Methanotrophs assisted bentazone degradation

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**Methanotrophs assisted bentazone degradation**

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**Introduction**

Drinking water is increasingly threatened by contamination from pesticides and pesticide metabolites, including bentazone, a thiazidane herbicide persistent in groundwater. Anaerobic groundwater often contains methane, which is easily oxidized by methane-oxidizing bacteria (MOB) upon groundwater aeration. These bacteria have known cometabolic degradation properties against some class of organic contaminants.

Goal: Test whether MOBs enriched from rapid sand filters can cometabolically degrade bentazone.

**Materials and Methods**

- Material from rapid sand filters used to enrich methanotrophic culture in continuous - flow lab scale reactors
- Batch assay of bentazone removal & mineralization
- \(^{14}\text{C}\) carbonyl-labeled bentazone in concentrations ranging from 0.2 to 2000 ug/L with and without methane (triplicates)
- Abiotic controls (autoclaved Filtralite)
- Methane analysis – GC-FID

**Bentazone Removal & Mineralization**

- No effect of CH\(_4\) in removal kinetics.
- Higher total mineralization in the absence of CH\(_4\)

**Concentration Effect**

- Removal in all concentration ranges
- Slower removal rate in the presence of CH\(_4\)
- Delay observed at high CH\(_4\) concentrations

**Conclusions**

- Microbial community fed only with methane in drinking water for > 1 year shows efficient and stable bentazone degradation in all concentration ranges
- Two possible removal patterns: (a) not inhibited by methane at low bentazone concentrations, (b) methane-inhibited at high concentrations
- Not consistent pattern with the typical cometabolic process
- Methane’s presence slows down bentazone degradation process unless present in low concentrations (<10 \(\mu\)g/L)
- Observed competitive inhibition between methane and bentazone