

Chapter 14

Cost-Effective Methods of Monitoring Pesticide Pollution in Water

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ABSTRACT

Environmental protection efforts require numerous advanced technologies to prevent and monitor the health and ecological effects associated with abiotic and biotic systems. Development of innovative tools and methodologies with the help of multidisciplinary approach to assess the transport, accumulation, and impact of pesticides will avoid the long-term effects in the environment. The lack of information about the pesticides hampers the labeling requirements that lead to misuse and discharge of pesticide-contaminated effluents into the water resources. This chapter covers the information on major sources of pesticides, chronic impacts, labeling of pesticides, multidisciplinary approach for monitoring, current cost-effective technologies, pros and cons of current technologies, and future perspectives of the pesticide monitoring technologies.

BACKGROUND INFORMATION

Pesticides are commonly known as inhibiting agents of pests and hostile plants that are harmful in agriculture practices. In recent past, the development of new technologies has given many target based pesticides that protect beneficiary crops and increases the production. Pesticides usages in highly populated countries like India have aided the food production to meet out the increasing demands. Pesticides also reduce the harmful diseases that occur in plants system throughout the growth phases

DOI: 10.4018/978-1-5225-6111-8.ch014

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and enhance the yield of production. However, enormous increase in pesticides usage have alarmed the environmental regulatory bodies to monitor the ecological and health impacts of pesticides in living system.(Samsidar *et al.*, 2018)

The fate of pesticides in ecosystem depends on the following factors such as chemical composition, reactivity, toxicity, mode of action, secondary metabolites and degradation capabilities. These factors decide the persistent level of pesticides in the environment that can cause many harmful impacts. Major sources of pesticides not only depend on agricultural runoff that also includes the sectors of health maintenance (vector borne diseases), building maintenance (to control insects), domestic managements and industries. Pesticides contaminated water runoff from major sources finally end up in water resources and wastewater treatment plants. Current treatment technologies to remove pesticides contamination in water resources require additional micro pollutant removal supports.(Rousis *et al.*, 2017)

World Health Organization says that there are three million poisoning cases occur every year in particular Organophosphorous (OP) category possess main role to cause severe health impacts. The OP pesticide's mode of action mainly depends on acetylcholine esterase (AChE) enzyme, which has a main role in central nervous system. OP pesticides inhibits AChE and causes death in insects in the same way if it get accumulated in human system that lead to several health issues and finally end up in disordering of nervous system.(Kanagasubbulakshmi *et al.*, 2017) According to current reports, the rigorous usage of pesticides automatically will laid platform to develop resistant in pests against pesticides. Therefore, findings of new composition for pesticidal effect again will end up in harmful effects to humans and to ecosystem as well. Moreover, the secondary metabolites can cause more harmful effects than the primary pesticides. A regulation to pesticide management is an essential tool to monitor and prevent lethal impacts on the society. United States Department of Agriculture (USDA) has amended the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) on 1972, which provides for federal regulation of pesticide distribution, sale, and use. In India, the Insecticides Act, 1968 and Insecticides Rules, 1971 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 insecticides (pesticides) have to undergo necessarily the registration process with the Central Insecticides Board & Registration Committee (CIB & RC) before they can be made available for use or sale.(Act *et al.*, 1968).

Pesticides monitoring, determination and detection methodologies have attracted many researches to develop field deployable monitoring systems to safe guard the environment. The conventional detection systems that include high-end analytical instruments have many pros and cons. Gas chromatography (GC) and liquid chromatography (LC) are considered as very laborious, time consuming, require skilled persons and not cost effective(Zhang *et al.*, 2017). Therefore, the detection and monitoring of pesticides still a fascinated field among the multi-disciplinary researchers. Several technologies were developed for the detection and monitoring for pesticides by using signature innovations in nano and multidisciplinary researches. Electrochemistry, fluorescent on – off technologies, immuno assays and lab on chip methods have many advantages than the traditional techniques as well as the disadvantages.(Wang *et al.*, 2017a)

Therefore, this book chapter covers the classification of pesticides, list of banned pesticides, need of detection, cost effective technologies in current scenario, mode of mechanism of the detection systems, pros and cons of existing technologies and research gap in the pesticide monitoring system.

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