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Carbon Dioxide Storage in Abandoned Coal Mines

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ABSTRACT

This study provides a conceptual approach to sorptive CO_2 storage from a pure CO_2 or flue-gas stream in abandoned coal mines. Two integrated concepts were considered: (1) CO_2 storage on residual coal, organic matter, and bed rock (e.g., shale) in goaf areas and damage zones of abandoned coal mines and (2) a joint deposition of CO_2 sorbed to mining waste. The first approach aims at the large quantities of residual organic matter associated with high permeability in subsurface mining damage zones as geologic filters to remove CO_2 from flue gas. The second approach combines sorptive CO_2 storage on mining wastes with subsidence reduction by stowage in operating and abandoned coal mines. These concepts could provide a reasonable and synergetic effect for CO_2 storage, mining waste disposal, and mining damage reduction (by stowage) and may offer a productive use of abandoned coal mines in the future.

The study comprised laboratory sorption experiments (single and mixed gases) on coals, dispersed organic matter, shales, and mining wastes. Furthermore, physico-chemical data were combined with engineering and mining information. To demonstrate the application of these concepts, the CO_2 storage potential of residual coal, bed rock and deposited mining wastes has been calculated for the abandoned Westfalen coal mine in the West German Ruhr Area.

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