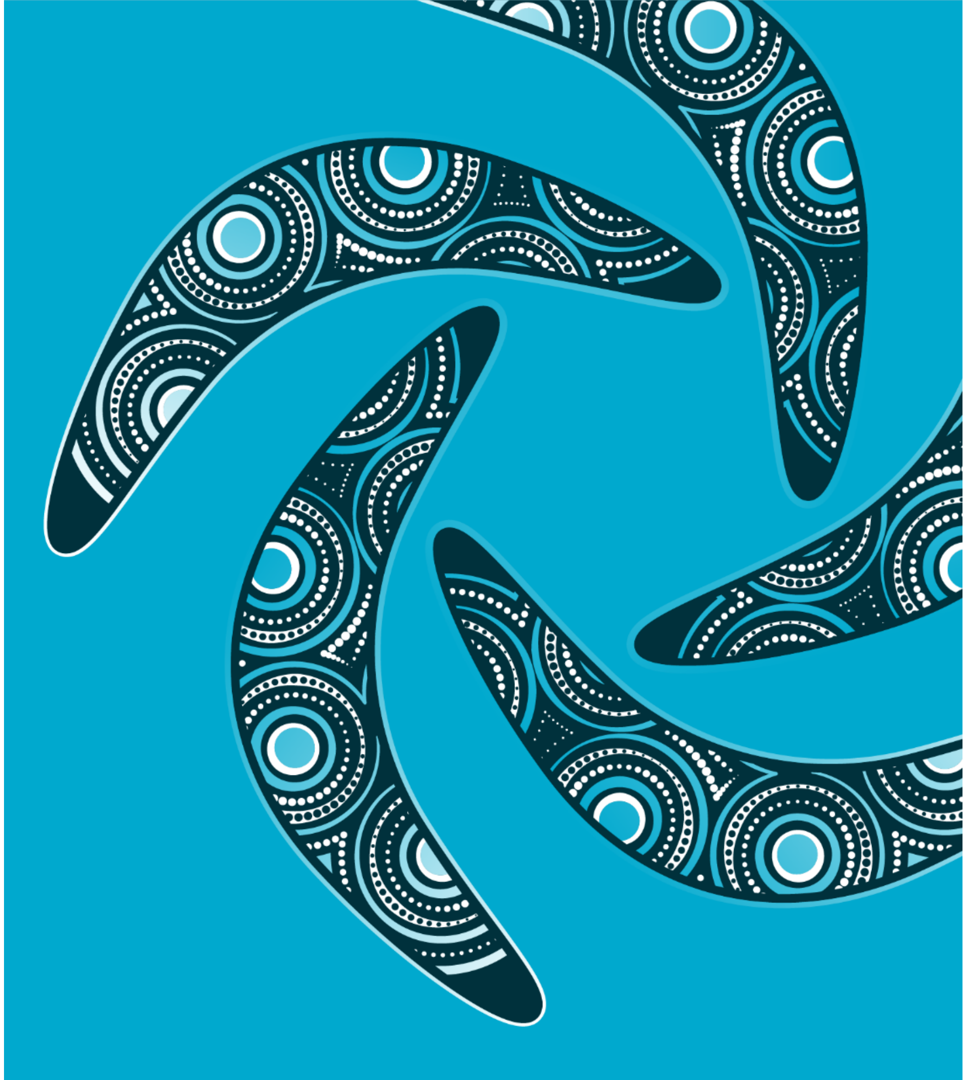
I would like to begin by acknowledging the Whadjuk people of the Noongar nation as the Traditional Owners of the land that we're meeting on today, and pay my respect to their Elders past and present.



Metal recovery from e-waste through innovative biotechnology

Naomi J Boxall[1], Ka Yu Cheng[1], Jonovan Van Yken[1,2], Christina Morris[1], Aleks Nikoloski[2], Navid Moheimani[2], Anna H Kaksonen[1]

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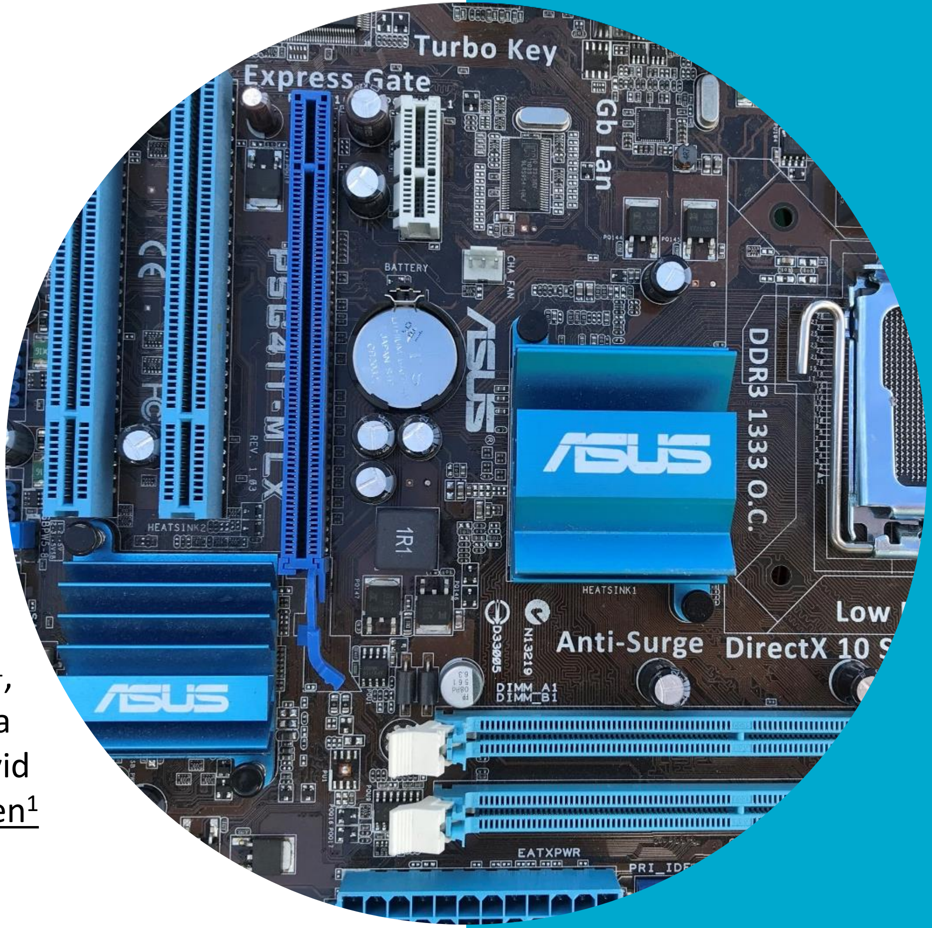
Australia's National Science Agency



[1]CSIRO Land and Water
[2]Murdoch University

Project approach

E-waste characterisation

Biological lixiviant (leaching reagent) production

Base metal bioleaching

Precious metal bioleaching

Base metal bioleaching yields at various e-waste pulp densities (PD)

- Base metal bioleaching was explored in bioreactors at 1%, 5% and 10% pulp density (PD) with biogenic lixiviant at 35°C over 3 days
- Leaching yields were determined based on the initial and residual content of metals in the e-waste
- Leaching yields varied depending on metal and PD
- Aluminium (52.4%), copper (99.8%), lithium (43.7%) and tin (73%) leaching were highest with 1% PD
- Cobalt (87.1%), manganese (94.4%) and zinc (90.0%) yields were highest at 5% PD
- Nickel (51.3%) leaching was highest at 10% PD

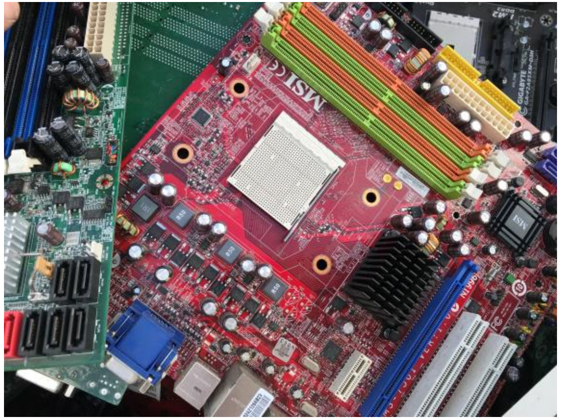
Gold and palladium leaching at various e-waste pulp densities (PD)

- Precious metal bioleaching was explored in shake flasks at 1%, 5% and 10% pulp density using contact, two step and spent medium leaching at 25°C over 3 days
- Yields determined based on metal content of initial material (base metal leach residues) and final residue (after precious metal leaching)

- Leaching yields for gold and palladium decreased mostly with increasing pulp density
- The highest gold yields were obtained at 1% PD with two-step and spent medium bioleaching (48.1%) and the highest palladium yields at 1% PD with two-step bioleaching (55.4%)
- At the higher pulp densities, spent medium bioleaching gave the most promising results

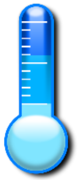
E-waste metal content, commodity prices, maximum leaching yields and potential recoverable value of extracted metals

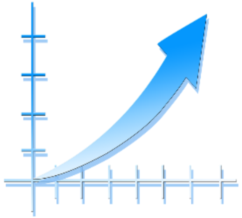
- Based on the e-waste metal content and commodity prices the metal value contained in the e-waste was determined to be AUD 63,000/ton of e-waste
- Using the maximum leaching yields from the experiments the potential recoverable value of metals was calculated to be AUD 31,000/ton of e-waste, with 88% of the value coming from gold
- The recoverable value could likely be further increased through process optimisation



Benefits of biotechnical metal extraction from e-waste

- Operate at low temperatures and ambient pressures
- No hazardous air emissions
- Can be scaled to suit e-waste feedstock flows
- Can utilise other wastes as inputs for biolixiviant production to reduce costs
- Each unit process can be optimised separately
- Can complement existing e-waste processing operations → could be adopted by waste treatment industry
- Can also be applied to other metal-containing wastes, such as mining and metallurgical wastes

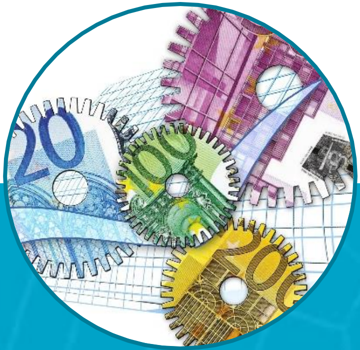




Next steps

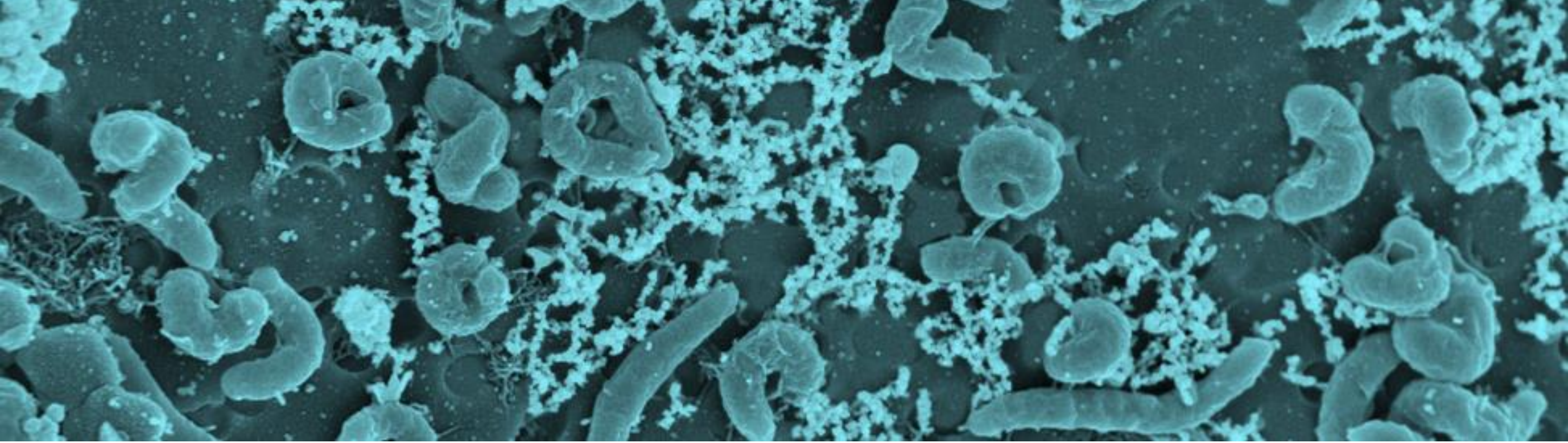
Further lab-scale optimisation



Techno-economic analysis

Partnering with industry

Pilot-scale testing



Thank you

Land and Water
Anna H Kaksonen
Group Leader – Industrial Biotechnology

+61 8 9333 6253
anna.kaksonen@csiro.au
https://people.csiro.au/K/A/Anna-Kaksonen

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