Acta Scientific AGRICULTURE (ISSN: 2581-365X)

Volume 5 Issue 9 September 2021

Editorial

Bioremediation: A Tool for Sustainable Agriculture

Junaid Ahmad Malik*

Department of Zoology, Govt. Degree College, Bijbehara, Kashmir (J&K), India

***Corresponding Author:** Junaid Ahmad Malik, Department of Zoology, Govt. Degree College, Bijbehara, Kashmir (J&K), India.

Received: April 20, 2021

Published: August 01, 2021

Toxic inorganic and organic compounds contribute significantly to environmental pollution and pose a serious health risk to humans. The scientific challenge of preventing potential pollution from these substances is immense. Inorganics must be removed or converted into a biologically inert form, unlike organic compounds, which can be mineralized. Therefore bioremediation is frequently considered a cost-effective and eco sustainable process and is increasingly making inroads for environmental clean-up applications.

In farming activities, a wide range of synthetic organic compounds are used. These chemicals are mostly used to combat pests and boost crop yields. These agricultural compounds, on the other hand, enter the soil, water, air, and plant tissues after they are used. Bioremediation is a natural mechanism, which depends on microbes, fungi, and plants to kill, eliminate, destroy, or immobilise environmental contaminants from soil and water, thereby returning polluted areas to a comparatively safe nontoxic setting.

Bioremediation is the method of successfully decontaminating a pollution environment by the use of living organisms. The species employed are non-toxic microbes that are healthy for humans and the environment. Water, carbon dioxide, and fatty acids are the by-products. Bioremediation is the use of naturally occurring microorganisms to speed up the biological breakdown process. Bioremediation is being used to treat a variety of toxic chemicals, including paper mill pollutants and heavy metals, PCBs, radioactive waste, high sulphur coal, compost sludge, yard waste, and even gold and copper mining waste.

Bioremediation is a mechanism that occurs spontaneously. The method has been used for decades to treat wastes such as urban sewage and effluents from industrial processes such as oil refining and chemical processing. It is quickly gaining traction as a cost-effective alternative technology for treating a wide variety of environmental pollutants. It is the world's oldest–yet most advanced–pollution-control technology. Man, nature's most sophisticated organism, is relying on nature's least sophisticated organism–the single cell microbe–to clean up environmental destruction caused by man's immense technical advancements. In essence, bioremediation is proving to become the most important breakthrough in the history of environmental research, allowing us (humanity) to advance our technology while still maintaining a sustainable climate.

Bioremediation has stood out from the different technologies used for soil remediation because of its high protection and low operating costs as opposed to physical and chemical approaches such as burning and adsorption. In situ bioremediation processes use the treatment method without shifting the contaminated soil, and ex situ bioremediation processes use the treatment method with the polluted soil moved. In situ bioremediation approaches such as bioventing and oxygen release compounds (ORC) have been used in several pilot experiments to remediate pesticide-polluted soil. Another choice is ex situ bioremediation, which involves excavating polluted soil and treating it elsewhere. Bioreactors, landfarming, and biopiles are examples of ex situ bioremediation techniques. A bioreactor is used to blend polluted soil with water and nutrients, then agitate the mixture with a mechanical bioreactor to induce microorganism activity.

Bioremediation technology utilises various naturally occurring mitigation processes: natural attenuation, biostimulation, and bioaugmentation. Natural attenuation refers to bioremediation that happens without human interference other than testing. This natural attenuation is based on the native soil microorganisms' natural conditions and behaviour. To remediate polluted soils, biostimulation also employs natural microbial populations. The addition of nutrients and other compounds to soil to catalyse normal attenuation cycles is known as biostimulation. Exogenic microorganisms (from outside the soil environment) capable of detoxifying a certain contaminant are introduced through bioaugmentation, which may include genetically altered microorganisms.

Microbes use chemical contaminants in the soil as an energy supply during bioremediation and metabolise the target contaminant into usable energy for the microbes by oxidation-reduction reactions. By-products (metabolites) are normally less toxic than the parent toxins when released back into the atmosphere. Microorganisms may, for example, degrade petroleum hydrocarbons in the presence of oxygen by aerobic respiration. The hydrocarbon is oxidised and lacks electrons, while oxygen gains electrons and is reduced. Carbon dioxide and water are generated as a result.

The existence of a contaminant, an electron acceptor, and microorganisms capable of degrading the same contaminant are the three main ingredients for bioremediation. Since microorganisms capable of biodegradation are more likely to have formed, a contaminant that is a naturally occurring compound in the atmosphere, or chemically identical to a naturally occurring compound, is more readily and rapidly deteriorated. Microorganisms capable of attenuating or decaying hydrocarbons remain in the atmosphere because petroleum hydrocarbons are naturally occurring chemicals. The development of synthetic chemical biodegradation technologies, such as DDT, is based on the findings of research into natural or genetically improved microorganisms that can degrade such pollutants into less toxic types.

If the difficulties of bioremediation, especially of in situ techniques, can be resolved, bioremediation has potential to provide a low cost, non-intrusive, natural way to make radioactive compounds in soil less hazardous or harmless over time. Currently, research is being done to develop and address the shortcomings that impede petroleum hydrocarbon bioremediation. In a larger scale, more study has been done and is still being done to further understand the nature of microbial activity as microbes associate with different harmful pollutants. More research is being done to determine the criteria for effective introduction of exogenic and genetically modified microbes into a polluted world, as well as how to convert laboratory success to field success.

Volume 5 Issue 9 September 2021