Chapter 7

Synergism Between Microbes and Plants for Soil Contaminants Mitigation

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ABSTRACT

Soil mitigation is an approach to reduce the soil degradation occurring in all aspects. Soil contamination mainly happens due to release of varieties of inorganic and organic constituents into soil. Presence of highly poisonous contaminants into soil in high concentrations is enough to cause a threat to ecosystem and on human health. Sustainable approaches can be designed by the direct and indirect utilization of microbes and plants to reduce the soil pollution load. The utilization of microbes with plants in “synergy” is considered as one of the most fruitful approaches for the removal of soil pollutants. It is well known that plant host a variety of microbes in their roots, rizosphere, and shoot by giving them essential environment to flourish and colonize. Similarly, microbes benefit by making available certain soil nutrients to plants and also help in maintaining the overall health of soil. This chapter will emphasize the problems related to soil degradation by metals, pesticides, and hydrocarbons, and their remediation by the utilization of plant-microbial synergism system.
BACKGROUND

Life-supportive and basic component of the bio-sphere is ‘soil’, it provides several benefits to the environment involving maintenance of biodiversity, primary production, management of biological cycles, bio-diversity and essence of life (Alexander, 1978; Kuske et al., 2002). Majority of the population dating few centuries back had a belief that the resources present on this land are surplus in amount and that these will remain available to man-kind for coming future generations. But unluckily due to extensive utilization and present exploitation, about half of this naturally present wealth is either damaged or is on the edge of exhaustion (Balba et al., 1998; Andreoni et al., 2004; Reda & Ashraf, 2010). The main factors causing depletion of healthy soil ecological system are the non-judicious application of pesticides, chemical fertilizers, hydrocarbons, petroleum compounds, metals, disposal of anthropogenic chemicals and deposition of industrial and domestic effluent into nature; each of these actions are creating a serious danger to mankind itself (Kuske et al., 2002; Srogi, 2007). In relation to other prevailing contaminants – toxic as well as heavy metals, petroleum hydrocarbons, xenobiotic compounds and pesticides are of immense concern due to their toxic behavior, ability to persist for a longer duration in nature and complexity of their structures. (Tolosa et al., 2004; Pinedo et al., 2013; Brevik et al., 2015; Fatima et al., 2015; Tahseen et al., 2017). Through the alliance of bio- and physio-chemical processes the soil system is able to convert, preserve, detoxify to some extent and discard contaminants (United States Environmental Protection Agency). Further it helps the microbial populations and other naturally occurring biota which are associated in the recycling of important nutrients and elements. On the other hand, it promotes the sequestration and processing of organic carbon. Besides the continuous over utilization and misuse of natural resources, population boom, and industrialization have made their way to the liberation of toxic compounds in the soil ecosystem (Mielke et al. 2004; Chen, 2007). The surrounding ecosystem can become contaminated with biodegradable and non-biodegradable chemicals as a consequence of naturally, accidental, or intended events like manufacturing industry waste, poor waste management and disposal, extraction of minerals, use of fertilizers, leaking of chemicals from underground storage sources, illegal waste dumping, and other mismanaged activities of various industries (Environment Act, 1995).

In order to categorize that soil is polluted, the current environmental behavior, strength and exposure route or a potential threat of a contaminant to health of humans or an ecological system, need to be characterized (Environment Act, 1995). Only then precise approach towards the soil mitigation can be designed effectively. Most of the contaminants enter into the environment, whether they are natural resources
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