Ore-ganic solutions: Microbial applications driving a circular
mining economy

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# ABSTRACT

As mining companies seek to meet increasing environmental, social, and economic expectations, the industry is being challenged to extract more value from less material, with lower impact. Bioprocessing (the use of microorganisms for metal extraction and waste treatment) represents a promising but underutilised strategy for achieving these goals. Unlike traditional metallurgical processes, microbial technologies such as bioleaching, biosorption, and bioprecipitation operate under mild conditions, require lower energy inputs, and generate fewer hazardous by-products. Once considered a niche or slow alternative, is now emerging as a viable strategy to meet this challenge, particularly when integrated into mine planning, end-to-end recovery, and sustainability frameworks.

This presentation explores the strategic role of bioprocessing - not only as a method of metal extraction, but as an enabler of circular economy principles across the mining lifecycle. From bioleaching of low-grade ores and tailings to biosorption of metals from effluents, microbial systems can unlock hidden value streams while reducing reagent use, waste generation, and environmental risk.

This examines the strategic integration of bioprocessing across the mining value chain, with a focus on its role in enhancing metal recovery from low-grade ores, tailings, and process residues. By viewing bioprocessing not just as a technical tool, but as a strategic planning element, mining companies can extract more value per tonne, lower environmental impact, and future-proof operations in an increasingly resource- and carbon-constrained world. When implemented strategically, microbial technologies can contribute significantly to improved resource utilisation, reduced environmental burden, and enhanced long-term site value.