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Bioleaching: Extract metals from solid waste using microbes

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Various processes for the extraction of metals from solid waste including hydrometallurgy and pyrometallurgy have been reported. These processes require large amounts of chemicals, high operating cost and also are difficult and complicated operation with low recovery. Legislation on environmental protection and increased environmental concerns limit the application of these technologies. It is essential to develop new technologies for extracting metals from solid waste that have higher recovery rates and also decreased pollution [1]. In place of traditional extraction methods, it is possible to use bioleaching to recover valuable metals from solid waste. Bioleaching has the advantage of simplicity, low energy input, low capital cost, mild operating conditions, does not require specialized labor and is environmentally friendly [2,3]. It is based on the interaction of microorganisms with metal sources for the transformation of organic or inorganic acids (protons), oxidation and reduction reactions and the excretion of complexing agents. Bioleaching uses mesophile, moderate thermophile and extreme thermophile bacteria to dissolve metals from solid waste. *Acidithiobacillus ferrooxidans*, *Acidithiobacillus thiooxidans* and *Thiobacillus thioparus* are the most common bacteria used in bioleaching. Additionally, some species of fungi like *Aspergillus niger*, *Penicillium simplicissimum* and *Penicillium chrysogenum* have been successfully employed in bioleaching of various heavy and valuable metals from solid wastes [3, 4].

Nowadays bioleaching leads to extract precious and rare earth elements metals from different solid waste like spent catalysts, electronic scraps, rechargeable batteries, red mud, coal and fly ash and municipal waste incineration fly ash. Results show it could recovery metals with high potential. Often bioleaching recovery efficiencies received to 80 to 90%. Additionally, the application of bioleaching techniques for the treatment of solid wastes might contribute to detoxification and conversion hazardous solid waste towards a more sustainable and environmental friendly economy.

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