Solubility controls that determine dissolved organic matter composition of surface- and ground-waters

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Various studies of organic precursors, diagenesis, and removal by water treatment of dissolved and colloidal organic matter in diverse surface- and ground-waters found dissolved organic matter (DOM) to be derived from amino sugar, condensed tannin, lignin, and terpenoid precursors. Terpenoid-derived DOM is not removed by sorption on sesquioxide coatings during infiltration of surface water into groundwater, and is not removed by water-treatment flocculation with ferric and aluminum salts (Leenheer et al., 2003). "Black waters", such as the Suwannee River, contains DOM derived from condensed tannins (Leenheer and Rostad, 2004) which is almost completely removed by water-treatment flocculation with ferric and aluminum salts (Croue et al., 2000). Recent studies of fulvic acids isolated from wheat straw (Wershaw et al., 2003) and from the Neversink Reservior water supply of New York City found methyoxy-lignin structures that did not bind to iron and aluminium sesquioxides. Therefore, both fulvic acid ligand structures and mineral coatings containing iron and aluminum sesquioxides act a solubility controls on DOM concentrations and composition in natural water.

References

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A new understanding of reactivity and composition of humic substances using modern NMR and electrospray ionization mass spectrometry

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The advent of modern analytical methodologies, namely nuclear magnetic resonance (NMR) and electrospray ionization coupled to ultrahigh resolution mass spectrometry (MS) have provided a wealth of new structural information that has allowed for a more advanced understanding of the chemical structure and reactivity of natural organic matter (NOM) from a variety of environments. !- and 2-D solution NMR techniques have demonstrated the presence of some new types of components from humic substances in different environments. Polyhydroxylated alicyclic structures are clearly noted as having proteinaceous origins and carboxylated condensed aromatic structures are probably derived from soot and charcoal (black carbon). Electrospray ionization MS has opened the door to obtaining detailed elemental compositions for nearly all ionizable components of NOM. With ultrahigh mass accuracy we can assign unique elemental formulas to the vast number of peaks observed. We can clearly differentiate black carbon components, from lipid-like substances, and from other biochemical components that contribute to NOM. We find that a significant amount of black carbon comprises NOM.