

## Organic Pollutants

- Biodegradation

→ Mineralization: organic substrates oxidized to CO<sub>2</sub>

→ Partial degradation:

↳ CO-metabolism → substrate partially degraded without energy gain  
Example: TCE degradation by methanotrophs  
→ non-specific action of certain enzymes  
(example: oxygenases)

→ Polymerization: substrates will polymerize into more complex structures

## Factors Affecting Biodegradation

1) Genetic Potential

acclimation: period before onset of biodegradation

- organisms need to reach critical biomass
- favorability of biodegradation
- limiting nutrients
- pathways "assembled" example (selection pressure affects spread of TNT-degraders)

2) Bioavailability

- aging
- sequestration
- complexation

- Substrates are hydrophobic

↳ partition into the organics (humics) of soil

- can also become trapped in micropores of soil
- polymerization

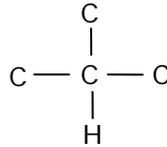
### Consequences

- less bio available for plants and animals
- uncertain fate and long persistence

### 3) Contaminant structure

#### a) Steric effects

branching and functional groups can hinder interactions with active sites in enzymes. Example: tertiary C:



Example: combinations of aromatic rings with alkyl moieties  
ring numbers in polyaromatic hydrocarbons

#### b) Electronic effects

Functional groups or residues on aromatic rings can affect chemical properties of rings because they can be:

- electron donating → example: -CH<sub>3</sub>
- electron withdrawing → example: -Cl
- substituent types: Xenophores  
-Cl, -NO<sub>2</sub>, -SO<sub>3</sub>H, Br, -CN, -CF<sub>3</sub>
- number of substituents
- position of substituents

#### 4) Toxicity: must have extremely high concentrations of toxins, which can intercalate into the cell membrane and disrupt function

not as generally true  
as stated → but for  
hydrocarbons the case

- Halogenated Hydrocarbon Degradation  
3 basic mechanisms

↳ highly dependent on number of substituents

- Aerobic degradation by oxygenases: works best with substrates carrying few halogens.
- Anaerobic degradation by enzymes carrying reduced metals: works best with substrates carrying many halogens.