Elemental sulfur production in hydrometallurgy

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Elemental sulfur obtained during oxidative leaching of sulfides at low temperature will contain mercury and gold and both can be effectively recovered using sodium sulfide. Other metals go into solution.

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**INTRODUCTION**

When sulfide minerals are treated in acid medium and in oxidizing atmosphere elemental sulfur forms while the metals go into solution (Figure 1). There is a narrow region where elemental sulfur can form (Figure 2).

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**SPECIAL CASES**

**Sulfides containing gold**

Sulfide ores may contain gold embedded in the sulfide matrix and as a result many gold producers treat such ores at high temperature to liberate gold then treating the residue containing gold by cyanidation to recover gold. It was found that gold will be associated with the sulfur.
Jeffrey and Anderson⁴ and Anderson and Twidwell⁵ found that sulfur formed agglomerates containing all the gold as well as unreacted sulfides. Cyanidation of these agglomerates was not effective in recovering gold but sodium sulfide was. This can be conducted by leaching the agglomerates in sodium hydroxide whereby sodium sulfide was formed:

$$4S^0 + 6NaOH \rightarrow 2Na_2S + Na_2S_2O_3 + 3H_2O$$

$$(x-1)S^0 + Na_2S \rightarrow Na_2S_x \quad (where \ x = 2\ to\ 5)$$

Gold dissolution was the result of leaching by polysulfides and sulfides:

$$2Au + S_2^{2-} + 2S^2- \rightarrow 2AuS^{2-} + 2S^{2-}$$

Gold was recovered from solution by including electrowinning, gaseous precipitation, chemical precipitation, cementation, solvent extraction and ion exchange.

Sulfides containing mercury

Jorjani and Ghahreman⁶ reported that if mercury is present in the ores the elemental sulfur will contain the mercury and this can be leached by sodium sulfide to free it from mercury by forming insoluble mercury sulfide while elemental sulfur forms soluble polysulfide:

$$Na_2S + (x-1)S^0 \rightarrow Na_2S_x$$

$$Hg^{2+} + S^{2-} \rightarrow HgS$$

In conclusion, it is obvious therefore that elemental sulfur obtained during oxidative leaching of sulfides will contain mercury and gold and both can be effectively recovered using sodium sulfide.

CONCLUSION

While metals in sulfide ores go in solution as elemental sulfur forms, gold and mercury are embedded in the sulfur and can be recovered by leaching with sodium sulfide provided a surface active agent is present.

REFERENCES


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