



Use of humic acids derived from peat and lignite as phenanthrene sorbents

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A broad range of materials is being applied for environmental remediation of water, among them sorbents such as humic acids. Being natural substances, the extraction and purification of humic acids might be cheaper than the production of synthetic sorbents. Having higher absorbing capacity than most of the sorbents used to date, humic acids have a competitive advantage against commonly used sorbents such as active charcoals and biochar. Humic acids are "complex colloidal super-mixtures" that are characterized by their functional groups. Therefore, composition and molecular formula can vary depending on the properties of the parent material. The aim of this project was (a) to study the sorption capacity of humic acids derived from peat and lignite samples picked up from deposits spread throughout Greece and (b) to compare the results with these of the parent materials. This comparison provides an insight to which matrix samples are suitable for further chemical treatment for the isolation of humic acids to be used as sorbents. The selected model pollutant was phenanthrene, which is a PAH that consists of three fused benzene rings. Humic acids were extracted according to the methodology proposed by the IHSS, slightly modified, in order to fit better to the properties of organic sediments. Sorption experiments were conducted by mixing 0.004 g of the sorbent (peat or lignite or humic acid) with aqueous solutions of phenanthrene at different concentrations of 30, 50, 100, 300, and 500 $\mu\text{g/L}$. The results show that phenanthrene sorption is higher for the humic acid than for the original lignite and peat samples. The original samples display higher sorption at the lower phenanthrene solutions (30 $\mu\text{g/L}$; K_d ranges from 15,000 to 47,000 L/kg) than at the higher one (500 $\mu\text{g/L}$; K_d ranges from 4,100 to 13,000 L/Kg) suggesting non-linear sorption. The humic acids display mainly linear isotherms with K_d ranges from 6,600 to 120,000 L/kg. Concerning the suitability of the studied samples as sorbents for remediation of aqueous environments, two samples showed significantly higher sorption capacity for the humic acid samples than for the original ones, most probably related to the higher coalification stage, and the maceral assemblage of the parent material.