

Neutralization of acid discharged water from the Kusatsu hot spring area of Japan utilizing industrial by-products

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The Kusatsu hot spring as one of the most famous acidic hot springs in Japan and closed mines taking Sulphur are located in the Eastern foot of Mt. Kusatsu-Shirane as an active volcano. The Yukawa river composed of the acid discharged water from the hot spring area is characterized by low pH value (less than 2.0) and high concentration of harmful chemical constituents such as Arsenic (As), Lead (Pb), and Fluorine (F). The neutralization treatment utilizing crushed limestone has been continuously carried out by the Ministry of Land, Infrastructure, Transport and Tourism (government of Japan) over 50 years. In this study, temporal and spatial variations of water quality in the Kusatsu hot spring area were investigated and the applicability of industrial by-products as alternative liming agents was experimentally examined. Acid discharged water and river water were obtained from the Kusatsu hot spring area. Water temperature, pH, and electric conductivity were performed at the sampling site. Concentration of major ions and heavy metals was measured after filtering the water samples. The batch neutralization experiment was conducted for the acid discharged water from the Kusatsu hot spring utilizing industrial by-products including fly ash, clinker ash, steel slug, autoclaved lightweight aerated concrete, and recycled concrete. Centrifuge tubes with 50 mL volume were filled with 4 g or 0.4 g of each waste material and 40 mL of the acid discharged water. The prepared tubes were shaken for 10 minutes, 1 hour, 3 hours, 12 hours, and 24 hours. Measurements of pH and heavy metal concentration were immediately performed. The acid discharged water showed significantly lower pH value (1.6 to 2.0) and relatively high concentration of As and Pb. Based on the result of batch neutralization experiment, steel slug and recycled concrete showed relatively high neutralization performance if compared to limestone used in the Kusatsu hot spring area.

Keywords: Kusatsu hot spring area, Acid discharged water, Water quality, Neutralization, Industrial by-products