

Behavior of Organic Matter and Elements Loaded into River Water on Reaching the Estuary

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To examine the behavior of organic matter and elements derived from terrestrial ecosystems as a result of river becoming estuaries, model experiments were conducted using peat, litter, paddy soil, and manure samples. First qualitative and quantitative changes in organic matter and elements in suspensions of the samples with water due to mixing with sea water were examined by fractionating elements into a free form and three bound forms with water soluble organic matter (WSOM), insoluble organic matter (IOM), and clay particles (CP). Qualitative change in WSOM due to mixing with sea water was investigated using fluorescence and IR spectra and molecular size distribution. Then chemical characteristics of humic and fulvic acid (HA and FA) fractions in WSOM as well as complex forming capacity with metals and their stability in sea water of the FAs were determined. The decrease in organic C after mixing with sea water was largest for the peat sample (>90%) and smallest for the manure sample (7%>). Large percentages of P, which mainly existed in the bound forms with IOM and WSOM, and Fe, which mainly existed in the bound forms with CP, precipitated at 5% sea water. Mn and Zn were larger in the percentage of free form at 0% sea water than other elements, and the possibility that these elements have been precipitated and are subsequently exchanged by ion exchange with the increase in mixing ratio of sea water for some of samples. It was indicated that the decrease in TOC in WSOM was due to co-precipitation with the precipitation of insoluble materials. The fluorescence spectra showed that some kind of WSOM precipitated selectively by mixing with seawater. The molecular size distribution indicated that WSOM with larger molecular size decreased while WSOM with smaller molecular size increased by mixing with seawater. Higher FA/HA ratios in water extract from the samples than those in river water samples suggested the selective removal of HAs, which were loaded from terrestrial origins, from river water due to precipitation. The elemental composition, IR and ¹³C NMR spectra showed that the manure and litter FAs were larger in the content of polysaccharides and proteinoous materials whilst the peat FA contained polymethylene structures with higher percentage. The percentage of aromatic C in total C was similar among the above three FAs. The relative peak intensity of carboxyl C in the ¹³C CP/MAS NMR spectra was in order of the FAs from the peat, manure, and litter samples. The solubility of Fe, Cu, and Zn in seawater was increased due to binding with FAs. The concentrations of the three elements in the soluble form under presence of FAs were the manure FA > peat FA > litter FA. The amount of the elements bound with FAs per unit C in the present experiment was much larger than that existed in the samples. The difference in the concentration of the elements bound with WSOM among the samples could be attributed to the amount of the elements being able to bind with WSOM rather than the complex forming capacity of WSOM with the elements.