

Microbial Degradation of Organic Pollutants

Biodegradation: Process in which highly complex substances are broken down into simpler products by the action of microbes

Mineralization: The breakdown of organic compounds into inorganic forms by microbes

Xenobiotics: Man-made synthetic organic compounds which are partially or completely non-degradable and create pollution problems

- Ex. Plastic

Bioremediation: Removal or detoxification of man-made xenobiotics compound by the use of microorganisms

Biodeterioration: process of chemical or physical alteration or deterioration of natural or man-made products of economic importance by microorganisms in such a form that decreases the usefulness of that product

Bioaugmentation: when microbes are added in combination with fertilizers containing nitrogen and phosphorus which enhance their growth to biodegradable pollutants

Biofilms: when microbes live in communities forming layers of organic matter

Bioaccumulation: accumulation of contaminants by species in concentration that are in order of magnitude higher than surrounding environments

- This process is the sum of
 1. Bioconcentration
 2. Biomagnification

Bioconcentration: Direct uptake of toxic substrate by a living organism from the medium via skin, gills, or lungs

Biomagnification: results directly by eating

Pollutants: Naturally occurring compounds in the environment that are present in unnaturally high concentrations

Ex. Crude oil, refined oil, phosphates, heavy metals

Xenobiotics: chemically synthesized compounds that have never occurred in nature

Ex. Pesticides, herbicides, plastics

- Solvents
- Lubricants
- Plasticizers
- Insulators
- Herbicides and pesticides

Degradation of Chlorinated Hydrocarbons

Degradation of organic toxins requires the participation of entire biochemical pathways involving many enzymes coded for by many genes

Some of the genes exist on the chromosome while other genes reside on plasmids

Phytoremediation

Approximately 350 plant species naturally take up toxic materials.

- Sunflowers are used to remove radioactive cesium and strontium
- Water hyacinths used to remove arsenic from water supplies in Bangladesh

Drawbacks

- Only surface soil (root zone) can be treated
- Cleanup takes several years

Biodeterioration

Biodeterioration: the chemical or physical alteration of a product that decreases its usefulness for its intended purpose caused by microorganisms or their enzymes

Both bacteria and fungi are involved in biodeterioration of daily use items

- Ex. textiles, leather, pesticides and paints

Microbes are also involved in deterioration of agriculture produce

- Ex. contamination of grains, fruits and vegetables during storage and transport