

COMPARATIVE STUDY OF THE EFFECTIVENESS OF ORGANIC PETRO- OR BIOSOURCED SURFACTANTS IN INHIBITING CARBON STEEL CORROSION IN A STANDARDIZED RECONSTITUTED GEOTHERMAL WATER (RGW)

Chahinez HELALI^{1,2}, Romain VALENTIN², Stéphanie BETELU¹, Sophie THIEBAUD-ROUX² and Ioannis IGNATIADIS¹, BRGM, ORLEANS/France¹; INPT, TOULOUSE/France²

Since 1989, organic petrosourced inhibitors (fatty amines and quaternary ammonium salts) have been gradually used to prevent corrosion-scale in geothermal installations exploiting the Paris Basin Dogger aquifer. This anti-corrosion-antiscaling treatment is preceded by studies on the corrosion phenomenology and kinetics or accompanied by studies carried out to refine the choice of effective inhibitors. Once injected in actual geothermal waters, those inhibitors are known to be anticorrosive and anti-scale at the recommended doses and bactericide at large doses. According to their physical and chemical properties, they significantly reduce the corrosion rate of the carbon steel and stop or delay the crystallization of mackinawite from an amorphous iron sulfide scale. Although, their use is far from being risk-free, some problems, encountered when using these products, have to be resolved, such as (i) under-deposit corrosion, which, in most cases, takes the form of pitting, and (ii) persistence of the non biodegradable petrosourced formulations.

At present, the orientation towards sustainable development and respect for the environment, whether by voluntary approaches or by the obligation to European regulations, gradually gives rise to a replacement of petrosourced and ethoxylated products by alternative, environmentally friendly bioproducts. Thus, innovative biosourced inhibitors are also tested, under the same procedures, to progressively replace partly or fully the petrosourced inhibitors. Testing the efficacy and understanding the behaviors of those corrosion inhibitors in the RGW is important to optimize their utilization. Therefore, stationary and transitory electrochemical methods were implemented with carbon steel XC38 working electrodes immersed from the start in an RGW, to measure corrosion rate and assess the inhibitive action of the formulas tested as a function of immersion time and surfactant concentration. By combining and comparing results gathered using various electrochemical and analytical techniques and including the case without inhibitor, the mechanisms governing the action of inhibitors and their effectiveness were determined.