

Supporting Information

Table S1. Composition of Ni plating sludge sample

Element	Units	Content
Al	mg/kg	7350 ± 113
Cr	mg/kg	6845 ± 254
Fe	mg/kg	35112 ± 2131
Ni	mg/kg	132071 ± 5343
Na	mg/kg	26114 ± 1424
Ca	mg/kg	10065 ± 954

Table S2. Summary of production cost of 1 kg Ni(OH)₂/NiOOH

Price Component	Consumption	Unit Price	Cost (USD/kg product)
H ₂ SO ₄ solution (5%) for leaching	22–26 L	0.15–0.25 USD/L	3.3 – 6.5
NaOH for pH adjustment and precipitation	2.0–2.3 kg	1.0–1.5 USD/kg	2.0 – 3.5
Electricity (stirring, separation, drying) ¹	30–45 kWh	0.12–0.15 USD/kWh	3.6 – 6.8
Hazardous sludge disposal (Fe–Al–Cr residue)	0.05–0.12 kg	—	0.8 – 2.4
Equipment depreciation, maintenance & labor	—	—	1.0 – 1.5
Total production cost	—	—	10.7 – 20.7
Market price: Ni(OH) ₂ ²	—	—	28 – 40
Market price: NiOOH ³	—	—	30 – 45
Potential profits	—	—	15 – 25

Note: The calculations were mostly based on the lab-scale process. Costs of labor, equipment and facility were not included.

Prices of chemicals were derived from commercial webpages.

¹Vietnam's electricity cost was taken from Vietnam Power Company (<https://en.evn.com.vn/>).

$^{2,3}\text{Ni}(\text{OH})_2/\text{NiOOH}$ powder price is taken from Alibaba website or supplier quote (<https://www.alibaba.com/>).

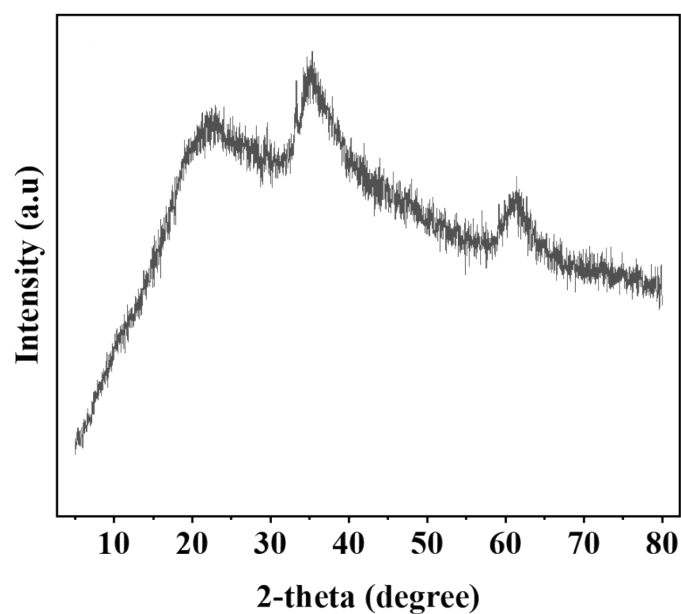


Figure S1. XRD pattern of initial Ni sludge sample

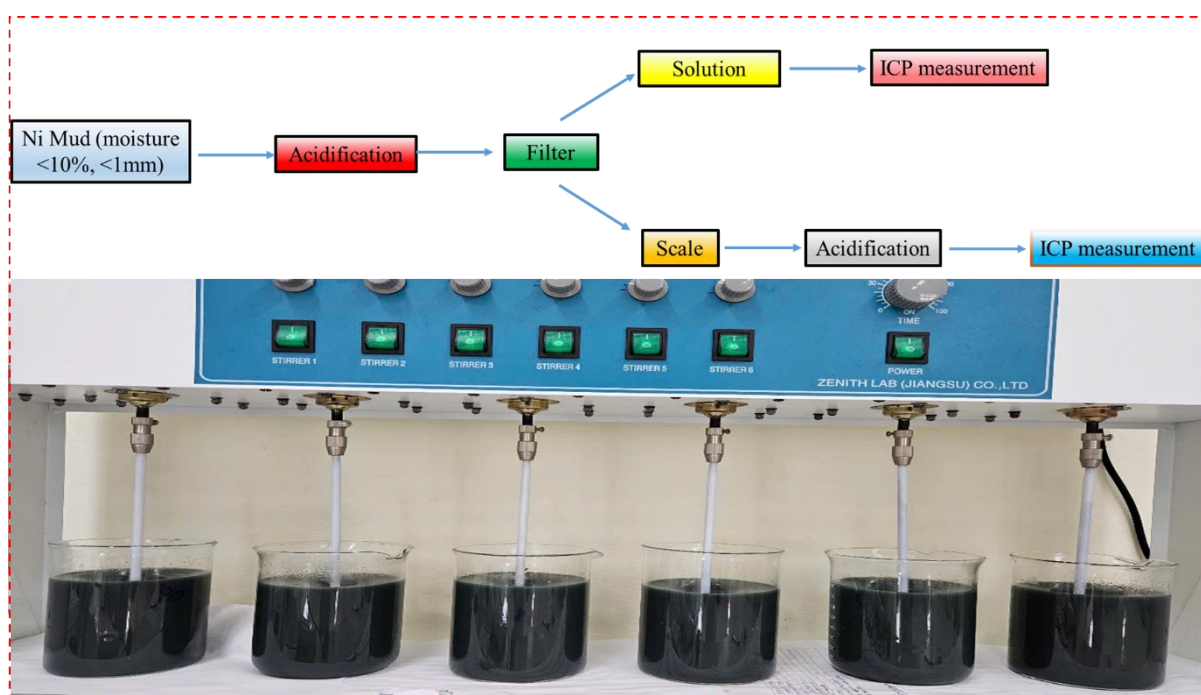


Figure S2. Ni sludge treatment process: acidification, leaching of solution and solid residue, and metal analysis by ICP.

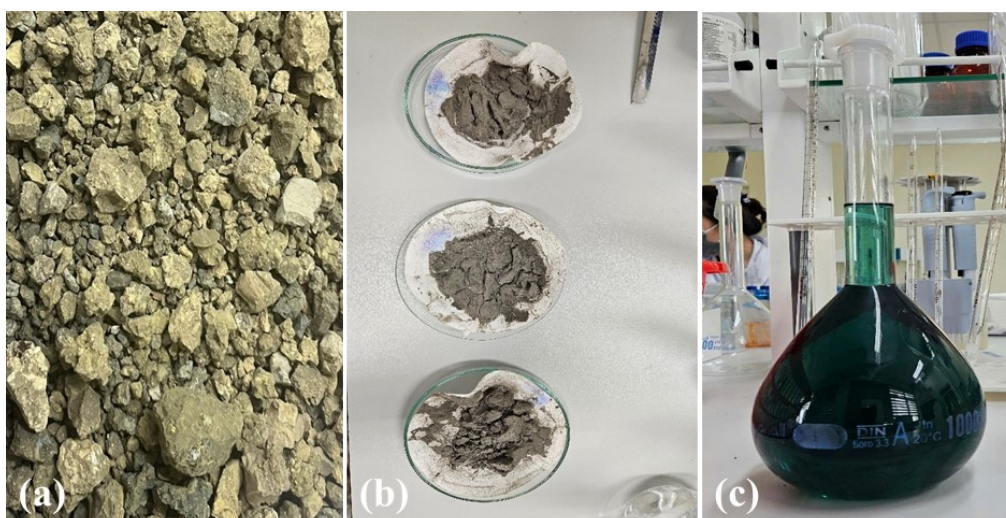


Figure S3. (a) Sludge before and (b) after digestion, and (c) solution after digestion

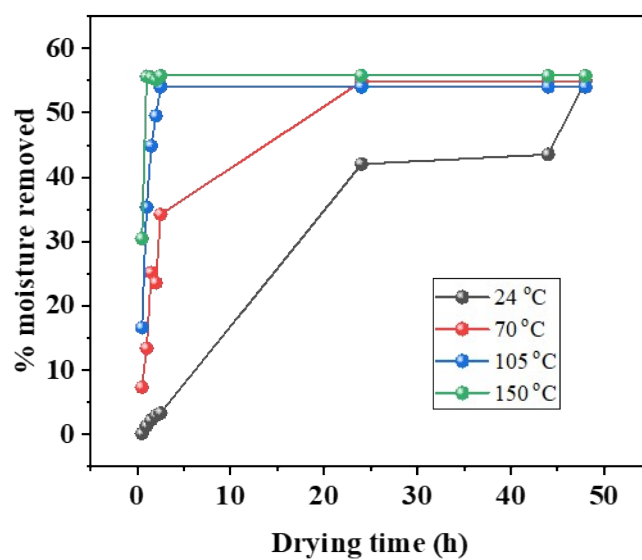


Figure S4. Effect of drying time to % moisture removed



Figure S5. Solution (diluted 100 times) after leaching with H_2SO_4 at concentrations of 2 – 5 – 10 – 15 – 20%

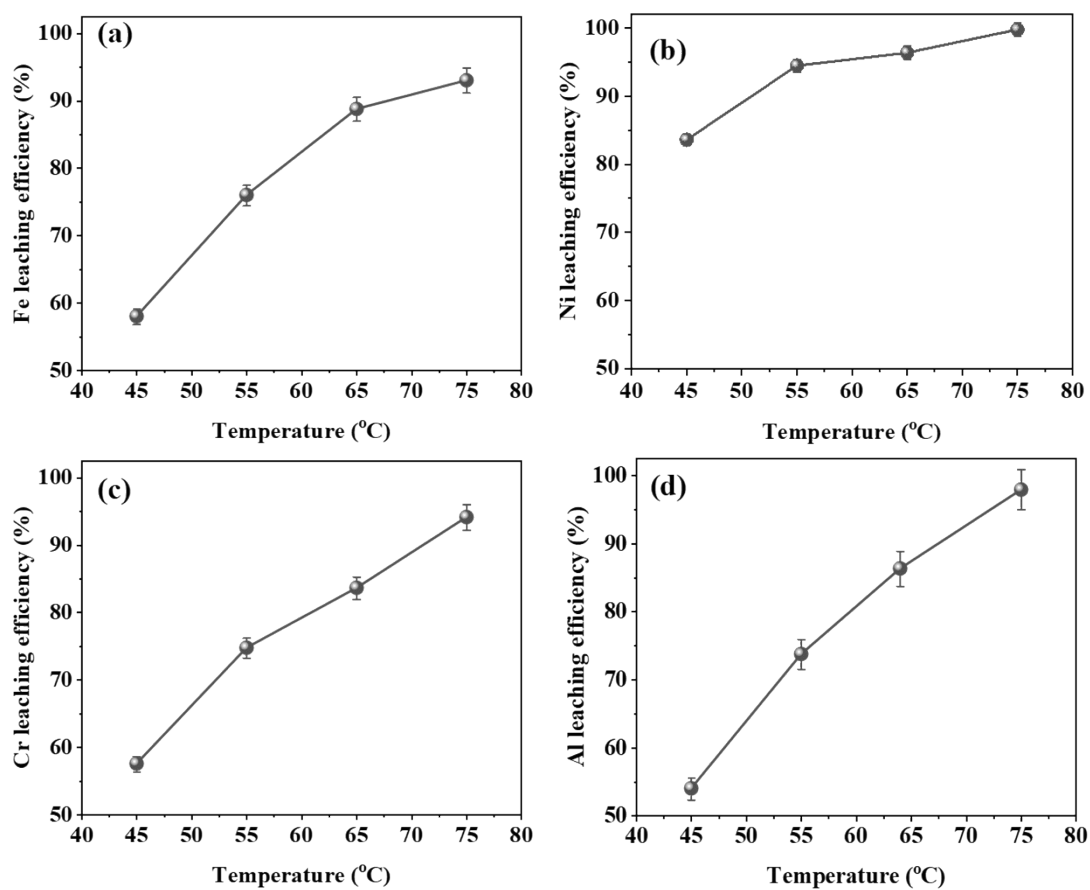


Figure S6. Correlation between temperature and leaching efficiency at 15 min for Fe, Ni, Cr, and Al. Error bars indicate the standard deviation calculated from three replicates.



Figure S7. Photograph of the green nickel precipitate obtained under optimal precipitation conditions. The distinctive green color confirms the formation of NiOOH and $\text{Ni}(\text{OH})_2$ as the dominant solid phase.