BioTransformation of Halogenated Flame Retardants

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This study examines two approaches to remediation of the potentially harmful compounds found in sediments throughout the Guangdong Province.

### Biological Remediation

Sediment samples from 2 e-waste sites and one control were inoculated with TBBPA and TCBPA. Microbes in the sediment are thought to use Halogenated compounds as their electron acceptors in their metabolic cycle. An electron donor was added to enhance degradation. The biodegradation was observed using a method adapted from Voordeckers’s et al\(^5\). In total there were 54 microcosms: 2 compounds, 3 sites, 3 treatments and triplicates of each condition. Each site tested for both contaminants, TBBPA and TCBPA. The three conditions were: the live control, dead control and an enriched electron donor. Samples were taken weekly for six weeks and underwent HPLC analysis. Further, PCR-DGGE analysis was performed for Week 0 and Week 5 samples. Ultimately it was found that all treatments degraded the compound by 80%.

### Abiotic Remediation

Abiotic Nano-Zero Valant Iron (nZVI) reactions were performed to compare methods of potential in-situ remediation of TBBPA at contaminated sites. nZVI catalysts are used as a commercial treatment for waterwaste plumes where a permeable reactive barrier is installed at a groundwater site\(^6\). The iron nanoparticles are formed in the following reaction:

\[
2\text{Fe}^{3+} + 3\text{H}_2\text{O}_4^- + 9\text{H}_2\text{O} \rightarrow 4\text{Fe}^{2+} \text{H}_2\text{BO}_3^- + 12\text{H}^+ + 6\text{H}_2
\]

The nanoparticles were vacuumed stored, observed with a scanning electron microscope, and used with a week to prevent oxidation effects. HPLC analysis was used to detect concentrations of TBBPA.

Degradation was observed in 3 experiments in hopes of determining the ideal conditions for dehalogenation:

1. Comparison of catalyst concentration
2. Effects of nickel coating on particles
3. Effect of PH

### Conclusion

**Significant degradation suggests that there may be other sources of loss besides microbial activity.**

DNA analysis suggest the magnification of certain preexisting microbes in week five and shows the same microbial community among all soil samples that were 80 km apart.

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### Literature Cited