Dechlorination of Organic Pollutants in Microcosms Amended with Cellulose and Chitin.

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Medium-Chain Chlorinated Paraffins (MCCPs) are industrial chemicals of increasing environmental concern. They came into wide use about 30 years ago as substitutes for the very persistent, toxic, and eventually banned polychlorinated biphenyls (PCBs). There is some evidence that MCCPs accumulate in animal tissues and aquatic sediments, but their distribution and environmental fate is not well described or understood.

It is known that aquatic sediments contain bacteria capable of breaking down chlorinated organics by a process called reductive dechlorination. These microbes, especially members of the Dehalococcoides genus, have been shown to break down other persistent chlorinated pollutants like PCBs, but as far as we know, nothing has been published on their action on MCCPs. If MCCPs were found to be effectuvely dechlorinated by natural bacteria, it would possibly open up new treatment technologies in the field to reduce the bioaccumulation and human exposure to MCCPs.

The experiment involves laboratory incubations of polluted or clean sediment with added MCCPs to understand whether and how bacteria break them down over a period of up to 6 months. Once the incubations are terminated, samples will be extracted and analyzed for MCCPs by gas chromatography coupled to mass spectrometry. In addition to MCCPs, some cultures receive nutrient chemicals (cellulose or chitin) to see whether the rate of breakdown can be accelerated. The abundance of Dehalococcoides and of a key dechlorination gene in the cultures at various time points will be estimated using real-time PCR, to understand how the microbial population respond to the various treatments, and whether the microbial changes explain the changes observed in the concentration of MCCPs. This work has important implications for the environmental chemistry and bioremediation of MCCPs.

This work was supported by RI INBRE