EFFECTS OF STRUCTURE ON SORPTION OF SELECTED TETRACHLOROBIPHENYL CONGENERS BY NATURAL SOLUBLE ORGANIC MATTER

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ABSTRACT

Observations of data collected from the literature regarding the sorption from aqueous solution of hydrophobic, synthetic organic contaminants (SOCs) by soluble humic substances (characterized as dissolved organic carbon, DOC) suggest behaviors that cannot be reconciled solely by the hydrophobicity of the solute (as characterized by the octanol/water partition coefficient, $K_{ow}$). Various researchers have postulated that sorption by DOC of SOCs having three-dimensional molecular structures (e.g., polychlorinated biphenyls) might be less intense for a given degree of base hydrophobicity than that of planar SOCs (e.g., polynuclear aromatic hydrocarbons). A significant problem associated with comparisons of sorption of various classes of SOCs by DOC arises from necessarily employing differing experimental methodologies in measuring the magnitude of the SOC-DOC distribution coefficient ($K_{DOC}$). In order that values of $K_{DOC}$ for SOCs of varying structure could be measured using a common methodology – Apparent Aqueous Solubility Enhancement (ASE) – three tetrachlorobiphenyl congeners were selected for study based on their differing ortho, meta, and para substitutions of chlorine for hydrogen on the base biphenyl molecule. Two sources of natural soluble humic-like material (aqueous extracts from Canadian peat moss and fresh silver maple, Acer saccharinum, leaves) were prepared, sorption experiments were conducted using the ASE methods, and results were analyzed and interpreted based on the degree to which rotation about the single carbon-carbon bond of the biphenyl molecule might impart hindrance to the physical association of the particular congener within the structure of the natural organic material. Experimental results indicated that the chlorine positions indeed affected the capacity for sorption.