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MOBILISATION OF POLYCYCLIC, ALKYLATED AND HETEROCYCLIC TAR OIL CONTAMINANTS FROM INDUSTRIAL SOILS USING LIPID EXTRACTION

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Abstract

Tar oil represents a complex mixture of environmental contaminants, where polycyclic (PAH) and alkylated (aPC) aromatic hydrocarbons are of main toxicological concern. These may occur as *pure* hydro-carbons as well as *impure* structures, where one or more carbon atoms in the aromatic ring are replaced with nitrogen, oxygen and / or sulphur atom(s) (heterocyclic or hPC). While investigations have focused mainly on the 16 pure PAH defined by the US-EPA for three decades, the risk potential posed by alkylated and / or *impure*, i.e. heterocyclic compounds in the environment has only been recognized recently.

The present study investigates whether the use of lipids as mild extractants for the biological or physical treatment of tar-oil contaminated soils can be extended to alkylated and impure compounds. Previous data indicated that spent and fresh vegetable oils can both be applied efficiently for the purpose of soil washing as well as amendments for soil bioremediation via increasing compound bioaccessibility, however focusing on pure PAH.

PAH alkylation and substitution induces different sorptive behavior in hPC and aPC as opposed to their pure and unalkylated counterparts. Accordingly, a pronouncedly different behavior in mobilization or extraction efficacy of aPC and hPC by lipids were observed in lab-scale experiments. Five fresh and spent vegetable oils were used to extract tar oil compounds from two historically contaminated soils over 7 days and were compared with bioaccessibility data from a passive sampler. Results indicate that alkylated and substituted compounds can be removed efficiently using vegetable oils from contaminated soils. Bioaccessibility of aPC and hPC was also found to be significantly different from their pure and unalkylated counterparts.

The present data support the use of mild lipid extraction as a possible treatment option for tar oil contaminated soils. Consequently, this treatment approach can be efficiently applied also to alkylated and substituted tar oil constituents exceeding the 'traditional' 16 EPA PAH.