

Advances and challenges in large-scale biofuel production

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The search for cheaper and cleaner fuels has led to significant efforts in search for novel techniques for biofuel production. The challenges in the area remain engineering microorganisms which can process cheaper and more readily available raw materials, give large yields of fuels, and are functional under a range of operational conditions. Large scale production of biofuels is likely to put ecological pressure on natural resources, and have strong impact on biodiversity. In this talk, I discuss the recent advances in engineering microorganisms, and critically analyze the potential impact of large scale production of biofuels on biodiversity and ecological balance.

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Effect of carbonaceous materials on the bioavailability of Polybrominated Diphenyl Ethers (PBDEs) to bacteria in sediment

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Bioavailability is an important factor regulating the fate and toxic effects of hydrophobic organic compounds (HOCs) in sediment. Carbonaceous materials (CMs) including carbon nanotubes and black carbon have attracted attention around the world because of their high sorption capacity for hydrophobic organic compounds (HOCs); however, the effect of CMs on the desorption and bioavailability of HOCs in sediments is not well known. In this research, desorption and anaerobic biodegradation of BDE 47, aged in sediments amended with CMs including two kinds of black carbon and two kinds of carbon nanotubes for 100 days, were studied. The desorption rate of BDE 47 was correlated with the specific surface area of CMs, and a negative correlation was observed. The desorption process of BDE 47 in sediment, which could be described by a three-phase first-order equation consisting of rapid, slow, and very slow desorption fractions, could strongly affect their degradation due to the slow rate of desorption. In the sediments containing CMs, positive correlations were observed between the degradation rate and the fraction of rapid desorption for BDE 47; meanwhile, negative correlations were observed between the degradation rate and the fraction of very slow desorption. This suggested that the fraction of rapid desorption of BDE 47 may dominate the degradation of BDE 47 in sediment amended with CMs, and can be used to predict the bioavailability of adsorbed BDE 47. With the increase of CM content in sediments, the quantity of degradation product from BDE 47 decreased rapidly. But when the content of CMs was higher than 3%, there was no significant difference of the total quantities of biodegradation products among various CMs in sediments, suggesting a greater impact of CM content on the bioavailability of BDE 47 to bacteria than CM sources.

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