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POLYCHLORINATED BIPHENYL (PCB) MICROBIAL REDUCTIVE DECHLORINATION POTENTIAL IN CONTAMINATED MARINE SEDIMENTS OF THE VENICE LAGOON

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Abstract

The microbial reductive dechlorination of pre-existing and spiked polychlorinated biphenyls (PCBs) has been documented in four sediments of the Venice lagoon, thus suggesting that the occurrence of microbial PCB dechlorinating capabilities might be widespread in this area. The aim of this work was to assess the microbial reductive dechlorination potential in seven sediments the Venice Lagoon contaminated by highly chlorinated PCBs at 0.2–3.3 mg (kg dry sediment)$^{-1}$. In order to better evaluate PCB dechlorination capability of the indigenous biomass under *in situ*-like biogeochemical conditions, sediments were spiked with the commercial PCB mixture Aroclor 1254 at 1 g (kg dry sediment)$^{-1}$ and incubated statically in site water at 28 °C.

PCB dechlorination occurred in three sediment slurries of the Brentella canal after a lag phase lasting 11 to 14 weeks. The shorter lag phase was observed in the most contaminated sediment, where the largest reduction of the chlorination degree of the PCB mixture (from 5.1 to 4.1 chlorines per biphenyl) and the bioconversion of 58.9 mol% of the penta- through epta-chlorinated biphenyls into tri- and tetra-chlorinated congeners were detected after 23 weeks of incubation. Similar lowering of the redox potential (from ca. -220 mV to ca. -400 mV) and pH (from ca. 7.7 to ca. 7.0) were detected in the three PCB dechlorinating sediment slurries. Conversely, complete consumption of sulphate within the first 11 weeks of incubation followed by methanogenesis were detected in two of them while no complete sulphate depletion and no methane production occurred in the other one during 23 weeks of incubation. Two sediment slurries that did not exhibit PCB dechlorination activity had higher initial redox potential and no or lower sulphate reducing activity compared to PCB dechlorinating slurries. The other two sediment slurries with no PCB dechlorination activity exhibited sulphate reducing and methanogenic activities, redox potential and pH values throughout incubation very similar to those of the PCB dechlorinating slurries.

These evidences indicate that microbial PCB dechlorination potential, although widespread, is not ubiquitous in the contaminated sediments of the Venice lagoon. Chemical characterization of the sediments and of their indigenous microbial communities are in progress to identify geochemical and microbial features that might be crucial for the establishment of PCB reductive dechlorination processes.

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