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Editorial

Bioremediation: An Eco-friendly Approach for Polluted Agricultural Soil

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A wide variety of synthetic organic compounds are used in agricultural practices. These compounds are used mainly to control pests and increase crop productivity. However, after utilization these agricultural compounds enter into the soil, water, air and plant tissues [1]. Some of the compounds such as dichlorodiphenyltrichloroethane (DDT), dieldrin, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), benzene hexachloride (BHC), propachlor and other many pesticides remain in the environment for a long time and are resistant to natural degradation [2].

Consequently, persistence of these toxic compounds in the environment results in bioaccumulation affecting plants, animals, aquatic life and human [3]. Thus, elimination of these contaminants from the environment is utmost necessary. Traditional techniques such as land-filling, recycling, incineration and excavation for removing pollutants from soil lead to the release of toxic intermediate compounds [4]. Therefore, an effective treatment method for removing toxic recalcitrant compounds is to apply the potent microorganisms to contaminated sites. Use of microorganism for

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remediation of pollutants is environment-friendly, cheap, less hazardous and less laborious. This process of remediation of toxic organic compounds by exploiting effective microbial strains in contaminated sites is known as bioremediation [5].

Keywords bioremediation, hazardous agriculture compound, microorganism, recalcitrant

Hazardous Agricultural Compounds

Agricultural compounds include insecticides, fungicides, herbicides, rodenticides, molluscicides, nematicides, algaecides and plant growth regulators. Most of these compounds are organochlorinated, organophosphate or carbamate. There are several benefits of using these compounds in agricultural field especially in increasing crop productivity, preventing plant diseases and enhancing the fertility of soil [6]. Unfortunately, unmanaged utilization of the agricultural compounds possesses threat to environment and health of animal and human.

Dissemination of these hazardous compounds into the food stuff has resulted in serious health implications [7]. Pesticides and others recalcitrant compounds have negative impacts on environment, surface water, ground water and soil fertility. Similarly, it has also adverse consequences on non-target vegetation and non-target organisms [8-12]. Organochlorides compounds cause cancer, neurological disorder and teratogenic effects [13]. Organophosphate pesticides affect nervous system and reproductive system. These compounds inhibit the activity of the enzymes cholinesterase (ChE), which is responsible for nerve impulse [14]. Carbamate causes symptoms such as sweating, lacrimation, hypersalivation and convulsion by inhibiting the enzyme activity of acetylcholinesterase [15].

Eco-friendly Remediation Technique

Globally, a huge budget is invested for the remediation of contaminated soil. The cost utilized for worldwide remediation of organic pollutants is projected to be USD 25-30 billion annually [1]. These days, interest in implementing traditional techniques for removing contaminants from soil is decreasing. Additionally, conventional methods such as excavation, land-filling, recycling, incineration, stabilization, and vitrification have enormous pitfall. These techniques are expensive, laborious and have adverse effects on the environment. Employing these methods in clean-up strategy may alter the geographical conditions, change the soil quality and even kills the native flora and fauna. The most important drawback is the production of toxic and hazardous intermediate compounds which affect entire ecosystem.

One promising method for removing hazardous agricultural compounds from soil is known as bioremediation which is eco-friendly, cost effective and non-laborious. It is a sustainable remediation technique in which micro-organisms and plants are exploited to remove hazardous organic compounds from soil. According to U.S. Sustainable Remediation Forum (US SURF), sustainable remediation is defined as a remedy or combination of remedies whose net benefit on human health and the environment is maximized through the judicious use of limited resources [16]. Microorganisms interact chemically and physically with the hazardous organic compounds and result in their structural changes or complete degradation [17]. Bacteria, fungi, and actinomycetes are mainly involved in pesticides degrading and transforming the harmful compounds [2]. These microbes transform the pesticides and other harmful toxic compounds into non-toxic substances and finally into carbon dioxide and water. Complex and effective metabolic pathways with unique set of enzymes are involved during the degradation by microorganisms. In some cases, fungi transform pesticides and other xenobiotic compounds by changing the structure of molecules and rendering them into nontoxic forms. These nontoxic forms of compounds are then completely degraded by bacteria [18]. *Pseudomonas* sps. *Burkholderia* sps., *Rhodococcus* sps., *Herbaspirillum* sps., *Sphingomonas* sps., *Sphingobium* sps., *Novosphingobium* sps., *Methylobacterium populi*, D*ehalospirillum multivorans, Bascillus* sps., *Acinetobacter* sps., *Nocardioides* sps. are some of the examples of bacteria that are well studied and known as the effective strains for degrading organic compounds [1, 19].

Conclusions

The continuous use of pesticides and the exposure of harmful compounds in soil will soon create an alarming situation in the world. Although, many

developed countries have banned the use of hazardous agriculture compounds like DDT; still in many developing countries there is unmanaged and uncontrolled use of harmful agricultural compounds. Traditional techniques of remediation are unable to cope with the problem of contaminated sites. On the other hand, these techniques have many side-effects on the ecological condition of soil. So, bioremediation may serve as a promising and eco-friendly technique for the remediation of hazardous agricultural compounds.

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