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PESTICIDES USE IN AGRICULTURE : AN ISSUE THAT NEEDS TO BE ADDRESSED

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Introduction

Pesticides belong to a category of chemicals used worldwide to prevent or control pests, weeds, plant pathogen, and diseases to eliminate or reduce yield losses so that high rate of product quality maintained. The positive scenario of using pesticides is that it resulted in enhanced crop productivity and there are reports which suggests that there is massive reduction in diseases which has originate vector-borne origin. Chemical pesticides can be classified according to their chemical composition. This method allows the uniform and scientific grouping of pesticides to establish a correlation between structure, activity, toxicity and degradation mechanisms, among other characteristics. There are different types of pesticides which fall under different category (**Table 1**) and has different feature according to their source of parent compound and some properties are, i) Pesticides guards the crops against weeds, insects, pests and other fungi, ii) one other very important feature regarding pesticides is their persistence and it has been observed that some cheaper and older pesticides can persists in soil and water for years. These chemicals have been banned from agricultural use in developed countries, but many developing countries still using these pesticides and they posse's potential toxic threat to humans and can cause both chronic and acute health related issues which directly under the influence of exposure time in which a person exposed to these toxic pesticides. The main problem of using pesticides in agriculture is its toxic nature and long persistence in environment and these problems need to be fixed for sustainable use of pesticides in future.

Table 1. General classification of pesticides

Pesticides	Characterstics	Example
ORGANO CHLORINE AND ORGANO PHOSPHATES	Soluble in lipids, get accumulated in fat tissues of animals, and transmit via food chain; posses toxicity to a variety of animals.	Malathion, methyl, DDT, chlordane, aldrin, lindane, mirex, parathion.
CARBAMATES	Carbamate kind of acid derivatives that has limited spectrum toxicity to insects, but highly toxic to vertebrates.	Sevin, carbaryl
PYRETHROIDS	It directly effects nervous system but has less persistent as compared to other pesticides.	Pyrethrins
BIOLOGICAL	<i>Bacillus thuringiensis</i> (Bt) and its subspecies are commonly used against pests specially to butterflies and caterpillars.	Dispel and thuricide

Global impact and WHO response

The United Nations Population Division estimates that, by the year 2050, there will be 9.7 billion people on Earth – around 30% more people than in 2017. Nearly all of this population growth will occur in developing countries. FAO (Food and Agriculture Organization) of the United Nations estimates that, in developing countries, 80% of the necessary increases in food production so that they can keep the pace of food production rate with population growth rate and the same pressure will now be there lands to increase crop production. Pesticides can prevent large crop losses and will therefore continue to play a role in agriculture. WHO, has been working in collaboration with FAO, and these two organizations seems to be responsible for assessing potential risks threat to humans by pesticides – that involves both direct exposure to pesticides, and via pesticides residues that remained in food – and for recommending adequate protection. To address the issue of having pesticides residues in food a separate independent body has been developed that consist of experts from international scientific groups and called JPMR (Joint FAO/WHO Meeting on Pesticide Residues).

Effect of pesticides

There are number of pesticides which are harmful to the humans and responsible for many disease and some of them are listed below, although fate of pesticides are generally depends upon the process it will undergo (**Figure 1**) but some prominent pesticides are, i) **Paraquat, a pesticide linked to Parkinson's disease**, is banned in China and the European Union but not in U.S.A. It's highly toxic and kills weeds on contact. A 2009 UCLA study found that a person exposed to paraquat and two other pesticides is three times as likely to develop Parkinson's disease, ii) **A volatile and toxic pesticide called 1,3-D (1,3-Dichloropropene) is one of the most heavily used pesticides in California** also known as Telone, the chemical is actually a gas, or a fumigant in pesticide speaks and thus diffuse readily in environment and can cause cancer, iii) **Glyphosate, the active ingredient in Monsanto's roundup** Ontario, Canada, banned it for home use as a "cosmetic" pesticide (chemicals that keep your yard looking nice). Srilanka also banned the use of glyphosate as scientists suspect it may be the culprit in widespread kidney disease among agricultural workers in Sri Lanka, India and Central America, iv) **A popular herbicide called atrazine is the pesticide most commonly found in American drinking water and due to this** European Union banned this pesticides in 2004 but the EPA (Environmental Protection Agency) re-evaluated it and allow the further use of atrazine use in 2009.

Pesticide remediation strategies

Due to persistence nature of pesticides in an environment and their toxic nature is now becoming a major threat and to counter these effective clean-up of residual pesticides from polluted site is very important and to achieve that development of new and innovative technologies should be applied that guarantee pesticides elimination from a site in a very safe, economical and in an efficient manner. Ideally, use of these new technology must result into destruction of parent compound without being generating so much intermediates compounds. However some major measures that have been taken to remove pesticides are as follows;

1. Thermal desorption (at low temperature)

This is an *ex situ* clean up technology that has been frequently used to decontaminate polluted pesticides sites via thermal desorption. But to carry out thermal desorption we need highly specialized equipments facility which may not be cost efficient. In this process volatile

and semi-volatile compounds are taken from sites that includes residual pesticides and further involves heating of substrate at high temperature e.g. between 300 to 1000°F, which causes volatilization of compounds.

2. Incineration

Incineration is another very well proven and one of the most frequently used technology to remediate pesticide from contaminated sites. Unlike thermal desorption incineration caused complete destruction of pesticides contaminant from the sample. Samples such as soil, sediments or sludge which are rich in high organic contaminants have been efficiently removed by incinerator that involves high temperature e.g. between 1,600 to 2,200°F.

3. Phytoremediation

Phytoremediation is very cost-effective and aesthetically-pleasing process that is used to treat the pesticides contaminated (U.S. EPA, 1999, 2000). Phytoremediation involves the natural ecosystems, in which the intermediates generated during process are being metabolized by plants, and in this technology plants act as filters. Phytoremediation involves used to remove pesticides contaminant from water and soil (Raskin et al., 2000). Example- Ethion phytoremediation, it is a phosphorus pesticide which was studied with water plant hyacinth; *Eichhornia crassipes* (Huilong et al., 2006).

4. Biodegradation of pesticides

Bioinoculants also play a very important role in remediating pesticides. There are many bacterial strains that are being reported to remove pesticides contaminant but fungi seem to have a very potential to bioremediate pesticides contaminant. Isolation of potential fungi from a natural source is first step and which later screened for its biodegradation ability of pesticides. For example, wood attacking fungi e.g. *Phanerochaete* possess a potential extracellular enzyme (Peroxidase) that seems to act on the broad range of parent compounds that are very similar in nature as pesticides.

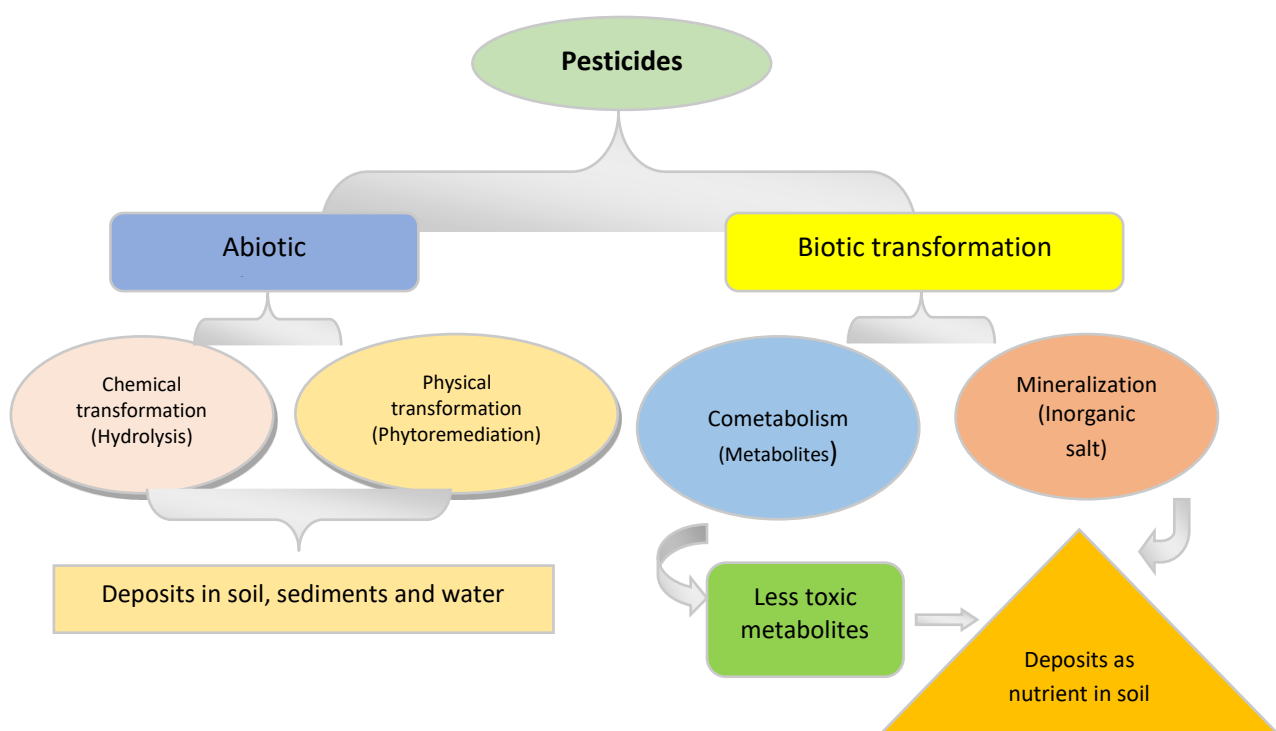


Figure 1. Fate of pesticides in an environment

Conclusion and future and prospects.

The role of pesticides in agriculture are unparalleled but these advantages came up with some serious issue like risk involved in human and environment health and these issue are needed to be check out in a serious manner.

In future planning several techniques are being used to remove residual pesticides contaminant and need some more modification so that pesticides are much more safer to use.

References

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