

## Chapter 3

# Soil Bioremediation Techniques

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### ABSTRACT

*Soil pollution is rising rapidly due to the existence of pollutants or natural alterations in the soil. It makes the drinking water ineffective and unusable by the human beings. The major cause of the soil contamination is agricultural activities, industrial activities, and inadmissible disposal of waste in the soil. The most common pollutants to accumulate in the soil are petroleum hydrocarbons, solvents, pesticides, lead, and other heavy metals. The important technology to remediate the pollutants or contaminants in the soil is bioremediation. The utilization of bioremediation in the contaminated soil is increasing rapidly due to the presence of toxic pollutants. It is the most advanced technologies which make use of organisms to deteriorate the harmful compounds in order to prevent the soil pollution. The aim of the chapter is to describe the available bioremediation technologies and their application in removing the pollutants exist in the soil.*

### INTRODUCTION

Issues related to the soil contamination is arising due to industrial activities, wastewater discharge and incorrect usage of chemical fertilizers and pesticides (Tang et al., 2015). Soil contamination with hazardous chemicals and toxins results in quick effect to the characteristics of the earth. Technology development for the restore of the polluted environment in an eco-friendly approach is increasing. The major worry in the world is soil contamination. Advancements in the treatment technologies are required because of the presence of contaminants which affect the biological system and human well-being. Soil contamination with toxic compounds rises ecological and health concerns. Site contamination is increasing rapidly that attracts many countries to develop a treatment technology. Nowadays, the hazard of contaminated soil on human health is high, leads to efforts has to be taken to remediate the sites and redeveloped for its use (Zouboulis and Moussas, 2011). The plants grown in the soil absorbs toxins from the soil. Entry of these crops into the human beings causes congenital illnesses and endless medical issues which

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cannot be cured effectively. Prolonged food poisoning also occurs due to the intake of these plants and crops. Through the inward breath of vaporized contaminants, it specifically influences the individuals. Due to the soil pollutants, ground water also gets affected that represents an extraordinary danger to the individuals by the utilization and moreover contaminated related sick are generated. Neurological problems are provoked to the young children due to the availability of trace quantities of metals in the soil. The arrival of volatile compounds from the air increases air pollution and the substantial metals reach into the ground water, lakes and oceans through run-off which results in water pollution. By consuming non-renewable energy resources like fossil fuels in the soil, the activity and growth of microbes get affected. Soil disintegration is another issue which is made by binding of fungi and bacteria together to decay the soil properties. The land becomes unsatisfactory for agricultural business due to its loss of fertility of the soil. The absence of nutrients in the soil decreases the generation of vegetables and natural products. Consuming lot of chemicals by the creatures changes the natural way of life, expanded death rates and even creature eradication. It demonstrates negative impacts which influence the metabolic exercises of creatures and arthropods. Traditional strategies like the removal of contaminated soil and transfer into the landfill site have some specific disadvantages. Presently, several technologies are usable for the treatment of contaminated soil and the treatments techniques are incineration, soil washing, soil flushing, dechlorination, ultra violet oxidation, thermal desorption etc. These technologies are more expensive and incomplete degradation of contaminants occurs. Hence biological treatment like bioremediation are chosen for the treatment of pollutants and plays a vital role in degrading a wide range of organic contaminants exist in the soil. Soil remediation is a natural depletion method which expels the contaminants by breaking the poisonous natural compounds into non-lethal natural compounds accumulated in the soil. Soil remediation comprises of different methods used to renovate the soil. These species consume contaminants and other pollutants that act as a medium for the growth of organisms in the soil. Microorganisms which are included in the bioremediation procedure are called bioremediators. Bioremediation is a biological conversion of hazardous compounds into non-hazardous compounds. It is a promising green innovation technique with the utilization of microbes like bacteria, fungi, algae, and plants. The few organisms involved in the bioremediation of soil contaminants are described in Table 1. By providing a suitable environment to the microorganisms, microbial degradation gets stimulated and consume contaminants and pollutants as a food for their growth. Bioremediation technology does not need a homogenous environment to degrade the pollutants like other conventional techniques. To carry out bioremediation procedure experience and specific approaches in ecology, microbiology, chemistry, and geology are needed. So far bioremediation usage is increasing worldwide with a great success. The intent of this proposal is to bring out the bioremediation techniques available for the corruption of pollutants and contaminants present in the soil. This information will help to identify the appropriate treatment technology required for the removal contaminants and pollutants from the soil.

## **BIOREMEDIATION PROCESS**

Interest related to the development of a biological system for the remediation technologies have been increased due to their application in the eradication of pollutants at the contaminated site (Grobelak et al., 2015). Researchers introduced various bioremediation techniques based on the nature and type of the pollutant. Through bioremediation process, the concentration of end product is lower than the concentration limit suggested by government authorities. Bioremediation is a biological mechanism to

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