Chapter 5
Effect of Plant Growth Promoting Bacteria (PGPB) on Phytoremdiation Technology

ABSTRACT

In this chapter, the authors describe how plant-growth-promoting bacteria is helpful for removing soil contaminants and also increasing the efficiency of phytoremediation technology. The plant growth bacteria seem almost good for removal of soil contaminants, and they can adsorb and accumulate metals in their cells and are being used in microbial leaching and also as agents of cleaning the environment.

INTRODUCTION

Phytoremediation has gained increased attention as a cost-effective method for the remediation of heavy metal-contaminated sites. Phytoremediation is the use of plants to remediate contaminated soil and water; it is a low cost effective technique (Singh et al., 2003). Phytoremediation techniques involve such as, phytofiltration, rhizofiltration, phytoextraction, phytostabilization, phytoimmobilisation and phytodegradation, and rhizodegradation (Ali et al., 2013). A primary termed of phytoremediation is phytofiltration. Phytofiltration is based on the adsorption and absorption of heavy metal contaminants from water with the help of plant roots (Mukhopadhyay and Maiti, 2010). Another form of involves phytovolatilization is the conversion

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of the pollutant into volatile form which allowing its escape from the soil into the atmosphere (Prasad and Freitas, 2003). Phytodegradation is also the category of phytoremidiation, metals pollutant are degraded into the small particles which easily uptake by the roots but yet does not apply to heavy metals because it is time consuming (Dixit et al., 2015). Phytostabilization is used for highly polluted areas to provide a complete capable of producing extensive and dense root systems covering compressed soils (figure 1) and also the restricting the pollutants to the soil zone near their roots by preventing their movement or leaching with a direct implication of the plant being more tolerant of pollutants (Salt et al., 1998; Yao et al., 2012; Dixit et al., 2015).

After high levels of heavy metal uptake in the plant organs which are harvested after drying, pollutant containing material dupmed separately and also use to make nanoparticle from this concentration mass material (Yao et al., 2012).The treatment of soil using plants as heavy metal uptake and storage by phytoremdiation approach can be distinguished (Yao et al., 2012; Dixit et al., 2015). The depth of soil which can be cleaned or stabilized is restricted to the root zone of the plants being used. Heavy metals are non-biodegrdable and they are very toxic to human health, plant and animals and also very affected to the microorganisms when they are present at higher quantity in the soil. As a result at higher concentration of heavy metals increase toxicity by generating reactive oxygen species which can lead to degradation of macromolecule, DNA damages, cell damage and also affected to ion uptake molecules (Ahmad et al., 2008, 2010, 2011, 2015). They also affected the process of photosynthesis by interfering with electron transport chain, water relations, enzymatic and biochemical activities (Rascio and Navari-Izzo, 2011; Ahmad et al., 2008, 2010, 2011, 2015; Qadir et al., 2014). They are also affecting biomass yield and somewhat soil fertility under the major condition present of heavy metals accumulation in soils (Bhargava et al., 2012). During the past few decades phytoremediation technologies has fastly grown and many new hyperaccumulator plants were identified.

ROLE OF HYPERACCUMULATOR PLANT

Hyperaccumulator term was proposed first time by Brooks et al. (1977) in reverence to those plants that can accumulate more than their natural favored condition approximately 1000 mg kg^{-1} of heavy metals. Plants accumulate more and more contaminants and tolerate without showing any symptoms (Memon and Schroder, 2009). According to Baker and Brooks suggested that

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