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Harnessing Algae and Wood Ash for Sustainable Mine Water Remediation in Northern Sweden

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The increasing global demand for raw materials has led to expanded mining activities. Mining operations often release harmful substances into surrounding waters, leading to contamination of surface and groundwater. These operations might raise significant environmental concerns, particularly in aquatic ecosystems[1]. This emphasizes the necessity for innovative and sustainable remediation technologies. Common issues include the formation of pit lakes[2], the development of acid mine drainage (AMD)[3], and the accumulation of heavy metals in recipient lakes[4]. This study evaluates the potential of wood ash to stimulate microalgal growth in three types of contaminated mine-waters: pit lakes, AMD-affected waters, and heavy metal-enriched recipient lakes. Water samples from Northern Sweden, a region where harsh climate presents unique challenges for algal growth, were incubated in climate chambers to assess their suitability for controlled algal cultivation. Fluorescence was measured as a proxy for algal biomass growth, and metal concentrations were determined using inductively coupled plasma mass spectrometry (ICP-MS). Results indicate that a specific wood ash type promoted algal growth in pit lake and recipient lake samples (11 and 9 days, respectively), whereas no growth occurred in AMD-affected water. Algae growth initiated by ash removed up to 42.85% of nickel from recipient lake samples. These findings suggest that wood ash is an effective enhancer for algal growth in certain mining-impacted environments, offering potential for bioremediation. The study also highlights the potential to identify algal species thriving in harsh climates while effectively remediating contaminated waters. Given the microalgae's ability for bioremediation[5], further research should evaluate its applicability in mine water treatment. Optimizing climate chamber conditions could also advance future research on sustainable remediation of contaminated water bodies, particularly in regions facing environmental challenges due to climate change.

1. Watari T, Nansai K & Nakajima K. *Resources, Conservation and Recycling* **164**, 105107 (2021).
2. Paulsson O, Widerlund A & Conrad S. *Applied Geochemistry* **151**, 105616 (2023).
3. Skousen J *et al. Mine Water Environ* **36**, 133–153 (2017).
4. Moghimi Dehkordi M *et al. Results in Engineering* **23**, 102729 (2024).
5. Suresh Kumar K *et al. Ecotoxicology and Environmental Safety* **113**, 329–352 (2015).