

## Chapter 20

# Testing and Monitoring of Biodegradable Contaminants in Bioremediation Technique

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### ABSTRACT

*Environmental pollution is one of the most acute global problems. Pollution is present at the every corners of the globe. Several methods are used for monitoring the pollutants in the environment. The present chapter includes the wide variety of testing such as physical, chemical, biological and as well molecular to determine the level of biodegradable contaminated substances in the environment and also check the feasibility of different bioremediation techniques. The monitoring and testing are essential and have an enormous impact on the cost of full-scale remediation. Successful remediation techniques completely degrade the contaminants. A successful bioremediation approach requires sufficient evidences for the non-toxicity of the contaminant. Current monitoring techniques require the disappearance of the contaminants. Different recombinant techniques also play great role to assess the pollution level. In the field and focus on interdisciplinary research, bioremediation technology will go a long way in cleaning our polluted environment in near future. Research on improved microbial strains and bioanalytical methods for measuring the level of contaminants should be strengthen.*

### INTRODUCTION

Intensification of agriculture and manufacturing industries has resulted in increased release of a wide range of xenobiotic compounds to the environment. Excess loading of hazardous waste has led to scarcity of clean water and disturbances of soil thus limiting crop production.

Microorganisms have an extensive but finite capacity to recycle synthetic organic molecules. One difficulty with microbial bioremediation is that not all components of chemical mixtures are degraded

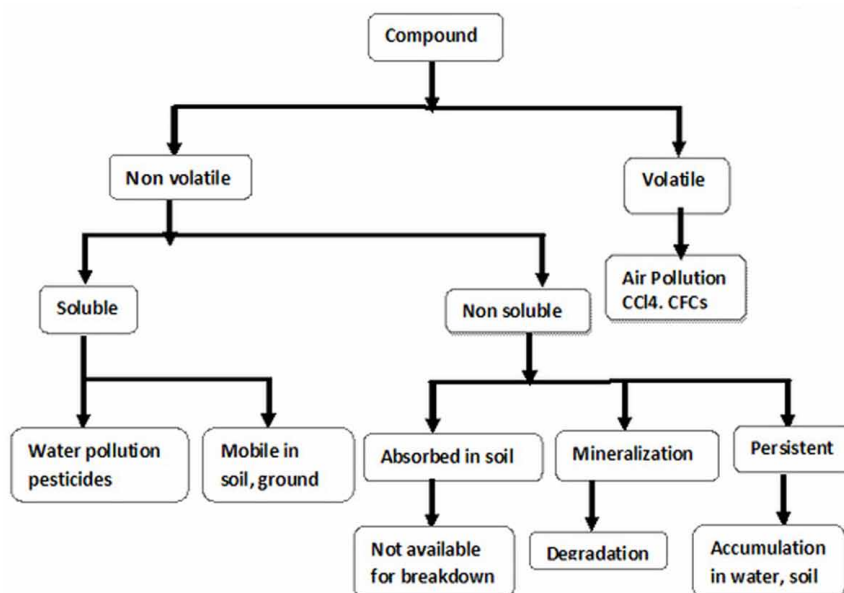
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with equal efficiency. By genetic engineering, the substrate range can be widened to include xenobiotics that are normally recalcitrant to degradation. Regulation of the deliberate release of genetically modified microorganisms requires, however, knowledge on the survival and effects of the inoculum in the environment (Gustafsson & Jansson, 1993). Government and the public become aware of the importance of the environment. To understand the changes in the environment, caused either by natural or mankind, large numbers of environmental parameters are considered. The range of environmental changes may from slow increase in global temperature to rapid accumulation of heavy metals and xenobiotics. Some changes are so slow that their determination requires careful monitoring for long time periods (Atlas, & Bartha, 1993). Pollution is defined by Holdgate in 1979 as “the introduction into the environment of substances or energy which causes hazards to human health, harm to living resources and ecological damage”. The first major human influence on the environment was perhaps agriculture but the industrial revolution was also very significant. The main environment pollutant are inorganic compounds such as metals and nitrates, organic compounds, microorganisms including pathogens, gaseous compounds such as volatile, gases and particulates which can contaminate land, air and water (Table 1).

The environmental conditions and the properties of the pollutant affect the fate of pollutant in the environment. The properties of the compounds such as solubility, volatility and reactivity affect the environment. The contaminants are not restricted to their site of introduction but depending on conditions which can migrate and contaminate other parts of the environment such as lakes, rivers and sea. Always the pollutants are not single but can be complex mixtures of toxic compounds. National laws are normally associated with a number of acts covering many types of pollutants, industries and conditions (Figure 1).

In the USA the Environmental Protection Agency (EPA) has listed 12 persistent, bioaccumulative and toxic (PBT) chemicals and more extensive lists of primary standards for drinking water including microorganisms and inorganic and organic compounds. Many of these compounds have strict legal upper limits on land and water. These compounds are aldrin, pyrene, DDT, hexachloro benzene, alkyl lead, mercury, PCBs and dioxins etc. (Table 2).

*Figure 1. Outline of the fate of compound release into the environment*



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