

Fluorescence characterization of dissolved organic matter in a city river of southwestern China

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Dissolved organic matter (DOM) in Nanming River and its streams, Southwest China was investigated using fluorescence emission spectra, synchronous fluorescence spectra and three-dimensional excitation emission matrix fluorescence (3DEEM) spectroscopy. There was a wide but featureless peak at $\text{Em} = 430 - 440 \text{ nm}$ in the emission spectra, 3 - 4 components can be distinguished from the synchronous fluorescence spectra with a maximum peak at 280 nm. With 3DEEM technique, we can differentiate three major fluorophores in the DOM samples, which were responsible for two humic-like and one protein-like fluorescence (Coble, 1996; Baker, 2001; Wu and Tanoue, 2001). Strong protein-like fluorescence occurred in most of the samples. Significant relationships were observed between the fulvic-like and protein-like fluorescence, and between individual fluorescence intensity, DOC, PO_4^{3-} , COD and ammonium concentrations in the river. It is suggested that fluorescence technique is a powerful tool to indicate the pollution situation of city river waters. Most importantly, our results show that municipal wastewater can be the source not only of protein-like fluorescence substances, but also of the humic-like fluorescence substances in aquatic environments.

References

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Mechanisms of organic matter and rare earth element release in soils: Experimental evidence

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We investigated the roles played by microbial activity, redox potential variations and pH changes on Organic Matter (OM) and Rare Earth Elements (REE) release in hydromorphic soils. Three types of experiments were conducted: (i) a soil suspension was incubated under anaerobic condition, without pH control (i.e. the pH was let to evolve in response to occurring biogeochemical reactions); this represents the "natural" reference case in which all tested parameters (pH, microbial activity, redox potential) can vary and control OM and REE exchanges between soil minerals and soil solution; (ii) a sterilized soil suspension was incubated under anaerobic conditions at pH 3 with hydroxylamine as chemical reducer; (iii) finally, three soil suspensions were incubated under aerobic conditions at pH 3, 5 and 7. Results demonstrate that large amounts of OM and REE are released from hydromorphic soils when soil Fe and Mn oxyhydroxides are reductively dissolved.

The role of micro-organisms appears to be secondary, the latter playing only a catalyst role. Incubations carried out with hydroxylamine at pH3 or in aerobic conditions at variable pH values demonstrate that the main mechanism controlling OM and REE release is OM desorption in response to pH increase.

REE patterns were very helpful in reaching this conclusion since OM adsorbed at the surface of soil minerals was found to have very specific and easily recognizable Z-shape REE pattern. This typical Z-shape signature was not found in experiment designed to promote reductive dissolution of soil Fe and Mn oxyhydroxides (flat REE patterns). This difference could be due to the release of REE co-precipitated within the soil oxyhydroxides solid or to the release of OM with different REE complexing capacities. Finally, experiments carried out under aerobic conditions at pH 3 yielded a third type of REE pattern (light REE enriched pattern). As a whole, these results demonstrate that REE may be used as a probe to monitor the activation of particular soil components during soil reduction and soil pH variations.