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The optimization of As and Bi removal from sulfur minerals by electrochemical separation

Eun-ji myung (1), Hyun-soo kim (1), Kang-hee cho (2), Nag-chul choi (2), and Cheon-young park (1)

(1) Dept. of Energy and Resources Engineering, Chosun Univ., Gwang-Ju, Korea, Republic Of (ej6865@naver.com), (2) Dept. of Rural Systems Engineering, Seoul National Univ., Seoul, Korea, Republic Of

Global population growth coupled with increased wealth and a desire amongst developing economies to achieve a higher standard of living has resulted in a significant demand for industrial metals. Concentrates can have significant penalty element(As, Bi etc.) concentrations depending on the nature of the ore source, specifically the mineralogy of the industrial minerals(Au, Cu etc.). In this case the penalty elements are associated with sulfide minerals that contain elements of value causing the penalty elements to become concentrated in the final concentrate. The objective of this study was to examine the As and Bi removal by electrochemical separation from sulfur minerals. The characteristics of sulfur minerals were analyzed using chemical, XRD, SEM/EDS and reflected light microscopy. Electrochemical separation (microwave) experiments were performed to examine the effects of exposure intensity and time. The results of XRD, SEM/EDS and reflected light microscopy showed that the sulfur mineral mainly composed of PbS, ZnS and FeAsS. The sulfur mineral had an Pb, Zn, As and Bi contents of 60,543.42, 110,293.49, 76,419.4 and 66.07 mg/kg, respectively.The As removal increased from 76,419.4 mg/kg to 364.60 mg/kg with increasing microwave exposure intensity from 1 kW to 5 kW, and microwave exposure time from 1min to 10 min. The Bi removal increased from 66.07 mg/kg to 19.84 mg/kg with increasing microwave exposure intensity from 1 kW to 5 kW, and microwave exposure time from 1min to 10 min. This phenomenon can be attributed to removal of As, Bi with volatilization of sulfur present in sulfur mineral by microwave heating.

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