Groundwater chemistry in 2012 in Miyagi Prefecture including Tsunami affected area

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Geochemical characteristics of the surface and ground waters (total 238 samples) in Miyagi Prefecture, of which coastal area was damaged by Tsunami occurred in association with the giant earthquake on the 11th March, 2011, was documented to figure out the situation of aqueous environment in 2012 and assess the future risk of groundwater by the Tsunami deposits and Fukushima-Daiichi nuclear disaster.

Anthropogenic impact on the studied water was not obvious for whole studied area, and all the studied waters were free from radiogenic Cs. Salinization is prominent in the groundwaters located in the Tsunami affected area, especially the shallow well waters from <10m depths in the southern part of the prefecture. The highest Cl concentration is 14000 mg/L, while the rate of seawater is commonly less than 3 % (500 mg/ L) one year after the Tsunami. Fe and Mn are occasionally higher than the standards of drinking water (0.3 and 0.05 mg/L respectively) in the Tsunami affected groundwaters, while, minor toxic element concentrations (As, Cd, Se, Pb, Cr^{VI}, Zn, F-) are generally lower than the standard values for drinking water. Those elements were released from the host sediments probably due to the reduction of groundwater in association with seawater contamination by the Tsunami, and Tsunami deposits do not seriously cause the contamination at present. However, the groundwater chemistry must be monitored in the future to assess the groundwater as water resources since the recharging age of the studied groundwaters are generally 20 to 50 years.

A model study on the effects of polyacrylic acid added in geothermal water on the growth of silica scale at a geothermal power plant

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Polyacrylic acid (PAA) has been added as an inhibitor of calcium carbonate scale at the Takigami geothermal power plant, Oita prefecture, Japan. In the geothermal power plant, since the addition of PAA, the amount of silica scale formed from geothermal water has been reported to incerase compared with that before the addition.
Alminum (Al) is extremely concentrated into the silica scales in spite of its low concentration in geothermal water. Therefore, it is considered that Al plays an important role for the formation of silica scale from geothermal water[1]. Moreover, Al forms a stable Al-PAA complex[2]. As a result, it is necessary to consider the interaction among Al, PAA and silicic acid in geothermal water.

In this study, some model experiments were carried out to elucidate wheather PAA accelerates the growth of silica scale in geothermal water containig Al, PAA and slicic acid.

At pH 8.5, which is pH value of the geothermal water, PAA didn't affect the polymerization of silicic acid, while Al and Al-PAA inhibited the polymerization between monosilicic acid and polysilicic acid (M-P reaction). From ^{27}Al NMR, we found that 4-coordinated Al in supersaturated silicic acid solution can convert into 6-coordinated Al by the addition of PAA, indicating the formation of Al-PAA complex. The Al-PAA complex adsorbed on the surface of silica gel and retarded the dissolution of the silica gel. It can be deduced that the growth of silica scales from geothermal water is accelerated due to the inhibitions of M-P reaction and of dissolution of silica by the Al-PAA complex.

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