Chapter 16
Residual Analysis of Pesticides in Surface Water of Nagpur, India:
An Approach to Water Pollution Control

Binota Thokchom
IIT Guwahati, India

Neeta Thacker
NEERI, India

ABSTRACT

Seventy-five percent of India's economy depends on agriculture with statewide pesticide consumption of 0.5 kg/h. The highest pesticide consuming states are Tamil Nadu and Andhra Pradesh in between 0.8 to 2 kg/ha. Maharashtra is the topmost consumer of pesticides with over 23.5% share. Nagpur city (the present study area) of Maharashtra has high population density with intensive farming practices. Organochlorine and organophorous pesticide residues were measured in surface water collected from major lakes and rivers located in and around this city. A comparative study with previous records has also been discussed. Monitoring experiments conducted during pre-monsoon, monsoon, and post-monsoon seasons allowed the different samples to show their susceptibility for the above-mentioned pesticide residues.

INTRODUCTION

Pesticides that are applied to soil or sprayed over crop fields are finally released to the environment. Some of them causes serious contamination and threaten human health. Monitoring of pesticide residues is one of the most important aspects in minimizing the potential hazards to human health (Ntow, 2005). Among the most prominent pesticides, organochlorines are highly toxic because of their persistence in the environment and their ability to bioaccumulate in food chain (Ballesteros & Parrado, 2004). In an effort to substitute persistent organochlorines, agricultural sectors have shifted towards organophosphate pesticides. However, organophosphates are generally much more toxic to vertebrates compared to other

DOI: 10.4018/978-1-5225-6111-8.ch016

classes of insecticides even though they rapidly degrade in the environment (Chambers *et al*., 2001). The usage of both the groups were banned and restricted in developed countries during 1970s and 1980s but some developing countries, including India are still using them for agricultural and public health purposes because of their low cost and versatility in controlling pest (Iwata *et al*., 1993). With the applications of pesticides in agriculture, runoff wastewater and the surrounding ecology, including the wells located in the middle of the agricultural fields are also contaminated. On consuming such commodities, bioaccumulation occurs, with human as the final pathway. Moreover, if more than one pesticide is used, the cocktail of multiple compounds synergize and antagonistic effects occurs, including the complexity in developing treatment system for such cocktailed contaminated water. The synergistic impact has posed the common discharge limit set for each individual pesticides (1-10 mg l^{-1}) as haphazard (Fernández-Alba *et al*, 2001). Besides, new generation pesticides, including the ones reported in this study, are highly soluble in water. Their low-sorption affinity to soils has also rapidly lead to extensive groundwater and surface water contamination. These compounds, often toxic, chemically stable and difficult to mineralize, have been proven recalcitrant to biological treatment. Due to their persistence and bio-accumulation, and consequent long-term toxicity, they have been designated as priority substances in EU legislation (Loos, 2012).

CLASSIFICATION OF PESTICIDES

1. **Based on the Target Organism (Yadav & Devi, 2017):** Chemical classification of pesticides (insecticides) (see Figures 1 and 2).
2. **Based on Applications:** These are generally sprays, dusts, aerosols, emulsifiable concentrations etc.

Originally, these chemicals were classified on the basis of their mode of entry in the bodies of insects, viz. stomach poisons, contact poisons and fumigants. However, this classification has become outdated, because most of the organic insecticides act both as stomach and contact poisons and some have also the added fumigant action.

Figure 1.