An Assessment of Dissolved Organic Carbon Biodegradability and Priming in Blackwater Systems

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Introduction

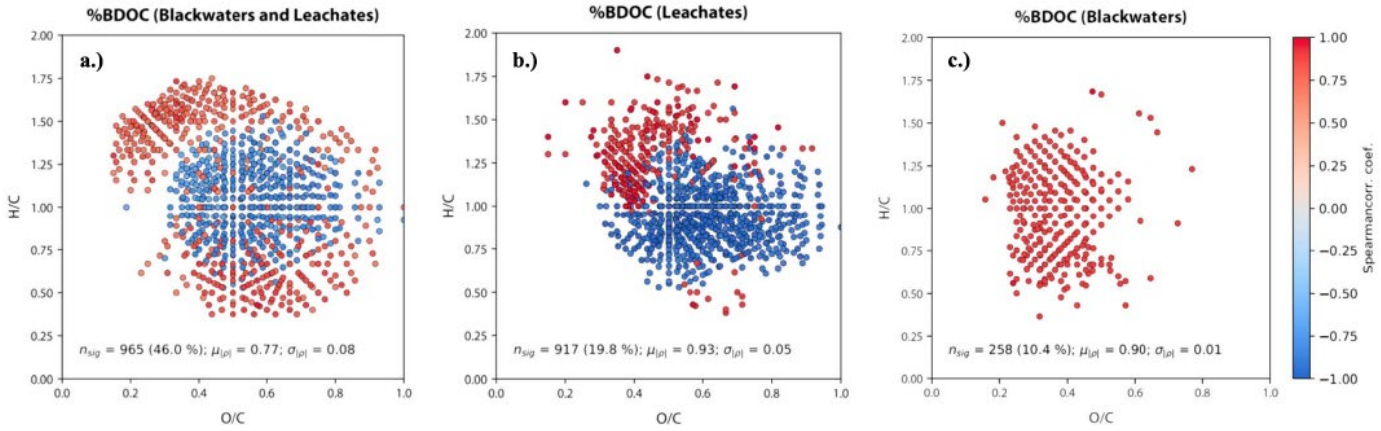
Rivers deliver approximately 260 Tg of dissolved organic carbon (DOC) to the ocean annually, yet there is little evidence of terrigenous DOC (tDOC) in the ocean. While tDOC was historically believed to be stable and resistant to microbial degradation, it has recently been shown that freshwater systems mineralize more tDOC than originally thought. The priming effect is a possible mechanism by which inputs of biolabile DOC enhance the bioavailability of stable DOC components in aquatic systems, resulting in higher rates of microbial remineralization. Here we investigate tDOC biodegradability by conducting bioincubation experiments and utilizing ultrahigh resolution mass spectrometry to characterize the chemical composition of blackwater and leachate dissolved organic matter (DOM) samples.

Experimental

Sample sites include four blackwater ecosystems in northwest Florida, namely the Ochlockonee River, Sopchoppy River, Aucilla River, and Suwannee River, and a blackwater swamp in southwest Florida that is situated in the Corkscrew Regional Ecosystem Watershed. The role of priming in blackwater ecosystems was assessed through the inclusion of bioincubation treatments amended with a variety of simple biolabile OC substrates.

Results and Discussion

Blackwaters lost 6.10 ± 3.85% DOC within 1 month, while leachates lost 38.10 ± 16.74% DOC. There were no significant differences between DOC remineralization in control and primed treatments, indicating that priming is not an important factor in the biodegradation of DOC in blackwater ecosystems. However, the proportion of biodegradable DOC and DOM composition were significantly correlated, mostly driven by the contribution of aliphatic compounds (H/C ≥ 1.5, O/C < 0.9) that were abundant (9.3 ± 5.2%) in leachate DOM (Figure 1). The molecular signature of biodegraded leachate DOM resembled that of stable blackwater DOM, indicating that bioavailable DOM components leached from plant litter are rapidly utilized and stable DOM is exported downstream.



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References

[1] Textor, *et al*., Journal of Geophysical Research-Biogeosciences, **123**, 2998-3015 (2018).