Heterotrophic bioleaching of mine tailings

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From the early days of the Industrial Revolution, primary mining and metal processing industries in Europe have, and continue to landfill and/or stockpile significant quantities of metal containing tailings, which often represent an environmental and health risk. However, this 'tailings problem' may be seen as an opportunity and by valorising these historical and fresh tailings can provide a new source of sustainable critical raw materials. Traditional hydrometallurgical methods for the recovery of metals involve large quantities of concentrated acids or alkalis, and often require re-landfilling of the residual fractions. Therefore we propose an alternate strategy for the recovery of metals from mine tailing using heterotrophic bioleaching, via acidic biolixiviants.

To further our understanding of heterotrophic bioleaching, we first characterised organic acid production by several yeast and fungal cultures, *Candida Viswanathii*, *Saccharomyces Cerevisiae* and *Aspergillus Niger* and found that a mix of oxalic, gluconic and citric acids were produced. Subsequently, we investigated the impact of carbon, nitrogen, phosphorus, amino acid, vitamin and trace metal sources and concentrations on organic acid production. Furthermore, we attempted a bio-encapsulation method for novel application to promote bio-lixiviant formation. Finally, we tested the bioleaching potential of our cultures with several metallurgic mine tailing residues. These results will be discussed in the context of bioleaching of mine tailings as a foundation for future sustainable metal recovery.