Geophysical Research Abstracts, Vol. 9, 08669, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08669

Quantification of sedimentary organic matter composition using Pollut Eval pyrolysis

T.J. Tambach, H. Veld, G.T. Klaver, B.J.H. van Os, and J. Griffioen

TNO Geological Survey of the Netherlands, Utrecht, The Netherlands (tim.tambach@tno.nl / Fax: +31-30-2564605 / Phone: +31-30-2564793)

Sedimentary organic matter (SOM) has important geochemical and hydrochemical properties that influence the reactivity of the sediment. Among others, SOM adsorbs organic pollutants and (trace) metals, or microorganisms may use organic matter as substrate for reduction of inorganic compounds (e.g. sulfate and nitrate). For prediction of future soil and groundwater quality it is essential to gain more insight in the various functions of SOM in the groundwater environment. For this purpose, we studied the content and composition of sedimentary organic matter (SOM) in sandy aquifer sediments using Pollut Eval pyrolysis. Our goal was to investigate the feasibility of this technique for easy and routinely characterization of SOM on major compounds, such as black carbon and amorphous organic matter.

We obtained soil cores (8.0 m depth) from a farm in Spankeren (The Netherlands), sampled the individual geological and lithological layers, and measured their total organic carbon (TOC) content. Several samples with TOC contents larger than 0.5% were purified with HCl/HF treatment. We then analyzed both the purified and unpurified samples using Pollut Eval pyrolysis.

Our results indicate variations in the pyrolysis spectra of the organic matter for various depths, which are (partially) related to their variations in chemical and physical properties. Using deconvolution techniques we further quantified these observations. Amorphous material dominates over black carbon in the upper parts of the core, whereas the contribution of the latter is higher at larger depths. The composition of SOM in these aquifer sediments thus varies. This insight is useful in considering the reactivity of SOM towards inflowing contaminants such as nitrate, pesticides, and trace metals.

Although it is commonly accepted that purification does not affect the composition of

SOM, our results provide evidence that oxygen-bearing compounds are systematically removed during the purification: a significant release of CO and CO_2 occurs during pyrolysis of unpurified samples, but this contribution has become less important for the purified samples. We further observe that the maximum temperature of the major peaks in the pyrolysis signal decreases when purifying the organic matter. Although such an effect is probably influenced by changes in organic geochemistry, we also put forward that this effect is caused by the release of relatively much exothermic energy during combustion of highly concentrated SOM.