THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
June, 2023; 3(06), 1049-1053
Popular Article

Effect Of Pesticides in Aquatic Environment

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https://doi.org/10.5281/zenodo.8058543

Introduction

Pesticides are chemical compounds which are toxic in nature to destroy insects in aquatic environment. Pesticides are widely used in modern aquaculture to enhance the quantity and quality of yield in efficient manner. Organochlorines organophosphates, carbamates, pyrethroids and neonicotinoids are four major group of pesticides used. Pesticides tend to bio accumulate in food chain. Aquatic animal's aquatic sources are precious herbal belongings. Micro-organisms also contribute significantly to primary production, nutrient cycling and decomposition in estuarine eco system. Both structure and function of microbial communities may be impaired by pesticide toxicity. Herbicides are generally more toxic to phototrophic organisms Atrazine is most widely used herbicide.

- It can also use as fungicide, rodenticide, and insecticide.
- Annually 40%of the food produced worldwide is destroyed due to pests, therefore it is necessary to implement effective pest management using wide range of pesticide.
- Pesticides effectively increase the quality and quantity of yield in agriculture as well as aquaculture with less economic cost.
- After 1950's gradual increase in the manufacture and utilization of pesticides in agriculture and aquaculture
- Pesticides are basically classified into four major groups they are, Organochlorines, organophosphates, carbamates, and pyrethroids among all these pesticides **organochlorines** are the oldest group of pesticides
- Most of the pesticides are Broad spectrum insecticides for control of agriculture, aquaculture and domestic insects.
- These pesticides show long term persistence atmosphere.
- The mode of action of organochlorines is to disrupt the nervous system and paralysis of insects

- Most common examples for organochlorines are DDT(Dichlorodiphenyltrichloroethane), lindane Endosulfan, Aldrin, dieldrin.
- even DDT has banned in many developed countries still it is used in many developing countries
- In India it is used for malaria vector control
- Organochlorines are widely used till 1995'safter that increased use of organophosphates
- Organophosphates are also broad-spectrum pesticide which acts as stomach poison and contact poison
- Malathion, diazinon and glyphosate are similar to organophosphates
- Carbofuran, category, synthetic pesticides like pyrethroids, neonicotinoids are highly toxic to insects and fishes but less toxic to mammals and aquatic bird's
- Cypermethrin and permethrin are most widely used synthetics pyrethroid pesticide
- Pesticides can be carried to aquatic ecosystem through agriculture run off, spray drift, soil erosion etc.
- It is also seen that farmers do not fallow proper safety protocols during application of pesticides.
- Thus, safety use of pesticides is important with respect to health and protection environment and ecosystem the infant government has recommended maximum residual limit (MRL's)under food safety and standards.

Table 1: Permissible limits of major pesticides in drinking water

Pesticides	ISI Limit (µg/L)
DDT	**42**
Aldrin	**17**
Lindane	**56**
Organic phosphate	**100**
Carbamate	**100**
Heptachlor	**18**
Dieldrin	**17**

Aquatic toxicology

- Aquatic toxicology is the study of the effects of environmental contaminants on aquatic organisms, such as the effect of pesticides on the health of fish and other aquatic organisms.
- The pesticide's capacity to accelerate the harmful effect of fish and aquatic animals are large.
- toxicity always depend upon exposure time, dose rate, persistence time in the environment.
- Brief exposure to some chemicals may have little effect on fish, whereas longer exposure may cause harm Bio-concentration is the accumulation of pesticides.
- Soil are ecologically important for aquatic habitat, which plays a significant role in nutrients hooding capacity.
- Highly polluted sediments or accumulation of nutrients are adversely affecting the ecological functioning of rivers

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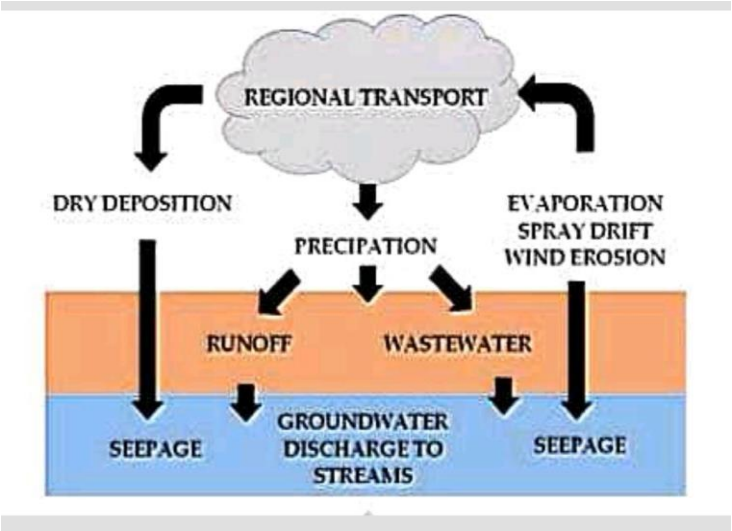
Published 20.06.2023

- Due to persistence in the environment and long-range transport. Repeated exposure to certain insecticides occurs frequently
- In decreased fish egg production and hatching, nest and brood abandonment, decrease resistance to disease.
- reduced body weight, hormonal modifications, and reduced avoidance of predators.

Effect on Aquatic Ecosystem

- Individual pesticides are harmful to the ecosystem, but combining effect together results in enhanced toxicity
- Knowledge about interaction of specific pesticides belonging to these group in aquatic organisms is lacking
- The extent of bioaccumulation of different pesticides in fish is influenced by the polarity and water solubility of the pesticides
- There is an inverse relation between water solubility of pesticide chemicals and bioaccumulation of that chemicals in fish.
- If the solubility of the pesticides in water increases extent of bioaccumulation decreases.
- Hence water solubility is an important parameter in decreasing the dynamics of pesticides in aquatic environment
- The rate of elimination of pesticide is to be species specific.
- The level of pesticides in given species is determined by rate of absorption and rate of elimination reaction.



- Many toxic effects associated with organophosphates, carbamate and organochlorines have been discovered by residue analysis program (RAP)

Effect On Micro Organism

- Microorganisms are important inhabitants of aquatic ecosystem system they play critical role in primary productivity, nutrient cycling, decomposition.
- Aquatic environment receives direct and indirect pesticides input exposing microorganisms and aquatic animals to pesticides.

Pesticidal effects on humans: Pesticides and their residues cause harm full effect on humans Pesticides can enter in to human body and food chain through direct contact, food and polluted air. Many symptoms like skin rashes, cramps, impaired vision.

Bioaccumulation of pesticides: Pesticides could accrue into aquatic animals via several means

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Published **20.06.2023**

directly from water through skin (or) gill, ingestion of polluted food (bio magnification). The effect of pesticide in fish result in behavioral change sluggish movement of fish and alteration of swimming ability makes more susceptible to predators

Immune system: Low concentration of pesticide disturbs the fish immune system, also work as impersonator of sex hormones function of immune system is modified by pesticides leading to immune depression

Geno toxicity: The Geno toxicity effect has become the key biomarker for assessing contamination related to damage.

Behavioral variation: Fish behavior is mostly affected by the uptake of contaminants; fish eat and accumulate various pollutants including pesticides. Imbalanced swimming, darting, and erratic movement etc.

Microbial Sensitivity to Pesticides

- It is not surprising that there is a considerable diversity in the sensitivity of micro-organisms to pesticides
- the majority of available pesticide data regarding aquatic micro-organisms is for algae**.**

Chlorinated hydrocarbons

- Various responses were observed among marine and freshwater algae to the effect of chlorinated hydrocarbons
- Aldrin, dieldrin, and endrin had no significant effect on respiration of green and blue green algae.
- At higher concentration lowered ATP levels but not population density

Endosulfan

- Endosulfan is a synthetic, chlorinated cyclodiene insecticide it is applied to grains, fruits, vegetables Etc.
- Endosulfan inhibit blue green algae Anabaena.

Atrazine:

- Atrazine is an s- triazine herbicide used to control broad leaf plants and greasy weeds.
- Inhibiting photosynthesis by blocking electron transport.

Legislation in India to tackle pesticide pollution:

- The government of India has taken significant measures to protect environmental resources
- The first law in 1972, wild life protection act, by national committee on environment planning and coordination.
- In 1974 water act (prevention and control of pollution) ,1986 Environment protection act
- Environment protection act 1986 encompassing legislation providing a single regulatory body for protection of environment.
- Directorate of plant protection, Quarantine and storage (DPPQS) have passed insecticide act in 1968, these regulate the import, registration process, manufacture, sale, transport distribution and use of pesticides.
- All pesticides are sold in India have to mandatory undergo approval process with central insecticide board and Regulation committee

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Conclusion

The popular article on the existing literature on pesticides pollution reveals that it is widespread in aquatic ecosystem in India. As aquatic organisms have a tendency to bio accumulate these pesticides along with food chain. It is necessary to have a strict implementation of existing policies and development of mitigation strategies in India.

References

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