

**E3B**The Elements of
Bioremediation,
Biomanufacturing
& Bioenergy**Metals in Biology**PROJECT PARTNERS: Jon Lloyd and Vicky
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MANCHESTER
1824

The University of Manchester



Microbial recovery of e-tech metals

“Mint has a sustained interest in harnessing microbes to help recover metals, yet our company lacks cutting-edge imaging and characterisation tools, so a longer-term collaboration will help better elucidate metal capture mechanisms.”

PROJECT AIMS: The project is a collaboration between Mint, a cleantech start-up working on the recovery of valuable materials from urban-mine feedstocks such as electronic waste, and the Geomicrobiology Group at the University of Manchester who have expertise in and access to anaerobic metal-reducing bacterial cultures. The aim of the project is to facilitate a mapping exercise around e-waste metal biorecovery, identifying where the commercial and academic partners can benefit from further collaborations. The work includes:

- (1) Testing Mint leachates against Manchester cultures.
- (2) Identifying mechanisms of metal recovery and metallic nanoparticle formation.

RESULTS: The project supported close contact between Mint and the University of Manchester, supporting metal recovery (especially gold) from e-waste leachates.

The capacity of model metal-reducing bacteria to reduce Au(III) and recover it as nano Au(0) was tested against process solutions representative of those generated by Mint. The work included:

- Optimising electron donors for rapid metal bioreduction at realistic Au(III) concentrations.
- Assessing the impact of co-contaminants and pH of leaching solutions on metal recovery.
- Determining the impact of buffer on the bioprocess.
- Characterising end-products, including assessing the impact of process conditions on particle size and Au(0) localisation.

Test systems were optimised using synthetic test solutions in this project, and work on real industrial leachates is continuing using follow-on funding.

Change in technology readiness level: 1 to 2/3

OUTCOMES & NEXT STEPS:

- Work is being continued via a new engineering biology project: ‘Engineering Microbial Metal Recovery: EMMR’ (BB/W014351/1), which was developed directly from work initiated via this Business Interaction Voucher.
- Optimised processes from the University of Manchester are being tested against Mint waste streams and being improved using engineering biology approaches to enhance recovery via an iterative programme of work.
- The academic partner is involved with discussions to support future work in the UK with Mint, including investigating a wider range of waste

Electron micrograph showing gold nanoparticles (light precipitates) recovered from solution by metal-reducing bacteria.

