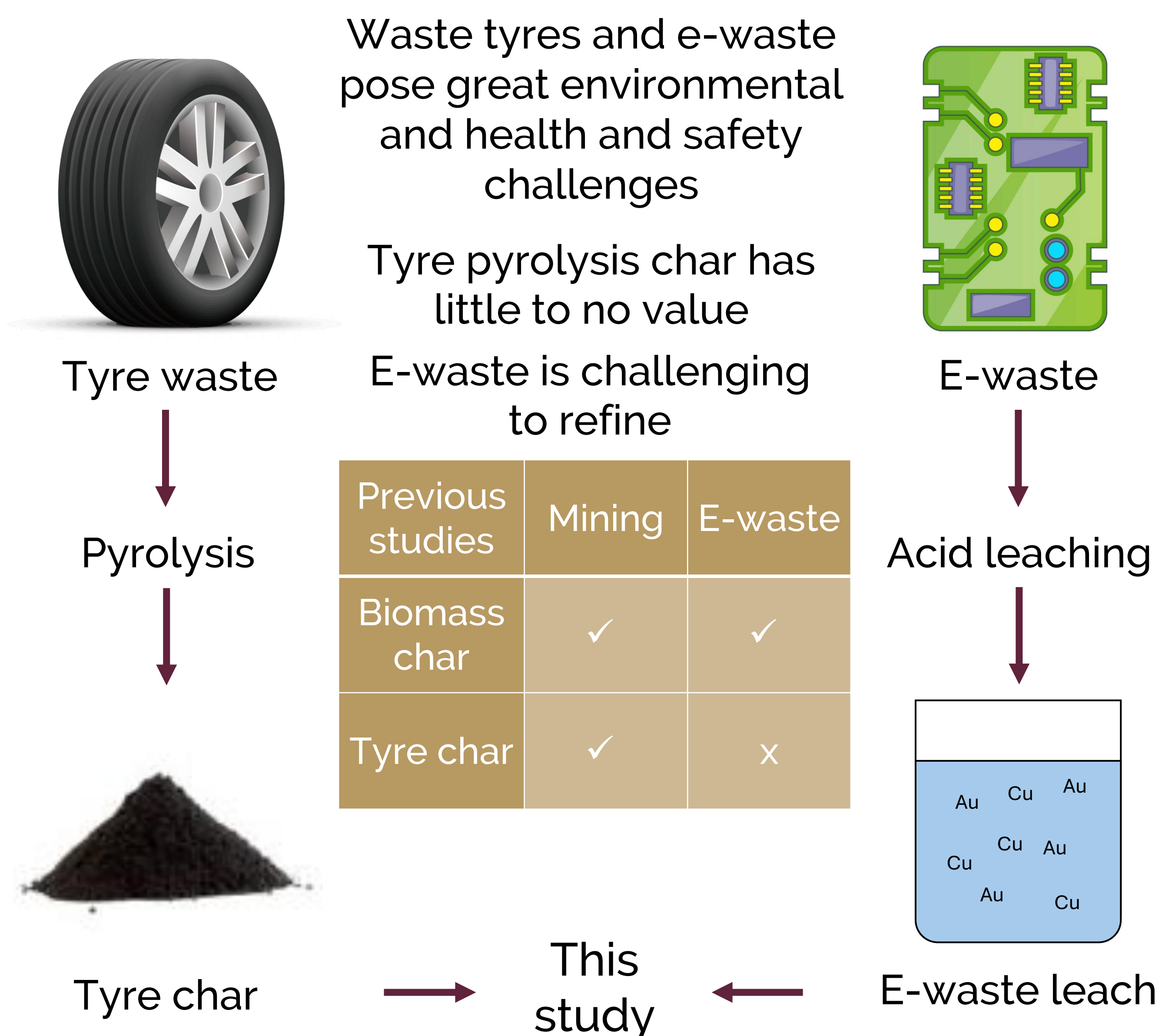# Stellenbosch UNIVERSITY IYUNIVESITHI UNIVERSITEIT

Valorisation of pyrolysed tyre char as an adsorbent for the recovery of metals from e-waste leach

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Introduction

Waste tyres and e-waste pose great environmental and health and safety challenges

Tyre pyrolysis char has little to no value

E-waste is challenging to refine

Tyre waste

Pyrolysis

Tyre char

E-waste

Acid leaching

Previous studies	Mining	E-waste
Biomass char	✓	✓
Tyre char	✓	✗

Tyre char → **This study** ← E-waste leach

Aim and Objectives

Aim:
Investigate viability of using tyre char as adsorbent for gold and copper recovery from e-waste leachate.

Objectives:
- Apply char upgrading methods
- Calculate and compare removal efficiencies of Au and Cu from synthetic e-waste leachate onto tyre char.

Methodology

Char pretreatments
- Demineralisation (HCl)
- Chemical (KOH) activation
- Physical (steam) activation

Synthetic e-waste
- 0.15 g Au(III)/L in 1 M HCl
- 0.15 g Cu(II)/L in 1 M HCl

Adsorption experiments
- 20 mL e-waste solution
- 20 g char/L
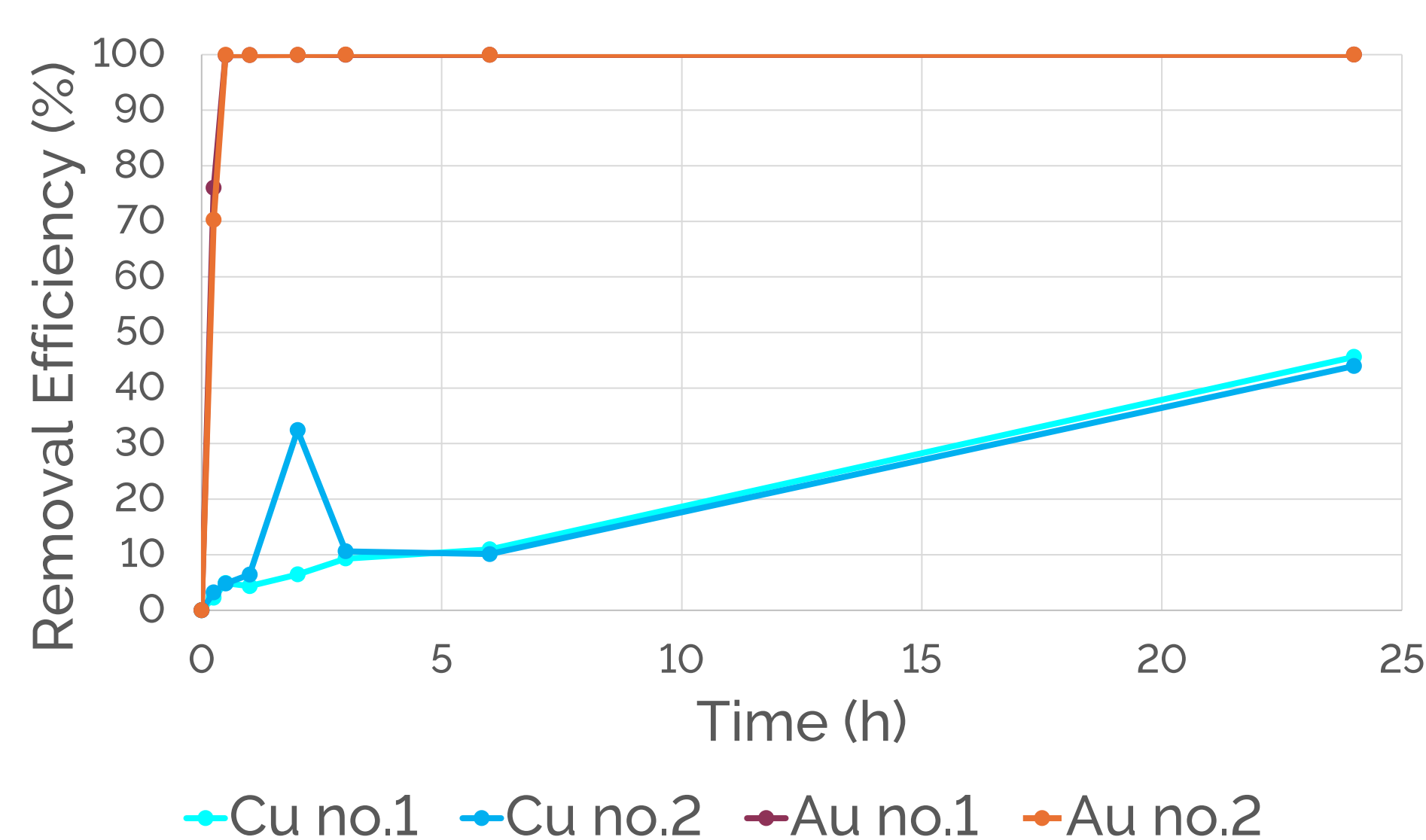- 40 °C

Results and Discussion

Untreated char is suitable for Au recovery, unsuitable for Cu recovery, and <u>unsuitable for separating Au from Cu.</u>
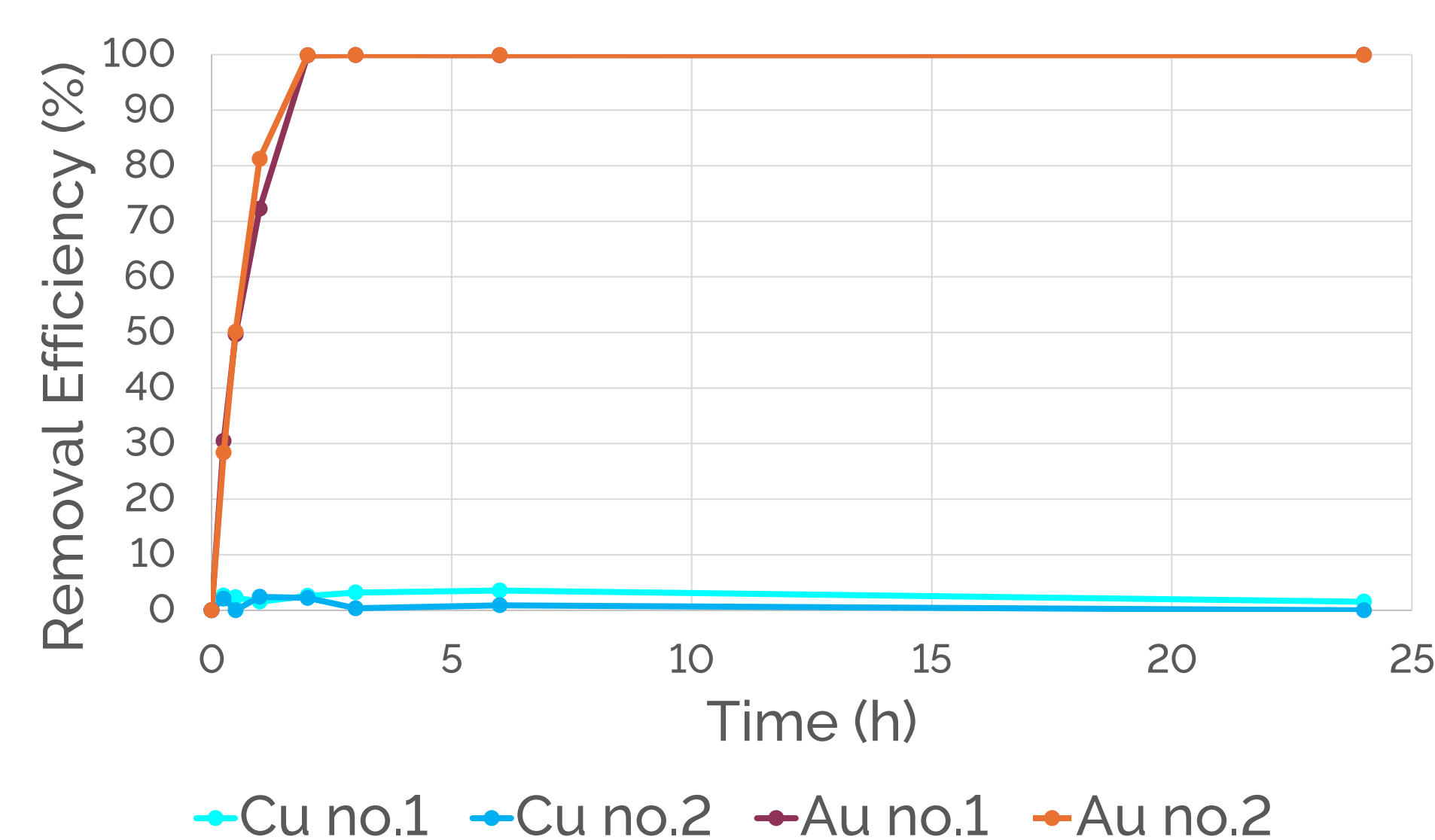
Figure 1: Removal efficiencies for untreated char

Demineralised char is suitable for Au recovery, unsuitable for Cu recovery, and <u>suitable for separating Au from Cu.</u>

Figure 2: Removal efficiencies for demineralised char

KOH activated char is suitable for Au recovery, unsuitable for Cu recovery, and <u>unsuitable for separating Au from Cu.</u>
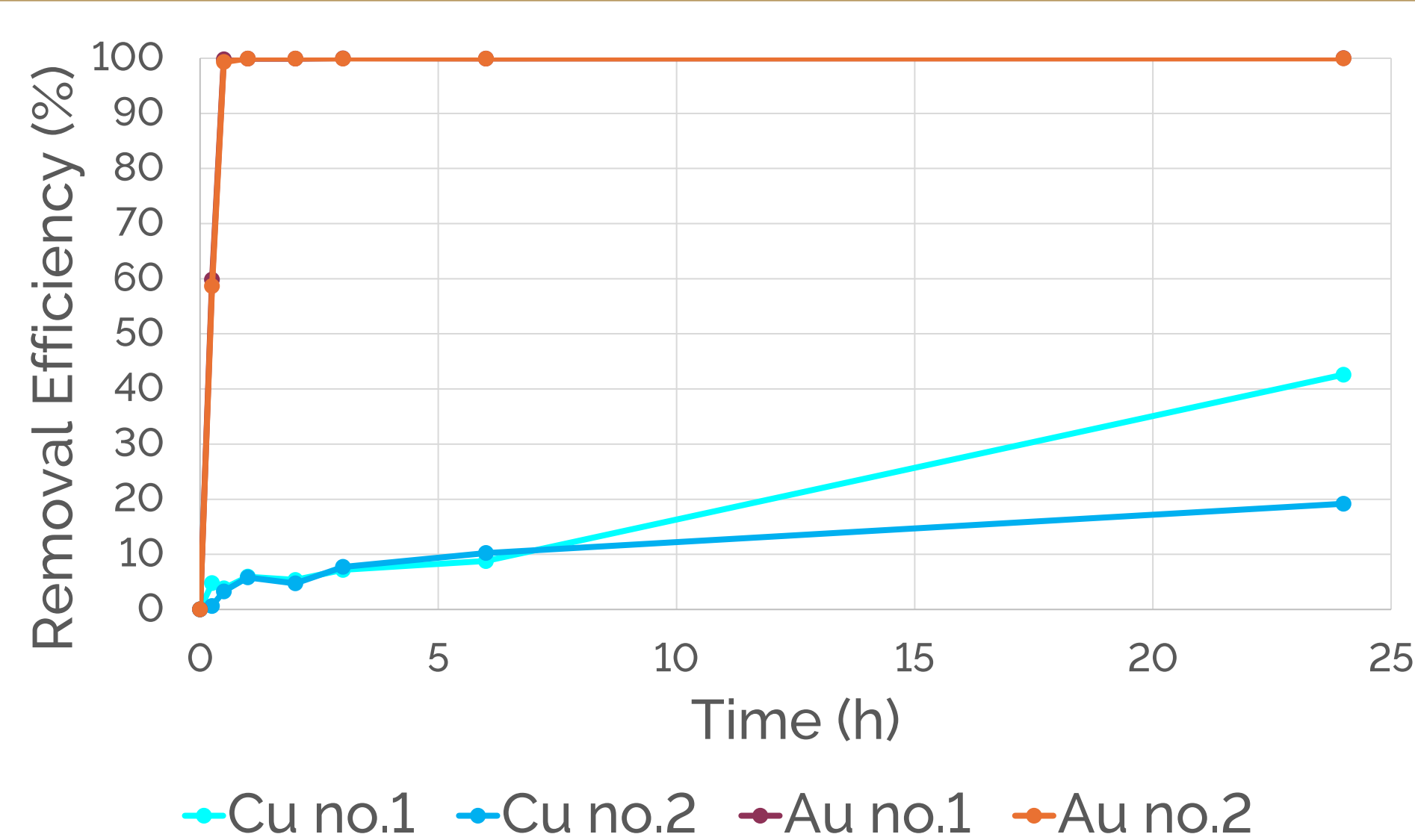
Figure 3: Removal efficiencies for KOH activated char

Steam activated char is suitable for Au recovery, suitable for Cu recovery, and <u>unsuitable for separating Au from Cu.</u>
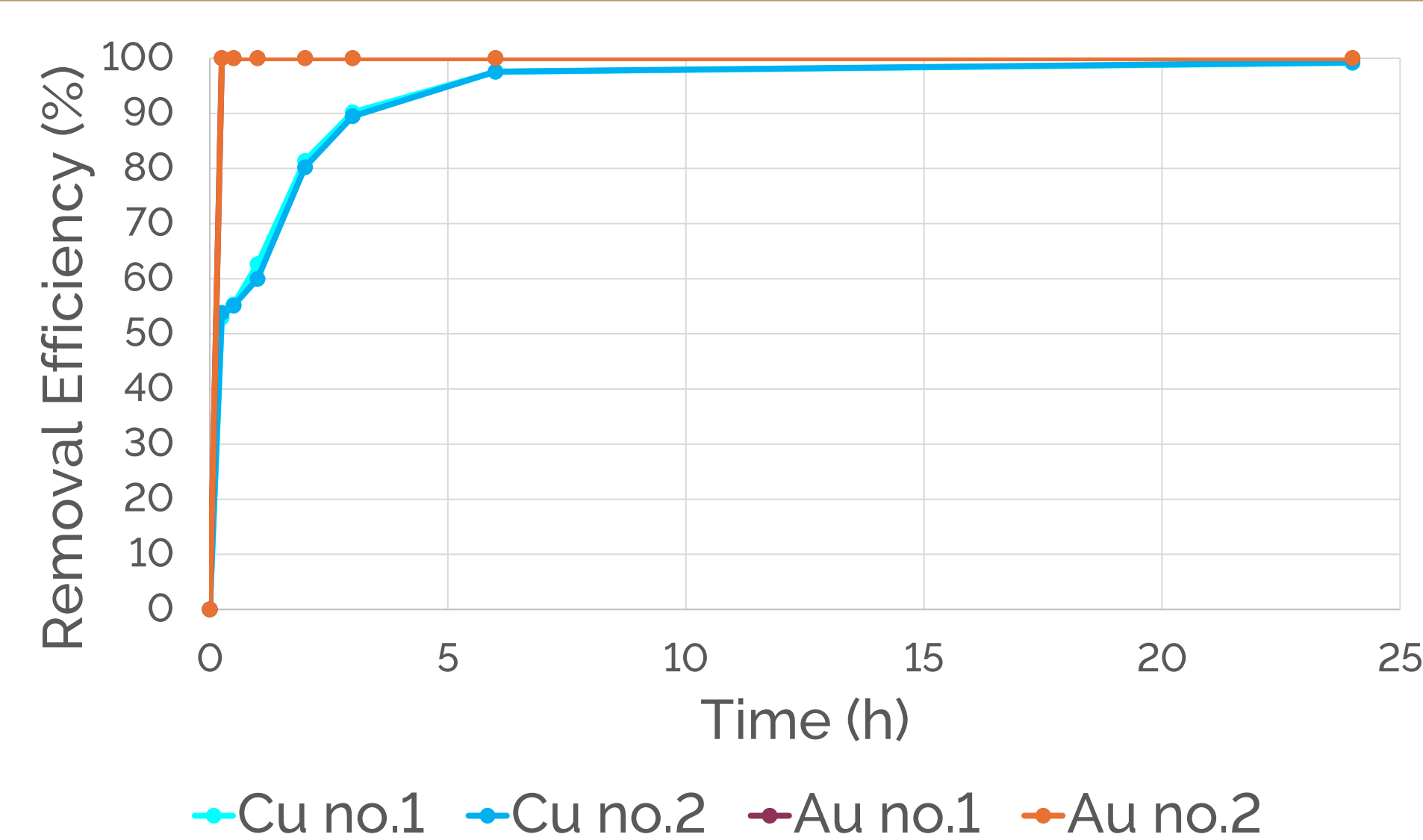
Figure 4: Removal efficiencies for steam activated char

Conclusions

- Char upgrading methods of demineralisation, KOH activation and steam activation were applied.
- Demineralisation is the best upgrading method for separating Au from Cu.
- Steam activation is the best upgrading method for recovering both Au and Cu.

Further work

- Perform temperature trials for kinetic modelling
- Perform char dosage trials for equilibrium modelling
- Test multi-component systems to establish selectivity
- Perform BET surface area analysis to inform results