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Investigating the effect of test concentration on biodegradation kinetics of two hydrophobic complex mixtures

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While risk assessment of mono-constituent substances has been in focus for many years, regulatory and scientific attention has lately shifted towards investigating the exposure, fate and effects of chemical mixtures. This includes multi-constituent substances and substances of Unknown or Variable Composition, Complex Reaction Products and Biological Materials (UVCBs). Petroleum products and essential oils are UVCBs, and difficult to test as they cannot be described by a simple chemical structure and contain unknown constituents and highly hydrophobic organic chemicals. In this study we combined a recently established platform for biodegradation testing of hydrophobic and volatile chemicals with new advancements in passive dosing to determine biodegradation kinetics of two complex and hydrophobic mixtures, diesel oil and lavender oil. The aims were 1) to investigate the effect of changing the initial mixture concentration on the biodegradation kinetics and 2) to couple delayed biodegradation to toxicity, which was measured as inhibition of ^{3}H-leucine incorporation. Passive dosing from a silicone rod was used to set the mixture composition and mixture concentration level in the tests and facilitated stable and reproducible initial test concentrations in many replicate test systems. All tests were carried out in gas-tight autosampler vials with a headspace. Automated head-space Solid Phase Microextraction (HS-SPME) was carried out directly on the test systems and coupled to gas chromatography mass spectrometry (GC-MS) for chemical analysis. Primary biodegradation kinetics were then calculated based on a ratio between biotic and abiotic test systems. The first results show a correlation between test concentration, biodegradation kinetics and toxicity and provide a basis for further studies on biodegradation of complex mixtures as well as on the link between toxicity and biodegradation kinetics.