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Aerobic and oxygen-limited enrichment of BTEX-degrading biofilm bacteria: dominance of Malikia versus Acidovorax species

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Abstract:

Due to their high resistance against environmental challenges, bacterial biofilms are ubiquitous and are frequently associated with undesired phenomena in environmental industry (e.g. biofouling). However, because of the high phylogenetic and functional diversity, bacterial biofilms are important sources of biotechnologically relevant microorganisms, e. g. those showing bioremediation potential. In our previous work, the high phylogenetic and metabolic diversity of a clogging biofilm, developed in a simple aromatic hydrocarbon (BTEX)-contaminated groundwater well was uncovered. The determination of relationships between different groups of biofilm bacteria and certain metabolic traits has been omitted so far. Therefore, by setting up new biofilm-based enrichment microcosms, the research goal of the present study was to identify the aerobic/hypoxic BTEX-degrading and/or prolific biofilm-forming bacteria. The initial bacterial community composition as well as temporal dynamics due to the selective enrichment has been determined. The obtained results indicated that the concentration of dissolved oxygen may be a strong selective force on the evolution and final structure of microbial communities, developed in hydrocarbon-contaminated environments. Accordingly, members of the genus *Malikia* proved to be the most dominant community members of the aerobic BTEX-degrading enrichments. *Acidovorax* spp. dominated the oxygen-limited/hypoxic setup. During the study, a strain collection of 23 different bacterial species was obtained. Non-pathogenic members of this strain collection, with outstanding biodegradation (e.g. *Pseudomonas*, *Variovorax* isolates) and biofilm-forming potential (e.g. *Rhizobium*), may potentially be applied in the development of biofilm-based semipermeable reactive biobarriers.

Keywords: biodegradation, biobarriers, biofilm, BTEX, Catechol 2,3-dioxygenases, oxygen-limited