



A CRITICAL REVIEW ON ORGANOCHLORINE

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ABSTRACT

Organochlorine(OC) pesticides are synthetic pesticides widely used all over the world. They belong to the group of chlorinated hydrocarbon derivatives, which have vast application in the chemical industry and in agriculture. These compounds are known for their high toxicity, slow degradation and bioaccumulation. Even though many of the compounds which belong to OC were banned in developed countries, the use of these agents has been rising. This concerns particularly abuse of these chemical which is in practice across the continents. Though pesticides have been developed with the concept of target organism toxicity, often non target species are affected badly by their application. The purpose of this review is to list the major classes of pesticides, to understand organochlorine pesticides based on their activity and persistence, and also to understand their biochemical toxicity. In this article all information about the organochlorine is compiled as its type, their toxicity, mechanism of action, fatal dose, fatal period, management, PM appearances and its medicolegal importance.

KEYWORDS: Pesticides, DDT, Endrin, Organochlorine(OC) pesticides.

INTRODUCTION

Pesticides are a group of chemicals used for the destruction of insects, weeds, fungi, bacteria, etc. They are generally called insecticides, fungicides, bactericides, herbicides or rodenticides. Most of the pesticides have the ability to destroy a wide variety of pests or weeds, but some are developed against specific pests or pathogen. Most of these chemical are designed in such a way to disturb the physiological activities of the target organism, leading to dysfunction and reduced vitality. Pesticides residues may constitute a significant source of contamination of environmental factors such as air, water and soil. This phenomenon could become a continuous threat to the co-existence of plant and animal communities of the ecosystem. The greater use of pesticides for high agricultural production has led to increased pollution of environmental compartments- soil, water and air. The overuse or misuse of pesticides is contributing adversely to the environmental health as well as to ecosystem services. Pesticides are reported to affect many aquatic and terrestrial species. Life in aquatic ecosystem such as microorganism, invertebrates, plants and fish are badly affected by the "Green Revolution" was initiated and maximum agrochemical were used to achieve high agriculture production.

Classification of pesticides based on chemical nature are

1- Organochlorines- DDT, DDD, Eldrin, Dieldrin, etc.

2- Organophosphates- Dimefox, Mipafos, Methyl Parathion, Bidrin Etc.

ORGANOCHLORINES

Organochlorines(OC) are group of chlorinated compounds widely used as pesticides. These chemical belong to class of persistent organic pollutants(POPs) with high persistence in the environment. Organochlorines insecticides were earlier successfully used in control of malaria and typhus, yet they are banned in most of the advanced countries. Due to their low cost and the need against various pests, organochlorine insecticides such as DDT, aldrin and dieldrin are among the most widely used pesticides in developing countries. The basic characteristics of organochlorine pesticides are high persistence, low polarity, low aqueous solubility. Organochlorine pesticides can enter the environment after pesticides application, polluted wastes discarded into landfills and discharge from industrial units that synthesize these chemicals. They are volatile and stable; some can adhere to the soil and air, thus increasing the chances of high persistence in the environment, and are identified as agents of chronic exposure to animal and humans.

Organochlorines are nonselective insecticides(A selective insecticides attacks only a particular target insect. Non selective insecticides kill all insects it comes in contact with, including those that may be natural

enemies of the target insect). They are also dangerous to human beings and carry enormous environmental risk. Non selective insecticides must be used only when a total kill of a selected area is desired. They are cyclic in nature, have molecular weight between 300 and 550D, they are CNS stimulate, poorly soluble in water but readily soluble in organic solvents, lipids and fats.

The best known organochlorine, DDT was synthesized by the German chemist Othmar Zeidler in 1874, but he failed to realize its value as an insecticides. It was the Swiss Paul Hermann Muller(1899-1965) who recognized DDT's potential as an effective insecticides.

CLASSIFICATION

Based on their chemical structure, OCs can be divided into four categories:

- 1- Dichloro diphenyl trichloroethane (DDT) and related analogs, such as methoxychlor.
- 2- Benzen hexachloride or lindane
- 3- Cycloienes and related compounds (e.g. aldrin, dieldrin, endrin endosulfan, chlordane etc.)
- 4- Toxaphene and related compound.

TOXICOKINETICS

1- ABSORPTION

(A)General- Absorption by any route depends on (a) vehicles and (b) the physical state (solid or liquid) of the compound.

(B)- Ingestion and inhalation- All OCs are well absorbed by these routes.

(C)- Transdermal absorption- (a) variable. Factors which enhance dermal absorption are (a) Nature of the compound (b) anatomic site.

2- METABOLISM

OC are metabolized by the hepatic microsomal enzyme system by dechlorination, oxidation, with subsequent conjugation.

(A) OCs rapidly metabolized (a) Endrin (b) Lindane.

(B) OCs slowly metabolized (a) DDT **(b)** Dieldrin.

3-EXCRETION

- (1) Primary route of OC excretion is bile.
- (2) Excreted in maternal milk(because lipophilic)
- (3) Most OCs have significant enterohepatic or enteroenteric recirculation(eg chlordecone, mirex).

ACUTE POISONING

PRODROMAL SIGN OR SYMPTOMS

1. Agitation
2. Confusion
3. Dizziness
4. Headache
5. leg weakness
6. Nausea

CNS STIMULATION

(a)-Myoclonus (b)-Tremors (c)-Seizures(occur within 1-2 hours of ingestion on an empty stomach; 5-6 hours on a

full stomach). Its also occur on dermal application. (d) EEG abnormalities- occur before, during, and following seizures. (e)-Hyperthermia 4- pupils dilated 5- Respiratory failure and death.

FATAL DOSE

- 1- Aldrin, Dieldrin, Endrin- 2-6g.
- 2- DDT- 15-30g.

FATAL PERIOD- One to several hours.

MANAGEMENT

- 1- Should wear protective apron gloves because OC may be absorbed through skin.
- 2- Immediate resuscitative measures- ABCD of resuscitation.
- 3- Clothing, jewellery etc remove immediately.
- 4- Decontamination(wash skin, hair, nails, eyes, other exposed area with water)
- 5- On Ingestion- Emetics, Gastric Lavage, cathartics.
- 6- Specific antidote(none)

PM APPERANCE

- 1- Mouth and stomach contents- smell of kerosene.
- 2- Sign of asphyxia.
- 3- Liver- centrilobular hepatic necrosis.

SPECIFIC ORGANOCHLORINES

1- DDT

DDT is an organochlorine insecticide. Its is colorless, crystalline chemical compound, insoluble in alcohol and kerosene oil, is used as 2-5% solution in kerosene to kill bugs, mosquitoes, lice, flies and fleas. DDT was used in second half of world war to control malaria and typhus among civilians and troops. Muller was awarded the Nobel Prize in Physiology or Medicine "for his discover of the high efficiency of DDT as a contact poison against several arthropods" in 1948.

MECHANISM OF ACTION

It stimulates the CNS, and irritates GIT.

SIGNS AND SYMPTOMS

Poison may be absorbed through stomach, lungs or skin.

ACUTE POISONING Manifests as vomiting, cough, excitation, vertigo, tremor, convulsions, incoordination and paralysis of muscles, pulmonary oedema and coma.

IN CHRONIC POISONING- There is mental anxiety, insomnia, muscular weakness and pain, anaemia, convulsion, coma and death.

FATAL DOSE

About 30 gm

FATAL PERIOD

About 24 hours

TREATMENT

- 1-Gastric lavage
- 2-I.V calcium gluconate
- 3-Injection Atropine
- 4-Symptomatic

POSTMORTEM APPEARANCE

Suggestive of asphyxia
 Cyanosed face
 Stomach- blood stained contents with kerosene like or garlicky smell, congested mucosa and submucous petechial haemorrhage
 Pulmonary and cerebral oedema.

MEDICOLEGAL ASPECTS

Poisoning is commonly accidental.

2- ENDRIN(NEUROTOXIC CEREBRAL INEBRIANT POISON)

Is insoluble in water, but is soluble in alcohol and kerosene oil.

SIGNS AND SYMPTOMS

Nausea, vomiting, abdominal pain or discomfort, fine blood tinged oronasal froth, lethargy, tremors, convulsion, coma and death.

FATAL DOSE

About 6gms

FATAL PERIOD

½ TO 24 hrs

TREATMENT

Stomach wash, I.V. calcium gluconate, symptomatic.

POST MORTEM APPEARANCE

Suggestive of asphyxia
 Cyanosed face
 Stomach- blood stained contents with kerosene like or garlicky smell, congested mucosa and submucous petechial haemorrhage
 Pulmonary and cerebral oedema.

MEDICOLEGAL ASPECTS

Suicidal, homicidal, and accidental poisoning is common.

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