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Perspective

Applications of Environmental Biotechnology: Aerobic Treatment and Bioremediation

Allison Schwartz *

Department of Chemical and Biomolecular Engineering, University of Nebraska-Lincoln, Lincoln, USA

DESCRIPTION

Environmental biotechnology can be applied in a variety of methods to identify, stop, and correct harmful emissions into the environment. Wastes that are solid, liquid, or gaseous can be changed, either through recycling to create new goods or by purification to produce an end product that is less damaging to the environment. Environmental harm can be minimized by substituting biological technologies for chemical ones.

Environmental biotechnology can significantly aid in sustainable development in this way. One of today's most rapidly developing and practically valuable scientific topics is environmental biotechnology. Technologies for reversing and avoiding additional environmental degradation are being developed quickly from research into the genetics, biochemistry, and physiology of exploitable microorganisms.

Applications of environmental biotechnology

Sustainable development includes environmental conservation as a key element. Every day, human activity puts the environment in danger. Environmental issues are getting worse as a result of an expanding global population's increased consumption of chemicals, energy, and non-renewable resources. The amount of environmental harm caused by overconsumption, the amounts of trash produced, and the degree of unsustainable land use are likely to keep increasing despite increased efforts to minimize waste accumulation and to promote recycling.

Environmental biotechnology techniques, which involve live organisms in hazardous waste treatment and pollution management, can be used to some extent to implement the therapy. Environmental biotechnology has a wide range of uses, including bioremediation, prevention, detection, and monitoring, as well as genetic modification for better living conditions and sustainable development.

Bioremediation

The term "bioremediation" refers to the beneficial employment of microorganisms in the removal or detoxification of pollutants, typically as contaminants of soils, water, or sediments that would otherwise be dangerous to human health. The alternative names for bioremediation are biotreatment, bioreclamation, and biorestoration. The use of bioremediation is not new. For a very long time, harmful substances and organic debris have been removed from home and industrial waste disposal by microorganisms.

For the microbial activity in the polluted site, it might be necessary to add nutrients, terminal electron acceptors (O_2/NO_2), temperature, and moisture to encourage the growth of a specific organism. Operations for bioremediation might be carried out in situ or ex situ, on or off-site. Water and soil contaminated by a range of dangerous chemicals, household wastes, radioactive wastes, etc. can potentially be cleaned up via bioremediation.

The fact that the majority of organic compounds are vulnerable to enzymatic attack by living organisms is taken advantage of by biological cleaning processes. The strategy used most frequently is the employment of enzymes in place of chemical catalysts. It is possible to significantly reduce or completely eliminate the use of harsh chemicals, as is the case in the pulp and paper industry, leather processing, and textile manufacturing.

Waste water and industrial effluents

In many nations around the world, there is a severe problem with water contamination. Large amounts of waste water were produced by rapid industrialization and urbanization, which led to the depletion of groundwater supplies and surface water resources. The water bodies are contaminated by organic, inorganic, and biological pollution.

There are a variety of techniques, such as aerobic, anaerobic, and

Correspondence to: Allison Schwartz, Department of Chemical and Biomolecular Engineering, University of Nebraska-Lincoln, Lincoln, USA, E-mail: schwartzallison@nbl.edu

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physico-chemical processes in bioreactors and fixed-bed filters where the materials and bacteria are kept suspended. If left untreated, sewage and other waste waters would go through a process of self-purification, but this takes a lot of time. The application of bioremediation techniques hastens this process.

Aerobic biological treatment

Trickling filters, rotating biological contactors, and contact beds often consist of an inert substance rocks, ash, wood, or metal on which a complex biofilm of microorganisms grows. These have been employed for the treatment of sewage and waste water for more than 70 years. These procedures involve the oxidation of degradable organic material by microbes into CO_2 that can be released into the atmosphere.

Activated sludge process

This sludge typically contains bacteria, fungus, protozoa, and rotifers as its microorganisms. Various bacterial species, including Acinetobacter, Mycobacteria, Pseudomonas, and others, yeasts, Cladosporium, and Scolecobasidium, breakdown petroleum hydrocarbons. By the fungus Xylaria xylestrix, pesticides (aldrin, dieldrin, parathion, and malathion) are detoxified. Organic substances such hydrocarbons, phenols, organophosphates, polychlorinated biphenyls, and polycyclic aromatic hydrocarbons can be detoxified by Pseudomonas, a common soil microorganism.

The transformation of wastes into valuable goods can lower the expenses associated with wastewater treatment. Heavy metals and sulphur compounds can be extracted and reused by sulphur metabolizing bacteria from the waste streams of the galvanization industry. Biogas is a beneficial byproduct of most anaerobic wastewater treatment methods.