



In-situ Down Hole Gas Measurements During Geological Storage of CO₂ at Ketzin, Germany

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The continuous investigation and direct determination of the gas composition in the storage horizon during and after the injection of CO₂ is needed to understand the behaviour of CO₂, to trace the fate of the injected gas and to critical test the geological field models. Therefore, we developed and applied a new, innovative geochemical monitoring tool for the real time and in-situ determination of CO₂ and other gases in the underground and in bore holes. The method uses a phase separating silicone membrane, permeable for gases, in order to extract gases dissolved in borehole fluids, water and brines. Argon is used as a carrier gas to conduct the collected gases through capillaries to the surface. Here, the gas phase is analyzed in real-time with a portable mass spectrometer for all permanent gases. In addition, gas samples were collected for more detailed investigations in the laboratory. Down hole extraction and on-line determination of gases dissolved in brines using this gas membrane sensor technique was successful applied at the scientific CO₂ storage test site in Ketzin, Germany. The dissolved CO₂-concentration in the natural formation water at depth was quantified and changes in the reservoir gas concentrations of helium, hydrogen, methane and nitrogen during CO₂ injection were continuously monitored. The arrival of injected krypton tracer gas at the observation well was detected and changes in hydraulic pressure and temperature were recorded. The breakthrough of CO₂ into the observation well, in 50m distance, was observed after the injection of 531.5t CO₂.