



On the challenge to assess the exposure of organic contaminants in matrices with high partition coefficients

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Published in:
SETAC Europe 25th Annual Meeting

Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Hilber, I., Mayer, P., Gouliarmou, V., Hale, S. E., Cornelissen, G., & Bucheli, T. (2015). On the challenge to assess the exposure of organic contaminants in matrices with high partition coefficients. In *SETAC Europe 25th Annual Meeting: Abstract Book* SETAC.

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MO406 On the challenge to assess the exposure of organic contaminants in matrices with high partition coefficients. Hilber, Agroscope ART; P. Mayer, Technical University of Denmark / Department of Environmental Engineering; V. Gouliarmou, Aarhus University, Science and Technology Faculty / Environmental Chemistry and Microbiology; S.E. Hale, Norwegian Geotechnical Institute / Environmental Engineering; G. Cornelissen, NGI; T. Bucheli, Agroscope ART / Analytical Chemistry Natural Resources Environmental Protection in Agriculture. To assess aqueous concentration (C_{free}) and bioaccessibility of organic contaminants in matrices that have high solid-to-water phase partition coefficients ($\log K_D > 5$) is an inherent challenge. Experiments that achieve efficient mass transfer and infinite sink conditions need to be properly designed. One key parameter controlling the (de)sorption process is the magnitude of the K_D value of the sample and the sink. Thus, the ratio of the $K_{D, receiving\ polymer}$ over the $K_{D, sample}$ multiplied by the $\frac{mass_{receiving\ polymer}}{mass_{sample}}$ should be at least 10 for depletive methods (bioaccessibility) and < 0.01 for non-depletive methods to determine C_{free} of a pollutant. We have chosen to investigate biochar as challenging matrix due to its PAHs formed during pyrolysis, the expected high K_D , and its agglomerative and hygroscopic nature. The slowly pyrolysed elephant grass (biochar 1) and sieved coniferous wood residues (biochar 2) had total concentrations of the sum of 16 US EPA PAHs of 63 mg/kg and 355 mg/kg, respectively. Polyoxymethylene was equilibrated with the biochars to assess the C_{dw} [1], whereas Tenax [2], silicone rods [3] and activated carbon/silicone composite (1:9 mass ratio) [4] were used as sorptive sink for the determination of PAH bioaccessibility. Cyclodextrin was in some of the approaches used as diffusive carrier [3, 4] in order to enhance the PAH desorption from the biochar. The C_{free} of 16 US EPA PAHs was 52 ng/L for biochar 1 and 71 ng/L for biochar 2, which are very low levels for a matrix containing PAHs in the mg/kg range. The reason for these low C_{free} are the very high $\log K_D$ values that ranged from 5.7 for naphthalene in biochar 1 to 7.6 for pyrene in biochar 2. The results from the depletive methods revealed at the most 1-2% of bioaccessible PAHs. The depletive methods impressively showed the virtual absence of bioaccessibility in situations in which the contaminants are strongly sorbed or entrapped in the matrix. The results suggest that the tested biochars are rather diffusive sinks than sources for PAHs. To consolidate the findings, more biochars with different feedstocks will be tested. Additionally, depletive methods for PAHs in biochar should be adapted by e.g. using biological media such as gut fluids. Both methods shall be used to adequately and conservatively assess the exposure and the risk and thus facilitate regulatory acceptance. Future research should address the influence of biochar stability.