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Microbial effect on the Molecular Structure and Reactivity of Dissolved Organic Matter in wetland soil solutions

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Wetlands represent a reservoir of 20-30% of the world carbon (C) stocks and supply 15 % of terrestrial organic C to the oceans via runoff1. Dissolved organic matter (DOM) in wetlands is a complex mixture of various organic compounds with distinct compositions and properties, from various sources like decomposition of local biomass, labile compounds desorbed from soil. A crucial step in understanding the variability observed in composition and reactivity of wetland DOM is to elucidate its modification induced by microorganisms. To address this issue, spectroscopic and experimental approaches were combined to identify the organic structures in a wetland DOM and its modification induced by bacteria.

The spectroscopic signatures of a wetland DOM (after purification) were investigated by recording 3D excitation-emission fluorescence matrices (EEM) of DOM: (i) in interstitial waters collected from a humic wetland soil (Rophin, France) by lysimeter, (ii) in final solutions of laboratory experiments designed to recover from this soil the labile organic compounds desorbed or soluble (at the soil pH of 5.7). EEM provided information on the structures of the labile fraction, showing fluorophores emitting in regions characteristics of condensed, substituted, functionalized aromatics and lignocellulosic derivatives, respectively. In contrast, DOM of interstitial waters showed intense emission in regions corresponding to moderately aromatic, weakly oxygenated molecules of low molecular weight, as “fresh” products resulting from microbial activity, and protein derivatives, respectively.

The question of how bacteria modify the molecular composition of DOM was handled by performing laboratory experiments on a model DOM-bacteria system, by contacting during 14 days (30°C) a solution containing the soluble fraction of the soil organic matter (at pH 6) with *Microbacterium* (a common soil bacterium). EEM showed the degradation / consumption of aromatic-type fluorophores during the first week, while protein derivatives and low-oxygenated molecules with a low molecular weight appeared as products of bacteria lysis and/or production. After 14 days, the latter peaks disappeared while more aromatics were formed, although with a less intensity than in the initial sample.

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