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Extent of Contaminant Degradation

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Editorial Note

The use of bacteria for biodegradation of varied natural and artificial substances, and thereby reducing the extent of hazards, is increasingly drawing attention. Bacteria possess a good sort of bioremediation potentials which are beneficial from both an environmental and an economic standpoint. Bioremediation and biotransformation methods are employed to tap the present metabolic ability of microorganisms to degrade, transform, or accumulate toxic compounds including hydrocarbons, heterocyclic compounds, pharmaceutical substances, radionuclides, and toxic metals. The goal in bioremediation is to stimulate microorganisms with nutrients and other chemicals that enable them to destroy the contaminants. The bioremediation systems operational today believe microorganisms native to the contaminated sites, encouraging them to work by supplying them with optimum levels of nutrients and other chemicals essential for their metabolism. However, researchers are still investigating ways to reinforce contaminated sites with non-native microbes also as genetically engineered microbes fitted to degrading the contaminants of concern at particular sites.

Microorganisms gain energy by catalysing energy producing chemical reactions that involve breaking chemical reactions, thus transferring electrons far away from the contaminant. The energy gained from these electron transfers is then invested, along with some electrons and carbon from the contaminant, to provide more cells. There are a minimum of five critical factors that ought to be considered while evaluating the microbial bioremediation for site clean-up. These factors include:

Magnitude, toxicity, and mobility of contaminants: the location should be properly investigated and characterized to work out the (i) horizontal and vertical extent of contamination: (ii) the kinds and concentrations of contaminants at the site: (iii) the likely mobility of contaminants in future, which depends on the geological characteristics of the location.

Proximity of human and environmental receptors: Whether bioremediation is an appropriate clean-up remedy for any site is dependent upon the rate and extent of contaminant degradation.

Degradability of contaminants: The degradability of a compound depends on the occurrence of the compound in nature. In some instances, compounds with a high molecular weight, particularly those having complex ring structures and halogen substituents, degrade more slowly than simpler open chain hydrocarbons or low relative molecular mass compounds. Thus, the speed and extent to which the compound is metabolized within the environment is decided by the supply of electron acceptors and other nutrients.

Planned site use: The critical factor deciding the appropriateness of bioremediation is that the rate and extent of contaminant degradation.

Ability to properly monitor: There are inherent uncertainties within the use of bioremediation for contaminated soils and aquifers thanks to physical, chemical, and biological heterogeneities of the contaminated matrix.

Heavy metal pollution caused by various natural and anthropogenic activities is one among the foremost important environmental concerns. Though various physical and chemical methods are proposed to get rid of such hazardous metals from the environment, they're least successful in terms of cost effectiveness, limitations, and generation of harmful substances Microorganisms solve these problems as they are doing not produce any by-products, and that they are highly efficient even at low metal concentrations.