Geophysical Research Abstracts, Vol. 9, 11400, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-11400
© European Geosciences Union 2007

Carbon dioxide sequestration with brown coal fly ashes

M. Back (1), M. Kühn (2), H. Stanjek (3), S. Peiffer (1)

(1) Hydrology, University of Bayreuth, Germany, (2) Applied Geophysics, RWTH Aachen University, Germany, (3) Clay and Interface Mineralogy, RWTH Aachen University, Germany (martin.back@uni-bayreuth.de / Phone: +49-921-552170)

Rising concentrations of CO_2 in the athmosphere are mainly due to fossil fuel combustion and are commonly regarded as the major cause of global warming. Mineral trapping is a promising technology for CO_2 sequestration and is characterised as a safe and long-term storage option.

In Germany, about 15 Mio tons of brown coal fly ashes per year accumulate due to power generation. They are mostly of high alkalinity and their reactivity makes them suitable as a feedstock material to neutralize CO_2 at low economic and energetic costs. The largest amount of these ashes is still being deposited in landfills as residual waste material and is therefore available for CO_2neutralisation. Although absolute amounts are limited, the economical potential of these neutralizing reactions could be significant in terms of emission trade and essential to fulfil the requirements of the Kyoto protocol.

Within the research project CO_2Trap, funded by the German Federal Ministry of Education and Research (BMBF) we evaluate a novel approach to induce aqueous carbonation reaction with fly ashes and flue gas in large scale chemical reactors implemented in a coal combustion plant. After the treatment, the carbonated fly ash could be deposited in landfills or used for other industrial purposes. The topic of another sub-project within CO_2-Trap (Kühn et al., this conference) studies the application of surface water treatment with fly ashes to store CO_2 as calcite in geothermally used deep aquifers (mineral trapping).

Fly ash samples have been taken from the lignite coal power plant Neurath near Grevenbroich and are characterised by a high acid neutralizing capacity (ANC) of nearly 6 mmol(eq)/g ash. Chemical and mineralogical investigation proved that the

alkalinity of the ashes stems mainly from the presence of the earth alkaline elements Ca and Mg (up to 55 wt %), bound in fine-grained oxides and hydroxides (e.g. lime, portlandite).

To provide necessary geochemical and kinetic data, we performed batch reactor experiments studying the dependence of the CO_2 uptake rate on the relevant process variables, e.g. partial pressure of CO_2, solid/liquid-ratios and purging rates of CO_2. The resulting kinetic parameters are applied in numerical simulations for optimization of the treatment strategy.

More than 0.1 kg CO_2 per kg ash could be neutralized at moderate process conditions without the use of any additives in the laboratory experiments. That means that 1.5 Mio tons CO_2 could be captured yearly by this type of ash.