ENVIRONEWS

INTERNATIONAL SOCIETY OF ENVIRONMENTAL BOTANISTS

Newsletter

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IN THIS ISSUE

AMELIORATING INDOOR AIR POLLUTION

The U.S. Environmental Protection Agency (EPA) ranked indoor air pollution fourth, in cancer risk among the 13 top environmental problems analyzed. The pollutants of major concern are: environmental tobacco smoke, carbon monoxide (from gas appliances or wooden stove), nitrogen oxides, organic chemicals (aerosol sprays, solvents, glues, cleaning agents, pesticide, paints, insect repellants, air fresheners etc.), formaldehyde (plywood, particle board, furnishings, paints etc.), respirable dust (from wood stoves, aerosol sprays and house dust), biological agents (pets, poorly maintained air conditioners, furnishings, neglected moist corners), asbestos (damaged insulations, acoustical materials), lead paints, house dust and radon. The indoor pollution may cause eye, nose, throat and respiratory diseases, pneumonia, emphysema, heart, kidney and liver diseases. It may also lead to impaired mental functioning, growth retardations, allergic reactions and finally, cancer. The California Air Resources Board has estimated the economic impacts due to indoor pollution at billions of dollars each year.

In the Indian scenario, the haphazard urbanization, unprecedented vehicular emissions and inadequate infrastructure development are responsible for the fall in air quality, both outdoor and indoor. Prof. Norman Borlaug, (Noble Laureate), during a visit to India underscored the need for a detailed and comprehensive investigation on the impact of indoor pollution on the housewives, especially in rural areas, who pass more than seven hours a day (with their kids on their lap), getting continuously exposed to wooden stove exhausts while cooking food for the family in poorly ventilated rooms/kitchens.

Recently, NASA scientists in U.S.A., after an exhaustive screening, have identified 19 species of plants that can filter toxic chemicals from the indoor air. There is an urgent need for Indian environmental scientists to follow this lead and organize comprehensive studies to evaluate the role of house plants in ameliorating indoor air pollution

Kamla Kulshreshtha
Joint Secretary ISEB

- Informative news, views and popular articles/write-ups on current environmental researches/issues are invited for publication in ENVIRONEWS.
- Environews is published quarterly on the first of January/April/July/October; and is supplied free to all members of ISEB.
- Environews is also supplied in exchange for scientific literature published by reputed organisations.
- All correspondence should be addressed to : **The Secretary, International Society of Environemental Botanists,** National Botanical Research Institute, Lucknow - 226 001 (India).
- **E-mail : isebnbrilko@satyam.net.in • Website : http://isebindia.com**

LETTERS

I am interested in the membership of the ISEB. Kindly let me know about the proceedings of 3rd International Conference on Plant & Environmental Pollution held during 28th November 2nd December, 2005 at Lucknow, India and send a copy of the proceeding.

Prof. Dr. Muhammad Ashfaq
(Tamgha-i-Imtiaz)
Dean, Faculty of Agriculture,
*University of Agriculture, Faisalabad-**Pakistan***

I am one of the founders of the International Society of Environmental Bioindicators (ISEBI) and Co-Editor-in-Chief of the new society's journal, Environmental Bioindicators (EBI).

In the next issue of EBI, we are putting together a news section that will be submitted within the next few days. I just learned of the Third International Conference on Plants & Environmental Pollution held in Lucknow in November 2005. The Conference's focus on the "emerging role of plants in pollution indication" would be very interesting to our readership. If you have a brief summary of the meeting with principal achievements I would like to include it in the News section of the upcoming issue of EBI.

If you have a longer summary of the meeting already prepared and think it would be appropriate for publication in EBI, please feel free to submit this for consideration.

I have attached EBI's mission statement and the publisher's press release for the journal. Information on the April meeting of ISEBI is available at
http://www.tandf.co.uk/JOURNALS/cfp/uebicfp.pdf#search='iubs%20commission%20environmental%20bioindicators'
Does ISEB publish its own journal?

Edward J. Zillioux, Ph.D.
Co-Editor-in-Chief, Environmental Bioindicators
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U.S.A.
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It's my pleasure to invite you to the **2nd Conference on Bioremediation & Environmental Pollution** organized by Department of Botany and Microbiology, Faculty of Science, Helwan University, Cairo, EGYPT, to be held on Wednesday, 8th November, 2006 at Heiwan university campus, Ain Helwan, Cairo, EGYPT. If it's possible, can you announce the attached circular to the members of International Society of Environmental Botanists (ISEB). At the same time, any suggested joint arrangements for this Conference are welcomed.
If you can help in supporting the conference, in any way, it will be great. Hope to hear from you as soon as possible.

Mohamed Soliman
Prof. of Cytogenetics and head of Botany & Microbiology Department,
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I am an annual member of International Society of Environmental Botanists, but now I want to be a life member. I hope you will consider my request and provide me full information

Fozia Bashir
Department of Botany, Faculty of Science,
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Please send us details of the Third International Conference on Plants and Environmental Pollution (ICPEP-3) organized by you during 28 November 2 December 2005. We are willing to post it on our website.

Dr. Ram Dane Dris
Secretary General,
International Society of Food, Agriculture & Environment,
*Helsinki**, Finland**.*
E-mail: dris.uh@a1netti.com

I am interested in accessing your website. However, I could not access it due to some technical reasons. Could you mail a hardcopy of this document or advise me how can I access this document? I will appreciate your help.

I want to know some publication / information about bio-remediation of environment. If you have any such document, can you please send me either a hardcopy through mail or through e-mail. I am sorry to bother you.

Dr. Dang Van Minh
Dean, Post-graduate faculty
*Thai Nguyen University of Agriculture and Forestry, **Vietnam***
E-mail: minhdangtn@hn.vnn.vn

I feel happy to inform you that after my retirement from NBRI, I have joined as the head of the Amity Institute for Herbal & Biotech Products Development (AIHBPD) Noida. My office however is now located in the Rajiv Gandhi Centre for Biotechnology (RGCB) Trivandrum (Kerala). AIHBPD and RGCB have signed an agreement to jointly undertake research in developing value added products in herbal and biotech sectors. The infinite potential of this sector particularly having regards to the rich resource base of this region induced me to accept this offer. I joined this collaborative system from 1st March 2006 and am in the throes of organising it on a sound footing. I have a very strong feeling that this private-public partnership could yield best results and I look up to ISEB family for guidance, blessing, co-operation and support to enable me to carry out this challenging task in the best possible manner.

P. Pushpangadan
(Former Director NBRI & President ISEB)
Head, Amity Institute for Herbal & Biotech Products Development (AIHBPD)
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I am a Life member of ISEB. I have recently joined B.B.A. University, Lucknow. Kindly note the change in my address for incorporation in your records:

Prof. Rana P Singh
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(Formerly, Deptt. of Biosciences, M.D.Univ. Rohtak 124 001, Haryana, India

I am a PhD student with Central Queensland University, Australia. I am currently working on phytocapping of landfill sites using 21 Australian native species and evaluating their performance with regards to water uptake, rainfall interception and methane restriction. I would like to avail information on the forthcoming events and conferences.

Kartik Venkatraman
Doctoral Fellow
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I am doing research on bioremediation of polycyclic aromatic hydrocarbons. So please give me information on this type of work have done in your Institute, if any.

Kiran Vishnoi
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WELCOME NEW LIFE MEMBERS

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NEWS FLASH

A scientific Society named, as International Society for Environmental Bioindicators (ISEBI) has been formed in U.S.A. to provide a home and forum for bioindicator research at all levels of biological organization including genes, molecules, individual organisms including humans, populations and ecological communities. This Society had organized **First International Conference on Environmental Bioindicators** in collaboration with International Union of Biological Sciences and International Commission of Bioindicators in Prague in June 2005. The Second Conference is being organized during 23 26 April 2006 at Maryland, U.S.A.

This Society has launched an international journal, ***Environmental Bioindicators,*** which seeks to explore the scientific bases and uses of bioindicators and biomarkers as they relate directly to specific measurable effects in ecological and human populations from environmental exposures. The journal is being published by well known publishers 'Taylor & Francis', U.S.A.

For details, contact:
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USE OF POLLEN IN PLANT BIOMONITORING OF AIR POLLUTION

JEAN-PIERRE GARREC

SUMMARY

There has been an ever-increasing interest in plant bio-monitoring of air quality. This paper discusses the possibilities of using pollen as bio-monitor to evaluate air pollution. The advantages and limitations of methods that use pollen as biomonitoring agent are also described.

INTRODUCTION

Numerous studies have been devoted to the impact of air pollutants on pollens but in contrast, only few works are available on the use of pollen to evaluate atmospheric pollution (i.e. pollen as bioindicator).

Pollen as other plant or animal bioindicators, does not provide information on absolute concentrations of pollutants in the air, however, it indicates, with accuracy, their relative levels. Bioindicators can give relevant information on pollutants: their identities, their levels and their geographical localisation, and may eventually help us drawing pollution maps. Actually, the methods using plants for biomonitoing of air quality may turn out to be successful, as they are simple, cheap and fast and can supplement the classical physico-chemical methods.

This small paper discusses the possibilities of using pollen for air pollution biomonitoring; the advantages and limitations of methods using pollen as the biomonitor to evaluate air quality are also described in this paper.

POLLEN AS AIR POLLUTION BIOINDICATOR

The information on the pollutants is derived from the study of the biological response of pollen to air pollution. As a lot of primary and secondary physiological processes are involved, the physiological responses usable for bioindication could be numerous ranging from molecular level to pollen functioning.

Pollen used as bioindicator gives, from its physiological perturbations, time integrated information on doses of pollutants present in the air. We can say that pollen does not indicate levels of pollutants, but it measures their biological impact. Thereby pollen, as other bioindicators, provides particularly original and interesting information on the potential adverse effects of pollutants on living organisms. This direct assessment of risk by bioindication methods is of greater importance compared to the physico-chemical methods.

If in the atmosphere the pollutants have a direct impact on the physiology of pollen, they have also an indirect impact on its ontogenesis *via* their effects on the producing plants. It may be pointed out that this ontogenesis is also subordinated to the other environmental factors (atmospheric and/or edaphic) acting on the producing plants.

When pollen is used as bioindicator and we want to eliminate these indirect effects, we have to work with pollen coming from plants cultivated in an unpolluted area (greenhouse) and then introduce "in situ" at the beginning of the study (active bioindication), and not with pollen coming from local endemic plants (passive bioindication) with unknown environmental history.

Another easier solution is the "transplant method". In this case the pollen is first collected from flowers in an unpolluted area, and then exposed in the polluted sites inside narrow-mesh bags.

These active bioindication methods have the advantage of being easily standardized at the level of the producing plant and allow to control the pollen characteristics, origin and quality. The "transplant methods" inform with precision how long the pollen has been contaminated.

POLLEN AS AIR POLLUTION BIOACCUMULATOR

In this case, information on the pollutants is based on the study of their accumulation on the pollen. The accumulated pollutants are quantified after extraction from the pollinic matrix and from physico-chemical analysis.

Due to the rugosity of the micro-relief at the surface of pollen (exine), and also due to its lipophilicity, the pollen is a very good accumulator of all types of pollutants: gaseous or particulate on one hand and organic or non-organic on the other hand. This accumulation is mainly dependent on physico-chemical processes at the surface level, and for this reason is not much influenced by the physiological condition of the pollen or of the producing plant. Practically, all the pollutants (pesticides, HAP, heavy metals, fluoride, etc...) can be accumulated on pollen for passive or active bioindication.

Pollen used as bioaccumulator gives information directly linked to pollutant concentrations. The accumulation of pollutants is dependent on the fluctuating characteristics of the air as it is influenced by the dynamic equilibrium between pollen and atmosphere. Indeed, numerous factors tend to continuously eliminate, chemically or mechanically, the pollutants accumulated on the pollen surface: rain, wind, dust, rubbing, etc...

But this information is never instantaneous, as we have to take into account an equilibrium time between atmosphere and pollen which is not very well known.

To collect enough biological material, pollen is always directly sampled from the flowers, but in polluted areas, by active or passive bioindication, we never know precisely the contact time between pollutants and pollen. To eliminate this problem, we have to use, as with other bioindicators, the "transplant methods".

CONCLUSIONS

Plant biomonitoring methods will be never a substitute to physico-chemical methods for air pollution studies, but they constitute complementary methods, as they provide essential information on biological impact of pollutants.

Among these methods of plant biomonitoring, the method using pollen as bio-accumulators or as bioindicators could be a good one due to the peculiar characteristics of the pollen surface. Unfortunately, some constraints in relation to pollen physiology limit the wide application of this method "in situ". These constraints are as follows:

- For facility and rapidity reasons, pollen is generally directly sampled from flowers in polluted areas, but in this case it is impossible to know with precision
  i) the contact time between pollutants and pollen
  ii) the influence of producing plant environment on pollen physiology during its ontogenesis, and
  iii) the quality of the sampling sites including its homogeneity and representativity.
- Pollen production takes place over a limited period during the year, and it is very often irregular.
- Pollen life-time is always short (few days only) and it could be a limiting factor for a good accumulation of pollutants or for producing measurable physiological perturbations.

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BACTERIAL RESISTANCE: A TOOL FOR REMEDIATION OF TOXIC METAL POLLUTANTS

O.P.SHUKLA, U.N.RAI, SMITA DUBEY & KUMKUM MISHRA

INTRODUCTION

Bioremediation is a process that utilizes inexpensive microbial biomass to sequester toxic heavy metal and is particularly useful for the removal of contaminants from industrial effluents. Bioremediator agents are prepared from the naturally abundant and waste biomass of algae, moss, fungi and bacteria that have been killed while the biomass is pretreated by washing with acids and bases before final drying and granulation. Bacterial biomass is more useful and effective during the remediation of contaminated sites. This process offers the advantage of low operating cost, minimization of volume of chemical or biological sludge to be disposed and high efficiency in detoxifying very dilute effluent. These advantages have served as the primary incentives for developing full-scale bioremediation process to minimize heavy metal pollution.

PLASMID MEDIATED TOXIC METAL RESISTANCE

Many bacterial strains contain genetic determinants of resistance to heavy metals such as mercury, silver, arsenic, bismuth, cadmium, chromium, nickel, lead and undoubtedly others. These resistance determinants are often found on plasmids and transposons, which facilitate their analysis by molecular genetic technique. In the frequent absence of any obvious source of direct selection, these resistances occur with surprisingly high frequencies. It has been suggested that heavy metal resistances may have been selected in earlier times, and that they are merely carried along today for a free ride with selection for antibiotic resistances. We doubt that there is such a thing as a free ride as for as these determinants are concerned. For example, in Tokyo in the late 1970s both heavy metal resistances and antibiotic resistances were found with high frequencies in *Escherichia coli* isolated from hospital patients ,where as heavy metal resistance plasmids without antibiotic resistance determinants were found in *E. coli* from an industrially polluted river. Selection occurs for resistances to both types of agents in the hospital, but only for resistance to toxic heavy metals in the river environment. Redfard et al. found mercury resistance microbes in agricultural soil with no known mercurial input. In such settings, resistance microbes may be very rare, but they may come into much greater quantitative prominence after industrial or agricultural pollution. These major recent progresses have consisted of the cloning and DNA sequence analysis of determinants for mercury, arsenic, cadmium and tellurium resistances and initial reports of still additional resistances

RESISTANCE TO ARSENIC

The mechanism of arsenate resistance is reduced accumulation of arsenate by induced resistant cell. Arsenate ions enter bacterial cells via the phosphate transport systems. Arsenate is toxic to bacteria because it is an *analog* of phosphate and can inhibit enzymes such as kinases. Also, arsenylated sugar hydrolyze spontaneously, resulting in a loss of free energy in glycolysis. Resistance to arsenate is determined by plasmid in *S. aureus* and enteric bacteria. The arsenate resistance determinants of both *S. aureus and E. coli* specify an efflux system, which has recently been studied in some detail by measuring the loss of arsenic from preloaded resistance cells.

Arsenic resistances are governed by plasmids that also code for antibiotic and other heavy metal resistances. The presence of the resistance plasmid does not alter the kinetic parameters of the cellular phosphate transport system; even the Ki for arsenate as a competitive inhibitor of phosphate transport is unchanged. Direct evidence for plasmid governed enzyme dependent efflux of arsenate indicated that the reduced net uptake of arsenic resulted from rapid efflux. Molecular genetic studies, cloning, Southern blotting and minicell polypeptide synthesis followed the physiological and biochemical studies of the arsenic resistance determinants. The DNA sequence of a *Staphylococcus* arsenic resistance determinants was recently completed.

The plasmid determined arsenic resistance system has always had the same biochemical mechanism, reduced uptake due to an ATPase efflux system in both gram-negative and gram-positive bacteria.

RESISTANCE TO MERCURY

Mercuric ions are toxic to bacteria because they bind avidly to sulpha hydryl groups and inhibit macromolecule synthesis and enzyme action. Many enzymes have critical thiol group and are sensitive to mercury in vitro. Transcription and translation are particularly sensitive. This may be due to the inhibition of precursor synthesis or mercury binding to polynucleotide. Resistance to mercurial is a common plasmid determined

property of both gram positive and gram negative bacteria. A decreasing incidence of mercurial resistance in hospital strains has coincided with the discontinuation of mercurial disinfectant usage. Also, mercury is frequently specified by drug resistance plasmids and is also common in soil *Pseudomonas* and *Bacilli*. It has recently been found in *Thiobacillus ferrooxidanns*. Bacterial resistance to mercury is determined by enzymatic reduction of the ion to mercury, which is much toxic. The enzyme that catalyses the reduction of mercury is the intracellular, cytoplasmic, FAD-containing mercuric reductase. The reductase mechanism also involves a plasmid specified mercury specific transport system. It seems to be required to direct mercury through cytoplasmic membrane, when it would otherwise encounter sensitive enzymes. It seems that the reductase and transport function might interact physically. Indeed, some reductase protein appears to be membrane-associated in *E. coli* minicells.

RESISTANCE TO TELLURIUM

Tellurite and tellurate resistances have been detected from plasmid-mediated determinants. The resistance mechanism is not known. Early work on tellurite resistance in bacteria showed that although reduction of TeO_3^{-2} to black Te^0 can be seen, it is apparently not the resistance mechanism because it occurs with both sensitive and resistant cells. Alkylation of tellurium is apparently also not the mechanism of resistance. Recently, Jobling and Ritchie cloned the tellurium resistance determinants from a large alcaligenes plasmid in to *E. coli*, where it was expressed from a 3.55 kb DNA fragment. However, there is a low frequency mutation on the plasmid that results in a tellurite resistance determinants on RP4.

RESISTANCE TO CHROMIUM

Bacterial resistance to chromate has been found in several *Pseudomonas* strains and also with a plasmid in *Streptococcus lactis* . Horitsu et al showed that a CrO_4^{-2} a sensitive *Pseudomonas ambigua* strain accumulated six times more chromate than a resistant strain. Ontake et al. recently concluded that the basis of plasmidmediated chromateresistance in pseudomonas is the reduction in chromate uptake by the plasmid bearing strain. With *P. fluorescens* containing a chromate resistance plasmid the V max for chromate uptake was reduced, the K for chromate uptake was unchanged, and Ki for chromate as a competitive inhibitor of sulfate transport was unchanged. There was no difference in chromate efflux between the sensitive and resistant *P. fluorescens* strain,which suggests that the block may be at the level of uptake rather than efflux. Thus, there is an interplay between plasmids governed fucntions and chromosomal gene determined properties. The sulfur source used for cell growth greatly affects chromate resistance level. The rate of chromate uptake by *P. aeruginosa* also was regulated by the sulfur source.

RESISTANCE TO CADMIUM

There are six or more systems for bacterial cadmium resistance known today. However, little physiological and biochemical work has been done. Only one of these systems has been cloned, and DNA sequencing has just been completed in our laboratory. Therefore, our understanding of bacterial cadmium resistance is preliminary and tentative.

Cadmium ions are taken into sensitive bacterial cells by the energy-dependent manganese transport system, where they cause rapid cessation of respiration by binding to sulfahydryl group in protein. Resistance to cadmium is a common plasmid specified function in *S. aureus*. In other bacterial genera cadmium resistance is frequently associated with the large "penicillinase" plasmids. Some plasmid specified both Cad A and Cad B resistance determinants, whereas other carry Cad A determinants. A small multicopy Cad A plasmid has also recently been described. It has been known for some time that high level resistance to cadmium involves decreased accumulation. It is now clear from the detailed studies of Tynecka et al. that cadmium resistance is caused by a plasmid encoded efflux system.

RESISTANCE TO COPPER

Plasmid determined copper resistance has been reported on an antibiotic resistance plasmid, in *E. coli* isolated from pig fed copper supplements as growth stimulants, and in *P. syringae* from plants treated with copper as an antibiotic reagent. Although the genes determining copper resistance from *P. syringae* have been cloned and transferred into *E. coli*, there have been no detail studies of the mechanism of copper resistance. Thus the proposed cellular copper sequestration might be the basic mechanism of copper resistance.

RESISTANCE TO SILVER

Microbial silver toxicity is found in situation of industrial pollution, especially those associated with mining and use of photographic film. In hospitals, silver salts are the preferred antimicrobial agent for tropical use on patients with large burns. It is thus not surprising that silver resistant bacteria and silver resistant plasmids have been described and found in polluted industrial and mining sites. Plasmid determined silver resistance is very strong. The ratio of minimal inhibitory silver concentration for resistant and sensitive strain can be greater than 100:1, and under some condition resistance cell can be grown in concentration of up to 0.5 M added silver salts. The level of resistance depends on silver complexing components. However, it is unclear how this type of resistance mechanism can explain the accumulation of amounts of silver equivalent to up to 30% of cell mass by resistant cells. Apparently, silver is reduced to metallic silver equally by sensitive and by resistant cells, so that reduction of silver does not appear to be a primary resistance mechanism.

CONCLUSION

Analysis of DNA sequence of some heavy metal resistance system have advanced our understanding of mercury, cadmium and arsenic resistance mechanisms enormously. Understanding of tellurium resistance is less complete because the biochemical mechanism is not known. There remain resistance system for about ten additional toxic heavy metal. Heavy metal resistant strains isolated from environmental or clinical sources generally have these resistances on plasmid. Chromosomal mutation to heavy metal resistance can be produced in the laboratory but does not generally occur in nature. The chromosomally determined mutation leading to arsenate, cadmium, chromate and cobalt resistances are due to changes in the membrane transport system responsible for uptake of the beneficial materials such as phasphate, manganese, sulfate and magnesium along with these toxic materials.

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FOOD COLOURS: CONCERN REGARDING THEIR SAFETY AND TOXICITY

V.P. KAPOOR

Presently, there is global trend towards the more usage of natural colours in food, pharmaceutical and personal care industries. Much awareness is created amongst consumers regarding the natural products and adopting more natural way of life. Now days, people prefer natural food, herbal medicines, natural curing practices and even biological farming without using synthetic fertilizers and pesticides. All this happened due to excessive use of synthetic chemicals/colours/derived products in the last one and half century which production and application cause human health hazard, environmental pollution and disturbing our eco-system. Due to adverse effect of synthetic dyes, all countries have made strict regulations about the permitted colours to be used as food additives. Most of the countries have prohibited the use of several synthetic dyes as food colouring agents and permitted a limited number of synthetic colours under specified maximum limits. The number of permissible colours vaired to some extent depending upon particular country. Apart from edible food colours, strict measures have been enforced for the use safe dyes for colouring textile and consumer goods. For example, Germany and Netherlands have imposed ban on the use of specific synthetic dyes for textile dyeing. India has also banned the use of 70-odd azo-dyes for colouring textile and other consumer goods and 118 chemicals have been put up in Red-List.

We need colour in food because all the senses contribute to the experience of eating. The impression food makes on us is a melange of sensations, and colour and surface appearance are amongst the most important. Many of the great experience in life involve a mix of sensation and eating is one of the original multimedia experiences. Addition of a suitable colour enhanced the appearance of fresh and process foods. In some cuisines, colour has played a more important part than others; for example saffron-coloured rice and lurid red of tandoori chicken.

PERMITTED NATURAL COLOURS

In India, Rule 26 of The Prevention of Food Adulteration Act, 1954 (PFA) and The Prevention of Food Adulteration Rules, 1955 & 1999 permit following colours whether isolated from natural sources or produced synthetically in food items:

a) Beta-carotene, b) Beta-apo-8' carotenal; c) Methylester of Beta-apo-8, carotenoic acid; d) Ethylester of Beta-apo-8' carotenoic acid; e) Canthaxanthin; f) Chlorophyll; g) Riboflavin (Lactoflavin); h) Caramel; I) Annatto; j) Saffron; k)Curcumin (or temetic)

In the preparation of annatto colour in oil, any permitted vegetable oil may be used either singly or in combination and name of the oil or sils should be mentioned on the label.

Rule 27 of the PFA prohibits the addition of inorganic matters and pigments in any article of food.

PERMITTED SYNTHETIC COLOURS

According to the Rule 28 of Indian PFA, following synthetic colours shall be used in food:

S.No.	Colour	Common name	Colour Index	Chemical Class
1.	Red	Ponceau 4R	16255	Azo
		Carmoisine	17420	Azo
		Erythrosine	45430	Xanthene
2.	Yellow	Tartrazine	19140	Pyrazolone
		Sunset Yellow FCF	15985	Azo
3.	Blue	Indigo Carmine	73015	Indigoid
		Brilliant Blue FCF	42090	Triarylmethane
4.	Green	Fast Green FCF	42053	Triarylmethane

Rule 29 specified the food item in which these synthetic colours are permitted. These include ice-cream, frozen dessert, flavored milk, yoghurt, biscuits, peas, strawberries, cherries, custard powders, ice-candy etc.

Maximum limit of the permitteed colour (Rule 30) shall not exceed 100 or 200 ppm of the final food or beverage for consumption. The colours should be pure and free from any harmful impurities (Rule 31)

INTERNATIONAL STATUS

Natural colours are widely permitted throughout world but there is no universally accepted definition of colouring matter. Some countries exclude the species from their list which have both flavouring and colouring effect. The species viz. turmeric, paprika, saffron, sandalwood oil etc. which have a secondary coloring effect are not classified as colours but declared as ingredients in the normal way. The list of permitted natural food colours in US and EU is bigger than Indian list. Apart from all 11 sources mentioned in Indian PFR, it includes vegetable carbon, copper complexes of chlorophyll and chlorophyllins, paprika extracts, lycopene, lutein, beetroot red, anthocyanins, cochineal, camine, cottonseed flour etc.

As regards to synthetic permitted colours, legislations of different countries differ to some extent on particular colours. Some synthetic colours are permitted in one country but banned in others. For example, Tartrazine (FD&C Yellow No. 5) is banned in Norway and Austria; Sunset Yellow FCF (Orange Yellow S) is banned in Norway; Yellow 7G is banned in Australia and USA; Ponceau; 4R (FD&C No. 4) is banned in USA and Norway; Erythrosine (FD&C Red No. 3) is banned in Norway;

Brilliant Blue FCF (FD&C Blue dye No. 1) is banned in Belgium, France, Germany, Switzerland, Sweden, Austria and Norway; Indigotine-Indigo carmine (FD&C Blue No. 2) is banned in Norway; Green S is banned in Sweden, USA and Norway; Red 2G is banned in Australia and many other countries except U.K.; Vegetable carbon is banned in USA, Brown HT (Chocolate) is banned in Denmark, Belgium, France, Germany, Switzerland, Sweden, Austria, USA and Norway. As aregard to natural colours, Amaranth; FD&C No. 3, derived from the small herbaceous plant *Amaranth* is banned in USA, Russia, Austria and Norway. Similarly, some countries have banned the use of Paprica extract (Capsanthin & Capsorubin).

Colouring ingredients include natural colours, derived primary from vegetable sources; inorganic pigment; combination of organic and metallic compounds (lakes) and synthetic colours. These are used in processed food, sausage casting, baked goods, candies, ice cream, dairy products, sugar confectionary, flour confectionary, frozen products, gelatine desserts, dry-mixes, carbonated and other drinks. The principal natural colours, most of which, in refined form, are used as additives, are the green pigment chlorophyll, carotenoids, flavonoids, anthocyanins, betalains & betanins, anthraquinones, diarylmethane. At international level, the following natural colours are produced by numerous companies and available in market

⇒Annatto (ellow/Orange); ⇒Carotene (Orange); ⇒Beetroot (Pink/blue/red); ⇒Chlorophyll (Green); ⇒Beta Carotene (Yellow/Orange) ⇒Chlorophyllin (Green); ⇒Capsanthin (Red/Orange); ⇒Curcumin (Yellow); ⇒Carmine (Red); ⇒Lycopene (Reddish orange); ⇒Carminic Acid (Orange/Red); ⇒Lutein (Yellow); ⇒Anthocynin (Red/Purple); ⇒Vegetable carbon (Black)

TOXICITY OF FOOD COLOURS

The use of certain food colours has been banned on their toxicity observations on experimental animals. The use of non-permitted colours and excess of permitted colours generally cause adverse effects on human health. Some of the common after effects of prolonged use of synthetic colours cause hyper acidity, thyroid tumors, urticaria (hives) dermatitis, asthma, nasal congestion, allergies, abdominal pain, nausea, eczema, liver and kidney damage and cancer. For example, Auramine was found to cause dysfunction of liver and kidney; Rhodomine B was shown to cause retardation of growth and degenerative changes in liver in kidney; Malachite green caused decrease in appetite, growth rate and fertility rate; Yellow G provoked asthma; Allura red caused cancer in mice. In view of above, list of permitted food colours in different countries has some exceptions depending upon the recommendation of their food & Drug Authority Regulations.

NATURAL COLOURS AS HEALTH CURE

Besides colouring food, several natural dyes posses bioactive properties and have been used as therapeutic agents and as diagnostic tools. Some of the dyes have been reported for following curative effects; analgesics, antibacterial, antifungal, antileprotic, antiviral and anti-inflammatory. Turmeric has been reported as a digestive aid and treatment of carminative and stomach disorder. It has also been found as potential biomolecule for the treatment of cancer. Presently, there has been much interest in carotenoids, especially beta-carotene (carrots, mango, papaya etc.) which besides natural orange pigment is converted in body to vitamin A and has antioxidant powers. Similarly, there is trend towards the use of anthocyanins (red grapes, red cabbage, elderberries, sweet potatoes etc.) and betacyanins (red potatoes, beet, amaranth etc.), which contribute positive health effect. There is lot of scope to introduce alternative sources of natural food colours but according to legislation, there exit a need for their extensive safety evaluation study through systematic pharmacological and clinical trials.

CONCLUSION

In India, only reputed companies, hotels, bakery, confectionaries and sweet-shops use the permitted colours in safe limits whereas its status at small or rural level is highly unsatisfactory. According to some reports, generally non-permitted colours are being used in the preparation of sweets, confectionery, bakery, ice-cream and other food items at local level especially at rural areas. The use of non-permitted colours and excess of permitted colours cause adverse effects on human and animals beings. There is an urgent need to undertake the issue at national level and create awareness in public for the safe use of edible colours.

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The earlier ad-based web page: http://www.geocities.com/isebindia/ will no longer be updated.

Secretary, ISEB

NEWS AND VIEWS

HEALTH HAZARDS OF AIR POLLUTION

Air Pollution is the environmental factor with the greatest impact on health in Europe and is responsible for the largest burden of environment-related disease, states the European Environment Agency (EEA) in a new report, which also highlights the following facts:

- Recent estimates indicate that 20 million Europeans suffer from respiratory problems every day.
- Particulate matter and especially small particles with a diameter less than 2.5 micrometres ($PM_{2.5}$) are associated with increased mortality, especially from cardiovascular and cardiopulmonary diseases.
- Recent estimates made in the CAFÉ programme found that in the EU about 350,000 people died prematurely in 2000 due to the outdoor air pollution caused by fine particulate matter ($PM_{2.5}$) alone. This corresponds to an average loss of life expectancy of about nine months for every EU citizen.
- Current levels of ozone have severe health implications, such as bringing forward the deaths of more than 20,000 people per year.
- Respiratory health improves when air quality improves. One of the best examples is a labour dispute that shut down a large steel mill in Utah Valley. Respiratory hospital admissions in children were clearly decreased during the strike and returned to pre-strike levels after the dispute ended.

The report also examines other environmental factors that affect people's health, including noise and endocrine disruptors.

Environment and health. EEA Report No. 10/2005

(From: *Acid News*, Goteborg, Sweden)

CLIMATE CHANGE MAJOR THREAT

Researchers have investigated the future of 1,350 species of European plants that can be regarded as representative of their flora on the continent, looking ahead to 2080. Their conclusion is that more than half of them are under threat as a consequence of expected climate changes.

Seven different climate scenarios were examined in the study, with mean global temperature rising by between 1.8 and 3.6 degrees Celsius between now and 2080.

The current distribution of each species was recorded on a 50x50 kilometre grid covering the entire continent. To assess the level of threat posed by climate change the researchers used criteria developed by the International Union for Conservation of Nature and Natural Resources (IUCN).

Little is known about the ability of species to migrate with their climate zones, so the researchers used two extremes - no migration and universal migration. The actual migration of each species will naturally lie somewhere between these extremes.

Under the assumption of no migration, more than half the species considered become vulnerable or committed to extinction by 2080.

The scenario that portrays the biggest rise in the mean temperature in Europe, 4.4°C, results in a mean species loss of 42 per cent and turnover of 63 per cent in each 50 x 50 kilometer square, but with very large variations depending on where in Europe the square is located.

Species loss in this scenario ranges from 2.5 to 86 per cent per square, while turnover a measure of how many species disappear and how many new ones appear ranges from 22 to 90 per cent. The percentage of species loss could exceed 80 per cent in some mountainous areas, such as north central Spain and central France.

In the boreal regions of Europe immigrant plants from the south replace many of the plants that cannot cope with the rise in temperature. Alpine flora are severely affected, however, Species that already face competition and have found refuge at high altitudes will be out-competed by species that move upslope as the temperature rises.

The researchers acknowledge that there are large elements of uncertainty, but believe their findings provide an illustration of the potential importance and the likely direction of climate change effects. Even under the least severe scenario considered, the risks to biodiversity appear to be considerable.

- Per Elvingson
Acid News

Source: Climate change threats to plant diversity in Europe. Published in Proceedings of the National Academy of Sciences of the United States of America, PNAS 7 June 2005, vol. 102, no. 23, 8245-8250.

GAINS AND LOSSES OF GM CROPS

After the world was introduced to genetically modified (GM) crops a decade ago, by Monsanto, a US-based company, rewards are only now being reaped.

Ten years ago biotech advancement was heralded as the dawn of a new era that could reduce world hunger, help the environment and bolster struggling farmers.

Now, biotech beans, cotton, corn and canola are profit-drivers at Monsanto.

The gains are largely due to a broad US acceptance of crops that have been genetically altered to withstand weed killers and insects, and generate higher yields.

But as the industry celebrates its 10th anniversary, the early promises of biotech crops remain largely unrealised, and many countries have banned the technology amid concerns about potential danger for human health and the environment.

Indeed, for nearly every step forward, there is a step back.

Last month, cereal giant Kellogg announced it would start using healthy low linolenic oil derived only from Monsanto's biotech soybean in its biscuits, crackers and other food products.

But less than two weeks later, rival Kraft Foods, the world's second-largest food producer, said it would stop supplying all genetically engineered food products, including additives, to China due to a lack of market acceptance.

There have been other recent setbacks, including a decision in November by Swiss voters to ban the planting of biotech crops for five years, and the recent revelation in Australia that a biotech pea caused health problems in research mice, forcing cancellation of that project.

In 2004 Monsanto was forced to withdraw biotech wheat it planned to sell in the United States and Canada because of strong market opposition. Other failed projects include Monsanto's delayed-ripening tomato and a healthier potato.

Critics say biotech crops have created more problems than they have solved, creating herbicide-resistant weeds, for instance.

Backers say biotech crops are good for the environment, because they can reduce the amount of chemicals needed to grow healthy crops. Opponents say chemical use increases many times because of weed resistance and other problems. And they say that farmer profits tied to better yields get eaten up by the higher prices they pay for biotech seeds.

Critics say the technology has not eased hunger because many poor countries are unable or unwilling to adopt it. Still, acreage planted with biotech crops around the world is increasing and this year topped more than 1 billion acres sown to soybeans, corn, cotton, canola and other crops.

Barriers in Europe are slowly lowering and new products in the pipeline should help improve acceptance, biotech backers say.

Cotton, corn, soybeans and canola, all first rolled out in the 1995/1996 growing seasons, remain the top biotech crops but the future should bring new crops, biotech backers say.

Syngenta last year announced a new strain of "golden rice" that produces up to 23 times as much beta-carotene as previous varieties. The rice will be available freely to research centres across Asia.

Reuters

ATMOSPHERIC BROWN CLOUD (ABC)

ABC or 'Asian Brown Cloud' originally referred to the enormous blanket of pollution spreading across Asia, distorting normal weather patterns in the region and threatening to devastate many countries' economies. It was called Asian Brown Cloud in 2002 when a U.N. report first warned of this layer of pollution comprising ash, acids and aerosols. At that time, the two mile thick haze existed in most densely populated areas of Southern, Southeastern and Eastern Asia. Subsequently, similar patterns were detected elsewhere in the world and it was renamed 'Atmospheric Brown Cloud'.

Asia is particularly vulnerable as the ABC causes changes in the winter monsoon season, sharply reducing rain over northwestern parts of the continent and increasing rain along the eastern coast. This could potentially cut winter rice harvests by as much as 10 per cent.

The cocktail of soot, aerosols and other pollutants results as much from forest fires, burning of agricultural wastes and fossil fuels, industries and power stations, as emissions from inefficient cookers that use wood or bio-fuels.

Countries have no choice but to pool their resources and data to tackle ABC's threat

Hindustan Times

GLOBAL WARMING POSES MAJOR HEALTH RISKS

Australian scientists have warned that global warming is already causing death and disease across the world through flooding, environmental destruction, heat waves and other extreme weather events. And it is likely to get worse. In a review published in The Lancet medical journal, the scientists said there was now a near-unanimous scientific consensus that rising levels of greenhouse gases would cause global warming and other climate changes. The advent of changes in global climate signals that we are now living beyond the Earth's capacity to absorb a major waste product.

Source: The Age(Intaernet), Australia

PIGEONS WITH BACKPACKS WILL MONITOR AIR POLLUTION

A flock of pigeons will be fitted with backpacks of mobile phone and released into the skies from San Jose, California. These pigeons numbering 20 will monitor air pollution, according to the New Scientist magazine's report.

Each of these birds would be carrying, in addition to a cellphone, a GPS receiver and air pollution sensors. These gadgets will determine levels of pollutants encountered by the pigeons and the readings would be beamed back.

Pigeons' will also have miniature cameras around their necks that will send back aerial snaps. A prototype of pigeon's kit has been built, which contains a mobile phone circuit board with SIM card and communication chips, carbon monoxide and nitrogen dioxide sensors and a GPS receiver. To squeeze in all of these components into a single small board, which birds can carry easily.

Pigeons are credited with having an acute visual memory and they have been known to use tools with a little bit of training.

Source: www.earthtimes.org

GLOBAL WARMING: PLANTS ARE NOT TO BLAME

Plants are not to blame for climate change, according to a statement issued by the researchers who reported that plants emit up to a third of the methane - a potent greenhouse gas - in the atmosphere. Surprised by the wave of media attention generated by their study, the authors (Frank Keppler and colleagues in Heidelberg, Germany) have hastened to add that because these previously unsuspected methane emissions come

from a natural source, they are not the culprits in contemporary climate change. They existed long before man's influence started to impact upon the atmosphere. The fundamental problem still remaining is the global large-scale burning of fossil fuels.

Keppler said he wanted to make three points clear to the public.

First, their findings do not mean that reforestation programmes should be condemned. Trees absorb carbon dioxide, the most important greenhouse gas, so planting them is still beneficial.

When the methane emitted by trees is taken into account, the benefits of planting trees to absorb atmospheric carbon dioxide diminish by just one to four per cent - a negligible effect.

Secondly, changes in the overall amount of methane emitted by plants - including changes that could worsen global warming - are likely to be caused by human activities such as deforestation.

Finally, he says that much more research is needed to discover how methane emissions from plants vary according to species, temperature, humidity, sunlight and other factors, as well as how these emissions might change as the environment does.

To those who are wondering if they should start chopping down trees, Keppler says they should imagine a world without any trees. "What do we have, then?" he asks.

Catherine Brahic in scidev.net

FISH OIL CAN PROTECT AGAINST AIR POLLUTION EFFECTS

A recent study has now established that consumption of fish oil can counteract the effect of air pollution, known to have a disastrous effect on cardiac health. The results of the present study have valuable implications with the ever-increasing air pollution levels in our environment.

The study participants were required to consume a 2g fish oil supplement everyday for a period of 6 months. Those who consumed soy oil supplements formed the control group. At the end of the study, it was found that those who consumed soy oil had marginal, non-significant benefit while the heart rate was found to be stable in the experimental group.

It is hypothesized that the presence of omega-3 polyunsaturated fatty acids in fish oil could contribute to the observed therapeutic effect against arrhythmia and sudden cardiac death as a result of exposure to air pollution. The study has revealed that highly purified ethyl ester form of fish oil could reduce heart attack deaths by 45%.

Previous studies have already established the health benefits of fish oil supplementation. This is the first study to highlight the importance of fish oil supplements to protect against air pollution.

Following the promising findings, the researchers advocate the consumption of fish oil for a substantial improvement in general health. This is especially important, as there is a decline in the quality of the fish consumed over the recent years as a result of water contamination with mercury and PCBs.

Source: www.medindia.net

LIGHTER ON THE ENVIRONMENT

Sometimes solutions to large problems can be fairly simple. Take the energy problem. Matt Prescott, a British environmental scientist wants a complete ban on the traditional light bulb. The cheapest way for developing countries to make optimum use of limited energy supplied, and for developed countries to achieve cuts in their carbon dioxide emissions, is to augment energy efficiency. As a first step, he suggests making light bulbs a major source of waste in energy consumption museum pieces. This could even encourage people to 'aim higher' in increasing efficiency in everything from hot water systems to home insulation, thereby cutting Green House Gas (GHG) emissions.

After all, it is domestic energy consumption that causes more than 25 per cent of the global GHG emission of carbon, sulphur and nitrogen dioxide. Recent research indicates that the wider use of 'green lighting' can cut this dramatically. Compact fluorescent light bulbs, for instance, use only about a quarter of the energy of incandescent bulbs to produce the same number or more lumens. That they also last about ten times longer than regular bulbs is a bonus. Compact fluorescents may be more expensive initially, but the long-term savings would surely offset this. Light emitting diodes (LEDs) also offer an excellent alternative to the light bulb.

Hindustan Times

RESEARCHERS FIND POLLUTION LIMITING SUNNY DAYS IN CHINA

China's skies have darkened over the past 50 years, possibly due to haze resulting from a nine-fold increase in fossil fuel emissions, according to researchers from the U.S. Department of Energy. The researchers found that the amount of solar radiation measured at more than 500 stations in China fell from 1954 to 2001 despite a decrease in cloud cover.

Normally, more frequent cloud-free days should be sunnier and brighter but this did not happen in the study.

The pollution (that) resulted from human activity may have created a haze which absorbs and deflects the sun's rays. Air pollution is widespread in China. Antiquated factories billow smoke, many residents still use coal to heat their centuries-old houses, and a sharp increase in car ownership has bathed the motorways in exhaust fumes. Using data from more than 500 weather stations in China, researchers found the amount of sunlight hitting the ground has fallen by 3.7 watts per square yard in each of the last five decades amid a nine-fold increase in fossil fuel emissions, the study said. The study also said haze appears to have masked the impact of global warming by reflecting sunlight back into space and cooling the Earth's surface.

The haze may have masked the effects of global warming across large parts of China, particularly in the central and eastern regions, where daily high temperatures have actually been decreasing

Source: Associated Press

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Contact: Dr. Andrzej Bytnerowicz <abytnerowicz@fs.fed.us>

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Wessex Institute, Ashurst Lodge, Ashurst, Southampton, SO40 7AA, UK
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Email: owaters@wessex.ac.uk

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