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Distribution of polycyclic aromatic hydrocarbons between dissolved /colloidal and particulate phases in Aegean Sea water

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Polycyclic aromatic compounds (PAH) are widespread organic contaminants and considered as hazardous to the environment. Since PAHs are nonpolar and practically insoluble in seawater their biogeochemical cycling is controlled by their high affinity to aquatic particles, especially to the organic carbon or lipid content. Their partitioning between particulate and dissolved phases, is primarily controlled by the physicochemical characteristics of the PAH compounds and particles, including the solubility, and hydrophobicity of the PAHs and the chemical composition and surface area of the particles. Dissolved PAH are transported by molecular and turbulent diffusion and advection, while particle bound compounds are transported by turbulent diffusion and sediment transport, including settling and resuspension.

The aim of this work was to study the distribution of PAHs in Aegean seawater in both the dissolved / colloidal and the suspended particulate matter (SPM), to recognize their sources and to investigate the transformations affecting PAHs in the water column. The seawater samples were collected during 2014 and filtered through GF/F, 0.7 μm filters in order to separate the dissolved phase which contains not only the truly dissolved compounds but also most colloidal material and very fine particles and SPM. The PAHs were determined in the two phases by gas chromatography / mass spectrometry.

Although most PAHs are insoluble in seawater, their levels in the phases passed through the filters were much higher than those encountered in the corresponding SPM and accounted for 34 - 99 % (mean value 83 %) of the total. This suggests that in Aegean Sea the dissolved / colloidal phase play a significant role in the transport and flux of PAHs as well as in their bioavailability and ultimate fate. No correlation between the PAH concentrations in dissolved /colloidal phase and the SPM was observed, possibly due to the high contribution of PAHs in the colloidal form and to a differentiation of PAH association according to particle size The lower MW PAHs predominated in both dissolved and particulate phases and this demonstrates a mainly fossil origin for the PAHs.