

Hydrogeochemistry and Heavy Metal Enrichment of Supply Water from the Chungnam National University and Taejon Area, Korea

Chan Hee Lee¹⁾ · Hyun Koo Lee¹⁾ · Jong Chang Lee¹⁾

This study was undertaken to provide a drinking water quality on the basis of physicochemical properties for total 66 supply waters, which were collected on January (30 samples), February (25 samples) and August (11 samples) in 1999 from the Taejeon area (25 sites) and Daedeok Campus (30 sites) of the Chungnam National University (CNU), Korea. And then, we were verified to analytical procedures and reliabilities of ICP-MS (Perkin-Elmer, Model; ELAN 6000) and IC (WATERS, Model; WA/2690) set on the Central Research Facilities at the CNU of recently.

Hydrochemistry of supply water from the studied samples belong to the $\text{Ca}^{2+}\text{-HCO}_3^-$ type, and this waters were characterized by the relatively significant enrichment of Ca^{2+} , Na^+ , K^+ , HCO_3^- , SO_4^{2-} and Cl^- ions compared to the original surface water from the Daecheong lake. Generally, the supply water of the CNU has a slightly higher values of temperature (14.1 °C), pH (6.95), Eh (0 mV), conductivity (117 $\mu\text{S/cm}$) and TDS (86.975 mg/l) compared to the original lake water. Whereas, supply water of the Taejeon area has a mean values for 10.7 °C of temperature, 6.86 of pH, -12 mV of Eh, 88 $\mu\text{S/cm}$ of EC and 70.379 mg/l of TDS in February, and the waters of the same sites in August are a slightly high temperature (26.1 °C), TDS (78.069 mg/l) and extremely high EC (442 $\mu\text{S/cm}$) value. These values are similar to physicochemical properties of the lake water by seasonal differences.

Geochemical modeling showed that potentially toxic ions might exist in the forms of mainly free metal such as Cu^{2+} and/or Zn^{2+} and a small amount of CO_3^{2-} and/or OH^- in the supply water. Saturation indices of the mostly silicate minerals in the water samples show undersaturated, and then progressively evolved toward the saturation condition because of TDS increases. The water seemed to be in equilibrium with stable kaolinite field of the normal stability diagrams for the silicate minerals between the natural water to mineral reactions. Normalized by concentrations of original lake water, the average EIs of the CNU supply water can be calculated with the major anions = 1.05, major cations = 1.56 and toxic cations = 13.05. As the Taejeon, the average EIs of supply water can be calculated with nearly 1.00, but the average EIs on Cu+Zn possible source of decrepit pipe lines are 71.92 in February and 52.11 in August samples, respectively. The EI values varied with sampling sites, however, do not exceeded by concentrations of drinking water standard.

All kinds of the water sample for chemical analyses were filtered through a 0.45 μm cellulose nitrate membrane filter using hand vacuum pump. In this study, the filter papers for the supply water are adhered to pale yellow or yellowish brown colored dissolved solids and precipitates, which are coated by 0.02 to 0.75 mm thick per one liter of water with colloidal particles of about 1 to 2 μm size. Those are mainly

Fe-Cu-Zn compounds and partly detected to Mn, Ni and Pb, which of the compounds range from 0.01 to 3.25 mg/l by net weight. The concentrations of mostly major and some minor elements have not filtering effect with the exception of Cu, Fe and Zn. Especially, mean concentration of total Fe in non-filtered supply water was 168.52 $\mu\text{g/l}$ but this content decreased to 42.58 $\mu\text{g/l}$ after filtering as the same sites.

This study suggests that we will be understand not only a water quality and assessments of the severely polluted drinking water but also attenuation methods on the possible future pollutions with turbidity, stain and organism of the supply water influenced with sewages and decrepit pipe lines. And we discuss results from each analytical procedures including instrumental detection limit, precision and accuracy of ICP-MS and IC in the CNU. Although our previous and present experiments provide data on those instruments with water samples, this represents our initial attempt to extrapolate those data to more complex geologic materials. The authors aspire to hope for a wide use and ask much good advices for those instruments.

Key Words : Supply water, Hydrogeochemistry, Heavy metals, Taejon area

1) Department of Geology, Chungnam National University (chanlee@cnu.ac.kr)