Enhancement of the solubility of chlorinated pesticides by cosolvent-induced dissolution of sediment organic matter

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Ethanol has been promoted as a component of renewable fuels. Because of its miscibility, it can increase the aqueous solubility of persistent organic pollutants (POPs) by orders of magnitude. Sediment contains organic matter that, if dissolved, can likewise act as a cosolvent, further increasing the solubility of POPs. Under natural conditions, dissolved organic matter (DOM) may be composed of humic substances. However, sediment in urban rivers may contain other types of organic matter resulting from anthropogenic activity. This research seeks to assess the impact of DOM on the aqueous solubility of POPs, specifically organochlorine pesticides, in the presence of ethanol.

^{13}C-NMR and SEM-EDX were used to characterize the composition of DOM dissolved by ethanol-water mixtures. The carbonaceous speciation of the DOM varied depending on the source of the organic matter and the ethanol fraction of the mixture. The organic matter dissolved from an urban river sediment increased the pesticide aqueous solubility by as much as 1.5 orders of magnitude over that observed with ethanol as the sole co-solvent, a significantly larger increase than that observed for humic-based DOM. This increase could not be attributed solely to differences in the total amount of DOM. Elemental analysis of the DOM derived from the urban river sediment showed a greater preponderance of aliphatic carbon than the DOM derived from a humic soil, suggesting that carbon species dissolved from anthropogenically-impacted sediment have a greater potential for enhancing the solubility of POPs in the presence of ethanol.

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