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Distribution Characteristics and Potential Risk of PHAHs in Surface Sediments from Three Gorges Reservoir

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This study was undertaken to investigate the current contamination status of polyhalogenated aromatic hydrocarbons (PHAHs) in sediments from mainstream and 22 primary tributaries of the Yangtze River in Three Gorges Reservoir. The concentrations of 22 polybrominated biphenyl (PBB) congeners, 27 polybrominated diphenyl ether (PBDE) congeners, and 27 polychlorinated biphenyl (PCB) congeners in sediment samples were measured using the GC-MS/MS technique. The result shows that the observed values of PBBs and PBDEs were 22.41 and 35.24 pg g⁻¹ dw, respectively. PBB1, 31 and 103 are the most predominant PBB congeners. PBDE28, 47, 77 and 99 are the most predominant PBDE congeners, PBB209 and BDE209 were detected in > 39% of the samples, with geometric means 2.43 and 11.92 pg g⁻¹ dw. PCBs are the predominant compounds in sediment samples among the three PHAH subfamilies, with geometric mean 1,231.11 pg g⁻¹ dw, PCB8, 18, 28, 52 and 66 are the primary PCB congeners. The measured levels of PHAHs were compared with recent results reported in the literature and their respective sediment quality guidelines recommended by USEPA. The levels of PHAHs in the present study were generally lower than their respective threshold-effect levels, or were comparable to those reported in relatively uncontaminated freshwaters from other regions. This suggests that, in the reservoir, toxic biological effects on aquatic biota - due to PHAH contamination of sediments - can be expected to be negligible.

Photochemical sample treatment: A greener approach for PCBs analysis in sediments.

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Electrical installations and industrial outlets are the major source in environment of chlorinated organic compounds. These are distributed in several geographical areas through long-range atmospheric transport and deposition. Additionally, chlorinated organic compounds can be introduced in the food chain and reach the consumers in very high levels.

Besides toxicological studies on PCBs, recent research is focusing on more sophisticated analytical methods for PCBs detection. Distribution and dispersion of PCBs mostly occur through air, water, soils, and sediments. The latter are complex matrices whose analysis often involves costly extraction and purification procedures. In particular, PCBs are separated from environmental matrices by complete extraction with organic solvents, such as dichloromethane, hexane, acetone, or a combination of them.

Sample purification can be considered the most polluting step of the whole analytical process for PCBs determination in sediment samples. The use of photochemical methods for sample purification represents a state-of-the-art technique in Green Analytical Chemistry. In this work, first application of photochemical sample treatment for the selective removal or reduction of organic substances interfering with PCBs analyses in the sediments is reported. The method efficiency and robustness was compared with currently used chromatographic purification. Results based on the analysis of real and certified samples showed similar or improved detection thresholds and pointed out the advantages of the photochemical methodology in terms of costs and environmental friendly conditions.

Effect of External Sulfate on the Phosphorous Components Determined by 31P-NMR in the Sediments from Lake Donghu

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The influence of increasing external sulfate to lake eutrophication is of great significance. A six week experiment under indoor simulated condition was carried out to investigate the external sulfate transformation between the sediments and overlying water from Lake Donghu in Wuhan, China, and the influence of sulfate on the phosphorus components and enzyme relating to organic phosphorus degradation was discussed. The results showed the sulfate concentration in the overlying water decreased followed by a slow increase. The amount of sulfate reducing bacteria (SRB) in the sediments achieved the peak value in the third week, and the SRB amounts in the sediments of treatment with input sulfate were much higher than that of the control. ³¹P nuclear magnetic resonance was used to investigate the relative quantity of phosphorus components in the sediment extracts leached by NaOH-EDTA. The main components of phosphorus in Lake Donghu sediment were orthophosphate, phosphate monoester and phosphodiester, and the predominant one was orthophosphate. As for the organic phosphorus, the contents of phosphate monoester were much more than that of phosphodiester. The phosphate monoester increased due to the input of sulfate during the first four weeks, especially when the amounts of SRB were high. The activity of phosphomonoesterase of both treatment with input sulfate and control appeared maximum at the third week - and the former was significantly higher than the latter. It suggested that the external sulfate affected both the behavior of phosphate monoester and the activity of phosphomonoesterase, resulting in the variation of phosphorus of sediments.