EBNet Environmental Biotechnology

PROJECT PARTNERS:
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BIV202101

UKRI Biotechnology and Biological Sciences Research Council

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Bioleaching application for the recovery of Minor and Rare Earth Metals from Complex Nickel Alloys Dust

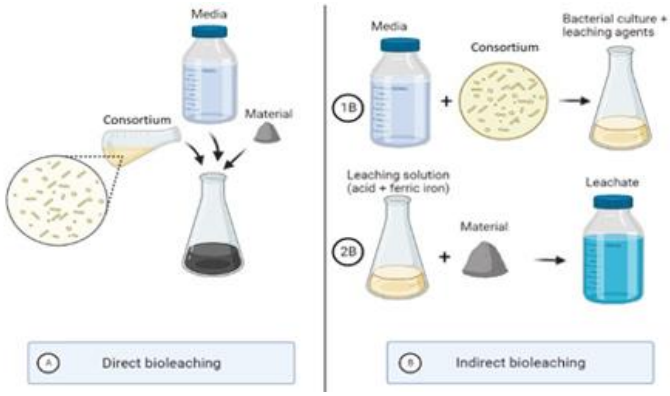
"We are very encouraged by the positive results this initial study has highlighted and are excited to continue the partnership with Coventry University to unleash the potential of bioleaching technology and its essential contribution towards more effective recycling and sustainability." – Advanced Alloys Services (AAS)

AIM:

This project is a collaboration between Advanced Alloys Services (AAS) Ltd and the Bioleaching Research Group (BRG) from Coventry University (CU). The aim is to develop bioleaching-based sustainable processes to recover metals from metric tons of dust, which are generated from the process of abrasive wheel-cutting of superalloys at AAS. In this project, which involves the selective recovery of metals using microorganisms, the objectives are environmental and economic, as the project will reduce waste, while providing the company with another source of income from the sale of the recovered specific valuable metals.

During AAS Ltd processes, several metric tons of dust are generated and collected each month. This dust contains valuable and rare elements, such as Ta, Re, Co, Cr, Mo, W, Hf as well as Nickel. Although some of the dust is currently processed to recover Re and other elements in a processing plant in Canada, the rest of the dust is sold at low value for its Nickel content into the stainless-steel industry, where the other valuable elements are lost forever. The bioleaching-based methodologies developed in this project, in combination with the recovery of solubilised metals using electro-chemical methods, will result in closed-loop systems.

"This initial work with AAS establishes the potential for Bioleaching as a sustainable technology for the recovery of precious and rare metals in the Super-alloy industry, and the beginning of a successful partnership that demonstrates the need for collaboration between Academia and industry."
- Professor Sebastien Farnaud, Coventry University



RESULTS:

In this project, successful methods were applied to powder format, <250nm, as a potential secondary source for the metals used in this industry with limited processing. Three types of biogenic lixiviants were used to assess which combination of leaching agents were the most potent in extracting the metals. The lixiviants were generated through growing an acidophile, iron and sulfur oxidising consortium of bacteria on a combination of substrates that would generate the leaching agents (sulfuric acid and ferric iron or just sulfuric acid).

Successful recovery rates of between 41-57% for major components, were obtained with (nickel, aluminium, cobalt, molybdenum) 7 days of leaching activity, with minimum control and costs on the systems. Additionally, nickel content in the powders was between 65-70% which represent 613-785 g/kg and a recovery rate of 50% was achieved. These very encouraging preliminary results provide extensive observations to determine the optimum conditions of the leaching systems that can be further integrated into a closed-loop industrial mechanism, which can potentially produce superior recovery rates.