Sofia Johnsson defended her thesis at Umeå University, Chemistry on April 17th. The opponent was Tuula Tuhkanen, Professor at the Institute of Environmental Engineering and biotechnology. Tampere University of Technology, Finland. A vast number of sites that have been contaminated by industrial activities have been identified worldwide. Many such sites now pose serious risks to humans and the environment. Given the large number of contaminated sites there is a great need for efficient, cost-effective remediation methods. Extensive research has therefore been focused on the development of such methods. However, the remediation of old industrial sites is challenging, for several reaons.

One major problem is that organic contaminants become increasingly strongly sequestered as they persist in the soil matrix for a long period of time. This process is often referred to as ‘aging', and leads to decreasing availability of the contaminants, which also affects the remediation efficiency. In the work underlying this thesis, the influence of soil and contaminant properties on the efficiency of various physical and chemical soil remediation methods was investigated. The investigated contaminants were polycyclic aromatic hydrocarbons (PAHs), polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs).

Briefly, the results show that as the size of soil particles decreases the contaminants become more strongly sorbed to the soil's matrix, probably due to the accompanying increases in specific surface area. This affected the efficiency of the removal of organic pollutants by both a process based on solvent washing and processes based on chemical oxidation. The sorption strength is also affected by the hydrophobicity of the contaminants. However, for a number of the investigated PAHs their chemical reactivity was found to be of greater importance for the degradation efficiency. Further, the organic content of a soil is often regarded as the most important soil parameter for adsorption of hydrophobic compounds. In these studies the effect of this parameter was found to be particularly pronounced for the oxidation of low molecular weight PAHs, but larger PAHs were strongly adsorbed even at low levels of organic matter. However, for these PAHs the degradation efficiency was positively correlated to the amount of degraded organic matter, probably due to the organic matter being oxidized to smaller and less hydrophobic forms. The amount of organic matter in the soil had little effect on the removal efficiency obtained by the solvent-washing process. However, it had strong influence on the performance of a subsequent, granular activated carbon-based post-treatment of the washing liquid.

In conclusion, the results in this thesis show that remediation of contaminated soils is a complex process, the efficiency of which will be affected by the soil matrix as well as the properties of the contaminants present at the site. However, by acquiring thorough knowledge of the parameters affecting the treatability of a soil it is possible to select appropriate remediation methods, and optimize them in terms of both remediation efficiency and costs for site- and contaminant-specific applications.

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