Interactions between a calcium scaling inhibitor, geothermal fluids, and microorganisms – Results of in situ monitoring in the molasse basin and laboratory experiments

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The economic and technical efficiency of geothermal plants is often impaired by corrosion, scaling and biological fouling. In Germany, the highly saline fluid of the North German Basin is known to cause severe corrosion. Meanwhile geothermal plants in the southern Molasse Basin, one of the most extensively exploited geothermal regions in Germany, are troubled by carbonate scaling. One possible solution is the employment of a scale inhibitor. A novel scaling inhibitor is evaluated in field- and laboratory tests. This inhibitor consists of a polysaccharide backbone structure and branches of polyacrylic- and maleic acid copolymer.

The laboratory tests with different scaling inhibitor concentrations were designed to observe the biodegradation of the scaling inhibitor in an anaerobic environment similar to the conditions found in heat exchangers of geothermal plants. The concentration of inhibitor was quantified by UV/VIS and liquid chromatography (LC). Molecular biological techniques (PCR, DGGE, Microbiome analysis) were used to characterize the biocenosis on metal surfaces and in fluids of the experiments.

During the experiment the concentration of inhibitor decreased up to 3 % of the initial concentration. The formation of methane and acetate was observed which indicates a biological degradation by acetoclastic methanogenesis. Hydrogen formation was observed in setups containing steel coupons. This implies that hydrogen is primarily formed by corrosion processes and in tests with active microorganisms hydrogen was consumed completely. Various fermentative bacteria classified as Clostridia and Firmicutes as well as methanogenic archaea were identified. In some experiments sulfate reducing bacteria were found. Those are well known to catalyze corrosion processes.

Results of field experiments in a bypass system as well as microbiological monitoring of the
inhibitor application in geothermal plant located in the molasse basin will be presented.