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Assessing roles of accumulated Mn oxides in slag reactor: autocatalytic oxidation of Mn and adsorption of Ni

DAE-GYU LIM[1], DUK-MIN KIM[2], HYE-LIM KWON[2], WOONG-LIM LIM[2], JOON-HAK LEE[3,4] AND SEONG-TAEK YUN[5]

[1]Korea university
[2]Sangji University
[3]Korea Mine Rehabilitation and Mineral Resources Corporation
[4]Hanyang University
[5]Korea University

Presenting Author: daegull1995@korea.ac.kr

As treatment of Mn using alkaline agents requires pH of >9 and oxidants such as potassium permanganate is expensive, novel technologies utilizing passive slag reactor is needed. In this study, Mn and Ni of mine drainage were treated in column- and pilot-scale slag reactors for ~1 yr. The outflow of column was mainly saturated with manganite and sometimes with rhodochrosite. A lot of birnessite which has a low point of zero charge and sorbed Ni was observed in the generated precipitates of the reactor using a scanning electron microscopy-energy dispersive spectroscopy. This suggests that adsorptive removal of Ni was effective although most of outflow samples were undersaturated with Ni precipitates. In the pilot-scale experiments, the increase of pH by steel slag resulted in supersaturation of manganite and rhodochrosite as the inflow had relatively high alkalinity of 139–252 mg/L as $CaCO_3$. Mn concentrations at the outflow of the pilot-scale slag reactors decreased with time when assessed at similar pOH ranges. This result could be attributed to the autocatalytic oxidation by MnO_2 which accumulated in the pilot-scale reactors. Thus, the utilization of the slag reactor with accumulating Mn oxides can be a promising technology to remove Mn and Ni.

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