

Investigations of several inhibitors for silica scale control in Sumikawa geothermal brine, Japan

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In geothermal power plants, silica in brines precipitates as scale in pipes and injection wells and decreases the amount of injecting brine. A pH adjustment method has been applied to prevent the silica scaling so far, but this method can not completely prohibit the scaling. There is a problem that added sulfate for the pH adjustment promotes anhydrite (CaSO₄) precipitation in production wells.

The purpose of this study is to develop a new method to prevent silica scale with chemical reagents. We examined nine organic inhibitors by passing brine with the reagent through columns. The brine used in this study is taken from well SC-4 under an atmospheric pressure (pH:6.48, Cl:1,100mg/L, SiO₂:980 mg/L) at Sumikawa geothermal power plant (50MW), Akita, Japan. The internal diameter and length of the column in our experiments are 15mm and 40cm, respectively. A teflon pipes is set in the column and filled with glass beads with a diameter of 1mm. The mixed geothermal brine (1L/min) and inhibitor solution (2, 10, and 25mg/L) were passed through the column for 4 days. The flow rates, pH and EC were monitored.

The flow rates of brines in all columns decreased with time, whereas those of the brine without addition of any inhibitors quickly decreased up to 0 L/min within 3 days. The results indicate that the cationic inhibitors showed an aggregation effect of silica in brines and the inhibitor concentration is critical to control the silica precipitation. The best concentration for the prohibition of silica scaling in this study is 2mg/L. This inhibitor can reduce by 10 to 20% of the silica precipitation rates compared to no addition test into the brine. Therefore, we concluded that the effective inhibitor condition is 1) anionic inhibitor and 2) the low concentration.