

**Pungut Ulang Logam Tanah Jarang dari Limbah Elektronik Menggunakan
Cairan Ionik Terfungsionalisasi Karboksilat: Studi Literatur dan Analisis
Tekno-Ekonomi**

SKRIPSI

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



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UNIVERSITAS PENDIDIKAN INDONESIA
BANDUNG
2021

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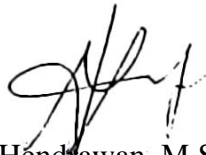


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ABSTRAK

Penelitian ini bertujuan untuk mengevaluasi kinerja dan menganalisa prospek ekonomi dari cairan ionik terfungsionalisasi (*Functionalized Ionic Liquids*, FILs) karboksilat untuk proses pungut ulang logam tanah jarang (*Rare Earth Elements*, REEs) dari limbah elektronik. Penelitian dilakukan dengan metode studi literatur naratif dan analisis tekno-ekonomi. Karena pasokan REEs sebagai bahan baku penting dalam teknologi modern dikhawatirkan semakin menipis dan proses penambangannya sulit, alternatif baru untuk memperoleh REEs diperlukan. Salah satu caranya adalah dengan memungut ulang REEs dari limbah elektronik yang kaya akan REEs menggunakan FILs-karboksilat. FILs-karboksilat umumnya memiliki viskositas yang besar dan stabil secara termal. Kinerjanya dapat dilihat dari nilai efisiensi ekstraksi (E%) terhadap masing-masing REEs di mana FILs-karboksilat ini cenderung mengekstrak REEs berat. FILs-karboksilat dari asam lemak tunggal memiliki rata-rata E% paling besar dibandingkan dengan FILs-karboksilat dari senyawa karboksilat non-asam lemak dan campuran asam lemak pada minyak nabati. E% dapat dipengaruhi oleh tingkat kemurnian dan perbedaan struktur FILs seperti panjang rantai alkil, jumlah ikatan rangkap karbon serta posisi gugus karboksilat pada kondisi tertentu. Berdasarkan analisis tekno-ekonomi, pungut ulang yttrium dari limbah lampu menggunakan FILs-karboksilat layak dilakukan dalam skala besar secara komersial karena perubahan parameternya cenderung positif dengan keuntungan paling besar saat menggunakan $[P_{8,8,8,8}][Oleat]$ dibandingkan dengan $[N_{1,8,8,8}][NA]$ dan $[N_{1,8,8,8}][PO]$.

Kata Kunci: Pungut Ulang, Logam Tanah Jarang, Limbah Elektronik, Cairan Ionik, dan Karboksilat.

ABSTRACT

This study aims to evaluate the performance and analyze the economic prospects of carboxylate functionalized ionic liquids (FILs) for the recovery of rare earth elements (REEs) from electronic waste. The research was conducted using narrative literature study methods and techno-economic analysis. Because the supply of REEs as an important raw material in modern technology is feared to be running low and the mining process is difficult, new alternatives to obtain REEs are needed. One way is to recover REEs from electronic waste rich in REEs using FILs-carboxylate. FILs-carboxylate generally have a large viscosity and are thermally stable. Its performance can be seen from the value of extraction efficiency (E%) for each REE where these FILs-carboxylate tend to extract heavy REEs. FILs-carboxylate from single fatty acids had the highest average E% compared to FILs-carboxylate from non-fatty acid carboxylic compounds and fatty acid mixtures from vegetable oils. E% can be influenced by the level of purity and differences in the structure of FILs such as alkyl chain length, number of carbon double bonds and the position of carboxylate groups under certain conditions. Based on the techno-economic analysis, recovery of yttrium from lamp waste using FILs-carboxylate is feasible on a large scale commercially because the parameter changes tend to be positive with the greatest advantage when using $[P_{8,8,8,8}][Oleat]$ compared to $[N_{1,8,8,8}][NA]$ and $[N_{1,8,8,8}][PO]$.

Keywords: Recovery, Rare Earth Elements, Electronic Waste, Ionic Liquids, and Carboxylate.

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