

Characterisation of fractionated Antarctic fulvic acid, Evidence for micelle formation

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Study of chemical structure of Antarctic fulvic acid has been of considerable interest in recent years due to its microbial-based origin and limited input from terrestrial or anthropogenic sources [1, 2]. In this work, fractionation of Pony lake fulvic acid from Antarctica provided by International Humic Substance Society (IHSS) was performed using C18 SPE cartridge and water – acetonitrile mixture into four hydrophilic and hydrophobic fractions. Bulk analyses using elemental analysis, FT-IR and fluorescence spectroscopy exhibit obvious distinction between four fractions in terms of C/H, C/N ratio as well as fluorophores distribution.

Ethyl chloroformate for the first time was used as a derivatisation reagent for GC/MS analysis of fractions. Our results reveals that hydrophilic fractions mostly contain heterocyclic nitrogen-containing compounds such as functionalised or branched imidazole or pyrimidine, while hydrophobic fractions comprise branched fatty acids, ethers, non-proteinogenic branched-chain amino acid, functionalised quinones and indoles.

Surprisingly, there are overlaps of components in all four fractions. An obvious explanation can be “micelle” formation resulting in carryover in all fractions. Micelle formation has been previously observed in humic acid [3], but it has not been reported for fulvic acids to date. Acetonitrile addition as a micelle disaggregation agent to hydrophilic fraction significantly decreases its average molecular weight which supports micelle hypothesis. Experiments were also carried out that identified possible temperature –dependent micelle formation process.

- [1] D’Andrilli *et al* (2013) *Organic Geochemistry* **65**, 19-28.
- [2] Cawley *et al.*(2013) *Environ. Res. Lett.* **8**, 045015 (10 pp).
- [3] Guetzloff & Rice (1994) *The Science of the Total Environment* **152** , 31-35.