

INTISARI

Saat ini, *red mud* menjadi salah satu permasalahan serius dikarenakan sifatnya yang sangat basa, volume produksi yang tinggi, serta mengandung logam berat yang berpotensi mencemari lingkungan. Di sisi lain, *red mud* memiliki berkah tersendiri yakni berupa adanya kandungan logam berharga berupa logam tanah jarang (LTJ) atau *rare earth elements* (REE) yang dapat di-*recovery* karena memiliki nilai ekonomis tinggi. Salah satu metode ramah lingkungan yang dapat digunakan untuk proses *recovery* logam REE pada *red mud* yakni *phytomining*, yaitu metode dengan menggunakan bantuan tanaman yang sekaligus dapat meremediasi lahan. Penelitian ini bertujuan untuk mengevaluasi kemampuan tanaman *Imperata cylindrica* dalam hal *recovery* logam, rehabilitasi *red mud*, serta potensi utilisasi biomassa sebagai bahan bakar alternatif berupa *refused derived fuel* (RDF). Studi diawali dengan pengkondisian media tanam berdasarkan penambahan tanah dan asam sitrat dengan *red mud* berdasarkan hasil optimasi menggunakan metode *Response Surface Methodolgy* (RSM). *Phytomining* dimulai tatkala kondisi pH telah mencapai kondisi ideal yang berada pada rentang 8,0-8,5. Hasil penelitian menunjukkan bahwa tanaman *Imperata cylindrica* mampu untuk mengakumulasi logam REE (Sc, Nd, Gd, Ce, dan La) dan logam mayor seperti TI, Fe, dan Al ke dalam badan tanaman. Logam Gd memiliki kuantitas serapan tertinggi dengan nilai 119,5 mg/kg, adapun untuk logam mayor, serapan logam terjadi di seluruh bagian tanaman dengan serapan tertinggi terjadi pada logam Al. Praktik *phytomining* juga memberikan hasil berupa peningkatan kualitas substrat pasca panen sebagai indikator keberhasilan restorasi lahan. Selain itu, tanaman *Imperata cylindrica* juga memiliki potensi *yield* biomassa dengan nilai tertinggi di angka 2,95 ton/ha yang berimplikasi pada potensi energi yang dapat dihasilkan sebesar 46.159,81 MJ/ha.

Kata kunci: Aluminium, logam tanah jarang, *phytomining*, *red mud*, restorasi lahan

ABSTRACT

*Currently, red mud is a serious problem due to its highly alkaline nature, high production volume, and heavy metal content that has the potential to pollute the environment. On the other hand, red mud has its own benefits in the form of valuable metal content such as rare earth elements (REE) that can be recovered because it has high economic value. One of the environmentally friendly methods that can be used for the recovery process of REE metals in red mud is phytomining, which is a method that utilizes plants that can also remediate the land. This study aims to evaluate the ability of *Imperata cylindrica* plants in terms of metal recovery, red mud rehabilitation, and the potential utilization of biomass as an alternative fuel in the form of refused derived fuel (RDF). The study began with the conditioning of the growing media based on the addition of soil and citric acid with red mud based on the optimization results using Response Surface Methodology (RSM). Phytomining began when the pH condition has reached the ideal condition which is in the range of 8.0-8.5. The results showed that *Imperata cylindrica* plants were able to accumulate REE metals (Sc, Nd, Gd, Ce, and La) and major metals such as Ti, Fe, and Al into the plant body. Gd metal has the highest uptake quantity with a value of 119.5 mg/kg, while for major metals, metal uptake occurs in all parts of the plant with the highest uptake occurring in Al metal. The practice of phytomining also provides results in improving the quality of the post-harvest substrate as an indicator of the success of land restoration. In addition, *Imperata cylindrica* plants also have biomass yield potential with the highest estimated value at 2.95 tons/ha which has implications for the energy potential that can be generated at 46,159.81 MJ/ha.*

Keyword: *Aluminum, land restoration, phytomining, rare earth elements, red mud*