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Changes in spectroscopic DOM source indices upon natural transformation processes

Mi-Hee Lee (1), Kyung-Hoon Shin (2), and Jin Hur (1)

(1) Sejong University, Department of Environment and Energy, Seoul, Republic of Korea, (2) Hanyang University, Department of Marine Sciences and Convergent Technology, Ansan, Republic of Korea

Although absorption and fluorescence spectroscopy have been widely used for tracing the sources of dissolved organic matter (DOM) in natural systems, no studies have been conducted to explore the potential of changes in the spectroscopic indices upon natural transformation processes.
For this study, two different DOM end members (Suwannee River fluvic acid (SRFA) and algogenic organic matter (algal DOM) were used to track the changes of several well-known optical indices caused by biodegradation, photoirradiation, and adsorption. The DOM mixtures with the two sources were prepared with the mixing ratios of 0:1, 1:9, 1:3, 1:1, 3:1, 9:1 and 1:0 for SRFA: algal DOM, and they underwent the natural transformation processes in laboratory.
Biodegradation and photoirradiation resulted in the opposite directions of the changes (e.g., a280, SUVA280, and HIX), while the indices were shifted in similar directions by photoirradiation and adsorption. BIX showed a decreasing trend with the progress of the three processes. The extent of the variation in SUVA280 was smaller for the DOM mixture with more abundant SRFA than the counterparts under biodegradation. However, the opposite trends were observed for photoirradiation and adsorption. Overall, the processes-driven variations in fluorescence indices were greater for the algae-versus the terrestrial source DOM except for HIX (Zsolnay). Three different fluorescent components were identified as microbial humic-like (C1), terrestrial humic humic-like (C2), tryptophan-like fluorophores (C3) via EEM-PARAFAC. Before the natural transformation processes, the original SRFA and algal DOM were mostly comprised of C1+C2 (91 - 94%) and C3 (95 - 96%), respectively. For the DOM mixture with more contribution of algae, C1 and C2 tend to increase, and C3 was decreased by biodegradation. The opposite directions of the changes between C2 and C3 were observed upon photoirradiation and adsorption.
This study provided a new insight into the roles of natural transformation processes in altering the optical indices for tracking DOM sources.