Chapter 15
Occurrence of Pesticides and Their Removal From Aquatic Medium by Adsorption

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ABSTRACT

Large amounts of pesticides are used annually, and in some cases, a part of the pesticide enters the water bodies by surface runoff to form long-term residues. In the recent past, the adverse effects of pesticides on the environment and human health received serious attention by the public and the competent authorities. Various conventional methods are used to remove these pesticides from water, but those methods are either costly or typical in operation. Therefore, adsorption is considered as an ecofriendly method. The adsorbent derived from biomaterial is considered an encouraging adsorbent due to its cost-effective and high adsorption capacity. In this chapter, detailed information on different types of pesticides, their metabolites, environmental concerns, and present status on degradation methods using adsorbents will be reviewed. This chapter presents a comprehensive overview on the recent advancement in the utilization of different adsorbents for the removal of pesticides. Overall, this study assists researchers to move forward in exploring a simple and economically viable technique to produce adsorbents with outstanding physiochemical properties and excellent adsorption capacity, so that the pesticides can be removed from aquatic ecosystem.

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INTRODUCTION

Different types of pesticides have been extensively used by modern agriculture practices. The major pathways thought which pesticides reach into the environment are by application, disposal, runoff or a spill (Adachi et al., 2001). Environmental contamination due to the extreme use of pesticides has become a great opposing effect on human health and environment (Bakour et al., 2009). The unwarranted use of pesticides to control the crop destroying insects has gained momentum in last two to three decades. Due to their extensive usage, they easily contaminate different media i.e., air, soil and ground water. Their deposits may remain in soil which decreases the biodiversity in the soil and they may also pass into the ground waters by percolating through soil (Shukla et al., 2006). Many Organophosphate compounds are currently being used as pesticides are of concern due to their diligence, bioaccumulation as well as their toxicological effects on human health and the environment (Monirith et al., 2003). Pesticides are hazardous and toxic in nature and persist in the aquatic environment for many years. (Radan et al., 1999).

Pesticides are the substances that are used to kill, destroy or control pests which harm the agricultural produce. In the recent time the increasing population results in increasing demand of agricultural products and the quality of these products is controlled by using different kinds of pesticides and these pesticides may enter the human body through food chain. Pesticides used for agriculture purpose are released into the water bodies by surface runoff from agricultural landscape and also through municipal and industrial discharge which results in deterioration of water quality (Luo et al., 2008). The presence of pesticides in water bodies affect the aquatic biodiversity and other associated living organisms (Simazaki et al., 2015, Gou et al., 2016). It is important to understand the impact of pesticides on the aquatic animals and their ecosystem and also on humans which are sensitive to pesticides which may suffer from serious acute and chronic diseases ((Maund et al.,1997; Liess et al., 2003; Noyes et al.,2009).The exposure of human to those pesticides results in many disorders like infant mortality (Cremonse, 2014), Alzheimer's disease (Hayden, 2010), Carcinogenicity (Vopham, 2015), Neurotoxicity (Kiefer, 2007), reproductive toxicity (Chevier, 2013), and metabolic toxicity (Evanglou, 2016).

Pesticides are the kind of substances which cause major stress in aquatic ecosystem because they are persistent, bio-accumulative and toxic and can affect all kind of aquatic biodiversity ((Malaj et al., 2014;) Kohler &Triebskorn, 2013). The water bodies that are small in size and surrounded by landscape are mostly affected by pesticides and other pollutants. These water bodies have high proportion of biodiversity and lower dilution potential and the pesticides are adsorbed on the sediments which results in strong ecological effects as compared to the large water bodies (Lorenz et al., 2016, Munz et al., 2017, Neale et al., 2017, Szocs et al., 2017). Therefore, the small water bodies are given the more attention because they provide variety of habitat to the aquatic biodiversity (Downing, 2010; Biggs et al., 2016; Hill et al, 2016).

The different kinds of pesticides that are used to kill pests and some of them are banned in some developing countries and irrespective of the ban they are still producing these toxic pesticides in bulk quantity in order to increase their agricultural yield (Luo et al., 2016). The improper handling, lack of knowledge about toxic pesticides and poverty status of users becomes the major cause of deaths by pesticides in developing countries (Kesavachandran et al., 2009) and also the pesticides and their metabolites were not recognized as environmental toxicants. Pesticides are great threat to the environment globally because of their low polarity, high solubility in water, bioaccumulation in food chain (Afful et al., 2010). The pesticides in water bodies in a concentration which exceeds the limit damages the aquatic biodiversity (Kole, Banerjee, & Bhattacharyya, 2001).