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Deep microbial life in the Altmark natural gas reservoir: baseline characterization prior CO_2 injection

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Within the framework of the CLEAN project (CO_2 Largescale Enhanced gas recovery in the Altmark Natural gas field) technical basics with special emphasis on process monitoring are explored by injecting CO_2 into a gas reservoir. Our study focuses on the investigation of the in-situ microbial community of the Rotliegend natural gas reservoir in the Altmark, located south of the city Salzwedel, Germany. In order to characterize the microbial life in the extreme habitat we aim to localize and identify microbes including their metabolism influencing the creation and dissolution of minerals. The ability of microorganisms to speed up dissolution and formation of minerals might result in changes of the local permeability and the long-term safety of CO_2 storage. However, geology, structure and chemistry of the reservoir rock and the cap rock as well as interaction with saline formation water and natural gases and the injected CO_2 affect the microbial community composition and activity. The reservoir located at the depth of about 3500m, is characterised by high salinity fluid and temperatures up to 127° C. It represents an extreme environment for microbial life and therefore the main focus is on hyperthermophilic, halophilic anaerobic microorganisms. In consequence of the injection of large amounts of CO_2 in the course of a commercial EGR (Enhanced Gas Recovery) the environmental conditions (e.g. pH, temperature, pressure and solubility of minerals) for the autochthonous microorganisms will change. Genetic profiling of amplified 16S rRNA genes are applied for detecting structural changes in the community by using PCR- SSCP (PCR–Single-Strand-Conformation Polymorphism) and DGGE (Denaturing Gradient Gel Electrophoresis). First results of the baseline survey indicate the presence of microorganisms similar to representatives from other saline, hot, anoxic, deep environments. However, due to the hypersaline and hyperthermophilic reservoir conditions, cell numbers are low, so that the quantification of those microorganisms as well as the determination of microbial activity was not yet possible. Microbial monitoring methods have to be further developed to study microbial activities under these extreme conditions to access their influence on the EGR technique and on enhancing the long term safety of the process by fixation of carbon dioxide by precipitation of carbonates.

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