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MICROBIAL COMMUNITY STRUCTURE SHIFTS IN RESPONSE TO DIFFERENT BIOTIC AND ABIOTIC CONDITIONS

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Abstract

Wide-spread use, improper handling, and disposal of certain synthetic organic chemicals have resulted in contamination of soils, waters, and sediments. Among the compounds released, polychlorinated biphenyls (PCBs) are of major concern due to their toxicity for certain organisms. In addition, PCBs volatilize and migrate to places far from the original release and pose a threat to human health not only in the neighbourhood of the contaminated area. One of the most ecologically-sound and inexpensive ways of removing PCBs from contaminated sites is bioremediation, which takes advantage of enzymatic capabilities of certain microorganisms (microbial bioremediation) and plants (phytoremediation) and/or their consortia (rhizoremediation) to transform these compounds.

In this study, microbial community structure shifts were monitored in relation to different biotic and abiotic conditions. These included vegetation by different plant species (horseradish /*Armoracia rusticana*/, black nightshade /*Solanum nigrum*/, and tobacco /*Nicotiana tabacum*/), addition of fertilizers (N-P-K), and addition of allochtonous bacterial degraders isolated previously from a PCB-contaminated sediment. Several approaches were used to assess the changes in microbial community structure, including direct plate counting (using plate count agar and mineral medium with biphenyl as a sole carbon and energy source), pyrosequencing of 16S rRNA gene amplicons, and stable isotope probing.

Our results show that the vegetation itself influences microbial diversity and metabolic degradation activity to a much larger extent than fertilization, which can be documented at the level of cultured bacteria, total communities, and metabolically active populations (as determined, respectively, by direct plate counting, pyrosequencing analyses, and stable isotope probing with ^{13}C-labeled biphenyl as a substrate). This trend was especially obvious with horseradish and tobacco. At the same time, our experiments pointed out to a poor survival of allochtonous bacteria added into soil, either bulk or vegetated. In summary, obtained data can be beneficial for more effective designing of engineered bioremediation strategies based, for instance, on intrinsic microflora stimulation.

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