# STRATEGI BARU VALORISASI PRODUK SAMPING KALKOPIRIT INDONESIA: PELINDIAN LANGSUNG MENGGUNAKAN *EUTECTIC IONIC LIQUIDS* (EILs) UNTUK PUNGUT ULANG LOGAM KRITIS PRODUK SAMPING SUMBER PRIMER

**SKRIPSI**

diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains pada Program Studi Kimia

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**PROGRAM STUDI KIMIA**

**FAKULTAS PENDIDIKAN MATEMATIKA DAN ILMU PENGETAHUAN ALAM**

**UNIVERSITAS PENDIDIKAN INDONESIA**

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## ABSTRAK

Logam kritis produk samping pada kalkopirit dapat dimanfaatkan sebagai teknologi energi bersih. Logam kritis produk samping yang terdapat pada kalkopirit ialah Mn, Co, Zn, Ga, Se, In, Sn, Sb, Hg, Ti, dan Bi. Logam kritis produk samping tersebut diambil dengan EILs sebagai alternatif dari metode pirometalurgi dan hidrometalurgi karena tingkat pencemaran lingkungannya yang rendah. Tujuan dari penelitian ini untuk mengetahui efektivitas EILs dalam melindi logam kritis produk samping kalkopirit, mengetahui pengaruh variasi rasio padatan/EILs, suhu, dan waktu, juga mendapatkan persentase kandungan logam kritis produk samping yang berhasil dipungut ulang dengan EILs betain-asam oktanoat. Pungut ulang logam kritis produk samping kalkopirit menggunakan metode pelindian dengan EILs campuran dari betain (HBA) dan asam oktanoat (HBD) yang ramah lingkungan. Karakterisasi pun dilakukan dengan FTIR, XRF, XRD, dan SEM-EDX. Didapatkan hasil unsur pungut ulang pada kalkopirit ialah In, Zn, Hg, Si, S, Ag, La, Fe, Cu, dan Pb. Analisis lebih lanjut dilakukan pada logam kritis produk samping kalkopirit yang berhasil didapatkan ialah In, Zn, dan Hg dengan kondisi pelindian optimum rasio 1/10, 95°C, dan 48 jam beserta persentase pungut ulangnya ialah In 100%, Zn 31,25%, dan Hg 48,57%. EILs betain-asam oktanoat hanya efektif untuk melindi logam kritis produk samping kalkopirit indiun (In) dengan persentase 100%, untuk logam lain kurang efektif karena persentasenya dibawah 50%.

**Kata kunci:** EILs, kalkopirit, logam kritis, pelindian, produk samping

**_ABSTRACT_**

*Critical metals as by-products in chalcopyrite can be utilized in clean energy technologies. The critical by-product metals contained in chalcopyrite include Mn, Co, Zn, Ga, Se, In, Sn, Sb, Hg, Ti, and Bi. These critical metals are extracted using Eutectic Ionic Liquids (EILs) as an alternative to pyrometallurgical and hydrometallurgical methods due to their lower environmental impact. The aim of this study was to evaluate the effectiveness of EILs in leaching critical by-product metals from chalcopyrite, to investigate the effect of variations in the solid/EIL ratio, temperature, and time, as well as to determine the recovery percentage of critical metals using betaine-octanoic acid EILs. The recovery of critical by-product metals from chalcopyrite was carried out through leaching with environmentally friendly EILs composed of betaine (HBA) and octanoic acid (HBD). Characterization was performed using FTIR, XRF, XRD, and SEM-EDX. The recovered elements from chalcopyrite included In, Zn, Hg, Si, S, Ag, La, Fe, Cu, and Pb. Further analysis focused on the critical by-product metals successfully recovered, namely In, Zn, and Hg, under optimum leaching conditions of a 1/10 solid/EIL ratio, 95℃, and 48 hours. The recovery percentages were 100% for In, 31.25% for Zn, and 48.57% for Hg. Betaine-octanoic acid EILs proved effective only for leaching indium (In) with 100% recovery, while less effective for other metals, with recovery rates below 50%.*

***Key word**: by-products, chalcopyrite, critical metals, EILs, leaching*

**DAFTAR ISI**

## DAFTAR GAMBAR

## DAFTAR TABEL

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