

Pesticides

Page No. _____

Date _____

Biopesticides & its degradation by M.O.s:

Certain type of pesticide derived from the biological material such as plants, Animals & M.O.s. e.g - canola oil has pesticidal action that's why canola oil is a biopesticide.

- There are 3 main categories of biopesticide

① Microbial biopesticide - in which the active ingredient is M.O.s. They are very site specific ^{for a particular} & they can control the diff type (kind) of pests.

e.g ① Bt (*Bacillus thuringiensis*)

② *Bacillus subtilis* - they are also used to control ~~for~~ plant pathogen.

② PIP's (Plant incorporated protectants): -

- genetic material is added to the plant so that plant ^{itself} produces pesticidal substances.

e.g - we can add gene for Bt pesticidal protein.

③ Biochemical: - are naturally occurring substances that ~~called~~ can control the pest by non-toxic ~~mechanisms~~ mechanism.

e.g - plant products like terpenoids & the insect pheromones.

Page No. _____
Date _____

Degradation of Pesticides → (by bacteria)

- Biodegradation is the degradation of materials by bacteria.
- It is environmental ecofriendly method.

• Pesticides → are grouped by target organism —

Insecticides, Herbicides, Fungicides, Rodenticides, Nematocides.

- Problems related to pesticides are — persistence, bioaccumulation and biological magnification.

It causes high risk of cancer in human being.

Also causes sterility, miscarriages, & High risk for Parkinson's disease.

• Degradation of Pesticides is the breaking down of toxic chemicals into nontoxic compounds.

• The most common type of degradation occurs through the activity of Microorganisms, especially fungi & bacteria.

• Microorganisms simply supply a medium and an energy source for rather simple chemical reactions to take place. They, in return, obtain food, essential elements & energy to carry on their life functions.

• Some pesticides like soil fumigant methyl bromide etc. are degraded by NO_2 . The degradation of CH_2Br_2 (methyl bromide) is a simple process involving

the liberation of methane gas leaving the bromine behind to be bound to soil particles or to become part of some new compound.

• Pesticides which are readily degraded in the environment are called non-persistent while those which are not degraded readily are called persistent.
e.g. - DDT, chlordane are persistent pesticides.

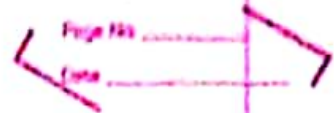
• A diverse group of bacteria like *Alcaligenes*, *Flavobacterium*, *Pseudomonas* and *Rhodococcus* metabolize pesticides.

• Pesticides are degraded in the environment by the action of indigenous MOs, called biodegradation, (substances are broken down to small inert end products.)

• Only MOs are not necessary for pesticide degradation also some environmental conditions are necessary like temp, pH, water potential and available nutrients.

• This process may be in situ & ex situ. -
Bacteria degrades the chemical substances in the pesticides. Degradation is time dependent. Non strong pesticides degraded quickly while persistent (strong) pesticides degrades after long time.

Degradation of Pesticides :-



any substance or mixture of substances destroying or preventing any pest called Pesticide.

- degradation of pesticides can occur in plants, animals and in the soil & water. the most common type of degradⁿ is carried out in the soil by Mos. specially fungi & bacteria that use pesticides as food source.
- The soil fumigant methyl bromide & the herbicide dalapon are e.g of pesticides which are degraded by Mos.

- Criteria for biodegradⁿ :-
 - (i) Organisms must have catabolic activity required for degradⁿ of pesticide
 - (ii) target contaminant must be bioavailability
 - (iii) soil condⁿ must be good for microbial/plant growth / enzymatic activity
 - (iv) cost must be less.

- Strategies for Biodegradⁿ :-
 - (i) Intrinsic bioremediation - natural bioremediation process by Mos. independent of any external inputs of nutrients or energy.
 - (ii) Biostimulation - addition of nutrients or growth factors to stimulate Mos in soil.
 - (iii) Bioventing - using gases like O₂ & methane are added into soil to stimulate microbial activity.
 - (iv) Bioaugmentation - introduction of Mos in contaminated site/soil for biodegradⁿ.
 - (v) Composting - pesticides are composted & treated with aerobic thermophilic Mos to degrade pesticide.
 - (vi) Phytoremediation - by planting plants directly that uptake heavy metals & directly by Mos in soil.
 - (vii) Bioremediation - detoxification of toxic compounds by microbes.
 - (viii) Mineralization - conversion of organic contaminant to inorganic by species of Mos.

→ Bacterial degradation: - Many bacterial species degrade pesticides. undergo partial degradation leading to the formation of a number of metabolites.

→ Series of biochemical steps occur during chemical biodegradation -

- (i) Detoxification
- (ii) Degradation
- (iii) conjugation
- (iv) Activation
- (v) Change in spectrum of toxicity
- (vi) Leaching

⊙ DDT - (Dichloro diphenyl Trichloro ethane)
It is a chlorinated pesticide. control numerous insect pests.

DDT present in soil can be degraded in few years. while others can take for it. 20 yrs.

degradⁿ steps → DDT → DDE → DDD ⊙

Pseudomonas, *Bacillus*, *Acetobacter*^{etc.} in soil can degrade DDT.