Microbial Redox Reactions During Underground Storage of Hydrogen

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Underground storage of hydrogen (H_2) could be an alternative or important supplement to energy storage. However, there is still lack of knowledge about fundamental biogeochemical aspects of underground H_2 storage. The BMBF-funded project H2_ReacT investigates fundamental petrophysical, geochemical and biogeochemical aspects of underground H_2 storage. The work presented here addresses the microbial consumption of H_2 and the involved microorganisms at potential underground storage sites.

Microbial reactions that consume H_2 are still a major uncertainty factor for underground H_2 storage. Microbial life is widespread in the crust of the earth and geological formations suitable for underground H_2 storage often contain a deep subsurface biosphere. Thus, an underground H_2 storage site needs to be seen as a habitat for microorganisms. Microbial activity at the H_2 storage site might affect the stored H_2 as well as the integrity of the storage site itself. A specific interest is to gain information about microbial activity that might result in a loss of stored hydrogen as well as the production of unwanted metabolic products e.g. H_2S. The importance of specific conditions with relevance for underground hydrogen storage i.e. elevated pressure, high temperature and rock material, will be addressed.

Preliminary results showed the consumption of H_2 by indigenous microorganisms from a porous rock reservoir fluid. Hydrogen was consumed at different temperature and pressure conditions relevant for underground H_2 storage. Here, hydrogen consumption rates were strongly influenced by temperature and pressure. Currently effects of several geochemical parameters on microbial H_2 consumption are studied in more detail. Furthermore, molecular biological approaches are used to identify the involved microorganisms.