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Geochemical properties of groundwater used to geothermal cooling and heating system

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Recently, geothermal cooling and heating system has been used in many countries to reduce emission of greenhouse gases such as water vapour and carbon dioxide (CO_2). Especially, CO_2 is emitted from combustion of fossil fuel used for cooling and heating of buildings. Therefore, many countries make an effort to reduce amount of CO_2 emitted from use of fossil fuel. The geothermal cooling and heating system is good to reduce amount of CO_2. Especially, open loop geothermal system shows good thermal efficiency. However, groundwater contaminations will be considered because groundwater is directly used in open loop geothermal system. This study was performed to examine chemical and isotope compositions of groundwater used in open loop geothermal system and to evaluate influence of the system on groundwater using hydrochemical modeling program (preequc). Water temperature of well used in the system (GH) and well around the system (GB) ranged from 8.4 to 17.0 ° and from 15.1 to 18.0 °, respectively. The water temperature in GH was lower than that in GB because of heating mode of the system. Also, EC in GH and GB showed significant difference. The variation trend of EC was different at each site where the system was installed. These results mean that main factors controlling EC in GH was not the system. Generally, EC of groundwater was influenced by water-rock interaction. However, DO and Eh hardly showed significant difference. The operation period of the system observed in this study was short than 5 years. Therefore, influence of the open loop geothermal system on groundwater did not shown significantly. However, while Fe^{2+} and Mn^{2+} were not observed in GB, these components were measured in GH. The concentrations of Fe^{2+} and Mn^{2+} in GH ranged from 0.02 to 0.14 mg/L and from 0.03 to 0.18 mg/L, respectively. These results mean that redox conditions of GH were changed by the system little by little. In this study, influence of the open loop geothermal system on groundwater did not shown significantly. However, change of redox condition was slightly observed. To significantly observe influence of the open loop geothermal system, monitoring for well installed the system is necessary during long period. This work was supported by the Energy Efficiency and Resources of the Korea Institute of Energy Technology Evaluation and Planning (KETEP) grant funded by the Korea government Ministry of Knowledge Economy (No.20123040110010).