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Tasmanian Institute of Agriculture

Evaluating algal and microbial communities for the bioremediation of acid mine drainage at Savage River, Tasmania

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Background

- Mining produces Acid Mine Drainage (AMD）
- AMD is acidic and metal-rich

  Environmental impact: water pollution & ecosystem damage
- Algal bioremediation = promising solution

Objectives

- Identify algal and microbial species

(not included in this presentation)

- Test bioremediation potential (pH change)
- Determine optimal algal growth conditions

Study Site: Savage River Mine

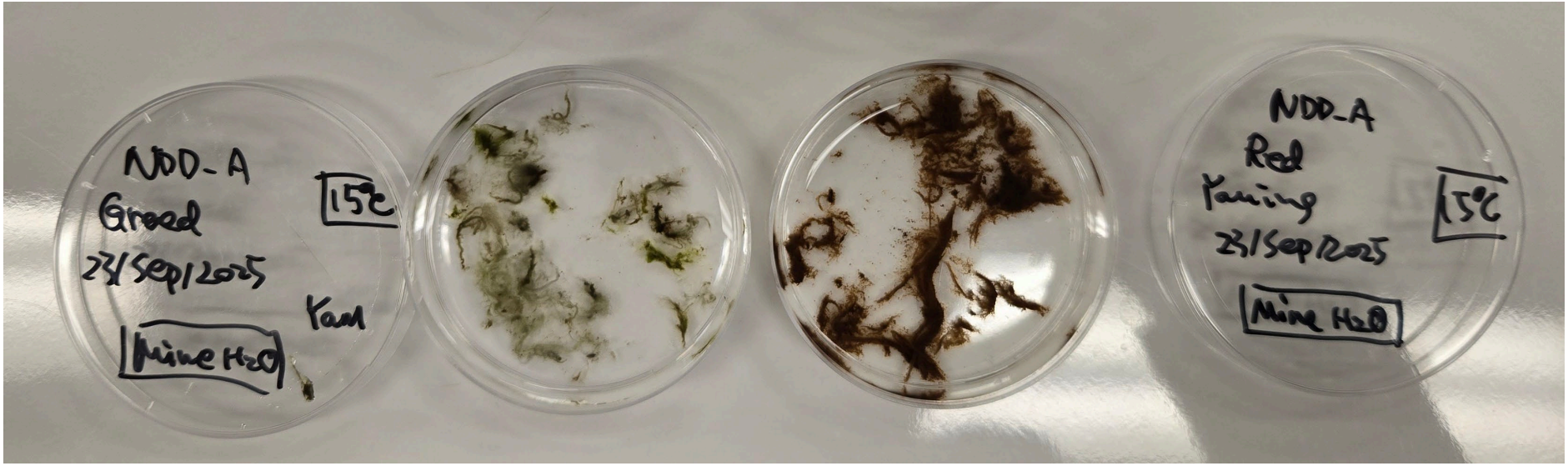
North Dump Drain (NDD)

Old Tailing Dam North (OTDN)

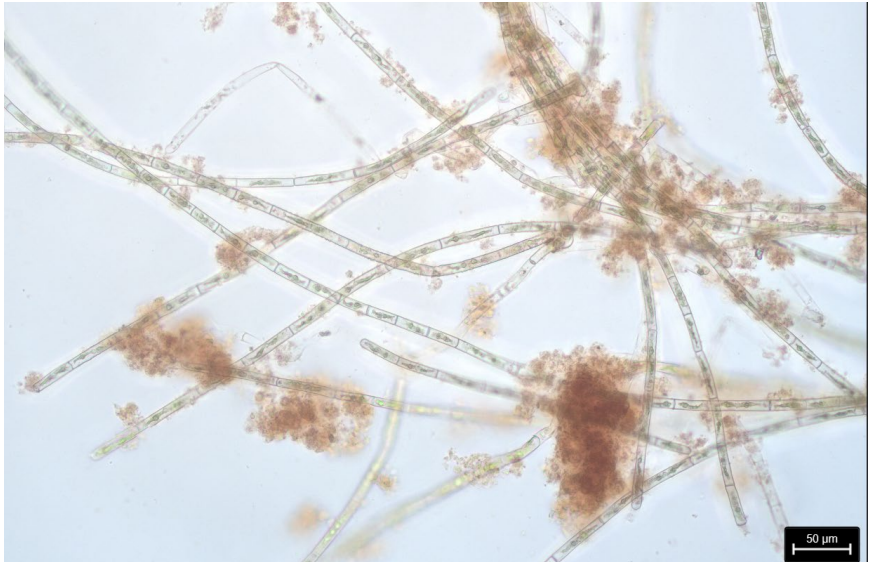
Methods Overview

- Field sampling (water + algae)
- Water chemistry analysis (EPA TAS)
- Lab cultivation experiments ▸
- DNA extraction and sequencing (Flinders University)

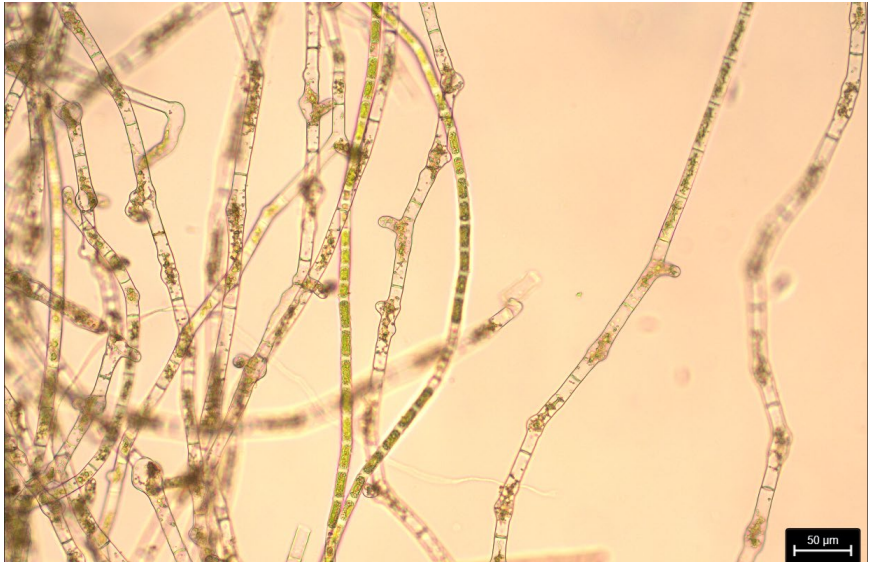
Algal field sample from mine water



Filamentous algal species found in OTDN & NDD



OTDN_ Filamentous algae (Red)

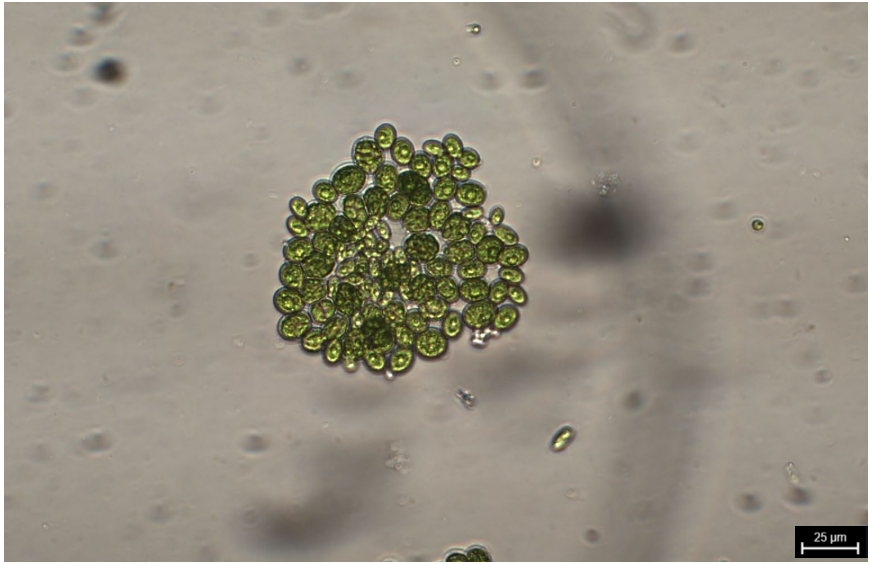


NDDA_ Filamentous algae (Green)

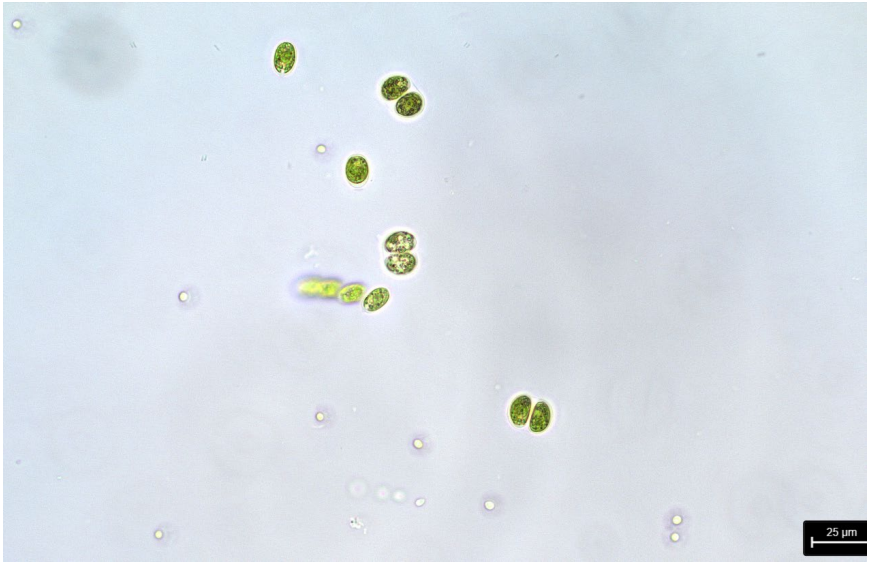
Filamentous green genus found in mine waters include ***the genus Klebsormidium and genus Mougeotia,*** *both have* morphotypes similar to these microscope images

NDD algal culture in BG-11 Media

(post 3 months of laboratory cultivation)



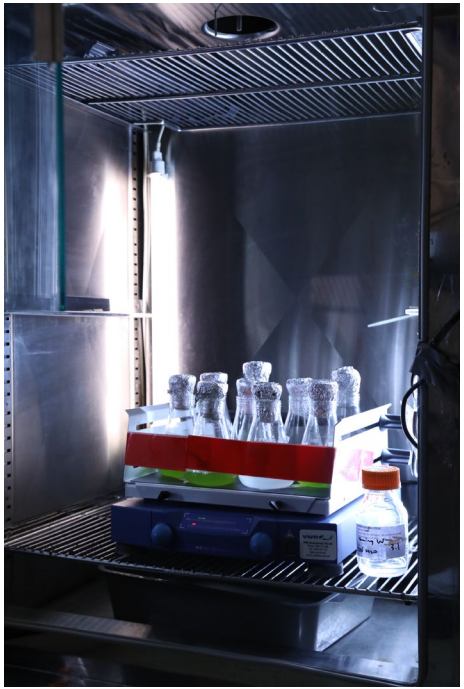
Colonial spherical green algae (*Chlorococcum* genus)



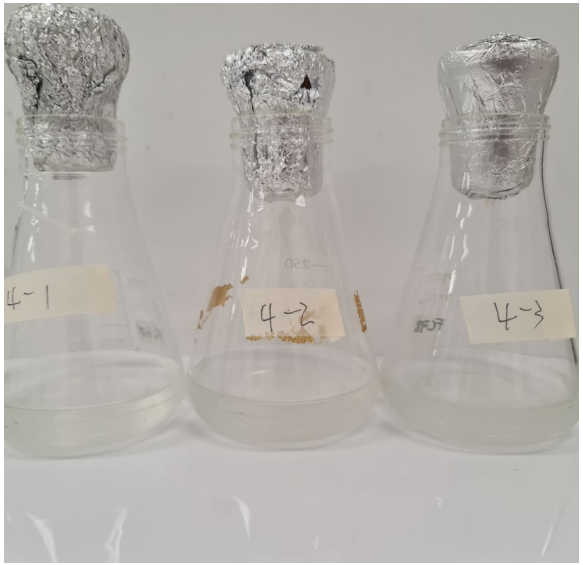
Unicellular spherical green algae (*Chlorella* genus)

Experiment Design (pH Study）

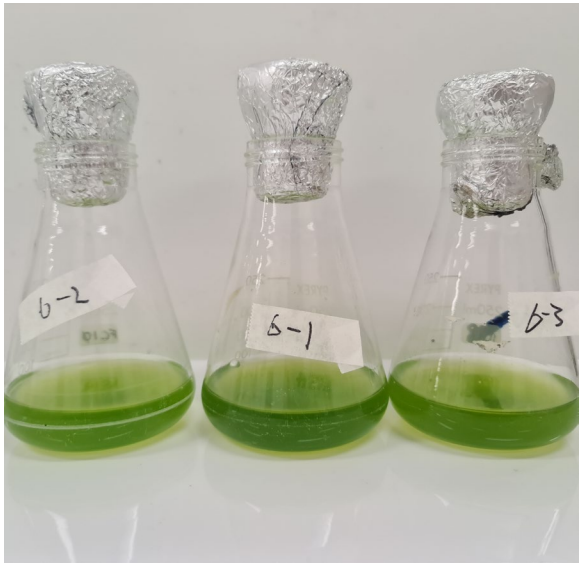
- pH treatments: ~3–7
- Media: BG11, NDD, OTDN water
- 10-day growth experiment
- Control: 20 °C , 16:8 light: dark, ~2800 lumen



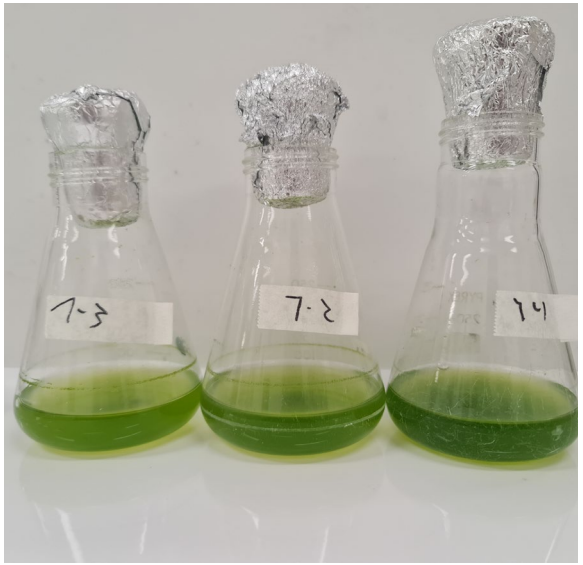
After 10 days of treatment: Color change observed



BG-11 Media: pH 4

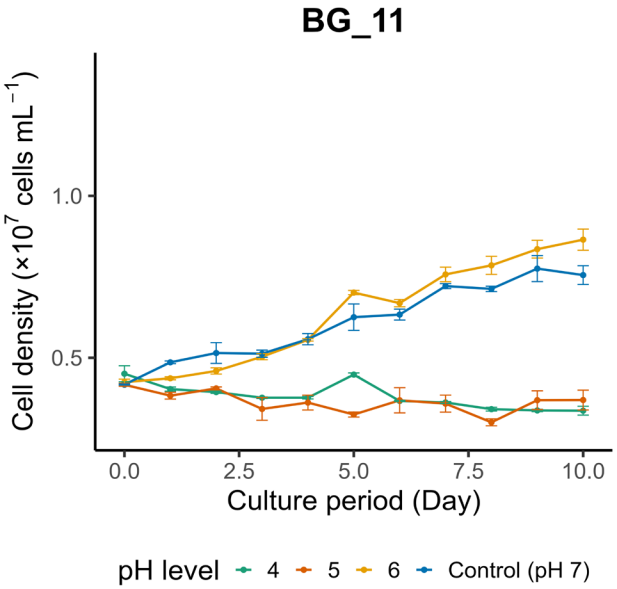


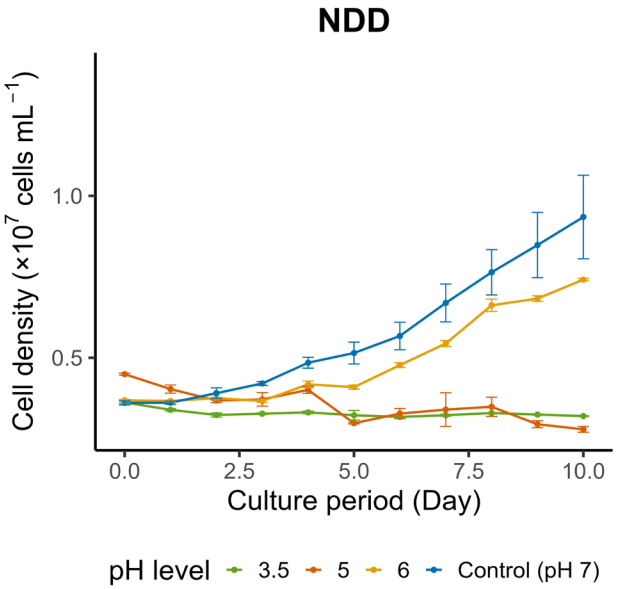
BG-11 Media: pH 6

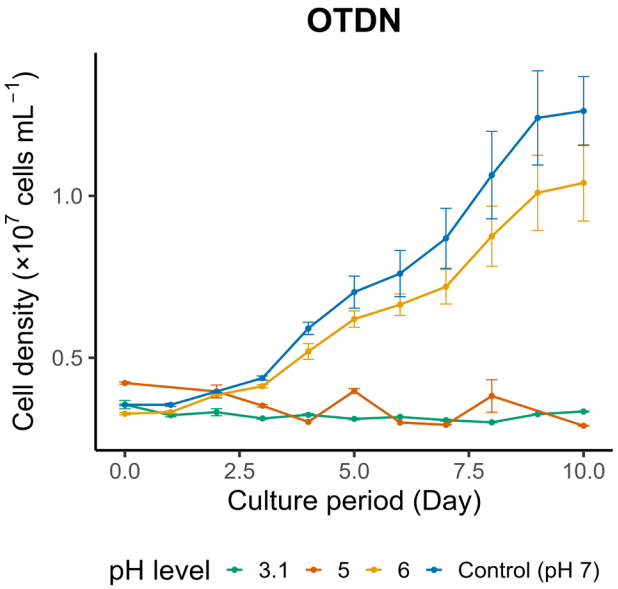


BG-11 Media: pH 7

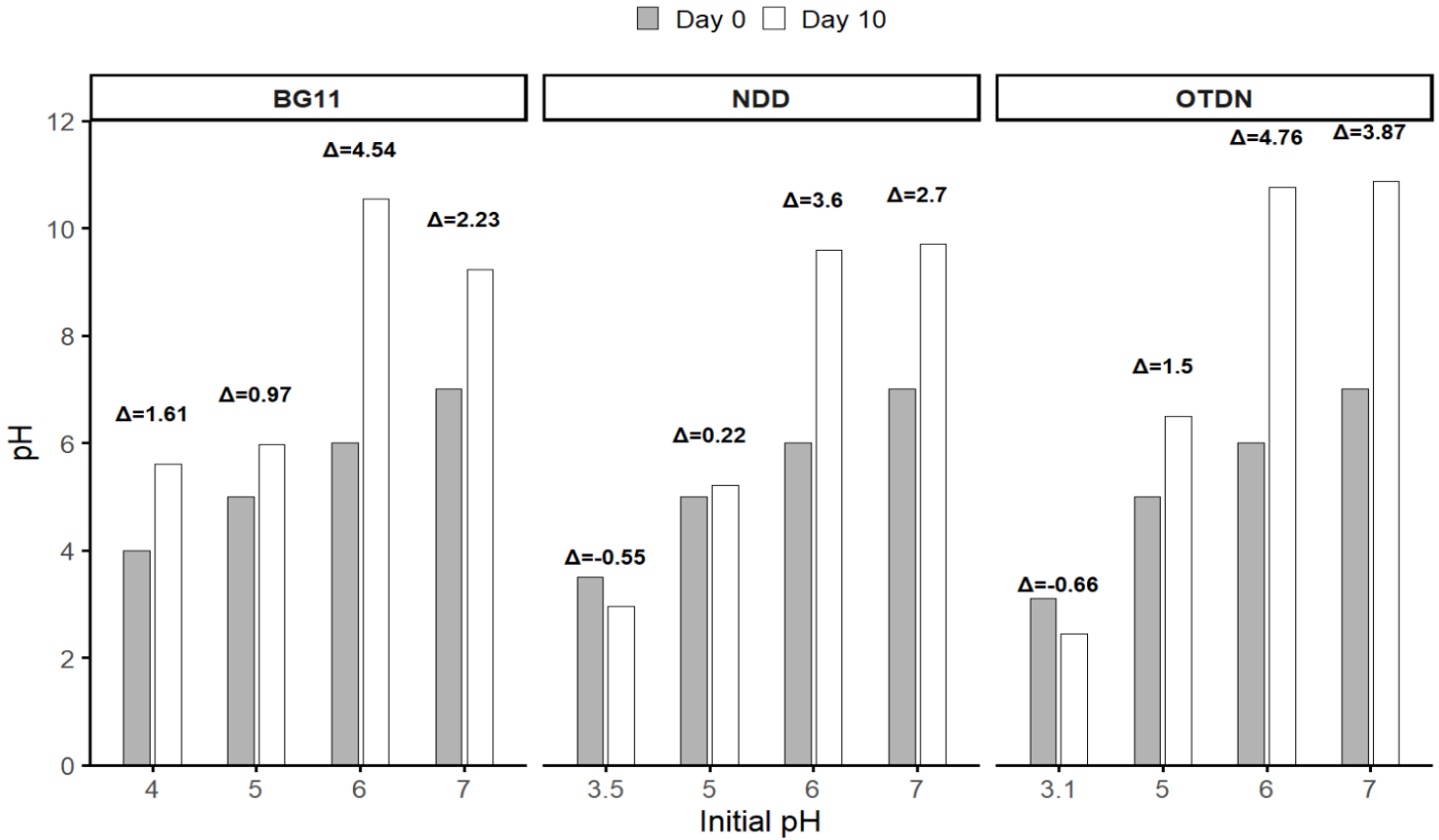
Result 1 - Growth improves with increasing pH, with strongest response in OTDN medium







Result 2 - Algal Activity Drives pH increase, with Strongest Effect in OTDN



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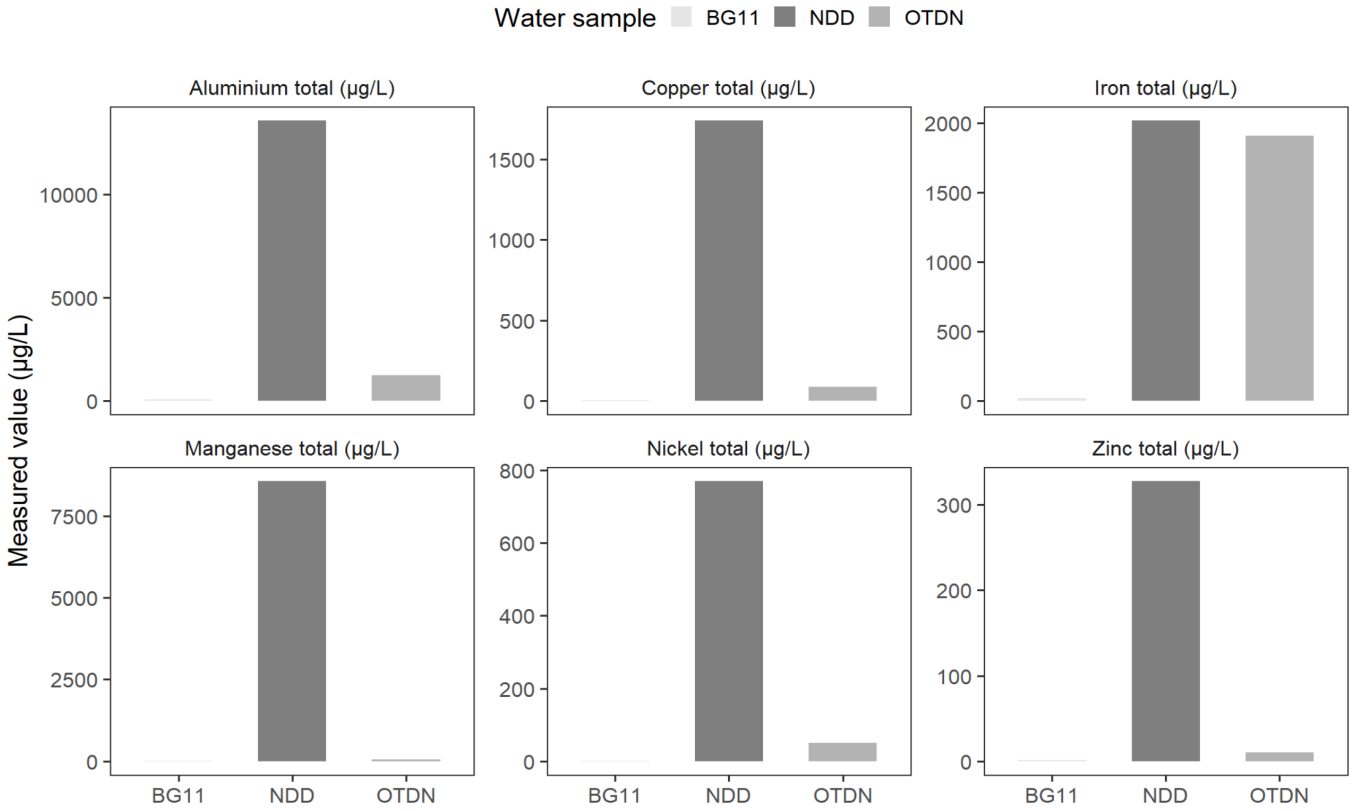
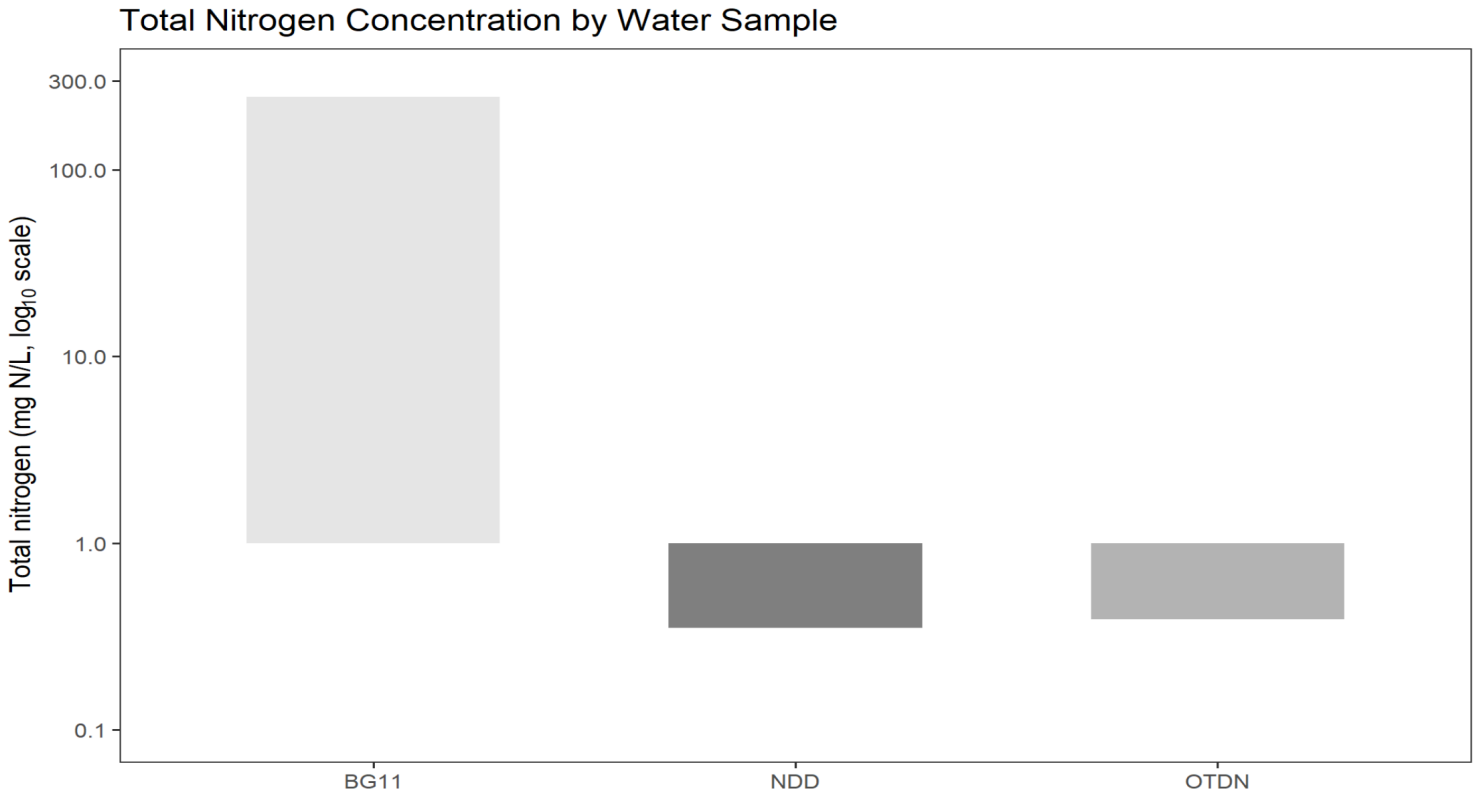
Result 3 - Comparison of Dissolved Metal Concentrations Among Media Types



Result 4 –Total Nitrogen Concentrations (Log_{10}-Scaled) Highlight Nutrient Limitation in Field Waters

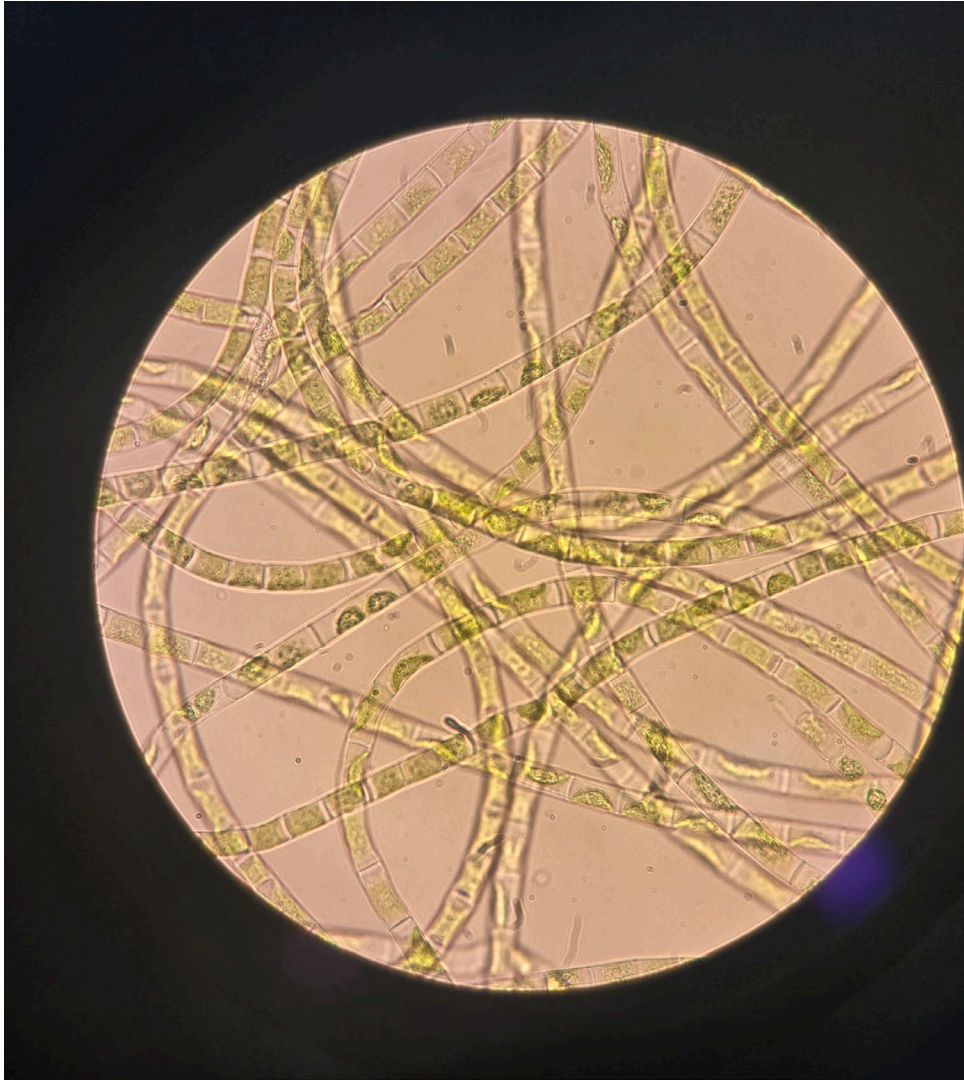


Key Findings

- Freshwater algal community growth rate was influenced by **higher pH**
  → **Optimal** growth at **pH 6–7**, minimal growth at acidic pH
- **pH increase** was noted when **algal growth was highest**
- Most significant change in growth rate was evident in **OTDN water** which had the **highest** algal growth rate and **largest** pH increase

Overall Conclusion

- The results observed an increase in pH indicating the potential use of algae to **bioremediate** mine water.
- Algal in-situ community are **adapted to low pH & high metal concentrations,** specifically **iron.**
- Further research at laboratory and pilot level to evaluate **the financial viability and the practical application** of this approach to a real-world mine site remediation project.



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Thank you