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Characteristics and behavior of dissolved organic matter in the Kumaki River in Noto Peninsula, Japan

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[Introduction]

The management of SATOYAMA is important to sustain material cycle and ecosystem. Recently, SATOYAMA faces to degradation of ecosystem caused by the abandonment of forest and farmland, and then influence chemical properties of water from soil and river. Humic substances being high-molecular organic acid is concerned with the coastal biological productivity. The change in SATOYAMA environments caused by deforestation and unmanagement of forests and paddy fields may reduce transport of organic matter from watershed to coastal area. Therefore, we need to elucidate the migration behavior of humic substances on a scale not only local, but also watershed.

The purpose of this study was to elucidate the variation of structural properties, concentration and migration behavior of organic matter caused by abandonment of farmland and forest area. We also assess the impact of the abandonment to ecological system in river ? coastal environment. This study investigated at the Kumaki River and Nanao Bay, which is located on the Noto Peninsula in Ishikawa Prefecture. The coastal biological productivity is high in the Noto Peninsula, and the abandonment of forest and farmland in progressing. In this presentation, we report seasonal dynamics of humic substances in Kumaki river waters collected on the rainless days in during the period from June 2009 to May 2010.

[Study sites and Methods]

Water and sediment samples were collected from river, paddy and drainage at Kumaki River, Hiyou River and Ninomiya River during the period from June 2009 to November 2011. We also collected water and sediment samples at the western part of Nanao Bay in August 2011. Water samples were filtered through GF/F filter and kept under freezing until analysis. To reveal the structural properties and concentration of dissolved organic matter (DOM), river water samples were measured by three-dimensional excitation emission matrix (3D EEM) spectroscopy and high-performance size exclusion chromatography (HPSEC). Precipitation and water level data was provided by Ishikawa prefecture river total information system (Ishikawa prefecture, civil engineering division).

[Results and Discussions]

Humic-like peaks were detected at Excitation / Emission: 300-340 / 430-465 nm for 3D EEM spectra in all river water samples. Relative fluorescence intensities (RFI) of humic-like peaks increase downward from upstream to downstream. This is considered that humic-like materials flowing into the river between midstream and downstream. The peak position of the highest RFI of four humic-like peaks (Peak H1-H4) was different from upstream and downstream. Whereas upstream and midstream river waters has a higher RFI of Peak H1, but downstream river water has a higher RFI of Peak H2.

Moreover, to understand characteristics of humic-like materials, the river water samples were analyzed by HPSEC with detection wavelength of Ex. / Em.: 320 / 430 nm corresponding to humic fluorescence peak. Three sharp peaks were detected among retention time 8.5 - 10.5 minutes (Peak 1-Peak 3), and Peak 2 was highest peak intensity. Intensity ratio of Peak 1 and Peak 2 was lower in midstream and downstream than upstream. The low peak intensity ratio shows the contribution of low-molecular fraction. This is considered that low-molecular materials are supplied from paddy fields expending from midstream to downstream watershed. These results indicate that humic-like materials are loaded from midstream and downstream have different properties.

Keywords: Noto Peninsula, DOM, Humic substances, 3D EEM spectroscopy, HPSEC