Sorptive capacities of lipids determined by passive dosing of non-polar organic chemicals - DTU Orbit (08/11/2017)

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Lipids often are considered the major partitioning phase for non-polar organic chemicals. What is referred to as “lipid”, however, is a complex matrix consisting of a highly variable mixture of neutral (‘storage’) and polar (‘membrane’) lipids that usually is operationally defined by the extraction protocol. Furthermore, depending on an organism’s fraction of lipids and proteins and the properties of a chemical, other sorptive phases (e.g. proteins) may be particularly important. The aim of the present study was to expand our previous studies of the sorptive capacities of pure storage lipids into other pure phases and more realistic media, i.e. extractable organic matter (EOM) obtained by lipid extraction of various biota samples. Our experimental protocol included: i) extraction of biota tissues; ii) passive dosing of replicates of each EOM sample with cyclic volatile methylsiloxanes (cVMS), chlorobenzenes and polychlorinated biphenyls via a common headspace over an olive oil donor phase to transfer the same chemical activity into the samples; iii) sampling of EOM and olive oil controls at different time points; iv) purge-and-trap extraction of the model chemicals onto ENV+ SPE cartridges, elution and GC/MS analysis; v) characterization of the lipid composition in all samples via NMR. Our experiments demonstrate that the sorptive capacities of the EOM samples do not differ significantly from the olive oil controls if the EOM consists of neutral lipids only. However, the EOM samples show small but statistically significant differences in their sorptive capacities for the (semi)volatile model chemicals if other components such as phosphatidylcholine (PC) and cholesterol are present in quantifiable amounts. Based on the lipid composition quantified by NMR and literature data for the chemicals’ partition ratios between PC/water and storage lipid/water, we modeled the chemicals’ partitioning into the EOM and compared the model results to the measured concentrations. The study provides a new basis for unravelling biomagnification, since an increase in concentration with trophic level can be divided into a sorption capacity effect and an increase in chemical activity.

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