Use of pyrolysis-GC/MS combined with petrographic analysis to monitor changes of organic matter in coal and biomass derived materials

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Charred solid organic residues produced during biomass and fossil fuel combustion are collectively referred as black carbon (BC). BC is ubiquitous and can be found in sediments, soils, and the atmosphere [1]. Because of the important role and effect of BC materials on the environment and biogeochemical cycles, different techniques have been used to study their chemical properties and structures [2].

In this study (project IAA300460804), pyrolysis of coal and biomass was studied under varying conditions of temperature and environment. The solid products, i.e. chars, were analysed by combination of optical microscopy and pyrolysis-GC/MS methods. The elemental composition was also determined and the chemothermal oxidation method [3] was employed to determine the BC content in the samples.

The composition of chars was dependent on the used conditions and indicated that incomplete combustion leads to the formation of aromatic structures and regions. Chars prepared in oxidative atmosphere created more condensed aromatic network at lower temperatures by comparison to chars prepared in inert atmosphere. Compounds typical for the BC presence like indene, benzonitrile, naphthalene, methylnaphthalenes, fluorene were found in all chars.

The results of BC determination were in good consensus with H/C atomic ratios and reflectance values. The found relation among identified organic compounds and BC corresponds with the results for carbonaceous matter in dust and lacustrine seidments from Prague [4].

[1] Goldberg (1985) John Wiley and Sons, New York. [2] Song and Peng (2010) *J. Anal. Appl. Pyrolysis*. **87**, 129-137. [3]Gustafsson *et al*. (2001) *Global Biogeochemical Cycles* **15**, 881–890. [4] Sykorova *et al*. (2009) *Int.J. Coal Geol*. **80**, 69-86.

LTD Phase I.: Long-term real-scale diffusion experiment results

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Matrix diffusion can significantly decrease the amount of radionuclides potentially released from deep geological repository of radioactive waste. A systematic reseach approach to understanding the diffusion process was applied within Phase I of the Long Term Diffusion Project (LTD) at the Grimsel Test Site, Switzerland (GTS, www.grimsel.com).

In workpackage 1 of the LTD project, a cocktail of ^{3}H, ^{22}Na, ^{131}I and ^{134}Cs tracers was circulated in a packed-off interval in a borehole drilled 8 m into undisturbed granitic matrix in GTS and left for 26 months in the contact with the rock. Tracer solution was regurarly sampled in order to obtain the pattern of radionuclide activity decrease in the test interval. Later the borehole was overcored and the rock segments were analysed for radionuclide content.

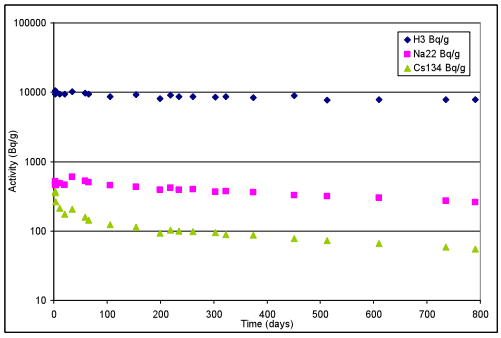

Figure 1: Radionuclide activity (Bq/g) decrease in the test interval.

The activity decrease in the circulation tank is shown in Fig. 1. ^{22}Na and ^{134}Cs were analysed in the rock samples, using γ-spectroscopy. Special care had been applied for ^{3}H analyses (modified LSC). Diffusion profiles within the rock segments clearly showed that ^{3}H had reached a distance of 17 cm from the borehole. ^{22}Na migrated up to 7 cm and ^{134}Cs up to 1.5 cm distance respectively. The results are under further evaluation.

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