

Pesticide Pollution

Definition

* Any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest.

or

* A pesticide is any substance or mixture of substances used to destroy, suppress or alter the life cycle of any pest.

Why Pesticides are a Problem?

- * Break-down very slowly in soil, air, water and living organisms, and persist in the environment for long periods of time.
- * Concentrate in the food chain, building up to high levels in the tissues of all living creatures.
- * Travel long distances in global air and water currents and concentrate in high latitude, low-temperature regions of the globe.
- * Linked with serious health effects in human and other species including reproductive and developmental illnesses, immune suppression, nervous system disorders, cancers and hormone disruption.

Types of pesticides

- Bactericides:
- These destroy, suppress or prevent the spread of bacteria. eg.chlorine containing chemicals.
- Baits:
- These are ready-prepared products which need to be mixed with a food to control a pest.
- eg. baits for cockroaches and ants.
- Fungicides:
- These control, destroy, render ineffective or regulate the effect of a fungus.
- Eg: Bordeaux mixture
- Herbicides:
- These destroy, suppress or prevent the spread of a weed or other unwanted vegetation.
- eg. glyphosate.

- Insecticides:
- These destroy, suppress, stupefy or inhibit the feeding of or prevent infestation or attack by an insect.
- eg. Dichlorodiphenyltrichloroethane, gammahexachlorocyclohexane.
- Lures:
- These are chemicals that attract a pest for the purpose of its destruction.
- Rodenticides:
- These are used for controlling rodents
- eg. zinc phosphide, warfarin
- Repellents:
- These repel rather than destroy a pest
- eg. camphor, clove oil

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Sources and Pathways of Pesticides

- Anthropogenic activities provide the primary source of chlorinated hydrocarbon input into the aquatic environments. Chlorinated hydrocarbon enter the aquatic environment mainly by deliberate application or accidentally, while poly chlorinated biphenyls entry into the aquatic environment is indirect and principally accidental.
- * Deliberate application – spraying of pesticides on agricultural crops, control of weeds, eradication of trash fish, etc.
- * Dumping of waste/containers from public health agriculture and industrial usage

- * Domestic and industrial effluents.
- * Accidental spillage from agricultural and industrial sites, road and rail vehicles and ships
- * Drainage and run – off from treated farm lands, garbage and industrial solid wastes dump
- * Dumping of sewage sludge, municipal and industrial solid wastes
- * Atmospheric input (dry deposition and precipitation) burning/incineration of domestic, municipal/industrial solid wastes; industrial emissions.

Half-lives of Pesticides

- It is the amount of time it takes for half the active ingredient to disappear.

Pesticide	Half Life
Carbofuran	150 days
2,4 D	7 to 50 days
Diazinon	20 to 180 days
Dichlorvos	2 to 4 days
Lindane	200 days
Malathion	1 day
Simazine	200 days
Endosulfan	4 to 50 days

The ecological impacts of pesticides

- * Death of the organism.
- * Cancers, tumours and lesions on fish and animals
- * Reproductive inhibition or failure
- * Suppression of immune system
- * Disruption of endocrine (hormonal) system
- * Cellular and DNA damage
- * Teratogenic effects (physical deformities such as hooked beaks on birds)
- * Poor fish health marked by low red to white blood cell ratio, excessive slime on fish scales and gills, etc.
- * Intergenerational effects (effects are not apparent until subsequent generations of the organism)
- * Other physiological effects such as egg shell thinning

Dichloro Diphenyl Trichloroethane(DDT)

- The most notorious organochlorine is the DDT promoted as a “cure all” insecticide in the 1940 DDT was widely used in agricultural production around the world for many years. It was also the chemical of choice for mosquito control. DDT was banned in many countries in the 1970’s in response to the public concern and mounting scientific evidence linking DDT with damage to wildlife. Since then agricultural uses of DDT have been outlawed worldwide. DDT has been shown to cause breeding failures in birds.
- Derivatives of DDT:
 - * DDE – Dichloro Diphenyl Ethane
 - * DDD – Diclorophenol Dichlorethane

- Drins
- These belong to a class of closely related, highly toxic organo chlorine pesticides. This group of insecticides include aldrin, dieldrin, endrin and heptachlor. These are used to control pests in vegetables, fruits, cereal grains and cotton. Endosulfan is applied to control pests on cashew plantations in India.
- Lindane (Hexachloro Cyclohexane - HCH)
- Lindane has been used to protect crop seeds from insects, for pest control in forests, on livestock and house hold pests for control of ticks and other pests and in homes to control ants and other household pests. It is also the active ingredient in many medicated shampoos and soaps to control head lice and scabies.

- **Bioaccumulation**
- Biodegradable substances are those which can be broken down by microbes into harmless compounds. Conservative pollutants are unable to be broken down and will build up in the soil or marine environment. Conservative pollutants include some pesticides, industrial chemicals such as PCBs and heavy metals such as tin, lead and mercury.

- Bioaccumulation
- Conservative pollutants can enter living organisms at any time and accumulate in their tissues. Such organisms are able to build up very high levels of such pollutants - eg oysters can concentrate DDT from 0.001 ppm in sea-water to 700ppm in their bodies. This is known as bioaccumulation.
- Bioaccumulation occurs within a trophic level.
- The rate at which pollutants are accumulated in the tissues of an organism may be influenced by the following:
 - * The concentration of pollution in the water
 - * The water temperature - if the metabolism of the organism increases, so too may its rate of uptake.
 - * The age and sex of the organism.

- **Biomagnification**
- Conservative pollutants are not metabolized (broken down inside an organism) and therefore when an organism containing a pollutant is eaten, the pollutants are simply passed on to the predator and accumulate in its tissues. By consuming many preys an organism may build up very high concentrations of the pollutant in its tissues.
- This process may continue up the foodchain, leaving the top predator with very high and sometimes lethal concentrations of the pollutant. Pollutants will enter organisms via different routes eg. through the mouth and digestive tract or across gill surfaces.
- Small aquatic organisms absorb most toxins directly from the water whereas carnivores at the top of the food chain - eg. birds and mammals - receive most of their pollutant uptake from their food.
- Biomagnification occurs across trophic levels.