

Improvement in grade of minerals using simultaneous Bio-oxidation of invisible gold concentrate and deep-sea manganese crust

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Many sulfides of metal such as galena, sphalerite, chalcopyrite, and pyrite, are semiconductors. When two kinds of such minerals contact each other in an electrolyte, a galvanic couple, where the mineral of lower rest potential as anode, and that of higher rest potential as cathode forms. Manganese dioxide is also a semiconductor with much higher rest potential than all sulfides mentioned above, so that a galvanic couple in which both the minerals would dissolve simultaneously can form, when it contacts with any of the sulfides. The aim of this study was to investigate the improvement in grade of minerals using the simultaneous bio-oxidation of deep-sea manganese crust and invisible gold concentrate. The samples(deep-sea manganese crust and invisible gold concentrate) were characterized by chemical and XRD analysis. The primary components of the invisible gold concentrate was pyrite and quartz and the deep-sea manganese crust was amorphous material, as detected using XRD. The result of chemical analysis showed that Au, Ag, Te contents in the invisible gold concentrate 130.2, 954.1 and 1,043.6 mg/kg, respectively. and that Mn, Ni, Co contents in the deep-sea manganese crust 19,501.5, 151.9, 400.4 mg/kg, respectively. In order to increase the bacteria's tolerance of heavy metals, the bacteria using bio-oxidation experiments were repeatedly subcultured in an Cu adaptation-medium containing of 382.98 mg/l for 20 periods of 21 days. The improvement in grade of samples of in present adapted bacteria condition was greater than another conditions(control and in present non-adapted bacteria). The Au-Ag-Te contents in the invisible gold concentrate was enhanced in the order of physical oxidation, simultaneous/non-adaptive bio-oxidation, adaptive/bio-oxidation, simultaneous/adaptive bio-oxidation. If the bacteria is adapted to heavy metal ions and an optimization of conditions is found in future bio-oxidation-leaching processes.

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