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Injection techniques for CO_2 storage by sorptive linkage to mining waste in abandoned coal mines

T. Kempka (1), M. Waschbüsch (1), T. Fernández-Steeger (1) and R. Azzam (1)

(1) Chair of Engineering Geology and Hydrogeology, RWTH Aachen University, Germany (kempka@lih.rwth-aachen.de / Phone: +49 2418096777)

Coal processing of mined hard coal results in high amounts of mining waste materials like flotation sludge. The discussed technology provides an alternative for disposal of these wastes with reduction of mining subsidence by stowage, and sorption capacities for CO_2 as synergetic effect.

Single-gas sorption experiments were performed on mining waste samples from the Ibbenbüren and Ruhr districts in Germany. The analyses of these materials at selected pressure fields (low, medium and high) revealed appreciable CO_2 sorption capabilities in comparison to compact coal seams.

Three pressure dependent techniques for underground storage of sorptive fixated CO_2 on mining waste are currently investigated:

Simultaneous injection of CO_2 and mining waste is based on stowage in conjunction with underground waste disposal during longwall mining. A suspension of CO_2 and mining waste is established in a sorption reactor at the surface and serves as stowage material after injection at low pressure into the mined cavities.

Pre-flooding CO_2 injection consists in filling of mining drifts with mining waste material and subsequent CO_2 injection at medium pressure after mine abandonment.

Post-flooding CO_2 injection comprises CO_2 and mining waste fixation in a sorption reactor at the surface. The injection of this composite proceeds at high pressure after shutdown of water management.

A CO_2 storage potential for Germany of about 225,000 t/a has been estimated for the use of the simultaneous injection technique. Based on the amount of mining waste

accumulated since 1980 a CO_2 storage potential of about 50 Mt is feasible in Germany by use of mining waste as storage medium.

The finally applied storage technique depends on regional established mining procedures. Simultaneous injection is applicable for storage during longwall mining, pre- and post-flooding injection techniques are suitable for stowage after pillar mining.

On a world-wide scale this technology provides substantial additional storage potentials for CO_2. Therefore, a detailed survey of internationally established mining techniques and usable underground cavities will be a major objective in the future.