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CHEMICAL CONTROL

Introduction → Methods by which the insects population are brought under control is called pest control or more specially insect control. Use of chemicals for checking pest damage on crops has been tried from very early times. Though attempts to control pests by pesticides. Insecticides have become an accepted control measures on agricultural pests. Thousand of insecticides and insecticide combinations are now available with wide spectra of effectivity on insects for the farmers.

Compared to physical control and biological control measures pesticides remain the most popular method this is due to immediate and spectacular results the chemicals bring out. Further work led to the discovery of many inorganic and organic pesticides. In number and effectiveness organic pesticides are much more than inorganic insecticides. Most of the insecticides are toxic to man also. Moreover the plants absorb and accumulate the chemicals in their tissues and they reach human body and exerts its toxic effects when consumed.

Classification of insecticides Many types of classification are possible on insecticides. They are based on:-

- (i) Mode of entry into the insect body
- (ii) Mode of Action
- (iii) Chemical nature

Mode of entry into the insect body :- This classification is not acceptable since many poisons get absorb by body surface and

through respiratory and alimentary systems. Move over the mode of entry of the chemical is more related to his physical state of the insecticide viz, as powder, solution aerosol etc. However the major groups of insecticides classified based on the mode of entry are Stomach poisons contact poison and fumigants.

(iii) Mode of action → classification based on mode of action is also not very scientific. This is because many of poisons have a very wide spectra of action affecting two or three systems together at a time. There are physical poisons protoplasmic, poisons leave poisons and respiratory poisons. Physical poisons act as factor in limiting one of physical factors of the insects environment. Examples are oils and tar oils which exerts an asphyxial effect mainly on aquatic insects protoplasmic poisons bring out alteration or disintegration of the macromolecular organization of cell protoplasm especially the proteins. Most of the inorganic insecticides like fluorides arsenates, borates are of this group.

(iv) Chemical nature → The most refined and acceptable classification of insecticides is the one based on their chemical nature. Insecticides are classified as inorganic and organic forms and the organic forms, and the organic insecticides are further grouped into as of plant origin and Synthetic compounds. Further classification of insecticides based on chemical nature. They are mainly

two types

- (a) Inorganic
- (b) Organic

(a) Inorganic insecticides :->

Inorganic insecticides are not used much in India as a pesticide. The advent of organic pesticides has replaced the use of this.

→ Inorganic insecticides include mainly compounds of arsenic, Copper and mercury.

→ Inorganic insecticide acts upon alimentary and respiratory system of the insects.

→ They are used as poison baits, stomach poison or as dusting compounds.

Few important Inorganic compounds, their dosages and types of insects controlled given below:—

<u>Insecticide</u>	<u>Dosages</u>	<u>Pest Controlled</u>
(i) Lead arsenate	1-1.5 kg for 100 gallons of water as spray	grass hoppers, locusts, Butterflies.
(ii) Calcium arsenate	0.5 kg to 1 kg for 100 gallon of water as spray	beetles, locusts
(iii) Mercuric chloride	as emulsion or spray	Maggot, Flea
(iv) Copper arsenite	Stomach poison	Slug, potato-beetles.

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(iv)

Rotenoids

Derris
Sp

as dust 0.1%

Caterpillars
aphids.

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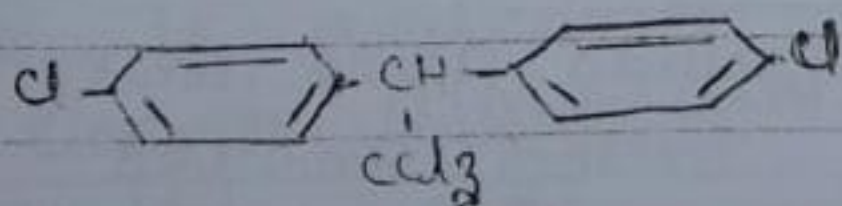
Synthetic pesticides \rightarrow A large number of organic pesticides are available which are synthesized in the laboratory. The toxicity of most of these chemicals is due to the reactive radicals contained in them. They are classified under different heads. Chlorinated hydrocarbon organophosphate, Carbamate and other groups.

More informations regarding some of the popular organic insecticides are given in the following.

(2)

D.DT - $C_{14}H_9Cl_5$ \rightarrow

Dichlorodiphenyl trichloro ethane or DDT was first synthesized in 1874 but its insecticidal value was discovered only in 1939. DDT is manufactured by reacting chloral with monochloro benzene in presence of concentrated sulphuric acid. pure DDT is a white crystalline compound, with B.P. $180.5^\circ C$. It is insoluble in water and fairly soluble in organic solvents. Its chemical structure is



DDT is widely used in the control of pests of crops and livestock. It acts on the sensory system of the insects, bringing out death very slowly. DDT is mainly used as dust or sometime as sprays.

A. (b) Organic insecticides

Organic insecticides are in wide use as pesticides to control insect population. In recent years the use of organic insecticides has increased in leaps and bounds and it has replaced the use of almost all inorganic insecticides. Today in India about 41 types of pesticides are in use in India.

As stated earlier organic pesticides are of two types: →

- (1) plant origin
- (2) Synthetically manufactured.

1 plant origin → Toxic chemicals from plants are extracted and applied as insecticide from very early days. Plants contain volatile oils and alkaloids which act as insect repellents or insect poisons. The important plant products, which are in use are nicotine, pyrethroids and rotenone.

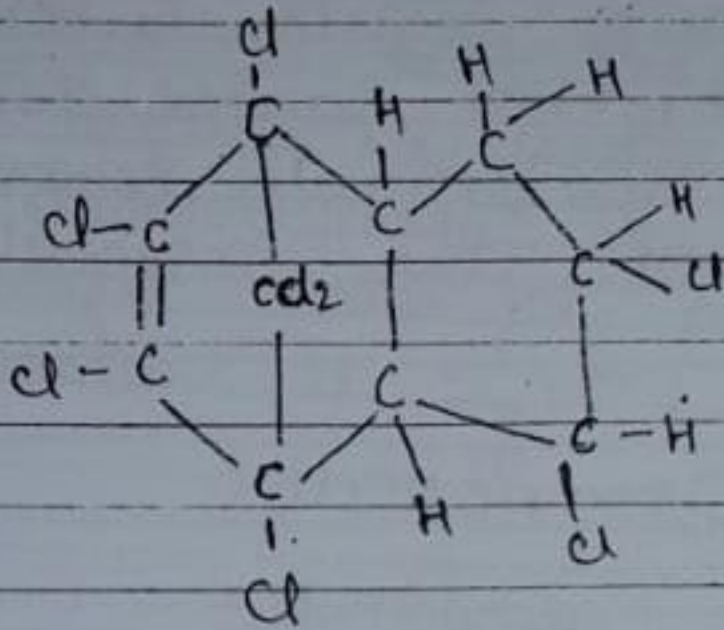
Few important pesticides of plant origin, their dosages and types of insects controlled given here:

Insecticide	origin	dosage	pest controlled
(1) Nicotines	nicotiana sp	40% nicotine water in ratio 1:500	cutworm thrips Aphids
(ii) Albasine	Anabasis Sp	As spray dissolved in water in the ratio 1:100 by weight	Aphids & termite
(iii) Pyrethroids	chrysanthemum	as spray in a ratio with water 1:400	scale insects weevils Beetles

disolved in work. Effective control of many house hold pests. like flies, ticks, mites and fleas is possible by use of this pesticide.

(N) Chlordane $C_{10}H_6Cl_8$:->

Chlordane and related pesticides contain 60 - 68% chlorine in their molecule. Chlordane is insoluble in water but soluble in organic solvents. It works as a contact and stomach poison. Chemically chlordane is octachlorotetrahydro-methyleneindane.



Chlordane is mainly used for control of soil insects, termites ants, grass hopper, flies, mosquito and cockroach. The insecticide is applied as dust emulsion or sprays. Dosage is 0.75 lbs to 1.5 lbs for 1 acre of crop field.

(V) Parathion $C_{10}H_{14}N_2O_5P_5$

parathion is a brown yellow liquid with a garlic odour. Parathion is a contact and stomach poison and sometimes used as fumigant. The chemical name is diethyl 1. Nitrophenyl Phosphorothionate.

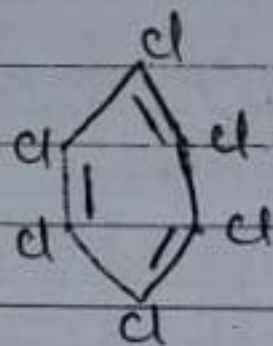
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The LD_{50} value of DDT to man is estimated to be 250 mg/kg, therefore is comparatively safe. Most of the insects develop resistance against this chemical easily.

<ii>

BHC $C_6H_6Cl_6$:->

The insecticidal property of BHC is due to the isomer. The commercial product is light brown powder with a persistent musty odour. The chemical name of the product is hexachlorocyclohexane.



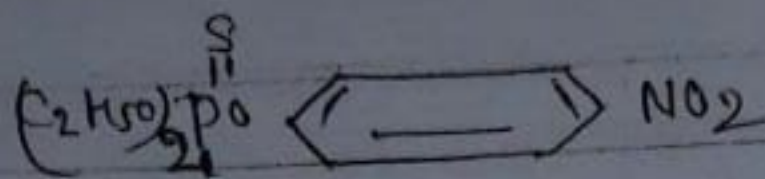
BHC is very effective in the control of many insects, but its use is restricted as it imparts a bad odour and hazard to food stuffs treated. Recommended dose to aphids and flies is 0.2 to 0.4 pounds per 100 gallons of water.

<iii>

Lindane $C_6H_6Cl_6$:->

The refined gamma isomer of hexachlorocyclohexane is called lindane. The compound is free of musty odour and can be applied more generously. It is a white crystalline substance with melting point $112^\circ C$. Lindane is used as spray on vegetable crops, livestock and household substances to eradicate pests. Concentration in spray mixture is 0.015% to 0.03%, lindane.

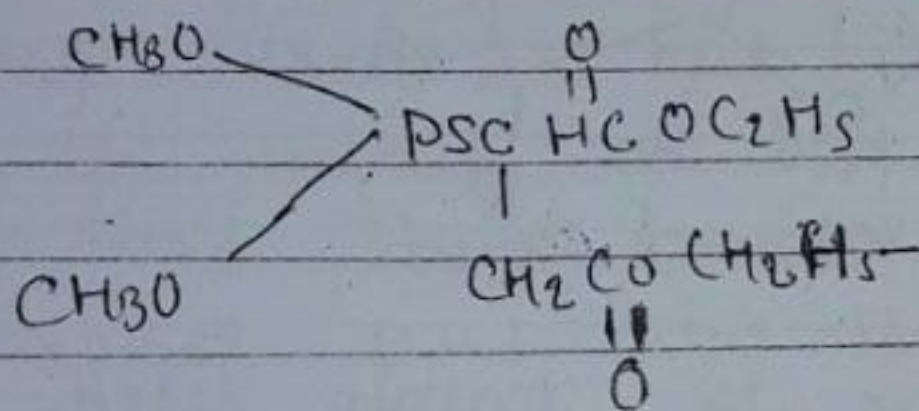
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Parathion is used for control of mites insects of field crops fruit crops and parts of green house. This works as a nerve poison on insects. As powder dust the dosage is 0.125 to 0.50 lbs per acre. of land. The same amount dissolved in 100 gallons of water is applied as spray.

(6) Malathion $C_{10}H_{19}O_6PS_2 \rightarrow$

Malathion is a popular insecticide. It is a dark brown liquid with garlic odour. It is slightly water soluble but freely soluble in organic solvent. Chemical structure of the insecticide is

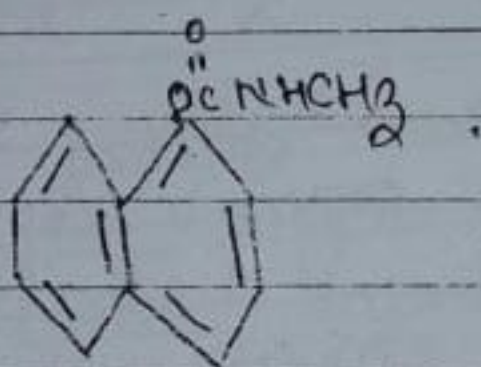


Malathion is comparatively a non-toxic organophosphorous compound. The insecticide does not accumulate much in plants. therefore, ~~low~~^{little} residue remains in plants. For reasons it is used more frequently than any other organophosphorous insecticides. It is recommended for a number of diverse pests of field crops, vegetable fruits livestock and stored products. It is contact and stomach poison of a wide

Recommended dosage is 0.25 lbs to 2 per acre of crop field and 0.30 lbs of 0.60 lbs @ dissolved in 100 gallons of water is the spray formulation.

2 Carbaryl \rightarrow

This is an ideal insecticide against many vegetable crops. The insecticide is white crystalline solid hardly soluble in water but fairly soluble in aliphatic and organic solvents. The chemical name is 1-naphthyl N-methyl carbamate.



Carbaryl has a wide spectrum of action is insects. It is used as a contact poison or stomach poison, with a long residual action. Carbaryl is used to eradicate pests of livestock and domestic animal. Applied as dust or emulsion. Pests contain 2.5% - 5% carbaryl is the recommended dosage.

Harmful effects of insecticides

\rightarrow The different types of insecticides described earlier are toxic to living organisms. They kill insects by effecting their life process like respiration, digestion, circulation, or Neural functions. The same effect man may experience if enough quantity of

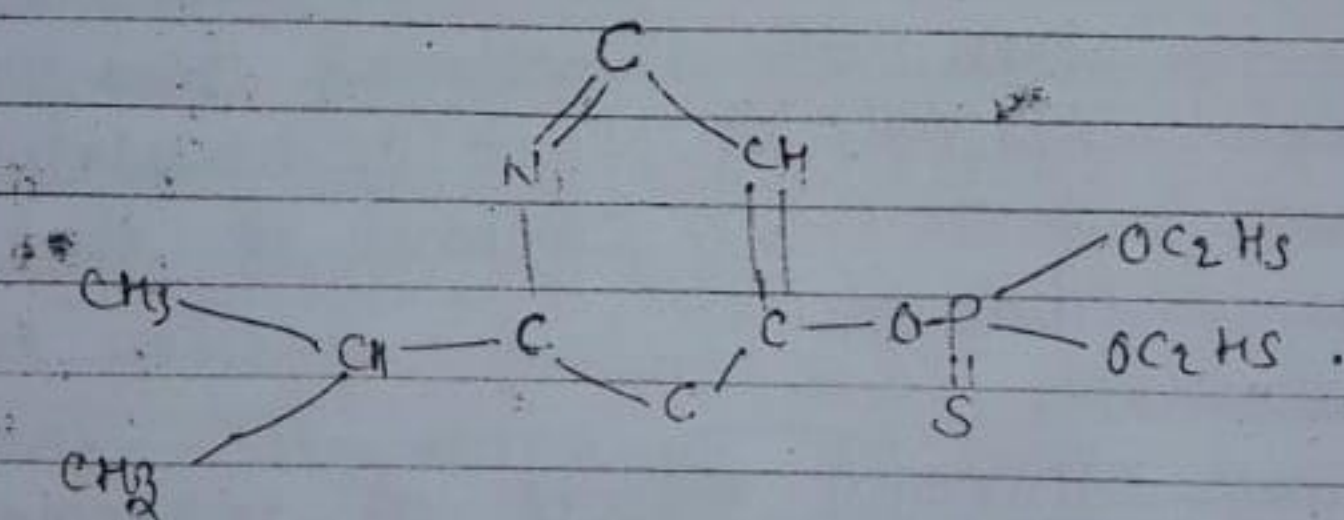
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Variety of pests like hoppers, aphids, Bugs, beetles, flea weevils, caterpillars, bugs scales and thrips. It is applied as dust or spray or in combination with other insecticides. Recommended dosages are 0.75 lb to 1.30 lbs per acre of land.

As spray 0.5 lb of malathion dissolved in 100 gallons of water is very effective.

Diazinon $C_{12}H_{21}N_2O_3PS$ →

Diazinon is a brown liquid slightly soluble in water but miscible in organic solvents. The chemical name is diethyl-2-isopropyl 1-methyl pyrimidinyl phosphorothionate. The insecticide act as a contact poison or a stomach poison. Sometime it is used as a fumigant.



Compared to malathion diazinon has residual effectiveness. It is applied as dusts emulsions wettable powders and as powder baits. The chemical is effective against cabbage root fly, maggots, soil termite, wireworms, aphids and field crickets. ~~Diazinon~~ Diazinon has some nematicide properties.

due to its persistence and accumulation
in animal fat. These chemicals are a
health hazard to man and wildlife

— End —