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Perspective

Microorganisms Involved in Biodegradation Process and their Functions

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DESCRIPTION

The biologically mediated decrease in chemical compound complexity is known as biodegradation. In fact, biodegradation is the process by which active microbial organisms break down organic materials into simpler molecules. "Mineralization" refers to the process after biodegradation is finished. However, the term "biodegradation" is typically used to refer to virtually any biologically mediated alteration in a substrate.

Understanding the microorganisms that drive biodegradation hence requires knowledge of the process itself. The material is changed by the microorganisms through metabolic or enzymatic reactions. It is based on two processes: cometabolism and growth. An organic contaminant serves as the only source of carbon and energy for growth. The organic contaminants are completely degraded (mineralized) as a result of this process. Cometabolism is the metabolism of an organic substance when a growth substrate, which serves as the main source of carbon and energy, is present. Fungi, bacteria, and yeast are just a few of the microorganisms that contribute to biodegradation.

There are few reports on how algae and protozoa contribute to biodegradation. Although there are many different biodegradation pathways, carbon dioxide is typically the end result of the breakdown. Anaerobic (without oxygen) or aerobic (with oxygen) degradation of organic material is both possible.

The term "biodegradable matter" refers to material that can be broken down by microbes, typically organic material like plant and animal matter, as well as other substances derived from living beings. Some microorganisms have an amazing, naturally occurring variety of microbial catabolic enzymes that enable them to break down, change, or accumulate a wide range of substances, including hydrocarbons (such as oil), Polychlorinated Biphenyls (PCBs), Polyaromatic Hydrocarbons (PAHs), radionuclides, and metals.

Microorganisms' function in the biodegradation of pollutants

Environmental bioremediation is described in conjunction with biodegradation. As a result, biodegradation is nature's technique of turning wastes into nutrients that may be utilised and recycled by other organisms. According to microbiology, the term "biodegradation" refers to the process by which all organic materials rot. This process is carried out by a wide range of life forms, mostly bacteria, yeast, and fungi, as well as possibly other creatures. Hydrocarbons (such as oil), Polychlorinated Biphenyls (PCBs), Polyaromatic Hydrocarbons (PAHs), radionuclides, and metals are just a few of the many chemicals that can be degraded, transformed, or accumulated using bioremediation and biotransformation techniques.

A few biodegradable toxins

Highly poisonous chemical compounds have been created recently and discharged into the environment for long-term use either directly or indirectly. Among these substances include fuels, insecticides, dyes, Polychlorinated Biphenyls (PCBs), Polycyclic Aromatic Hydrocarbons (PAHs), and Polychlorinated Biphenyls (PCBs). Other manufactured chemicals, such as radionuclides and metals, are much less likely to be biodegraded by local flora than naturally occurring organic molecules, which are easily broken down when introduced to the environment.

Organic molecules known as hydrocarbons have carbon and hydrogen atoms at their cores. Hydrocarbons can be thought of as cyclic, branching, or molecules with linear links. These hydrocarbons are seen to be either aromatic or aliphatic. The aliphatic one comes in three forms: alkanes, alkenes, and alkynes, whereas the first one has benzene in its structure.

Polycyclic Aromatic Hydrocarbons (PAHs) are a family of Hydrophobic Organic Contaminants (HOC) that is significant pollutants that are frequently detected in air, soil, and sediments. Industrial output is the main cause of PAH pollution. Since additional information concerning their toxicity, environmental persistence, and prevalence became available more than 20 years ago, there has been an increase in interest in the field of study. Fish and other aquatic creatures can accumulate PAH, which can then be consumed by people. PAH can also sorb to organic-rich soils and sediments. One way to think of the biodegradation of PAH is as a removal of man-made pollutants from the environment,

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and the other is as a regular part of the carbon cycle. An appealing approach for cleaning up polluted places appears to be the utilisation of microorganisms in PAH-contaminated environments during bioremediation.

Degradation by bacteria

There are numerous accounts on how certain microorganisms can break down environmental contaminants. Even some bacteria have been found to only consume hydrocarbons. Bacteria that can break down hydrocarbons are referred to as hydrocarbon-degrading bacteria. The nitrate-reducing bacterial strains *Pseudomonas sp.* and *Brevibacillus sp.* isolated from petroleum-contaminated soil exhibit both aerobic and anaerobic hydrocarbon biodegradation. However, the possibility that anaerobic biodegradation may be far more significant. From the marine environment, 25 species of bacteria that break down hydrocarbons were discovered. Additionally, *Bacillus* was the best hydrocarbon-degrading bacterium out of 80 isolated bacterial strains, which belonged to 10 different species, including *Corynebacterium*, *Staphylococcus*, *Streptococcus*, *Shigella*, *Alcaligenes*, *Acinetobacter*, *Escherichia*, *Klebsiella*, and *Enterobacter*.

Numerous bacterial strains, mostly from soil, have been discovered that have the ability to break down aromatic hydrocarbons. Most of them are *Pseudomonas* bacteria, which are typically gram-negative bacteria. Additionally, bacteria from the genera *Mycobacterium*, *Corynebacterium*, *Aeromonas*, *Rhodococcus*, and *Bacillus* have been found to possess the biodegradative processes.

CONCLUSION

The management of the global carbon cycle and the rejuvenation of our environment both depend heavily on microbial activity. The word "biodegradation" covers these processes. A large number of synthetic molecules and other chemicals, like hydrocarbons and heavy metals, have Eco toxicological effects and can be broken down or changed by microorganisms. However, this phrase typically refers to prospective degradability's that were calculated in the lab using chosen cultures and optimal growth circumstances. The rate of biodegradation in natural settings is lower due to a variety of variables, including competition with microorganisms, a lack of critical substrates, unfavorable environmental parameters (aeration, moisture, pH, temperature), and low contaminant bioavailability. In order to enable the usage of microorganisms in bioremediation technologies, environmental biotechnology aims to address and resolve these issues.