22.PESTICIDES FORMULATION

A) GRANULES

Granulated formulations are widely used for the control soil inhabiting pests and also for making plants poisonous to the sucking pests. They are more convenient to handle and leave a smaller residue on the plants.

Granules can be prepared by several methods

1. By impregnation of prepared granules or minerals like perlite or vermiculite with liquid pesticides or their solutions.
2. By granulating the powder formulation on a suitable diluent with subsequent screening.

The most widely used granular formulations are of 0.2 to 1 mm size. For the treatment of plants, granules of low strength are used. While for the control of weeds in water reservoirs, granules of high strength are used. Granulated formulations of pesticides with fertilizers are also being prepared on a limited scale since many of the pesticides degrade when mixed with fertilizers.

B) FUMIGANTS

Fumigants are substances sufficiently volatile to produce toxic concentration of vapour in closed space. Diffusion is faster with gases of lower molecular weights. Fumigant concentration is expressed in weight volume, eg. mg/l or 1bs/1000 c. ft. of fumigated space. Adsorption and leakage as well as setting and actual layering of the initially heavy vapour of most fumigants interfere with diffusion to such an extent that artificial means of stirring the gas mixture are usually employed.

Insect control of fumigation is practised in a number of fields like building fumigation, product fumigation crop fumigation and soil fumigation.

INSECTICIDE CLASSIFICATION – ORGANOCHLORINES – MODE OF ACTION – LINDANE, ENDOSULFAN – CHARACTERISTICS AND USE

LINDANE

Lindane is a contact, stomach and respiratory poison is lethal to chewing and sucking insects but not to spider mites. The vapour pressure and good water solubility (~10 ppm) make lindane an excellent soil insecticide.

The method of use permits effective control of economically important soil pests (eg. Beetle larvae, wireworms, white grubs, flea beetles, cutworms, fruit fly). The tainting property even of highly pure lindane prevents use on fruit and vegetable crops, but application in forest crops and cotton is wide. Under the name of lacutin it serves in veterinary medicine for control of ectoparasites such as ticks and mange mites.

Toxicicology. The acute mammalian toxicity of lindane is somewhat greater than that of DDT (LD_{50} rat 76-200 mg/kg). After administration, lindane is found in the milk, body fat and kidneys, but is excreted quickly. The danger of accumulation is very slight. In the technical product, hexachlorocyclohexane, the high chronic and cumulative toxicity of β-hexachlorocyclohexcane (present to about 5-14%) make the use of the technical product very undesirable.

Lindane has a similar insecticidal spectrum to DDT but its physical properties are more suitable than DDT for use as soil insecticides because of its greater volability and water solubility.

Mode of Action of Lindane

Lindane, like DDT, rapidly penetrates the insect cuticle and can exert a significant fungiant action in a dry atmosphere.

Uses

It is stable to heat and is useful as a soil dressing against soil insects. As sprays lindane is valuable against many sucking and chewing pests and as smokes for control of pests in grain stores.

The crude material has an impleasant musty odour and taste which tends to taint foodstuffs. This is due to the presence of other isomers because γ-HCH has no smell, but is more expensive.

The symptoms of insect poisoning superficially resemble those of DDT and γ-HCH is known to be a neurotoxicant. A concentration of 10 μm increase the frequency of spontaneous discharges in the cockroach nerve cord and extends the synaptic cleft after discharge. Lindane rapidly penetrates the cuticle of cockroaches and accumulates in the peripheral regions of the central nervous system quickly causing tremors, loss of bodily co-ordination, convulsions and prostration. Like DDT, lindane probably kills insects by bringing about sodium potassium imbalance in nerve membranes.

One of the initial products of metabolism of lindane in houseflies was the monodehydrochlorinated compound pentachlorocyclohexane, isolated from lindane – resistant houseflies and the resistance to γ-HCH observed in houseflies is due to this.

B) ENDOSULFAN

(6, 7, 8, 9, 10, 10-hexachloro-1, 5, 5a, 6, 9, 9a-hexahydro-6, 9, methano-2, 4, 3, benzodioxathiepin-3-oxide).

Other Names

Thiodan, Mallx, Cyclodan, Thimul, Thifur.

The insecticidal properties were first described by W. Finkenbrink. Since 1950 endosulfan has been on the market under the name Thiodan.

Synthesis

Thiodandiol (obtained by saponification of the Diels-Alder adduct from HCCP and Cisl-4-diacetoxybutene) is converted into technical Endosulfan by heating with thionyl chloride in xylene.

Technical material is a brownish solid (m.p. 70-100°C). It is a mixture of two isomers differing in the position of the sulfite group. α-endosulfan (70%) and β - endosulfan (30%). Both isomers yield the corresponding cyclic sulfate upon oxidation.

The α - endosulfan is slowly converted to more stable isomer at high temperature. Both the isoemers are slowly oxidized in air and biological systems by provides or permanganate to endosulfan sulfate. Endosulfan is slowly hydrolysed back to the thiodandiol by the action of aquous acid or base.

Endosulfan has a similar spectrum of insecticidal activity to aldrin, except that it is also acaricidal. Endosulfan, unlike most organochlorines is degraded in the environment and does not accumulate. It is the only organochlorine insecticide permitted in USA.