EXJOBB HOS RAGN-SELLS AB / MASTERS THESIS AT RAGN-SELLS AB

Optimizing Secondary Metal and Mineral Recovery from Waste Streams: A Data-Driven Approach

Background

Ragn-Sells Treatment & Detox (T&D) is a leader in sustainable waste management, transforming industrial and household waste into valuable resources. As Europe faces increasing environmental and supply chain challenges, the transition to a circular economy has never been more urgent. Critical (CRM) and strategic raw materials are essential for modern and green technologies, from smartphones to wind turbines, but their extraction comes with significant environmental costs and depletion risks (EU, 2023). The total environmental costs for mining and processing of 38 abiotic materials might be up to €5 trillion annually according to Arendt et al. (2022). According to the UN, extraction of virgin raw materials is responsible for half of all climate emissions, 90 percent of the loss of biodiversity and 90 percent of the water shortage in the world.

To address these challenges, circular economy strategies emphasize waste as a sustainable resource. This thesis investigates waste streams that could support CRM recovery, leveraging data and academic methodologies to bridge industrial needs with broader environmental goals. The aim is to help prioritize impactful innovations, implement them swiftly, and ensure detoxifying circular flows.

Research Question

How can data-driven methods help us better identify high potential mineral waste streams and improve the recovery of metals and minerals?

Objectives

This thesis combines academic exploration with practical application through the following objectives:

1. Literature Review:

Conduct a detailed review of secondary metal and mineral flows in Sweden and Northern Europe, focusing on existing data, trends, and research gaps. Identification of prioritized CRMs that will be included in the study.

2. Data Collection:

- **Internal Sources**: Analyze internal flow data from Ragn-Sells and existing lab analyses.
- **External Sources**: Review external sources such as, e.g., Urban Mine Platform, EPRTR, and other relevant databases or studies.
- **Primary Research**: Gather information from industry stakeholders and partners to fill critical data gaps.

3. Framework Development:

Develop a proof-of-concept framework for integrating data from multiple sources, identifying key opportunities for CRM recovery, and assessing gaps and barriers.

4. Example Technology Testing:

Apply the framework to identify and evaluate secondary waste streams for a specific recovery technology, e.g., titanium extraction, or Cu separation from Au. Aiming to demonstrate the approach's practical applicability and scalability.

5. Discussion and Broader Implications:

Analyze the academic relevance of the framework, including its potential applications in fields like industrial ecology, environmental policy, and green technology development.

Kvalifikationer / Qualifications

Requested: Background in chemistry, technology, or environmental science. Excellent research and academic writing skills.

Beneficial: Experience with database management and analysis. Interest in investigative research and practical applications in sustainability.

Beräknad tidsåtgång / Estimated Time

5 months

Antal studerande / # of students

1-2

KONTAKT OCH ANMÄLAN

Sista ansökningsdag / Last application date: 31 Dec 2024 (but decision can be made earlier)

Startdatum/ Start Date: 5 Jan 2024

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Introduction Literature

Arendt R., Bach V., Finkbeiner M. (2022) The global environmental costs of mining and processing abiotic raw materials and their geographic distribution, Journal of Cleaner Production vol 361 Link

European Union (2023) Study on the critical raw materials for the EU 2023, final rapport, Link

Tema Nord 2024:513 Recycling of Critical Raw materials in the Nordics - Waste types with CRM recycling potential, Link

Huisman, J., et al., 2017. Prospecting Secondary Raw Materials in the Urban Mine and mining wastes (ProSUM) - Final Report. [Link]

Dino, G., et al., 2017. Smart ground project: A new approach to data accessibility and collection for raw materials and secondary raw materials in Europe. [Link]

Lederer, J., et al., 2020. What waste management can learn from the traditional mining sector: Towards an integrated assessment and reporting of anthropogenic resources. Waste Management, 102, pp. 95-104. [Link]

Marcolongo, L., 2023. Secondary raw material analysis. In: 27th International Conference on Electricity Distribution (CIRED 2023). [Link]

Sadeghi, M., et al., 2020. Prospectivity mapping of critical raw material at the continental scale - a part of the FRAME project. [Link]

Chang, J.C., et al., 2015. Data Mining Toward Increased Use of Aluminum Dross. Journal of Sustainable Metallurgy, 1(4), pp. 285-293. [Link]

Kasmaeeyazdi, S., et al., 2021. Copernicus data to boost raw material source management: Illustrations from the RawMatCop programme. Resources Policy, 74, 102282. [Link]

Schleder, G.R., et al., 2019. From DFT to machine learning: recent approaches to materials science–a review. Journal of Physics: Materials, 2(3), 032001. [Link]

Supervisor plan/expectations

(What is expected of the supervisors in terms of involvement– supervision tasks)

Academic Supervisor:

- Driven and result focused supervisor that can take a large part of helping the student to stay focused within the scope of the thesis – keep students' motivation up
- Helping with general academic tasks (e.g. scientific report structure, methodology building)
- Continual synchronization meetings with the industrial supervisor every fortnight

Ragn-Sells industry supervisor/reference:

- Framing of the study, checkpoints
- Continual synchronization meetings with the academic supervisor
- Others, e.g. to help student to be familiar with Ragn-Sells, provide information/data