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MICROBIAL REMEDIATION- AN EMERGING TREND IN ENVIRONMENTAL SCIENCE!

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ABSTRACT

Bioremediation has become a powerful tool in the waste management technique in the present era. Bioremediation can be carried out using microbes, fungi, plants etc. Researchers and environmentalists are well aware of bioremediation as a key factor for eco-friendly treatment of wastes. The present paper describes the use of microbes in remediation, it's essential factors, advantages and disadvantages.

Keywords: Microbial remediation, essential factors for remediation, advantages of microbial remediation, Disadvantages of microbial remediation

I .INTRODUCTION

The nature cleans up itself by different processes that occur in the environment. The non-polluting substances are degraded by the microbes while they carry out their metabolism. If we employ microbes to degrade polluting substances, then some of the microbes may get killed but others survive. These survivors could be used for carrying out bioremediation of wastes.

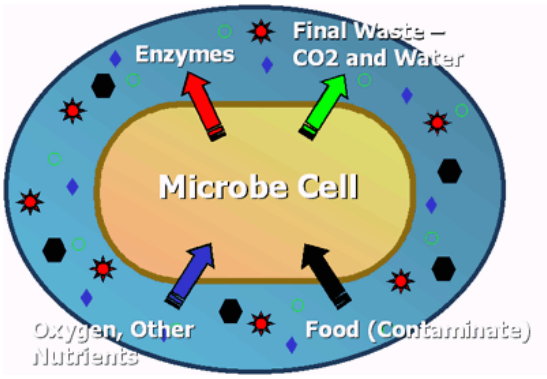
1.1Microbial remediation

Microbial remediation uses microorganisms to either degrade organic contaminants or to bind heavy metals in more inert and less bioavailable forms.Microorganisms break down contaminants by using them as food source or metabolizing them with a food source. There are aerobic bacteria, and then there are anaerobic bacteria. Aerobic processes require an oxygen source, and the end products typically are carbon dioxide, water salts. Anaerobic processes are conducted in the absence of oxygen, and the end products can include methane, hydrogen gas, sulfides, elemental sulfur and di- nitrogen gas.

Microbial remediation is done by:

- Breeding bacteria in high numbers and then introducing them into contaminated area

- Creating the ideal conditions in the affected soil or water to become the ideal habitat for bacterial growth to occur.



Essential Factors For Microbial Bioremediation

Factor	Desired Conditions
Microbial population	Suitable kinds of organisms that can biodegrade all of the contaminants
Oxygen	Enough to support aerobic biodegradation (about 2% oxygen in the gas phase or 0.4 mg/liter in the soil water)
Water	Soil moisture should be from 50–70% of the water holding capacity of the soil
Nutrients	Nitrogen, phosphorus, sulfur, and other nutrients to support good microbial growth
Temperature	Appropriate temperatures for microbial growth (0–40˚C)
Ph	Best range is from 6.5 to 7.5

Microorganisms that carry out biodegradation in many different environments are identified as active members of microbial consortiums. These microorganisms include: *Acinethobacter, Actinobacter, Acaligenes, Arthrobacter, Bacillins, Berijerinckia, Flavobacterium, Methylosinus, Mycrobacterium, Mycococcus, Nitrosomonas, Nocardia, Penicillium, Phanerochaete, Pseudomonas, Rhizoctomia, Serratio, Trametes and Xanthofacter.*

Some tools for microbial remediation are:

- Compost [Thermophillic]:
- Actively aerated compost tea
- Biochar
- Mycorhizal fungi
- Vermiculture

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1.2Advantages of microbial remediation

Advantages of bioremediation include (Sharma & Reddy, 2004) and (Vivaldi, 2001):

1. It is possible to completely breakdown organic contaminants into other nontoxic chemicals.
2. Equipment requirements are minimal compared to other remediation technologies.
3. Can be implemented as an in-situ or ex-situ method depending on conditions.
4. Low cost of treatment per unit volume of soil or groundwater compared to other remediation technologies.
5. Low-technology equipment is required i.e. readily available equipment e.g. pumps, well drilling equipment etc.
6. Bioremediation is perceived positively by the public because it is a natural process.
7. 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.

1.3 Disadvantages of microbial remediation

Disadvantages of bioremediation include (Sharma & Reddy, 2004):

1. If the process is not controlled it is possible the organic contaminants may not be broken down fully resulting in toxic by-products that could be more mobile than the initial contamination.
2. The process is sensitive to the level of toxicity and environmental conditions in the ground i.e. the conditions must be conducive to microbial activity e.g. need to consider temperature, pH etc.
3. Field monitoring to track the rate of biodegradation of the organic contaminants is advised.
4. If an ex-situ process is used, controlling volatile organic compounds (VOCs) may be difficult.
5. Treatment time is typically longer than that of other remediation technologies.
6. Range of contaminants that can be effectively treated is limited to compounds that are biodegradable.
7. Leaves residual levels that can be too high (not meeting regulatory requirements), persistent, and/or toxic.
8. Performance evaluations are difficult because there is not a defined level of a "clean" site and therefore performance criteria regulations are uncertain.

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II CONCLUSION

Microbial remediation is indeed an useful tool that helps us in marching towards eco-friendly and sustainable environment. Research in the above area is gaining speed with the involvement of sciences like genetic engineering, biotechnology, biochemistry and environment in the field of microbiology.

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