Impact of bacterial activity on turnover of insoluble hydrophobic substrates (phenanthrene and pyrene)—Model simulations for prediction of bioremediation success - DTU Orbit (08/11/2017)

Impact of bacterial activity on turnover of insoluble hydrophobic substrates (phenanthrene and pyrene)—Model simulations for prediction of bioremediation success

Many attempts for bioremediation of polycyclic aromatic hydrocarbon (PAH) contaminated sites failed in the past, but the reasons for this failure are not well understood. Here we apply and improve a model for integrated assessment of mass transfer, biodegradation and residual concentrations for predicting the success of remediation actions. First, we provide growth parameters for Mycobacterium rutilum and Mycobacterium pallens growing on phenanthrene (PHE) or pyrene (PYR) degraded the PAH completely at all investigated concentrations. Maximum metabolic rates vmax and growth rates μ were similar for the substrates PHE and PYR and for both strains. The investigated Mycobacterium species were not superior in PHE degradation to strains investigated earlier with this method. Real-world degradation scenario simulations including diffusive flux to the microbial cells indicate: that (i) bioaugmentation only has a small, short-lived effect; (ii) Increasing sorption shifts the remaining PAH to the adsorbed/sequestered PAH pool; (iii) mobilizing by solvents or surfactants resulted in a significant decrease of the sequestered PAH, and (iv) co-metabolization e.g. by compost addition can contribute significantly to the reduction of PAH, because active biomass is maintained at a high level by the compost. The model therefore is a valuable contribution to the assessment of potential remediation action at PAH-polluted sites.

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