

Neutralization using recycled waste materials for acid wastewater from the Kusatsu hot spring area in Japan

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Acid river waters from active volcanos and mines influence seriously to ecosystems in the river basins. This study is paid attention to the Yukawa River that is characterized by markedly lower pH value (less than 2.0) and higher concentration of harmful elements such as arsenic (As) and lead (Pb) and that is the acid discharged water from the Kusatsu hot spring and closed sulfur mines located in the eastern foot of Kusatsu-Shirane Volcano in central Japan. The neutralization treatment of this river water using crushed limestone has been continuously carried out by the Ministry of Land, Infrastructure, Transport and Tourism (government of Japan) for more than 50 years. We have examined the applicability of recycled waste materials as alternative liming agents to the neutralization treatment using crushed limestone through batch neutralization experiments in laboratory. The neutralization experiments for the acid wastewater were performed the mixing of water from the Kusatsu hot spring with fly ash, clinker ash, steel slug, autoclaved lightweight aerated concrete, recycled concrete, wood ash, oyster shell, and calcium carbonate as a reference liming agent. The experimental conditions are as follows. Centrifuge tubes with 50 mL volume were filled with appropriate weight of each recycled waste material and 40 mL of the acid wastewater to have the solid-liquid ratio of 1:10 to 1:4000. Water samples are separated by centrifugation after shaking for 10 minutes. Subsequently we measured pH, electric conductivity (EC), and concentrations of harmful elements (As and Pb) immediately. As the results, neutralization performance of steel slug and recycled concrete was significantly higher than that of other recycled waste materials. For removal performance of both As and Pb, steel slug, recycled concrete, and wood ash revealed clearly higher comparing with calcium carbonate as a common liming agent. The above results suggest that steel slug and recycled concrete are promising alternative liming agents to calcium carbonate.

Keywords: Kusatsu hot spring area, Acid wastewater, Neutralization treatment, Recycled waste materials