**Introduction**

Leaching of gold by thiosulfate is the primary non-toxic alternative to the traditional cyanidation.

**Electrochemical study of leaching of gold in thiosulfate solution**

**Experimental Results**

**Low cost**
**Reasonably simple chemistry**
**Environmentally friendly**
**Small consumption**

**Cyanide**

\[ \text{Cu}^{2+} + e^- \rightarrow \text{Cu}^{+} \]

**Thiourea**

\[ \text{NH}_2\text{SCH(NH)}_2 \rightarrow \text{NH}_2\text{SO}_3^- + \text{H}_2\text{O} \]

**Table 1. Toxicity values for cyanide, thiourea and thiosulfate obtained from MSDS**

<table>
<thead>
<tr>
<th>Compound</th>
<th>Toxicity in (ORL-RATLD50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cyanide</td>
<td>6.4 mg/Kg</td>
</tr>
<tr>
<td>thiourea</td>
<td>125 mg/Kg</td>
</tr>
<tr>
<td>thiosulfate</td>
<td>&gt; 2500 mg/Kg</td>
</tr>
</tbody>
</table>

**Decomposition of thiosulfate**

\[ \text{Au} + \text{S}_2\text{O}_3^- + \text{H}_2\text{O} \rightarrow \text{Au} + \text{S}_2\text{O}_4^2^- + 2e^- + 2\text{H}^+ \]

**Passivation of electrode**

\[ \text{Au} + \text{S}_2\text{O}_3^- + \text{Cu}^{2+} \rightarrow \text{Au} + \text{Cu}^{+} + \text{S}_2\text{O}_4^2^- + 2e^- \]

**Decrease in the rate of gold dissolution**

\[ \text{SO}_3^2^- + \text{S}_2\text{O}_3^- \rightarrow \text{S}_4\text{O}_6^2^- \]

**Organic Additives**

**Surface Enhanced Raman Spectroscopy**

**Identification of species present in the passive layer**

**Conclusions**

**Adsorption of thiourea (TU) on gold**

\[ \text{Au} + \text{NH}_2\text{SCH(NH)}_2 \rightarrow \text{Au} + \text{Au}^{2+} + 2e^- + \text{NH}_2\text{SO}_3^- \]

**Good organic additives**

- *Perpendicular orientation*
- *Complex with gold at the metal surface*
- *Interaction through the sulfur atom*

**References**

1. S. Y. Baron, J. Mirza, G. Szymanski, J. Lipkowski
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