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IMPACT OF PESTICIDE TOXICITY IN AQUATIC ORGANISM

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ABSTRACT

The use of fertilizers and pesticides indiscriminately is necessary for the accelerated agricultural crop production needed to cultivate high yield types. By protecting the crop from pests, these inputs enhance both the amount and quality of crops produced. Pesticide effusion in to the atmosphere through diffusion and drift, which can contaminant the aquatic environment. These pathways present significant health concerns to both humans and the aquatic ecosystem. All tiers of biological organization, including as primary producers, microbes, invertebrates, and fish, may be directly impacted by this exposure. In order to regulate the runoff events in the spraying process, monitoring techniques such as suspended matter samplers for particle-associated pesticides which can be utilized to reduce the amount of hazardous compounds in water bodies should be implemented.

KEYWORDS: aquatic ecosystem, pesticide, biological organization.

I. INTRODUCTION

Water is the most precious gift of nature. It can also be called the life line of life for survival on this earth. Pollution terms show that white the quantity of water has remained constant, the pollution has increased, leading to overexploitation of water resources, especially after industrialization. The impact on the environment due to human activities and disturbances to the water cycle has also increased. (Mc Michael 2009). Most of the water bodies located in and around human settlements have been polluted by industrial waste from various factories. All the chemicals in industrial water are toxic to all kind of aquatic life ranging from microscopic organism to large fishes. Aquatic animals are very valuable to humans as they provide food sources to meet the increasing demand for food. The widespread use of pesticides has

increased significantly over the past few decades. Surface water runoff carries pesticides residues into aquatic environments where they pose a threat to the plant and animals living there. As a human population increased, the toxicity of pesticides also increased. pesticides toxicity harms the aquatic food chain by reducing the amount of oxygen available in water bodies and contaminating the water. Contaminated water harms algae, microbes, plankton and benthos which in turn harm water quality and fish diversity.

One of the most prominent pollutants Is pesticides which contaminate water resources and cause huge harm to aquatic life. Pesticides can be defined as mixture of substances which may be of chemical and biological origin that are used by human beings to reduce or repel pests such as a bacteria, insect, mice, birds, insects and other organism.

They usually attempt to inactivate a pest by disrupting some component of the pest life process, which affect food production and interfere with human welfare.

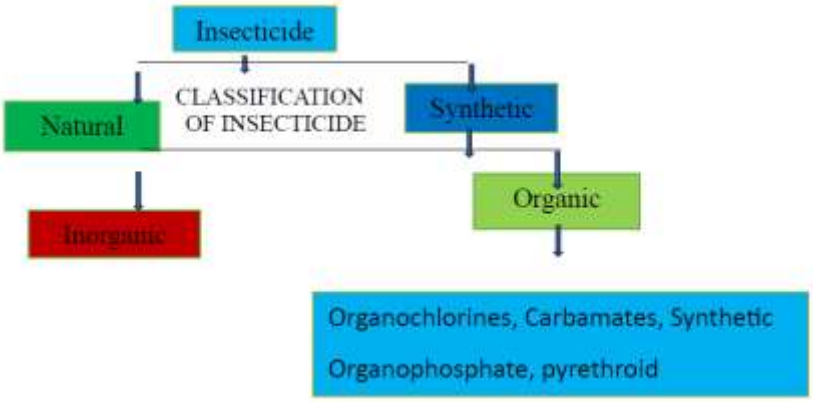
II. TYPES OF PESTICIDE

Insecticides

An insecticide is a type of pesticide used to combat insects, with ovicides targeting eggs and larvicides aimed at larvae. They find applications in agriculture, medicine, industry, and households, playing a pivotal role in enhancing agricultural productivity during the 20th century. However, most insecticides possess the potential to significantly disrupt ecosystems; many are harmful to humans and can accumulate within the food chain.

Insecticides applied to crops and urban areas do not degrade immediately but break down over time. Some, like organochlorines, persist in the environment for years, which though beneficial for sustained efficacy, also means they can persistently impact aquatic organisms if they enter water sources. Rainfall and irrigation can transport pesticides from application sites to various water bodies, where they may bioaccumulate in invertebrates and fish. This accumulation can lead to their transfer up the food chain to birds, mammals, and potentially humans.

Balancing the benefits of insecticides in pest control with their environmental and health impacts requires careful regulation and management to minimize adverse effects on ecosystems and human health.



Herbicide

The impact of herbicides on plants varies from minimal to severe, leading to plant death, a spectrum known as "selectivity". Some herbicides are termed "non-selective" because they can harm most types of plants at recommended weed control dosages. However, herbicides target processes specific to plants, not mammals or insects, which explains their relatively low toxicity to mammals.

The persistence of herbicides can be seen as either beneficial or harmful. Extended presence in the soil diminishes their environmental appeal over time.

Different herbicides exhibit varying abilities to enter water sources. Some are sufficiently water- soluble to dissolve with rainfall or irrigation, and their movement depends on soil conditions and erosion when applied to bare soil surfaces. The extent of leaching or movement depends on various physical and chemical properties of both the soil and the herbicide.

Fungicide

Fungicides are substances, either chemical compounds or biological organisms, designed to control or eradicate fungi and fungal spores. These agents are crucial in agriculture to mitigate the severe damage that fungi can inflict, leading to significant losses in crop quality and yield. Beyond agriculture, fungicides are also employed to treat fungal infections in animals.

Interestingly, fungicides are not solely effective against true fungi; they are also used against oomycetes, despite the biological distinction between the two. Oomycetes utilize mechanisms similar to fungi for infecting plants, which justifies their classification under fungicides.

There are several types of fungicides based on their mode of action: contact, translaminar, and systemic. Contact fungicides remain on the plant's surface where they are applied, providing protection locally. Translaminar fungicides redistribute within the leaf, offering protection to both the upper and lower surfaces. Systemic fungicides, on the other hand, are absorbed by the plant and moved through its vascular system (xylem), protecting new growth as it emerges.

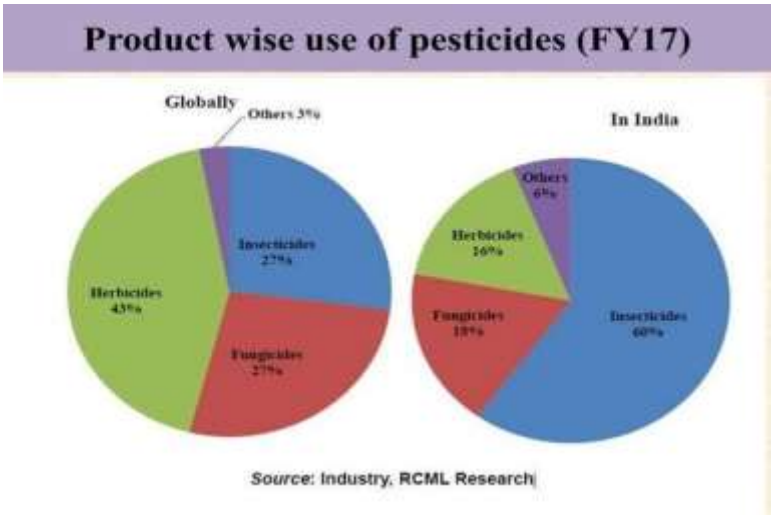
Fungicides are predominantly available in liquid formulations for commercial use. The active ingredients in these formulations vary widely, with sulfur being one of the most common, typically found in concentrations ranging from 0.08% to 0.5%.

In contrast, powdered fungicides may contain higher concentrations of sulfur, up to 90%, making them potent but also more toxic.

Other active ingredients found in fungicides include natural substances like neem oil, rosemary oil, jojoba oil, and even the bacterium Bacillus subtilis. These alternatives are gaining popularity due to their lower environmental impact compared to synthetic chemicals.

Some fungicides pose risks to human health, such as vinclozolin, which has been discontinued. Fungicides target a broader range of pests compared to insecticides, making them significant for water quality preservation due to widespread use in agriculture and by homeowners. The improper application, storage, and disposal of fungicides can lead to water pollution. Additionally, drift, leaching, and runoff from legally and properly treated areas contribute to pollution risks.

Awareness of the water pollution potential of fungicides allows for planning their use to minimize environmental impact. Fungicides employ various mechanisms, and the rapid development of resistance in target organisms has prompted diverse chemical approaches. Persistence in some fungicides can benefit users but poses risks as they may persist in the environment, potentially entering soil and water. It's noteworthy that the active ingredients of fungicides may not be as toxic or environmentally hazardous as some inert ingredients in their formulations.



PESTICIDE EFFECT ON AQUATIC ORGANISM

Aquatic pollution is a significant global concern due to various human activities releasing diverse pollutants into aquatic ecosystems, causing detrimental effects on the environment and organisms. Pesticides are potent chemical pollutants introduced into the environment through both natural processes and human activities. These chemicals adversely affect aquatic organisms' growth, physiology, reproduction, immunity, and biochemical profiles, leading to severe histopathological changes in their tissues. Pesticide contamination in water bodies can alter habitats critical for aquatic organisms. For instance, pesticides can diminish water oxygen levels by eliminating algae and other aquatic plants that produce oxygen via photosynthesis. This can result in hypoxic conditions harmful to aquatic life. The impact of pesticides on aquatic organisms underscores the importance of carefully managing pesticide application to mitigate water quality degradation and safeguard aquatic ecosystems. Strategies such as establishing buffer zones, adopting integrated pest management practices, and exploring alternative pest control methods are crucial for minimizing pesticide runoff and preserving aquatic environments.

EFFECT OF FISH: Fish are aquatic vertebrates known for their streamlined bodies, fins, and gills, thriving in diverse environments from freshwater to saltwater. They play vital roles as predators, prey, and contributors to ecosystem health. However, fish are highly vulnerable to water pollution, including insecticides, which can significantly disrupt their physiological and biochemical processes. Pesticides are commonly used in agriculture to control pests and weeds, but they also affect non-target organisms like fish, leading to metabolic disorders and increased mortality rates. Over the past two centuries, concerns have grown about pollution impacting fish health, particularly diseases affecting skin cells and

microbial infections in heavily polluted areas. Scientists are particularly worried about the potential link between pollutants such as chemicals, hydrocarbons, insecticides, heavy metals, and certain cancers like liver tumors in fish living in polluted coastal and estuarine waters.

EFFECT OF PESTICIDES

Pesticide can have significant effect on aquatic vertebrate, including fish, amphibians, reptiles and members of fresh water and marine water ecosystem. These effects may be direct or indirect, depending on factor such as the chemical properties of the pesticide, the Exlo-concentration period, and the sensitivity of the species involved. These effects may be direct. The effects of pesticides on aquatic vertebrates highlight the importance of implementing proper pesticide management practices to minimize environmental contamination and protect aquatic ecosystems. Integrated approaches, such as reducing pesticide use, implementing buffer zones, and promoting the use of less toxic alternatives, can help mitigate these impacts while ensuring the sustainability of agricultural practices.

EFFECT OF INVERTIBRATE

Aquatic invertebrates are essential components of freshwater ecosystems, encompassing a diverse array of organisms like insects, crustaceans, mollusks, and worms. They play crucial roles in ecosystem processes such as nutrient cycling and organic matter decomposition. These invertebrates serve as vital food sources for fish and other organisms, influencing the structure and function of aquatic ecosystems.

The use of pesticides in agricultural and urban settings poses significant risks to aquatic invertebrates. Pesticides, designed to target pests ranging from insects to plants, can affect non- target organisms directly through toxicity or indirectly through impacts on prey species and habitats. Factors like overspray, drift, and runoff can transport pesticides far from their application sites, potentially affecting distant aquatic environments.

The health of aquatic ecosystems is paramount for various economic and community benefits, including drinking water sources, storm buffering through wetlands, recreational fishing industries, and more. Invertebrates act as keystone species in rivers and streams, making them particularly vulnerable to environmental stressors like habitat degradation, fluctuating temperatures, and the impacts of pesticide exposure.

Understanding and mitigating the effects of pesticides on aquatic invertebrates is crucial for preserving the health and sustainability of freshwater ecosystems.

EFFECT OF MICROORGANISM

Aquatic microorganisms are microscopic organisms that inhabit freshwater, marine, and brackish water environments. Micro-organism are important inhabitants of aquatic ecosystems where they play vital roles in preference, productivity, food cycle and decomposition. Direct and indirect entry of pesticide into the aquatic environment occurs due to which micro-organism come in contact with pesticide. While pesticide produce a variety of acute and long-term toxic effects in microorganism also have the ability to accumulate, detoxify or metabolize pesticide to some extent. Harmful effects of pesticide on microbial species may have subsequent effect at higher and lower tropic levels. For example, changes in the macromolecular composition of phytoplankton species or changes in community structure may affect the growth rates of zooplankton as a result of the influence of grazing animals. The effect of pesticides on aquatic microorganism can be diverse and multifaceted, depending on various factors such as the type of pesticide, its concentration, exposure duration, and the sensitivity of the microorganism involved. Algae, protozoa, fungi, viruses and microscopic animals are some examples of the diverse range of microorganism that inhabit aquatic environments.

III. LEGISLATION FOR AQUATIC PESTICIDE TOXICITY IN INDIA

In India, many laws have been made with the aim to give priority to aquatic pollution. The Indian government has taken significant steps to protect the environmental resource. The water (prevention and control of pollution) Act 1974 water Act was passed by Indian parliament. An important provision of the water Act 1974 is to maintain and restore the full extent of our aquatic resources. The Water (Prevention and Control of Pollution) Cess Act was enacted in 1977, to provide for the levy and collection of a cess water consumed by persons operating and carrying on certain types of industrial activities. This cess is collected with a view to augment the resources of the Central Board and the State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974. The Act was last amended in 2003. The directorate of plant protection and storage under the ministry of agriculture and farmers welfare has passed the insecticides Act 1968 and insecticide rules 1971. These regulate the import, registration process, manufacture, sale, transport, distribution and use of insecticides (pesticides) with a view to

prevent risk to human beings or animals and for all connected matters, throughout India. All pesticides sold in india have to go through the approval process of the central insecticides board and registration committee. Thus all pesticides sold in india are listed in the schedule of the insecticides Act 1968. It is mandatory for the manufacture to clearly state the nature of the pesticides, its use composition, active ingredient, scheduled dosage, warning signs and safety precautions.

IV. CONCLUSION

Intensive agriculture crop production to grow high yielding variety requires indiscriminate use of pesticide and fertilizers which protect the crop from pests. Thus helping in improving the yield and quality of crops. The use of pesticide contaminates the environment which poses serious risks to the ecosystem as well as to human health. The use of pesticides contaminates the aquatic environment which poses a serious threat to the aquatic ecosystem as well as human health. This risk directly affects our level of biological organization including primary producer microbes invertebrate or fish. A review of the existing literature on pesticides pollution shows that it is widespread in freshwater ecosystem in india. These monitoring method should be ad0pted to control the sequence of events in the spraying process, for example suspended matter sampling for pesticides related to pesticide can be used to control the number of toxic substance in the water body. These pesticide tend to spread biologically along the food chain in aquatic organism. There is a strong reason and need for the development of an exciting policy and migration strategy in india.

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