Microbial H_2 consumption activity at conditions relevant for H_2 underground storage

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Underground storage of hydrogen could be an alternative way to store large amounts of energy. However, microbial consumption of H_2 is still a major uncertainty factor. Since microbial life is widespread in the crust of the earth an underground 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.
There is great need for more information about microbial H_2 transformation activity at conditions relevant for underground H_2 storage i.e. elevated pressure, high temperature and about potential geochemical interactions with surrounding fluid and rock material.
In this study, different fluids from potential subsurface storage sites representing storage in salt caverns or porous rock reservoirs were investigated. While some fluids were inactive, long lasting hydrogen consumption was observed by a porous rock reservoir fluid. Microbial H_2 oxidation tolerated high pressure as well as pressure and temperature fluctuations reflecting cycles of H_2 storage. In this fluid microbial H_2 consumption was shown to be sulfate dependent and led to the formation of sulfide. Furthermore, an increase of sulfate reducing bacteria during microbial H_2 consumption was identified by high-throughput sequencing of 16S rDNA. These results indicated the oxidation of H_2 by sulfat reducing bacteria to be the presumed process in this porous rock reservoir fluid. Due to the heterogeneity of the investigated fluids, microbial H_2 oxidation activity at different H_2 underground storage sites cannot be generalized but requires site specific investigations.