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INSECTICIDES AS ENVIRONMENTAL CONTAMINANTS AND THEIR REMEDIATION

Popular Article

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ABSTRACT

The air we breathe is an essential ingredient for our wellbeing and a healthy life. Unfortunately polluted air is common throughout the world especially in developed countries from 1960s. The WHO states that one sixth of the world's population, approximately 1.1 billion people do not have access to safe water and the major man-made sources of ambient air and water pollution include insecticides (European Public Health Alliance (EPHA)).

Introduction

Insecticide contamination is caused by diffuse sources and point sources. Diffuse sources are mainly related to drift losses and run-off during application and drainage discharge from treated fields. Point sources are mainly related to the handling of pesticides during transport, storage, filling, cleaning, and management of liquid residues and disposal of empty packages. When a pesticide is applied directly to a target pest (plant or animal) the whole site is affected including crop plants, soil organisms and potentially humans and wildlife in the immediate area. In the case of agricultural use, once they are applied, insecticides and their metabolites can enter the plant, soil, air and water. This may carry by the Pesticide volatilization (diffusion of pesticides through the soil and atmosphere) and pesticide emission from the plant canopy or soil surface to the atmosphere usually depends on vapour pressure and the chemical vaporization and the air flow mass transports the chemicals. Pesticides carried by surface runoff from agricultural areas constitute a significant portion of the pesticide pollutants entering surface water bodies. Leaching of pesticides through soil is an environmental concern because of the possibility of their reaching deeper soil and/or the water table and contaminating groundwater.

Impacts on aquatic environment

Insecticides can reach surface water through runoff from treated plants and soil. According to U.S.Geological Survey (USGS) more than 90% of water and fish samples from all streams contain one or more often, several pesticides. There are two principal mechanisms:

Bioconcentration: this is the movement of a chemical from the surrounding medium into an organism. Some ppp are lipophilic, such as DDT, meaning that they are soluble in and accumulated in fatty tissues.

Biomagnification: this term describes the increasing concentration of a chemical within the food chain. The concentration of ppp is increasingly magnified in tissues and other organs. Very high concentrations can be observed in top predators, including man.

Effect on soil organisms and processes

Soil microorganisms play a key role in soil. They are essential for maintenance of soil structure, transformation and mineralization of organic matter,

making nutrients available for plants. A few studies show that some organochlorine pesticides suppress symbiotic nitrogen fixation resulting in lower crop yields. Pesticides Pentachlorphenol, DDT and Methyl parathion at levels found in farm soils interfered signalling from leguminous plant such as alfalfa, peas, and soybeans to symbiotic soil bacteria. This effect, loosely comparable to endocrine disruption effects of pesticides in human and animals, significantly disrupt N_2fixation. Earthworms were detrimentally affected by the pesticides (Chlorpyrifos and Azinphos methyl) on their biomass and cholinesterase activity**.**

Effect on Beneficial species and Non-target organisms

Effect of pesticides on beesare closely watched because of their pollination. In recent study conducted in Italian agricultural area, authors monitored species richness of wild bees, bumblebees and butterflies were sampled after pesticides application. They detected decline of wild bees after repeated application of insecticide fenitrothion. Lower bumblebee and butterfly species richness was found in the more intensively farmed basin with higher pesticide loads.

Insecticide applications, lead to reduction of chick survival and bird population. Time of pesticides application plays also important role in availability of food.

Remediation

The use of synthetic pesticides has become an indispensable tool in agriculture for the control of pests. Therefore, the search for remedies and techniques for decontamination and detoxification of a pesticide-contaminated environment has become an important part of the research. Both bioremediation (using microbes) and phytoremediation (using plants) offer the potential for low-cost, low maintenance, environment-friendly and renewable resources for in situ remediation of contaminated environments.

Currently, bioremediation seems to be one of the most environmentally safe and cost-effective methods. The bacterial species found to be most useful in bioremediation belong to the genera Flavobacterium, Azotobacter, Burkholderia and Pseudomonas. Both bacteria and fungi can degrade OP pesticides through hydrolytic cleavage,andpyrethroids (e.g. permethrin) through cleavage of the ester bonds. With the exception of dithio-carbamates,microbial degradation of all types of carbamate pesticides has also been demonstrated; for example, a rapid hydrolysisofcarbaryl has been reported due to presence of the enzyme carbaryl esterase in Pseudomonas sp. A few strains of Pseudomonas have also been genetically altered to confer ability to degrade chlorobenzenes that are commonly used in pesticide synthesis**.** The use of mechanical aids like ploughing, biological means such as the use of microfauna and macro-invertebrates to disturb the soil matrix can enhance bioremediation in situ The use cell free enzyme preparations to degrade organic pollutants is also gaining popularity, as it is not subject to many of the limitations that are associated with microbial growth under field conditions. One example is the use of aqueous fire-fighting foam containing OP-hydrolase to degrade a number of organo-phosphate (OP) compounds. Bioremediation could also benefit from advances in techniques such as micro-encapsulation for a slow or timed release of bioremediations to overcome problems encountered under field conditions, and to enhance the persistence of microbial or enzymatic preparations to achieve maximum benefits.

Prevention of exposure

It has to be taken at Local level, National level, International level. Use pesticides ONLY when the benefits outweigh the risks: Avoid cosmetic or scheduled use of pesticides in the home, Use integrated pest management (IPM), non-chemical pest controls.

If pesticides are necessary

Store in original containers with child-proof seals, out of reach, in a locked cabinet, Educate on the safe use of pesticides, Usage of protective equipment, Pregnant women should not apply pesticides, Use least hazardous chemicals and least dangerous mode of application and has to Support organic farming. Education campaigns has to be conducted aimed at pesticide users, general population and children, Restrict availability or limit use, Establish and monitor maximum residue limits, Surveillance and epidemiological vigilance for acute and chronic related illness.

Conclusion

Education, research, and advocacy, are lacking in the region as preventive strategy for pollution especially in Asia. At present the adoption of environmental auditing in any economic sector is voluntary but future legislation could well make it mandatory and still time available to use technology and information for environmental health decision. Policymakers in developing countries need to design programs, set standards, and take action to mitigate adverse health effects of air pollution. Healthy people mean human resources are the main object of any successful business or country.

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