

IITR

ISSN: 0970-437X

TOXICOLOGY

Research Bulletin

Volume 28

Number 2

2008



DG's Visit	2
World Environment Day	3
CR Krishna Murti Oration	4
Research Highlights	5
Research Digest	13
Hindi Lekh	18



Indian Institute of Toxicology Research, Lucknow
(Formerly: Industrial Toxicology Research Centre, Lucknow)

DIRECTOR GENERAL, CSIR VISITS IITR

Prof. Samir K Bramhachari, Director General, Council of Scientific and Industrial Research, visited Indian Institute of Toxicology Research on May 28, 2008. Dr Ashwani Kumar, Acting Director, IITR briefed DG, CSIR about the activity and achievements of the Institute. Later DG, CSIR in a meeting with the scientists of IITR emphasized the need for team spirit and to think and act globally. In his interaction with the scientists 45 years of age

and younger he emphasized the relevance of new ideas in global competition. DG also visited the exhibition of IITR technologies and appreciated the achievements. At the end Prof. Bramhachari addressed entire IITR staff including research scholars and he encouraged them by saying that collective efforts can bring laurels to any organization.



DG discussing IITR's future plans with Acting Director, IITR



A look at IITR Technologies



Addressing young scientists



DG (inset) addressing staff in a packed auditorium

WORLD ENVIRONMENT DAY CELEBRATED AT IITR

The World Environment Day was celebrated at Indian Institute of Toxicology Research (IITR) Lucknow on June 5, 2008. Dr Ashwani Kumar, Acting Director, IITR welcomed the guests Prof. Harsh Gupta, Raja Ramanna Fellow and former Director, National Geophysical Research Institute, Hyderabad and Dr PN Razdan, Sr. Dy Director General, Geological Survey of India, Northern Region, Lucknow and said that this day is celebrated through out the world with great zeal to make more and more people aware of the environment.

On this occasion Prof. Harsh Gupta delivered the XII Dr CR Krishna Murti Memorial Oration. The lecture was on "How to Mitigate the Storm Surges and Tsunami" in southeast coastal areas of India with an ultimate goal to save lives and property.

Dr PN Razdan in his presidential address emphasized on deterioration of environmental quality. He said that the discipline and balance of nature has directly been challenged by the mankind due to overexploitation of the natural resources. Today, the world's natural resources have started deteriorating. Biodiversity, global warming, deforestation, lowering of ground water table, air, water and soil pollution, solid waste disposal are key issues to scientists, planners and governments. Global warming is accelerated by the human activities. Climatic change is the result of unsustainable activities. Since the late 19th century the industrialized world is using fossil fuels. In just over 100 years 1/3rd to 1/2nd of the world petroleum has been used which is thousand times faster than its replenishment. Similarly, coal is being used much faster than the nature can replenish it. Likewise the amount of CO₂ produced from the use of fossil fuel has risen from less than 300 ppm by volume in late 19th century to nearly 400 ppm today. Another major environmental problem is related to waste disposal. The mankind is becoming more and more civilized and its dependence on natural resources is increasing day by day as a result the amount of waste product which includes nuclear and chemical waste too is increasing. No clear cut global policy has yet being formulated to get rid of this problem which is slowly increasing the toxic level of natural

resources and becoming a threat to living beings. Now it is high time that proper steps are taken to mitigate this problem. He advocated self education for minimizing waste generation, and using our common sense to deal with the problem. Dr Razdan gave away prizes to the winners of the painting contest held on this occasion.

Dr PN Razdan released the report Assessment of Environmental Status of Lucknow City while Dr SK Bhargava, Head, Environmental Monitoring Division, IITR presented the summary of the report.

Environmental Status of Lucknow City

The results of the pre monsoon survey carried at Lucknow are given below:

Air Quality

In residential areas (Aliganj, Vikas Nagar, Indira Nagar and Gomti Nagar) the average concentration of RSPM and SPM were in the range of 162.7 to 199.2 and 357.6 to 410.5 $\mu\text{g}/\text{m}^3$, respectively. In commercial areas (Hussainganj, Charbagh, Alambagh, Aminabad and Chowk) the average concentration of RSPM and SPM were in the range of 183.8 to 216.2 and 371.8 to 425.1 $\mu\text{g}/\text{m}^3$, respectively. In industrial area (Amausi), the average concentration of RSPM and SPM were found to be 167.2 and 396.1 $\mu\text{g}/\text{m}^3$, respectively. All the values of RSPM and SPM, except in Amausi were above the prescribed National Ambient Air Quality Standards (NAAQS) 100 and 150 $\mu\text{g}/\text{m}^3$ for RSPM and 200 and 500 $\mu\text{g}/\text{m}^3$ for SPM in residential area and Industrial areas, respectively.

Noise Quality

In residential areas, the day and night time noise levels were recorded between 63.4 to 75.3 and 54.1 to 61.0 dB(A), respectively. All the values are higher than the prescribed limit of 55 and 45 dB (A) for day and night time, respectively. In commercial and traffic areas the day and night time noise levels were recorded between 67.1 to 75.3 and 59.5 to 71.2

dB (A), respectively. Noise levels at all the commercial sites during day and night time were found above the prescribed limit of 65 and 55 dB, respectively. In the industrial areas, Amausi and Talktora the day and night time noise levels were recorded between 70.4 to 78.5 and 62.8 to 68.9 dB(A), respectively. Noise level at Talkatora in the day time was higher than the prescribed limit of 75 dB (A).



Release of State of the Environment Report
(LR) Dr SK Bhargava, Dr PN Razan, Dr Harsh Gupta and Dr Ashwani Kumar

Lucknow people should be alert and aware enough about the progressive deterioration of the rising air and noise pollution problem to protect and should assist the authorities in combating the problem.



Winners of the painting competition

XII DR CR KRISHNA MURTI MEMORIAL ORATION

Dr CR Krishna Murti Memorial Oration is organized every year at Indian Institute of Toxicology Research (Formerly: Industrial Toxicology Research Centre) Lucknow, in memory of Dr CR Krishna Murti, a well known biochemist and environmental scientist of India and Director of IITR from 1978-83. It has been delivered earlier by eminent personalities like Prof. AK Tyagi (2007), Prof. NK Ganguly (2006), Prof. Mohan K Raizada (2005), Dr Dinakar M Salunke (2004), Prof. Samir K Brahmachari (2003), Dr Kanury VS Rao (2002), Prof. Rajendra Prasad (2001), Dr Maharaj K Sahib (2000), Prof. RK Maheshwari (1999), Prof. Asis K Datta (1998) and Prof. SS Agarwal (1997).

On June 5, 2008, **Prof. Harsh Gupta**, a renowned geophysicist, former Director, National Geophysical Research Institute (NGRI) Hyderabad and presently Raja Ramana Fellow at the same institute, delivered the **XII** oration in this series entitled '**India's Initiative in Mitigation of Tsunamis and Storm Surges**'. Prof Gupta said that the population of south-east coastal areas of

India is victim of both storm surges and tsunamis, and their mitigation have several commonalities in terms of observational network, data base on bathymetry and coastal topography, data communication, dissemination of warnings, training and education, and operational practices. It is, therefore, prudent and cost effective to address them together. Accordingly, it was planned to develop an integrated mitigation system for the oceanogenic disasters viz. Tsunamis and storm surges in the northern part of the Indian Ocean region with an ultimate goal to save lives and property. He explained that the design of the System is based on end-to-end principle, involving:-

- i) mean real time estimate of earthquake parameters,
- ii) assessment whether a tsunami has been indeed generated through deployment of ocean bottom pressure sensors and tide gauges,
- iii) numerical modeling for tsunami, storm surges with all associated data inputs,

- iv) generation of coastal inundation and vulnerability maps,
- v) development of Tsunami Warning Centre at INCOIS, Hyderabad and its operation on 24x7 basis for generation of timely advisories for implementation, and
- vi) Capacity building, education, and training for all stakeholders.

He informed that the planning of the project started in January 2005. All the details were worked out by March 2005 and it was estimated that it would be operational by September 2007. He proudly mentioned that the deadline was met successfully and system was validated during the occurrence of tsunamigenic earthquake on September 12 & 13, 2007. Today, this is the best system operating anywhere in the world. The Project was implemented by the Department of Ocean Development (now Ministry of Earth Sciences) through its institutions,

with active participation from Department of Science and Technology, Department of Space, Council of Scientific and Industrial Research, and University departments.



Acting Director presenting the memento to Prof. Harsh Gupta

IITR RESEARCH HIGHLIGHTS

1. Contamination of potable water distribution systems by multiantimicrobial-resistant enterohemorrhagic *Escherichia coli*.

[Ram S, Vaipayee P and Shanker R (2008). *Environmental Health Perspectives* 116(4): 448- 452]

The contamination of processed or unprocessed drinking water by fecal coliform, bacteria has been reported world-wide. Despite a high incidence of water-borne diseases, enterohemorrhagic *Escherichia coli* (EHEC) is an under acknowledged pathogen of concern to public health in India. Although the presence of EHEC is recorded in surface water sources of India, drinking water sources are yet to be investigated. The goal of this study was to analyze potable water samples for the presence of virulence determinants of EHEC and to determine the sensitivity of the virulence determinants to antimicrobials. Coliform, bacteria in potable water samples collected from six locations in Lucknow, a major city in northern India, were enumerated, using the most probable number method. *E. coli* (n = 81), randomly isolated by membrane-

filtration technique from four sites, were identified by biochemical characterization. *E. coli* were not detected in samples from two other sites. 15 randomly selected isolates from each site for virulence determinants of EHEC using polymerase chain reaction (PCR) were screened. The isolates positive for virulence determinants (n = 18) were screened for sensitivity to 15 antimicrobials by the disk diffusion method. Both stx1 and stx2 genes were present in 33.3% of isolates, whereas others possessed either stx1 (11.1%) or stx2 (55.6%). eaeA, hlyA, and chuA genes were present in 100, 23.3, and 16.7% of isolates, respectively. Resistance to multiple antimicrobials was observed in potential EHEC. The occurrence of multiantimicrobial-resistant EHEC in potable water is an important health concern because of the risk of waterborne outbreaks.

2. Nicotine and caffeine-mediated modulation in the expression of toxicant responsive genes and vesicular monoamine transporter-2 in 1-methyl 4-phenyl-1,2,3,6-tetrahydropyridine-induced Parkinson's disease phenotype in mouse.

[Singh S, Singh K, Patel S, Patel DK, Singh C, Nath C and Singh MP (2008). *Brain Research* 1207: 193-206]

Epidemiological evidence revealed that cigarette smokers and coffee drinkers have lower risk of Parkinson's disease (PD). Nicotine inhibits monoamine oxidase activity, and induces expression of neurotrophic factors and nicotinic acetylcholinergic receptors. However, caffeine is capable of antagonizing adenosine A(2A) receptor. Toxicant responsive enzymes and vesicular monoamine transporter-2 (VMAT-2) play critical roles in chemically induced PD. Despite some known functions, the effects of nicotine and caffeine on the expression and activity of toxicant responsive genes and on VMAT-2 are still not known. The study was therefore undertaken to investigate the effect of nicotine and caffeine on the expression and activity of toxicant responsive genes, i.e., CYP1A1, CYP2E1, GST-ya, GST-yc, GSTA4-4 and VMAT-2 in the striatum of control and MPTP-induced PD phenotype in mouse. The animals were treated intraperitoneally daily with nicotine (1 mg/kg) or caffeine (20 mg/kg) for 8 weeks, followed by 1-methyl 4-phenyl-1,2,3,6-tetrahydropyridine (MPTP; 20 mg/kg) + nicotine or caffeine for 4 weeks. MPTP significantly attenuated CYP1A1 and VMAT-2, and augmented CYP2E1, GST-ya, GST-yc and GSTA4-4 expression/activity. Nicotine or caffeine-treated animals showed significant restoration against most of the MPTP-induced alterations. The results obtained thus suggest that nicotine and caffeine modulate MPTP-induced alterations in CYP1A1, CYP2E1, GST-ya, GST-yc, GSTA4-4 and VMAT-2 expression/ activity.

3. **Rapid culture-independent quantitative detection of enterotoxigenic *Escherichia coli* in surface waters by real-time PCR with molecular beacon.**

[Ram S, Vajpayee P and Shanker R (2008). *Environmental Science & Technology* 42: 4577-4582]

Rapid and reliable detection of enterotoxigenic

Escherichia coli (ETEC) is critical for the management of the water-borne diseases threatening human lives world-wide. In this study, a culture-independent real-time PCR assay, in molecular beacon format, was designed and validated for detection and quantitative enumeration of ETEC harboring LT1 gene (encoding heat labile toxin) in surface waters contaminated by fecal pollutants of human and animal origin. It was observed that the assay was able to detect 2 CFU/mL of ETEC ($r = 0.997$; PCR efficiency = 99.8%) from water samples spiked by a reference organism (*E coli* MTCC 723). In the presence of 106 CFU/mL of non-pathogenic *E coli* (*E coli* DH alpha), the lowest detection limit from spiked water samples was 4 CFU/mL. The assay was 500 times more sensitive than conventional PCR using the same oligomers (Student's t test $p < 0.05$). The assay could specifically detect and quantify ETEC (1.2×10^3 to 1.4×10^6 CFU/100 mL) in polluted surface waters of river Gomti. The rapid culture-independent assay developed in this study for detection and quantitative enumeration of ETEC can be used for preliminary monitoring of surface waters to prevent water-borne outbreaks.

4. **Assessment of the phototoxic potential of cosmetic products.**

[Hans RK, Agrawal N, Verma K, Misra RB, Ray RS and Farooq M (2008). *Food and Chemical Toxicology*. 46(5):1653-8.]

The cosmetics are non-toxic or less toxic per se but photoactivation may sensitize them and they could produce additional phototoxicity. Phototoxicity assessment of ten different lipsticks and eight facial creams was conducted. Results revealed that six lipsticks and five facial creams generated reactive oxygen species (ROS), produced haemolysis and caused lipid peroxidation in human erythrocytes (*in vitro*) under sunlight exposure. Seven creams and one lipstick were alkaline while one cream and two lipsticks were acidic. The test lipsticks and creams showed absorption in UV/visible range. The study demonstrated synergistic action of cosmetic

products and sunlight. Therefore, sunlight exposure should be avoided after the use of photosensitive cosmetics.

5. Lupeol: Connotations for chemoprevention.

[Chaturvedi PK, Bhui K and Shukla Y (2008). *Cancer Letter* 263(1):1-13]

The perception of chemoprevention lies still in its infancy. Intervention, to slow down, arrest or reverse the process of carcinogenesis, by the use of either natural or synthetic substances individually or in combination therapy has emerged as a promising and pragmatic medical approach to reduce cancer risk. Pentacyclic lupane-type triterpenes exemplified by lupeol [lup-20(29)-en-3b-ol], are principally found in common fruit plants such as olive, mango, fig, etc. Although, lupeol exhibits an array of biological activities like anti-inflammatory, anti-arthritic, anti-mutagenic and anti-malarial activity both *in vitro* and *in vivo* systems yet, extensive exploration in regard to establish its role as chemopreventive compound is warranted. Interest in developing lupeol based potent anti-neoplastic agents, has led to the discovery of a host of highly active derivatives exhibiting greater potencies and better therapeutic indices. This review asserts on the chemopreventive prospects of lupeol and reveals potential chemoprevention drug targets, central to which are the cell cycle regulatory pathway genes and tries to explain the mechanism operating behind its action.

6. Influence of distillery effluent on germination and growth of mung bean (*Vigna radiata*) seeds.

[Kannan A and Upreti RK (2008). *Journal of Hazardous Materials* 153(1-2): 609-615]

Distillery effluent or spent wash discharged as waste water contains various toxic chemicals that can contaminate water and soil and may affect the common crops if used for agricultural irrigation. Toxic nature of distillery effluent is due to the presence of high amounts of organic and inorganic chemical loads and its high-acidic pH. Experimental effects of untreated

(raw) distillery effluent, discharged from a distillery unit (based on fermentation of alcohol from sugarcane molasses), and the post-treatment effluent from the outlet of conventional anaerobic treatment plant (treated effluent) of the distillery unit were studied in mung bean (*Vigna radiata*, L.R. Wilczek). Mung bean is a commonly used legume crop in India and its neighboring countries. Mung bean seeds were presoaked for 6 h and 30 h, respectively, in different concentrations (5-20%, v/v) of each effluent and germination, growth characters, and seedling membrane enzymes and constituents were investigated. Results revealed that the leaching of carbohydrates and proteins (solute efflux) were much higher in case of untreated effluent and were also dependent on the presoaking time. Other germination characters including percentage of germination, speed of germination index, vigor index and length of root and embryonic axis revealed significant concentration-dependent decline in untreated effluent. Evaluation of seedlings membrane transport enzymes and structural constituents (hexose, sialic acid and phospholipids) following 6 h presoaking of seeds revealed concentration-dependent decline, which were much less in treated effluent as compared to the untreated effluent. Treated effluent up to 10% (v/v) concentration reflected low-observed adverse effect levels.

7. Polymorphism in environment responsive genes and association with Parkinson's disease.

[Singh M, Khan AJ, Shah PP, Shukla R, Khanna VK and Parmar D (2008). *Molecular and Cellular Biochemistry* 312(1-2):131-8.]

Attempts were made in the present case-control study to investigate the association of polymorphism in the genes encoding proteins involved in toxication-detoxication and dopaminergic pathways and susceptibility to Parkinson's disease (PD). Seventy patients suffering from PD and one hundred healthy controls belonging to the same geographical location and same ethnicity were included in

the study. PCR-RFLP and allele-specific PCR-based methodology were used to identify the genotypes. Multivariate logistic regression analysis revealed that heterozygous genotypes of cytochrome P4502D6*4 (CYP2D6*4), CYP2E1*5B (RsaI) polymorphism and homozygous mutant genotypes of CYP2E1*6 (DraI) were found to be over represented in PD cases when compared to the controls. Risk was also found to be increased in patients carrying glutathione S-transferase T1 (GSTT1) null or homozygous variant genotypes of GSTP1. Significant association was observed for monoamine oxidase-B(MAO-B) variant allele G and PD, whereas no difference in genotype and allele frequencies was observed for manganese-superoxide dismutase (MnSOD), dopamine receptor-D2 (DRD2), and dopamine transporter (DAT) genes between controls and PD cases. Genotype combinations characterized by the presence of two variant genotypes on their corresponding loci revealed that four combinations of GSTT1 null and MnSOD(-9Val) or GST null and MAOB-G or CYP2E1*5B and MAOB-AG or CYP2E1*5B and DRD2 (Taq1A-het) genotypes in the patients exhibited several fold higher and significant association with risk to PD. The data suggest that polymorphism in the genes involved in detoxification and dopamine regulation may modulate the susceptibility to PD and could be important risk factors in the pathogenesis of PD.

8. Interaction of cytochrome P4501 A1 genotypes with other risk factors and susceptibility to lung cancer.

[Shah PP, Singh AP, Singh M, Mathur N, Pant MC, Mishra BN and Parmar D (2008). *Mutation Research-Fundamental and Molecular Mechanisms of Mutagenesis* 639 (1-2):1- 10]

Lung cancer is the most common cause of death throughout the world with cigarette smoking being established as the major etiological factor in lung cancer. Since not much information is available regarding the polymorphism in drug metabolizing enzymes

and lung cancer risk in the Indian population, the present case-control study attempted to investigate the association of polymorphisms in cytochrome P450 1A1 (CYP1A1) and glutathione-S-transferase M1 (GSTM1) with risk to squamous cell carcinoma of lung malignancy. Patients suffering from lung cancer (n = 200) and visiting OPD facility of Department of Radiotherapy, King George's Medical University, Lucknow, were included in the study. Equal number (n=200) of age and sex matched healthy individuals were also enrolled in the study. Our data revealed that the variant genotypes of CYP1A1*2A, CYP1A1*2C and CYP1A1*4 were found to be over represented in the lung cancer patients when compared to controls. CYP1A1*2A variant genotypes (combined heterozygous and mutant genotypes) revealed significant association towards the lung cancer risk (OR: 1.93, 95%CI: 1.28-2.89, p=0.002). Likewise, GSTM1 null genotypes were found to be over represented in patients when compared to controls. Haplotype analysis revealed that CYP1A1 haplotype, C-G-C increased the lung cancer risk (OR: 3.90, 95%CI: 1.00-15.04, p=0.025) in the patients. The lung cancer risk was increased two to fourfold in the patients carrying the genotype combinations of CYP1A1*2A and GSTM1 suggesting the role of gene-gene interaction in lung cancer. Cigarette smoking or tobacco chewing or alcohol consumption was also found to interact with CYP1A1 genotypes in increasing the risk to lung cancer further demonstrating the role of gene-environment interaction in development of lung cancer.

9. DNA damage induced by industrial solid waste leachates in *Drosophila melanogaster*: A mechanistic approach.

[Siddique HR, Sharma A, Gupta SC, Murthy RC, Dhawan A, Saxena DK and Chowdhuri DK (2008). *Environmental and Molecular Mutagenesis* 49(3): 206- 216]

Genomic stability requires that error-free genetic information be transmitted from generation to generation, a process that is dependent upon efficient DNA repair.

Industrial leachates which contain mixtures of diverse chemicals are a major environmental concern. The interaction between these chemicals may have synergistic, antagonistic, or simply additive effects on biological systems. In the present study, the Comet assay was used to measure the DNA damage produced by leachates of solid wastes from flashlight battery, pigment, and tanning factories in the midgut cells and brain ganglia of *Drosophila melanogaster* mutants deficient in DNA repair proteins. Larvae were allowed to feed for 48 or 72 hr on diets containing 0.1, 0.5, and 2.0% (v/v) of the leachates. Physicochemical analysis run on the solid wastes, leachates, and treated larvae detected elevated levels of heavy metals. Leachates produced significantly greater levels of DNA damage in mutant strains *mel41* (deficient in cell cycle check point protein), *mus201* (deficient in excision repair protein), *mus308* (deficient in postreplication repair protein), and *rad54* (deficient in double strand break repair protein) than in the OregonR(+) wild-type strain. Larvae of the *ligaseIV* mutant (deficient in double strand break repair protein) were hypersensitive only to the pigment plant waste leachate. Conversely, the *dnose2* mutant (deficient in protein responsible for degrading fragmented DNA) was more sensitive to DNA damage induction from the flashlight battery and tannery waste leachates. Our data demonstrate that repair of DNA damage in organisms exposed to leachates is dependent upon several DNA repair proteins, indicative of the involvement of multiple overlapping repair pathways. The study further suggests the usefulness of the Comet assay for studying the mechanisms of DNA repair in *Drosophila*.

10. Impact of cadmium in T lymphocyte subsets and cytokine expression: differential regulation by oxidative stress and apoptosis.

[Pathak N and Khandelwal S (2008). *Biometals* 21(2): 179- 187]

Cadmium (Cd), a possible human carcinogen is a potent immunotoxicant. In rodents it causes thymic atrophy and splenomegaly, in

addition to immuno-suppression and modulation of humoral and/or cellular immune response. Oxidative stress and apoptosis appear to be underlying mechanism of Cd induced thymic injury. To understand the involvement of reactive oxygen species (ROS), intracellular glutathione (GSH) and apoptosis in modulation of T-cell repertoire, the effect of Cd (10, 25 and 50 μ M) on primary T lymphocytes of BALB/c mice at different time intervals (6, 12 and 18 h) was studied. It was observed that a dose and time dependent decline in CD4(+)/CD8(+) ratio (a bio-indicator of immunotoxicity) as a result of significant suppression of CD4(+) subsets (helper T-cells) and enhancement in CD8(+) cells (cytotoxic T-cells). At the same time, the CD4(+)/CD8(+) (DP) cell population was lowered while the CD4(-)/CD8(-) (DN) cells were increased. The oxidative stress and apoptotic data revealed almost similar ROS generation in both CD4(+) and CD8(+) cells, but relatively more marked GSH depletion and apoptosis in CD4(+) than in CD8(+) population. On further analysis of CD4(+) T-subsets, cytokine release (IL-2 and IFN gamma) by Th 1 cells and IL-4 by Th 2 cells were shown to be significantly suppressed in a dose responsive manner. The highest inhibition was observed in IFN gamma, then IL-2 followed by IL-4. In conclusion, the data demonstrates that T-cell apoptosis by Cd, more in CD4(+) than in CD8(+) cells appear related to higher depletion of intracellular glutathione. Th 1 cells of CD4(+) sub-population are more responsive to Cd than Th 2, leading to higher suppression of IL-2 and IFN gamma than IL-4 and hence, the study unravels to some extent, the underlying events involved in Cd Immunotoxicity.

11. Isolation of hexachlorocyclohexane-degrading *Sphingomonas* sp by dehalogenase assay and characterization of genes involved in gamma-HCH degradation.

[Manickam N, Reddy MK, Saini HS and Shanker R (2008). *Journal of Applied Microbiology* 104 (4): 952- 960]

To screen and identify bacteria from

contaminated soil samples which can degrade hexachlorocyclohexane (HCH)-isomers based on dechlorinase enzyme activity and characterize genes and metabolites. Dechlorinase activity assays were used to screen bacteria from contaminated soil samples for HCH-degrading activity. A bacterium able to grow on alpha-, beta-, gamma- and delta-HCH as the sole carbon and energy source was identified. This bacterium was a novel species belonging to the *Sphingomonas* and harbour linABCDE genes similar to those found in other HCH degraders. gamma-Pentachlorocyclohexene 1,2,4-trichlorobenzene and chlorohydroquinone were identified as metabolites. The study demonstrates that HCH-degrading bacteria can be identified from large environmental sample-based dehalogenase enzyme assay. This kind of screening is more advantageous compared to selective enrichment as it is specific and rapid and can be performed in a high-throughput manner to screen bacteria for chlorinated compounds.

12. Prevalence of bacterial contamination with antibiotic-resistant and enterotoxigenic fecal coliforms in treated drinking water.

[Pathak SP and Gopal K (2008). *Journal of Toxicology and Environmental Health-Part A-Current Issues* 71(7): 427- 433]

Pollution indicator bacteria such as coliforms, fecal coliforms, and fecal streptococci were enumerated using a multiple-tube fermentation method in 100 treated drinking-water samples from 20 locations in residential, commercial, and industrial areas of a tropical city during summer. Thirty-four percent of the samples were bacteriologically nonpotable. Maximum coliform-contaminated (27%) samples were derived from industrial areas, while samples contaminated with fecal coliform (23%) and fecal streptococci (20%) originated from commercial areas. Coliforms identified where *Escherichia coli*, *Klebsiella* sp., *Enterobacter* sp., and *Citrobacter* sp. were present in 29%, 26%, 24%, and 15% of samples, respectively. Fecal coliforms were examined for antibiotic susceptibility with disc diffusion method. All test isolates exhibited multiple antibiotic resistance (MAR) for kanamycin, nalidixic acid, tetracycline, and trimethoprim. *Escherichia coli* isolates were examined for enterotoxigenicity using the suckling mice bioassay and 60% of the isolates displayed enterotoxigenicity. Data indicate that drinking water contaminated with antibiotic-resistant enterotoxigenic fecal bacteria may be responsible for presence of waterborne diarrheal diseases attributed to therapeutic agents used by urban populations in the tropics.

HONOURS AND AWARDS



Mr Rahul S Naryani, the ward of an IITR employee, Mr. Suresh Kumar, secured 97% marks in class X in Council for the Indian School Certificate Examinations, New Delhi. He also secured first position in the city among class X students.

ASSIGNMENTS ABROAD

- Dr K.C. Khulbe, Scientist visited Geneva, Switzerland under WIPO programme from May 1 to 31, 2008. (study leave)
- Dr P.D. Dwivedi, Scientist visited Germany to attend Fourth meeting of the Parties (MOP4) to the Cartagena Protocol on biosafety preceded by a preparatory meeting from May 9 to 16, 2008.
- Dr Alok Dhawan, Scientist visited U.K. under UKIERI Project from June 3 to 17, 2008 in connection with the research project entitled "Cellular fate of novel nanomaterials for therapeutics and consumer products".

APPOINTMENT



Dr Aruna Satish joined IITR Lucknow, in May 2008 as Scientist Gr. IV (1) in Embryotoxicology Division. She completed her graduation and post-graduation with a specialization in Drosophila Genetics from University of Mysore. After M.Sc., she joined Prof. Ranganath at DOS in Zoology, University of Mysore, and completed her Ph. D. in 2007. Immediately after

the award of Ph.D., she joined Dr Daniel Barbash at Cornell University, Ithaca, NY, USA for her Postdoctoral Research on Molecular genetics of hybrid sterility/lethality using Drosophila as a model system. Dr Aruna presented her findings at various national and international conferences. So far she has published four research papers in peer-reviewed high-impact national/international journals.

PROMOTIONS

Dr Ashwani Kumar	Gr. IV(5) to Gr.IV(6)	Dr DK Saxena	Gr. IV(5) to Gr.IV(6)
------------------	-----------------------	--------------	-----------------------

SUPERANNUATIONS

Mr. RC Pandey,	Gr. III(6)	30/4/2008
----------------	------------	-----------

INTERNAL SEMINARS

IITR Organizes internal seminars on each Friday of the week. Following seminars were held during this period.

Date	Speaker	Title of the seminar
27 th June, 2008	Anand Kumar Singh	Dicer loellar et. al., Proc. Natl. Acad. Sci., 2008, vol. 105(14): 56ss in striatal neurons Produces behavioral and neuroanatomical phenotypes in the absence of neurodegeneration (Cu14-5619)
	Anurag Jyoti	Gold nanoparticles for one step DNA extraction and real-time PCR of pathogens in a single chamber (Cheong et. al., Lab on Chip, 2008, vol. 8: 810-813)

20 th June, 2008	Israr Ahmad	Highly efficient and large-scale generation of functional dopamine neurons from human embryonic stem cells (Cho et. al., Proc. Natl. Acad. Sci., 2008, vol. 105(9): 3392-3397)
	Amit Sharma	AC Transgenomics: a high-throughout method for exploration of protein function in mammals (Poser et. al., Nature Methods, 2008, vol. 5(5): 409-416)
13 th June, 2008	Anil Kumar	Tumor promotion in liver of mice with a conditional Cx26 Knockout (Marx-Stoelting et. al., Toxicol. Sci., 2008, vol. 103(2): 260-267)
6 th June, 2008	Kumar Saurabh	Reduction of dynamic protein concentration range of biological extracts for the discovery of low-abundance proteins by means of hexapeptide ligand library (Guerrier et. al., Nature Protocols, 2008, vol. 3(5): 883-890)
	Shivam Priya	Differential expression of genes associated with cell proliferation and apoptosis induced by okadaic acid during the transformation process of BALB/c 3T3 cells (Ao et. al., Toxicol. In Vitro, 2008, vol. 22: 116-127)
23 rd May, 2008	Anwar Jamal Khan	DNA bar coding and pyrosequencing to identify rare HIV drug resistance mutations (Hoffmann et. al., Nucleic Acids Res., 2007, vol. 35(13): e91)
	Amita Misra	Induction of tolerance after establishment of peanut allergy by the food allergy herbal formula-2 is associated with up-regulation of interferon- γ (Qu et. al., Clin. Exp. Allergy, 2007, vol. 37: 846-855)
16 th May, 2008	Anurag Sharma	HSF1-TPR interaction facilitates export of stress-induced HSP70 mRNA (Skaggs et. al., J. Biol. Chem., 2007, vol. 282(47): 33902--33907)
	Dwaipayan Sinha	Protective effect of pine (<i>Pinus morrisonicola</i> Hay) needle on LDL oxidation and its anti-inflammatory action by modulation of iNOS and COX-2 expression in LPS-stimulated RAW 264.7 macrophages (Yen et. al., Food Chem. Toxicol., 2008, vol 46: 175-185)
9 th May, 2008	Rahul Kumar	Reduction in antioxidant defenses may contribute to Ochratoxin A toxicity and carcinogenicity (Cavin et. al., Toxicol. Sci., 2007, vol. 96(1): 30--39)
	Kavita Singh	The phosphorylation state of Ser-129 in human α -synuclein determines neurodegeneration in a rat model of Parkinson disease (Gorbatyuk et. al., Proc. Natl. Acad. Sci., 2008, vol 105 (2): 763-768)
2 nd May, 2008	Neha Saxena	Apple procyanidins induce tumor cell apoptosis through mitochondrial pathway activation of caspase-3 (Miura et. al., Carcinogenesis, 2008, vol. 29(3): 585-593)

	Seema Singh	The pRb/E2F cell-cycle pathway mediates cell death in Parkinson's disease (Hoglinger et. al., Proc. Natl. Acad. Sci., 2007, vol 104 (9): 3585-3590)
25 th April, 2008	Dr Y Shukla	Cellular origin of retroviral oncogenes - John Michael Bishop (Nobel Laureate- 1989)
4 th April, 2008	MP Singh	Local initiation of caspase activation in <i>Drosophila</i> salivary gland programmed cell death <i>in vivo</i> (Takemoto et. al., Proc. Natl. Acad. Sci., 2007, vol. 104(33): 13367-13372)
	Akanksha Nigam	Gene expression modulation in chicken macrophages exposed to <i>Mycoplasma synoviae</i> or <i>Escherichia coli</i> (Lavric et. al., Vet. Microbiol., 2008, vol 126: 111-121)

RESEARCH DIGEST

Food vs. Fuel: Diversion of Crops Could Cause More Hunger



Eager to promote non-petroleum energy sources to reduce dependence on oil imports and slow global warming due to fossil fuel emissions, the United States, Brazil, and the European Union are promoting biofuels made from food crops. Ethanol production (mainly in the United States and Brazil) tripled from 4.9 billion gallons to almost 15.9 billion gallons between 2001 and 2007, according to C Ford Runge, a professor of agricultural economics at the University of Minnesota. During that same period, biodiesel production (mainly for sale in the European Union) rose almost 10-fold, to about 2.4 billion gallons, although further expansion is now uncertain. Biofuel production has been prodded by government initiatives such as subsidies and tax incentives.

But action is not necessarily the same thing as progress, say some experts. "We are witnessing the beginning of one of the great tragedies of history," says Lester Brown, an analyst of global resources who founded the Worldwatch Institute and now heads the Earth Policy Institute. "The United States, in a misguided effort to reduce its oil insecurity by converting grain into fuel for cars, is generating global food insecurity on a scale never seen before."

The head of Nestlé, the world's largest food and beverage company, says "If as predicted we look to use biofuels to satisfy twenty percent of the growing demand for oil products, there will be nothing left to eat. To grant enormous subsidies for biofuel production is morally unacceptable and irresponsible."

Even as growing quantities of corn and other grains are being diverted for use as biofuel and feedstocks, newly affluent people mainly in Asia are eating more meat and dairy, which puts a further demand on animal feed supplies.

A Confluence of Factors

To be fair, no one is blaming the rapid price increases solely on biofuels hunger and malnutrition were widespread before the biofuels boom began. According to the UN World Food Programme, 854 million people were undernourished in 2001-2003, and about 10 million people die of hunger and hunger-related diseases in an average year. However, demand for biofuel feedstocks is

overwhelming a food supply system that was already overextended by surging demand. Moreover, the demand for biofuel affects even non feedstock crops, such as rice and wheat, as farmers plant feedstocks instead of food.

Meanwhile, biofuel production is booming around the world. Brazil, the United States, and Europe account for the lion's share of today's biofuel production and consumption. However, developers are beginning to take advantage of the many crops grown elsewhere that can be converted into fuel. In Malaysia and Indonesia, where vast palm oil plantations are being established in cleared rainforests, biodiesel refineries have created a palm oil shortage.

"A Perfect Storm"

O'Neil of Kansas State University says the biggest factor in soaring world grain prices was a "perfect storm" of poor weather in the breadbasket regions during 2007, including a severe drought in Australia and poor growing conditions in Russia, Eastern Europe, and parts of the United States. "The increase in prices we have seen lately is not by any means solely related to ethanol," he says. "It's not even primarily related to ethanol, although ethanol does have an impact."

Long-Term Impact

In an attempt to plumb international impact of biofuel production, IFPRI Director General Joachim von Braun projected in the February 2008 report that worldwide calorie consumption would fall by 2% in most regions by 2020 if the trend toward biofuels is "moderate." But a "drastic" biofuel expansion would reduce calorie consumption by more than 8% in Latin America and sub-Saharan Africa a devastating reduction for someone who is already hungry.

Questions about biofuels highlight the complicated structure of agricultural markets: prices reflect supply and demand, farmer decisions, weather, crop diseases, distance to market, and the price of alternative crops. If demand raises the price of corn, farmers will plant more corn, raising the yield and reducing the price. But if that corn is planted on land formerly devoted to soybeans, the price of soybeans and cooking oil also may rise as the effects echo through the food markets.

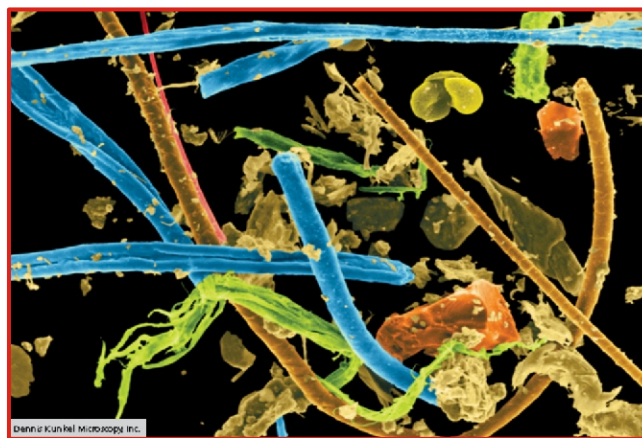
Now that food crops can be converted into fuels, a new factor must be considered the link between the price of food and the price of petroleum. As petroleum fuels get more expensive, biofuels become more profitable; therefore, biofuel producers can afford to pay more for their feedstock.

According to Brown, this new relationship puts hungry people in direct competition with empty gas tanks. "Historically the food and energy economies have been largely separate, but now with the construction of so many fuel ethanol distilleries, they are merging," he says. "If the food value of grain is less than its fuel value, the market will move the grain into the energy economy. Thus, as the price of oil rises, the price of grain follows it upward."

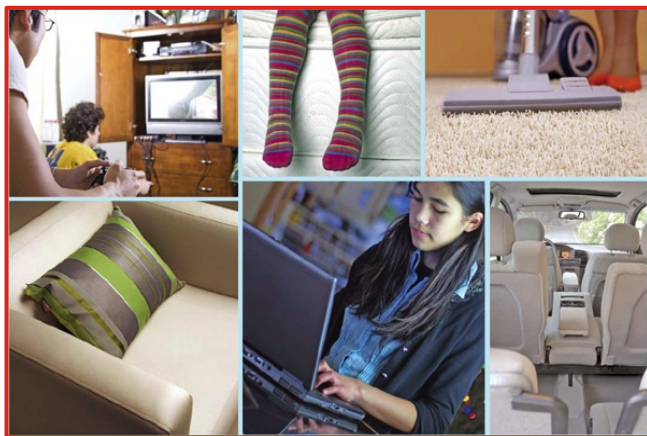
And that could mean more hunger for more people, says Runge, who participated in the FAO's High-Level Conference on World Food Security and the Challenges of Climate Change and Bioenergy in Rome in February 2008. Most of the 82 countries that import food are also net oil importers, Runge says, so this competition between food and fuel harms people who are already "in a world of hurt."

Environmental Health Perspectives Volume 116, Number 6, June 2008

Unwelcome Guest: PBDEs in Indoor Dust



Although house dust is known to be a predominant source of exposure to PBDEs, it's not yet clear which part of the dust these chemicals bind to. The dust pictured above contains pet hair (rust brown), pollen (yellow), plant fibers (green), dead skin cells (light to medium brown), dirt and minerals (orange), textile fibers (blue), and spider silk (pink).



PBDEs are used in a number of consumer goods, including video and computer equipment, cell phones, mattresses, upholstered furniture, carpet padding, and automobile electronics and seats.

Researchers have known for years that house dust is a major exposure route for lead and certain pesticides. Now attention is turning to another class of dustborne chemicals-polybrominated diphenyl ether (PBDE) flame retardants. A growing body of research documents that PBDEs and other brominated flame retardants (BFRs) released from many different consumer products can accumulate in people's homes, cars, and workplaces. Moreover, certain segments of the population have extremely high concentrations of these substances in their bodies. However, hard data on the human health impact of these exposures are only just beginning to emerge, with many studies focusing on thyroid effects.

PBDEs have been used extensively in the highly flammable plastic components of consumer goods including couches, mattresses, carpet padding, televisions, computers, cushions, car stereos, navigation systems, car seats, and padded dashboards. By 2001, a sufficient volume of data documenting PBDEs' persistence, toxicity, and tendency to bioaccumulate had emerged that Europeans were calling for two PBDE formulations-pentaBDE and octaBDE to be banned. Both formulations are mixtures of individual PBDE compounds, or congeners; they are named on the basis of the average number of bromine atoms making up the majority of each mixture. PentaBDE was used in cushioning material whereas octaBDE was used primarily in electronics including televisions, computers, and cell phones. Europe went on to ban both PBDEs in August 2004, and the

bromine and flame retardant industries also voluntarily ceased production in North America by the end of that year. PentaBDE and octaBDE are now candidates for inclusion in the United Nation's Stockholm Convention on Persistent Organic Pollutants (POPs), which globally bans chemical substances that bioaccumulate through the food web and pose a risk to humans and the environment.

A third PBDE, an additive known as decaBDE, is used in electronic devices and textile backing. It remains in use today in North America, but was banned on 1 April 2008 by the European Court of Justice. The Bromine Science and Environmental Forum (BSEF), an industry group, is contesting that ruling, and writes on its website: "After 10 years of scientific research and more than 588 studies conducted and/or reviewed, both the environment and human risk assessment reports concluded that there is no significant risk [for decaBDE]." However, animal research suggests the compound may be carcinogenic and links it with developmental toxicity.

Environmental Health Perspectives Volume 116, Number 5, May 2008

You emit what you eat



Worried about your food miles? With rising public concern over how individual lifestyle choices

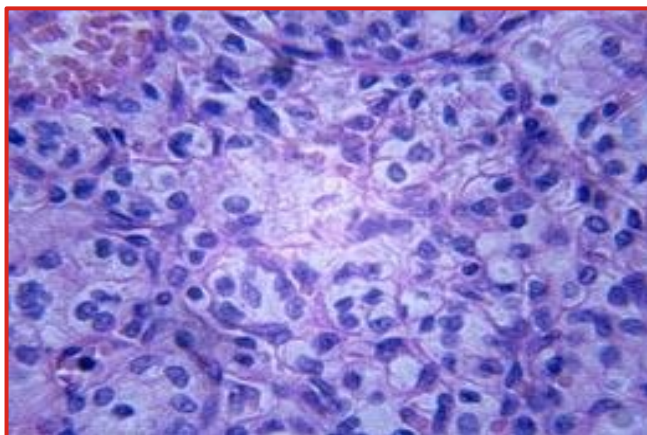
affect the climate, more attention is being paid to the notion that long-distance transport of goods can harm the environment.

But a new study by Christopher Weber and Scott Matthews of Carnegie Mellon University in Washington, DC, suggests that a dietary shift may be more effective in reducing your emissions than eating local produce. They conducted a life-cycle analysis of all greenhouse gas emissions, not just carbon dioxide, associated with the production of food consumed in the United States, compared against those associated with long-distance distribution. Food production far outstripped transport as a source of emissions, accounting for 83 per cent of the 8.1 tonnes of greenhouse gases that an average US household generates each year by consuming food. Although transport distances were considerable, they led to only 11 per cent of total emissions.

Different food groups varied widely in their emissions, with red meat, for example, producing 150 per cent more greenhouse gases than chicken or fish. The authors suggest that eating less red meat and fewer dairy products even one day per week would do more against global warming than becoming a 'locavore' who eats an entirely regional diet.

Environ. Sci. Technol. 42, 35083513 (2008)

Cancer reveals cruel trick: Some tumours may stimulate the growth of distant cancers within the body



Protein produced by some cancer cell

Some cancers can release a protein that awakens dormant cancer cells throughout the body, studies in mice suggest. The discovery could help doctors understand and prevent the spread of cancers through the body.

The results provide a possible explanation for why high levels of the protein, called osteopontin, in cancer patients have already been linked to an increased risk of death. Researchers are working to develop a drug that blocks the protein as a possible tool in the battle against the disease.

Most patients who die of cancer do not succumb to the initial cancer, called a primary tumour, but rather from the disease's spread to other parts of the body. Although the importance of this process, called metastasis, is clear, there is no currently available therapy that can specifically block this sinister march throughout the body.

It is already known that tumour cells can break away and enter a patient's blood early in the development of the disease. It is thought, however, that very few of these cells actually thrive and seed a new tumour in their new environment - which is part of the reason that metastasis has puzzled experts.

"For some reason the cells are just sitting there, dormant until something stimulates their growth," says Sandra McAllister, a cancer researcher at the Whitehead Institute for Biomedical Research in Cambridge, Massachusetts. "We didn't really know what those events are that activate disseminated metastatic cells."

The findings, published in *Cell* suggest a way in which the original tumour may support the growth of its cancerous 'offspring'.

Sleeper cells

McAllister and her colleagues, led by the Whitehead Institute's Robert Weinberg, co-implanted two kinds of cancer cells in mice. The first, which they termed an 'instigator' tumour, was made of fast-growing breast-cancer cells cultured in the lab. They also injected other cancer cells, called 'responder' cells, which were known to grow slowly and metastasize only rarely.

The researchers found that the presence of the instigator tumour was enough to speed development of the responder, which then spawned up to nine times as many metastatic tumours as when the instigator was absent. They found similar results on repeating the experiment using colon cancer cells collected from cancer patients as the responder tumours.

Subsequent analysis showed that the osteopontin protein is crucial for this instigator effect. Other researchers have been developing osteopontin as a biomarker to monitor cancer progression, and rising levels of the protein have been associated with increased likelihood of death from several cancers, including breast and prostate cancers.

When McAllister and her colleagues blocked osteopontin production in the cancer cells, the instigator tumour continued to grow and thrive, but it no longer stimulated responder cells. The researchers hypothesize that the protein could signal to the bone marrow to release a class of cells that help invasive cells to colonize new tissues.

Clinical questions

The work reveals an important new mechanism by which cancer spreads, says Ann

Chambers, a cancer researcher at the London Health Sciences Centre in Ontario, Canada. But sorting out its relevance in human patients is a challenging next step, she adds.

Previous results showed that some primary tumours act in the opposite way, blocking the growth of metastatic cells by inhibiting the establishment of a blood supply to the new tumour. McAllister speculates there may one day be a test that would enable clinicians to determine whether a patient's tumour is likely to boost or block other tumours, allowing them to treat patients accordingly.

Although osteopontin is an attractive drug target for cancer sufferers, the protein is also produced at low levels in healthy patients. This raises the possibility that interfering with the protein could have unwanted side effects.

Nevertheless, osteopontin is a complex protein, says Chambers, which is chemically modified by the body in a variety of ways. "Nobody has a really good handle of how all of these different forms differ functionally," she says, but once that is understood, it may be possible to target a specific tumour-stimulating forms of the protein.

Nature ,12 June 2008 doi:10.1038/news.2008.887

पर्यावरण व मानव स्वास्थ्य : औद्योगीकरण का प्रभाव

लेखक

पंकज शुक्ल 'प्रसून', डॉ वी पी शर्मा
भारतीय विषविज्ञान अनुसंधान संस्थान
लखनऊ

द्वुतगति से विकास की ओर अग्रसर मानव ने पर्यावरण दोहन में कोई कोर-कसर नहीं छोड़ी है। मानव प्रारम्भ से ही महत्वाकांक्षी रहा है और उसके विकास की राह में आने वाली बाधाओं के विनाश की प्रवृत्ति स्वभावतः उसमें शामिल है। सुजलाम्, सुफलाम्, मलयज शीतलाम्, पंक्तियों उसे सुनने में आनन्द प्रदान करती हैं, पर उसके क्रिया कलापों से प्रकृति स्वयं अनकही व्यथा की आग में जलती रही हैं और अंत में शेष बचती है तो सिर्फ भविष्य की कालिमा!

वैदिक ग्रंथ प्रकृति के साथ रागात्मक सम्बन्ध बनाने की बात कहते हैं परन्तु आधुनिकता के प्रवाह में बहते हुए हम समय की मांग और प्रकृति की पुकार को अनसुनी करते जा रहे हैं। ग्राम्यवासी गांव की प्राकृतिक जैवविविधता को सही तरह से न समझ पाने के कारण शहरों की ओर रुख कर रहे हैं। परिणाम स्वरूप शहरीकरण में अप्रत्याशित वृद्धि दर्ज हो रही है और शहरीकरण के फलस्वरूप तमाम कंपनियाँ धड़ल्ले से खुलती जा रही हैं और आज औद्योगीकरण उफान पर है।

कितनी विडम्बना की बात है कि एक ओर हम विश्व को 'ग्लोबल विलेज' का दर्जा दे रहे हैं तो दूसरी ओर विलेज या गांव की नैसर्गिक सुंदरता की उपेक्षा करते हुए उसे बनावटी कर देना चाहते हैं। आज पर्यावरण संरक्षण, संवर्धन एवं उसे स्वच्छ बनाने हेतु करोड़ों परियोजनायें चलायी जा रही हैं परन्तु यह वैनाशिक देन हमारी ही तो है। जगह-जगह मशरूम से उगते तमाम लघु-कुटीर उद्योगों में कार्य करने वाले कुछ अप्रशिक्षित या अल्पप्रशिक्षित लोग सुरक्षा मानकों की अवहेलना कर, कुछ सिर्फ पैसे बचाने के चक्कर में पर्यावरण को गर्त में ढकेल रहे हैं।

“अब है समय विज्ञान पे आओ करें अमल,
नदियाँ हुई प्रदूषित मुरझा गया कमल।
महकें प्रकृति मुसकाने लगे आम आदमी,
विज्ञान-मैराथन को कुछ ऐसे करें सफल।”

यदि बात हम उस माटी की करें जिसकी रक्षा हेतु तमाम सपूतों ने अपनी जान की बाजी तक लगा दी, वह माटी कितनी प्रदूषित है आज!

‘प्रतिपल हम खो रहे देश की प्रखर पुरातन परिपाटी।
राम कृष्ण खेले थे जिसमें अब विषाक्त है वह माटी।’
वीर लगाते जिसका चंदन
उसमें समा गये हैं लेड-टिन
जिसका संरक्षण न आता
क्यू कहता फिर उसको माता
जुते खेत को देख के मन में सौंधी खुशबू भर जाती।
रामकृष्ण खेल थे जिसमें, अब विषाक्त है वह माटी।।

भारी धातुएँ जिसमें शीशा, टिन, आर्सेनिक जैसे घातक तत्व शामिल हैं, न केवल पर्यावरण अपितु मानव स्वास्थ्य को भी गहराई से प्रभावित कर रही है। आर्सेनिकोसिस, प्लुओरोसिस व कैंसर जैसी भयावह बीमारियाँ मानव को अपने शिकंजे में जकड़ रही हैं। पवित्रता की प्रतीक मानी जाने वाली गंगा नदी जो एक विस्तृत भूभाग को अभिसिंचित कर उपजाऊ बनाती है, स्वयं भीषण प्रदूषण की विभीषिका से ग्रस्त है-

अपशिष्ट, रसायन कूड़ा डालते हैं सदा,
मानव की मानवता जाने कहाँ सो गई।
पर्यावरण हर पल होता दूषित है,
ताजी हवा विष वाली गैसों में है खो गई।
अपने ही पैरों पे कुल्हाड़ी मारता मनुज,
सोच आगे बढ़ने की जाल को पिरो गई।
पाप मैल धुलके तो मैली ही हुई थी गंगा,
धुलके रसायन प्रदूषित भी हो गई।।

कहते हैं कि प्लास्टिक का प्रयोग बंद किया जाय। तमाम स्वयंसेवी संगठन व समूह इसके प्रयोग पर प्रतिबन्ध लगा रहे हैं परन्तु यहाँ आवश्यकता है उचित प्रबन्धन की व विस्तारण सुरक्षा की दृष्टि से मूल्यांकित वैज्ञानिक तकनीकों के प्रयोग की।

“वो बोले प्लास्टिक की थैली फेंक दीजिए।
सामान कागजों और कपड़ों में लीजिए
इतना सुन मुसका के बोलती है प्लास्टिक
दुश्मन नहीं मैं दोस्त हूँ प्रबंधन तो सीखिए।”

प्रबंधन जीवन का महत्वपूर्ण पहलू है फिर चाहे वो संस्कृति का, सभ्यता का, व्यापार का, सरकार का या फिर मानवीय मूल्यों का हो। इसी प्रकार आज आवश्यकता है पर्यावरण के प्रबंधन की और इस प्रबंधन में आम आदमी को एक इकाई के रूप में कार्य करना होगा। यह दायित्व सिर्फ वैज्ञानिकों, इंजीनियरों या फिर संस्थाओं के बूते संभव नहीं। प्रकृति व जैव विविधता के संरक्षण हेतु जन-जन को अपना उत्तरदायित्व समझना होगा।

पर्यावरण बचाने का हम सबको प्रण करना होगा।
जल भूमि वायुमण्डल का संरक्षण करना होगा।
समय है विश्लेषण करने का क्या खोये हम क्या पाये,
आविष्कार का लक्ष्य यही है मानव जाति मुसकाये।।

Editor

Dr Anvita Shaw

Editorial Board

**Dr Jai Raj Behari, Dr Poonam Kakkar, Dr RK Upreti, Dr Rishi Shankar,
Mr. Bhaskar Dev Bhattacharjee, Dr FN Jaffery and Mr. Shailendra Kumar Gupta**

Services offered by IITR

- Safety evaluation of chemicals and products : Agrochemicals, dyes, food additives, plastics and polymers, petrochemicals, cosmetics detergents, fibers and particulate matters etc.
- Safety evaluation of drinking water
- Ecotoxicological impact assessment
- Waste water analysis from chemical, pulp and paper, distillery sugar, leather and food product industries
- IITR is accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) for chemical and biological testing
- Epidemiological surveys/studies on occupational diseases in industrial workers and suggesting remedial measures
- Monitoring noise level in industrial environment
- Environmental monitoring studies

Any feedback on this publication is welcomed.
For information and feedback please write to:

Director

Indian Institute of Toxicology Research

P.O. Box 80, M.G. Marg, Lucknow - 226 001

Telephone : 2628227, 2621856, 2611547

Fax : 91-522-2628227

E-mail : director@iitrindia.org