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Fluorescence in situ Hybridisation – a useful tool for analysing the microbial community from a saline aquifer during CO2 storage in Ketzin

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Within the GRASP program, sponsored by the European Commission, our working group aims to investigate the microbial aspect of the underground CO2 storage. Main purpose of the microbial monitoring is to analyse compositions and activities of the microbial communities in order to characterize microbial life in extreme habitats and its influence on corrosion and mineral dissolution and precipitation. Analyses of microbial community composition and its changes provide information about the effectiveness and reliability of long-term CO2 storage technique. The reactions between the microorganisms and the minerals of both the reservoir rock and the cap rock may cause major changes in the structure and chemical composition of the rock formations, and may induce corrosion at the casing and the casing cement around the well.

Fluorescence in situ hybridisation (FISH) is one of many nucleic acid techniques that are useful for studying microorganisms in their natural environments and investigate processes in the deep biosphere. FISH coupled with rRNA-targeted oligonucleotide probes allows direct visualisation, identification and localisation of bacterial cells from selected phylogenetic groups in environmental samples. This technique is based on the detection of rRNA and therefore is related to the activity state of the target cells.

In the first observation well, where CO2 break through after injection of 500 t, up to 106 cells ml-1 were detected (Morozova et al., 2011). The characterization of the microbial community from the second observation well, where CO2 arrived after injection of approximately 11.000 t, revealed low cell numbers and the presence of solids and particles in the reservoir fluids. Therefore an optimization of the FISH method was done with the new developed method – a combination of chemical and physical treatment followed by density centrifugation through a cushion of Nycodenz in order to separate bacteria from sediment matrix, and to avoid false fluorescent signals given by some organics and minerals. This method was successfully used on reservoir fluid samples from the second observation well prior to FISH.The detailed studies on the activity, quantity and physiology of the microbial communities was be performed, by using various probes which are targeting different groups of microbes. The results of microbial monitoring gained from the first observation well (Morozova et al., 2011) will be compared with the results from the second observation well in order to draw broader conclusions about the microbial community response to CO2 injection, chemical fluid composition and the well completion procedure.