CLASSIFICATION OF INSECTICIDES BASED ON CHEMICAL NATURE

WELCOME

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Classification of insecticides based on chemical nature

1. Inorganic insecticides
2. Organic insecticides
3. Synthetic organic insecticides
4. Miscellaneous compounds

1. Inorganic insecticides are from mineral origin

- **Arsenicals :**

  Ex: Lead arsenates : Widely used against beetle and insect having a biting & chewing type of mouth parts

  Calcium arsenate : It is a stomach poison, very effective against leaf eating insects

- **Fluorine compounds :**

Ex : Sodium fluoride : Used in baits against chewing insects & house hold pests

- **Other inorganic compounds:**

Ex : Sulphur: as a acaricidal and fungicidal action , available in dust & WP.

Zinc Phosphide : Used as rodenticide.

Organic insecticides/ compounds

Oils & Soaps (Kerosene, diesel, crude oil)	Insecticides of animal origin. Ex : Nereistoxin	Insecticides of plant origin.
➢ Used against household & orchard pests.	➢ Isolated from marine annelid. ➢ Nerve poison.	
➢ Used as a wetting agents, stabilizers & spreaders.	➢ Cartap hydrochloride (Padan) Effective against rice stem borer & DBM.	

2. Insecticides of plant origins

1. Pyrethrum
2. Nicotine
3. Rotenone
4. Neem products

1. Pyrethrum:

- ✓ Prepared from flowers of chrysanthemum.
- ✓ Contact in action with rapid knock down action.

2. Nicotine:

- ✓ Extracted from leaves of tobacco plant.
- ✓ contain 40% nicotine.
- ✓ contact, stomach, & fumigant in action.
- ✓ Used against sucking insects.

3. Rotenone: Extracted from roots of ***Derris elliptica.***

- ✓ Used against leaf eating insects & as a fish poison.

4. Neem products:

Ex : Neem oil, NSKE

3. Synthetic Organic insecticides/ compounds

a) Chlorinated Hydrocarbons (Organochlorine)

- These consist of Cl, H, C & Sometimes O2.
- They have a long residual stability.
- Both stomach & contact poison.

Important organochlorine insecticides

- DDT (Dichloro Diphenyl Trichloroethane)
- First synthesized by Othmer zeilder in 1874.
- Paul Muller found its insecticidal property in 1939.
- Nobel prize was awarded to Paul Muller in 1948.
- Stomach & Contact insecticides, Non phytotoxic except cucurbits.
- Long residual action, Oral LD50 for rat is 113-118mg/Kg.

BHC (Benzene Hexacholiride) 1,2,3,4,5,6-Hexachlorocyclohexane

- First prepared by Michael Faraday in 1825
- Van De Linden discovered four isomers in 1912
- Highly purified product containing 99% of gamma isomer of HCH (Hexa Chloro Cyclohehane) is know as **LINDANE** in honor of Van De Linden in 1949.
- Stomach & Contact insecticides.
- Lindane is more volatile than DDT & has fumigant action .
- Extensively used as a soil insecticides against termite, white grubs etc.

b) Cyclodine compounds

- ✓ It is a collective group of synthetic cyclic hydrocarbons.
- ✓ Act as neurotoxicants, Which disturb the balance of Sodium & Potassium ions within the neuron resulting tremors, Convulsions, Prostration & ultimately death of insects.
- ✓ Important insecticides : Chlordane, Heptachlor, Aldrin, Dieldrin, Endrin & Endosulfan.

Aldrin : Persistent & non systemic soil insecticides.

Formulation : 30%, Granule 5%, Dust5%. **LD50 :** 80-110mg/Kg

Endosulfan (Thiodan)

- ✓ Effective insecticide, acaricidal property & Toxic to fish.
- ✓ Non-systemic, Contact poison with fumigant action.
- ✓ Effective against borers & Sucking pests.
- ✓ LD50 : 80-110 mg/Kg

c) Organophosphates

- OP group of insecticides came to lime light during 2nd world war.
- Insecticidal action of OP compounds was discovered by Gerhard schrader in 1942 in Germany.
- TEPP (Tetra Ethyl Pyro Phosphate), Parathion & Schraden-1st Systemic insecticides.
- Most effective and low residual effect.

- **Important insecticides :**

Malathion, Methyl parathion, Diazion, Dichlorovas(DDVP),
Quinalphos, Chloropyriphos, Phosphamidon, Dimethoate,
Profenophos, Phorate etc.

Classification of OP insecticides

- **Phosphohalides & Cyanides :** Ex : Sarine, Tabum, Soman.
- **Phosphorothioates/ Phosphorodithioates** :

  Ex- Malathion, Phorate, Dimethoate, Disulfoton, Methyl Parathion.
- **Phosphates :** Ex : Dichlorovas, Phosphomidon, Monocrotophos.
- **Phosphorothiolates :** Ex : Profenophos, Methyl parathion.
- **Phosphorothionate :** Ex : Chloropyriphos, Quinalphos, Fenitrothion. Diazinon etc.
- **Phosphoroamidate :** Ex : Acephate, TEPP, Schradan.

- Among OP Dichlorovas shows a fumigant action.
- Chloropyriphos used against termite.
- Phorate widely used as Granular insecticides.
- Malathion- Safest insecticides.

Carbamate insecticides

- Carbamate insecticides are synthetic derivatives of Physostigmine commonly known as **Eserine.**
- it is a alkaloid extracted from the seeds of **Calabar bean.**
- They have systemic and contact action.

Carbamate insecticides are classified into

- Hetrocyclic carbamates : Ex- Isolan, Pyrolan.
- Napthyl carbamates : Ex- Carbaryl.
- Phenyl carbamates : Ex- Carbofuran.
- Oxime carbamates : Ex- Aldicarb, Methomyl.

- Widely used carbamate insecticide against borers- **Carbofuran.**
- Carbamate insecticide used against cockroach, flies, mosquitoes- **Propoxar.**
- Wide spectrum C. insecticide used against cotton pests- **Carbaryl.**
- Insecticide of Carbamate group which is highly toxic to mammals- **Aldicarb.**
- Carbamate insecticide which is used to control nematodes- **Carbofuran.**

SYNTHETIC PYRETHROIDES

- ✓ These are synthetic derivatives of natural pyrethrins.
- ✓ The main commercial source of pyrethrum is the mature flower of chrysanthemum .
- ✓ The high quality flowers contain up to 4 mg of pyrithrins.
- ✓ These are lipophilic compounds.
- ✓ Developed for the purpose of more stable in light & air and insecticidal activity.
- ✓ Synthetic pyrethroids have extremely high insecticidal activity at low doses & are bio-degradable in nature.
- ✓ Very less toxic to mammals.
- ✓ Pyrethroids are contact insecticides & less effective as stomach poison.

CHRONOLOGY SEQUENCE OF DEVELOPMENT OF SYNTHETIC PYRITHROIDS

Group	Year developed	Pyrethroids developed	Remarks
1st generation synthetic pyrethroids	1949	Allethrin	❖ Low toxic to mammals (rapidly broken down in body) ❖ Decompose quickly in sun light. ❖ Little risk in environment.
2nd generation synthetic pyrethroids	1960-1973	Resmethrin, Phenothrin, Bioallethrin.	❖ Not toxic to mammals. ❖ Decompose rapidly in sun light. ❖ Not suitable for agri. Purpose.
3rd generation synthetic pyrethroids	1975	Permethrin, Cypermethrin, Deltamethrin, Fenvalerate.	❖ Not highly toxic to mammals. ❖ Do not decompose in sun light. ❖ Powerful insecticidal activity.

LIMITATIONS OF SYNTETIC PYRETHROIDS

- ✓ These are not effective as soil insecticides.
- ✓ Causes resurgence of several insect(Whitefly & Aphids)
- ✓ Development of resistance in many insect pests.
- ✓ Poor acaricidal property.

4. MISCELLANIOUS COMPOUNDS

A. Neo-nicotinoids : They are synthetic analogues of nicotine developed by Bayer company.

Neo- nicotinoids are classified into:

Chloronicotinyl compounds:

Ex: Imidacloprid & Acetamiprid.

Imidacloprid :

- ✓ Inhibits nicotinic acetylcholine by binding with nicotine acetylcholine receptors.
- ✓ Used as a seed treatment, Soil & Foliar in application.
- ✓ Found effective against sucking pests (Aphid, plant hoppers etc.)
- ✓ Formulations : Imidacloprid 17.8%SL (Confidar), 70%WG (Admire), 70%WS (Gaucho).

Acetamiprid :

- ✓ Mode of action is same ass imidachloprid.
- ✓ Effective against sucking pests.
- ✓ Formulation: Acetamiprid 20 SP (Pride, Ennova).

B. **Thionicotinyl compounds :**

Ex: Thiomethoxam

- ✓ Broad spectrum insecticides effective against stem borer, jassids, whiteflies etc.
- ✓ Used as both seed treatment & foliar spray.
- ✓ Formulations: Thimethoxam 25%WG, 70%WS (Actara, Cruiser).

Phenyl pyrazoles:

Ex : Fipronil (Reagent)

- ✓ Broad spectrum insecticides, used as a both soil and foliar application.
- ✓ Formulation : Fipronil 5%SC and 0.3%GR.

Spinosyns : **Ex :** Spinosad.

- ✓ Isolated from actinomycetes bacteria, *Saccharopolyspora spinosa*.
- ✓ The formulation contained a mixture of two metabolites. Spinosyns A & D called Spinosad (Tracer).
- ✓ It has both fumigant & Stomach action.
- ✓ Highly effective against Lepidoptera, Diptera, Thysanoptera & Coleopteran pests.
- ✓ Low mammalian, avian & fish toxicity.
- ✓ Safer for use of beneficial insects.

Avermectins : Ex : Abamectin (Vertimec, Avid, Agrimec)

- ✓ Isolated from soil bacteria, *Streptomyces avermitilis.*
- ✓ Effective against sucking pests, Leaf minor and Lepidopteran pests.
- ✓ Avermectins having nematicidal, acaricidal, insecticidal activities.
- ✓ Emamectin benzoate (Proclaim) and Abamectin (Vertimec) are two major compounds in this groups.

Oxadiazine group :

Ex : Indoxacarb (Avunt, Avanut EC).

- ✓ It inhibits the flow of sodium ions into nerve cell leading to paralysis and death of insect.
- ✓ Enters into insect body wall through ingestion of treated foliage and through insect cuticle.
- ✓ Effective against lepidopteran pests (Helicoverpa armigera), DBM, etc.

The formulation available is 14.5 SC.

Thiourea derivatives :

Ex : Diafenthiuron 50 WP (Pegasus).

- ✓ Effective against sucking pests (White flies, Thrips, Aphids, Mites etc.)
- ✓ Safer to use on crops.
- ✓ Available in the market as Difenthiuron 50% WP as Pegasus.

GENERATION WISE INSECTICIDES

- **First generation** **:** Inorganic and Botanicals.
- **Second generation** **:** Synthetic organics.
- **Third generation** **:** Chemicals for reproductive control.

  Ex : Insect growth regulators viz; Moulting hormones, Juvenile hormones.
- **Fourth generation** **:** Synthetic pyrithroids.
- **Fifth generation** **:** Synthetic pyrithroids & Neo-nicotinoids.


THANK YOU
FOR WATCHING