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Short Communication

An Overview of Bioremediation Processing Methods and its Types

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DESCRIPTION

With the aid of microorganisms like bacteria, fungi, and even plants, bioremediation is the process of eliminating or utilizing the pollutants from a particularly polluted environment (oil spills in water or on land, municipal water tanks, or sewage water). It is a form of biotechnical waste management technique that doesn't utilize dangerous chemicals, protects the environment, and encourages a sustainable one.

There are a number of treatments where contaminated water or solids are cleaned up by chemical processing, incineration, and landfill entombment. There are also more waste management techniques, including those for managing nuclear and solid waste. Bioremediation is different since it does not involve the use of dangerous chemicals.

Biostimulation

The supply of growth-restricting nutrients, such as nitrogen and phosphorus, to facilitate the interaction of either exogenous or autochthonous microorganisms in the degradation of polluted environments is known as "biostimulation," and it is a common strategy used in *in situ* bioremediation of contaminated water bodies. This approach has mostly been employed in the past to treat hydrocarbon-polluted locations in order to promote the growth of local microorganisms and speed up the breakdown of crude oil. The majority of polluted water bodies are characterised by nutrients that have a growth rate restriction, which prevent the metabolism of both native and exogenous microorganisms and the subsequent increase in biomass, which is a necessary prerequisite for the biosorption and biodegradation of these pollutants.

Most bioprospecting research in severe environments, especially those contaminated by acid mine drainage, are based on the idea that pollution is a necessary component of global industrialization and that its impacts must be lessened. According to a number of studies, bacteria are capable of sensing even small changes in the quantity of harmful components in their environment and quickly adapting to deal with these changes. Microorganisms build up a tolerance to and resilience to the stress of these changes in their environment when they are frequently exposed to harmful substances. It is possible to use this microbial adaptability to contaminated settings as a bioindicator and tool to assess the level of pollution in the specific ecosystems.

Bioaugmentation

Bioaugmentation for chlorinated contaminants: Cultured microorganisms that are employed for bioaugmentation frequently have a "specialism" in decomposing particular target pollutants. For instance, some microorganisms might be able to breakdown chlorinated substances like Vinyl Chloride (VC) and Cis-1, 2 Drichloroethylene (cDCE) more quickly than the local microbial community that naturally lives there. Due to the utilisation of bioaugmentation to speed up the reductive dechlorination process, meet remediation goals, and save money, the remediation community has turned toward a more prescriptive approach.

To biodegrade the chlorinated pollutants cDCE and VC, specific strains of anaerobic bacteria have been identified, grown, and made commercially available. In order to allow complete and quick reductive dechlorination, it is frequently utilised in conjunction with electron donor solution like 3-D Micro emulsion.

Bio augmentation for petroleum hydrocarbons: It is extremely uncommon, if ever, that aerobic degrader augmentation is necessary to enable improved aerobic biodegradation of petroleum hydrocarbons or any other aerobically degradable pollutants in soil and groundwater.

Aerobic microorganisms are common and often restricted by the availability of oxygen to support and expand their numbers, according to research. Oxygen Release Compound (ORC) or ORC Advanced, which are both recommended by regenesis, promotes the current aerobic microbial community through improved aerobic biodegradation.

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Intrinsic bioremediation

Given that soil and water are two biomes that are almost certain to always be contaminated and toxic, intrinsic bioremediation is most successful there. Intrinsic bioremediation is typically applied in subterranean spaces, such as underground storage tanks for petroleum. Such a location makes it difficult to see leaks, and impurities and chemicals can enter through them to taint the gasoline. As a result, only microorganisms can clean the tanks and remove the pollutants.

Other methods of waste management

Incineration: Wastes and other undesired materials are burned during this procedure. The organic waste is converted during burning into ash, flue gas, and heat. The waste's inorganic components are still present as an ash. Thermal treatment is another name for it.

Phytoremediation: In this scenario, soil pollutants are directly cleaned up or contained by plants. By using this bioremediation technique, the contaminating material won't need to be removed and disposed of elsewhere, which will aid the environment.

When it comes to carrying out the bioremediation process, microorganisms like bacteria and fungi are the key players. The most important microbes in this process are bacteria because they convert waste into nutrients and organic stuff. Although this is an effective waste management method, bioremediation cannot completely eliminate toxins. Bacteria can quickly break down contaminants like chlorinated insecticides and remove oil spills, but they are unable to eliminate heavy metals like lead and cadmium.