

Pesticides Toxicity

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Definition:

- **Pesticides** are substances used to prevent, destroy, repel or mitigate any **pest** ranging from insects, animals and weeds to microorganisms such as fungi, molds, bacteria and viruses.
- Pesticides help to manage and prevent pests that spread disease, that damage crops, buildings, and other property, and that are a public nuisance.

- **Classification of pesticides according to use:**

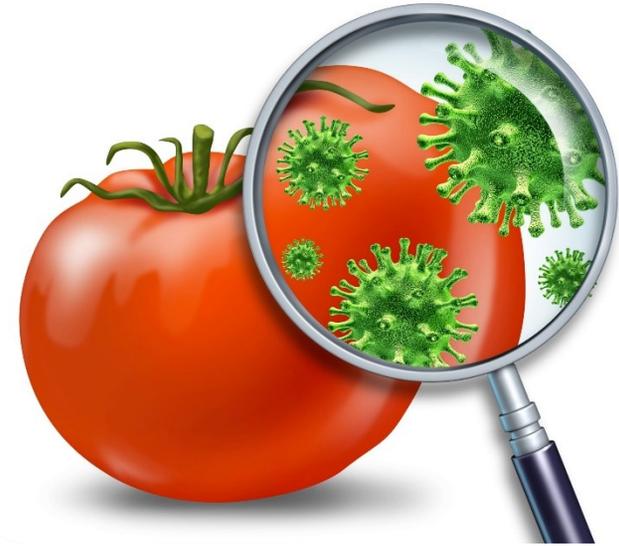
Target pest group	Type of pesticide
Plant	Herbicides (Bipyridyls , Chlorophenoxy)
Algae	Algicides (Oxyfluorfen)
Birds	Avicides (parathion)
Bacteria	Bactericides (Vancomycin..etc.)
Fungi and oomycetes	Fungicides (Thiocarbamates, Dithiocarbamates)
Insects	Insecticides (OPC, Carbamate..)
Mites	Miticides or acaricides (Permethrin)
Snails	Molluscicides (Metaldehyde)
Nematodes	Nematicides (Benomyl)
Rodents	Rodenticides (Warfarines, Indanodiones)
Viruses	Virucides (Acyclovire)

- **Classification of pesticides according to toxicity: according to FDA**

Toxicity Class	Toxicity Rating	Signal Word on Label	Example
I A	Extremely dangerous	DANGER- POISON	Parathion, Dieldrin
I B	Highly dangerous	WARNING	Eldrin, Dichlorvos
II	Moderately hazardous	CAUTION	DDT, Chlordane
III	Slightly hazardous	CAUTION	Malathion

❖ **BENEFITS of pesticides:**

1. Crop protection
2. Food preservation
3. Material preservation
4. Disease control

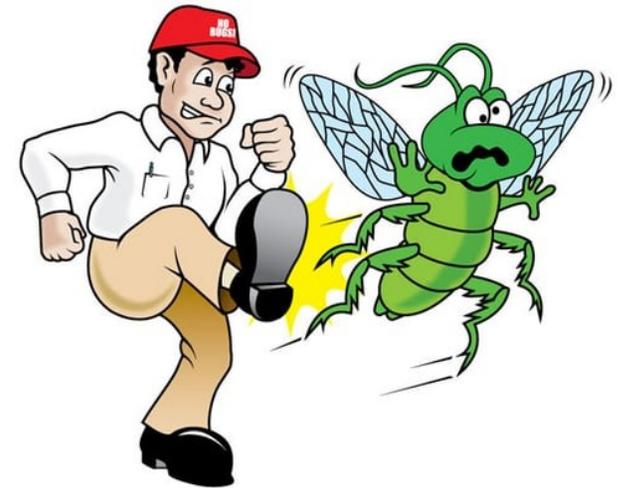


❖ **RISKS**

1. Toxic to humans
2. Impact on environment and ecosystems.

- **General modes of action of pesticides:**

1. Disturbance in energy production
2. Inhibition of photosynthesis
3. Free radical generation & SH-group reactivity
4. Interference with cell division
5. Inhibition of nucleic acid synthesis
6. Inhibition of enzymes: Ergosterol synthesis, Amino acid synthesis, Chitin synthesis, Cholinesterase.
7. behavior-modifying agents



Health effects and toxicity in humans

- exposure to pesticides can cause a variety of adverse health effects, ranging from simple irritation of the **skin** and **eyes** to more severe effects such as affecting the nervous system, reproductive problems, and also causing **autism**.
- most studies on **leukemia** showed positive associations with pesticide exposure.
- There is substantial evidence of associations between organophosphate insecticide exposures and neurobehavioral alterations.

Environmental effects:

- Pesticide use raises a number of environmental concerns. Over **98%** of sprayed insecticides and **95%** of herbicides reach a destination other than their target, including:

1. Non-target species.
2. Air.
3. Water.
4. Soil.



- Pesticide drift occurs when pesticides suspended in the air as particles are **carried by wind** to other areas, potentially contaminating them.
- Pesticides are one of the causes of **water pollution**, and some pesticides are persistent organic pollutants and contribute to **soil contamination**.



example



Insecticides: Carbamates:

- is an organic compound derived from carbamic acid (NH_2COOH). A carbamate group, carbamate ester (e.g., ethyl carbamate), and **carbamic acids are functional groups** that are inter-related structurally and often are interconverted chemically.
- They have lower dermal toxicities. Mostly absorbed via inhalation, ingestion.
- carbamates can be classified as category 4 (low hazard).



Mode of action:

- Carbamates are designed to inhibit the normal breakdown of Acetylcholine (ACh).
- ACh is neurotransmitter released in the junction between the two nerve cells (synapse) where it binds to its receptor on the target cell, inducing its activation and relaying the signal.
- Acetylcholinesterase (AChE) is an enzyme located in the intercellular space that is responsible for ACh degradation.
- OPs and CBs act by occupying and blocking the site where the neurotransmitter attaches to the ChE enzyme. This leads to the buildup of ACh and continuous stimulation of the receptors on the target cells.

Acetylcholine signaling at synapse



- Acetylcholine (ACh)
- U ACh Receptor
- ~ Signal transmission

ChE STOPS signaling process



- ACh
- U ACh Receptor
- ~ Signal transmission
- ★ ChE

OPs and CBs inhibit ChE



- ACh
- U ACh Receptor
- ~ Signal transmission
- ★ ChE
- ▲ OPs/CBs

Toxicity in Rats:

- The oral LD50 of carbamates is 300 to 2000 mg/kg.
- The oral administration of **300 mg/kg** of carbamates can cause following reversible signs:
 - various levels of immobility.
 - Muscle tremors.
 - prostration
 - salivation.
 - depression of spontaneous and provoked behavior.
 - paralysis with extension of hind quarters.
 - Respiratory distress.

- whereas those that occurred at the **2000 mg/kg** can be more severe and may caused rat death or cause euthanasia statue.

Management **Carbamate** poisoning:

Atropine:

The following features of cholinergic syndrome is an indication for atropine:

1. Poor air entry in to the lungs due to bronchorrhoea and bronchospasm.
2. Excessive sweating
3. Bradycardia
4. Hypotension
5. Miosis

Initial dose: 1.8 – 3 mg, 3-5 of 0.6 mg vials rapidly IV into a fast flowing IV drip depending on the condition.

After 5 min. check the five parameters and if there is no improvement double the dose.

Thank You

