ABSTRAK

High Pressure Acid Leaching (HPAL) adalah teknik pelarutan logam yang melibatkan suhu dan tekanan tinggi. HPAL diakui sebagai metode yang efektif untuk melarutkan logam secara selektif terhadap besi dan alumunium. Kinetika merupakan model matematika suatu proses kimia. Kinetika proses pelindian perlu diketahui untuk mengetahui faktor yang mengendalikan reaksi suatu proses. Penelitian ini mempelajari parameter persen solid dan temperatur terhadap persen ekstraksi nikel dan menganalisis kinetika non isothermal dan kinetika isothermal. Pengaruh logam lain terhadap pelindian nikel juga dipelajari. Hasil persen ekstraksi nikel dari pengaruhnya variable persen solid dan temperatur ditinjau dengan analisis statistika uji hubungan dan uji korelasi.

Serangkaian proses HPAL telah dilakukan pada bijih nikel yang berasal dari deposit laterit, dengan komposisi 1,11% Ni, 0,07% Co, 42,% Fe, 11% Al, 0,782% Mn, dan 0,048% Cr. Fase mineral utama yang teridentifikasi dalam bijih adalah goetit. Proses HPAL dilakukan selama 120 menit dengan kecepatan pengadukan 250 rpm, rasio asam sulfat terhadap bijih kering 300 kg/ton. Residu hasil penelitian dianalisis menggunakan XRD, XRF, dan SEM. Pengujian XRF menggunakan dua *certified reference material* (CRM), yaitu CRM laterit dan CRM hematit. Proses pelindian mencakup dua kondisi: non isothermal dan isothermal, analisis kinetika dilakukan pada kedua kondisi tersebut.

Hasil eksperimen menunjukkan bahwa persen ekstraksi nikel tertinggi, mencapai 90,4%, diperoleh pada persen solid 20% dan temperatur 250°C. Mineral dominan pada residu hasil pelindian adalah hematit. Model kinetika pada kondisi non isothermal adalah Difusi 1. Model ini mengasumsikan proses difusi dipengaruhi oleh laju reaksi yang melambat karena permukaan yang tidak bereaksi. Model kinetika pada kondisi isothermal adalah orde ketiga. Model ini mengasumsikan konsentrasi reaktan sangat berpengaruh terhadap persen ekstraksi nikel. Pada proses HPAL, besi dan alumunium mengalami presipitasi menjadi hematit dan alunit. Mangan, Kobalt, dan kromium merupakan logam pengotor yang berikatan dengan senyawa asam sulfat. Analisis statistika menunjukkan tidak ada perbedaan antara penggunaan CRM terhadap persen ekstraksi nikel. Persen solid tidak memiliki pengaruh signifikan terhadap persen ekstraksi nikel. Sedangkan temperatur memiliki pengaruh signifikan terhadap persen ekstraksi nikel.

Kata kunci: nikel laterit, HPAL, kinetika non isothermal, kinetika isothermal

ABSTRACT

High Pressure Acid Leaching (HPAL) is a metal dissolution technique that involves high temperature and pressure. HPAL is recognized as an effective method for selectively dissolving metals, particularly in relation to iron and aluminum. Kinetics is the mathematical model of a chemical process, and understanding the kinetics of the leaching process is essential for identifying the factors that control the reaction. This study investigates the effects of solid percentage and temperature on nickel extraction percentage, as well as analyzing both non-isothermal and isothermal kinetics. The influence of other metals on nickel leaching is also studied. The results regarding nickel extraction percentages influenced by solid percentage and temperature are examined using statistical correlation and relationship tests.

A series of HPAL processes were conducted on nickel ore sourced from laterite deposits, with a composition of 1.11% Ni, 0.07% Co, 42% Fe, 11% Al, 0.782% Mn, and 0.048% Cr. The main mineral phase identified in the ore is goethite. The HPAL process was conducted for 120 minutes with a stirring speed of 250 rpm and a sulfuric acid-to-dry ore ratio of 300 kg/ton. The residues from the study were analyzed using XRD, XRF, and SEM. The XRF testing utilized two Certified Reference Materials (CRMs), namely laterite CRM and hematite CRM. The leaching process was carried out under two conditions: non-isothermal and isothermal, with kinetic analysis performed for both conditions.

Experimental results show that the highest nickel extraction percentage, reaching 90.4%, was obtained at a solid percentage of 20% and temperature of 250°C. The dominant mineral in the leachate residue is hematite. The kinetic model under non-isothermal conditions is Diffusion 1, which assumes that the diffusion process is influenced by a slowing reaction rate due to an unreacted surface. The kinetic model under isothermal conditions is third-order, assuming that reactant concentration significantly affects nickel extraction percentage. In the HPAL process, iron and aluminum precipitate as hematite and alunite. Manganese, cobalt, and chromium act as impurities that bind with sulfuric acid compounds. Statistical analysis indicates no significant difference in nickel extraction percentage when using CRM. Solid percentage does not have a significant impact on nickel extraction percentage, while temperature has a significant effect.

Keyword**:** *nickel laterite, HPAL, kinetics non isotherm, kinetics isotherm*