A number of test programs have been undertaken for unnamed Australian clients into the amenability of leaching copper ore samples using GlyLeach™. The process was invented as an environmentally friendly process to leach copper from ores.

**GLYLEACH™ BENEFITS**

- **Environmental safety:** Glycine is non-toxic to humans as well as wildlife.
- **Selectivity:** Glycine will solubilise copper, nickel, cobalt and zinc, while iron, manganese, silicates and carbonates remain in the leach residue.
- **Alkalinity:** Leach conditions are alkaline pH, allowing simple and inexpensive materials of construction.
- **Mild conditions:** Leaching is typically at ambient temperature with no heating cost or pressure vessels.
- **Low consumption:** Glycine is non-volatile (unlike cyanide, ammonia, hydrochloric acid) and stable under process conditions.
- **Recycle:** Glycine is not chemically consumed in the overall process. It is easily recovered and recycled.

**INTRODUCTION**

**GLYLEACH™** is an environmentally benign hydrometallurgical process that will leach copper, nickel, cobalt and zinc from oxide, mixed oxide and supergene ores, and even primary sulphide ores. Glycine is the simplest amino acid and is available in bulk quantities. Its unique properties can offer substantial advantages over conventional lixivants.
The analysis of a geologist sample of calcite-hosted deposit containing malachite. Gangue mineral is predominantly calcite and kaolinite hosted in sandy shale. The material was crushed to 10 mm before being agglomerated in cement (10 kg/T) and packed into a column and glycine leached in open circuit.

Glycine used efficiently extracted the copper from a high acid-consuming sample. Copper recovery was 100%. There was minimal slumping as it is compatible with cement agglomeration.

Given the column was run in open circuit, a costing could not be performed but typically the copper is extracted, and the leachate recycled. The dissolved copper can be recovered by precipitation as a sulphide precipitate or copper sulphate or electrowon. Allowing for a glycine usage of 0.2 kg/t and a lime of 0.05 kg/t then a cost of $0.47 per tonne is predicted.

<table>
<thead>
<tr>
<th>System</th>
<th>NaCN (g/T)</th>
<th>Glycine (g/T)</th>
<th>Thiocyanate (SCN-)</th>
<th>Cyanate (OCN-)</th>
<th>WAD</th>
<th>Free CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyanidation</td>
<td>90</td>
<td>-</td>
<td>63</td>
<td>14</td>
<td>21</td>
<td>16</td>
</tr>
<tr>
<td>GlyCat™</td>
<td>90</td>
<td>4</td>
<td>28</td>
<td>7.5</td>
<td>3.2</td>
<td>54</td>
</tr>
</tbody>
</table>

**POSITIVE OUTCOMES**

- Glycine used efficiently extracted the copper from a high acid-consuming sample
- Copper recovery was 100%
- There was minimal slumping as it is compatible with cement agglomeration

**COST BENEFITS**

- Given the column was ran in open circuit, a costing could not be performed but typically the copper is extracted, and the leachate recycled
- The dissolved copper can be recovered by precipitation as a sulphide precipitate or copper sulphate or electrowon
- Allowing for a glycine usage of 0.2 kg/t and a lime of 0.05 kg/t then a cost of $0.47 per tonne is predicted