Title:

Biodegradation of 2-fluorophenol in a rotating biological contactor

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Rotating biological contactors (RBCs) are attached growth bioreactors that can be used for the treatment of slow degrading (micro)pollutants. The main advantages of RBCs are high biomass retention, simplicity of design and operation, short start-up and high treatment efficiency. These bioreactors are thus very promising for the biological post-treatment of industrial wastewaters, as several industries are dealing in their wastewaters with slow degrading compounds, such as organofluorines. The use of immobilised cultures is promising to enable long-term adaptation for biodegradation of these compounds, which generally cannot be attained in conventional activated sludge processes.

The performance of a laboratory scale RBC towards shock loadings of 2-fluorophenol (2FP) was investigated in this work. During a period of ca. 2 months, and every 2 weeks, a 48 h organic shock loading with 0.22 mM of 2FP fed simultaneously with an acetate (2.45 mM) containing medium was applied to a stable operated RBC. No biodegradation of 2FP was observed. Bioaugmentaion of the RBC with a specific bacterial strain able to degrade 2FP was subsequently carried out and, along ca. 6 months, intermittent 48 h organic shock loadings with a range of 0.22 mM to 1.76 mM of 2FP were applied. Degradation of the compound was observed, indicating that bioaugmentation is often necessary when biodegradation of highly recalcitrant compounds is targeted. The success of bioaugmentation was followed by molecular techniques (FISH, DGGE) and by plating biofilm samples in nutrient agar, in order to clarify the role of the inoculated strain in the biodegradation process and the impact on the microbial community of the biofilm. From the established microbial community in the biofilm, bacterial strains able to degrade other fluorinated compounds were recovered after one year operation, for which metabolic studies are under way.

The biodegradation of fluorophenols has been scarcely reported in the literature and this study reports successfully bioaugmentation of RBCs with specialized bacteria.

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