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Comparison of structural features of dissolved organic matter isolated from rainwater with those of aquatic humic substances

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The complexity of rainwater dissolved organic matter (DOM), a large percentage of which remains uncharacterized, has made difficult to determine the role of rainwater DOM in regional and global carbon budgets. Recent studies have focused on determining the structural characteristics of the bulk DOM in rainwater, reporting the prevalence of DOM with characteristics resembling those of natural humic substances due to its polyacidic nature. However, it is important to investigate the structural features of humic-like DOM isolated from rainwater and to evaluate whether such features differ from those found in aquatic humic substances, namely in what concerns the relative content of aliphacity and aromaticity.

In this work, rainwater samples were collected for about one year, in Aveiro (Portugal). Humic-like DOM was extracted from rainwater by a procedure based on adsorption onto DAX-8 resin. The International Humic Substance Society (IHSS) (http://www.ihss.gatech.edu) operationally defined dissolved humic substances (HSs) on the base of adsorption onto a XAD-8 like resin. The isolation and extraction procedure adopted in the present work for the extraction of DOM from rainwater was slightly modified from the procedure recommended by the IHSS as suggested by Santos et al. (2009). Then, humic-like DOM isolated from rainwater was analysed by 1H NMR spectroscopy. Due to the small amounts of DOM extracted from rainwater, the DOM fractions extracted from rainwater samples were combined for each sampling season, and the 1H NMR results were compared between seasons and also with spectra of aquatic humic substances from available literature.

Similar structural characteristics were observed for extracted DOM from the different seasons: high content of aliphatic structures, of hydroxy and alkoxy groups, of carbonyl groups and unsaturated carbon atoms, and low content in aromatic structures when compared with aliphatic structures. Moreover, results suggest that the DOM extracted from rainwater has higher aliphatic character and lower aromatic content than aquatic humic substances. Thus, the chemical characteristics of aquatic humic substances may not be good models for DOM extracted from rainwater.

Reference: Santos, P.S.M., Otero, M., Duarte, R.M.B.O., Duarte, A.C., 2009. Spectroscopic characterization of dissolved organic matter isolated from rainwater. Chemosphere, 74, 1053-61.