Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.25427

A novel approach for identifying anthropogenic DOM source using EMMA model based on spectroscopic indices and stable & radioactive isotopes in complex river watershed

MIN-SEOB KIM[1], SEOYEON HONG[1], BORA LIM[1], TAEWOO KANG[1], GWANHO LEE[2], BYUNGYONG YU[2], EUNMI KIM[1], YUJEONG HUH[1] AND JONGCHEON LEE[1]

[1]National Institute of Environmental Research
[2]Advanced Analysis Center, Korea Institute of Science and Techolonogy

Dissolved organic matter (DOM) in complex river watershed dramatically changes based on point and non-point sources. However, anthropogenic DOM sources have not been adequately explored to date. In this study, we developed an innovative approach to reveal DOM sources, and validated an integrated framework during pre-monsoon, monsoon with heavily rainfall, and post-monsoon season using multi indicators, such as spectroscopic indices (FI, BIX, HIX, SUVA), stable isotopes (^{13}C&^{15}N-POC, ^{13}C-DOC), radioactive isotopes (^{14}C-DOC, ^{7}Be, $^{210}Pb_{ex}$), and models (hydrological simulation program Web GIS and End-member Mixing Analysis (EMMA)), to determine anthropogenic DOM sources and fluxes among different land-use types in the complex river watershed. Several potential end-members of DOM sources were collected, including natural (soil, suspended algae, fallen leaves, riparian plant and groundwater) and anthropogenic source (effluent of urban, livestock, forest, agricultural land (rice, paddy field), wastewater treatment and artificial wetland). As a result, the contribution rate of effluent from rice farmland and urban was 64.8% during pre-monsoon season, and several origins (autochotonous and allochotonous) were mixed due to the influence of runoff water during heavy rain fall monsoon season, and contribution rate of the wastewater treatment plant effluent increased (49.4%) due to capacity of treated water in post-monsoon season. As a result of calculating the base outflow during monsoon season, the urban sewage effluent was the highest at 401m^3 for 8 hours in comparison with forest origin (126.2 m^3). In addition, DOM was primarily influenced by ^{14}C-enriched modern carbon origins (320~1,370 years) from rice agricultural land and forest during pre-monsoon season, but old carbon origins (472~2,570 age) introduced from groundwater and urban or recently atmospheric deposition are believed to dominant during monsoon season. Collectively, these results suggest that fresh or old-origin DOM sources flow into the complex river watershed, depending on land-use type and rainfall events. Our result clearly demonstrated that EMMA based on combing multi environmental indicators could be trace DOM source, which is important for understanding DOM quality changes. This study provides easy and intuitive techniques for the estimation of the relative impacts on DOM sources, which can be verified in various way rather than relying on single technique approach.