DEVELOPING METHODS TO STIMULATE DECHLORINATION OF HISTORICAL POLYCHLORINATED DIBENZO-*P*-DIOXINS AND DIBENZOFURANS IN CONTAMINATED SEDIMENT

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Polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) are unwanted byproducts from various industrial processes. They are of major concern due to their extreme toxicity and high resistance to microbial degradation. Anaerobic bacteria are known to dechlorinate PCDD/Fs, but their activity is low. To develop methods to stimulate the reductive dechlorination of aged PCDD/Fs we established micro- and mesocosms with contaminated sediment from Kymijoki River, Finland. In 30-liter anaerobic mesocosms we detected the dechlorination from octa-CDF to hepta- and hexa-CDF congeners, as well as production of non-2,3,7,8- substituted tetra- and penta-CDFs from hexa-CDFs after 3 years incubation. Whether the dechlorination of PCDD/Fs could be stimulated by different amendments was examined in 200 ml microcosms. The effects of spiked 1,2,3,4-tetrachlorodibenzo-*p*-dioxin (1,2,3,4-TeCDD), 1,2,3,4-tetrachlorobenzene (1,2,3,4-TeCB) and 1,2,3,4,5-pentachloronitrobenzene (1,2,3,4,5-PeCN) as "haloprimers" in the presence of combined electron donors were examined. Vegetable oil was tested for the effect on enhancing dechlorination of historical PCDD/F congeners in the sediments with and without bioaugmentation of *Dehalococcoides ethenogenes* strain 195. A similar production of non-2,3,7,8- substituted tetra- and penta-CDFs were observed in microcosms after 18 months. Extensive reductive dechlorination of spiked 1,2,3,4-tetrachlorodibenzo-*p*-dioxin and 1,2,3,4-tetrachlorodibenzofuran indicated that the sediments contained active populations of native dechlorinating bacteria. The results suggest ways to enhance dechlorination of historical PCDD/Fs contaminants by indigenous microbial populations and can be used for identification of potential dechlorinating microbes for in situ bioremediation of PCDD/F contaminated sediments.