Effects of iron and aluminium on the biodegradation of natural dissolved organic matter

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Iron (Fe) and aluminium (Al) can alter the biodegradation of dissolved organic matter (DOM). Because both of Fe(III) and Al(III) can form strong complexes with carboxylic and phenolic groups which are abundant in DOM. We isolated natural DOM and a bacterial community from a boreal lake water to study the effects of Fe and Al on bacterial growth on natural DOM. The association between DOM and Fe or Al (DOM-Fe and DOM-Al) were generated before introducing bacteria. The DOM-Fe decreased bacterial growth and respiration compared with DOM alone at the ambient concentration of phosphorus (P, 0.16 μmol L^{-1}), indicating that DOM-associated Fe limited the bioavailability of P. While when the concentration of P increased to 21 μmol L^{-1}, bacterial biomass and respiration were several times higher in DOM-Fe than no Fe treatment. Based on the next generation sequencing of 16S rRNA genes, *Caulobacter* dominated bacterial communities grown on DOM-Fe. Compared to Fe, the same molar concentration (60 μmol L^{-1}) of introduced Al precipitated a part of DOM and reduced bacterial growth on DOM. Our study demonstrated that DOM-Fe is bioavailable and associated Fe can even stimulate bacterial growth on DOM when P is not limiting. Al behaves differently from Fe on bacterial growth on DOM may be due to the fact that Al lacks redox chemistry and bacteria cannot dissociate DOM from DOM-Al through redox reaction.