

Biohydrometallurgy for metal recycling

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Primary resources are metals recovered from ore deposits. Secondary metal resources are of increasing relevance. Important secondary metal resources are mine waste dumps and tailings as well as residues from industrial processes such as ashes, slags, sludges, and electronic waste. Since these residues are complex polymetallic mixtures, established processing technologies are often complicated and not economically feasible. Biohydrometallurgy could be a meaningful alternative here. Sulfidic tailings from former mining activity often contain significant amounts of metals. A re-processing of tailings via biomining does not require further grinding of the material. Bioleaching or biooxidation of sulfidic tailings has successfully been applied for the recovery of gold, copper, nickel, silver and uranium in laboratory and pilot scale. The recovery of cobalt was conducted via tank bioleaching at industrial scale. Several industrial residues mainly consist of carbonates or oxides, thus bioleaching via biogenic production of sulfuric acid from elemental sulfur oxidation or reductive bioleaching may be of high relevance. In case of very valuable metals such as platinum or gold also the recycling of e.g. electronic waste has been demonstrated in the laboratory using either *Acidithiobacillus* or cyanide- or organic metal complexes-forming heterotrophic bacteria and fungi. This contribution provides an overview of the state-of-the-art of biohydrometallurgy for metal recycling.