Danish Offshore Technology Centre
Technology Conference 2022

Marine biodegradation of discharged chemical components –

Approaching actual environmental biodegradation kinetics

Mette T. Møller, Heidi Birch & Philipp Mayer

Technical University of Denmark, Department of Environmental and Resource Engineering

High volumes of produced water containing a complex mixture of chemicals are discharged from offshore oil platforms to the marine environment. High-quality and environmentally relevant biodegradation data for the discharged chemicals is needed for assessing and minimizing their environmental risks and impacts. Standardized biodegradation are typically conducted with single chemicals and at high concentrations, which is in contrast to the environmental situation that is characterized by complex chemical mixtures at very low concentrations. This research aims at bridging the gap between the biodegradation kinetics obtained in standardized laboratory tests and the actual biodegradation kinetics in the marine environment. Produced water from a platform in the North Sea (emitted chemicals) was thus diluted in seawater (native degrader microorganisms) in a novel biodegradation testing approach[1]. A series of parallel biodegradation experiments were run for 60 days at different dilution levels and at the sampling temperature of the seawater. During the experiments, the remaining of the individual produced water chemicals in biotic (seawater) relative to abiotic (ultrapure water) test systems was determined using a highly sensitive analytical technique. These experiments yielded a large set of biodegradation kinetic data for known and unknown chemical components, and at different dilution factors. Biodegradation kinetics were generally faster at higher dilution. The main challenge is now to assign more of the obtained biodegradation kinetics to the discharged chemicals.

[1]Birch, H., Hammershøj, R. & Mayer, P. (2018). Determining Biodegradation Kinetics of Hydrocarbons at Low Concentrations: Covering 5 and 9 Orders of Magnitude of K_{ow} and K_{aw}. Environmental Science and Technology 52: 2143-2151. DOI: 10.1021/acs.est.7b05624.