Distribution of dissolved humic subsrances in the Sanjyang Plain

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1. Introduction

Recent studies in the northern North Pacific have revealed that biological productivity is possible to be limited by iron availability there. Sanjyang Plain is located in the middle of Amur River. This area has most significantly changed recently. From Chinese scientific articles, approximately 10,000 km2 of wetland was reclaimed to form paddy fields from 1980 to 2000. Riverine iron cannot keep dissolved in the seawater without being a complex with organic materials such as humic substances formed in forest and wetland. Therefore, changes in land uses such as deforestation (forest fire, cultivation, and urbanization) and/or reduction of wetland may possibly reduce the biological productivity in the Sea of Okhotsk and the northwestern area of North Pacific Ocean.

The purpose of this study is to examine the characteristics of humic substances in the river water samples at Sanjyang Plain by three-dimensional excitation emission matrix (3-D EEM) spectroscopy.

2. Materials and methods

The river water samples were collected at 14 sites from nine rivers (Songhua R., Amur R., Muling R., Usuri R., Mudan R., Naoli R., Woken R., Yalu R., Nongjiang R) in August and September,2005. They were obtained using glass bottles, and filtered with Whatman GF/F glass fiber filters. The 3-D EEM spectra of the river water were measured by fluorescence spectrophotometry. Relative fluorescence intensity (RFI) of fulvic-like materials in the samples was expressed in terms of quinine standard unit (QSU). Ten QSU correspond to the fluorescence intensity of quinine sulfate(10ug/l) at an excitation wavelength (Ex.) of 350nm and an emission (Em.) wavelength of 455nm. We also measured absorbance spectra of the samples by UV-Vis spectrophotometry.

3. Results and discussion

The 3-D EEM spectra of fulvic-like materials in the river water samples had two peaks (Ex/Em=310-335nm/410-430nm[peak1] and Ex/Em=240-260nm/410-440nm[peak2]). RFI of both peaks was higher in August than in September except a few sites. Especially, at the upstream Songha River, the RFI was approximately three times higher than the middle-downstream. The peak height ratio of peak1/peak2 for the river samples was 0.9-1. These results indicate that humic substances in river waters from this area have similar structures.

Regarding to the Songha River, the RFI was almost constant from the upstream to downstream in August, but in September, it was approximately two times higher in the middle site than the upstream site. Absorbance at 280nm increased approximately three times from upstream to downstream. It’s different from variable trend of fulvic-like materials. This shows that aromatic materials in the Songha River may contain not only humic substances. The amount and behavior of humic substances in these rivers vary with month and are controlled by watershed environments.