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Abstracts

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Comparative Effects of Several Cyclodextrins on the Extraction of PAHs from a Real Contaminated Soil

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Polycyclic aromatic hydrocarbons (PAHs) are persistent organic pollutants (POPs) attracting extensive attention worldwide. Soils from many sites, such as areas of coal storage, coke oven plants, manufactured gas plants and areas of coal tar spillage present a high contamination level by PAHs. Due to their low solubility in water, the presence of PAHs in the soil matrix constitutes a long-term source of groundwater contamination, and their toxic, mutagenic and carcinogenic properties are responsible that the remediation of PAH-contaminated soil becomes a major environmental concern. In order to enhance the desorption rate of organic pollutants, various extracting agents have been used. Recently, cyclodextrins (CDs) have been proposed as an alternative agent to enhance the water solubility of hydrophobic compounds and thus their availability for biodegradation. The objectives of the present work were: to identify the level of PAHs of an aged-contaminated soil sample from a former chemical industry plant and to evaluate the ability of a natural cyclodextrin (β -cyclodextrin, BCD) and three chemically modified cyclodextrins: 2-hydroxypropyl- β -cyclodextrin (HPBCD), partially methylated- β -cyclodextrin (PMBCD), and hydroxypropyl- γ -cyclodextrin (HPGCD) to extract the sixteen PAHs considered as priority pollutants by US-EPA. A real contaminated soil from the surrounding area of a deserted chemical industry situated in Asturias (North of Spain) was analyzed exhaustively in order to know its PAHs content. Then extraction experiments using an aqueous solution or solutions of one of the four CDs selected were carried out on this soil.

The results presented in this study show that according to Spanish legislation the analyzed soil had to be considered as a contaminated soil. Its total PAHs content was about 1068.77 ± 100.81 mg Kg⁻¹, being phenanthrene, anthracene and naphthalene the most abundant compounds (25.3, 24.7 and 17.1% of the total PAHs content of the soil, respectively). After the extractions experiments using CDs solutions, it was observed that the percentages of PAHs obtained were always higher than when the aqueous solution was used, although the three chemically modified cyclodextrins achieved higher extractions percentages than the natural cyclodextrin (BCD). From the sixteen selected PAHs, the highest extraction percentages was always obtained for the 3-rings PAHs, what is related with the more appropriated size and shape of this compounds with respect to the cavity dimensions of the CDs studied.