Silica recovery from Sumikawa geothermal brines in Japan by additon of cationic flocculants

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Silica in geothermal brines deposits as a scale in pipes and injetion wells at geothermal plant and redues the capacity of the injection rates of brines. This is due to depotion of excess silica (ca. 600mg/L) in the geothermal brines. Currently, a pH adjustment method by addition of sulfate into brines has been carried out in the world. However, there are some problems such as corrosion of pipes and other scale generation such as anhydrite in the production well. In addition, most silica scales in Japan include a large amount of aluminum. The solubility of Al-containg amorphous silica is by 150 mg/L lower than pure amorphous silica. This means the pH adjusting method can not sufficiently inhibit scale precipitation.

We examined a recovery method for the excess silica by addition of cationic flicculants into the brines to prohibit the silica scaling by checking the clarity of geothermal brine after the treatment and the economy. The experiments of silica recovery were carried out using geothermal brine in Sumikawa geothermal power plant (50MW), Akita, Japan. We examined several experimental conditions such as effect of concentration of the cationic flocculant and retaining time of the brine before the addition of the flocculant. We measured the total silica concentration and turbidity of the brines.

Our results show that the cationic flocculant used in this study reacts with polymeric silica rather than monomer silica and that 50 mg/L of the cationic flocculants is enough to reduce the silica concentration to the solubility (ca. 380 mg/L) of amorphous silica at 95°C. At this treatment, the turbidity of the brine is low than 10mg/L. The sedimentation rates of precipitated silica by addition of cationic flocculants were also measured. The rate of precipitate reacted with monomer silica is faster than that with polymeric silica.

The geothermal brine used in this study is characterized by the low Cl concentration (less than 1,000 mg/L). To examine the application of our method to other geothermal brines, we also examined a salinity effect of our cationic flocculants to brines with different Cl concentrations. The result shows that the cationic flocculant can effectively remove silica in brines with higher Cl concentration.