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Contribution of ferric iron to the absorption by chromophoric dissolved matter

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Chromophoric dissolved organic matter (CDOM) is a major absorber of ultraviolet and visible radiation in surface waters. CDOM consists primarily of humic substances (HS), which can adsorb inorganic cations such as ferric iron. Often more than 99% of dissolved iron is complexed by CDOM in natural waters. Our study assessed the contribution of ferric iron to the absorption of CDOM by mixing dissolved humic substance (HS) standards with iron(III) in acidic conditions and later adjusting the pH to 8. The maximum iron-binding capacities for Suwannee River humic acid, Suwannee River fulvic acid and Pony Lake fulvic acid were 13.0, 13.5 and 7.64 μmol iron [mg C]$^{-1}$, respectively, suggesting higher iron-binding capacity for terrestrial- than microbial-derived CDOM. Iron(III) associated with HS increased the absorption coefficient by CDOM by 1.73-5.33 times (λ=254-550 nm). Inorganic iron, thus, contributed up to 4/5 of the absorption by CDOM (λ=550 nm). In other words, only less than 1/5 of the absorption by CDOM-iron mixture was generated by organic chromophores. The associated iron decreased spectral slope coefficients of HS. This finding indicates that changes of the spectral slope by CDOM can be solely caused by inorganic interference (e.g. iron). The increase of absorption by associated iron(III) was always spectrally similar among different HS standards. We calculated a specific absorption spectrum for iron associated with dissolved HS standards. This spectrum allows estimates for the absorption by iron associated with HS in circum neutral natural waters. For Löytynlähde spring water, iron contributed over 1/10 (ca. 0.108, λ=400 nm) to the total absorption. The contribution of iron to total absorption increased with wavelength. In typical CDOM absorption measurement, water samples are filtered for the removal of particulate constituents but no attempts are implemented for separating the organic chromophores from inorganic chromophores. Our findings show that inorganic chromophores can contribute remarkably to the absorption of filtered water. So, if inorganic chromophores cannot be separated from organic chromophores, we recommend a change in the current terminology. “Chromophoric dissolved matter, **CDM**” should be used instead of the earlier term “chromophoric dissolved *organic* matter, CDOM”.