Session: Linking Models, Experiments and Measurements to Reliably Investigate the Environmental Fate and Effects of Hydrophobic Organic Contaminants and Mixtures (I)
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Biodegradation testing of volatile chemicals in water-sediment systems (OECD 308)

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OECD 308 guideline is used for biodegradation testing of chemicals in water-sediment systems. The guideline mentiones that it is not suitable for testing volatile chemicals and recommends a closed flask setup for testing slightly volatile chemicals. However, a clear guidance on system geometry and construction of the recommended test setup is lacking. In such tests, the choice of system geometry and sediment:water (S:W) ratio influences the partitioning and hence degradation of test chemicals. Additionally, it needs to be addressed how volatilisation should be considered in such tests during data treatment. Our objective was to adapt recently developed improved test setups to conduct OECD 308 test using four ^{14}C labelled volatile chemicals with different volatilisation range (phenanthrene < biphenyl < tetralin< decane). The data obtained were used to understand the underlying processes and suggest possible data treatment and data reliability measures.

Two types of sediment were used. The test setup comprised of 50g (dry weight) sediment in a 500 mL vessel (Cylindrical, Ø= 5 cm) with location water with a S:W ratio of 1:3 and 1:4 for the high OC (Organic Carbon) and low OC sediment sample, respectively. The setup consisted of a permanently connected tenax tube and an internal NaOH trap to capture volatilized and mineralized fractions. The samples were applied with test chemicals using an appropriate co-solvent. Every week the headspace of samples was oxygenated to 18-20% oxygen saturation. At sampling the sample bottle was opened only after headspace stripping of air through the tenax tube. The tenax tube and NaOH trap were taken for analysis. The overlaying water was separated using a pipette and both sediment and water phase were further taken for extraction and further analysis. The sediment phase after extraction was allowed to dry and was combusted to determine the non-extractable residues (NER).

The average mass balance was 91.3% ± 7.3 (N= 48), 99.4% ± 7.0 (N=46), 86.4 % ± 6.93 (N=50) and 93.2% ±9.9 (N=44) for phenanthrene, biphenyl , tetralin and decane studies. Generally, we observed that system geometry, S:W ratio used, had an influence on the partitioning of the test chemicals. Formation of biofilms on the overlaying water phase was very characteristic to closed setup applied with co-solvent (except sterile samples). We suggest reporting of procedural recovery, which improves the data reliability in the context of testing volatile chemicals.