

Treatment of fluoride containing acid wastewater using red mud

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Capacity of red mud for the fluoride(F) removal and acid neutralization for the wastewater from a semiconductor manufactory was investigated using a batch experiment. The red mud was characterized for the chemical and mineralogical compositions using XRF and XRD, respectively. The pH was determined with 1red mud and 10distilled water after 24 hrs reaction. The point of zero charge(PZC) was determined with a potentiometric method. Red mud and wastewater was mixed at 0 – 25% of red mud. The suspension was reacted and the pH and F concentration of the solution were determined.

The red mud contained 34.3% of Fe₂O₃, 25.8% of Al₂O₃, 9.96% of SiO₂, 7.08% of Na₂O, 6.07% of TiO₂, and 5.07% of CaO. Hematite, boehmite, zeolite, quartz, anatase and calcite were identified as major minerals of red mud. The pH and PZC of red mud was pH 12.4 and pH 9.2, respectively.

The pH sharply increased and the F concentration decreased for initial 2 hrs of the reaction and then showed a steady state for all red mud content. The pH increased from 1.7 to 8.8 with increasing the red mud content. The F concentration decreased from 2,600 to 31 mg L⁻¹ with increasing to 7.5% of red mud. The F concentration of the solution was not significantly changed with increasing red mud content at > 7.5%.

The alkalinity of red mud neutralized the acidic wastewater. The F removal rate was increased with increasing content of iron oxides as major solid phases for the F adsorption at < 7.5% of red mud(pH 7.1). No significant change of F removal rate with increasing red mud content at > 7.5% might be due to the increased surface charge of iron oxide along with increased solution pH. The capacity of neutralization and F removal of red mud indicated that red mud can be utilized as a treatment agent for F containing acidic wastewater.

Hydrogeochemical characterization of urban groundwater in Seoul (South Korea) using Self-Organizing-Map technique

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Degradation of urban groundwater quality is serious in some metropolitan cities such as Seoul, South Korea. In Seoul, depression of groundwater levels by over-pumping is considered as a major cause of groundwater contamination. In this study, we investigated spatial variations of groundwater level (i.e., drawdown) and hydrochemistry in Seoul. Field measurements and water sampling were made in 2003 and 2004 for this study. The average and maximum groundwater depths were 13.3 m and 73.3 m, respectively. The average and maximum concentrations of Cl, NO₃, and SO₄ as the potential indicators of anthropogenic contamination were high (45.5 and 189.8 mg/L, 24.8 and 528.1 mg/L, and 40.1 and 128.1 mg/L, respectively). Based on the Hierarchical Cluster Analysis (HCA) and Self Organizing Map (SOM) technique, four main clusters of groundwater samples were derived. Cluster 1 has the lowest concentrations of most solutes and represents the non-polluted groundwater; Cluster 2 contains relatively low concentrations of most solutes except NO₃; Cluster 3 and Cluster 4 are highly enriched in solutes (esp., Ca, Mg, Cl, SO₄) because of anthropogenic contamination. Cluster 3 has the high NO₃ but low HCO₃ concentrations, while Cluster 4 is opposite. The relationship between groundwater quality and groundwater depth was further evaluated by SOM. However, there is a weak correlation between spatial distributions of classified groups and groundwater depth data because of high heterogeneity of urban groundwater. On the other hand, the use of geo-SOM method showed a rather spatially classified water chemistry.