

Factors controlling the spatial distribution of dissolved organic matter with changes in the C/N ratio from headwaters to lower reaches of the Ishikari River

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Dissolved organic matter (DOM) is important for the source of energy and organic matter in riverine ecosystems. In addition, dissolved organic nitrogen (DON) plays an important role as organic nutrient for heterotrophic microorganisms in rivers. Although factors controlling the quantity and quality of stream and riverine dissolved organic carbon (DOC) has been extensively studied, DON has been less studied compared with DOC. To evaluate the factors controlling the riverine DOM involving the C/N ratio, we investigated spatial distribution of DOC and DON concentrations and DOM optical properties in the Ishikari River and its tributaries, where the upper reaches are forested and the middle and lower reaches are used for agricultural purpose, in particular paddy fields. We also conducted dark incubation experiments to determine the bioavailability of DOC and DON as a factor controlling the spatial distribution. DOC and DON concentrations in the mainstream increased along with river flow in the upper and middle reaches and unchanged in the lower reaches. The C/N ratio of bulk DOM tended to continue to decrease from upper reaches to lower reaches. The optical properties showed changes in DOM characteristics to more high molecular weight and high aromaticity from upper reaches to middle reaches, suggesting flooded paddy fields largely altered the DOM concentration and composition in the mainstream. In the lower reaches, C/N ratio of bulk DOM decreased but optical properties did not change along with water flow, suggesting that C/N ratio of bulk DOM was changed with biological activity in situ in the river. The biodegradation of DOC was observed in four samples collected in the upper and lower reaches, while was not observed in two samples collected in the lower reaches. On the other hand, there was no significant change in DON concentration during dark incubation experiments in samples for all six sites. Such results of dark incubation experiments implied that microbial degradation is a factor decreasing the C/N ratio of bulk DOM in the upper and middle reaches of the Ishikari River Basin. On the other hand, large microorganisms, which are removed from dark incubations, are suggested to be degraded C-rich DOM to decrease the C/N ratio of bulk DOM in the lower reaches of the Ishikari River Basin.

Keywords: Dissolved organic matter, C/N ratio, Optical properties, Bioavailability, Land use land cover, Ishikari River