

Mechanisms of Polymer Degradation

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Main biodegradation mechanisms

- Microbial biodegradation
- Aerobic biodegradation
- Anaerobic biodegradation

Microbial Biodegradation

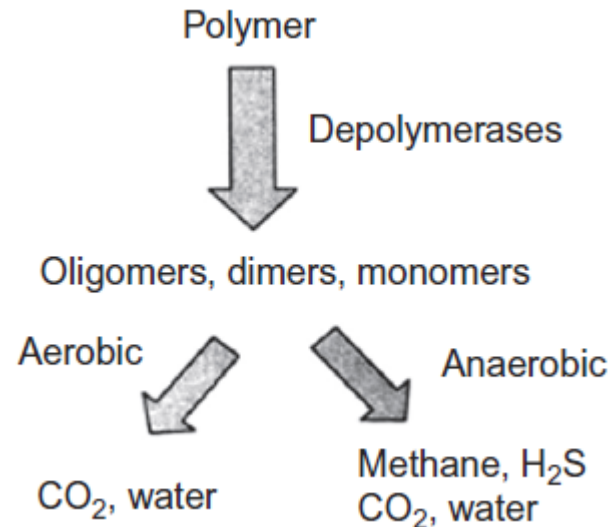
Microbial degradation takes place through

- Action of enzymes or
- By-products generated by microorganisms

Steps in the microbial polymer Degradation process

1. Depolymerization
2. Mineralization

Depolymerization



- Depolymerization is a free-radical mechanism
- Polymer is degraded to monomers, oligomers, and dimers
- When exposed to an aerobic environment yield carbon dioxide and water
- When exposed to anaerobic environment, the end products are methane, carbon dioxide and water
- Depolymerization occurs outside the organism due to the size of the polymer chain

Depolymerization...

Abiotic hydrolysis

- Polycarboxylates
- Poly(ethylene terephthalate) (PET),
- Polylactic acid (PLA)

Abiotic oxidation

- Polyethylene
- Polypropylene

Mineralization

- Process of conversion of organic products to inorganic compounds
- Results in the total destruction of the product

Aerobic biodegradation

Process of breaking down organic contaminants by microorganisms in the presence of oxygen

- Hydrolysis
- Acidogenesis
- Acetogenesis
- Methanogenesis