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Assignment viva

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Answer:

BIOREMEDATION:

- Bioremediation is a branch of biotechnology that employs the use of living organisms, like microbes and bacteria, in the removal of contaminants, pollutants, and toxins from soil, water, and other environments.
- Bioremediation may be used to clean up contaminated groundwater or environmental problems, such as oil spills. Bioremediation is used to clean up oil spills or contaminated groundwater.
- Bioremediation may be done "in situ"–at the site of the contamination–or "ex situ"–away from the site.

How Bioremediation Works

Bioremediation relies on stimulating the growth of certain microbes that utilize contaminants like oil, solvents, and pesticides for sources of food and energy. These microbes convert contaminants into small amounts of water, as well as harmless gases like carbon dioxide.

Bioremediation requires a combination of the right temperature, nutrients, and foods. The absence of these elements may prolong the cleanup of contaminants. Conditions that are unfavorable for bioremediation may be improved by adding “amendments” to the environment, such as molasses, vegetable oil, or simple air. These amendments optimize conditions for microbes to flourish, thereby accelerating the completion of the bioremediation process.

Bioremediation can either be done "in situ", which is at the site of the contamination itself, or "ex situ," which is a location away from the site. Ex situ bioremediation may be necessary if the climate is too cold to sustain microbe activity, or if the soil is too dense for nutrients to distribute evenly. Ex situ bioremediation may require excavating and cleaning the soil above ground, which may add significant costs to the process.

In situ soil treatment (aerobic)

Bioventing – Introduction of oxygen into the soil using forced air to encourage microbial activity. Nutrients such as nitrogen and phosphorus may also be added to the soil to increase the growth rate of microorganisms.

Injection or pumping of ORCs – ORCs are introduced into the soil to encourage microbial activity (similar to bioventing). This method is only used when the groundwater is already contaminated because ORCs are in liquid form.

Slurry-phase lagoon aeration – Air and soil are combined in a lagoon to encourage microbial activity.

Ex situ soil treatment (aerobic)

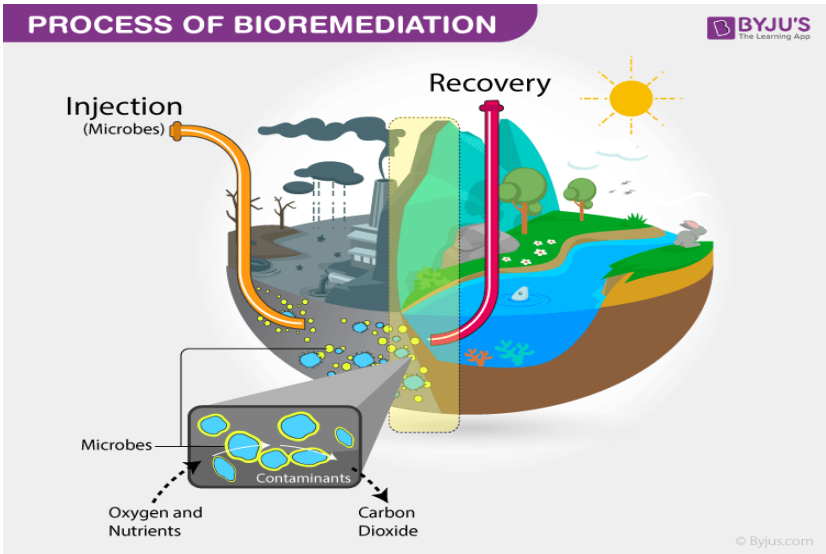
3 varieties of solid-phase treatment:

Contained or Biopiles – Soil is excavated and mixed with necessary amendments. Piles are placed in enclosed buildings and aerated using blowers and pumps.

Composting – Soil is excavated and combined with amendments e.g. wood chips to bulk out the soil. Organic amendments such as hay or manure are also added. The amendments help encourage microbial activity. The process takes place in enclosures called windrows. Open windrow systems stack the compost in elongated piles and aerate it by tearing down and rebuilding piles. Static windrow systems aerate the compost piles by a forced-air system (Sharma & Reddy, 2004). Figure 3 shows a diagram of a typical composting method.

Land Farming – Soil is excavated and spread in lined 'treatment beds'. Amendments are sometimes added. The soil is tilled to aerate as necessary to encourage microbial activity. Treatment is enhanced from photoxidation from the sun.

The bioremediation process may take anywhere from several months to several years to complete, depending on variables such as the size of the contaminated area, the concentration of contaminants, temperature, soil density, and whether bioremediation will occur in situ or ex situ.



Types of bioremediation:

Types of Bioremediation

Bioremediation is of three types –

1) Biostimulation

As the name suggests, the bacteria is stimulated to initiate the process. The contaminated soil is first mixed with special nutrients substances including other vital components either in the form of liquid or gas. It stimulates the growth of microbes thus resulting in efficient and quick removal of contaminants by microbes and other bacterias.

2) Bioaugmentation

At times, there are certain sites where microorganisms are required to extract the contaminants. **For example** – municipal wastewater. In these special cases, the process of bioaugmentation is used. There's only one major drawback in this process. It almost becomes impossible to control the growth of microorganisms in the process of removing the particular contaminant.

3) Intrinsic Bioremediation

The process of intrinsic bioremediation is most effective in the soil and water because of these two biomes which always have a high probability of being full of contaminants and toxins. The process of intrinsic bioremediation is mostly used in underground places like underground petroleum tanks. In such place, it is difficult to detect a leakage and contaminants and toxins can find their way to enter through these leaks and contaminate the petrol. Thus, only microorganisms can remove the toxins and clean the tanks.

Mycoremediation

We can't neglect the fungi, like mushrooms, molds, and mildews. For really big, hard to break down chemicals, fungi come to the rescue. 'Myco-' means relating to fungi, so mycoremediation is bioremediation carried out by fungi.

Fungi are able to produce enzymes that are kind of flexible and can adapt to fit large molecules. Fungi can also release their enzymes into the environment where they go to work on large molecules, breaking them up into smaller pieces that can be absorbed by the fungi and used for energy and growth.

Fungi in soil environments typically grow under the soil surface in large mats of interconnected filaments. Nutrients derived from environmental contaminants are taken up and spread through the fungal mat, accelerating the rate of bioremediation. Fungi are good at attacking pesticides, persistent organic pollutants, petroleum byproducts, and industrial wastes.

Naturally occurring fungi can certainly help with bioremediation, but in some cases certain fungi are applied to contaminated environments to support bioremediation. For example, in 2007 San Francisco was hit with a 58,000 gallon oil spill in the ocean. Volunteers used mats of hair to absorb the oil, then grew donated oyster mushrooms on the hair, which metabolized the oil into compost.

I think we can all agree that fungi also get a bioremediation gold star.

Advantages of Bioremediation:

Advantages of bioremediation include:

- It is possible to completely breakdown organic contaminants into other nontoxic chemicals.
- Equipment requirements are minimal compared to other remediation technologies.
- Can be implemented as an in-situ or ex-situ method depending on conditions.
- Low cost of treatment per unit volume of soil or groundwater compared to other remediation technologies.
- Low-technology equipment is required i.e. readily available equipment e.g. pumps, well drilling equipment etc.
- Bioremediation is perceived positively by the public because it is a natural process.
- Complete break down of pollutants in to non toxic compounds is possible because the process does not involve transferring of contaminants to other another environmental medium.