# Chapter 15
# Bioremediation of Agricultural, Municipal, and Industrial Wastes

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## ABSTRACT

*Growth of agriculture and manufacturing industries has resulted in increased a wide range of complex and hazardous compounds to the environment. Excess growth of hazardous waste has led to reduce availability of clean water and disturbances of soil thus limiting crop production. Waste generated from different sources like Industrial, domestic and agricultural etc. having different kinds of chemical compound i.e. organic or inorganic. Traditional methods are not able to deal with some of these chemical compounds. Bioremediation process is good option in such environmental problems. Bioremediation provides a technique for cleaning up pollution by enhancing the natural biodegradation processes. It treats such waste with the help of microorganism. Number of microbes including aerobes, anaerobic and fungi are involved in bioremediation process. Specific types of microbes are used to treat specific type of chemical contaminant. The chapter include all the techniques of bioremediation used to treat different kinds of contaminant.*

## INTRODUCTION

Ecosystems are threatened with natural environmental changes and disturbances that remove biomass from a community, such as fire, flood, drought, or predation over time and geographic space. (Levin, 1992) These disturbances needs new techniques emerge out of the patchwork of natural experimentation and opportunity implying a good measure of ecological resilience are a cornerstone theory in an ecosystem (Folke et al., 2004). The most common types of waste can be categorized into four types: agricultural, industrial, municipal and nuclear (Alloway, 1995). Agricultural waste, have both natural and non-natural wastes, is a general term used to describe waste produced from the fields through various activities. Agricultural wastes are the by-products of various agricultural activities such as crop production, harvesting of crops, saw milling, agro-industrial processing, and others. In India sugar industry alone produces about 90 MT of bagasse per year and being used in the manufacturing of insulation boards, wall panels, printing paper and corrugating medium (Sengupta, 2002). Generally, agricultural waste is produced in two forms- solid and liquid waste. The food harvesting and production industry generate crop residuals,

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as well as pre- and post- consumer food wastes. Some of the farmer burn agro- wastes after harvesting time; this causes a huge amount of air and land pollution. Municipal waste (MSW) composition can vary considerably with places and time depending on many factors, including socio-economic, climatic conditions, living standards, waste collection, and disposal methods, sampling and sorting procedures. MSW is heterogeneous in nature and have a number of different materials derived from various types of activities. Municipal waste generated from residential and domestic sources. This type of waste is commonly called trash or garbage and includes everyday items, spoiled food, broken things, or simply any item a person no longer needs or wants. The most commonly disposed of items as municipal solid waste are paper, yard trimmings, food, plastics, metals, rubbers, and textiles. In recent years, the amount of electronic waste, also known as e-waste, has increased drastically as people become more dependent on electronics, such as cell phones and computers that are replaced and disposed of frequently. Based on the definition of municipal solid waste, the waste that you dispose of everyday would fall into this category. Municipal solid waste categorized into two types: garbage and rubbish. Garbage or food waste is the animal and vegetable residue resulting from the preparation, cooking and serving of food. These wastes contain organic matter and moisture. Kitchens, restaurants, and markets are sources of garbage. Rubbish consists of old tin cans, newspaper, tires, packaging materials, bottles, plastics etc. Both combustible and non-combustible solid wastes are included in this category but do not include garbage. Trash is the combustible portion of rubbish. The rise in the number of industries producing glass, textile, leather, plastic and metal products food, and electronics, has significantly contributed to waste production. Rapid industrialization has resulted in the generation of a huge quantity of wastes, both solid and liquid, in industrial sectors such as fruit and food processing, pulp and paper, sugar, sago / starch, distilleries, dairies, tanneries, poultries, etc. These wastes are generally dumped on land or discharged into water bodies, without adequate treatment, so pollute environment and cause health hazard. In a broad sense, industrial wastes could be classified into two types i.e. Hazardous wastes and non- hazardous wastes (Table 1). Hazardous industrial wastes in India can be categorized broadly into two categories: Hazardous wastes generated from various industries in India and Hazardous industrial wastes imported into

*Table 1. Different types of industrial waste classified on the basis of their composition*

| | Hazardous Waste Component | Sources |
|---|---|---|
| Heavy Metals | Arsenic | Mining, non-anthropogenic geo-chemical formation |
| | Cadmium | Mining, fertilizer industry, battery waste |
| | Chromium | Mining areas, Tanneries |
| | Lead | Lead acid battery smelters |
| | Manganese | Mining areas |
| | Mercury | Chloro-alkali industries, healthcare institutes |
| | Nickel | Mining, metal refining |
| Hydrocarbons | Benzene | Petrochemical industries, solvents |
| | Vinyl chloride | Plastics |
| Pesticides | | Insecticides |
| Organic chemicals | Dioxins | Waste incineration, herbicides |
| | PCBs | Fluorescent lights, e-waste, Hydraulic fluid |