Quick Assessment of Petroleum Products for Water Treatment and Potential Oil Exploration

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Abstract

All the petroleum products contain polycyclic aromatic hydrocarbons (PAHs). Depending upon the crude source and the distillation procedure, the amount and types of PAHs content in different petroleum products differ. Therefore, PAHs can be used as markers to detect petroleum products from different sources/site and/or for oil exploration. In addition, PAHs are often carcinogenic, and mutagenic, therefore rapid regulation in water is of interest. To analyze these compounds, conventional methods like GC-MS, HPLC with UV visible or fluorescence detector etc. are time consuming, expensive and require a pre-separation procedure before analysis. In contrast fluorescence, can be performed directly and selectively on petroleum products. Petroleum products contain a broad range of PAHs that exhibit fluorescence maxima at various excitation/emission wavelengths. Two ring aromatic hydrocarbons such as naphthalene exhibit fluorescence maxima at low emission and excitation wavelengths, while five ring compounds such as perylene have maxima at high emission and excitation wavelengths; three and four ring compounds exhibit intermediate fluorescence characteristics. Total synchronous fluorescence spectroscopy developed during PhD work of the PI (Anal. Bioanal. Chem. 374, 2002, 304 – 309) has been a good tool to analyze petroleum products and PAHs for a quicker assessment. In this proposal, we will collect the samples from different sites in Lebanon to generate a fluorescence fingerprint database for quick assessment of petroleum products/PAHs for water treatment and potential oil exploration. Further a quantitative model will be developed based on various chemometric principles for the analysis of petroleum products/PAHs. A successful fluorescence database will trigger to develop a fiber optic fluorescence sensor in future that can be applied for direct and online monitoring of petroleum products/PAHs in various sites. Water free of petroleum products/PAHs is essential. Second part of the project aims to address this concern by synthesizing nanomaterials and using nanotechnology, where curcumin will be doped in ZnO nanoparticles to efficiently remove petroleum products/PAHs from contaminated water. Our hypothesis is that doping curcumin in ZnO would further enhance adsorption of petroleum products/PAHs on ZnO surfaces. This hypothesis will be tested in this proposal by synthesizing a new series of curcumin

doped ZnO. These nanomaterials will be characterized by various spectroscopic and analytical techniques. Degradation/removal of PAHs in water samples by these nanomaterials will be investigated using the total synchronous fluorescence spectroscopic methods developed above. The effect of concentration, kinds of petroleum products, types of PAHs, and catalytic cycles will be examined towards possible water treatment.