

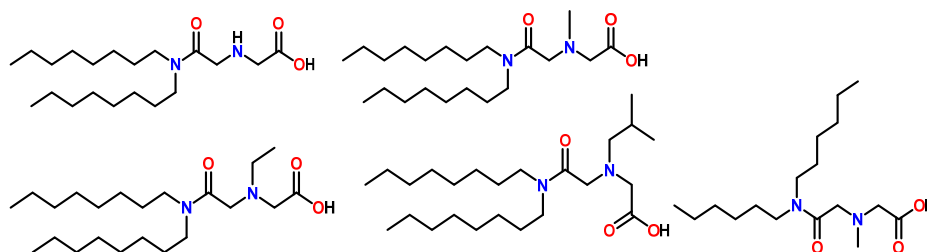
USE OF NEW AMIC ACID LIGANDS FOR THE COORDINATION AND SEPARATION OF BASE METAL IONS

Nonkosi Matinise, Claire Ineza, Nusrat M. Begum, Segun D. Oladipo
and Robert C. Luckay

Department of Chemistry & Polymer Science, Stellenbosch University,
Stellenbosch, South Africa

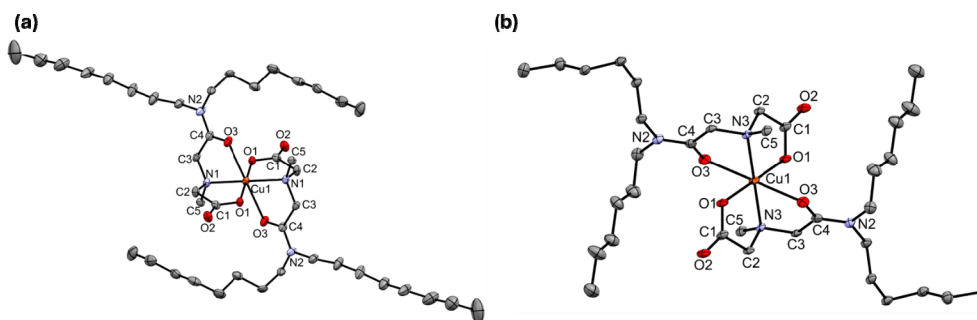
The growing demand for cobalt, primarily driven by the rapid growth of the rechargeable battery industry, has resulted in an increase in the development of efficient and sustainable methods for the recovery of cobalt from spent batteries.

This study focuses on the design and synthesis of new amic acid extractants for the selective recovery of cobalt from other base metal ions, contributing to a more circular economy.



Structure of ligands discussed in this work.

The extraction efficiency was influenced by factors such as ligand structure, concentration, pH isotherms, diluents and pH. The recyclability of the extractants were demonstrated, highlighting its potential for sustainable metal recovery. The study discussed valuable insights into the design and optimization of extractants for selective metal ion separation. DFT computational studies and crystal structures were also obtained of selected complexes.



Crystal structure for complex (a) $\text{Cu}(\text{L}2)_2$ and (b) $\text{Cu}(\text{L}5)_2$.

Mechanistic insights were obtained through slope analysis, which confirmed a predominant 2:1 ligand-to-metal coordination ratio and a proton-exchange extraction mechanism. Among these extractants, **L2** displayed superior extraction performance, achieving rapid Co^{2+} extraction within five minutes and favourable selectivity over Ni^{2+} and Mn^{2+} ions, particularly in the pH range of 3–5. Additionally, the same extractant, **L2** could be used for high separation of Ni^{2+} over Co^{2+} and Mn^{2+} after a longer period of time (24 h).