# Factors Affecting Colored Dissolved Organic Matter in Aquatic Environments of the Southeastern United States

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The sunlight-absorbing (colored) component of dissolved organic matter (CDOM) in aquatic environments is widely distributed in freshwaters and coastal regions (Figure 1), where it influences the fate and transport of toxic organic substances and biologically important metals such as mercury, iron, and copper. CDOM also has significant effects on underwater visibility and ultraviolet radiation, and it is an important component of remotely sensed ocean color. In this research, we have examined two key factors, microbial degradation and sorption, that affect the loss of CDOM in rivers, estuaries, and coastal shelf regions of the Southeastern United States (Figure 2). Sorption involves the sticking of CDOM to particles that are in the water.

***Figure 1.*** *The Satilla River, like many rivers and estuaries in the coastal Southeastern United States has a high concentration of colored dissolved organic matter (CDOM) that gives the river a black appearance.*

CDOM is generally resistant to microbial decomposition, but this research has discovered an important pathway for its loss from aquatic environments that involves "photochemically stimulated" microbial degradation. We discovered that absorption of sunlight by CDOM results in its breakdown to low-molecular-weight substances that are readily degraded by microorganisms (Figure 3). Using measured efficiencies for the effects of sunlight on microbial decomposition of CDOM, we have developed procedures for forecasting its degradation as a function of time, location, and depth in coastal rivers and shelf regions of the Southeast (Figure 4).

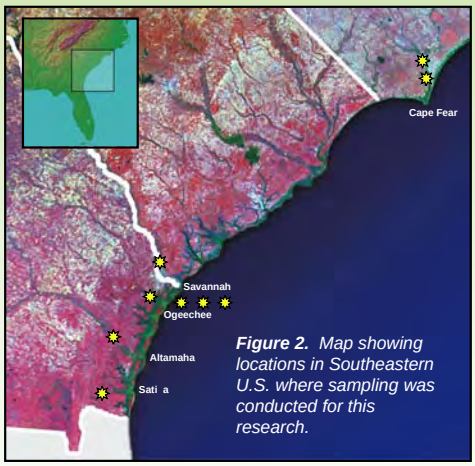


***Figure 2.*** *Map showing locations in Southeastern U.S. where sampling was conducted for this research.*

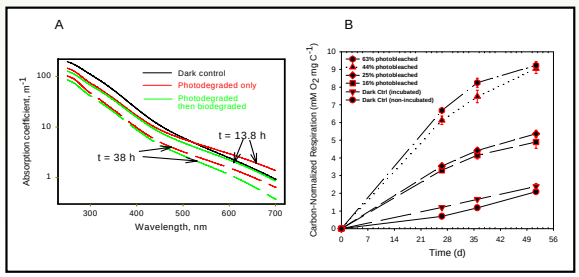


***Figure 3.*** *(A) Exposure to sunlight causes loss in the color and UV absorption by CDOM (photobleaching); (B) The photobleaching is accompanied by large increases in the biodegradability of the CDOM, indicated here by the observed increase in respiration for the photobleached CDOM.*

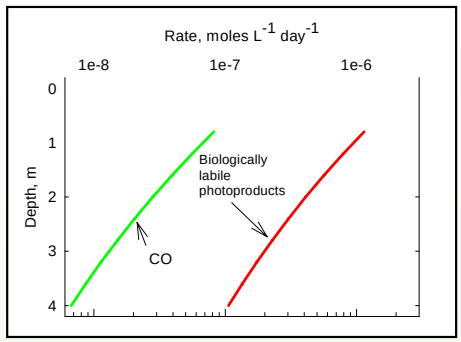


***Figure 4.*** *Depth dependence for CDOM photoreactions in the South Atlantic Bight (31o 43.43' N, 80o 38.83' W) on a cloudless summer day (June 28) in the southeastern U.S. These modeled results are based on measured efficiencies for the effects of sunlight on microbial decomposition of CDOM.*

CDOM also is lost by sorption to settling aquatic particulate matter (PM). We found that CDOM sorption to aquatic PM is a reversible process that can be quantified by use of partition coefficients. The research demonstrated that sorption is a major pathway for loss of CDOM in turbid waters, such as coastal estuaries (Figure 5), and that this loss is accelerated when ocean water mixes with freshwater. Measurements of changes in CDOM fluorescence showed that photo-stimulated microbial degradation coupled with sorption of CDOM onto aquatic PM can result in substantial losses of CDOM within estuaries of the coastal Southeastern United States (Figure 6).

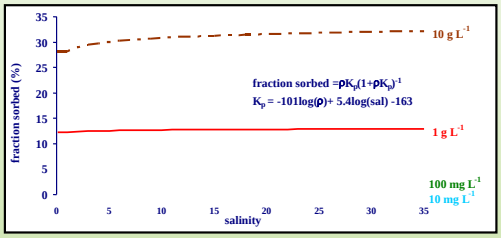


***Figure 5.*** *Sorption of CDOM to sediments is shown here to be a major pathway for loss of CDOM in turbid waters, such as coastal estuaries and it controls the concentration of CDOM in pore waters of bottom sediments.*

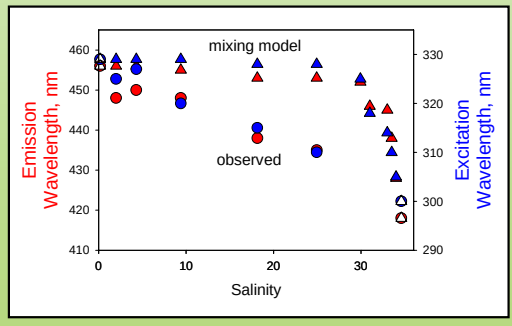


***Figure 6.*** *Comparision of observed data for CDOM fluorescence in the Satilla estuary on the coast of the Southeastern U.S. with data estimated using a mixing model that assumes no degradation of CDOM. The comparison indicates that substantial loss of CDOM has occurred during passage through the estuary.*

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