

**INDICATIVE ASSESSMENT OF Ni PHYTOMINING
VIABILITY IN SERPENTINITE OUTCROP AT
GINIGALPELESSA**

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Degree of Master of Philosophy

Department of Earth Resources Engineering

University of Moratuwa

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Thesis submitted in partial fulfillment of the requirements for the degree of Master of
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Abstract

With the recent recognition of Ni as a critical metal, it is challenging to find alternative Ni resources and new extraction techniques to secure a stable supply of Ni. In this context, Ni phytomining has attracted widespread attention as an eco-friendly mining approach, which was especially developed to extract metal from low-grade metal resources. In phytomining, hyperaccumulator plants are used to recover Ni from Ni-rich low-grade soils such as serpentine. Ginigalpelessa is one of the largest serpentinite deposits in Sri Lanka, where the geology and serpentine toxicity are well-documented. However, limited approaches have been taken to study the potential of Ni phytomining in soil. Therefore, 31 locations were sampled and collected soil and rock to assess the Ni enrichment in the serpentine soil. The native plants were analyzed to identify hyperaccumulators for phytomining experiments. Though the total Ni grade in soil varied from 0.4-1.7 wt%, the low bioavailable fraction (1-4 wt%) makes it challenging to implement phytomining in the deposit. Hyperaccumulation assessment of native plants recognized *Apluda mutica* (*A. mutica*) as the best plant species for phytomining. During phytomining trials, the selected Ni accumulator species showed a strong negative correlation between hyperaccumulation and increasing soil treatments. *Crotalaria verrucosa* and *A. mutica* produced the highest Ni-rich bio-ores. The leaching assays were carried out with open burnt and incinerated bio-ores of *A. mutica* under different pulp densities (100 g/L and 200 g/L) and H₂SO₄ concentrations (1 mol/L and 5 mol/L). The highest leaching efficiency was observed as 59% in open burnt samples (under 100 g/L; 5 mol/L H₂SO₄). The high Ni-enriched locations (>1.5 wt%) in the deposit need to be assessed further for direct Ni mining while the remaining area can be developed for in-situ phytomining. The hyperaccumulators identified in the study can be used for soil remediation from Ni and Co-contaminated soils.

Keywords: Ni enrichment, Ni hyperaccumulators, bioconcentration factor, leaching efficiency

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LIST OF ABBREVIATIONS

Abbreviations	Description
EDTA	Ethylenediaminetetraacetic Acid
ICP-MS	Inductively Coupled Plasma Mass Spectrometer
REE	Rare Earth Elements
USGS	United State Geological Society
XRD	X-Ray Diffraction

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