ISSN No.: 0972-1266

ENVIS Newsletter

Vol. 15 No. 1 February 2008

INDIAN INSTITUTE OF TOXICOLOGY RESEARCH
(Formerly Industrial Toxicology Research Centre, Lucknow)

IN THIS ISSUE

EDITORIAL

Vegetables, cereals and fruits are a source of vitamins, minerals and carbohydrates which are essential for maintaining health and life. It is considered that food provides only nutrients but other aspect is that if contaminated food is consumed, rather than benefit, causes severe health hazards to human beings.

Farmers use pesticides to protect crops from pests and enhance productivity. Even following good agricultural practices, residues of pesticides may still end up in the food we eat. With an increasing concern about fresh water shortage due to rapid urbanisation, the practice of using wastewater for irrigation of food crops in urban fringe (peri-urban) areas is encouraged. Considering this aspect it seems that we are fulfilling the demands of increasing population but on the contrary contaminated food crops when consumed by humans may pose them to greater risk. However, food handling, storage and food processing can reduce the levels of these residues. Relatively simple procedures such as peeling root crops like carrots and potatoes can considerably reduce exposure. The more urgent need is for efforts to ensure that the general public is better informed about the risks from contaminants in foodstuffs and, in particular, how they can reduce their personal exposure by simple procedures such as adequate washing and peeling. However, it should be stressed that the levels of pesticide residues in vegetables are low and can be reduced further by appropriate preparation and cooking. The risks to health that they may present are outweighed by the nutritional benefits of a healthy balanced diet including the recommended consumption of vegetables each day.

The production and use of pesticides are regulated by certain laws like The Central Insecticides Act 1968, Prevention of Food Adulteration [PFA] Act, 1954, The Environment Protection Act, 1986. These legislations are governed and administered by different ministries. PFA also sets maximum residue limits for heavy metals found in contaminated vegetables.

In our country all laws are in place, more stringent implementation of these rules is the need of the hour.

Editor :
Dr. Farhat N. Jaffery

Sub Editor :
Dr. Anvita Shaw
Dr. Abha Sharma

Published by :
Distributed Information Centre on Toxic Chemicals
Environmental Information System (ENVIS)
at IITR, Lucknow

ODDS & ENDS

High level of contamination in Eloor-Edayar belt

A study has shown that vegetables, fruits and poultry grown on residents' lands in the industrially polluted Eloor-Edayar area have high levels of pesticide and heavy metal residues that are harmful to human health. Residues were found in food articles such as milk, fish, chicken and duck meat, coconut, banana, papaya, curry leaves and a host of other items produced by Eloor residents in their homes and backyards. The study, prompted by the complaints of heavy environmental pollution caused by the chemical factories in the area, was conducted by the Cochin University of Science and Technology (CUSAT) and the NGOs Periyar Malineekarana Virudha Samiti and Thanal under the supervision of N. Chandramohan Kumar, head of CUSAT's Chemical Oceanography Department. “They wanted to verify the locals' complaints of contamination of their land and water bodies through a scientific study,” The study, which used only food items produced in the area, showed that there were 'unacceptably high levels' of heavy metal contamination in these food items. The levels of lead, cadmium, zinc, chromium and nickel were very high in the samples analysed. For instance, in the samples of curry leaves there was 2.364 mg/kg of cadmium; 5.842 mg/kg of zinc, 8.044 mg/kg lead and 5.433 of nickel. In chicken liver, the residues of these metals were 1.388, 42.88, 4.0, 0.715 and 0.255 respectively. In the milk samples, there were 8.72 mg/ l of chromium and 2.688 of zinc. These metal residues had got into the foods from the contaminated soil of Eloor. C. Jayakumar of Thanal said that the levels of organochlorine pesticide such as DDT, DDE, DDD and BHC were 'alarmingly high' Although Benzene hexachloride (BHC) production had been banned in India way back in 1996, chicken fat extracts had 0.372 mg/litre BHC level. It is quite possible that industrial effluents let out by the chemical factories in the Eloor-Edayar area had got into the food chain. The heavy metal and pesticide residues are much higher than the tolerance limits prescribed by the World Health Organisation and the Kerala State Pollution Control Board (PCB).

http://www.hindu.com/

Contamination of vegetables of different seasons with organophosphorous pesticides and related health risk assessment in northern India

India is an agrarian country. The use of pesticides, herbicides and fungicides were introduced in India during the mid-sixties, which are now being used on a large scale and is a common feature of Indian agriculture. Initially, the use of pesticides reduced pest attack and paved way for increasing the crop yield as expected. Simultaneously, increased use of chemical pesticides has resulted in contamination of environment and also caused many long-term affects on the society.

In the present study an effort has been made to evaluate the residual concentration of selected organophosphorous pesticides (methyl parathion, chlorpyriphos and malathion) in vegetables grown in different seasons (summer, rainy and winter). Data obtained was then used for estimating the potential health risk associated with the exposure to these pesticides. The pesticides residue concentrations in vegetables of different seasons show that the winter vegetables are the most contaminated followed by summer and those grown in rainy season. The concentrations of various pesticides were well below the established tolerances but continuous consumption of such vegetables even with moderate contamination levels can accumulate in the receptor's body and may prove harmful for human population in the long term. The analysis of health risk estimates indicated that chlorpyriphos and malathion did not pose a direct hazard, however, exposure to methyl parathion has been found to pose some risk to human health.

Chemosphere, 2007, 69(1), 63-68.

Heavy metal contamination of soil and vegetables in suburban areas of Varanasi, India

Heavy metal contamination of soil resulting from wastewater irrigation is a cause of serious concern due to the potential health impacts of consuming contaminated produce. In this study an assessment is made of the impact of wastewater irrigation on heavy metal contamination of palak; this is a highly nutritious leafy vegetable that is widely cultivated and consumed in urban India, particularly by the poor. A field study was conducted at three major sites that were irrigated by either treated or untreated waste-water in the suburban areas of Varanasi, India according to normal practice. Samples of irrigation water, soil, and the edible portion of the palak were collected monthly during the summer and winter seasons and were analyzed for Cd, Cu, Zn, Pb, Cr, Mn, and Ni. Heavy metals in irrigation water were below the internationally recommended (WHO) maximum permissible limits set for agricultural use for all heavy metals except Cd at all the sites. Similarly, the mean heavy metal concentrations in soil were below the Indian standards for all heavy metals, but the maximum value of Cd recorded during January was higher than the standard. However, in the edible portion of Palak, the Cd concentration was higher than the permissible limits of the Indian standard during summer, whereas Pb and Ni concentrations were higher in both summer and winter seasons. Results of linear regression analysis computed to assess the relationship between individual heavy metal concentration in the vegetable samples and in soil showed that Zn in soil had a positive significant relationship with vegetable contamination during winter. Concentrations of Cd, Cu, and Mn in soil and plant showed significant positive relationships only during summer. Concentration of Cr and Pb during winter season and Zn and Ni during summer season showed significant negative relationships between soil and plant contamination. The study concludes that the use of treated and untreated wastewater for irrigation has increased the contamination of Cd, Pb, and Ni in edible portion of vegetables causing potential health risk in the long term from this practice. The study also points to the fact that adherence to standards for heavy metal contamination of soil and irrigation water does not ensure safe food.

Ecotoxicol. Environ. Saf. 2007, 66(2), 258-66.

Genetically engineered crops contain latent pesticides that are activated when eaten by consumers

According to a recent article from the Institute for Responsible Technology, certain varieties of herbicides used on genetically modified (GM) crops -- though inactive inside the plants they protect -- can be re-activated after consumption and cause toxic reactions. Herbicide tolerance (HT) is a common trait in roughly 71 percent of all GM crops, which are mostly comprised of corn, soy, cotton and canola. HT crops tend to make a lot of money for biotech companies, since farmers who buy HT seeds are required to purchase that company's brand of herbicide as well. The herbicide used in many GE crops is derived from a natural antibiotic found in soil, which produces specialized enzymes that transform from an antibiotic to a non-toxic form called NAG (N-acetyl-L-glufosinate). The enzymes are then inserted into the DNA of GM crops, so that when the crop is sprayed with herbicides, the plant transforms the herbicide into non-toxic NAG -- essentially, the plant is able to protect itself from the toxic chemicals that kill the weeds surrounding it. However, recent animal studies have shown that after GM crops -- which have accumulated high levels of NAG after several herbicide sprays -- are consumed, stomach bacteria can re-transform NAG back into the toxic herbicide. Two rat studies found a 10 percent and a 1 percent rate of NAG conversion after consumption of HT crops. According to a January 2006 report by the Environmental Protection Agency's Office of the Inspector General, certain pesticides easily enter the brains of young children and fetuses, where they then destroy cells. Studies of mice embryos exposed to glufosinate resulted in reduced numbers of vital brain receptors, growth retardation, increased death rates and incomplete development of the forebrain. EPA could adopt more rigorous testing of genetically engineered crops, and incorporate stricter labeling laws on GM products so consumers can more easily avoid them.

http://www.newstarget.com/

Residues of DDT and HCH in wheat samples collected from different states of India and their dietary exposure: A multicentre study.

Under a multicentre study conducted by the Indian Council of Medical Research, 1712 samples of wheat grain/flour were collected from urban and rural areas in 11 states representing different geographical regions of India. These samples were analysed for residues of DDT (2,2-bis (p-chlorophenyl)-1,1,1-trichloro ethane) and different isomers of HCH (1,2,3,4,5,6-hexachlor cyclohexane, a mixture of isomers). Residues of DDT were detected in 59.4% of 1080 samples of wheat grain and in 78.2% of 632 samples of wheat flour. Different isomers of HCH were present in about 45-80% of the samples of wheat grain/flour. Medians of DDT and total HCH, respectively, for pooled samples of wheat grain were 0.013 and 0.035 mg/kg, while those for wheat flour were 0.01 and 0.02 mg/kg. Estimated daily intakes of DDT and different isomers of HCH through the consumption of wheat contaminated at their median and 90th percentiles constituted a small proportion of their acceptable daily intakes. Amongst the pesticide residues analysed, statutory maximum residue limits have been fixed only for gamma-HCH in wheat in India, as 0.1 mg/kg in wheat grain and zero in wheat flour. Residue levels of gamma-HCH exceeded these maximum residue limits in five of 1080 samples of wheat grain and in 340 of 632 samples of wheat flour. The failure to meet the requirement of the gamma-HCH maximum residue limit in large number of wheat flour samples was attributed to the fixation of practically unachievable zero limit. However, comparing previous studies and the present one, the levels of residues of DDT and HCH in wheat were significantly decreased.

Food Addit Contam. 2006, 23(3), 281-8.

Some pesticides banned in India, others face partial curbs

Some 25 pesticides are banned for manufacture, import and use in India. Two other pesticides and formulations are banned for use in the country but their manufacture is allowed for export. As India grapples with this complex issue at the intersection of agricultural productivity and environmental safety, there are four pesticide formulations banned for 'import, manufacture and use' and another seven pesticides on the 'withdrawn' list. Another 18 pesticides have been 'refused registration'. In Kerala, the ministry of agriculture's secretary, Kulshrestha adds that others had been placed in the 'withdrawn' list, as 'these are likely to cause risk to human beings and animals as their safety cannot be fully established for want of complete data asked for from the pesticide industry'.

Thirty-seven pesticides are on the list 'under review' for their 'continued use or otherwise' in the country. Included here are organophosphate insecticide monocrotophos, seen in the West as acutely toxic to birds and banned in the US and elsewhere. Large bird kills, especially of Swainson's Hawks from the prairies and grasslands of western North America, have been reported allegedly from the use of monocrotophos. On the 'banned' pesticides and formulations list are aldrin, benzene hexachloride, calcium cyanide, chlordane, copper acetoarsenite, cibromochloropropane, endrin, ethyl mercury chloride, ethyl parathion, heptachlor, menzaone, nitrofen, paraquat dimethyl sulphate, pentachlorophenol, phenyl mercury acetate, sodium methane arsonate, tetradifon, toxafen, aldicarb, chlorobenzilate, dieldrine, maleic hydrazide, ethylene dibromide, and TCA (trichloro acetic acid). India has currently banned for use two pesticides and formulations - the suspected neurotoxicant nicotin sulfate and the Bangalore-manufactured broad-spectrum protective contact fungicide captafol 80 percent powder - but their manufacture is allowed for export. Pesticides - substances used for preventing, destroying, repelling or lessening the damage of pests - are known to have an impact on the environment, on farmers and on consumers. Pesticide residues in food have also been a cause for concern. Used since before 2,500 BCE, the first known pesticide was elemental sulfur dusting used in Sumeria about 4,500 years ago. By the 15th century, toxic chemicals such as arsenic, mercury and lead were being applied to crops to kill pests. In the 17th century, nicotine sulfate was extracted from tobacco leaves for use as an insecticide. The 19th century saw the introduction of two more natural pesticides, pyrethrum, which is derived from chrysanthemums, and rotenonem, derived from the roots of tropical vegetables. In 1939, Paul Muller discovered that DDT was a very effective insecticide. By the 1960s, DDT was found to be preventing many fish-eating birds from reproducing, threatening biodiversity. DDT is now banned in at least 86 countries, but it is still used in parts of the world, seen as needed to prevent malaria and other tropical diseases by killing mosquitoes and other disease-carrying insects. Figures available indicate that global pesticide use has increased 50-fold since 1950, and 2.5 million tonnes of industrial pesticides are now used each year worldwide. Currently, India has 203 pesticides registered under Section 9(3) of the Insecticide Act 1968.

http://www.hindustantimes.com/

Cheap pesticide testing kit (Sci col)

A cost effective method has been developed for trace pesticides in food. Researchers said this enzyme-based technique is quick and cost-effective. The method uses a specially devised set of screen-printed electrodes, which are coated with enzyme acetycholine esterase (AChE). The enzyme controls nerve impulses and is easily inhibited by pesticides. Thus when the electrodes are dipped in the pesticide-containing sample, pesticides deactivate AChE. This indirectly helps detect the quantity of pesticides since enzyme deactivation is inversely related to the amount of pesticides present in the sample. The greater the amount of pesticide present, the more is the deactivation rate. “The method can be used to estimate organophosphorous and carbamate-based pesticides in food, drinks and vegetables,” said the lead researcher Priyabrata Sarkar of Calcutta University. The device can detect pesticides over the concentration range of 0-10 parts per billion. Unlike the existing detection practice that takes more time and requires specialised analytical equipment and technical expertise, the new method is rapid and cost- effective. “It takes about 10 to 15 minutes, and One set of electrodes cost around Rs 40. The method is ideal for Indian conditions. The experiment, conducted by researchers from the Department of Polymer Science and Technology of Calcutta University, Jadavpur University and Cranefield University, the UK.

http://www.thestatesman.net/

Heavy metal load of soil, water and vegetables in peri-urban Delhi

Peri-urban lands are often used for production of vegetables for better market accessibility and higher prices. But most of these lands are contaminated with heavy metals through industrial effluents, sewage and sludge, and vehicular emission. Vegetables grown in such lands, therefore, are likely to be contaminated with heavy metals and unsafe for consumption. Samples of vegetables i.e., spinach (*Spinacia oleracea* L.) and okra (*Abelmoschus esculentus* L.); soil and irrigation water were collected from 5 peri-urban sites of New Delhi to monitor their heavy metal loads. While heavy metal load of the soils were below the maximum allowable limit prescribed by the World Health Organization (WHO), it was higher in irrigation water and vegetable samples. The spinach and okra samples showed Zn, Pb and Cd levels higher than the WHO limits. The levels of Cu, however, were at their safe limits. Metal contamination was higher in spinach than in okra. Spatial variability of metal contamination was also observed in the study. Bio-availability of metals present in soil showed a positive relationship with their total content and organic matter content of soil but no relationship was observed with soil pH. Washing of vegetables with clean water was a very effective and easy way of decontaminating metal pollution as it reduced the contamination by 75 to 100%.

Environ. Monit. Assess. 2006, 120 (1-3), 79-91.

Wastewater irrigation make vegetables toxic

According to Indian and UK scientists study on vegetables grown in semi-urban areas, which use industrial wastewater for irrigation, have high levels of heavy metals such as lead, which is neurotoxic and cadmium, which can cause cancer were found. The study which was carried out by researchers from the University of Sussex, Toxics Link (an NGO), Delhi University and Banaras Hindu University, established an unambiguous relationship between heavy metals contamination in food crops and its source in wastewater from industries, treatment plants and municipal and domestic source. Scientists said that in a rapidly urbanising world, where there is increasing concern about fresh water shortage, the practice of using wastewater for irrigation of food crops in urban fringe (peri-urban) areas is encouraged. One potential risk of wastewater use is the contamination of food as a result of industrial pollution. It can have serious implications for health and livelihoods of those who consume produce that was irrigated with wastewater and for the poor in particular.

Wastewater, used for irrigation in India, has no standards for heavy metals, though standards for bacterial content are there. Even if waste water is treated before being used for irrigation, 40-60 per cent of heavy metals remain in the treated water. Lead was found to be high in almost all the samples as per the country's own Prevention of Food Adulteration (PFA) standards and Indian standards are lax in comparison to European standards. Another heavy metal, cadmium, was found high in 60 per cent of samples as per Indian standards. But according to European standards, the two heavy metals were at "alarmingly high levels" in the vegetable samples tested. In the current policy and practice, there is little recognition of the link between industrial pollution and food safety. The study was carried out during 2003-2007 in three areas of Varanasi ~ Dinapur (in the vicinity of the city's major sewage treatment plant), Shivpur (to the north east of the city, close to the Shivpur industrial area) and Lohta (to the west of the city close to several industrial areas). The heavy metals samples include zinc, lead, copper, cadmium, chromium, manganese and nickel. Of these, potentially the most toxic are cadmium and lead. These heavy metals are widely associated with many small-scale industries in Varanasi that include metal works, paper manufacturers and chemical and paint works. Vegetables such as spinach, radish, brinjal, cauliflower, tomato and cabbage were tested.

[http://www.sussex.ac.uk/spru/documents/brochure_final.pdf]

Organic vegetables not pesticide-free

As a nearly $8 billion business in the U.S. alone, according to 2000 data from the U.S. Department of Agriculture, organic fruits and vegetables have moved rapidly from a fringe business at the local food co-op to a mainstream supermarket staple. A key reason consumers buy organic is to avoid pesticide residues, but a small study suggests that organic

produce may not be quite as clean as shoppers expect. Banned pesticides like DDT were found in organic carrots and potatoes at levels as high as or higher than conventionally grown produce, according to a screening study conducted by a college undergraduate and presented at the Society of Toxicology and Chemistry annual meeting in November.

Under Federal law, crops labeled organic must be grown without the use of synthetic pesticides, chemical fertilizers, or sewage sludge. Such treatments must not have been used on a field for at least three years prior to planting of the organic crop. Those three years are meant to cleanse the soil of pesticide residues. But many long-usedand now-banned toxic organochlorine pesticides can take decades to break down. Because root crops, such as carrots, grow directly in the soil, they represent a worst-case scenario for evaluating whether crops acquire such lingering pesticide residues.

Organic produce though has lower levels of pesticides overall, according to agricultural scientist Brian Baker.

The new results attest to the persistence of organochlorine pesticides, adds Baker, who is research director for the Organic Materials Review Institute, a nonprofit organization that specializes in the review of substances for use in organic production, processing, and handling.

Beth Wolensky, a senior at Chatham College in Pittsburgh, Pa., bought 20 batches of carrots half labeled organic and half grown conventionally. She washed the carrots as if she were cooking them for dinner and peeled some of them. Every carrot she tested harbored traces of *p,p*N-DDE, a breakdown product of the insecticide DDT, which has been banned for more than 30 years. Many of the carrots also carried residues of chlordane, a common pesticide that was banned in 1983. Some samples also contained small amounts of heptachlor, once popular as an agricultural pesticide and residential termite treatment.

In all the carrot samples, concentrations of these chemicals were very low, in the low parts-per-trillion (ppt) range. The chemicals concentrated in the skin of the vegetables. In conventionally grown whole carrots, the mean concentration of *p,p*N-DDE was 40 ppt, but organic carrots had mean concentrations of 340 ppt. However, the skin of the conventionally grown carrots had concentrations of 588 ppt, compared to 3050 ppt for the organic ones. Renee Falconer, the analytical chemist who served as Wolensky's faculty adviser, notes that the study lacks the statistical power to determine whether the organic carrots actually contain higher levels of the banned pesticides. She thinks it instead reflects the variability of the data.

In 2004, another Chatham student, Tanieka Motley, found similar results for potatoes, Falconer notes. At the concentrations detected, none of the chemicals in the carrots or potatoes is harmful. “But these low levels add to the overall pesticide load entering our bodies from all sources,” she says. Falconer notes that organic produce does have lower overall levels of pesticides that are currently in use. To reduce the pesticide load to her family, she buys organic and peels her root vegetables.

[http://pubs.acs.org/subscribe/journals/esthag-w/2006/jan/science/rr_organic.html

Breakdown Products of Widely Used Pesticides are Acutely Lethal to Amphibians

The breakdown products (oxons) of the three most commonly used organophosphorus pesticides in California's agricultural Central Valley -- chlorpyrifos, malathion and diazinon -- are 10 - 100 times more toxic to amphibians than their parent compounds, which are already highly toxic to amphibians, according to experiments conducted by scientists of Southern Illinois University, Carbondale, and the U.S. Geological Survey (USGS) Western Ecological Research Center.

Since some of the parent pesticide compounds are already at concentrations sufficient to cause significant amphibian mortality in the Sierra Nevada, the higher toxicity of the breakdown products poses a serious problem," said Dr. Gary Fellers, coauthor of the study. Dr. Donald Sparling, a research biologist and contaminants specialist at Southern Illinois University, and Fellers, a research biologist and amphibian specialist at the USGS Western Ecological Research Center in California, conducted laboratory tests to determine the acute toxicity -- the lethal dosage causing death in 96 hours or less -- of chlorpyrifos, malathion and diazinon, and their oxon derivatives on tadpoles of the foothill yellow-legged frog (*Rana boylii*). Organophosphorus pesticides have been implicated in the declines of several amphibian species in the California Central Valley and in downwind mountain areas, including the Cascades frog, California red-legged frog, mountain yellow-legged frog and the foothill yellow-legged frog, which inhabit foothill or montane regions east of the Central Valley. More than 6 ½ million pounds of active ingredient organophosphorus pesticides were used in California during 2004, the most recent year for which data are available. Researchers estimate that this accounts for about 25 percent of organophosphorus pesticide use nationwide. Organophosphorus pesticides suppress an enzyme called acetylcholinesterase, which is essential for the proper functioning of the nervous system. Reduced levels of acetylcholinesterase cause neurological synapses to fire repeatedly and uncontrollably, leading to death, usually by asphyxiation as the animal loses respiratory control. Most pesticides of this group reach their greatest potencies when metabolized internally and converted to an oxon form in the liver. However, oxons can also be found in the environment, formed by bacterial decay of the parent pesticide. For the laboratory experiments, tadpoles were raised from eggs collected from a stream in the California Coast Range, upwind of agricultural activities in the Central Valley and away from areas where significant quantities of pesticides are used. Test results indicated that chloroxon killed all tadpoles and was at least 100 times more toxic than the lowest concentration of the parent compound chlorpyrifos, which resulted in no mortality. Maloxon was nearly 100 times more toxic than malathion, and diazoxon was about 10 times more toxic than diazinon. It was observed that the combination of field and laboratory studies is revealing that organophosphorus pesticides are posing serious hazards to the welfare and survival of native amphibians in California. The authors noted that amphibians inhabiting ponds in the Central Valley of California could be simultaneously exposed to two or all three of these pesticides and their oxons. "Because of this," said Sparling, "the potential for interactive effects of these chemicals needs to be explored." Organophosphorus pesticides form the largest group of chemicals used in the control of pests, including invertebrates, vertebrates and, to a lesser extent, plants. Some 200 organophosphorus pesticides available in this class have been formulated into thousands of different products for use in agriculture, forests, gardens, homes and industrial sites.

Environ. Pollu. 2007, 147(3): 535-539.

Heavy metal (Cu, Zn, Cd and Pb) contamination of vegetables in urban India.

The contributions of heavy metals in selected vegetables through atmospheric deposition were quantified in an urban area of India. Deposition rate of Zn was recorded maximum followed by Cu, Cd and Pb. The concentrations of Zn and Cu were highest in *Brassica oleracea*, Cd in *Abelmoschus esculentus* and *B. oleracea*, while Pb was highest in *Beta vulgaris*. Heavy metal pollution

index showed that *B. oleracea* was maximally contaminated with heavy metals followed by *A. esculentus* and then *B. vulgaris*. The results of washing showed that atmospheric deposition has contributed to the increased levels of heavy metals in vegetables. Both Cu and Cd posed health risk to local population via test vegetables consumption, whereas Pb posed the same only through *B. oleracea*. The study concludes that atmospheric depositions can elevate the levels of heavy metals in vegetables during marketing having potential health hazards to consumers. Atmospheric depositions can significantly increase the heavy metal concentrations in vegetables during marketing.

Environ. Pollu. 2007, Nov 19

Multi-residue method for the analysis of 101 pesticides and their degradates in food and water samples by liquid chromatography/time-of-flight mass spectrometry

A comprehensive multi-residue method for the chromatographic separation and accurate mass identification of 101 pesticides and their degradation products using liquid chromatography/time-of-flight mass spectrometry (LC/TOF-MS) is reported here. Several classes of compounds belonging to different chemical families (triazines, organophosphorous, carbamates, phenylureas, neonicotinoids, etc.) were carefully chosen to cover a wide range of applications in the environmental field. Excellent chromatographic separation was achieved by the use of narrow accurate mass windows (0.05 Da) in a 30 min interval. Accurate mass measurements were always below 2 ppm error for all the pesticides studied. A table compiling the accurate masses for 101 compounds together with the accurate mass of several fragment ions is included. At least the accurate mass for one main fragment ion for each pesticide was obtained to achieve the minimum of identification points according to the 2002/657/EC European Decision, thus fulfilling the EU point system requirement for identification of contaminants in samples. The method was validated with vegetable samples. Calibration curves were linear and covered two orders of magnitude (from 5 to 500 ìg/L) for most of the compounds studied. Instrument detection limits ranged from 0.04 to 150 ìg/kg in green-pepper samples. The methodology was successfully applied to the analysis of vegetable and water samples containing pesticides and their degradation products. This paper serves as a guide for those working in the analytical field of pesticides, as well as a powerful tool for finding non-targets and unknowns in environmental samples that have not been previously included in any of the routine target multi-residue methods.

Journal of Chromatography A, 2007, 1175(1), 24-37.

Effects of home preparation on pesticide residues in cabbage

China is the world's largest producer of vegetables followed by India. These two countries have 61% of the vegetable cultivated area and contribute to 71% of the vegetable production in the world, and China accounts for 40% of the world production. Vegetables play important roles in human nutrition and health by providing minerals, micronutrients, vitamins, antioxidants, phytosterols and dietary fiber. Experiment was carried out to evaluate the pesticides (chlorpyrifos, *p,p*-DDT, cypermethrin, chlorothalonil) residue levels in cabbage in the process of home preparation by washing with different concentrations of acetic acid and sodium chloride, and tap water, preserving in refrigerator, and stir-frying for different time. Results showed that washing by tap water and/or detergent solution for cooking are necessary to decrease the concentration of pesticide residues in cabbage. Washing with acetic acid solutions (at 10% concentration for 20 min) caused 79.8%, 65.8%, 74.0% and 75.0% loss of the above pesticides respectively. Washing with NaCl solutions (at 10% concentration for 20 min) produced 67.2%, 65.0%, 73.3% and 74.1% loss, respectively, and washing by tap water (for 20 min) were 17.6%, 17.1%, 19.1% and 15.2% loss, respectively. The reductions due to the refrigeration (for 48 h) were 3.4%, 2.6%, 3.1% and 3.6%, respectively, and those due to the stir-frying (for 5 min) were 86.6%, 67.5%, 84.7% and 84.8%, respectively. The data indicated that washing by detergent solutions and stir-frying of cabbage are the most effective home preparations for the elimination of pesticide residues.

Food Control, 2007, 18(12), 1484-1487.

A Study to Evaluate Heavy Metals and Organochlorine Pesticide Residue in *Zingiber officinale* Rosc. Collected from Different Ecological Zones of India

Products derived from medicinal plants have been used for therapeutic purposes for centuries. Herbal products are generally considered safe and have been proven effective against certain ailments. They are also extensively used, particularly in many Asian, African and other developing countries. There is an urgent need to establish the identity, purity and quality of herbal products in order to have full efficacy and safety. Plant materials are liable to contain pesticide residues that accumulate due to different agricultural practices, soil treatment and storage practices, such as administration of fumigants. Widespread presence of heavy metals in soil, due to geoclimatic conditions and environmental pollution is inevitable, therefore their bioaccumulation in plants occurs. Organochlorine pesticides such as isoforms of hexachlorocyclohexane (HCH), metabolites of DDT, endosulphan and heavy metals, including non-volatile and volatile metals, have the potential to cause toxicity to liver and kidney, and may impair oxygen transport in blood. Our laboratory has been involved in the estimation of contaminants in medicinal plants. Levels of heavy metal/ trace elements have been reported in some therapeutically important Indian medicinal plants and various herbal teas. The World Health Organization has also emphasized the need to ensure quality of plant products by using modern techniques and applying suitable standards. Thus it becomes mandatory that all herbal preparations and raw materials be checked for the presence of heavy metals and residual organochlorine pesticides. Ginger, the underground rhizome of the plant *Zingiber officinale*, family Zingiberaceae, is the most extensively used Indian plant in traditional preparations since ancient times. It has a remarkable reputation in the treatment of many gastrointestinal disorders and is often promoted as an effective herbal antiemetic. It has been proposed for therapeutic uses due to its anti-inflammatory, cholesterol-lowering and anti-thrombotic properties. The present study deals with the estimation of selected heavy metals (Pb, Cd, Cr, Ni, As, Hg) and residual organochlorine pesticide concentrations in *Zingiber officinale* collected from various ecological zones of India with the objective to compare the variation in environmental contamination of samples collected from different locations/ regions.

Bull. Environ. Contam. Toxicol. 2007, 79, 9598.

Determination of thiophanate methyl and carbendazim residues in vegetable samples using microwave-assisted extraction

Microwave-assisted extraction (MAE) was carried out for the determination of the fungicides thiophanate methyl [1.2-alpha-(3-methoxycarbonyl-2-thioureido) benzene] and carbendazim (methyl benzimidazol-2-ylcarbamate) in vegetable samples. Two vegetable samples, cabbage and tomatoes, were fortified with the two pesticides and subjected to MAE followed by cleanup to remove co-extractives prior to analysis by high-performance liquid chromatography (HPLC). Using the selected microwave exposure time and power setting, the recoveries of carbendazim ranged from 69 to 75%. But thiophanate methyl could not be recovered as the parent compound. It was converted and recovered as carbendazim. The conversion was quantitative as confirmed by high-performance liquid chromatography-mass spectrometry (HPLC-MS).

J. Chromatogr. A. 2007. 1148(2):152-7.

Decontamination of Pesticide Residues on Fruits and Vegetables

Raw agricultural commodities (RAC) samples used in processing studies should contain field treated quantifiable residues as close as possible to the MRL, so that measurable residues are obtained, and transfer factors for the various processed commodities can be determined. A transfer factor gives the ratio of the residue concentration in the processed commodity to that in the RAC. For example if the residue concentration is 0.5 mg/kg in olives and 0.2 mg/kg in olive oil, the transfer factor is 0.2/0.5=0.4. A factor 1 (= concentration factor) indicates a concentration effect of the processing procedures. Enhancing the residues either by increasing the application rates, shortening the pre-harvest interval (PHI) or spiking the RAC with the active ingredient and its metabolites *in vitro* is not, as and rule, desirable. Spiking is only acceptable if the RAC residues can be shown to consist only of surface residues. However, in some cases, especially where residues in the RAC are close to the analytical limit of determination, field treatment at exaggerated rates or shortened PHIs is advisable to obtain sufficient residue levels for the processing studies. The first step in household or commercial food processing is the preparation of food using various mechanical processes, such as removing damaged or soiled items or parts of crops, washing, peeling, trimming or hulling. This often leads to significant declines in the amount of pesticide residues in the remaining edible portions.

Washing

Household washing procedures are normally carried out with running or standing water at moderate temperatures. Detergents, chlorine or ozone can be added to the wash water to improve the effectiveness of the washing procedure. If necessary, several washing steps can be conducted consequently.

Peeling

The outer leaves of vegetables often contain residues of pesticides applied during the growing season. Therefore, peeling or trimming procedures reduce the residues levels in leafy vegetables. Peeling of root, tuber and bulb vegetables with a knife is common household practice. Many examples show that most of the residues concentration is located in or on the peel. Peeling of the RACs may remove more than 50% of the pesticide residues present in the commodity. Thus, removal of the peel achieves almost complete removal of residues, so leaving little in the edible portions. This is especially important for fruits which are not eaten with their peels, such as bananas or citrus fruits.

Cooking

Cooking procedures at different temperatures, the duration of the process, the amount of water or food additives, and the type of system (open or closed) may have an impact on the residue level. Normally, residues are reduced during the cooking process by volatilization in open systems or by hydrolysis in closed systems. In any case, adding cooking liquid dilutes the residues.

Dipping In Chemical Solution

Sodium chloride solution is largely used to decontaminate the pesticide residues from different fruits and vegetables .there are several studies to prove the efficacy of salt water washing to dislodge the pesticides from crops. In this process, sample of chopped fruits and vegetables is put in a beaker containing 5% sodium chloride solution. After 15 minutes the plant samples are gently rubbed by hand in salt solution and alt water is decanted.

Http://www.articlesbase.com

DID YOU KNOW ?

Pesticides can disrupt hormone function and balance and have been linked to cancers, headaches and birth defects. Prolonged human consumption of unsafe concentrations of heavy metals in food stuffs may lead to the disruption of numerous biological and biochemical processes in the human body.

HUMAN EXPOSURE TO ORGANOCHLORINE PESTICIDES FROM VEGETABLES

Seema Dogra
ENVIS Centre, Indian Institute of Toxicology Research
M.G. Marg, Lucknow 226 001, India

Among various developing countries in Asia, considerable information on organochlorines in foodstuffs has been available from India since the late 1960s. DDT and HCH were the major insecticides in Indian food-stuffs. Concentrations of these insec-ticides have declined more than two orders of magnitude in farm products, such as food grains and vegetables, in two decades. Milk and milk products are the major sources of dietary exposure to DDT and HCH in India. The residues of these insec-ticides in dairy products were close to or above the MRLs of the FAO/WHO. Dietary intake of DDT and HCH by Indians was > 100 fold that in more developed nations. Sporadic inciden-ces of greater concentrations (>1 microgram/g) of aldrin, dieldrin, and heptachlor have been measured in Indian vegetables (1). Untreated surface waters could be a potential source of DDT and HCH exposure. In most Southeast Asian countries DDT was the common contaminant in animal origin foodstuffs. The higher percentage of p,p'-DDT in meat and fish from Southeast Asian countries, except Japan and Korea, indicated the recent use of DDT in vector control operations. Dietary intakes of DDT and HCH in Southeast Asia were an order of magnitude less than those of Indians but 5 to 10 fold greater than in more developed nations. In addition to DDT, aldrin and dieldrin were prominent in meat collected from Thailand and Malaysia. Aquatic food products from more industria-lized countries, such as Japan, South Korea, Hong Kong, and Taiwan, contained significant levels of PCBs. In South Pacific countries, particularly in Australia and New Zealand, chlordanes and PCBs were the most prevalent organochlorines in food-stuffs. Food contamination by DDT, HCH, aldrin, and dieldrin was less in developing countries in Asia but greater in the U.S. and Japan. Intake of PCBs in Australia was greater than in the U.S. Meat and fish were the major sources of organochlorine exposure in Australians. Human dietary intake of orga-nochlorines has been declining more slowly in developing countries in Asia. Current intakes were at least 5- to 100 fold greater than those in more developed nations, suggesting a greater risk from organochlorine exposure. Factors such as malnutri-tion, common among rural poor in developing nations, can increase these risks.

Among fruits, vegetables, wheat and rice, there is nothing which does not contain residues of pesticides. They have affected the water and even the mother's milk. In order to assess this, the Indian Council of Agriculture Research had taken samples of various commodities to monitor pesticide residues in them (2).

Potato, cauliflower and spinach samples were collected from different cities of Uttar Pradesh-- Lucknow, Gonda, Hordoi, Sitapur, Kanpur and Rai Bareily, for analysis of residues of organochlorines pesticides.

Potato:- α-HCH residue was lowest in Lucknow city and highest in Gonda city, in Hardoi and Rai Bareily, they were below detection limit. β-HCH residue was not present in any sample apart from the one collected from Hardoi. γ-HCH residues were higher in Gonda, in comparison to Lucknow, Kanpur and Sitapur and below detection limit in Hardoi and Rai Bareli. δ-HCH was present only in Rai Bareli sample. α-endosulfan was found only in Rai Bareily, whereas in the rest of the cities it was below detection limits. pp' DDE was detected only in Lucknow and Rai bareli and pp' DDD was present only in Kanpur.

Cauliflower:- α-HCH residue was higher in Lucknow and Kanpur in comparison to Gonda, Sitapur and Rai Bareli whereas in Hardoi it is below detection limit. γ-HCH was below detection limit in Hardoi and Rai Bareli samples whereas it was highest in Kanpur and low in Gonda samples. β-HCH and δ-HCH were found only in Rai Bareily sample and it was below detection limit in all other cities. The α-endosulfan, DDE and its derivatives were found below detection limits in all cities except from Kanpur where pp'DDT was found.

Spinach:- α-HCH residues was below detection limit in Sitapur, Hardoi and Rai Bareily samples, whereas in Gonda, Kanpur α-HCH residues were higher in comparison to Lucknow. γ-HCH was highest in Sitapur in comparison to Lucknow, Kanpur and Gonda, whereas it was below detection limit in Hardoi and Rai Bareli. β-HCH was found only in Lucknow and below detection limit in all other cities. δ-HCH was below detection limit in all the cities. α-endosulfan was below detection limit in Lucknow, Kanpur and Gonda whereas traces of α-endosulfan residues were detected in Sitapur, Hardoi and Rai Bareily. pp'DDE was present only in Kanpur and Hardoi, whereas op'DDT and pp'DDD were detected only in Hardoi and Gonda.

The use of pesticide in agriculture to boost up the food production is indispensable. This study with limited sample size clearly shows that the vegetables consumed in and around Lucknow have residual organochlorine pesticides. A systematic analysis with large sample size and covering more areas may evolve a clear picture.

There is strong scientific evidence that pesticides as a whole can induce a wide array of human health effects ranging from myelotoxicity to cytogenetic damage and carcinogenicity. The developed countries have already addressed the pesticide problem, but we are still facing some problems in certain areas and locations. Therefore, it can be deduced that problems associated with pesticide hazards are not confined to the developing countries. Generally, in third world countries, pesticides need to be used carefully since toxic outbreaks are often attributed to misuse of these substances. Magnifying the severity of pesticide misuse is the availability of banned compounds in the market, an urgent matter that needs attention of the concerned authorities and regulatory agencies.

The concentration of these pesticides in vegetables were well below established tolerances, but continuous consumption of such vegetables even with moderate contamination level can accumulate in the receptor's body and may cause chronic effects in human population in the long term. The results also indicate that the vegetable growers of the selected cities are making a non-judicious use of pesticides, which may be responsible for the contamination of vegetables. It has been found that the farmers are neither observing recommended waiting periods nor following good agriculture practices. Thus, a well developed and co-ordinated programme on farmer's participatory training and research should be initiated that can enhance farmers' knowledge of pests, their ecological casualties and non-chemical alternatives and management options. Ideally farmers' participatory research and training programme should be complemented by a well-developed mass media campaign.

The monitoring studies indicate that though all the vegetable samples were contaminated with pesticides, none of the samples contained pesticides above the prescribed tolerance limit. Although in our country DDT is used only for vector control under the Malaria Eradication Programme, its residue and metabolites i.e. pp' DDE was detected in our vegetables samples. Use of pesticides in the appropriate dose and restricting the spray of pesticides just before harvesting the crop or during transportation can reduce the residue level on the edible commodity and also the environmental contamination. Awareness among the consumers and proper culinary processes will also enable pesticide free edible commodities.

Organochlorine compounds are reported to have endocrine disrupting properties, and some are known or suspected carcinogens. Thus, their presence in food is of concern and intakes should be as low as reasonably practical. Food containing residues at or below the respective MRLs are considered to be toxicologically acceptable for long-term intake (3). On this basis, the concentrations of contaminant residues in the vegetables analysed here should not give cause for concern, however, it is possible that even such low levels of contaminants may merit more detailed scrutiny in the near future. For example, Pesticide Safety Directorate, 2001 and Codex Committee on Pesticide Residue, 2001 have stated that the need for an Acute Reference Dose (ARD) will be considered for all pesticides in the future, and the estimated short-term intake of pesticide residues will be compared with the ARDs in order to interpret the possible risks associated with unit-to-unit, variability in residue levels (4).

Since the toxicity of the pesticides is well established, it becomes necessary to monitor seasonal vegetables regularly, covering a larger area of the state, and to educate farmers regarding potential risks and safe use of pesticides.

References

1. Kannan K, Tanabe S, Giesy JP, Tatsukawa R. (1997) Organochlorine pesticides and polychlorinated biphenyls in foodstuffs from Asian and oceanic countries. *Rev Environ. Contam. Toxicol.* **152**, 1-55.

2. ICAR Report (2001) Pesticide Pollution: Trends and Perspective, ICAR, New Delhi.

3. White S.N., Fernandes A., Rose, M. (2002) Polyaromatic hydrocarbons (PAHs) in the UK 2000 total diet samples. FD 01/42, Central Science Laboratory.

4. Renwick A.G., Barlow S.M., Hertz-Picciotto I. Boobis A.R, et al. (2003) Risk characterisation of chemicals in

food diet, *Food Chem. Toxicol.* **41**, 12111271.

Contamination of vegetables is a serious issue of concern and it should be considered on a priority list for its prevention. The potential sources of contamination of vegetables grown in urban and peri-urban areas include irrigation water contaminated by

REGULATORY TRENDS

sewage and industrial effluent and unsafe or excess application of pesticides. Following points should be taken into account to prevent the contamination of vegetables at least up to the permissible limits of toxic substances.

1. Appropriate methods of monitoring contamination in irrigation water should be followed. Wastewater should be tested before being used for irrigation purpose

2. Spread awareness about the adverse effects of contaminated vegetables consumed.

3. Farmers should be aware not only about consuming contaminated food crops but also handling of wastewater for irrigation.

The Registration Committee constituted under Section 5 of the Insecticides Act, 1968 registers pesticides only after satisfying itself regarding their efficacy and safety. Toxicity and residues data generated under supervised trials is analyzed and used to fix Maximum Residue Limits (MRLs) by the Ministry of Health & Family Welfare under the Prevention of Food Adulteration Act, 1954 and Rules framed there under. The inspection of fruits and vegetables for the presence of pesticide residues and other harmful substances falls under the purview of the Ministry of Health & Family Welfare. However, as per the directions of the Inter Ministerial Committee constituted to review the use of hazardous chemicals and insecticides, 33 samples of vegetables have been drawn from Agricultural Produce Marketing Committee, Azadpur, Delhi since June, 2006 and tested for residues of organo-chlorine, organo-phosphorous and synthetic pyrethroids

Pesticides for which Maximum Residue Limit (MRLs) are set as per PFA Act		
1.	Carbaryl	5 ppm
2.	Dicofol	1 ppm
3.	Dimethoate	0.5 ppm
4.	Inorganic bromide	400 ppm
5.	Endosulfan	1 ppm
6.	Monocrotophos	0.2ppm
7.	Mancozeb	1 ppm
8.	Thiophanate Methyl	0.2 ppm
9.	Quinalphos	0.2 ppm

ON THE LIGHTER SIDE

pesticides. Residues of chlorpyriphos were detected in two of these samples at the level of 0.18 ppm. 24 of these samples have also been analysed for the presence of heavy metals like lead, cadmium and arsenic. The heavy metals found in the samples of vegetables were below the maximum limit prescribed under the Food Adulteration Rules, 1955.

The Ministry of Agriculture has also taken up a scheme for Monitoring of Pesticide Residues under which 21

ON THE WEB

laboratories under various Ministries/ Department have been provided with equipments to undertake analysis of pesticide residues in vegetables, water, meat and meat products, and marine products.

A girl visited a farm one day and wanted to buy a large watermelon.

"That will be three dollars," said the farmer.

"I've only got 30 cents," said the young girl.

The farmer pointed to a very small

BOOK STOP

watermelon in the field and said, "How about that one?"

"Okay, I'll take it," said the girl, "but leave it on the vine. I'll be back for it in a month."

www.cseindia.org/html/lab/health_pest.htm - 45k

Application and health effects of pesticides commonly used in India.

http://cibrc.nic.in/list_pest_bann.htm

List of pesticides / pesticides formulations banned in india. Pesticide / Pesticide formulations banned for use but their manufacture is allowed for export. Pesticide formulations banned for import, manufacture and use.

Botanical Pesticides in Agriculture

Author's: Anand Prakash, Jagadiswari Rao

Publisher: CRC

ISBN-10: 0873718259

ISBN-13: 978-0873718257

Due to the prohibitive cost of synthetic pesticides and the problems of environmental pollution caused by continuous use of these chemicals, there is a renewed interest in the use of botanicals for crop protection. Agricultural entomologists, nematologists, and pathologists the world over are now actively engaged in research into the use of plants to fight agricultural pests and diseases, and to reduce the losses caused by them. Botanical Pesticides in Agriculture reviews the research on botanical pesticides used to combat losses due to pests of agricultural importance, with special attention focused on the use of higher plants. This book will serve as the baseline reference work for future research, and many of the botanicals discussed, such as neem, bael, begonia, pyrethrum, tobacco, karanj, and mahuwa, may become integral parts of pest control programs currently being developed. It is believed that botanical pesticides will minimize the undesirable side effects of synthetic pesticides and help preserve the environment for future generations.

Chemical Pesticides: Mode of Action and Toxicology

Author: Jørgen Stenersen

Publisher: CRC

ISBN-10: 0748409106

ISBN-13: 978-0748409105

This provides answers to questions such as why pesticides are toxic to the target organism and why pesticides are toxic to some organisms and not others. It describes how various poisons interfere with biochemical processes in organisms. The book also explores how resistance to pesticides develops, how resistance can be used to illustrate the theory of evolution, and how it can be used to produce herbicide-resistant crop plants.

CONFERENCES

Pesticides in the Diets of Infants and Children

Author: Committee on Pesticides in the Diets of Infants and Children, National Research Council

Publisher: National Academy Press

ISBN-10: 0-309-04875-3

ISBN-13: 978-0-309-04875-0

The book summarizes the status of pesticide use, data collection and toxicity testing methods, and federal pesticide regulation. It details the special characteristics of children and analyzes toxicity information based on their exposure to pesticides in the diet.

4th Pan Pacific Conference on Pesticide Science

June 1-5, 2008

Waikiki Beach Marriott in Honolulu, Hawaii.

Website : http://acswebcontent.acs.org/meetings/panpacific2008/index.html

4th Pan Pacific Conference on Pesticide Science is sponsored by the ACS Agrochemical Division and the Pesticide Science Society of Japan. The focus of this conference is research directed toward identification and resolution of issues related to discovery, selection, evaluation and use of pesticides intended for crop, public health and environmental protection. The conference is set up to foster interactions between scientists involved in pesticides in the Pan Pacific Region.

International Conference of South Asean Congress of Forensic Medicine, Forensic Science and Toxicology

October 10-12, 2008

MINI PROFILE OF MALATHION

Noida, Uttar Pradesh, India.

Website: http://amity.edu/aibhas/safcon/

Deadline for abstracts/proposals: 30 June 2008

Contact name: Professor Dr. V.Veeraraghavan

Organized by: Amity Institute of Behavioural Health and Allied Sciences, Amity University,UP and All India Institute of Medical Sciences, New Delhi.

The main aim of the conference is to bring together researchers, academicians, scientists and professionals from the fields of forensic science and share their views and works on one platform.

Synonyms: 1,2-di(ethoxycarbonyl) ethyl O,O-dimethyl phosphorodithioate, carbophos (dimethoxyphosphinothioyl) thio] butanedioic acid diethyl ester, carbofos, etiol, malathine, malathyl, malatol, mercaptothion, moscarda, organoderm

CASRN: 121-75-5

Molecular Formula: $C_{10}H_{19}O_6PS_2$

Molecular Weight: 330.36

Properties: Yellow to brown liquid with an odour of skunk, M.Pt: 156-157 ^{0}C @ 0.7 mm Hg, B.Pt: 2.9 ^{0}C, Corrosive to iron & some other metals, Solubilitie: 145 ppm in water @ 20 ^{0}C, Density/Specific Gravity: 1.23 @ 25 ^{0}C/4 ^{0}C, Vapor Pressure: 1.78X10-4 mm Hg @ 25 deg C.

Uses: Used to control insects in a wide range of crops, including cotton, pome, soft, and stone fruit, potatoes, rice and vegetables, major arthropod disease vectors in public health programs, ectoparasites of cattle, poultry, dogs, cats, human head and body lice, household insects, and for the protection of stored grain.

Environmental Quality Standard:

Permissible Exposure Limit: TWA (8 hr): 15 mg/cu m.

Threshold Limit Values: TWA (8 hr): 1 mg/cu m

Toxicity Data:

ORL-RAT, LD50: 2100 mg kg^{-1}

IPR-MUS, LD50: 985 mg kg^{-1}

Route	Symptoms	First Aid	Target Organ
Inh & Ing	Produce mucous membrane and upper airway irritation and bronchospasm. Nausea, vomiting, abdominal cramps, and diarrhea are mus-carinic effects. Anorexia, Fecal and urinary incontinence, and esophagitis have been also reported. CNS depression, agitation, confusion, delirium, coma, seizures.	Move patient to fresh air. Gastric lavage, Activated charcoal	GIT, Respiratory tract, CNS
Cont	Inducing mild cutaneous reaction.	Irrigate exposed eyes with copious amounts of water for at least 15 minutes. Remove contaminated clothing and jewellery; wash skin, hair and nails vigorously with repeated soap washings.	Eyes & Skin

ENVIS QUERY FOR

Name : ____________________

Designation : ____________________

Address : ____________________

Phone: __________ Fax: __________

E-mail: ____________________

Field of specialisation : ____________________

Type of organisation : ____________________

Views on your Newsletter : ____________________

____

____

____

Views on Scope of improvement : ____________________

____

____

____

Any additional comments : ____________________

____

____

I would like information on the following :

Subject	Keywords		
Health & Toxicology	______	______	______
Pollution	______	______	______
Toxic Chemicals	______	______	______
Environment	______	______	______
Others	______	______	______

Signature:

Please mail to the attention of Dr. (Mrs.) F.N. Jaffery, Scientist in charge, ENVIS Cenre,
Indian Institute of Toxicology Research
Post Box# 80, Mahatma Gandhi Marg, Lucknow- 226 001 India.
Phone : (0522) 2284 591, Fax : (0522) 2628227 Email: itrc@itrcenvis@nic.in
web : http//www.itrcenvis.nic.in

MAY WE
HELP YOU

To keep you abreast with the effects of chemicals on the environment and health, the ENVIS Centre of Industrial Toxicology Research Centre, deals with:

Maintenance of a toxicology information

database on chemicals

Information collection, collation and dissemination

Toxic chemical related query response service

Preparation of monograph on specified chemicals of current concern

Publishing Abstract of Current Literature in Toxicology

for further details do write to

Scientist in Charge

ENVIS CENTRE

INDIAN INSTITUTE OF TOXICOLOGY RESEARCH
(Formerly Industrial Toxicology Research Centre)

Post Box# 80, Mahatma Gandhi Marg, Lucknow-226 001, India
Phone : {0522} 2284591, Fax : {0522} 2628227
E-mail :itrc@itrcenvis.nic.in
web : http://www.itrcenvis.nic.in