

GOVT. POLYTECHNIC SHAHJHANPUR

SUBJECT – CHEMICAL TECHNOLOGY –II

BRANCH - CHEMICAL ENGG.

SEMESTER - 4TH

TOPIC – PESTICIDES AND INCECTICIDES

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Pesticides

- A pesticides is any substance or mixture of substance intended for preventing , destroying, repelling or mitigating any pest.
- **Pest:** any organism that damages crops, injures or irritates livestock or man or reduces the fertility of land.
- Pesticides derived from latin word pestis means plauge (unusually large number of insects or animals and causing damage) and cides means kill.

- Pesticides are chemical substances that are meant to kill pests. In general, a pesticide is a chemical or a biological agent such as a virus, bacterium, antimicrobial, or disinfectant that deters, incapacitates, kills, pests.
- This use of pesticides is so common that the term pesticide is often treated as synonymous with plant protection product. It is commonly used to eliminate or control a variety of agricultural pests that can damage crops and livestock and reduce farm productivity. The most commonly applied pesticides are insecticides to kill insects, herbicides to kill weeds, rodenticides to kill rodents, and fungicides to control fungi, mold, and mildew.
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A Brief History

- Pesticides are not recent inventions! Many ancient civilizations used pesticides to protect their crops from insects and pests. Ancient Sumerians used elemental [sulfur](#) to protect their crops from insects. Whereas, Medieval farmers experimented with chemicals using arsenic, lead on common crops.
- The Chinese used arsenic and mercury compounds to control body lice and other pests. While, the Greeks and Romans used oil, ash, sulfur, and other materials to protect themselves, their livestock, and their crops from various pests.
- Meanwhile, in the nineteenth century, researchers focused more on natural techniques involving compounds made with the roots of tropical vegetables and chrysanthemums. In 1939, Dichloro-Diphenyl-Trichloroethane (DDT) was discovered, which has become extremely effective and rapidly used as the insecticide in the world. However, twenty years later, due to biological effects and human safety, DDT has been banned in almost 86 countries.

Definition of Pesticides

The Food and Agriculture Organization (FAO) has defined pesticide as:

any substance or mixture of substances intended for preventing, destroying, or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals, causing harm during or otherwise interfering with the production, processing, storage, transport, or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances that may be administered to animals for the control of insects, arachnids, or other pests in or on their bodies.

Types of Pesticides

These are grouped according to the types of pests which they kill:

1- Grouped by Types of Pests They Kill

- Insecticides – insects
- Herbicides – plants
- Rodenticides – rodents (rats & mice)
- Bactericides – bacteria
- Fungicides – fungi
- Larvicides – larvae

- Based on how biodegradable they are:

Pesticides can also be considered as:

- **Biodegradable:**

The biodegradable kind is those which can be broken down by microbes and other living beings into harmless compounds.

- **Persistent:**

While the persistent ones are those which may take months or years to break down.

Another way to classify these is to consider those that are chemical forms or are derived from a common source or production method.

- **Chemically-related pesticides:**

- **Organophosphate:**

Most organophosphates are insecticides, they affect the nervous system by disrupting the enzyme that regulates a neurotransmitter.

- **Carbamate:**

Similar to the organophosphorus pesticides, the carbamate pesticides also affect the nervous system by disrupting an enzyme that regulates the neurotransmitter. However, the enzyme effects are usually reversible.

- **Organochlorine insecticides:**

They were commonly used earlier, but now many countries have been removed Organochlorine insecticides from their market due to their health and environmental effects and their persistence (e.g., DDT, chlordane, and toxaphene).

- **Pyrethroid:**

These are a synthetic version of pyrethrin, a naturally occurring pesticide, found in chrysanthemums(Flower). They were developed in such a way as to maximise their stability in the environment.

- **Biopesticides:**

The biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals.

Examples of pesticides

- Examples of pesticides are fungicides, herbicides, and insecticides. Examples of specific synthetic chemical pesticides are glyphosate, Acephate, Deet, Propoxur, Metaldehyde, Boric Acid, Diazinon, Dursban, DDT, Malathion, etc.

Benefits of Pesticides

- The major advantage of pesticides is that they can save farmers. By protecting crops from insects and other pests. However, below are some other primary benefits of it.
- Controlling pests and plant disease vectors.
- Controlling human/livestock disease vectors and nuisance organisms.
- Controlling organisms that harm other human activities and structures.

Effects of Pesticides

- The toxic chemicals in these are designed to deliberately released into the environment. Though each pesticide is meant to kill a certain pest, a very large percentage of pesticides reach a destination other than their target. Instead, they enter the air, water, sediments, and even end up in our food.
- Pesticides have been linked with human health hazards, from short-term impacts such as headaches and nausea to chronic impacts like cancer, reproductive harm.
- The use of these also decreases the general biodiversity in the soil. If there are no chemicals in the soil there is a higher soil quality, and this allows for higher water retention, which is necessary for plants to grow

Insecticides

- Substances which are used to kill insects are called insecticides. Insecticides have a wide application in the field of medicine, agriculture, and industry. They have the potential to alter ecosystem components majorly and are toxic to animals as well as humans. Some insecticides become concentrated as they spread in the food chain.

Classification of insecticide

- Based on chemical composition, it is classified as organic and inorganic.
- Based on the mode of entry in the insects, it is classified as contact poisons, fumigants poisons, stomach poisons, and systemic poisons.
- Based on the mode of action, it is classified as physical poisons, nerve poisons, respiratory poisons, protoplasmic poisons, general poisons, and chitin inhibitors.
- Based on toxicity, it is classified into four types:
 - Extremely toxic – Color: red, symbol: skull and poison, oral LD50: 1-50
 - Moderately toxic – Color: blue, symbol: danger, oral LD50: 501 – 5000
 - Highly toxic – Color: yellow, symbol: poison, oral LD50: 51 – 500
 - Less toxic – Color: green, symbol: caution, oral LD50: >5000
- Based on the stage of specificity, it is classified as ovicides, pupicides, larvicides and adulticides.

Types of insecticides

- There are three different types of insecticides. They are
- Systemic – This type of insecticide is introduced into the soil for it to get absorbed by the plant roots. Once the insecticide enters the roots, it moves to external areas such as leaves, fruits, twigs, and branches. It forms a layer on the plant surface area and acts as a poison to any insect that comes to chew the plant.
- Ingested – Some examples of ingested pesticides are rat and roach.
- Contact – These type of insecticides act like bullets that aim only at a particular target to kill insects by its application. Usually, household insect spray works like contact insecticides as it must directly hit the insect.

Classification of insecticides based on chemical nature

Based on the chemical nature, insecticides are classified into four groups:

- Organic insecticides
- Synthetic insecticides
- Inorganic insecticides
- Miscellaneous compounds

Disadvantages of insecticides

- Non-target organisms – Insecticides can kill more than intended organisms and are risky to humans. Also, when insecticides mix with water sources through leaching, drift, or runoff, they harm aquatic wildlife. When birds drink such contaminated water and eat affected insects, they die. Some examples of insecticides, like [DDT](#), were banned in the US as it affects the reproductive abilities of predatory birds.
- Resistance – Insects when repeatedly exposed to insecticides build up resistance until finally, they have little or no effect at all. The reproduction in insects is so quick that they produce a new generation every three to four weeks. Therefore, the resistance builds up rapidly.