

A NEW, QUICK, CLEAN AND EASY WAY TO MEASURE PAH AVAILABILITY IN CONTAMINATED SOILS USING THERMODESORPTION COUPLED WITH MOLECULAR ANALYSES

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The determination of the available fraction of a contamination is a major concern in risk assessment and management of contaminated sites as the impact of the contamination on the biota and the efficiency and/or the necessity to apply remediation treatments are ruled by this parameter. Availability measurement of organic contaminants, including PAHs, can be achieved through several methods (mild-solvent extraction, Tenax extraction, cyclodextrin extraction, passive sampling, biosensors...). However, several studies aiming to compare some of these methods point out inconsistencies in the results [1-4], underlining the need of a standardized method. Another challenge is to determine the available fraction in relation to a specific treatment/process (e.g. bioremediation, oxidation with specific oxidants...).

Therefore, the aim of this study is to develop a new method using thermodesorption (Td) for the determination of the fraction of the contamination available for different remediation treatments. This method is based on linking the desorption temperature to the binding strength between the contaminant and the soil constituents, i.e. the higher the desorption temperature of a compound, the higher its binding strength with the soil and the lower its availability.

This method was tested on PAH contaminated soils presenting different properties, exhibiting a varied range of PAH concentrations and different levels of PAH availability. The soils were desorbed during six 50 °C-temperature ranges (from 100 to 400 °C), followed by a 400-500 °C desorption and finally from 500 to 800 °C. The desorbed compounds were analyzed by GC-MS/FID coupling allowing the separation, the identification and the quantification of the PAHs, respectively.

The desorption steps allowed to determine a temperature profile for each PAH in each soil which was then compared to the efficiency of several chemical and biological remediation treatments performed in the lab. It was then possible to determine for each compound and for each treatment (microbial incubation, H₂O₂ oxidation, Fenton-like oxidation and KMnO₄ oxidation), the desorption temperature range corresponding to the available fraction of the contamination.

These first results are encouraging and underline the potential of the Td-GC-MS/FID for a quick determination of the available fraction of the contamination and could prove to be a powerful tool to assess the risks associated with the presence of contamination and/or to select the appropriate remediation treatment for sites contaminated with organic compounds.

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