

Microbial interactions of different hydrogen consuming microbes and impact of minerals during hydrogen underground storage

VERENA NIKELEIT, NICOLE DOPFFEL AND BIWEN AN-STEPEC
NORCE

For a sustainable future it is essential to reduce greenhouse gases by transitioning to renewable energy. However, due to the irregular nature of renewable energy production, large-scale energy storage solutions are necessary to maintain balance. Generated excess energy could be converted into an energy carrier like hydrogen (H_2) and stored in underground reservoirs like salt caverns, saline aquifers and depleted gas/oil fields. Many reservoirs harbor diverse microbial communities and H_2 serves as an excellent energy carrier for both human industry and microbes. For instance, many sulfate-reducers, methanogens, acetogens, and Fe(III)-reducers can utilize H_2 . This leads to questions about how these microbes would interact between each other when vast amounts of H_2 gets injected into a field and the microbes start competing for the same substrate. In microcosm experiments we inoculated members of four different metabolic groups (*Desulfofundulus kuznetsovii*, *Thermoanaerobacter kivui*, *Methanothermococcus thermolithotrophicus* and *Deferribacter autotrophicus*) individually and in pairs to study how growth and H_2 consumption is affected. Additionally, we studied how these microbes interact with minerals found in these reservoirs as these can be used not only as an additional source of carbon but also as e-donor, e-acceptor and/or an ideal surface for attachment. For this we conducted H_2 microcosm experiments where we added different representative minerals (pyrite, siderite, quartz, calcite) and followed how and if H_2 consumption and microbial growth is affected by the mineral presence. Via XRD we also will identify potential changes of the minerals, which might cause reservoir specific challenges including mineral precipitation or dissolution. Overall, our aim is to realistically estimate operational risks of potential storage sites, develop screening criteria and specific monitoring tools.