Biochemistry undergraduates such exercises will enhance their image in the society and hence cultivate them into better citizens of our country.

6. Further Plans (100 words):

The most important goals of sustainable development are reducing the adverse consequences of the substance we use and generate. The role of chemistry is essential in ensuring that our next generation of chemicals, materials and energy is more sustainable than the current generation. Worldwide demand for environmentally chemical processes and products requires the development of novel and cost-effective approaches to pollution prevention. The development of green products and processes requires the chemists and chemical engineers become molecular designers and molecular engineers respectively. Keeping the essence of above thoughts in mind, we have synthesized functionalized silica gels and taken up their applications as metal scavengers. Considering the selectivity and reusability of these functionalized silica gels we can further develop sensors which provide a fast, accurate, reproducible, selective, convenient and an economic method for onsite

determination of metal ions. Further, we can also use the functionalized silica gels as catalysts for various organic transformations and as pseudo affinity matrices for purification of biopharmaceuticals.

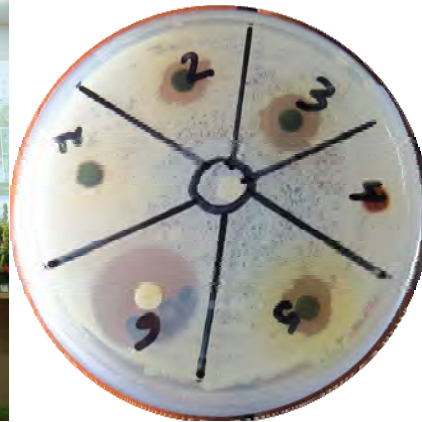
DESHBANDHU COLLEGE

Project Title: Effect of Plant Extracts on the Midgut Microbial Flora of *Aedes aegypti*

Project Code: DB-101



National Symposium Organized at Deshbandhu College



Disc diffusion bioassay of plant extract on gut microbes of *Aedes*

1. Objective:

All arthropod vectors harbour a number of microorganisms in their midgut. These microbes have an impact on the ecology and behaviour of their hosts. It is well known that microbial communities associated with insects can contribute to growth and development, survival and reproduction, community interactions and vectorial competence of the host. In the vector mosquitoes, the presence of midgut bacteria may affect the ability to transmit pathogens. Once a key bacterium is discovered, it may be modified or eliminated from the host vector in order to affect the pathogen development and, consequently, the disease transmission. The objectives of the present research proposal were to assess the antimicrobial activities of plants like *Lantana*, *Ocimum*, *Azadirachta*, *Curcuma*, *Syzygium* and *Catharanthus* against gut microbiota of *Aedes aegypti*. This will help in formulating a sustainable, environment friendly, economical and effective strategy for the control of mosquito by the use of indigenous plants and traditional knowledge.

2. Final Findings:

Antimicrobial activity of five Indian traditional plants such as neem, ocimum, turmeric, clove, aloe and an obnoxious weed lantana was evaluated against the gut microbiota of dengue fever mosquito *Aedes aegypti*. The microbes were isolated from the midgut of lab-reared fourth instar larvae of *Aedes*, and were grown on LB agar medium at an optimum temperature of 25 °C. The bacteria were differentiated based on their colony characteristic such as colony size, shape, opacity, elevation, consistency, and growth. The different strains of gut microbes were isolated, separated and purified by streaking method. Eleven different types of bacterial clones were isolated from the midgut of fourth instar larva of *Aedes*. Light microscopic studies of the gut microbes revealed dominance of Gram-negative cocci. Gram positive cocci and bacilli and Gram-negative bacilli were also identified. It was observed that the bacilli were fast growing and cocci were slow growing on the LB agar plates. The bacterial species were identified by chemical characterization of the colonies using Biolog. Our studies indicated presence of *Bacillus subtilis* subsp. *spizizenii*, *Bacillus cereus*, *Bacillus pumilus*, *Elizabethkingia meningoseptica*, *Exiguobacterium aurantacum*, and other strains of *Bacillus*. Crude extract, ethanol extract and hexane extract of Tulsi *Ocimum sanctum*, Neem *Azadirachta indica*, Turmeric *Curcuma longa*, Lantana *Lantana camara* and Clove *Syzygium aromaticum*, Vinca *Catharanthus rosea* were screened for their antimicrobial activities against these microbes by disc diffusion assay. The results indicated that the plants screened possessed antimicrobial activities. However, response of microbes tested was different to different plant extracts tested. The zone of exclusion seen after 24 hr of incubation in different assays revealed that

hexane and ethanol extracts had the most potent antibacterial activities. It was also seen that ethanol extract of clove was most effective against all the bacteria followed by hexane extract of clove. The extracts of neem, catharanthus and lantana were also shown to have antimicrobial activity against gut microbes of *Aedes*.

3. Learning for Students:

A team consisted of ten undergraduate students of various stream worked on this innovation research project of interdisciplinary nature. During the tenure of project the team members were exposed to various dimensions of the research work. They learned how to access e Journal in a workshop organized at Deshbandhu College. The students participated and delivered talk related to research proposal in the seminar on vector biology and importance of plant products in vector control organized in the college. The student developed interest in reading, understanding, analyzing, and appreciating the scientific literature and research papers. The team members designed experiments based on the skills developed in the classroom. This broadened the horizon of the academics and developed passion to the research among the students. The students learned collection of research data, its analysis, interpretation and presentation. The team members learned to identify different types of mosquitoes and their life stages and understood vector biology. They independently handled research activities such as rearing and maintenance of *Ae. aegypti* colony in laboratory under control conditions, handling the mosquito for the research purpose, and micro dissection of the *Aedes* larva under sterilized condition. The students were trained to microbiological techniques such as isolation, culturing and purification of the gut microbes. The team members prepared plant extracts in polar and non-polar solvents and performed bioassay for screening of plant extracts for their antimicrobial and insecticidal activities. They organized national symposium on vector biology and vector management at Deshbandhu College and also presented their findings in a conference organized by Acharya Narendra Dev College, University of Delhi.

4. Benefits to College:

Innovation research project an initiative taken by University of Delhi provided a platform for a team of ten undergraduate students to interact with interdepartmental faculty members and a mentor and to pursue research work in Deshbandhu College. This initiated research activities in the college at undergraduate level. At present many more students and teaching faculty members are keen to pursue research work. By this project we imparted our research skills to the students. In Deshbandhu College we have established infrastructure and paraphernalia for the research in mosquito biology and management. The college has facility for rearing and maintenance of *Ae. aegypti* under control conditions for the research purpose. Deshbandhu College also organized one day national symposium on vector biology and vector management under the auspices of innovation project. The aim of the symposium was to make the student aware about the latest research by discussing science with experts in the field of vector biology and management.

5. Benefits to Society:

Aedes aegypti is a primary vector for viruses that cause dengue fever, dengue haemorrhagic fever, chikungunya and yellow fever. It is widely distributed over large areas of the tropics and subtropics. According to recent reports of WHO about two-fifths of the world's population are now at risk of dengue and the only way to prevent dengue virus transmission is to control the disease-carrying mosquitoes. Spraying insecticides is widely used to combat mosquito population. However, the continued and indiscriminate use of chemical insecticides in agriculture and public health programmes has caused problems like insecticide resistance, resurgence of pest species, environmental pollution, toxic hazards to humans and other non-target organisms. The study undertaken in the present research proposal will provide sustainable methods of mosquito and dengue management using indigenous plants and traditional knowledge.

6. Further Plans:

We intend to continue the present research work for molecular identification of gut microbes of *Aedes* and chemical analysis of plant extracts by gas chromatography mass spectrophotometry GCMS. The effect of plant extract on

reproductive behaviour of *Aedes* mosquito will also be studied. The present studies can be extended for the research work on different mosquito species in different regions of Delhi and National Capital Region.

DESHBANDHU COLLEGE

Project Title: Qualitative analysis of water and gaseous pollutants from different zones of NCR region and designing some tools and techniques to eradicate them by using absorption and adsorption techniques involving biodegradable materials

Project Code: DB-102



Students working in laboratory.



Visit to National Physica Laboratory

1. Objective :

To identify and analyse the pollutants in ground water and air sample of different regions of NCR. To eradicate them by using absorption and adsorption methods using biodegradable materials. Pollution is defined as the addition of harmful gaseous, particulate matter in case of gases and chemicals and biological waste in case water that cause harm or discomfort to humans or other living organisms or disturbs the delicate equilibrium of the environment. The major reasons for this are: excess usage of underground water resource, deforestation, increasing population, high industrial development, population explosion, climate/environment change, high water demand, lack of knowledge of water recycling and judicious usage, high consumption of fossil fuels and change in lifestyle in metro cities. An attempt was made to analyze and make water portable for a better society and designing some tools and techniques to eradicate them by using absorption and adsorption techniques involving biodegradable materials

2. Final Findings :

We have collected ground water samples from various regions of Delhi and NCR covering Faridabad, Ghaziabad, Noida, Bahadurgarh, Nangloi, Maharani Bagh, Gurgaon and Surya Vihar followed by their physical analysis which included measuring the pH, temperature, alkalinity, hardness, turbidity, TDS (total dissolved solids) and detection of toxic metals like Pb, Cr, Cu and Ni. We performed the biological tests also and we counted the colonies also. We observed that the result obtained from the water sample are within permissible limits. Then according to our survey and results we found that Yamuna water consist of so many toxic element but nickel, chromium and lead are in excess amount which is carcinogenic and toxic to our health. So we prepared the lead solution, nickel solution and chromium solution in our laboratory and we plot the graph between concentration v/s absorbance by the help of Jenway spectrophotometer and in these solution we add the almond peels and the groundnut peels in these solution, we found that the lead adsorbed by almond peels is about 79 percents, and Chromium 43% and nickel 25% by the use of UV spectrophotometer. Then the mentioned procedure was followed with Yamuna water and the concentration of nickel, lead and chromium reduced from their initial concentration.

3. Learning for Students :

From these types of project Students can learn so much things about the surrounding and environment, that can't be learnt in college laboratories. The student can handle the instruments like spectrophotometer, TDS, Autoclave,

laminar hood and many more by its own. They can able to find their problem and solve them by the help of research papers and invigilators . It is also beneficial to college students by projects presentation, seminars. When the students get good findings which is beneficial to the society, even they more excited to extend that result. The students attended “ Antardhwani “ and presented their stalls, from these things students got open in public and remove its fear in speaking in public areas. They presented their studies in national and international seminars. They won second prize in National seminar with the cash prizes 5000Rs. And that time students get more excited and even it college students get motivated to come up and participate in these projects.

Techniques learnt by the students are:

- Sampling of water
- Spectrophotometer techniques
- Use of turbidity, pH ,TDS and Conductivity meter
- Process of growing bacteria by laminar hood and autoclave instruments
- Total bacterial count
- To study the adsorption of metal by biomass
- Working with various computer software
- Preparation of power point presentation and report
- Working of Distillation Plant
- Weiquing techniques by electronic
- Filtration by vacuum pump
- Preparation of biodegradable material

4.Benefits to College (100 words):

The project given by the University of Delhi gave a wonderful opportunity to the student of Deshbndhu college to get involved in the analysis and experimental based project in which the student were able to participate in research project. The fund given for the project enable us to buy laboratory instruments, chemicals and glassware to carryout experimental work which were not possible without these requirements. Through the project the college got fame in the field of research work and project work going on in the campus. Now the College have facility to run such project at high level also .The purchased glassware and instruments will help in next coming project to carryout work in labs. The project work encouraged the college to take more projects in interdisciplinary studies also. The college students are now fascinated in field of research and want to go in the field research work to make it as a career.

6. Benefits to Society :

From these project the society get the benefit from our result , As from our result the almond peels adsorbed about lead 79% ,Chromium 43% and Nickel 25% concentration .These types of metals are very toxic and dangerous for our society which may cause cancer, Ulcar, asthma, typhoid, jaundice and even death .These can be adsorbed by the waste product and the water can be purified. Through this process we can treat the waste product for purification of water which is very eco-friendly. From these project students get motivated and will effort to develop some new techniques for the development of Science and technology.

7. Further Plans (100 words):

We have decided that we want to continue the project and we will implement in different location like Haryana, Punjab, Himachal Pradesh and many more with different biodegradable waste materials like maize, zwar, aqua , peels of banana , apple and many more . We will try to make the instrument in better way and can take less time as comparatively to our old biodegradable instruments. We will try to patent that instrument such that society will adopt this instrument and enjoy the purified water with their waste materials.

DEEN DAYAL UPADHAYAYA COLLEGE

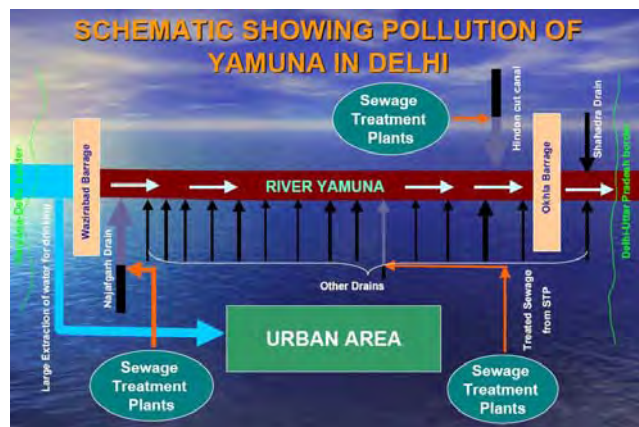
Project Title: Studies on Water Pollution of River Yamuna in Delhi

Project Code: DDU-101



1. Objective :

The entire Yamuna river right from the origin to confluence with the Ganga and its tributaries are subject to human activities, storage discharge without treatment and industrial pollution, which affects its water quality. Yamuna enters Delhi at Palla village and at Wazirabad is trapped through barrage for drinking water supply to urban agglomeration of Delhi. About 22 km. river stretch between Wazirabaad and Okhla barrage in Delhi is severely polluted. So, we planned to study the water pollution between this stretch and we selected four locations i.e., Wazirabad barrage, Geeta colony bridge, Nizamuddin bridge and Okhla Barrage to collect the water samples for our study. Since this project was primarily designed for undergraduate students , we planned to study those parameters of water quality which can be easily measured/ studied in our laboratory with the help of facilities available in the college or with our mentor’s laboratory. The primary objective of the project was to inculcate the scientific temper among the undergraduate students and to motivate them for higher studies in science. We undertook the measurement of parameters like temperature, pH, conductivity, alkanity,presence of carbonate / bicarbonate , chloride,fluoride, sulphate, silica, phosphate ions, total hardness, DO, BOD, COD, coliforms, etc. at various places to assess the quality of water. We have collected samples before monsoon, after monsoon, after Deepawali/chhath pooja and after Holi to assess the change in water quality parameters. We have also tried to study the economic factors responsible for water pollution of river Yamuna in Delhi.



2. Final Findings :

Water samples were collected from four specific locations, i.e.,Wazirabad Bridge, Geeta Colony Bridge, Nizamuddin Bridge and Okhla Barrage at an interval of 3-4 months to check the variations in values of water quality parameters. The collected samples are preserved either in ice or by chemicals depending upon the parameters and transported to the laboratory for the analysis. Measuring of few parameters like temperature, pH, conductivity and DO have been

carried out at the sample collection site. Analysis of most of the parameters have been carried out using standard methods (APHA,2012).

As reported by the CPCB studies the water quality of River Yamuna in terms of organic pollution had been quite good from origin till Palla (the entry point of Yamuna in Delhi). Though there was a gradual increase in BOD from river stretch between origin to upstream Delhi. However, the average BOD values have been found to increase significantly between Wazirabad and Okhla Barrage.

pH : The pH in the entire Yamuna stretch in Delhi varied from 7.27 to 8.21. The pH in the River Yamuna has remained within prescribed limit,i.e., 6.11-9.39.

Conductivity: The conductivity in the River Yamuna stretch in Delhi between Wazirabad bridge and Okhla Barrage varied between 358 to 1780 umho/cm. Whereas it varies from 45 umho/cm(Yamuntri) to 2290umho/cm (Agra down steam) as reported by CPCB study,2005.

Dissolved Oxygen(DO): The availability of dissolved oxygen (DO) in River Yamuna depends on various factors, one of them is water temperature. So, the DO depends on the time of sampling.The DO level in Yamuna river fall significantly after Wazirabad. Most of the time DO level has been found nil at most of the sites. THE DO level slightly rises during monsoon/water supply from Haryana.

Biochemical Oxygen Demand (BOD): The BOD level in Yamuna from its origin till Palla has been reported (CPCB study) in the range of 1-3mg/l.However, the BOD level rises significantly downstream to Wazirabad barrage. At Geeta colony bridge BOD level has been found in the range of 4 - 62mg/l. At Nizamuddin bridge the BOD level was found between 3 and 56mg/l. The BOD level was comparatively low at Okhla Barrage varying between 2.3 to 47mg/l. The possible reason for this trend may be that Okhla barrage converts Yamuna river into a big reservoir, which acts as an oxidation pond. Another reason may be that fresh water is received from Hindon cut canal.

Chemical Oxygen Demand(COD) : Main contributor to the COD level are waste water discharge and excessive presence of algal mass. The COD level increased drastically downstream Wazirabad barrage. The higher level of COD was recorded at Geeta Colony Bridge, which decreases slightly at Nizamuddin Bridge. The COD level was surprisingly low at Okhla Barrage, which may be due to addition of fresh water from Hindon cut canal and decrease in algal mass.

Coliform/E.Coli Study: The presence of total coliform and faecal coliform were determined qualitatively and quantitatively using Merck ready to use kit.The qualitative study indicated the greater presence of coliform at Geeta Colony bridge, which decreased towards Okhla Barrage. The quantitative study could be carried only twice and the values recorded were found much higher than the permissible limit(TC,5000/100ml,MPN).Total coliform have increased significantly (CPCBstudy,2009;9.7Cr/100ml,MPN) at all sites and were recorded almost 20-30 times higher value at Geeta Colony bridge and Nizamuddin bridge, which may be due to addition of untreated waste water from Najafgarh and Shahdara drains.The presence of E.Coli has been determined using Mac Conkey agar medium and prescribed method.The pink coloured colonies were reported having around 1100 E.Coli/ml,MPN.



Fig.1:Coliform Test(Qualitative)
Fig.2:E.Coli Test

Other Physicochemical Characteristics :
The other water

quality parameters were also determined during the study throughout the year since June,2012. The results of these parameters are listed in Table 1.The chloride was recorded between 17mg/l and 211mg/l(Geeta Colony bridge). Fluoride values varied from 0.04mg/l to 0.34mg/l(Geeta Colony bridge). Higher values of nitrate and sulphate were recorded at Wazirabad. At Nizamuddin Bridge the higher values of phosphate, carbonate, bicarbonate and total hardness were recorded.

Table 1: Water Quality Parameters and their minimum and maximum values

S.No.	Parameter	Analysis Method	Min. Value	Max. Value
1.	pH	pH meter/water analysis kit	7.27	8.21
2.	Conductivity (umho/cm)	Conductivity meter/water analysis kit	358	1780
3.	Chloride (mg/l)	Titrimetry(Argentometry)	17	211
4.	Fluoride(mg/l)	Ion Selective Electrode	0.04	0.34
5.	Carbonate(mg/l)	Titrimetry(EDTA)	102.85	510
6.	Bicarbonate(mg/l)	Titrimetry(EDTA)	122	1073.60
7.	Total Hardness(mg/l)	Titrimetry(EDTA)	120	352
8.	Sulphate(mg/l)	Spectrophotometry	30.84	110.72
9.	Nitrate(mg/l)	Spectrophotometry	0.43	7.02
10.	Phosphate(mg/l)	Spectrophotometry	2.14	52.66

Economic Factors of water Pollution of River Yamuna:

We have also carried out study to find out the reasons /factors responsible for water pollution of river Yamuna in Delhi. In the stretch of river Yamuna in Delhi between Wazirabad bridge and Okhla Barrage, we found about nineteen drains falling into the river, out of which Najafgarh drain and Shahdara drain are the main contributors of pollution. The waste water mostly untreated is added through these drains. Moreover, the inhabitants reside in the riverbed near Geeta colony bridge, Nizamuddin Bridge and Okhla Barrage adding their waste into the river. Near Geeta Colony bridge we found that the people have occupied a major portion near its east bank and used bhatti to wash the clothes. A large portion of river bed is used for growing vegetables near Nizamuddin bridge and Okhla barrage. They use this polluted water for irrigations and use fertilizers, pesticides etc for early growth of the vegetables. This adds a major junk of pollutants into the river. We noticed that entire Yamuna stretch is covered with water hyacinth which is supposed to absorb some heavy metals, but simultaneously does not allow growing the other water plants. Other contributors to the pollution of river Yamuna are idols immersion during Durga festival & throwing pooja materials, washing of clothes, cattle wading and defecation in open at the riverbed of Yamuna. The measures/efforts to keep clean the river Yamuna must be done by the Government and common people; otherwise this lifeless drain which was a river will become history in coming years.

3. Learning for Students :

We have got the feedback of all the students engaged in the project and everybody has shared his experiences. Following is the experiences of one of the student.

Working in this Project was totally a great pleasure to me through which I was motivated towards scientific studies and was a great experience for me. In this project, I came to know how a scientific study, for both aspects of Biology and Chemistry, to analysis water pollution is carried out. I with my colleagues analyzed the various parameters like temperature, pH, conductivity, chloride, fluoride, phosphate, sulfate, silica, nitrate, carbonate, bicarbonate, total hardness, DO, BOD, COD and to assess the the presence of bacteriological contaminants in the water samples of River Yamuna that gave me a better knowledge and understanding about a research project and about the worst condition of River Yamuna as well. Being a Botany (H) student, especially, Now I have a better knowledge about culturing bacteria in different media - simple Agar and Macconkey agar medium (for isolation and differentiation of non-fastidious gram-negative bacteria like E. coli), how to make a perfect and

sterilised conditions while dealing with culture, also came to know about ReadyCult coliform test (for rapid detection of coliform in a water sample), came to know how to handle and use the various Instruments and Equipments. I got a chance to work in the research Laboratory of Dr. Dinesh Mohan, Associate professor, School of Environmental Sciences, JNU, during the project that adds a great experience in my studies at this level. Though, many studies are being done and have been done by many governmental and non-governmental organizations to check the water pollution in River Yamuna, but in this Project I with my colleagues analyzed the water samples taken from different locations of River Yamuna in Delhi and seasonal variations were checked. After our findings, I can say that River Yamuna's water is highly polluted, not fit for drinking, bathing, even for growing vegetables on the River bank. The sacred River Yamuna is now in a critical situation that should be protected and conserved. I have learnt a lot through this project.

4. Benefits to College :

This initiative of awarding research project to college teachers is introduced for the first time in the history of University of Delhi. Moreover, the involvement of undergraduate students in these projects is of prime importance to introduce the research culture among the students. We have engaged the students from Chemistry and Botany Honours to inculcate the scientific temper and interest in research. The research culture is developed by awarding these projects in colleges. We have purchased sophisticated water analysis kit from Merck, which can be used for basic research by chemistry and other departments for research projects related to water analysis. We have also standardized the analytical methods for water quality parameters using APHA methods from the book we have purchased from the grant which may be an asset for the college and can be used for reference by colleagues. Above all the college teachers have started to think about involving themselves in some research in their respective fields.

5. Benefits to Society :

Many studies on water pollution have been carried out and the results were published in journals and newspapers, but still the common man is not bothered about the pollution. The society at large must be made aware of harmful effects of pollution on their life and specifically the water pollution. The rich people are not affected much by water pollution because they can afford their ignorance, they can purchase mineral water, water purifiers etc. They can also take precautions to medicate themselves but the poor people are worst affected. The policies are made by the rich class and they can't think until they are affected. So, these types of studies must be conducted and published to spread awareness among the common people. Our study was published in Mail Today and widely discussed in media to make aware the harmful effects of polluted water of river Yamuna on vegetables. This study which was of common nature may be beneficial for society if the students who were involved in this project spread awareness among the common mass.

6. Further Plans :

We have conducted our study on water pollution of River Yamuna in Delhi between Wazirabad Bridge and Okhla Barrage at four locations. To get the complete information's on water pollution of river Yamuna in Delhi we have to carry out the study right from Palla till Okhla Barrage. We should also take into account the water added by various drains into Yamuna. We have planned to continue our study and we will study a large number of water quality parameters right from Palla till Okhla Barrage. We will also take into account the presence of heavy metals in water of Yamuna and to identify the source of these metals. We would like to focus our study on DO, BOD, COD and presence of coliform bacteria, which are of prime importance to judge the quality of water.

DEEN DAYAL UPADHYAYA COLLEGE

Project Title: A study of physio-neuro- psychological aspects of archers in Indian perspective

Project Code: DDU-102



Archery in India: Flying High

1.Objective (150 words):

The main objective of the study was to find out the significance and obstacles of Physiological, Neurological and Behavioural Aspects of Archers in India based on Competitive anxiety, Blood Pressure and Nerve conduction velocity of archers.

A hypothesis was made that there is no relationship between blood pressure, nerve conduction velocity and competitive anxiety among Archers during competition. The Primary data was collected keeping in view the research objectives and hypotheses to be tested. Standard questionnaires were provided to respondents selected for the study. EMG device and BP measurement device were used to measure nerve conduction velocity and Blood Pressure respectively.

2.Final Findings (300 words):

In our study, we correlated the physiological changes with the mental state of an individual participant in the competition. As Archery is the mental game it has less to do with the intense physical exercise comparing to sports involving complete body.

Heart Rate is considered to be an important measure of the physiologic and mental state of any sportsman. It helps them to meet the challenge of the competition ahead. The difference exists in the pattern of changes brought about in Heart Rate amongst Elite, Mid-level and Novice Archers.

The findings in our study showed that the Elite Archer by way of intense training adapted to meet the physical challenge but could not avoid the mental anxiety before the competition starts in order to give their best performance. At the same time Mid-level Archer tries to prove them while some element of mental component affects their physical effort as well. The Novice Archer who is little trained would shoot with his experience in training with little mental management.

The Systolic component of the blood pressure was taken into consideration that is responsible for the change brought about by anxiety. It was shown that the Elite class Archer have a better and quick control over BP than the mid-level and Novice archer suggesting their ability to adapt to the situation

We performed physical tests by taking Heart Rate and Blood Pressure into consideration in our studies. We found that the variation amongst the Novice, Mid-level and Elite Archers in Heart Rate did not have a direct relationship with their performance as psychomotor auto regulation takes into account suggesting the physical factors are dependent on various other factors than the training and skill of the shooters for which coach gives training. Mental regulation is done by individual sportsman by way of her/his experience.

3. Learning for Students (200 words):

There are numerous benefits for undergraduate students who get involved in research. Research experience allows undergraduate students to better understand published works, learn to balance collaborative and individual work, determine an area of interest, and jump start their careers as researchers. Through exposure to research as undergraduates, many students discover their passion for research and continue on to graduate studies and faculty positions. By engaging in research firsthand, students find it easier to understand the rationale underlying others' research. Additionally, undergraduate research can provide students with an ongoing source of one-on-one mentorship that is otherwise unheard of in the undergraduate curriculum.

In addition, graduates from higher degree by research programs are highly employable, across all fields of study.

Students got an option to:

- Work one-on-one with faculty;
- Contribute to the creation of new knowledge;
- Sharpen their critical and analytical thinking skills;
- Complement and extend the classroom learning;
- Enhance their confidence in their abilities;
- Increase ability to think, learn, and work independently;
- Strengthen oral and written communication skills;
- Group work, time- and resource-management and data handling;
- Enhance their resume;
- Prepare for graduate-level study; and,
- Explore their interests and clarify their career goals.

4. Benefits to College (100 words):

Research relationships benefit both undergraduates and faculty, develop over time, and enable:

- Commitment to scholarly development; and,
- Engagement in collaborative inquiry.
- Positive environments, which encourage questions and foster curiosity;
- Consideration of new or alternative approaches;
- Constructive, reciprocal feedback;

And often provide:

- Guidance for the undergraduate in making important research or related career decisions;
- Oversight of the undergraduate's research methods and practices;
- Up-to-date knowledge of available resources and funding;
- Support in sharing and publicly presenting research;

All of which supports the enjoyment of active participation in research.

5. Benefits to Society (100 words):

In recent years, there has been a noted policy shift towards measuring the value and benefit of university-based research. Rather than measuring inputs (e.g. human, physical, and financial resources), the emphasis has switched to looking for outcomes (the level of performance or achievement including the contribution research makes to the advancement of scientific-scholarly knowledge) and ultimately to requiring an impact and benefit (e.g. the contribution of research outcomes for society, culture, the environment, and/or the economy). This marks a move away from seeing higher education as a vehicle of human-capital development to being an arm of economic policy. Drawing conclusions about the value of research based on its social impact and economic performance is complex. Knowledge transfer is the exploitation of research findings to benefit society – financially, or regarding health, the environment or public services.

6. Further Plans (100 words):

No research work, however, is complete to its fullest extent – it's an ongoing process. The generalizations occurring from this study are more conducive and are based on the perceptions of a limited to a particular group of archers who were included. The importance and utility of this small effort lies in its practicality and if this work is able to stimulate further research in this area, it would achieve its purpose.

The present study has certain limitations that need to be taken into account when considering the study and its contributions. Based on the current results, it is recommended that sport psychologists, sport counsellors, and coaches use the findings and appropriate training programs can be designed to help athletes acquire suitable coping strategies so as to reduce their anxiety levels and enhance their performance.

DELHI COLLEGE OF ARTS & COMMERCE

Project Title: Symphonies of Life in Nature and Environment Folksongs of Punjab, Jammu and Kashmir

Project Code: DCAC--102



Workshop on Kashmiri Folksongs with Dr Muzaffar Ahmad Bhatt and Ms Shazia in Progress, Srinagar, Kashmir

1. Objective (150 words):

The focus of the Innovation Project was Student Centric and its main aim was to introduce students, through their own hands-on experience, to methodologies of research. The subject chosen was the creation of a knowledge resource regarding the cultural ethos, the lived experience and the social history as expressed through the folksongs of Punjab, Jammu and Kashmir, and their relativity to Nature and Environment. Our objective here was to create an awareness in the students regarding the diversity of parallel cultures along with the thread of commonality amongst them, as seen through folksongs of neighbouring regions. Further, they could relate to the richness of lived experience by interacting with people in their own milieu, in their own environment, and not through books but an 'out of the box/classroom' experience. Also our objective was to inculcate in them a sense of participation in the celebration of life as reflected in these folksongs.

2. Final Findings (300 words):

One of the major findings of the team was that the use of language becomes crucial in preserving folksongs since, with change in language usage, certain genres and songs gradually go into oblivion. Folksongs follow the language in use by the masses as they are sung by the common people and handed down from generation to generation. They have their own dynamism as they adapt to the changing usage of idioms, tones and pronunciation.

Moreover, folksongs were found to be connected to the people's own lifestories. Memories of childhood and of the mother singing with them played a major role in their interest in folksongs. The elders also went into the memories of their past, their younger days when modern modes of entertainment were not available and singing of folksongs was a means of relaxation and bonding at communal gatherings. Along with this, there was also an element of nostalgia when they talked of the past with its practice of sitting in the open in the evenings and singing songs which is no longer a practice.

The diligent case studies of the three regions made by the team also dispersed the different memories associated with the life-patterns and history of the specific region. In Punjab the longing for the western Punjab now separated by partition of the country, was a common memory, in Jammu it was the simplicity of life and the innocence and modesty that characterized the womenfolk whereas in Kashmir it was the desire for union, especially spiritual union and the integrity of the people that is missed.

The individual consciousness of the cultural ethos and traditions of the community is very important for treasuring this rich heritage of folksongs. Though passed by word of mouth and picked up by recurrence, they are full of wisdom as well as reflections on the social condition, especially that of women going into their in-laws' home and the treatment that they receive, their memories of their parents' home and their looking for support from their husbands who are often unsympathetic to their positioning in the family.

There are also reflections on ecology and the significance of its sustainance for the survival of the human beings. There are also folksongs which advise people to rise beyond barriers of religion and just be good human beings.

The most prominent of the findings was the desire of everyone interviewed that the folksongs must be preserved and revived. The common voice of opinion across all three regions was that folksongs must be given space in public dominion through the practitioners and also that interest of the youth must be revived and propelled towards an interest in the folksongs.

3. Learning for Students (200 words):

The project has enhanced the essential student learning capabilities outside the walls of the classroom. Timely funding has made it possible for attempting things that were not possible before. It has essentially added an effective learning tool to their C.V., making it possible to be recognized in the future. The project has facilitated easy access to media personalities/academics who have influenced the student group in an informed way, enhancing their research methodology. The project emphasized the importance of interpretation in research .It also developed the skill of analysis of the data collected through interviews.

Not only has this been a once in a life time experience for them, but it has been wonderful to actually meet people at the grass root level, to have a first hand experience of such an important field of folklore adding to the knowledge of folk music. Working on the project 'Symphonies of life: Nature and Environment in Folk Songs of Jammu, Kashmir and Punjab' has helped not only to break barriers of regional differences but has also brought close intricacies between the culture in these particular regions to the better understanding of the entire group. During the course of the field trips, particularly to Jammu, they had the opportunity to meet several eminent personalities like-Padmashree Pradyumann Singh and learnt to conduct a formal one to one interview with him and with Dr. Rama Sharma. They also had a very lucid and enlightening session with honorable Dr. Karan Singh, member, Rajya Sabha and an authoritative voice on Dogri folk songs and culture.

Being actively involved in the research also contributed to their photographic skills, breathing color into this project. This project has not only inculcated a better understanding of intense connections between nature and folksongs but has also honed their skills to carry forward the knowledge of efficient research for future prospects.

4. Benefits to College (100 words):

The new FYUP introduced at the undergraduate level with its emphasis on cultural studies, this Knowledge resource creation can be used as study material and it can be carried forward as further research avenues open up. An extensive list of Resource Persons has been made available to pursue further research. In the Documentary submitted with the Final Report, an extensive footage of Audio-Visual documentation is provided which shows a wide range of interviewees – right from the grassroots level to practitioners, to academicians to renowned and recognized scholars and writers.

The students in the College have benefitted from this primary research and at Antardhwani 2013, the College became well known by this project.

5. Benefits to Society (100 words):

The main point is that we have brought this subject of folksongs into public space and have created an awareness of our cultural roots. The dynamics of face to face, one to one interaction, with folksongs being sung by practitioners, has much more impact on the awareness of people than simply listening to a CD. Antardhwani2013 provided a platform for the dissemination of the knowledge creation by research and interaction, bringing these singers to the center from the margins. A very significant question asked again and again was how to carry this work forward, how to make people again develop interest in the lilting rhythm and the simple but profound emotions of folksongs.

6. Further Plans (100 words):

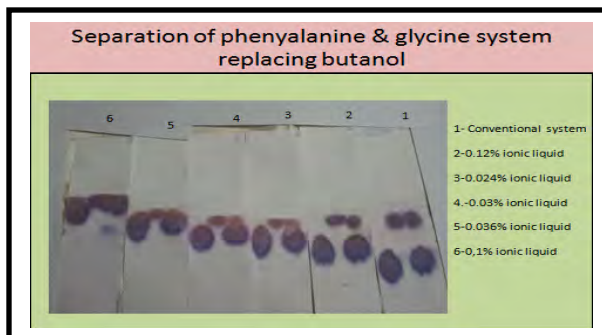
A two-fold further plan is given below. It merits consideration in view of the compliments received from the experts and Folksongs Veteran Dr. Karan Singh, Chairperson, ICCR.

- To bring out a pictorial book on Folksongs based on the research findings by the team DCAC-102, and pictures taken by our team of students. This will be a primary research material for use by the academics and research fellows.
- The estimated cost of 50 copies (120 pages, 80 pictures) of the proposed book will be around Rs.85,000/- . Funds for the book are left over from the grant of Rs ten lakh allotted for the Project and it would be published in four months time.
- To carry out this seminal research further to adjoining areas of Himachal Pradesh and Laddakh, in response to the recommendations received from reputed scholars in the field who audited our work.

DYAL SINGH COLLEGE

Project Title: Synthesis and Characterization of Ionic Liquids for their use in Chromatographic Separation of Amino Acids and Sugars

Project Code: DS 101



1. Objectives (150 words)

General health hazards associated with solvent exposure lead to various health issues including toxicity to the nervous system, reproductive damage, liver and kidney damage, respiratory impairment, dermatitis etc. Many solvents can lead to a sudden loss of consciousness if inhaled in large amounts. The used organic solvents reach the underlying soil and cause soil contamination. So steps should be taken to minimise the exposure to VOC's. Efforts are needed to explore & devise methodologies in reducing these levels. Industries are working in developing in plant control measures and we as R& D scientist can work in direction of controlling these levels by developing newer substituents or work in the direction of minimizing use of organic solvent systems to curb the generation of these volatile organics.

The use of paper chromatography in the separation and identification of amino acids and sugars is of paramount importance. It is an essential technique which is mainly carried out by undergraduate students in organic and biochemistry labs. Conventionally the solvent systems used are based on primary alcohols and acetic acid mixtures in water. These solvents are flammable and have low vapor pressure. Inhaling of these solvents leads to harmful effects on human health as well as the environment. Thus we proposed to design ionic liquid based solvent systems which could be safer and environment friendly.

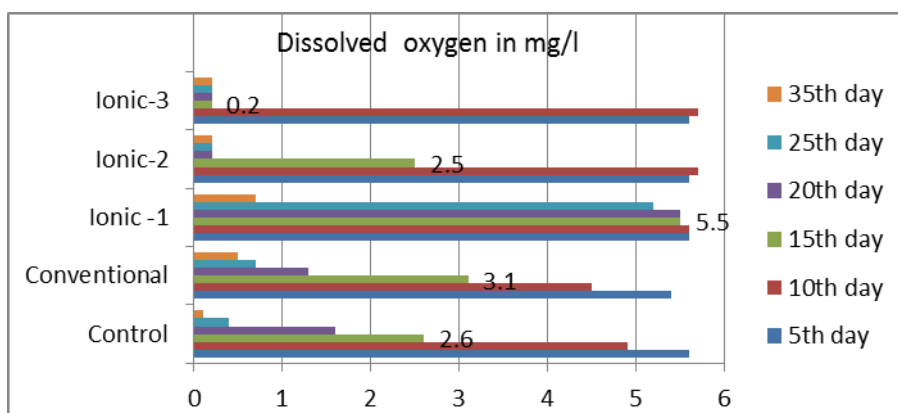
2. Final Findings (300 words)

For carrying out chromatographic analysis and separation we have been able to replace the conventional solvent system by a different class of solvents known as ionic liquids. These are nonvolatile and do not contribute to the generation of VOC's. We have been able to replace 25% -30% of the conventional solvents with 0.024% of the ionic liquids.

- On replacing both butanol & acetic acid much better results were observed. Combinations of phenylalanine and glycine; phenylalanine & lysine ; phenylalanine & serine; phenylalanine & aspartic acid have been observed.
- On increasing the concentration of ionic liquid in these systems have resulted in improved R_f values and also separations unlike the only butanol system.
- It is possible to replace both butanol & acetic acid with low concentrations of ionic liquids.
- Ionic liquids used for carrying out the chromatographic separations of amino acids using paper and thin layer chromatography are:
 - 2-Hydroxyethyl-trimethyl ammonium L+ lactate
 - Triethylmethyl ammoniumdibutyl phosphate

- Choline acetate
- 1-Ethyl-3-methyl imidazolium dibutyl phosphate
- 1-Ethyl-3-methyl imidazolium lactate

As far as the environment friendliness is concerned we have carried out studies by disposing these in both soil & water. Plant growth has been not affected by the disposal of these innovative systems in comparison to the conventional systems. In case of disposal in water it has been studied that the level of dissolved oxygen, an important parameter for aquatic life has been observed to be not affected.



Effect of designed solvent systems on plant growth and water

3. Learning for Students (200 words)

As far as our students are concerned, setting up of a new research lab by themselves, conducting scientific literature searches, set up of a new research lab by themselves, reading, interpreting and extracting information from journals and articles relevant to the project, interpreting results, reaching conclusions and generating new ideas based on results, interacting professionally with students and professors within as well as from different schools (students got a chance to attend the Academic Congress, organized by University of Delhi) and communicating results orally and in writing to the mentor, preparations for poster presentations at college seminars at DU Colleges and journal article preparation for publication are the new areas they got full exposure to thus enhancing their learning experiences. It gives us a feeling that we are in the right direction utilizing the funds received and preparing our students for a better future in the field of scientific research.

4. Benefits to College (100 words)

A well equipped chemical laboratory has been set up in the college as “Innovative Lab” for undergraduate students to have a firsthand training of the handling of equipments and experience the innovative experiments related to the Innovative Project. It has created an altogether different atmosphere in the college motivating other UG students also to have an innovative approach towards the curriculum and work in a cordial

environment as students from different courses are involved in the project. All the facilities present in the Innovative Lab are an asset to the college that may be used by other UG or research students.

It would help to develop and strengthen the research links between colleges, universities and business to accelerate the development of promising technologies and promote their commercialization into the market. Ultimately it proved helpful in improving the academic background and intellectual property of the college.

5. Benefits to Society (100 words):

Thus it is important to work on developing solvent which have low volatility and flammability as in the R&D labs at University level and even at the undergraduate level, organic solvents are used for carrying experiments in the area of analysis, synthesis and separation and students are not aware of the level of exposures thus causing health hazards.

This would thus help in minimizing risk factors involved during the experiments being carried out at the undergraduate level. The ionic liquids thus developed have low volatility & flammability resulting in safer and cleaner environment. This would thus result in saving of certain petroleum resources by minimizing the use of organic solvents. Ionic liquids stable at room temperature have been focused on. Thus, such a study has been a step towards sustainability both from environmental and societal point of view.

6. Further Plans (100 words):

Bioactive compounds or their precursors (antibiotics, chemo-preventive agents, alkaloids, etc.) are extracted by the pharmaceutical industry, either with conventional methods or modern technologies. Recent trends in extraction techniques have largely focused on finding solutions that minimize the use of solvents. This, of course, must be achieved while also enabling process intensification and a cost-effective production of high quality extracts. Three major solutions have been identified to design and demonstrate green extraction on laboratory and industrial scale to approach an optimal consumption of raw materials, solvents and energy: (1) improving and optimization of existing processes; (2) using non-dedicated equipment; and (3) innovation in processes and procedures but also in discovering alternative solvents.

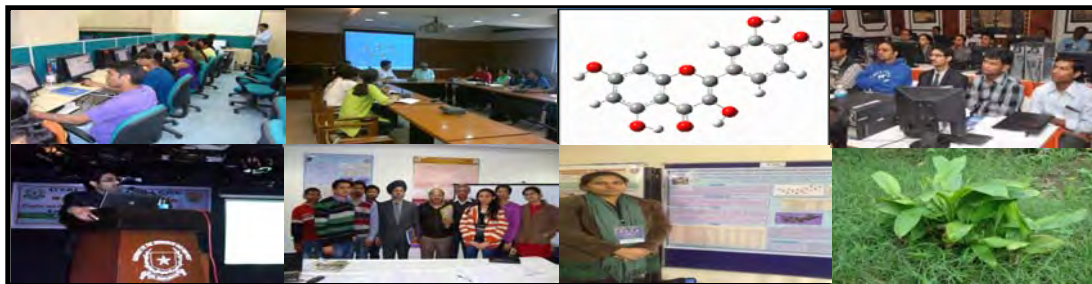
The principles of green chemistry have been identified and described not as rules but more as innovative examples to follow, discovered by scientists and successfully applied by industry. As some ILs are immiscible with water (which allows the formation of biphasic systems) and the organic species have high solubility in these ILs, they are suitable as solvents for the extraction most of bioactive compounds from plants and as mobile phase modifiers to improve LC separation for bioactive targets. ILs, as extraction solvents, can promote interactions between the analyte and solvent because of their unique chemical functional groups. The extraction of bioactive compounds from plants using ILs has great promise, which can alleviate the environmental pollution and improve the selectivity and extraction yields of interesting compounds in sample pre-treatment processes compared to conventional organic solvents.

Thus ILs would be explored for microwave assisted *green* solvent extraction for Isolation of active Principles from unexplored medicinal plants mentioned in Ayurveda having anticancer properties.

DYAL SINGH COLLEGE

Project: Title: Understanding the mechanism of action of Prime Ayurvedic Plant drugs by undertaking a first principles quantum mechanical study of the structure property relationship and activity of the various chemical ingredients of these plants and undertaking In-Campus-Plantation aimed at understanding entrepreneurial activities in this area

Project Code: DS 102



Group Discussion, Literature Survey, Computational Work, Seminar Series, Innovation Plaza, Research Paper Presentations and In-Campus Plantation as milestones achieved: A Short Display

1. Objective (150 words):

Traditional *Ayurvedic* therapeutic formulations draw on an impressive array of plants. One of the main objectives of the project is to carry out investigations on scientific lines aimed at understanding antioxidant properties of various active ingredients of these plants. A multidisciplinary approach with an objective to provide an apt solution to the current innovation research quandary is being put to use. The use of *Quantum Mechanics* and *Computational Chemistry* offer an innovation pathway in this regard. *Computational Chemistry* is a set of techniques investigating chemical problems on a computer with regard to investigation of *Molecular Geometry*, *Energy of molecules*, *transition states*, *chemical reactivity* and hence *physical & biological activities* of substances. The research work in the project is based on *First Principle's* quantum mechanical study of the structure property relationship of various chemical ingredients of these plants belonging to the *Flavanoid* and *Curcuminoid* class of naturally occurring compounds aimed at clarifying the active sites and hence mechanism of action of the molecule responsible for the antioxidant activity.

2. Final Findings (300 words):

We have carried out detailed first-principles density functional calculations of the structures and energetics, ionization potentials, electron affinities and various DFT-based global chemical reactivity descriptors of interest for antioxidant molecules as prime ayurvedic plant constituents (natural products)—*Quercetin*, *Leuteolin*, *Taxifolin*, *Kaempferol*, *Curcumin*, *Rosmarinic Acid* and *Aloe Emodin* in addition to *Vitamin A* and *Vitamin E* molecules in both neutral and charged states. Our results are in good agreement with the few relevant experimental results reported in the literature, giving us confidence in the ability of DFT to accurately describe these systems and providing a benchmark for further experiments. Thus, our study has expanded the application of reactivity indices to these molecules. The variations in structural parameters and the vertical values of ionization potential and electron affinity indicate that these antioxidant molecules prefer to lose electrons to neutral reactive oxygen species.

The amount of charge transfer between the antioxidant molecules and various ROS, calculated using the charge transfer parameter (ΔN) reveals that these natural products are much better antioxidants for electronic charge transfer to the ROS and hence possesses greater antioxidant activity in comparison to both Vitamin A and Vitamin E. In contrast to these natural products we find that vitamins in their neutral state do not act as antioxidant for the ionic ROS $O_2^{\cdot-}$. The reactivity (antioxidant behaviour) of vitamins as well as of these molecules with reactive oxygen species found to depend on the nature of the medium. In the presence of

solvent water the reactivity found to be increased. In order to probe the preferred site of reactivity of *these molecules* towards the ROS, the Fukui function f_k^- was evaluated at the oxygen atom site of primary hydroxyl group of these antioxidant molecules. f_k^- indicates the decrease in negative charge from the site k(oxygen atom), upon the removal of one electron from the molecule. The trends observed in f_k^- values indicate that the substitution of B ring in the *flavan* structure and the C_2-C_3 double bond is very important in determining the antioxidant properties of flavanoid molecules-*Quercetin*, *Taxifolin*, *Leuteolin* and *Kaempferol*. It is further clear from the Fukui function values that it is the phenolic groups of the molecule rather than the central CH_2 group which determine antioxidant properties of the molecule. We note that the probability that the antioxidant reaction will take place is given by the reaction rate constant, which is dependent on the reaction energy barrier. Thus our study represents a vital first step towards the detailed investigation of the antioxidant mechanisms of various molecules with antioxidizing properties, several other factors would obviously be expected to play important roles in such complex biochemical processes.

3. Learning for Students (200 words):

Lectures on basic principles of Quantum Chemistry and on introduction to the proposed research field enabled the students not only to have an understanding of antioxidant mechanism of known drug molecules but also instilled in them the basic instincts to pursue research. Students were then apprised of the methods for the Literature Survey, using latest research facilities in the University, such as *Scifinder* and *Nimbus* platform. Careful analysis of the literature also helped the students to learn how to make preliminary findings regarding the present status of research work reported in the journals of National and International repute so that the research work is given proper direction.

Students learnt the use of *Gaussian 09 W* and *Gauss view* software and using these softwares students studied various theoretical parameters e.g. conformational analysis, geometry optimization and energy calculations on both neutral and charged prime ayurvedic plant ingredients under consideration for understanding antioxidant properties of these natural products. Students also presented the research work in the form of research paper poster in national conferences and seminars. Such participation helped boost the confidence of students besides providing them the opportunity to interact and learn from experts in the field acknowledged internationally. Thus the research group comprising of 10 undergraduate students has benefitted through the exposure to most modern methods of theoretical research.

4. Benefits to College (100 words):

The scheme of the Innovation Research Project has provided the much needed spark to pursue research using the multidisciplinary approach to the faculty at one hand besides encouraging the students on the other. The *Workstation/Server* and the *Gaussian 09 W* software procured in the Innovation Research Project will serve as research facility for pursuing theoretical research. The research project has also provided the faculty with collaboration opportunities with the mentor and many other scientists to pursue further research in the field. In-Campus plantation of many important prime ayurvedic plants has been a first step developing medicinal herbal garden in the college.

5. Benefits to Society (100 words):

Extensive R&D in science and technology is needed for designing new products and processes for the benefit of society. However, R&D in applied scientific fields require deep rooted long term basic science research aimed at generating knowledge of active scientific principles especially in the field of life sciences and healthcare. The area of naturally occurring antioxidants becomes increasingly important because of their health promoting ability. The research project has provided much needed exposure of innovations in research practices and the timely opportunity to pursue research to the undergraduate students in this area. The project thus viewed as preparedness of future scientists for the benefit of the society.

6. Further Plans (100 words):

The research group is planning to explore a number of other naturally occurring compounds for their antioxidant properties. The research group is also planning to write a project proposal in this area. Further plans also aimed at involvement of undergraduate students in the research work so as to bring excitement and zeal in them to pursue research in applied scientific fields. The concept of developing an herbal garden in the college is also a prime task. Our future plans include expansion of the herbal garden to include many more species and varieties of medicinally important plants.

DYAL SINGH COLLEGE

Project Title: Chemistry Learning: Eco- Friendly and Inquiry-model based experimental chemistry with inherent safety aspects.

Project Code: DS-103



Students involved in chemistry-learning through experiments

1. Objective (150 words):

Chemistry practical for education are important and give students a chance to learn through hands-on training. Moreover, educational research with reference to laboratory work at university level must have its own features. The presently known laboratory work is quite routine in nature and does not give much enthusiasm to students. It needs to be changed and made more expository, enquiry and problem based. The present chemistry laboratory experiments also use toxic chemicals in large quantities and generate hazardous gases, fumes, liquid/solutions and solid waste. Issues of safe handling of toxic and dangerous chemicals also need to be addressed. The reduction in quantity to be used and safe disposal of toxic chemicals is another challenge at hand. In order to address these issues following strategies are adopted.

1. To standardize some of the existing chemistry practical both in terms of quantities of chemicals and the methodology used.
2. To suggest some alternate experiments that can enhance the learning experience of students.
3. To address 'Safety concerns' of students while teaching them to handle chemicals with confidence; using chemical apparatus in developing basic 'Manipulative skills'; designing virtual experiments with emphasis on the use of enriched instrumentation techniques of the quantitative analysis such as UV-Vis spectroscopy and FTIR spectroscopy.
4. Designing chemistry practical exercises that would be cost-effective, eco-friendly, thought-provoking and knowledge-oriented.

2. Final Findings (300 words):

The objectives of the project have been achieved. The assessment and suggestions for chemistry based experiments have been done. The important findings are listed below:

I. Judicious use of hazardous chemicals and their disposal.

To know the actual impact of chemical-waste generated in chemistry laboratories, a sample survey was conducted for yearly consumption of toxic chemicals that are drained out in water bodies without treatment by various Delhi University Colleges. It has been noticed that some highly hazardous chemicals like phenols, heavy-metal salts (Cd, Hg, As, Pb), acids/bases, organic solvents are used and thrown in drain beyond the permissible limits. In some cases,

the quantities are alarmingly high. The various chemicals used in the college laboratories (yearly consumption) are listed in the table below:

CHEMICALS	YEARLY CONSUMPTION IN DU COLLEGES	TOXIC EFFECTS
Acetic acid	540L	Irritation of eyes, skin, nose, throat; dental erosion; hyperkeratosis; conjunctivitis, lacrimation , pharyngeal edema, chronic bronchitis ,Mutagenic for mammalian somatic cells
Acetone	660L	Depresses the central nervous system, severe irritant on contact with eye & a potential pulmonary aspiration risk.
Alcohol	1230L	Can cause major health problems, including cirrhosis of the liver. Causes anemia, cancer, cardiovascular disease.
Ammonia	750L	Depresses central nervous system and a potential pulmonary aspiration risk ,causes eutrophication
Aniline	20L	Can irritate eyes & may affect blood (methamoglobinemia), resulting in cyanosis, brain damage and kidney failure, a probable carcinogen and reproductive hazard.
Benzoyl chloride	24Kg	Causes increased incidences of respiratory illness & dermatitis, abnormal liver function & serum protein levels & decreased WBCs counts.
Copper sulphate	90Kg	Causes acute toxicity in spleen, liver & kidney. Irritating to eyes & skin, very toxic to aquatic organisms.
Heavy metals (Cd, Hg ,As, Pb)	120Kg	Exposure to heavy metals causes developmental retardation, various cancers, kidney damage & even death.
Sulphuric acid	2640L	Exposure to sulphuric acid can irritate eyes, nose, throat& lungs. At higher levels can cause a lung disease known as pulmonary oedema.
Zinc oxide & zinc sulphate	39Kg	Causes stomach cramps, skin irritation, vomiting, nausea, can damage the pancreas & disturb the protein metabolism.
Potassium iodide	285Kg	A possible tetrogen, Causes cold ,sneezing, conjunctivitis, headache, fever, various skin rashes .It can cause fetal death ,severe goiter. Hypothyroidism and the cretinoid appearance of the newborn.
Potassium permanganate	39Kg	Affects respiration, (hypoxia, dyspnea), cardiovascular system,(hypertension, hypotension, tachycardia), liver (hepatitis, jaundice, hepatocellular necrosis), blood (methemoglobinemia), urinary system (renal failure, albuminuria, hematuria, proteinuria), behavior/central nervous system
Potassium dichromate	75Kg	Affects the respiratory system, liver, kidneys, eyes, skin and blood, may cause allergic reaction. Cancer hazard can cause cancer. increased risk of respiratory tract cancer in humans

Experiments are designed keeping in mind the need to control the enhanced pollution/hazard caused by the above-mentioned chemicals, avoiding various steps wherever possible that use these hazardous and toxic chemicals. It is, therefore, our responsibility:

- ❖ To reduce and minimize the amount of chemical-waste produced
- ❖ To dispose chemical-waste without adverse impact on the environment.

University and colleges need to impose self-regulations to control the pollution caused by our laboratories.

II. New suggestive experiments for undergraduate courses.

A number of existing experiments needs to be standardized in view of the above findings to lower the waste produced in many of the experiments. Many new experiments have been tested so that they can be carried out at undergraduate level. A laboratory manual of these experiments giving all findings and standardized procedures also needs to be created.

1. Determination of optical band gap of various materials by UV-visible spectrophotometer.
2. Calculation of particle size from band gap and study the variation of band gap with particle size
3. Preparation of mixed metal oxide: verification by XRD, and UV-visible spectroscopic study of these compounds
4. Standardization of the method of determination of CST of phenol water system by using same composition (reproducible results for three months)
5. Qualitative Analysis:
Modification and deletion/avoidance of steps of qualitative analysis, wherever possible, using hazardous and toxic chemicals, is proposed.
 - i) Spot test can be used as an alternative to reduce use of chemicals.
 - ii) Use of ZnS granules to test the presence of group II and group-IV cations, so that in the absence of group II and group-IV cations H_2S maynot be consumed.
7. Various types of transitions ($n \rightarrow \pi^*$, $\pi \rightarrow \pi^*$) in UV visible spectroscopy.
8. Effect of solvent (polar or non-polar, hydrogen bonding) on the UV spectra of carbonyl compounds and effect of conjugation in alpha beta unsaturated carbonyl compounds.
9. How to measure $10Dq$ value of various complexes and experimentally verify the factors affecting $10Dq$ value of the complexes.

3. Learning for Students (200 words):

Inquiry-based activities have an undetermined outcome and require the learners to create their own procedures. A student-centric approach gives the students more responsibility for determining procedural options different than the existing traditional format. In essence, it gives students ownership of the laboratory activity that can result in students' improved attitude towards management of laboratory resources. Such activities require learner to formulate the problem, relate the investigation to previous work, state the purpose of the investigation, predict the result, identify the procedure and perform the investigation. This type of practical work can foster many of the aims implicit in the goals of science education, some of which are outlined below:

- The project has helped the students-researchers to learn many of the concepts as outlined above.
- It has helped them in understanding the various aspects of chemical education through hands-on training and learning.

- The students have been able to study statistically the standard chemistry experiments for the quantity and nature of chemical used (hazardousness and toxicity) in various chemistry laboratories of Delhi University colleges. They have learnt to work as team and also got a chance to go to different colleges for data collection. They analyzed the data and used the findings to suggest important improvements in some of the chemistry experiments for social and scientific benefits to society.
- Student-researchers have also actively involved themselves in learning the use of sophisticated instruments like UV-Vis spectrophotometer for performing some of the experiments.

This project has helped the student-researchers to interact closely with fellow students in different colleges and departments, which has resulted in overall improvement in general academic approach and understanding among them

4. Benefits to College (100 words):

The higher education has two broad components - education and research. In our undergraduate colleges, though we serve the purpose of spreading education, the research component is generally missing. This project has given an opportunity to faculty and students to involve them in active research. Both faculty and students have been actively involved in exciting and constructive academic activity beyond teaching-learning hours of present fixed curriculum syllabus.

We have been able to procure a UV-Visible spectrophotometer interfaced with a computer for digital data acquisition that would enhance the infrastructure/research-capabilities existing in college and would be available for use for the faculty as well as the students in their pursuit for research. To undertake this project dedicated space in college was created for carrying out the experiments. Through this endeavour we have been able to create an environment which is conducive for the academic/research enrichment of the college as a whole.

5. Benefits to Society (100 words):

We have carried out a survey of yearly consumption of most commonly used chemicals by chemistry laboratories of various colleges of Delhi University and concluded that huge amount of toxic chemicals are disposed into the environment without any treatment. In view of this some existing experiments have been modified to reduce chemical consumption and some new innovative and eco-friendly experiments have been designed which can be considered for inclusion in the curriculum of Delhi University. However, the problem is not fully solved till we impose self-regulations and standardize experiments to control the pollution caused by Delhi University colleges / Schools / Polytechnics / Engineering colleges, etc. It is our duty towards society to minimize the pollution caused by our laboratories. Through this project we have been able to create awareness, among not only the faculty of the various colleges of Delhi University, but also the society in general, about the possible hazardous nature and impact of various chemicals used in our laboratories and are drained out without any treatment.. The study would be very useful for the purpose of enhancing public-health through advocating safe and correct use of chemicals in our laboratories.

6. Further Plans (100 words):

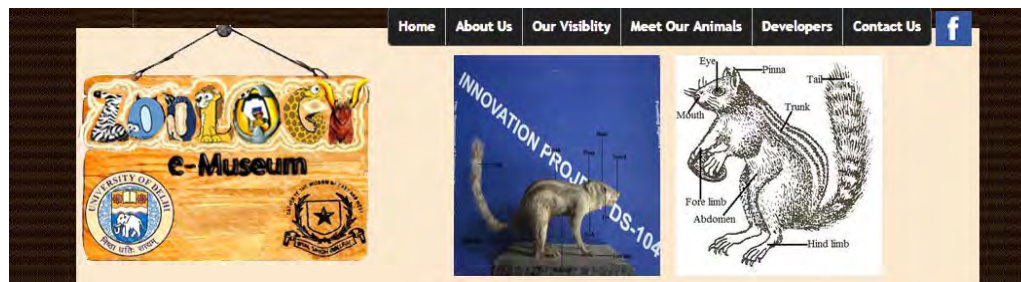
As an extension of this project, we propose to analyze and treat the laboratory effluent from college/ school laboratories before it is drained into the sewage at source level to minimize the pollution. It is, therefore, suggested to treat hazardous chemistry laboratory effluents by cost-effective and Green-technologies. We propose a multidisciplinary approach with an objective to provide an apt solution to the waste water treatment. We propose to carry out a model analytical study of waste water to know the harmful chemicals before and after the treatment. We expect that these studies will not only be useful for college/ school laboratories but also for test-houses and small industrial units using such chemicals. Based upon the requirements any one or a combination of the following approaches will be worked out to treat the waste water.

1. Adsorption of toxic chemicals by low cost non-conventional adsorbents such as agriculture bio-wastes.
2. Phyto-remediation
3. Solar detoxification

DYAL SINGH COLLEGE

Project Title: Development of Zoology E-Museum for Courses of University of Delhi

Project Code: DS-104



Zoology e-Museum(Snapshot)

1. Objective (150 words):

Zoology Museums at College/University level where variety of animal specimens, slides etc. are stored in preserved form to educate the society in general and students/explorer in particular. Present work is based on the idea of integration of work among two branches of science viz., Animal Taxonomy (from Zoology) and IT (from Computer Science). It was proposed to access some of the best known Zoology Museums in and around Delhi and, if possible, to farther places in India as well. As there is only limited knowledge about our biodiversity, present work is likely to generate further understanding towards various life forms around us. It will be helpful in creating a common database of specimens available related to syllabi of University of Delhi. It is an effort to integrate the physically available specimens into an electronic database or virtual zoology museum primarily for the specimen of syllabus of B.Sc. (H) Zoology & B.Sc. Life Sciences of University of Delhi.

2. Final Findings (300 words): Copy of product as CD and Hardcopy enclosed

I. Product Submission Details:

- Hard Copy (to be submitted very soon)
- Copy of Product as CD
- Hosted on local server in the college at the link: 10.140.1.79/zooemuseum
- Accessible from anywhere on DU website.

II. Identification of Resource Base- Extensive search to identify resource base for the Database. Various centers in and around Delhi were requested for respective permission. Personal reference and contact was also explored for the same.

III. Continuous/extensive literature survey- Foundation of any project lies in extensive & in-depth literature survey. Innovation Team search for available information from all possible sources & update about dataset under study.

IV. Continuous/extensive site (internet) survey- Web search for features and patterns related to present work so as to integrate some of the best tools.

V. Demand/expectation survey from the target group- The expectations of the target group collected by survey method.

VI. Collection of Data for Database/Museum from Resource Base- Collection of the information in the suitable format. A diagrammatic sketch may also be essentially required and will be made to put up possible minute details.

VII. Compilation of information – Information so collected from sl. 1-4 may be compiled accordingly. Development of Electronic Database & User Interface- A user friendly interface to be developed to access the datasets conveniently. The data is presented in the form of a website and the work done along with the features are as follows:

- Designing of Logo
 - Choosing the plaque
 - Designing of “Zoology” using Animals
 - Including college logo

- Including DU logo
- Presenting slide show on website
- Website tabs
 - Selecting tabs
 - Location of tabs in website
 - Selecting hierarchical structure for sub-tabs
- Deciding on placing slideshow of animals
- Mouse over color change on selection of tab
- Account creation and management of social media
 - Facebook
 - LinkedIn
 - Google plus
- Understanding the procedure to enlarge image on click
 - Zoom in
 - Zoom out
- Our Visibility
 - Poster/Banner
 - Brochure
 - Documentary
 - PPT
 - Workshop Poster
 - Workshop Banner
 - Workshop Pamphlet – simple, detail
 - Certificate
 - Workshop tit-bits
 - Entry card
 - ID card
 - Registration form
 - Newspaper – TOI 1
 - Newspaper – TOI 2
- Link to DU website from here
- Images enlarge on click and also zoom in
- Slideshow of images with following features
 - Forward
 - Background
 - Play
 - Pause
 - Button to choose the slide group
- Specific characters, habits and habitats, classification
- Photoimages and line diagrams
- Social media connectivity
 - Facebook link
 - Linked in
 - Google plus
- Accepts user input
 - Feedback
 - New contributions

3. Learning for students:

Student developed understanding about the biodiversity. Problem related to zoology museum were assessed. Expectation from the target group was taken into consideration for making current product. The concept of integration of ICT in teaching or development of resource using ICT was taken care during the present innovation project. During the workshop participants get benefitted from the program in general. The workshop feedback seems to be particularly motivating as the participants come up with variety of ideas, the possibility of exploring and learning from the workshop in their respective fields. Student investigators learn integrated approach using two different streams for benefit of larger group. Student learned to work in team in an heterogeneous interdisciplinary environment. Concept of research investigation, time management, planning and systematic organizing of data was learned as a learning process during the project. Tools and flavor of interdisciplinary approach for understanding and presentation of findings were also explored.

4. Benefits to College (100 words):

College may act as central point for resource based on this aspect. Future upgradation may be carried out subject to availability of necessary resources. By getting center of attraction for such a project college may be key spot for similar studies and projects in near future. Other agencies willing to explore the idea may take benefit from the experiences from the college. As planned initially, our project developed a product which may be accessible to end users easily. The possibility of revenue generation in near future cannot be ruled out. This may be appreciated in view of approaching towards self-sufficiency.

5. Benefits to Society (100 words):

This project leads to development of awareness and understanding for our faunal biodiversity. Extension of understanding beyond the boundaries of traditional museums by one click point allows us to access certain less known organisms and facts about those organisms. This will be surely helpful in generating awareness to broader mass, not only to the students but also anyone interested in faunal biodiversity. This kind of awareness may be aiding in busting prevailing myths about different life forms around us directly and conservation of biodiversity indirectly. This will be also helpful in bringing down the cost of maintenance for larger number of museums as well as growing attraction for such museums, which might be helpful in generating revenues as well for the resources.

6. Further Plans (100 words):

The concept of E-museum may be extended to further depending upon available resources. Based on feedback at ANTARDHWANI, The Innovation Project DS-104 team was greatly motivated and felt that this concept may be further carried with input from other resources towards integration of additional informations. It is suggested that animal specimens listed in the courses of other Central and State Universities of India may be included during the future expansion of this project. Further, additional animals listed in Discipline I and Discipline II of Animal Biodiversity of four year undergraduate course may also be included.

Additional inputs received during the course of development give us the strength to integrate images, facts (comments), systematic position along with line drawing of the specimens. In future, live images even video clippings of live animals in their natural habitat of various Biodiversity Reservoirs may also be included.

GARGI COLLEGE

Project Title: Synthesis and Characterization of Novel Nanomaterials using green methods for antimicrobial applications

Project Code: GC-101



1. Objective (150 words):

The field of nanotechnology is one of the most active area of science. This project aimed at synthesis of novel nanoparticles such as silver using green methods. These methods offer multi-fold benefits such as mitigating the harsh effects of the chemicals, unwanted toxic waste as byproducts etc. Hence, the project advocates the replacement of expensive harsh chemicals by inexpensive, safe counterparts. The benign materials such as Mulberry tea extracts have been used for the synthesis of nanoparticles, in the present project. The Mulberry tea extract serves the dual purpose of effective reducing as well as capping agent. The synthesized materials were characterized using various analytical tools such as UV-Vis spectroscopy, Transmission Electron Microscopy (TEM), Particle size Analyzer. The developed materials were optimized for Ag : Mulberry extract ratio in terms of stability. The samples which stayed stable over a period of time, were tested for, their antimicrobial activity against E.coli.

2. Final Findings (300 words):

The summary of the project is given below:

1. The synthesis of novel nanoparticles using inexpensive, easily available and harmless materials such as plant extract is an upcoming field of research. In the present studies, the synthesis of silver nanoparticles has been done using Mulberry tree leaves extract (commercially available product from Sericha Co. Ltd.). The students were trained for the following in a phased manner such as literature survey, modes of synthesis of nanomaterials using plant extract, preparation of extracts and optimization of silver: extract ratio, optimization of synthesis conditions such as temperature and duration of synthesis, characterization of the developed material, microbial techniques for culturing Escherichia coli, in both solid and liquid cultures for antimicrobial activity of these materials and analysis of results to establish structure-property correlation. The molar ratio of AgNO_3 : Mulberry Tea Leave Extract has been optimized. 0.005 M AgNO_3 : 1% Mulberry Tea Leave Extract were taken in ratios such as 4:1, 3:1, 2:1, 1:1, 1:2, 1:3 and 1:4 to study the effect of variation of these ratios on the evolution of various properties such as particle size, shift in SPR (Surface Plasmon Resonance) peak, and stability of nanoparticles with time as well as antimicrobial studies.

2. The compositions were studied using UV-Vis spectroscopy and Transmission Electron Microscopy (TEM). The compositions 1:2, 2:1 and 3:1 were selected for further studies due to better stability as

compared to other compositions. The particle size increases for 3:1 as compared to 2:1 (as evident from TEM studies). The shift observed in the SPR peak could be attributed due to silver and a shift in peak position is correlated to particle size.

3. The antimicrobial property of the most stable sample were studies using E.coli and a significant reduction in the growth is observed. The results have been optimized for selective ratio (Nanoparticles : Culture) ratio of 6: 4. These preliminary studies could be exploited further.

3. Learning for Students (200 words):

It has been immense learning experience for the students in the following ways.

It introduced relatively new field of research i.e Green Chemistry, Nanotechnology and the interface between these to our students which they were not previously familiar. This was a great learning experience for them.

The students were exposed to Research methodology which has the following components – Literature survey, Defining the problem, existing data, methodology, characterization techniques, data collection and analysis of results.

This project provided a golden opportunity to work with sophisticated instruments and present their work in the form of posters and oral presentation in national and international conferences. This led to immense confidence building and they can mention their research work with great pride. Antardhwani was another platform to interact with participants of other projects which was very motivating.

This also led to time management, group activities, sharing of data and exchange of ideas leading to inter-disciplinarity as these students belonged to different courses. They had a chance to interact with Prof. Mangala Joshi, mentor for our project and Dr. Shubha Gokhale (IGNOU) from time to time. The talks by Prof. Ram S. Mohan a Fulbright US Fellow. They also got a chance to interact with Father of Green Chemistry, Prof. John F. Warner who appreciated the work during an International conference.

The green methods need to be incorporated in every aspect of life and this kind of exposure is very much required.

To conclude it was a wonderful experience which would enhance communication skills and add significantly to advancement of scientific temper and its propagation.

4. Benefits to College (100 words):

The college has benefitted in many ways

1. The research program of the college is activated in terms of inter-disciplinary research. The college had faculty members working in the respective departments on various topics but working in their own domains. This has provided an opportunity for a integrated research.

2. It has added to enhancement in infrastructure as well as availability of various requirements for the research.

3. The interactions of the students, faculty with the mentor and other scientists (Dr. Shubha Gokhale) have resulted into active discussion on the topic which could be beneficial later also.

4. The seminar was an eye-opener for the students not just from Gargi but from various other colleges, who got a chance to listen to scientists of international repute like Prof. John C. Warner, Prof. Ram S. Mohan and our Mentor, Prof. Mangala Joshi.

5. The students, lab-staff and faculty were able to work on UV-Vis spectroscopy which adds to skill enhancement. This is worth to mention that a few of our lab staff members were enthusiastic about the program and helped the students especially while handling the UV-Vis and preparation of cultures etc.

5. Benefits to Society (100 words):

The science and technology are the backbone for the society development. These kind of scheme which offer contents beyond curricula are important for the overall development of the students and prepare them for doing better at later stages. It is difficult otherwise to expose our students to newer topics of research which need special techniques and infrastructure but are possible due to such projects. Green chemistry is a powerful tool to design eco-friendly products and provide solutions to many health and environmental related problems. The training of students for such fields will ultimately be a boon for the society.

6. Further Plans (100 words):

The project has progressed from inception to end in a systematic manner, except during the practical and theory exams when students were not available. We would be very keen to add to it afterwards also in the following ways as these studies need more verifications especially for the stability with time, temperature etc. The anti-microbial studies are indicative and need to be more comprehensive. These studies could be extended further which we are in a position to do now due to establishment of facilities such as UV-Vis Spectrophotometer as well as other synthesis facilities. These studies could be done with new set of students in the coming sessions

GARGI COLLEGE

Project Title: To Devise a cost effective set up for Cell Identification, characterization and Separation
Project Code: GC-102



Project Team of GC-102

1. Objectives:

The isolation of pure populations of cells from heterogeneous cell suspensions is an essential part of clinical as well as basic research. Isolation of pure cell populations is important for understanding fundamental aspects of biological organization and body's response to injury.

In conventional techniques of cell separation involving centrifugation cells are subjected to huge forces ($10^4 - 10^6$ times the force of gravity) which cause various complications in separated cells such as cell damage and aggregation. Some of the modern techniques of cell separation such as FACS and MACS require fluorescent labels, expensive antibodies, prior knowledge of the target cells and costly equipments.

In the current project an effort will be made to develop a system for label free sorting and characterization of different types of cells for fundamental studies by combining a laser source and a digital microscope. Our project has important research and biomedical applications. There is growing interest in research on Separation and purification of cells as pure cells are required for newly emerging cell therapies for a number of diseases. Cell separation techniques are extremely important for research on stem cells.

In fact lasers are becoming universal tools for micromanipulation in cellular and subcellular dimensions and laser techniques have gained remarkable interest within the entire community of biological research and biomedical applications.

Experiments have been conducted to study:

- The optical characteristics of different types of blood cells, bacteria, fresh water organisms, based on differences in the deflection of the laser beam.
- Optical trapping of different types of cells with the help of single and multimode optical fibers. A system has been developed to generate images of trapped cells with the help of a digital microscope.
- Separation of Blood Cells

2. Final Findings

Light is a powerful tool for manipulating microscopic objects. Since light carries momentum when a beam of light strikes microscopic particles photons exert pressure on the particles which is known as

the *radiation pressure*. Lasers have sufficient intensity and coherence to generate the requisite density of photons with uniformly directed force of momentum.

Infra- red laser are most compatible biologically and wave lengths range 600-900 nm is most suitable for working with biological cells.

Optical Characteristics of *E. coli*:

When laser beam through single mode optical fiber was directed at an angle of 35° on *E. coli* in a suspension of medium on specially designed slide with channel, rapid changes were observed in the motility of the cells. This was due to the force of radiation pressure which gives momentum to the cells.

Optical trapping of few *E. coli* cells could be observed after exposure to laser beam. Majority of *E. coli* depicted rapid movement along the z axis which appeared to be faster than the movement expected because of the refracted rays of light. This interesting phenomenon may reflect a behavior pattern of *E. coli*.

Optical Characteristics of Blood Cells:

Experiments were conducted to study the optical characteristics of blood cells by using a single mode optical fiber in which red light of He- Ne laser (2mw) was launched.

RBC in a suspension of 0.9% isotonic saline depicted oscillations upon exposure to He-Ne laser on a microscopic slide. Optical trapping of RBC was also observed.

Set up of capillary tubes attached to the slide was created and blood was drawn into the capillary tubes. Set up was placed under the digital microscope and the blood solution was viewed before and after the application of laser light.

Due to the application of laser through optical fiber ,the movement of RBC's was accelerated in a direction away from the source of laser .Under the influence of radiation pressure RBC's moved out of other end of the capillary and trailing of blood cells could be observed under the digital microscope. Trailing of RBC's also showed a deflection of few degrees away from the source. When laser light through single mode optical fiber was applied at the tip of the capillary some changes were seen in the position of cells inside the capillary. Red Blood Cells seem to settle downwards while WBCs remained in the upward position inside the capillary. We could also observe the lateralization of RBCs inside the capillary tube after *application* of laser through optical fiber.

2-D Rotation of Red Blood Cells:

Application of two laser beams from two opposite directions caused the creation of torque and resulted in 2-D Rotation of red blood cells. This is a very unique and significant finding with our simple set-up and has application in diagnosis of infected cells, abnormal cells and micromanipulation of cells.

Separation of Blood components under the influence of gravity

Separation of blood cells carried out in capillary columns under magnetic field indicated faster as compared to the separation under the influence of gravity.

Separation of Blood components using semiconductor diode laser:

Columns of freshly drawn blood were set up in clean new syringes and light from He-Ne laser was launched through an optical fiber into the top of the blood column without touching the blood.

Identical control columns of blood were set without laser. Separation of plasma in laser treated was rapid. Plasma fractions were aspirated and number of white blood cells were counted using haemocytometer.

Number of white blood cells in plasma fractions from laser treated columns was nearly identical to number of cells in whole blood indicating nearly complete separation. Number of white blood cells in these fractions was double the number of cells in comparison to controls.

Seminar Organised

We organised a seminar on “Optical fiber based Probes” on 12 April under the auspice of Innovation project entitled “To devise a cost effective set-up for cell identification, characterisation and separation”. Dr M.K. Shenoy, Professor , Indian institute of technology, Delhi delivered a informative talk on optical fiber probes for measurement of scattered light. His talk was greatly appreciated by the teachers and students of various colleges of Delhi University. Talk was followed by a Poster competition where students of other colleges participated in large numbers. Posters were judged by Dr Shashi Tyagi, Principal, Gargi College also a botanist who critically analysed each poster and asked relevant questions from participants. The following prizes were given to Students:

First Prize-----Gargi College

Second Prize-----Acharaya Narendra Dev College

Third Prize-----Deen Dayal Upadhaya College

Acharaya Narendra Dev College

Other achievements

(1) Research Paper entitled “Optical Trapping of E.Coli” has been presented as ORAL presentation by students in National Symposium on Recent Trends in Innovative Research at Undergraduation: Science and Society” held on Feb 28th& 1-2nd March 2013 at Sri Venketeshwara College,DU.

(2) Research Paper Entitled “ Motion Analysis of Optically trapped biological cell” has been presented by group as Poster presentation in National Symposium on Recent Trends in Innovative Research at Undergraduate:Science and Society held at Sri Venketeeshwara College,DU.

3. Learning for Students

Innovation project instituted by Vice Chancellor of Delhi University is a step towards bridging a gap between students and faculty members, definitely must for enhancing communication skills, achieving definite goal together and exploring the problems with different dimensions. Project based learning is a dynamic approach to teaching in which students explores a real world problems and challenges .With this type of active and engaged learning, students are inspired to obtain deeper knowledge of the subject.

It is a research training for students along with their regular curriculum. They were exposed to different types of research methods for interdisciplinary science. So that in future they are ready to explore research based problems and some of them might consider it as career options.

Innovation project is a group activity so they learnt to achieve common goal with different ideologies. Interdisciplinary approach helps them to perceive the task with different dimensions.

Students got the opportunity to interact with senior faculty members of IIT Delhi and Delhi University and visited prestigious research labs of country.

Group interaction gives them chance to explore new fields of science apart from the major chosen after Schools. Also they were inculcated the habit of multitasking and problem solving inherently.

Confucius and Aristotle, great philosophers, were early proponents of learning by doing. So definitely innovation projects are based on their concepts.

4. Benefit to college

Faculty members got an opportunity to work in interdisciplinary fields. There was a clear cut demarcation between physical and life sciences subjects at College level. Innovation projects did play a strategy to melt the boundaries. Every college in few years of time would definitely create a resource centre of its own to carry out research in any field of science. This is very much essential for undergraduate students for project based learning. Every college can arrange autumn and summer workshops on different fields of science to equipped students to face the future challenges.

Reputation of any college is not only guided by the number of toppers it produce but by a single student who attain achievement at national level by her own creativity and research to help mankind.

5. Benefits to Society:

We have reported micromanipulation, optical trapping and two dimensional rotation of biological cells using single mode optical fiber and infrared laser. The field of optical tweezers has enjoyed a wide range of applications. By using light to trap microscopic objects noninvasively, optical tweezers provide a flexible tool for ultrafine positioning, measurement, and control. In practice, objects studied have their characteristic dimensions similar to the wavelength of light. Particle positioning and detection capabilities are therefore on a spatial scale of micrometers down to angstroms.

The emerging applications of laser-based optical traps are quite diverse and extensive, ranging from atomic physics to the medical sciences. As a result, optical tweezers have been a focal point for interdisciplinary science. Owing to their exquisitely controllable force-exerting properties, optical tweezers are useful for a variety of Nano-mechanical measurements, particularly those with biological applications.

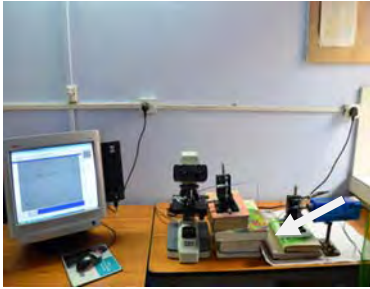
2D rotation of blood cells has tremendous potential for medical diagnosis.

6. Future plan:

We plan to work with a single mode lensed optical fiber for optical trapping and micromanipulation of biological cells. The virtues of optical manipulation technique is that it is simple almost noninvasive and non-destructive. We can squeeze bend and rotate the blood cell all without destroying it. Biological cells are viscoelastic materials with a wide range of adaptable mechanical properties. Cellular mechanical properties are known to change in disease.

In biological application of optical trapping and manipulation it is possible to remotely apply controlled forces on living cells without damaging the cells using infrared laser beam. This will result in many unique application.

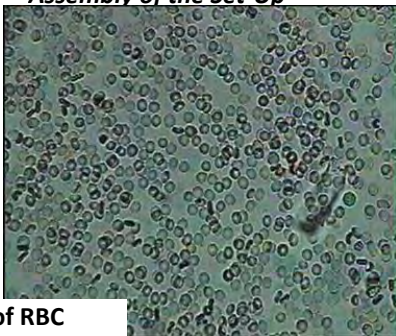
We further plan to measure the force exerted on a cell by infrared laser using single mode optical fiber which can be calibrated and this technique can be exploited medically for the diagnosis of diseased cells.



Assembly of the Set-Up



Lateralization of RBC



2-D Rotation of RBC



Separation of Blood Cells with laser



**Separation under Gravity
laser**



Magnetic separation of blood cells



Rapid migration of blood cells with

GARGI COLLEGE

Project Title: Daastan-e-Nisvaan (Stories of Women)

Project Code: GC 103



1. Objective (150 words):

This project was an endeavor by Gargi College to empower its students to become socially sensitive using unconventional approaches, to foster a spirit of inquiry in them, to be potential game changers of tomorrow by catering to their multiple intelligences and to think beyond their prescribed curriculum. In order to achieve this goal, the students were engaged in researching, composing, scripting and producing an inspiring multi-genre, cross cultural play invoking the stories of four powerful women from mythology, history and literature. The larger goal of the project was the belief that this exploration and journey in the making of Daastan-e-Nisvaan would lead to suggestions for reform and change in the perception of women in society. We believed that this process of researching, scripting, producing and staging the play would make the students realize that such women are not restricted to only legend but are indeed part of our contemporary world.

2. Final Findings (300 words):

Daastan-e-Nisvan has been a creative project. The students were engaged and involved with the project from its very inception. They conducted an in-depth research on the four women characters from history, mythology and literature in the first phase. They explored how these women faced challenges with rationality, intuitiveness and revolutionary ideas and were game changers in their own right.

The second phase focused on the students developing the script. This crucial phase was marked by innovation and their own creativity as it involved invoking the stories of these women and translocating them into meaningful and relevant contemporary situations. We can confidently claim that the workshops by the resource persons facilitated them a great deal for them to become powerful script- writers.

The third and the final phase of this project involved the students' innovation and creativity in the form of dramatization and production of the play. The play was staged twice in our college on 19th July 2013 and once in Delhi University during Antardhwani.

The group, which was completely unknown to each other, to begin with, became fused into one unit during the making of DEN. There was a growing sense of self-belief and a quiet confidence.

The project helped build the unit into one united powerhouse, collating all the gains from the various workshops they attended to concretize into a final script.

The students while scripting the stories of these four women realized that these women were not going to be portrayed or projected as victims or as epitome of the soft virtues, but as imbued with potential for transcending gender borders and social mores to become game changers. These women emerged as archetypal images that could be recast in new situations and in different ages. The play helped our students to interrogate, celebrate and extend the choices made by these women.

3. Learning for Students (200 words):

Daastan-e-Nisvaan was a unique learning experience for the students for it enabled them to question themselves and empowered them to work with their creative instincts. Their journey passed through numerous stages, each stage being a new experience for the students, participating in team building workshops, meeting different social activists, scripting the play and finally staging it.

During the metamorphosis of the play, the ability of the students to think out of the box and their sense of imagination widened. The experience of the project sensitized the students towards the social issues concerning women as they interacted with a panorama of social activists and luminaires like Dr.Kiran Bedi and Mrs.Savita. The students got a chance to understand the plight of victims of female foeticides & domestic violence. Such interactions made the students incorporate these elements into the play. The workshops conducted by Mr. Avijit Dutt and Mr. Ishwar Shunya not only honed the dramatic skills of the students but also taught them the importance of working in a team and trusting each other.

The experience was a fruitful one, because the students in a matter of about eleven months not only scripted and produced a multi-genre play but also developed the ability to think beyond the given boundaries of their curriculum and became socially sensitive citizens.

4. Benefits to College (100 words):

This prestigious project has been greatly beneficial to our college and students. Not only did our students from different departments get an opportunity to work together creatively on a project which extended beyond their fields of discipline, the various newspaper coverage brought a lot of credibility to the effort of our students. Our students got exposure and an opportunity to interact with a range of experts from the fields of dramaturgy, theatre and those working in the areas of women's empowerment. This has enhanced the confidence of our students to try out new things beyond their secure areas of study.

5. Benefits to Society (100 words):

Since the play has already been staged thrice for the students of Delhi University, teachers parents, grandparents and friends, we feel that our students have been successful to some extent in sensitizing them to the issues that women have faced in the past and continue to do so in the contemporary world.

We are convinced that raising awareness of this nature will bring about a change in the attitude and perception of our society at large towards women. And women, taking inspiration from these characters, will have greater determination to survive and prevail in a discriminating world.

6. Further Plans (100 words):

Since we received the second installment during summer vacations, we have not been able to utilize the grant to bring out the monograph and publish the play in a book-form. If possible, we would like to go ahead with these two plans.

HANSRAJ COLLEGE

Project Title: राष्ट्रीय राजधानी क्षेत्र में दृष्टिबाधितों से सम्बंधित संस्थाओं एवं संस्थानों की उपलब्धियां और चुनौतियाँ

Project Code: HR 101



रोहिणी स्थित नेशनल फेडरेशन ऑफ ब्लाइंड में स्थित ब्रेल प्रेस.



अंतर्ध्वनि २०१३ में प्रोजेक्ट टीम कुलपति प्रो. दिनेश सिंह के साथ.

1. Objective (150 words):

राष्ट्रीय राजधानी क्षेत्र में कार्य करने वाली संस्थाओं के कामकाज, उसकी कार्य-प्रणाली, उसके संगठन, प्रबंधन, संसाधन, कार्यक्रम आदि का समग्र अध्ययन कर इन संस्थाओं की उपलब्धियों और चुनौतियों का एक खाका तैयार करना. इसके जरिये भारत जैसे कल्याणकारी राज्य व्यवस्था में विकलांगों विशेषकर दृष्टिबाधितों के लिए संचालित नीतियों एवं कार्यक्रमों की खामियों और उसमें सुधार की संभावनाओं की तलाश करना ताकि उनके हित में बेहतर नीति निर्माण की दिशा में कुछ सहायता हो सके.

इसके साथ ही सरकारी और गैर सरकारी आर्थिक सहायता के बल पर काम करने वाली विविध संस्थाओं एवं संस्थानों के काम-काज और उसमें बरती जाने वाली इमानदारी एवं पारदर्शिता आदि का भी एक आकलन करना, दूसरे शब्दों में कहें तो इन संस्थाओं एवं संस्थानों की सोशल ऑडिटिंग करना.

स्वयंसेवी संस्थाओं के रूप में पंजीकृत विविध संस्थाओं एवं संस्थाओं के कार्यक्रमों एवं योजनाओं से दृष्टिबाधितों को मिलने वाली सुविधा, सहायता एवं इसके द्वारा उनके जीवन में हो रहे सकारात्मक बदलाव एवं व्यक्तित्व विकास आदि का व्यापक अध्ययन एवं विवेचन विश्लेषण करना तथा इस सम्बन्ध में जरूरी तथ्य जुटाना भी हमारा ध्येय रहा.

दृष्टिबाधितों के जीवन यापन के लिए पुनर्वास एवं प्रशिक्षण आदि के जरिये बेहतर कौशल प्रदान कर उनके जीविकोपार्जन के प्रबंध की दिशा दशा का आकलन भी हमारे इस परियोजना कार्य का एक महत्वपूर्ण हिस्सा रहा है.

कुल मिलाकर राष्ट्रीय राजधानी क्षेत्र में कार्यरत इन सभी प्रमुख संस्थाओं एवं संस्थानों का समग्र अध्ययन कर इनकी स्थिति, प्रभाव, परिणाम के साथ साथ इनकी अपनी चुनौतियों के परिप्रेक्ष्य को सामने लाने के साथ साथ इनकी उपलब्धियों का आकलन विश्लेषण कर नीति निर्माण में सहायक तथ्यों एवं आंकड़ों को प्रस्तुत करना और रचनात्मक परिवर्तन लाने लायक वातावरण निर्मित करना ही इस परियोजना कार्य के उद्देश्यों की परिधि रही है तथा

वर्ष भर परियोजना कार्य से जुड़े सदस्यों ने इन्हीं बिन्दुओं के इर्द-गिर्द काम करते हुए पूरी म्हणत और लगन के साथ काम किया है जिसके अनेक सकारत्मक प्रभाव भी देखे जा सकते हैं.

2. Final Findings (300 words):

परियोजना कार्य से जुड़ी टीम सम्बंधित विषय पर वर्ष भर जुटाए गए तथ्यों एवं जानकारियों के आधार पर कुछ महत्वपूर्ण निष्कर्षों तक पहुँचने में सफल रही है. जिन्हें निम्नलिखित बिन्दुओं के जरिये समझा जा सकता है.

१. दृष्टिबाधितों के लिए काम करने वाली अनेक संस्थाओं एवं संस्थानों का कामकाज अपनी तमाम सीमाओं एवं चुनौतियों के बीच भी अद्भूत एवं प्रभावकारी हैं. इनमें लोधी रोड स्थित ब्लाइंड रिलीफ एसोसिएसन, साकेत स्थित नॅशनल फेडरेशन ऑफ ब्लाइंड, रोहिणी स्थित ऑल इंडिया कन्फेडरेशन ऑफ द ब्लाइंड, रामकृष्णपुरम स्थित नेशनल असोसिएशन फॉर द ब्लाइंड आदि प्रमुख संस्थाओं का नाम लिया जा सकता है.
२. इस क्षेत्र में काम करने वाली संस्थाओं एवं सरकार के बीच सहयोग एवं समन्वय का जबर्दशत अभाव देखा जा सकता है. इसके कारण सरकार द्वारा निर्धारित धन एवं संसाधन का समय पर तथा बेहतर वितरण नहीं हो पता है जिसके चलते इन संस्थाओं के कामकाज में रुकावट एवं गतिरोध पैदा होते रहते हैं. इस समस्या को लगभग सभी संस्थाओं से सम्बद्ध अधिकारियों ने न केवल स्वीकार किया है बल्कि कई संस्थाओं ने इसके कारण सरकारी सहायता लेने से अपने को दूर रखने की बात भी कही है.
३. दृष्टिबाधितों के लिए काम करने वाली विभिन्न संस्थाओं एवं संस्थानों के बीच परस्पर सहयोग, समन्वय एवं सहकार से और बेहतर एवं प्रभावकारी परिणाम की आशा की जा सकती है. परन्तु इस सम्बन्ध में इसका अभाव सहज ही देखा जा सकता है. ऐसे में एक संस्था जिन समस्याओं का समाधान नहीं कर पाती है उन समस्याओं को उसके समाधान में सक्षम दूसरी संस्था को अग्रसारित करने की प्रवृत्ति देखने को नहीं मिलती है. इस दिशा में जरूरी सुधार के बिना महत्वपूर्ण बदलाव संभव नहीं है.
४. इस क्षेत्र में काम करने वाली विविध संस्थाओं एवं संस्थाओं में उन संस्थाओं को चिन्हित करने की आवश्यकता है जो वास्तव में पूरी प्रतिबद्धता एवं लगन के साथ दृष्टिबाधितों के लिए दिन रात काम कर रही हैं. ऐसी संस्थाओं को और अधिक सहयोग एवं सहायता सरकार और समाज की ओर से मिले यह सुनिश्चित करना भी जरूरी है. इसके साथ ही स्वयंसेवी संस्था के रूप में पारदर्शिता और इमानदारी की कमी के साथ काम करने वाली संस्थाओं एवं संस्थाओं पर नियंत्रण एवं उसका नियमन भी अनिवार्य है.
५. विभिन्न संस्थाओं के निरंतर प्रयास से दिल्ली दृष्टिबाधितों के लिए सर्वाधिक अनुकूल शहर के रूप में सामने आयी है. परिणामतः देश भर के दृष्टिबाहित बड़ी संख्या में दिल्ली में न केवल रहते हैं बल्कि शिक्षा और प्रशिक्षण प्राप्त कर समाया जीवन जी रहे हैं.

६. दृष्टिबाधितों के पुनर्वास, प्रशिक्षण, आवास, उपकरण वितरण आदि के साथ साथ अनेक संस्थाओं ने अंध विद्यालय महाविद्यालय आधी के सञ्चालन के जरिये उनके लिए बेहतर शिक्षा व्यवस्था को सुनिश्चित किया है और बेहतर करियर की अनेक संभावनाएं और अवसर भी पैदा किया है.
७. लोधी रोड स्थित ब्लाइंड रिलीफ असोसिएसन सहित कई संस्थाओं ने मोमबत्ती बनाने, कुर्सी बुनने, लिफाफा बनाने सहित कई ऐसे रोजगारपरक प्रशिक्षण की व्यवस्था की है जिसके बल पर दृष्टिबाधित स्वावलंबन के साथ जीवन यापन करने में स्वयं को सक्षम पाते हैं और जीवन के प्रति उनके दृष्टिकोण में सकारात्मकता आती है.
८. कई संस्थाएं सेमीनार एवं कार्यक्रमों तथा आंदोलनों आदि के जरिये लगातार दृष्टिबाधितों के अधिकार और उनके लिए जरूरी नीति निर्माण की दिशा में सरकार और समाज का निरंतर ध्यान आकृष्ट करते रहते हैं. साकेत स्थित नॅशनल फेडरेशन ऑफ ब्लाइंड, रोहिणी स्थित ऑल इंडिया कन्फेडरेशन ऑफ द ब्लाइंड आदि संस्थाओं ने तो कई बार इसके लिए जरूरी कानूनी लड़ाई भी लड़ी है जिसके परिणामपरक प्रभाव भी रहे हैं.
९. कुछ संस्थाओं ने जीवन यापन और रोजगार के साथ साथ आवास आदि की व्यवस्था के लिए दृष्टिबाधितों को वित्तीय सहायता भी प्रदान किया और जो प्रायः न्यूनतम कागजी कार्यवाही के साथ कम से कम दर पर कर्ज के रूप में उपलब्ध कराया जाता है. इस दिशा में नॅशनल फेडरेशन ऑफ ब्लाइंड का कामकाज अत्यंत ही सराहनीय है.
१०. रामकृष्णपुरम स्थित नेशनल असोसिएशन फॉर द ब्लाइंड ने दृष्टिबाधित वृद्धों के लिए वृद्धाश्रम निर्माण की दिशा में भी गंभीरतापूर्वक कार्य प्रारंभ किया है जो न केवल काबिले गौर है बल्कि काबिले तारीफ भी है.
११. कुल मिलाकर इस क्षेत्र में काम करने वाली विभिन्न संस्थाओं का काम काज अपनी तमाम सीमाओं के बावजूद अत्यंत ही सराहनीय रहा है और इन्हें सरकार और समाज से अधिक से अधिक सहयोग एवं प्रोत्साहन की आवश्यकता है.

3. Learning for Students (200 words):

संबंधित परियोजना कार्य में काम करने वाले छात्रों के लिए पूरा वर्ष ज्ञान, प्रशिक्षण, नयी दृष्टि के निर्माण एवं सामूहिक अनुसंधान की प्रक्रियाओं को जानने-समझने का रहा. उन्होंने अनेक संस्थाओं का भ्रमण कर जरूरी तथ्य तो जुटाया ही उसके विवेचन विश्लेषण और निष्कर्ष तक पहुँचने की कवायद में भी स्वयं को पूरी तत्परता के साथ शामिल किया और अनेक रोचक एवं संवेदनशील अनुभवों से गुजरते हुए स्वयं के सामाजिक दायित्व को ढंग से समझने की कोशिश की. विद्यार्थियों को इस परियोजना कार्य से मिली सीख को इस प्रकार से देखा जा सकता है –

१. किसी भी कार्य को समूह में सम्पादित करने की पद्धति को जानना-समझना और उसमें अपने अधिकाधिक रचनात्मक योगदान को सुनिश्चित करना.
२. तथ्यों को जुटाने, उसे एकत्रित करने, उसके विवेचन विश्लेषण और निष्कर्ष तक पहुँचने के साथ साथ सर्वेक्षण के तौर तरीकों आदि को जानने और प्रमुख विद्वान विशेषज्ञों से साक्षात्कार आदि लेना और उसके लिए खुद को तैयार करना.
३. सेमीनार-संगोष्ठी आदि के आयोजन एवं प्रबंधन का व्यावहारिक ज्ञान प्राप्त करना और स्वयं को अकादमिक रूप से उच्चता प्रदान करना.
४. सामाजिक महत्व के विषयों पर अपना दृष्टिकोण बनाना और अपने सामाजिक दायित्व को भली भाँति जानना और तदनुरूप आचरण करना.
५. प्रयोगधर्मिता की प्रवृत्ति का विकास और समग्र एवं संतुलित विकास के लिए जरूरी नीति निर्माण की आवश्यकता एवं उसकी सीमाओं आदि की समझ का निर्माण के साथ साथ इस क्षेत्र में काम करने वाली संस्थाओं की कार्यपद्धति को नजदीक से देखना और समझना.
६. कुल मिलाकर शोध, सामूहिक रूप से कार्य करने की प्रवृत्ति, सामाजिक दायित्व की जानकारी, संस्थाओं के संगठन एवं प्रबंधन और उसकी उपलब्धियों और चुनौतियों को जानना और सर्वेक्षण, साक्षात्कार, सेमीनार के आयोजन आदि के बारीकियों की समझ विकसित करना और स्वयं को इस दिशा में अधिक योग्य और कुशल बनाना आदि इस परियोजना कार्य के अंतर्गत काम करने वाले विद्यार्थियों की महत्वपूर्ण उपलब्धि रही है और समग्र रूप में बेहतर व्यक्तित्व विकास की सीख भी मिली है.

4. Benefits to College (100 words):

इनोवेशन प्रोजेक्ट के तहत महाविद्यालय में आयोजित विविध गतिविधियों, सेमीनार, संगोष्ठी आदि से बेहतर अकादमिक माहौल निर्मित होने के साथ साथ इनोवेशन और शोध के प्रति विद्यार्थियों का रुझान बढ़ा है. इसके साथ ही अनेक विद्वान विशेषज्ञों के समय समय पर महाविद्यालय में दिए गए व्याख्यान आदि से भी महाविद्यालय के सभी विभाग के विद्यार्थी और प्राध्यापक भी लाभान्वित हुए हैं. एक साथ एक ही परियोजना कार्य में कई विभागों के प्राध्यापकों और विद्यार्थियों की सामूहिक कोशिश से सम्पन्न इस परियोजना कार्य ने महाविद्यालय में सामूहिकता की प्रवृत्ति को भी बढ़ावा दिया है और भविष्य में इसका सकारात्मक प्रभाव स्वाभाविक ही है . इस इनोवेशन प्रोजेक्ट ने शोध, सामूहिकता, प्रयोगधर्मिता, सामाजिक दायित्व आदि के प्रति महाविद्यालय को और अधिक जागरूक बनाया है.

इसके अतिरिक्त परियोजना कार्य के लिए जुटाए गए जरूरी उपकरण आदि ने महाविद्यालय की आधारभूत संरचना को बढ़ाने में भी सहायता की है जिससे भविष्य में महाविद्यालय के विद्यार्थी लाभान्वित होते रहेंगे.

5. Benefits to Society (100 words):

दृष्टिबाधितों से सम्बंधित इस परियोजना कार्य का सर्वाधिक महत्व इसके सामाजिक दायित्वबोध में ही निहित है. इस परियोजना कार्य ने न केवल दृष्टिबाधितों से सम्बंधित समस्याओं की ओर इस क्षेत्र में काम करने वाली संस्थाओं और सामाजिक कार्यकर्ताओं का ध्यान आकृष्ट किया है वरन उन संस्थाओं की समस्याओं और चुनौतियों के व्यावहारिक पहलुओं को भी सामने लाने का काम किया है.

दृष्टिबाधितों के अधिकारों और आवश्यकताओं के प्रति जागरूकता पैदा करने के साथ साथ उनके लिए उठाये जाने वाले जरूरी कदमों की समीक्षा और उनकी नयी आवश्यकताओं और इस सम्बन्ध में आवश्यक नीति निर्माण की ओर ध्यान आकृष्ट करने की दृष्टि से भी परियोजना कार्य के निष्कर्षों में कई महत्वपूर्ण बिन्दुओं को शामिल किया गया है.

इस परियोजना कार्य के तहत काम करते हुए परियोजना टीम ने इस दिशा में काम करने वाली संस्थाओं, उसके प्रबंधकों, कर्मचारियों और समाज के विभिन्न तबकों को पहले से अधिक संवेदनशील बनाया है जिससे समग्र रूप में समाज में दृष्टिबाधितों के प्रति नयी दृष्टि के निर्माण में मदद मिली है.

कुल मिलाकर इस परियोजना कार्य से जुड़ी टीम दृष्टिबाधित समाज और समाज के सभी तबकों को प्रशिक्षित, संवेदनशील, पारदर्शी और जागरूक बनाने में अपनी महती भूमिका का निर्वहन करती हुयी वर्ष भर कार्यरत रही और अपने रचनात्मक सामाजिक दायित्व के प्रति सतत सचेत और जागरूक बनी रही.

6. Further Plans (100 words):

किसी भी शोध एवं परियोजना कार्य के निष्कर्षों को अंतिम नहीं जा सकता है खासकर तब जब वह सामाजिक महत्व का विषय हो. समाज में होने वाले दैनिक परिवर्तनों से उसके निष्कर्षों में परिवर्तन स्वाभाविक है. बावजूद इसके सामान्य प्रवृत्तियों के आधार पर जरूरी और महत्वपूर्ण निष्कर्षों तक तो पहुंचा ही जा सकता है.

इस शोध कार्य में जैसे तो परियोजना टीम ने लगातार कठिन श्रम और लगन से जरूरी तथ्य और आंकड़ों को जुटाकर महत्वपूर्ण कार्य को अंजाम दिया है परन्तु भविष्य में हम कई और बिन्दुओं के साथ इस परियोजना कार्य से जुड़े विषय को आगे बढ़ाने की दिशा में काम करने की योजना बना रहे हैं.

दृष्टिबाधितों के अतिरिक्त अब समग्र रूप से हर प्रकार के विकलांगों के लिए काम करने वाली संस्थाओं और संस्थानों के काम काज का आकलन करने और उनके लिए जरूरी नीति निर्माण की आवश्यकता आदि का विवेचन विश्लेषण करने की दिशा में भी काम करने की योजना है. इस सम्बन्ध में महत्वपूर्ण शोध कर सरकार और समाज को ध्यान इस ओर आकृश किया जा सकेगा.

इसके साथ ही इस परियोजना कार्य के तहत वर्ष भर जिन तथ्यों, आंकड़ों, सर्वेक्षणों, साक्षात्कारों आदि को जुटाया गया है उसके आधार पर जुलाई तक एक पुस्तक तैयार और प्रकाशित कर विश्वविद्यालय में जमा करने और दुसरे जरूरी संस्थाओं एवं संस्थाओं तक उसे पहुंचाने के प्रति भी हम प्रतिबद्ध हैं.

कुल मिलाकर इस परियोजना कार्य से प्राप्त उर्जा और प्रेरणा को भविष्य में और अधिक रचनात्मक और सकारात्मक दिशा में लगाने और सामजिक दृष्टि से लाभकारी आयामों तक पहुंचने की दिशा में हम भविष्य में निरंतर सक्रिय बने रहेंगे.

HINDU COLLEGE

Project Title: Green Approach for the Extraction of Hazardous Heavy Metal ions and Dyes from Waste water using Synthetic and Natural Wastes

Project Code: HC-101



1. Objective (150 words):

Dyes and heavy metal cause one of the most serious environmental pollution problems today, mainly due to their high mobility and persistent nature. Heavy metals are discharged from almost all types of industries- mining, smelting, energy and fuel production, electroplating, fertilizer etc. Similarly, dyes from dyeing processing are found in the wastewater streams of industrial processes, including paint manufacture, dyeing, textiles, paper, and others.

This project is an effort in the direction of development of newer, simpler and cost effective chemical, electrochemical and biological processes/techniques for the estimation and removal of some very toxic pollutants (mainly dyes and heavy metals) from waste water. In the present project, low cost adsorbents and biosorbents from industrial and agricultural waste respectively, such as used rubber tyres and deoiled mustard, have been used, along with micro-organisms. Adsorption studies have been carried on various metal ions & the following organic dyes: Safranin T, Rhodamine B, Azo dyes such as Reactive Black 5, Acid Orange 7.

2. Final Findings (300 words):

The present study was done using 6 agricultural waste products and 2 microorganism species to evaluate their adsorption potential for 12 organic dyes such as Orange G, Crystal violet, Alizarin etc. as well as Metal ions like Chromium, Cadmium. Highlights of the results of this work are:

- Adsorption technique is an efficient and environmentally safe and friendly technique for the remediation of waste water, removing 98% toxic substances within first two hours of the process.
- Characterization of various plant based biosorbents, using the techniques like FTIR, TEM, SEM, XRD, gave an insight to their structure.
 - Cationic dyes are favourably removed at higher pH (8-10).
 - Dosage as low as 0.05g of these sorbents, especially of neem leaf powder, is highly effective in removing 98% of the dye from waste water
 - Four different particles size, in the range of 50 – 250 μ were used in conjunction with the dye solutions of different concentration . Smaller particle size provided higher surface area, thereby increasing its adsorption capacity.
 - In general, adsorption capacity of neem leaf powder was maximum, followed by chana skin powder, drumstick powder and walnut shell .

- Optimum temperature for the removal of these dyes/metal ions is found to lie in the range 35-45°C.
- The adsorption of certain cationic dyes, such as Fuchsin Basic was exothermic in nature. Hence, the dye removal capacity of the adsorbent decreases with increase in temperature, due to increasing mobility of the dye molecules.
- Some of the adsorptions follow Langmuir Isotherm Model (Figure 9), whereas others follow Freundlich Isotherm Model.
- Basic dyes could stain the cytoplasm of normal living paramecium whereas acidic dyes could not.
- The stain disappeared from the cytoplasm of the living animals within a few hours after their removal from the dye solution. Animals with stained cytoplasm could live indefinitely in dilute solutions of dyes used, the stained paramecia eventually died unless they were removed from the stain.
- Competition between *Paramecium coudatum* and *Vorticella* was observed in different dye solutions, when the former was found to be the dominating species.
- While the growth of *Vorticella* was significant, *Paramecium coudatum* ceased to grow in comparatively higher dye concentration.

3. Learning for Students (200 words):

- By become the team members of the project, the under graduate students got the experience of “hands-on” for the first time- starting from the Literature survey to the compilation of the experimental work
- They are now able to correlate better their theoretical knowledge with the real world.
- The students interacted with the experts in the area of Environmental Science as well as Chemistry via various Workshops organized under the aegis of the project. This not only helped in spreading awareness about the current Environmental issues around the Globe, with special reference to India.
- The students are now well versed with the various principles-such as chemical precipitation, reverse osmosis, ion-exchange and adsorption, involved for waste water treatment.
- The students are also trained in various instrumentation techniques and have also learned the technique of sampling.
- With high level of enthusiasm and motivation, the students participated in the Poster/Paper Presentation at National /International Conferences across the nation. At ICAIECS, Ranchi,(Nov 2-4, 2012), they were declared the youngest group of Scientists pursuing research.

4. Benefits to College (100 words):

- Arising out of the work done in the project, the College has been enriched with the following Instruments and Glass Apparatus, to be used by the students as well as the Faculty members.
- Instruments : Thermostat water Bath Shaker, UV-Vis Spectrophotometer, Magnetic Stirrer, Microwave Oven, Digital pH-meter .
- Apparatus: Volumetric Flasks, Storage Bottles, Dispensers, Sieves etc.
- Collection of books in the broad subject area on Waste Water Technologies are kept in the Department for all the stake holders.
- Presentation of the work done by the team members in various National/International Conferences was much appreciated and brought laurels to the Institution.

5. Benefits to Society (100 words):

- Biosorb Bags, under development by the team proposes to be a viable, economical and green tool to treat a certain level of contamination of waste water.
- When developed, it has the potential to be successfully used at every household.

- The three day Science Fiesta, organized in Antardhwani, proved to be an excellent platform to show case the work of the team to various sections of the society, including school/college teachers, research scholars, academia, NGOs and the common man. The overwhelming response of the visitors motivated the young Undergraduate Team members. The silver lining of the whole event was the visit of the Hon'ble Vice Chancellor. His brief, yet impactful charismatic words "Why don't you patent this work of biosorb bags ?", has given students enough reason to pursue with research activities.
 - There were many maiden experiences for the students- Paper/Poster Presentation at various National/International Conferences, at Jaipur, Ranchi, Ramjas College, DDU College and Gargi College
- 6. Further Plans (100 words):**
- Regeneration of adsorbents using Column technique.
 - Study of the efficiency of these biosorbents on real-world effluents obtained from industries situated in Moradabad and local plants at Delhi.
 - Study of adsorption of dyes /metal ions by industrial wastes, such as red mud, waste rubber tyre, and comparing their 'dye uptake capacity' with the biosorbents used.
 - Study of Biosorption using various other microorganisms.
 - Designing a handy and ready- to- use tool for removing trace amounts of dyes & metals from water.

HINDU COLLEGE

Project Title: Isolation and characterization of metal corrosion inducing bacteria from the polluted water and development of inhibitors of microbial induced corrosion (MIC)

Project Code: HC-102



1. Objective (150 words):

Main objectives of the projects:

1. Isolation and Purification of MIC Bacteria from Polluted Water.
2. Study the Corrosion Behavior of these Bacteria on Metal Surface.
3. Characterization of Bacteria Inducing Corrosion.
4. Selection of Corrosion Inhibitors that will Work under Occluded Conditions as exist during Microbial Induced Corrosion (MIC).
5. Protection of the Metals from the Microbial Induced Corrosion (MIC) by using these Inhibitors.

WORK PLAN

- Serial Dilution Agar Plating Methods for the Isolation of the Microbial Diversity in the Water Samples.
- Streak Plate Methods for the Purification of the Microbes
- 16SrRNA Gene Sequences Analysis for the Identification of the Bacteria and its Pylogenetic Analysis
- Gravimetric and Electrochemical Studies of the Effect of these Bacteria on Metal Surface.
- Selection of Corrosion Inhibitors.
- Quantitative assessment of the inhibition efficiency of different types of inhibitors which the applicant proposes to study on metal surfaces by (a) Gravimetric determination of inhibition efficiency, (b) polarization curves (Galvanostatic) and determination of Tafel parameters etc.
- Surface characterization by (a) Scanning electron microscope (SEM) and (b) Atomic Force Microscopy (AFM) to get the quantitative analysis and depth analysis of the adsorbed layers of inhibitors.

2. Final Findings (300 words):

This project consists of preparation of the Microbial cultures to cause corrosion on mild steel surface under observation. For the preparation of culture medium 2 bacteria and 1 fungus were used. We have studied the Weight loss and Galvanostatic Polarization parameters for mild steel in *Pseudomonas fluorescens* in the presence and absence of all the four inhibitors having four concentration levels at 298 K and the result drawn from these techniques. Further these results were supplemented by surface morphological studies i.e SEM & AFM.

Weight loss studies reveal the following facts:

- All the studied additives are effective corrosion inhibitors for mild steel in corrosive solution.
- The inhibition efficiency increases as the concentration of inhibitor increases.
- The corrosion rate is maximum in a corrosive solution as compared to those of the inhibitor solutions.
- Half life increases with concentration.

Galvanostatic Polarization studies result the following conclusions:

- All the additives are effective corrosion inhibitors for mild steel in bacteria/fungus culture.
- These are mixed type of inhibitors but act as cathodic inhibitors to some extent.
- The inhibition efficiency increases as the concentration of inhibitor increases.
- There is no regular trend in b_c and b_a values of all the inhibitors indicates that for corrosion inhibition adsorption is not the only mechanism.

The phosphonium compounds were analyzed as very good corrosion inhibitors for the corrosive culture with the help of the above techniques. The results obtained from above techniques will be further supplement surface morphological techniques (AFM/SEM).

3. Learning for Students (200 words):

Project-based learning is a dynamic approach to teaching in which students explore real-world problems and challenges. With this type of active and engaged learning, students are inspired to obtain a deeper knowledge of the subjects they're studying. They become Self-awareness: recognizing feelings and identifying interests, strengths, and weaknesses. By project work they are managing feelings and behavior to control impulses and persevere in achieving important personal and academic goals. By becoming the team members of the project, the undergraduate students got the experience of "hands-on" for the first time- starting from the Literature survey to the compilation of the experimental work. They are now able to correlate better their theoretical knowledge with the real world. The students interacted with the experts in the area of Biological Science as well as Chemistry via various Workshops organized this project. This not only helped in spreading awareness about the corrosion issues around the Globe, with special reference to India. The students are now well versed with the various principles-such as isolation, purification and identification of bacteria/fungi culture, Weight loss & Galvanostatic Electrochemical technique, involved in corrosion studies. The students are also trained in various instrumentation techniques and have also learned the technique of sampling. With high level of enthusiasm and motivation, the students participated in the Poster/Paper Presentation at the Conferences.

4. Benefits to College (100 words):

- Arising out of the work done in the project, the College has been enriched with the following Instruments and Glass Apparatus, to be used by the students as well as the Faculty members.
- Instruments : Lamellar Flow, Incubator Shaker .
- Apparatus: Volumetric Flasks, Burettes, Storage Bottles, etc.
- Presentation of the work done by the team members in various Conferences was much appreciated and brought laurels to the Institution.

5. Benefits to Society (100 words):

The effects of corrosion in our daily lives are both direct, in that corrosion affects the useful service lives of our possessions, and indirect, in that producers and suppliers of goods and services incur corrosion costs, which they pass on to consumers. In the present study we want to isolate, purify and characterize the bacteria that actively take part in the metal corrosion. This research is to define the conditions under which pollutants, including those produced by bacteria such as the sulfide end product of the sulphur reducing bacteria (SRB), affect the amount of hydrogen absorbed by mild-steel during open circuit corrosion. At the same time, we will be investigating protective measures including the development of improved inhibitors that will work under occluded conditions as exist during Microbial Induced Corrosion (MIC). The prevention and control of MIC may seem like a daunting task. However, with knowledge of how and where MIC occurs, as well as the prevention and control methods that may be used, a majority of problems can be prevented. Maintaining the cleanliness of systems is the best method to prevent MIC. Once biofilms have established themselves, it is difficult to get rid of the bacteria entirely. There is a need to implement a better means of destroying biofilms and also to develop environmentally friendly biocides. WE evaluated new Corrosion Inhibitors that will Work under Occluded Conditions as exist during Microbial Induced Corrosion (MIC). Protection of the Metals from the Microbial Induced Corrosion (MIC) by using these Inhibitors When developed, it has the potential to be successfully used at every household. The three day Science Fiesta, organized in Antardhwani, proved to be an excellent platform to show case the work of the team to various sections of the society, including school/college teachers, research scholars, academia, NGOs and the common man. The overwhelming response of the visitors motivated the young Undergraduate Team members.

6. Further Plans (100 words):

1. Isolation and Purification of new MIC Bacteria/fungus from different Water sources.
2. Study the Corrosion Behavior of these Bacteria on various Metal Surfaces.
3. Evaluation of different types of Corrosion Inhibitors that will Work under Occluded Conditions as exist during Microbial Induced Corrosion (MIC) for the corrosive species in this project.
4. Protection of the Metals from the Microbial Induced Corrosion (MIC) by using these Inhibitors.

HINDU COLLEGE

Project Title: Innovative Projects for Science Learning-Design, Spread and Documentation

Project Code: HC-103



A Line Follower Robot Designed by the group



Prof. Malashri distributing certificates to the workshop participants

1. Objective (150 words):

The innovation project is aimed at involving the students to setup and perform interdisciplinary experiments involving the concepts of physics, chemistry and mathematical programming. The basic aim was to familiarize the students with the application and appreciation of theoretical concepts that are studied in text books to be applied in practice to perform homemade experiments which can be readily done independently by them. The students have been using computers as well as software as the black boxes. The learning in view of the working of computers basic and designing of software are also the objectives of this present project. It is also important to propagate the concept through conducting workshops for the students and teachers of various institutions. The students should also be trained in the documentation field at the initial stage of their education. Therefore this is another objective of this present project.

2. Final Findings (300 words):

A number of innovative projects have been designed and developed by the core team in a number of fields.

- Under Instrumentation (10), designing of instruments like Emf/pH meter, Conductometer, Thermometer and Colorimeter.
- Subsequently plot of pH metric titration curves, p_z orbital shapes, d_z^2 orbital shapes in QBASIC as well as in C++ Languages under Computer Programming (100).
- Computer Embedded System (10) were used to setup experiments like A Programmer, Night Lamp Saver, A Line Follower Robot, Crono and Thermometer.
- Alongside many home done experiments were also conducted as part of science demonstration. Few of them are Egg in a bottle, Non burning Rupee note, Oscillatory Reactions, and Battery Operated Chemical Reactions.

To spread the concepts and applications of the above mentioned experiments were tested during a number of workshops conducted in vacations for students and teachers of various institutions.

The following workshops involving different activities were held during summer and October vacations:

- May 21-22, 2012 workshops: thirty class XII students fabricated and evaluated 15 electronic thermometers.

- May 23 -24, 2012 workshop: another 30 class XII students fabricated and evaluated 15 electronic thermometers
- June 8-10, 2012 workshop: 20 students of various undergraduate classes from different colleges fabricated and evaluated 10 PC interface electronic thermometers. They also plotted ideal gas, van der Waals isotherms in QBASIC and C++ languages.
- June18-20, 2012 workshop: 19 postgraduate students from Delhi University, Indira Gandhi National Open University and IIT Kanpur fabricated 9 PC Interface mV/pH meters and also compared the results with the commercial instruments. They finally compared theoretical results and experimental results by plotting pH metric titration curves using q basic and c++ languages.
- June28-30, 2012 workshop: 30 class XII students fabricated and evaluated 15 emf meters.
- July24, 2012 workshop: 30 class XII and PGTS of sprindales school evaluated 10 science demonstrations and found them quite interesting.
- October 5-6, 2013 workshop: around 20 students fabricated and evaluated 6 programmers 6 ADC Converters and 6 LED blinking projects
- December 14-17, 2012 workshop: 52 students of class XII and BSc attended International symposium for science learning held at science education centre.in this around 20 C++ programs were made and night lamp saver , crono thermometers and line follower robot were made by the participants.

All the work done in the above mentioned workshops was documented in the form of two manuals QBASIC and C++ Programs for Physical Chemistry Problems and Science demonstration-Home Experiments. The copies of these manuals have already been submitted to the Innovation desk.

3. Learning for Students (200 words):

The students learned how to design new innovative projet in interdisciplinary subjects. In fact some of the students have started thinking of synthesizing nano particles for energy and electronics subject. They are also planning to design a low cost version of DLS/Zeta Potential device which is being extensively used for the characterization of these nano particles. The commercial instrument is very expensive that is why this technique is not very popular for science education so far. The students are quite keen to design low cost version of the mentioned device using easily available materials.

An educational paper entitled, “Revisiting Atomic orbitals shapes in QBASIC and C++ Programming Languages” by Tarun Gera and CK Seth is also communicated to be published in the Journal of Science Education.

4. Benefits to College (100 words):

An effort is being made to have a Memorandum Of Understanding (MOU) with Hindu College and KMIT for carrying out further work in the field of microcontrollers. A copy of the draft MOU is shown below:.

Draft

MEMORUNDUM OF UNDERSTANDING

BETWEEN King Mongkut’s Institute of Technology Ladkrabang, Thailand
AND Science Education Centre, Hindu College, Republic of India

This Memorandum of Understanding establishes the guidelines for collaboration between King Mongkut's Institute of Technology Ladkrabang, Thailand and Science Education Centre, Hindu College, Republic of India.

Agreement:

1. Both institutions will collaborate conducting the workshop on Microcontroller for Science Learning in Thailand, India and ASEAN countries.
2. Develop a four months add-on course on Microcontrollers for Science Learning for Indian as well as for other Asian countries.
3. Exchange program of students/teachers for short term period of three to four months as interns to both the institutes.
4. Arrangement for the interchange visits, host institute will provide the accommodation.
5. Initiate of collaborative projects for science education in both countries.

Both institutions will co-operate in actively seeking funds from Government agencies, International organization and private foundations for supporting the activities.

This MOU will be effective upon the date of signature by the representatives of two institutions unless either party declare its termination by informing the other party six months in advance.

Prof.Dr. Tawil Puangma

President

King Mongkut's Institute of Technology Ladkrabang, THAILAND

.....

Principal Hindu College

.....

5. Benefits to Society (100 words):

Not Applicable

6. Further Plans (100 words):

- We are starting an add-on course on electronics and computers for Science Students after the completion of this present innovation project.
- A project is being planned on "Investigation of Clay-metal nanoparticle composite using Locally Produced Zeta Potential Device" in collaboration with Chemistry Department, University of Delhi and DRDO Delhi.

HINDU COLLEGE

Project Title: Development of Thin Films / Nano materials for their Electronic and Biomedical Applications

Project Code: HC-104



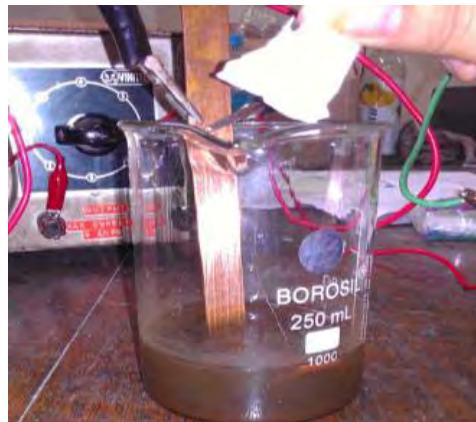
In front of Innovation lab Hindu College & interaction with V.C., Delhi University during *Antardhvani 2013*

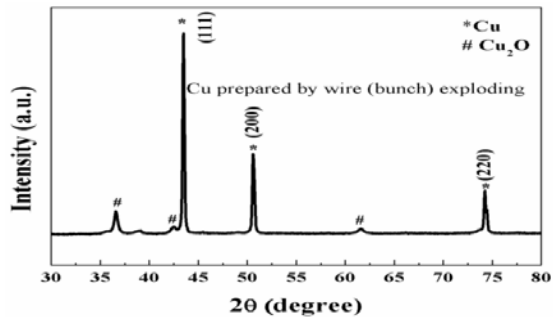
1. Objective (150 words):

The materials science tetrahedron symbolizes the goal of materials science and engineering. The points represent characterization, processing, structure, and performance. Understanding how each of these relates to each other lies at the core of materials science and engineering. The key role of a materials scientist and engineer is to optimize the match between materials and their applications; and when a new material is needed it is to be discovered. While materials science and engineering is important in understanding metals, glasses, and stone, it is also important for new materials, such as photovoltaic solar cells, polymers, and composites. Everything we see and use is made of materials: cars, airplanes, computers, refrigerators, microwave ovens, TVs, dishes, CD-ROMs and even biomedical devices.

2. Final Findings (300 words):

(i) Characterization and Applications of metal Nanoparticles prepared through wire explosion Technique
Nanoparticles of copper are produced in distilled water by the controlled-current wire explosion process. Distilled water acts as stabilizer during the synthesis procedure. Then the X-Ray Diffraction (XRD) was carried out for structural analysis. The particle size is evaluated about 37 nm by using Debye Scherrer's relation. The voltage applied during the synthesis process has control over the particle size.





XRD pattern of Cu nano-particles prepared by wire exploding technique

Results: XRD pattern of Cu particles has been shown in Figure 2. The average crystalline size of Cu was determined from the measured width of their diffraction curves using Debye Scherrer's relation: $D = 0.9 \lambda / \cos \theta$ where λ is the wavelength of the CuK α radiation ($\lambda = 1.5443 \text{ \AA}$), θ is the full width half maxima in radians. Debye Scherer's formula assumes approximations and gives the average crystalline size. Other measurements are in progress.

(ii) Preparation of Ferrofluids, its Characterization and Applications:

A Mn-Zn ferrite was not synthesized successfully. The precipitate obtained had very weak field and hence did not show the properties of ferrite (strongly magnetic).

An iron oxide Ferro fluid was synthesized using kerosene oil as carrier fluid while so was not obtained when vegetable oil was used as the carrier. Such an observation can be explained on the basis that a carrier of appropriate viscosity should be used. Ferrofluids suspend in carriers of low viscosity such as kerosene.



A photograph of ferrofluid prepared in our lab

Further investigation is going on.

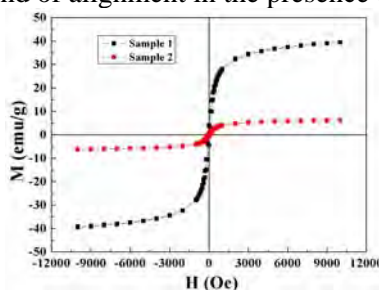
(iii) Preparation, Characterization and Applications of Iron Oxide Nanoparticles using Sol-gel Technique



Sample 1- Fe₂O₃ Nanopowder and Sample 2- Fe₂O₃ Nanopowder

Results & Discussions:-

The samples formed through the above two processes were sent for their characterization which included their X-Ray Diffraction pattern and VSM technique. These two techniques determined the purity of the sample formed. The data obtained was tallied with the standard data. It was found that the first sample (the one prepared in basic medium) was highly magnetic with high degree of purity since the peaks obtained in diffraction pattern of this sample exactly matched with one of the standard data. Through VSM, we determined the magnetic property, e.g., retentivity and coercivity. These two parameters obtained for the first sample were relatively less as compared to the second one. In the presence of an appreciable magnetic field, the particles aligned in the direction of magnetic field as was expected. As far as second sample is concerned, since there was defect during the process of formation so it couldn't be as magnetic as it should have been. The X-ray diffraction pattern obtained for this sample clearly demonstrated the presence of several impurities. When the obtained pattern was tallied with the standard data, certain peaks were not in synchronism with each other. Some of the extra peaks obtained in the pattern were particularly due the presence of impurities. Still the particles obtained were feebly magnetic since they showed some kind of alignment in the presence of magnetic field.



M-H curves of sample 1 and sample 2.

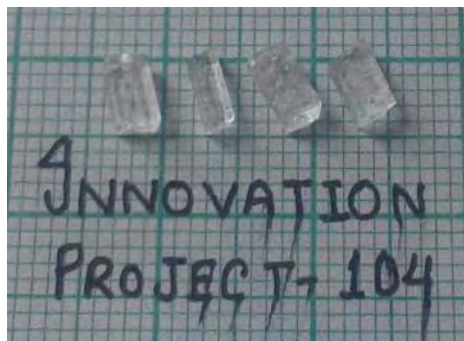
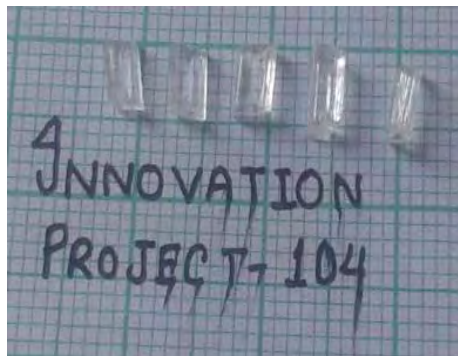
Conclusion:-

Iron(II) oxide nanoparticles were prepared via sol gel technique in two different media, i.e., acidic medium (Citric acid) and basic medium (ethylene glycol). It was found that the nanoparticles formed in basic medium were highly magnetic and pure whereas those formed in acidic medium contained several impurities. Maintaining the temperature of the solution is an important aspect of this experiment since it has been observed that uneven heating results in reversible reaction (e.g., formation of liquid phase even after gel formation). The solution in any of the setups should not be stirred vigorously through magnetic stirrer since there are chances of spilling of the solution.

Several unsuccessful attempts were given for the electro-deposition of ZnO thin film on ITO coated glass

substrate. Initially the metal clips through which the glass electrode was suspended interacted with the electrolyte. Hence dirty brown precipitate deposited on glass substrate. But even after taking the precaution in the next attempt, the desired result couldn't be obtained.

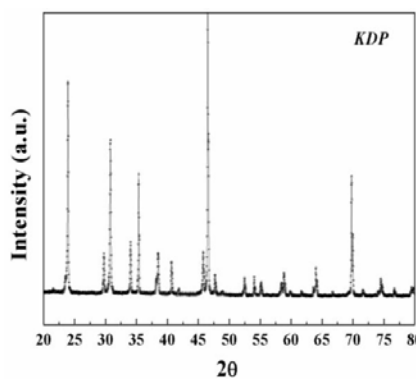
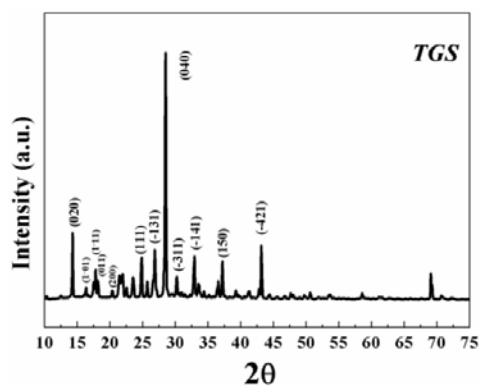
(iv) Preparation, Characterization and Applications of Single Crystals.



Photographs of TGS and KDP Single Crystals

Characterization

To confirm the quality and structure of the crystals, the grown crystals were subjected to powder XRD using a powder X-Ray diffractometer. The samples were scanned over the 2θ range of $5-80^\circ$ with the step size of 0.02. Results match very well with the reported data.



XRD pattern of TGS and KDP

Conclusion

Pure crystals of TGS and KDP were obtained by slow evaporation technique at room temperature. The Powder XRD study confirms the crystals to be of good quality and structure.

Future work: We will prepare a good quality single crystal for piezoelectric, ferroelectric and Multiferroic applications.

(v) Preparation of Nanoparticles by Reverse Micelle technique and its characterization, Applications.

Arrangement for mechanical stirring:-

Solution on left:- RM1

Solution on right : RM2



1. An arrangement for preparation of nanoparticles by Reverse microemulsion, Similarly we used two other techniques for preparation as mention below:
2. Using CTAB as the surfactant, isoamyl alcohol as cosurfactant, and cyclohexane as solvent.
3. Using CTAB as surfactant, n-hexanol as cosurfactant and cyclohexane as solvent.

3. Learning for Students (200 words):

Students become aware of the current research going on in India and abroad on material sciences because of this project. This will help them to decide their field of work/research in the future. They were even taken to National Physical Laboratory to do some measurements and interacted with scientists. They were motivated by different scientist during visit of NPL. They were made to go to the Department of Physics for all the characterization (XRD, VSM, HRTEM, FTIR, Dielectric studies), after following the necessary procedure. It was a good experience and has made them confident for future. Even working during the summer and winter holidays was a learning experience. We introduced them to new concepts from his field of research, also took their presentations continuously which further helped them in understanding physics. We also encouraged them to pursue physics in the future and recommended books to read. Working on this project was overall very educational experience.

4. Benefits to College:

During this project tenure we set up an Innovation project lab in the Department of Physics, Hindu college. We purchased many equipments related to our project that can be utilized in future for research work.

5. Benefits to Society:

There is no any direct benefit to the society from our project. But we are working on bio-sensors, and gas-sensors that can be useful to the society.

6. Further Plans:

There is some work that is undone due to lack of time like-

- (a) In-situ polymerization of nano materials with different polymers followed by shielding and sensing studies.
- (b) Preparation of good quality single crystal for piezoelectric, ferroelectric and Multiferroic applications.
- (c) Thin films for different applications. Etc.

INDRAPRASTHA COLLEGE FOR WOMEN

Project Title: *To Prepare a Glossary of Technical Terms in Yoga Philosophy*

Project Code: IP-101



Innovation Project Team (IP-101) during Antardvani Festival organized by Delhi University

1. Objective (150 words):

The primary objective of the project was to prepare a tri-lingual glossary of technical terms in Yoga Philosophy, with a complementary understanding from modern psychological perspective. Specific objectives of the project were as follows:

1. To prepare a glossary of technical terms in Yoga Philosophy based on original Sanskrit texts.
2. To present the terms and their explanatory Sanskrit sentences in Romanized and transliterated form using diacritical marks.
3. To translate the meanings of the technical terms in Hindi and English so that readers from varied disciplines can understand Yoga philosophy and apply it in their learning as well as in their day-to-day behaviour.
4. To present *Yogic* technical terms with modern psychological interpretation, wherever possible, so that the knowledge contained in Yoga can be fully utilized by students and researchers in the field of psychology.
5. To explore parallels between traditional Indian *Yogic* wisdom and modern psychological thought so that the project is truly interdisciplinary in nature.

2. Final Findings (300 words):

150 technical terms have been compiled, presented in both Romanized and transliterated form and translated into Hindi and English. Parallels have been drawn between relevant terms as explained in Yoga philosophy and in Western psychological thought. This is a kind of first attempt where *Yogic* technical terms as understood in original Sanskrit texts have been interpreted in the light of theories and concepts found in modern psychological literature. Both Sanskritists and psychologists can take help from this work and apply it for further interdisciplinary research. Sanskritists require modern scientific approach and psychologists need traditional wisdom. This research can provide ample material for both.

We have found many other yogic terms that are related to other disciplines such as philosophy, Ayurveda, social medicine, management, consciousness etc. Some of the terms are multidimensional and can be applied to any discipline of knowledge system. Yoga studies an individual and human nature as a whole

with a holistic view whereas modern university education primarily based on western way of looking at reality approaches it with a reductionist and mechanistic view. This kind of interdisciplinary research will prompt readers and researchers to develop integrated thought and a holistic kind of personality, which is the goal of yogic seers and also the need of the hour to establish a sustainable society.

The entire work is in the process of being published in the form of a book for readers and scholars. The tentative date for the publication of the book is 15th September 2013.

3. Learning for Students (200 words):

- *Enhancement of students' knowledge on Yoga philosophy* – Several lectures and sessions were held with the students wherein they were given detailed information on the following:
 - a) Yoga Philosophy and its basic tenets
 - b) Epistemology in Yoga philosophy
 - c) Metaphysics in Yoga philosophy
 - d) Significance of Yoga in mental and physical health
 - e) Relevance of Yoga glossary for interdisciplinary research
 - f) The inter-disciplinary nature and application of Yoga philosophy

These sessions helped the students understand the metaphysics, epistemology and ethics of Yoga philosophy. Reading material and a set of references were also provided to the students to enhance their understanding of Yoga philosophy and its significance as an integrated psycho-spiritual system.

- *Training of students on transliteration work* – Students were trained on transliteration work. Transliteration helps in converting a text from one script to another. Since the glossary was meant for easy readability in three languages, it was an essential part of the project work.
- *Students' engagement in research review activities* – Through this project, the students have learnt to index, review and refer to research literature. They engaged in an extensive compilation of scholarly articles, research material and unpublished manuscripts that helped them understand the process of research review entailing any project.
- *Organizing seminars and other such academic events* – A seminar was held on “Yoga and Psychology: An Integrated Approach” on 11th April 2013. The students enthusiastically participated in the seminar by making presentations on the project. They were also instrumental in making the seminar a huge success by their unstinted effort in organizing all activities associated with it. This was a huge learning experience for them and it would go a long way in making them better equipped to take up such challenges in the future.

4. Benefits to College (100 words)

- This project has inspired an intellectual fervor for interdisciplinary research within the college community. Faculty members from different academic departments are closely collaborating for undertaking research that transcends the scope of a single discipline. Many research proposals have been sent to the University on issues that were neglected in the traditional disciplinary structure of research.
- Through this project, we have been able to procure a number of important books on Yoga philosophy and psychology that will serve as a truly rich resource for reference by students and teachers alike. These books are a reservoir of information and knowledge on the

- traditional wisdom of Yoga philosophy that can be accessed by the college community for its research as well as personal needs.
- The seminar on “*Yoga and Psychology: An Integrated Approach*” held on 11th April 2013 brought together eminent academicians and scholars from diverse disciplines. The seminar facilitated academic interaction on issues concerning Yoga world-view, its psychological process and its role in holistic health and well-being. Prof. Girishwar Mishra from Department of Psychology, University of Delhi speaking on Yoga and well-being highlighted the importance of yogic way of understanding reality and applying it to our day to day behaviour and academic researches across the boundary of different disciplines of learning. Dr. Angiras (Sanatan Dharma College, Ambala Cantt, Lahore) while delivering lecture on Form and Essence of Applied Indian Psychology tried to build Indian model of psychology which requires to be understood and taught properly on the basis of Indian knowledge system. Dr. Ram Nath Jha from Jawaharlal Nehru University speaking on Yoga and Holistic Health co-related Yoga with complete and holistic health on the basis of health-definition given by WHO (World Health Organization). As per his talk, complete health, a state of happiness, can be achieved through Yoga. In this interdisciplinary Seminar around 200 students including faculty from different disciplines of learning participated and interacted with each others. The exchange of perspectives during the seminar has encouraged college students and teachers to undertake interdisciplinary research, education, and training on the traditional wisdom contained in the Yoga system of philosophy.

5. Benefits to Society (100 words)

Patanjali’s Yoga discloses the secret of bringing under control the divergent modifications (*vrittis*) of the mind, and through controlled mind, transcendental *Atman*, which is the foundation-head of knowledge, discriminative wisdom and bliss. To truly appreciate the traditional wisdom embedded in the Yoga Sutras, it is important to understand its thought and method in its pure form, as recorded in Sanskrit language. This glossary is a step in that direction. The original thought contained in Sanskrit texts with its translation in both Hindi and English will help society at large to understand the deeper meaning of Yoga's symbols and its metaphoric language, and to use this rich source of knowledge in one’s personal life. Yoga is the key to good health and happiness in today’s world. It develops our ability to maintain inner peace at all times, in our actions, and thereby achieve physical and mental health.

6. Further Plans (100 words)

This research encompasses the area of epistemology, consciousness, metaphysics, psychology, Ayurveda etc. In future, we will prefer to take up these issues for further research. This kind of interdisciplinary approach to research will help to bridge the gap between compartmentalized areas, which are being currently felt and is the need of hour. Among above-mentioned areas, the study of consciousness is the favorite one, which preferentially we will take up in near future.

As the century draws to a close, the study of consciousness has become of paramount importance. We are facing a series of problems such as environmental, social, economic, health etc., which are the product of so-called modern education that confines our personality and trains us to look at reality with a shallow vision. The worldview of modern science has transcended reductionist approach and fragmented way of thinking as established by Newtonian science. Since the apparent multifarious realities are interconnected and interdependent, an underlying and unifying reality is required to be accepted that is nothing but the energy of modern science and *Prakriti* or *Maya* and moreover

Brahman of Vedanta. To understand and realize this ultimate reality is the goal of each individual whether they belong to science, humanities or other streams of learning. In this regard, Vedanta and Yoga can play an important role because both the systems primarily study consciousness at all levels. This is an appropriate time to study the nature of consciousness as understood by modern science along with the traditional wisdom of Vedanta and Yoga. Einstein rightly says, “Science without religion is lame, religion without science is blind”.

Consciousness is the essence of individual and universal reality. It is consciousness through which we cognize this gross universe. It is consciousness that leads us from gross to subtle, subtler and subtlest aspect of this universe. It is consciousness that reveals its own nature, prompts us to get realized it, strengthen us to transcend all problems related with *adhyatmika*, *adhidaivika* and *adhibhautika* pains and equip us with ecological or holistic world-view.

We have sent one more project proposal for ‘Innovation Projects from Colleges 2013-14’ on “Consciousness as reflected in Vedanta and Modern Physics”. This project is about a new understanding of life at all levels of living systems. It is based on a new perception of reality that has profound implications not only for science and philosophy, but also for business, politics, health care, education, and everyday life.

INSTITUTE OF HOME ECONOMICS

Project Title: Ensuring Access to Safe Street Food

Project Code: IHE – 101



1. Conducting a survey & campaign 2. At Antardhvani Developing Communication Aids 3. Poster Presentation at NIFTEM

1. Objective:

In India, food vending on streets pertains to unorganized sector of food processing where sometimes poor hygiene and inappropriate sanitation measures may cause contamination of food products. The project was undertaken with an aim to assess the existing scenario of this highly popular and widespread activity and spread awareness about food safety among the selected consumers and street food vendors to promote good health.

The specific objectives were:

1. To understand the knowledge, attitude and practices of consumers and street food vendors related to food safety and hygiene.
2. To study the types of street foods available outside the selected institutions of higher education.
3. To analyze the microbial quality and adulteration in street foods.
4. To design and execute a food safety training program for food vendors.
5. To enhance awareness of students of higher education about the importance of consuming safe street food by undertaking a communication campaign.

2. Final Findings:

- i) Survey: Consumers' attitudes toward food safety, nutrition & health

Ensuring food safety is very important and this project showed the urgent need to spread awareness among consumers and food vendors to reduce food safety hazards. Research has shown that the attitude, knowledge and practices of consumers play a significant role in ensuring safety of street food. In the first phase of the project, an AKP questionnaire was designed for consumers as well as for vendors. The data was collected from five different zones of Delhi including 500 students of higher institutions based in Delhi as consumers and 250 street food vendors.

Data analysis showed that popularity of street foods in Delhi is high due to its variety, affordability and taste but most of the consumers were unaware about the various associated food safety hazards. Knowledge, attitude and practices scores of consumers were found to be positively correlated with each other thereby indicating that consumers with better knowledge and positive attitude follow food safety

related practices more. The study concludes that there is need to spread awareness related to food safety to ensure that such practices can be inculcated in the consumers.

ii) Quality evaluation of street food samples

Poor quality ingredients and spices were used in preparation of street food and many food samples were found contaminated with microbes. The fat quality was done with the analysis of peroxide value of different street food samples showed that poor quality fat/oil is being used for cooking/frying of street food products. The mean free fatty acid value and peroxide value of almost all the products are exceeding the permissible limit posing serious risk to consumer's health. The adulteration testing of street foods indicated that poor quality and adulterated spices are being used in the street food preparations. In the spices commonly used in food preparation tested (such as Salt, Garam masala, Red chillies powder, Amchur), apart from the impurities present, there were adulterants such as Brick powder, Metanil yellow and Rhodamine color.

For microbiological testing of street food products except five out of 89 food samples, most were found to be highly contaminated with microbes with involvement in food spoilage or acting as a cause of food borne diseases. They were found to be contaminated with the one or another pathogen. Out of 89 samples tested, *E.coli* was found tentatively in 65 (73.0%) samples, *Salmonella* in 38 (42.6%), *Shigella* in 38(42.6%), *Vibrio* in 55(61.7%), *Staphylococcus* in 77 (86.5) and *Pseudomonas* in 31 (34.8 %).

iii) Developing communication strategy for safe street food and BIS

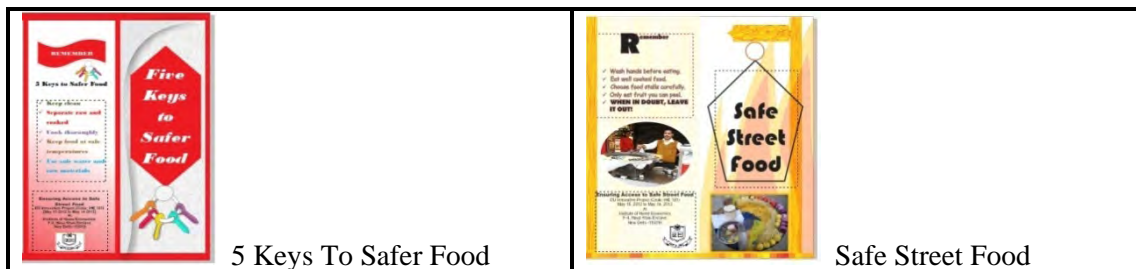
A regional workshop on “Developing communication strategy for safe street food” was organized for creating food safety awareness. Mr. Ajai Kumar (UNDP Consultant, Ministry of Rural Development) spoke on the relevance of a comprehensive communication strategy. Ms Praveen Gangahar (Quality Council of India) presented a voluntary standard on Safety of Street Food in India created by Bureau of Indian Standards (BIS).

iv) Production of relevant Information Education and Communication aids (IECs)

The development and production IECs proved to be important educational tools as they helped in imparting relevant facts in promoting safe street food and raising public awareness.

The following mentioned IECs have been prepared:-

Brochures- Two leaflets on ‘5 Keys To Safer Foods’ & ‘Safe Street Food’



- A Short video documentary (Duration 5-6 minutes) – which documents the activities undertaken in different phases of the project.
- An Educational Film – Using Puppets Characters (Duration 11 minutes) – ‘Sach Ka Samna’

Both the films have proved extremely popular and useful to student-consumers.



3. Learning for Students:

- The project being interdisciplinary in nature involved undergraduate students from different Departments viz. Communication and Extension, Food and Nutrition, and Microbiology exposed students to different tools, techniques and equipments used in other disciplines. They learnt team spirit as they worked together with sharing of their knowledge and experiences. They learnt to conduct and analyse surveys; quality testing of food samples (microbial and nutritional); communicate successfully with vendors and consumers on hygiene and sanitation aspects through communication aids. They mastered Microsoft excel and statistical techniques.
- The students imbibed the flare for research. They learnt survey of literature to acquaint themselves about the work done at national and international levels and the importance of research design & its execution. They learnt to plan the experiments, implement it and analyze the results and overcome if any shortcoming is there in planning.
- The students attended international conferences in and outside the Institute. The exhibition at *Antardhwani* organized by University of Delhi was particularly educational. This helped in enhancing their presentation skills in a scientific community and interaction with the intellectuals.
- It was a great learning experience on the significance of food safety in their day to day life as street food consumption is universal
- The students could realize ample opportunity in the area for advanced study/research.
- The project not only helped the students involved in project, but also motivated other students to get involved in such projects.

4. Benefits to College:

- ✓ It was the step forward to consistently carry on the research in a critical area in food safety in pursuit of establishing itself not only as an educational institution but as a center of par excellence for research.
- ✓ Enhanced recognition of the Institute through presentations at conferences and organizing workshops.
- ✓ Best Research Poster Presentation Award The Ist International Conference of National Institute of Food Technology, Entrepreneurship and Management (NIFTEM), Kundli, Haryana, 10-12 January, 2012.
- ✓ Paper 'The case of street food in Delhi: Situation analysis for awareness campaign' accepted for presentation at the 22nd AMIC Annual Conference, in partnership with the Department of Communication, Faculty of Social and Political Sciences, Universitas Gadjah Mada 4-7 July 2013, Indonesia
- ✓ Through coverage of project by media viz. newspapers, radio and T.V. channels (Zee).



- ✓ Creation of an infrastructure which would help to sustain many more research in future and expose students of under- and post- graduate students to know about the working of these equipments.
- 6. Benefits to Society (100 words): The project did bring awareness/ awakening in the society both for the vendors and consumers:
 - ❑ Consumers – The consumer can realize that they have a right for safe and hygiene food. Safe and healthy food helped in improved health care with better nutrition and substantial deduction of health care spent
 - ❑ Vendors - They could know the importance of hygiene and sanitary in food preparation, handling and serving. They could also know how they can achieve the same and make their food safer with no additional cost but for better profits.

This could lead to realization that hygienic and safe food would lead to larger sale and repeated consumers, rather than stale food which could take the consumer away from it.

7. Further Plans:

The proposed project deals with various strategies to ensure access to safe street food. In order to achieve project's goal to a greater extent, we have come up with some further plans:

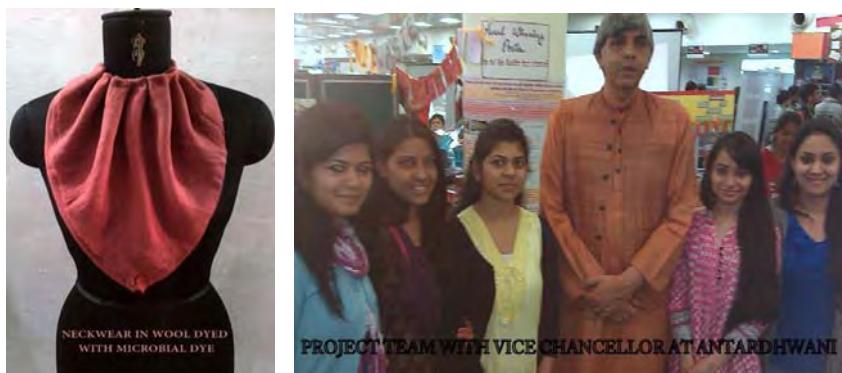
- Seasonal testing of microbial and nutritional quality of varied food stuffs: The microbial as well as nutritional quality analysis can be done *seasonally* as it can vary with seasons. This will help in creating better awareness guidelines that need to be followed seasonally to avoid health-hazards.
- Adulteration testing: Quality of spices and other ingredients used in food products need to be assessed thoroughly to avoid serious health hazards as some of the adulterants may be even carcinogenic.
- Awareness campaign for consumers and vendors: It is imperative to create awareness among consumers and food vendors regarding food-borne diseases & the related health concerns, the importance of hygiene & sanitation and to make them aware of various guidelines, rules and regulations provided by health concerned authorities (e.g. 5 keys of WHO).
- Making street food healthy: Research can be undertaken on evolving different recipes to street food vendors which would be of low cost and provide cheap, tasty and healthy street food.
- Creating an innovation Centre for food safety: A Centre which could help in dispensing awareness and knowledge about food safety, providing testing and training facilities for assessing

food quality and would also be a common platform to help implement rules and regulations laid by food regulatory authorities.

INSTITUTE OF HOME ECONOMICS

Project Title: ISOLATION AND IDENTIFICATION OF PIGMENT PRODUCING FUNGI FOR USING AS TEXTILE DYE

Project Code: IHE-102



1. OBJECTIVE:

(1 a) Introduction

Synthetic dyes are commonly used to impart color to the textile fibers. At present more than 30 million tons of synthetic dyes are used annually for this purpose. There are, however, certain limitations in use of synthetic dyes. Firstly, these are produced from non-renewable sources Secondly, being non-biodegradable and toxic; these pollute the environment and pose health hazards.

(1 b) Project hypothesis

Colorants presently used to impart color to variety of textile substrates are mostly synthetic, produced from non-renewable sources, pollute the environment and pose health hazards. Therefore, there is a growing demand for eco-friendly, biodegradable natural nontoxic colorants for dyeing of textiles which can be obtained from renewable resources like plants, animals and microbes. Microbes can be exploited as one of the natural sources of colorants as these multiply very fast and are capable of growing on large scale on a variety of raw materials requiring limited space. Keeping these points in mind the present study was planned with following objectives:

(1 c) Objectives

- i. Screening and isolation of pigment producing saprophytic and endophytic fungi.
- ii. Identification and preservation of pigment producing fungi.
- iii. Testing for dye ability of isolated fungal pigments on different fabrics.
- iv. Optimization of culture conditions for maximizing color production.
- v. Product development.

2. FINAL FINDINGS:

(2 a) Screening of pigments producing microbes:

Screening of pigment producing microbes (fungi and bacteria) from different sources like soil, leaf, water, bark was carried out using different microbiological media. A total 134 samples were screened, from which about 67 microbes were isolated. 45 were producing color on the agar

plates. They were further analyzed for color production by growing on broth media. Six out of 45 microbes which were producing sufficient pigment in broth cultures were maintained in pure form. These were grown in sufficient quantity and the crude culture filtrates were used for dyeing various textile fabric. Wool and silk samples dyed easily with these colorants without mordant. However, cotton fabric did not dye with these colorants. The pH range for dyeing was found to be 4-6. Color fastness to washing was reasonably good for all the samples tested (Annexure I).

(2 b) Optimization of physico-chemical conditions and product development:

Optimization of physiochemical conditions was performed for maximum pigment production by five microbes using different carbon and nitrogen sources and varying pH (5, 7, 9) and temperature conditions (15^oC, 28^o C, 37^oC). As evident from Table 1, different carbon and nitrogen sources promoted extracellular pigment production in the five fungi tested. However complex carbon and nitrogen sources like soluble starch, yeast extract and peptone were found to be quite effective. Efforts thus can be made in future project to find complex natural (plant or animal) waste carbon and nitrogen sources so as to make the process cost effective.

Optimization of physical conditions revealed that incubation of test fungi at temperature of 28^oC with slightly acidic to neutral pH yielded maximum pigment production. However, the room temperature of 37^oC did not show much decline in the pigment production, thus can be used in the scale up process and so as to reduce the cost of the pigment production.

Various textile products (like neck tie, bow, cravat) were developed using color pigment produced by *Monascus purpureus* (Annexure II). The products were highly appreciated during Antardhwani exhibition.

3. LEARNING FOR STUDENTS:

The project benefitted the Students a lot. Besides inculcating the flare for research, students also got financial support.

The project was interdisciplinary in nature involving undergraduate students from the two departments viz Department of Microbiology and Department of Fabric and Apparel Sciences, working towards the development of a technology for natural dye production. The students, thus, not only acquainted with their own subject but also got an idea about other stream.

Under this project students learnt how to do review of literature, browse various national and international journals on intranet, understanding statement of objectives and research design.

Training was also given to all the students involved in the project, to acquaint them in various Microbiological and dyeing techniques to be used during the study such as sterilization, media preparation, inoculation, dyeing process etc.

(3d) All the students have worked on different types of equipment's like laminar chamber, vortex, water bath, incubators etc.

(3e) The project helped the students to get hand on experience on instruments and learnt to design the experiments, implement and analyse the results. Through Project exhibition in Antardhwani, they developed the skill to present the results and interact with the intellectuals. They motivate other students in the college to get involved in such projects.

4. BENEFITS TO COLLEGE:

The project helped in infrastructure development of Department of Microbiology and Department of Fabric and Apparel science of the college. Lyophilizer (freeze dryer) was purchased for drying the color pigment and to find out the yield of the product.

Department of Microbiology and Fabric Apparel Science have basic equipment to carry out the class experiments. For research some advance equipment are required. From the project we purchased a lyophilizer (freeze dryer) to dry the color pigment produced by microbes. This would help in standardizing the technique of dye production and finding the yield. Material was also purchased for developing a resource Centre in Department of Fabric and Apparel Science, the need for which was always felt for undergraduate and post graduate students. Project also helped in inculcating the zeal of research among the students. The research work was appreciated and covered in the media which helped in the recognition of the institution.

Seminar: One day seminar on 'Isolation & identification of pigment producing fungi for use as a textile dye' was held on 29th April 2013. Lectures on 'Surface modification of polyester: a chemical and enzymatic approach' and 'Spider silk produced in genetically engineered bacteria: Biotechnological intervention in the field of textiles' topic was given to emphasize the importance of ecofriendly biotechnological process in textiles. A question answer session was held among students, researchers and mentors. This was followed by poster making competition on 'Green technology initiatives in textiles'.

5. BENEFITS TO SOCIETY:

Textile industry particularly wet processing releases the most toxic effluents in the Ecological Systems. Synthetic dyes are largely azo based or contain harmful metals which are carcinogens. Natural dyes which are plant based also use metallic mordants and thus are not truly friendly. Dyes from fungi and bacteria do not use petrochemicals as raw material can be standardized in the lab. If these dyes are explored and optimized they would replace the synthetic dyes and thus yield benefits to the mankind at large.

6. FUTURE PLANS:

- Development of an ecofriendly, cost effective technology for large scale microbial pigment production and the technology transfer to industries.
- Use of microbial pigment to dye various other materials like leather, cotton fiber.
- To exploit the use of microbial pigment in other areas as in food, pharmaceutical, indicators etc.

JESUS AND MARY COLLEGE

Project Title: SOLID WASTE MANAGEMENT

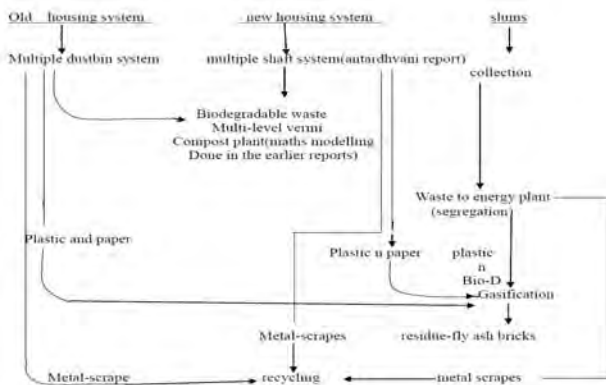
Project Code: JMC 101



Mumbai based German company Concord blue and their official.

1. Objective (150 words):

Our objective is to frame our waste management system in this manner so as to increase the lifespan of the landfills



Under the old or the existing localities, the only possible way of collecting waste is that every building should have their 4 dustbins namely-bio-degradable, plastic, glass/ceramic/debris, paper.

Every zone has to run a pilot project to determine the constituent percentage of the garbage produced by them. The highest percent constituent will be collected frequently and like-wise the least produced will be collected every fortnight or as per the requirement. One exception will be food material which will be collected everyday. Defaulters will be pointed by the waste collector in case segregation is not done efficiently. In case of multiple ownership in one building, different colored bags can be used by different owners.

The similar process will be applied under the multiple shaft system (mentioned in the old report) applicable mandatorily in the new constructions or proposed constructions.



Courtesy-architect

MULTI-LEVEL VERMI_COMPOSTING

The aim of vermi-composting is to convert the bio-degradable waste into a useful and revenue generation commodity and to discourage the usage of chemical fertilizer.

The realistic consequences of vermi composting were observed in NALANDA district in BIHAR as a joint initiative of the district agriculture officer Mr. Mahato and the farmers wherein they got positive result and steady increase in yield.

The attached document is provided by Mr, dhananjay kumar

जैविक विधि एवं रासायनिक विधि से सब्जी फसलों का तुलनात्मक उत्पादन प्रतिवेदन

क्र.सं.	फसल का नाम	उत्पादन क्वी./हे० (रासायनिक)	उत्पादन क्वी./हे० (जैविक)
1.	फूलगोभी	280	335
2.	पत्तागोभी	275	315
3.	बैंगन	260	315
4.	टमाटर	650	745
5.	प्याज	270	315
6.	मटर (हरी फली)	60	85
7.	लोकी	190	235
8.	करेला	130	165
9.	आलू	250	325
10.	मिर्च	60	85

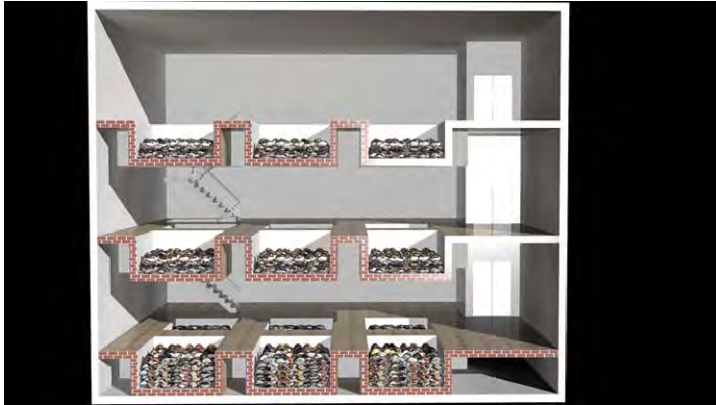
नोट- उपरोक्त उत्पादन नालंदा जिले के विभिन्न किसानों द्वारा उत्पादित किये गये उत्पाद का औसत उत्पादन दर्शाया गया है।

During the case study of vermi-composting vs. Incineration, one drawback of adopting vermi-composting we found out was the amount of land that is needed to setup vermi-composting plants for many tons of waste generated. Due to urbanization, land has become a scarce commodity. A single vermi-composting plant can take a huge amount of land, depending on how big a plant is to be established. Also, for the tons of waste generated every day, we would need many composting plants over the city. This is not feasible as it leads to excess pressure on the economy, and land (which is a scarce resource).

As a solution, our team has come up with the idea of MULTI-LEVEL COMPOST PLANTS.

If we can have multi-level parking lots in residential areas and malls, why not compost pits?

We can construct a building with as many floors as the amount of compost plants needed in that particular locality; each floor pertaining to one compost plant. For the same, we have been in touch with an architect, Ms XYZ.



Multilevel Composting System is basically like Multi-level Parking practiced in many places. We propose that vermi-composting can be done at multiple pits built at various levels/floors. It will require a concrete building with a roof having 2-3 floors, each floor having multiple units/pits according to the maintaining power of the concerned authority. Also, to further reduce land use, multilevel can be designed at underground level i.e. we can have 1-2 levels in the basement and a entry on the ground level. Separate workers can be employed on part time basis to look after the composting process on regular basis. This is a low maintenance and hassle-free process. Also, it requires one time investment of only building material and procuring worms. The concrete construction cost adds up to Rs.1000-1200per square meter. As once the multilevel setup is ready, it will continue to generate compost for lifetime if everything goes well-planned and in an organized manner. Buying worms is needed just once as afterwards they keep multiplying on their own.

This is an effective system and can put an end to dhalaos in future if implemented judiciously. The biodegradable waste can be directly transferred from MCD trolleys to these pits.

Vermi-composting can be performed indoors as well, as only the moisture and temperature should be checked. Therefore, a well-built multi-level building can serve the purpose of Multi-level composting where the pits may be installed.

Also, having multi-level compost pits in a locality would help segregate the biodegradable waste from household waste at the source,(as all the biodegradable waste will be sent to the compost plants) thereby minimizing waste sent to landfills.

ADVANTAGES OF MULTILEVEL COMPOSTING:

1. Turns food waste into a resource
2. Conserves limited landfill space
3. Recycles nutrients
4. Improves soil structure, aeration and water retention
5. Contributes to soil fertility and healthy root development
6. Increases organic content of the soil
7. Generates revenue for the govt.
8. Generates employment

9. Odorless, non-polluting and hassle-free
10. Effectively solves the problem of scarcity of resources, i.e. land.



This will overcome the problem of land availability. It can be centrally controlled by the govt. or separately can bifurcated into 3 MCD zones which are: North zone, South zone and West zone.

Moreover, we can also utilize existing Barren Lands, for construction purposes. We got in touch with MCD and NDMC for the same.

However, the existing barren lands are a source of much dispute. Many corporations and government organizations are forerunners in the race of owning the land.

As a result, the MCD and NDMC officials were ambiguous about the current status of barren lands and due to lack of specific department concerning the barren land, specific information could not be procured.

To solve this problem, we thought to transform existing dhalaos into multilevel compost pits.

Disposal of waste forms a very important parameter of the solid waste strategy. After collecting the waste the garbage goes straight to the dhalao or dustbin. Dhalaos are concrete structures varying in size from 4.5m * 3 m * 13.5m * 9m. These can store up to 4-16 tons of garbage. The existing dhalao, dustbins are mainly depots which act as transfer stations (secondary community storage bins) rather than serving people directly due to their locations.

The requirement of these Dhalaos has been worked out on the basis of solid waste generation per capita per day, as in NDMC area it is 0.67kg waste per capita per day and in MCD , it is 0.60kg per capita per day.

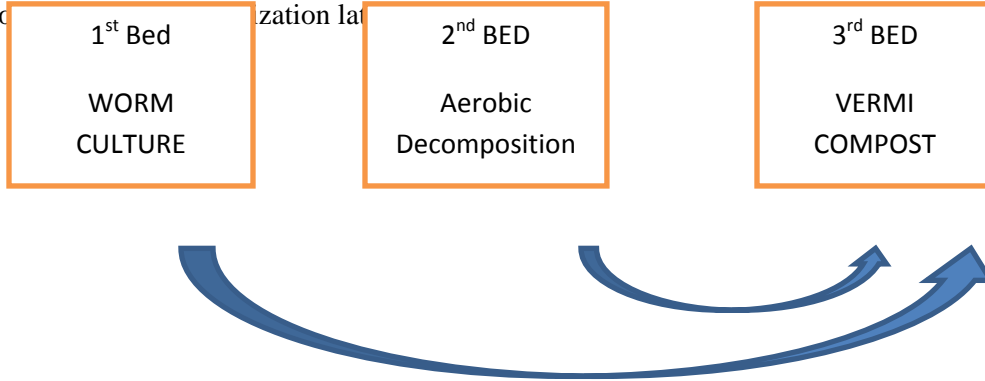
Neighborhood dhalao are covered structures more or less closed to the outside. They are 813 in number, in addition, there are 294 sites for dumping garbage. The availability of number of waste receptacles varies from one zone to another

VERMI COMPOST MODEL

MODELLING VERMI- COMPOSTING

Objective of the model: To understand the inflow rate of solid biodegradable waste and the outflow rate of decomposed waste converted to manure for a particular plant (i.e. a fixed area allotted for vermi-composting), so that we can target the objective of waste minimization by not collecting biodegradable

waste at the source or diverting it to Landfills, by analyzing if the inflow rate is more or less than the outflow rate through compartmental modelling. We also will study the economic benefits of Vermi



Remark: These are compartmental models involving differential equations as they involve the variable time t . The proposed model is a linear, continuous, dynamic and inductive model as it is based on empirical findings and generalizations.

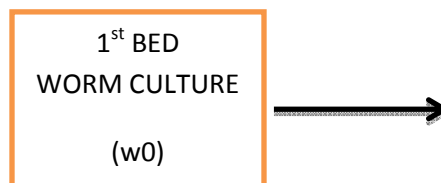
Problem1: WORM CULTURE

We have a fixed amount of land area allotted to us- divided into separate trenches and beds of fixed sizes i.e. fixed length and breadth.

In the first bed, say w_0 (we assume taking 700-800 worms or depending on the weight) amount of worms are put to culture. We need to obtain a minimum of say w_1 amount of worms (we assume 10,000 worms) eventually. In how much time t will we be able to obtain w_1 amount of worms from the 1st bed to put into the 3rd bed.

Hypothesis and underlying assumptions:

1. Limited space is available for worms to reproduce, and mating is possible, but whenever felt there occurs crowding worms are shifted from the 1st bed to the 3rd bed therefore there occurs no case of crowding in worm culture in vermin-composting. (Note: We culture the worms to vermi-composting economically beneficial)
2. Optimal supply of cow dung and water.
3. Temperature of 25°C -30°C is maintained containing cow dung and worms.
4. Moisture of 50%-60 % is maintained in the bed with optimum watering (i.e. watering according to the season) to the bed.
5. The worms are protected from the predators and enemy populations like Peacock, Mongoose, Ants, Snakes, Rodents and Spiders.



Since there is removal of worms from the 1st bed to 3rd bed trenches, and there is optimal supply of cow dung and water to the bed, death rate due to crowding and competition is avoided. Hence, we can exponentially model this system using differential equations where the population size of worms grow continuously with time.

The rate of reproduction of worms directly depends on the population size of the worms keeping in mind the assumptions.

Here, w is a $w(t)$ (i.e. a function of time), and a is a constant (i.e. constant birth rate – death rate) .

Solving the above differential equation we get,

$$\frac{dw}{dt} = a * w$$

$$w(t) = w_0 * e^{(a * t)}$$

We need to find a empirically.

This model can help us predict how much waste can be decomposed into vermi-compost, which eventually tells us how much waste out of total produced is reduced.

Further, once the composting starts in the college we can analyze and probably produce an approximate study of how much waste will be /can be reduced through this technique, if practiced on a larger scale and also prepare an economic household composting plant model.

WASTE TO ENERGY PLANT

AIM: TO OPTIMISE THE COST OF OPERATING DELHI'S WASTE

Delhi is a city spread over a land of 1483 sq km with the human population of 1.68 crores. Every day 7-8 tons of waste is generated approximately with a complex composition. According to the 2011 census 97% of its population corresponds to urban areas whereas 3% lives in the rural areas. The urban population comes under municipality and has access to all its facilities, on the other hand the rural sector is much unorganized and there is no proper system of collecting waste from these regions.

EFFICIENT WASTE MANAGEMENT OF RURAL AREAS

Firstly there should be a proper system of collecting the waste from these zones. Use of compactors to transport the waste will be cost effective due to cut down on the number of trips performed also there will be no spilling and overflow hazards of the waste. Compaction of waste is necessary as that leads to increased storage space. There onwards this waste can be put to use generate fuel by using Gasification.

Gasification is a process that converts **organic** or **fossil** based **carbonaceous** materials into **carbon monoxide**, **hydrogen** and **carbon dioxide**. This is achieved by reacting the material at high temperatures (>700 °C), without combustion, with a controlled amount of **oxygen** and/or **steam**. The resulting gas mixture is called **syngas** (from *synthesis gas* or *synthetic gas*) or **producer gas** and is itself a fuel. The power derived from gasification and combustion of the resultant gas is considered to be a source of **renewable energy**.

Concord blue technology private limited Mumbai, Maharashtra delivers environmentally friendly,

economically feasible and sustainable WASTE TO ENERGY solutions. The Concord Blue process employs gasification followed by gas reforming to produce a tar free, hydrogen intensive syngas which can be utilized to generate power directly. The company's headquarters are in Germany and was founded in 1998. The factory is based in Pune and it has a plant with a capacity of 700 tons per day. Pune generates 1500-1700 tons of waste per day out of which 400 tons is taken by concord blue to efficiently convert it into energy. Gradually this plant is expected to increase its capacity to 1000 tons. It takes nonsegregated waste and through their fine machinery separate nonessential materials at different stages to finally get the desired intake material for the gasifiers. The machinery used for segregating has 90% efficiency and the plant profitably generates 1 MW electricity out of 3 tons of waste. The residue of this process is ash which is further used in making ash bricks . In this way this plant is able to use the city's waste productively henceforth setting an example for various waste to energy plants in Delhi which are faulty and incapable of making best out of its waste.

EFFICIENT WASTE MANAGEMENT OF URBAN AREAS

Since the segregation is possible in a settled population,100% segregated plastic can be send to gasifier,saving the cost of operating the segregation plant.hence the only section relying on segregation plant is the slum's un-segregated waste and miscellaneous.

This reduce the energy consumption of the waste to energy plant thus increasing the profit.

AIM: TO OPTIMISE THE COST OF OPERATING DELHI'S WASTE

Delhi is a city spread over a land of 1483 sq km with the human population of 1.68 crores. Every day 7-8 tons of waste is generated approximately with a complex composition. According to the 2011 census 97% of its population corresponds to urban areas whereas 3% lives in the rural areas. The urban population comes under municipality and has access to all its facilities, on the other hand the rural sector is much unorganized and there is no proper system of collecting waste from these regions.

EFFICIENT WASTE MANAGEMENT OF RURAL AREAS

Firstly there should be a proper system of collecting the waste from these zones. Use of compactors to transport the waste will be cost effective due to cut down on the number of trips performed also there will be no spilling and overflow hazards of the waste. Compaction of waste is necessary as that leads to increased storage space. There onwards this waste can be put to use generate fuel by using Gasification.

Gasification is a process that converts **organic** or **fossil** based **carbonaceous** materials into **carbon monoxide**, **hydrogen** and **carbon dioxide**. This is achieved by reacting the material at high temperatures (>700 °C), without combustion, with a controlled amount of **oxygen** and/or **steam**. The resulting gas mixture is called **syngas** (from *synthesis gas* or *synthetic gas*) or **producer gas** and is itself a fuel. The power derived from gasification and combustion of the resultant gas is considered to be a source of **renewable energy**.

Concord blue technology private limited Mumbai, Maharashtra delivers environmentally friendly, economically feasible and sustainable WASTE TO ENERGY solutions. The Concord Blue process employs gasification followed by gas reforming to produce a tar free, hydrogen intensive syngas which can be utilized to generate power directly. The company's headquarters are in Germany and was founded in 1998. The factory is based in Pune and it has a plant with a capacity of 700 tons per day. Pune generates 1500-1700 tons of waste per day out of which 400 tons is taken by concord blue to efficiently convert it into energy. Gradually this plant is expected to increase its capacity to 1000 tons. It takes

nonsegregated waste and through their fine machinery separate nonessential materials at different stages to finally get the desired intake material for the gasifiers. The machinery used for segregating has 90% efficiency and the plant profitably generates 1 MW electricity out of 3 tons of waste. The residue of this process is ash which is further used in making fly ash brick. Hence the efficient residue consumption and 12Mwatt generation makes it revenue generating which can even act as a strategic business unit for funding the vermi-compost sector.

EFFICIENT WASTE MANAGEMENT OF URBAN AREAS

Urban waste is a combination of biodegradable and non-biodegradable waste. Biodegradable waste is the one which can be naturally synthesized and non biodegradable is further divided into recyclable, non recyclable and inert waste .

Firstly the most important step in managing the waste would be segregation at the source, therefore every household must maintain two different dustbins for the two types of waste and this should be implemented by law. After separating the waste , the biodegradable waste could be composted by each household individually or collectively by a community. The government’s share in this would be usage of all the barren lands in the city for various types of composting, vermi composting being the most preferred one.

After using the biodegradable waste effectively we have the non-biodegradable waste to put to use. Either the entire waste could go to a Gasification plant if further segregation is not manually possible or the recyclable waste could be sent to recycling companies. In this way all our waste is taken care of and we get profited by our waste.

AUTHORIZING KABARIWALLAS UNDER ONE ROOF

Another way of generating revenue through recycling(which does not yield anything to the government currently) can be authorizing kabari-wallas under one roof made by the government. Since we proposed collection of waste entirely by the government, this step will give boost in generation of income in form of yearly tax for authorizing them under one roof and also keeping a check on the carbon footprint which otherwise cannot be govern.

MITIGATION

Since the garbage collectors tend to sell the recyclable waste for their person profit to local kabari-wallas we can keep a check on them through following model

LEAST SQUARE APPROXIMATION

t_1, t_2, t_3, t_4 be the time when x_1, x_2, x_3, x_4 tonnes of plastic is send by a particular zone.

$$A = \begin{pmatrix} t_1 & 1 \\ t_2 & 1 \\ t_3 & 1 \\ t_4 & 1 \end{pmatrix} \quad X \text{ plastic waste} = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix}$$

NOTE-this model is applicable if there is a linear growth in plastic.in case of exponential or some other nature of growth then we follow lagrange,newton interpolation method.

Since the relation follow $x=ct+d$ hence we find c,d and also the error E

$$(A^*A)^{-1}=L$$

$$\begin{pmatrix} c \\ d \end{pmatrix} = L^*A^t *X= y_0$$

$$\text{Error}=\|A*y_0-X\|^2$$

If in the following months the growth remains steady up/constant then we may not intervene but if the growth slumps down or exceed the error in graph then we may intervene in the following zone.

SOCIO_ECONOMIC ASPECTS

The following are the initiatives by government which we only observed on paper Government Initiatives and Policies(on papers) Employment requirements of increasing numbers of urban poor and management of vast quantum of solid waste generated are the key factors that have combined to create the increasingly growing occupation of waste picking. Though the waste pickers play a significant role in the entire process of waste management yet their services go unnoticed and issues concerning their livelihood go unaddressed. Government approaches to the needs of the waste pickers are too compartmentalized and fails to have a holistic view of their problems and requirements. It is imperative that policies be so designed that they are more responsive to the needs of the waste pickers. In the present section an analysis has been done of the government policies and programs on the main factors that have contributed towards the growing occupation of waste picking.

1. Employment opportunities of the urban poor

The number of urban poor has increased over the last three decades in contrast to the decreasing rural poverty in India. This can be attributed to the fact that the Indian policy makers focused on rural development. Urban poverty alleviation got sidelined as it was assumed that urban poor had greater access to opportunities in urban areas and hence had less insecurity to cope with. As urban systems and poverty within it grew, urban poverty could no longer be ignored. However, so far there is no segmentation of the urban poor to determine the size of the waste pickers in urban setups for enabling exclusive interventions.

Employment integrated into overall planning process and Employment Oriented Urban Poverty Alleviation Programmes Urban poverty as a priority area occupied the attention of the planners only in the Seventh Five Year Plan (1985-1990) when urbanization was realized as an integral part of economic development⁶.

In the seventh plan emphasis was given to urban employment generation as a means to tackle urban poverty. Self-employment programmes, namely, Self-Employment Programme for the Urban Poor (SEPUP) was introduced in 1986 and Nehru Rozgar 6 NIUA, 1990 Yojana (NRY) was introduced in

1989. SEPUP was the first urban poverty reduction programme with emphasis on employment. It was a stand alone, one-dose small credit intervention programme. NRY was a more comprehensive employment programme with increased number of interventions like widening the employment base for the skilled as well as unskilled workers including women, through promotion of micro-enterprises (ME). Thereafter, other poverty alleviation programmes were also introduced. The informal sector, as a component of the development process in the economy, was first recognized in the Eighth Five Year Plan (1992-97). The National Capital Region Planning Board, Government of India's regional planning agency, has accepted the informal sector employment generation route as one of the policy strategies to develop towns around Delhi and to decrease unemployment of increasing migrated population in Delhi. In the nineties, two micro enterprise oriented programmes, were introduced in view of the growing urban poor. The basic objectives of these new Programmes were employment generation, community empowerment and environmental improvement giving attention to the informal sector, which was growing at a rate of 6% against the tardy general employment growth. To provide sustenance to programmes of income generation, the Urban Basic Services for the Poor (UBSP) was implemented as a centrally sponsored scheme during the Eighth Five Year Plan. Its main objective was to meet the basic physical and social needs of the urban poor through community organisation, mobilisation and empowerment.

In the Ninth Plan (1992-97), it was recognized that rapid economic growth was most important to increase employment opportunities. Public intervention for employment generation was considered crucial and the necessity of achieving full employment was a major determining factor in setting up of the growth rate of the Indian economy during the nineties. The Prime Minister's Integrated Urban Poverty Eradication Programme (PMIUPEP) was launched in November, 1995. It was basically an employment generation programme which sought to address the problems associated with urban poverty by building up community based organizations (C BO) as the centre of the development process and by facilitating direct participation of the targeted groups.

Towards the end of the nineties, another programme, Swarna Jayanti Shahari Rozgar Yojana (SJSRY) was introduced that included all the urban programmes in existence. The programme seeks to alleviate urban poverty by converging employment components of the earlier schemes and seeks to provide gainful employment to the urban unemployed or underemployed poor through encouraging the setting up of selfemployment ventures or provision of wage employment. The two schemes under SJSRY are the Urban Self Employment Programme (USEP), and the Urban Wage Employment Programme (UWEP).

OUR REPORT

REPORT ON OKHLA- the landfill site
This study attempted to assess the respiratory and general health of rag pickers who rummage through the garbage dumps and landfill sites in Delhi to collect and sell recyclable materials for a living. Rag picking is probably one of the most dangerous and dehumanizing activity in India. The 3 major landfill sites of Delhi are Bhalaswa, Okhla, and Gazipur.

We chose OKHLA for our study. The Ohkla landfill is a controlled open dump, owned and operated by the Municipal Corporation of Delhi. The site opened in 1994. The site currently has 7 million tonnes of waste in place. The objective of the study was the study was to examine the respiratory and general health of workers employed there. Child rag pickers were seen working in filthy environments, surrounded by crows or dogs under such hot and humid weather conditions and had to search through hazardous waste without gloves or shoes.

Handling waste we observed posed many health risks to workers. These were greater for informal workers due to their daily unprotected exposure to contaminants and hazardous materials. Risks included

contact with fecal matter, paper saturated by toxic materials, bottles and containers with chemical residues, health residues, contaminated needles, and heavy metals from batteries. Due to the lack of worker protection and poor access to health care these risks we saw were further aggravated.

On interrogating RAMU, a 10 year old boy, we learnt they often eat the filthy food remnants they find in the garbage bins or in the dumping ground. Using the dumping ground as a playing field, the children run the risk to come upon needles, syringes, saline bottles, soiled gloves and other hospital wastes as well as ample of plastic and iron items. They suffer from many diseases, such as upper and lower respiratory symptoms, worms, anaemia, fever and other problems which include cuts, rashes, dog bites. On asking the rag pickers about the common problems they suffered from, there was a high prevalence of low haemoglobin, unhealthy gums, frequent diarrhoea, dermatitis, fungal infection, ulceration of the skin, burning sensation in the extremities, tingling or numbness, transient loss of memory, and depression.

Landfill workers at Okla. reported that they face great risks of injury, especially those working at open dumps, as many times workers have been run over by trucks or become the victims of surface subsidence, slides and fires. They are also exposed to great quantities of toxic fumes. Landfill workers there endure ergonomic hazards such as heavy lifting, static posture and repetition, and may have high incidences of low back and lower extremity pain.

The rag pickers in the Okhla district suffer from a multitude of health problems which seem related to their occupation. Once they are in this landfill site, belonging to the profession of rag picking, they face still more problems by the police, by the public, by the middle men, by the other rag pickers and so on. Workers complained about being treated as nuisance by authorities and with disdain by the public. They are particularly susceptible to violence by the police. They hesitantly owned up to exploitation by middlemen, which affected their earnings.

Apart from these problems they face acute health hazards, no proper place of sleep, exposure to evils of society (like ganja addiction, alcohol, smoke, sex, etc.), which are forcefully imposed upon them due to their profession as rag pickers.

3. learning for Students (200 words):

We learnt to sensitize this issue of waste management and do not take it lightly. We understood how small variations can reduce waste and also how methods like vermi-composting should be adopted. We learnt the whole procedure of vermi-composting. We learnt how waste management can turn from a zero returns charity to a revenue generation, electricity generating venture. Moreover we also learnt how we are self-sufficient in producing electricity with the amount of waste in landfill waiting to be utilized as a fuel with zero carbon footprints. We learnt how under public-private partnership the kabari-wallas can be rehabilitated and how waste to energy plant and recycling venture can turn out as a strategic business unit for generating revenue.

4. Benefits to College (100 words):

We got a vermi-compost plant set-up in our college which will be generating revenue from this year after operation on full scale. NSS will also start a cleanliness drive for which we have provided them 2 types of dustbins for the entire college campus.

5. Benefits to Society (100 words):

We aim at the betterment of karamcharis family who seemed to be living a very poor life because of meagre wages. We have provided amenities like gloves, boots, masks for safai karamcharis.

This session will evident the beginning of a campaign called "care for those who care for us" wherein we will fix deposit some amount along with initial funding from student every year. The fund will be used for medical and educational benefits of kamarchari's family and the interest will be used as maintaince capital for vermi-compost. We aim at providing tuitions to their children under education campaign. We are also doing our bit to reduce the waste going into landfills.

6. Further Plans (100 words):

Our campaign for changing the lifestyle of karamcharis as mentioned above and full scale operation of vermi compost plant as a pact between IARI and college. We are also going to refer CPCB the Concord blue company for waste to energy plant along with teaching the freshers about cleanliness drive and certificates for those who will voluteer in learning composting and garbage shifting job in college. Our college is working on coffee table project book which will include our project. Note-some expenses like the printing of the coffee table book are pending.As a result there might be some changes in the figures mentioned in the utilization certificate. They will be settled and communicated to the innovation desk within a week's time.

SURVEY CONDUCTED TO CHECK AWARENESS

Next,we revised the previous questionnaire (Please check the copy of revised questionnaire in OTHER section in the next few pages) and carried out a survey on around 300 households to know how the waste is being disposed by them.

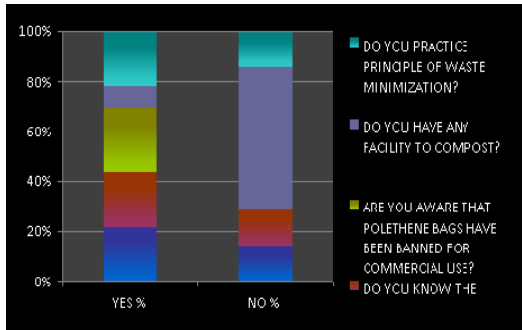
This survey has the qualitative as well as quantitative aspects. To study the quantitative part we have categorized the sample space according to the family income.

Quantitive analysis

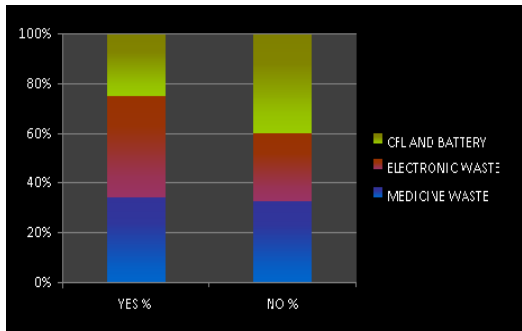
Economy group -income below Rs. 25,000

INCOME LESS THAN 25,000 PER MONTH		
	YES %	NO %
DO YOU KNOW ABOUT WASTE SEPARATION?	83.33333	16.66667
DO YOU KNOW THE DIFFERENCE B/W BIODEGRADABLE AND NON BIO DEGRADABLE?	83.33333	16.66667
ARE YOU AWARE THAT POLETHENE BAGS HAVE BEEN BANNED FOR COMMERCIAL USE?	100	0
DO YOU HAVE ANY FACILITY TO COMPOST?	33.33333	66.66667
DO YOU PRACTICE PRINCIPLE OF	83.33333	16.66667

WASTE MINIMIZATION?



7. SEPERATION OF WASTE	YES %	NO %
MEDICINE WASTE	45.45455	54.54545
ELECTRONIC WASTE	54.54545	45.45455
CFL & BATTERY	33.33333	66.66667



5 GARBA GE DIPOSA L METHO D	GARBA GE PICKER	THROWI NG IN NEARES T DUMP	BURNIN G	THROWI NG ON STREET
	66.66667	50	0	0



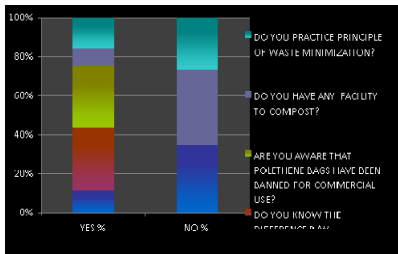
9. RE-USE PRACTICE	BOTTLE	BOXES	POLYTHENE	PAPER
	100	100	100	50



INCOME ABOVE Rs25,000

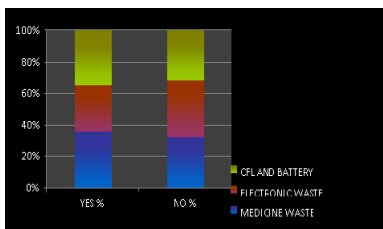
INCOME MORE THAN 25,000 PER MONTH

	YES %	NO %
DO YOU KNOW ABOUT WASTE SEPARATION?	35.71429	64.28571
DO YOU KNOW THE DIFFERENCE B/W BIODEGRADABLE AND NON BIO DEGRADABLE?	100	0
ARE YOU AWARE THAT POLETHENE BAGS HAVE BEEN BANNED FOR COMMERCIAL USE?	100	0
DO YOU HAVE ANY FACILITY TO COMPOST?	28.57143	71.42857
DO YOU PRACTICE PRINCIPLE OF WASTE MINIMIZATION?	50	50



7. SEPERATION OF WASTE

	YES %	NO %
MEDICINE WASTE	50	50
ELECTRONIC WASTE	42.85714	57.14286
CFL AND BATTERY	50	50



5 GARBAGE DIPOSAL METHOD

GARBAGE PICKER THROWING IN NEAREST DUMP BURNING THROWING ON STREET

71.42857

28.57143

0

0



9. RE-USE PRACTICE

BOTTLE

BOXES

POLYTHENE

PAPER

78.57143

71.42857

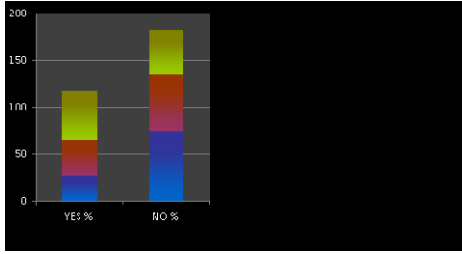
71.42857

71.42857



BELOW 1 LAKH

	Yes %	No %
DO YOU KNOW ABOUT WASTE SEPARATION?	65.21739	65.21739
DO YOU KNOW THE DIFFERENCE B/W BIODEGRADABLE AND NON BIO DEGRADABLE?	95.65217	4.347826
ARE YOU AWARE THAT POLETHENE BAGS HAVE BEEN BANNED FOR COMMERCIAL USE?	100	0
DO YOU HAVE ANY FACILITY TO COMPOST?	26.08696	73.91304
DO YOU PRACTICE PRINCIPLE OF WASTE MINIMIZATION?	73.91304	26.08696
7. SEPERATION OF WASTE		
	YES %	NO %
MEDICINE WASTE	26.08696	73.91304
ELECTRONIC WASTE	39.13043	60.86957
CFL AND BATTERY	52.17391	47.82609

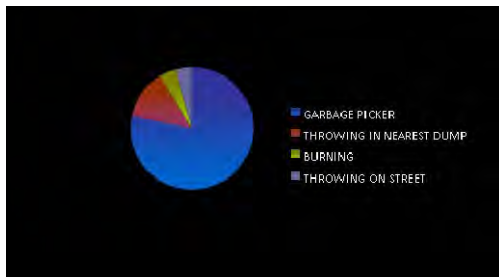


Yellow-cfl and battery

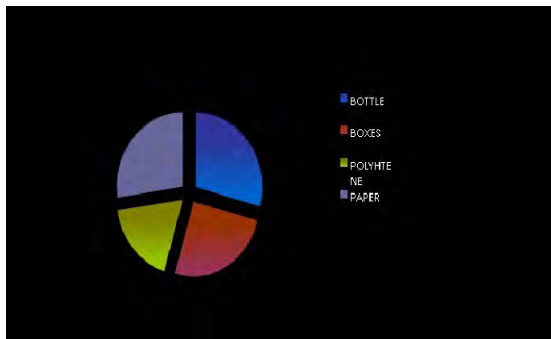
Red-electronic waste

Blue-medicine waste

5 GARBAGE DIPOSAL METHOD	GARBAGE PICKER	THROWING IN NEAREST DUMP	BURNING	THROWING ON THE STREET
	78.26087	13.04348	3.225	5.8023



9. RE-USE PRACTICE	BOTTLE	BOXES	POLYTHENE	PAPER
	69.56522	60.86957	43.3566	65.54346



ABOVE 1 LAKH

Income above 1 lkh.