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DISSOLVED-OXYGEN CONCENTRATION AT DIFFERENT  
CaO AND H<sub>2</sub>SO<sub>4</sub> CONCENTRATIONS

BY

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DISSOLVED-OXYGEN CONCENTRATION AT DIFFERENT  
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SUMMARY

The dissolved-oxygen content at saturation of aqueous solutions containing up to about 2.4 lb CaO/ton solution and 100 lb H<sub>2</sub>SO<sub>4</sub>/ton solution were determined at 20°C using a galvanic-cell oxygen analyzer. The capacities of these same solutions to hold oxygen, when they were mixed with quartz in the amount of 50% solids by weight, were also measured.

The test results, when treated statistically, showed no real change of dissolved-oxygen content in the solutions from that of distilled water. For all practical purposes the oxygen solubility at 20°C of aqueous solutions under the conditions that would be encountered in gold and uranium leaching plants could be taken as 9.24 mg O<sub>2</sub>/l solution, which is the solubility of oxygen in distilled water under the conditions used in this work.

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## INTRODUCTION

In the hydrometallurgical treatment of gold and uranium ores using alkaline-cyanide, and sulphuric acid leach solutions respectively, it is necessary for dissolved elemental oxygen to be present in the leach solutions if the leaching reactions are to take place (1, 2, 3 and 4). The question has arisen in the past as to whether the presence of lime or sulphuric acid in these leaching solutions has any effect on their capacities to hold dissolved oxygen or not. Since no references were found in the literature regarding this point, and since it was a question of some interest to gold and uranium hydrometallurgists, a test program designed to resolve the question was undertaken. This report describes the results of this work.

## PROCEDURE

The aqueous solutions of calcium hydroxide and sulphuric acid were prepared with distilled water and certified reagent-grade chemicals. The calcium oxide (CaO) concentrations of the prepared solutions were determined by titrating them with 0.0893N oxalic acid with phenolphthalein indicator (5). The sulphuric acid ( $H_2SO_4$ ) solution concentrations were determined by titration with 0.5 v/o NaOH and methyl orange indicator.

The dissolved-oxygen contents of the solutions were measured using a galvanic-cell oxygen analyser (6) made by the Precision Scientific Company of Chicago, Illinois, U.S.A. Preliminary tests showed that sparging of the solutions with air for fifteen minutes was sufficient to saturate them with oxygen. It was also shown in these tests that three to four minutes were required for the galvanic-cell electrode reaction to reach equilibrium. It is essential that the solutions contain no air bubbles while the dissolved-oxygen content is being measured. All the tests were done at atmospheric pressure with the temperature controlled at 20°C.

## RESULTS

The solubilities of oxygen, in six aqueous solutions containing from 0.2 to 2.4 lb CaO/ton solution and in five aqueous solutions containing 20 to 100 lb  $H_2SO_4$ /ton solution, were determined. Five determinations of the dissolved oxygen concentration at saturation were made on each of the lime and acid solutions investigated. The results of the tests done on the CaO and  $H_2SO_4$  solutions are shown in Figure 1. These tests were repeated on slurries of quartz (75% minus 200 mesh) with equal weights of these solutions and the results are shown in Figure 2.

The overall standard deviation was calculated for the test results for each of the four systems tested and was compared with the standard deviation obtained in calculating the linear regression analyses of the same data (7). This comparison is shown in Table 1.

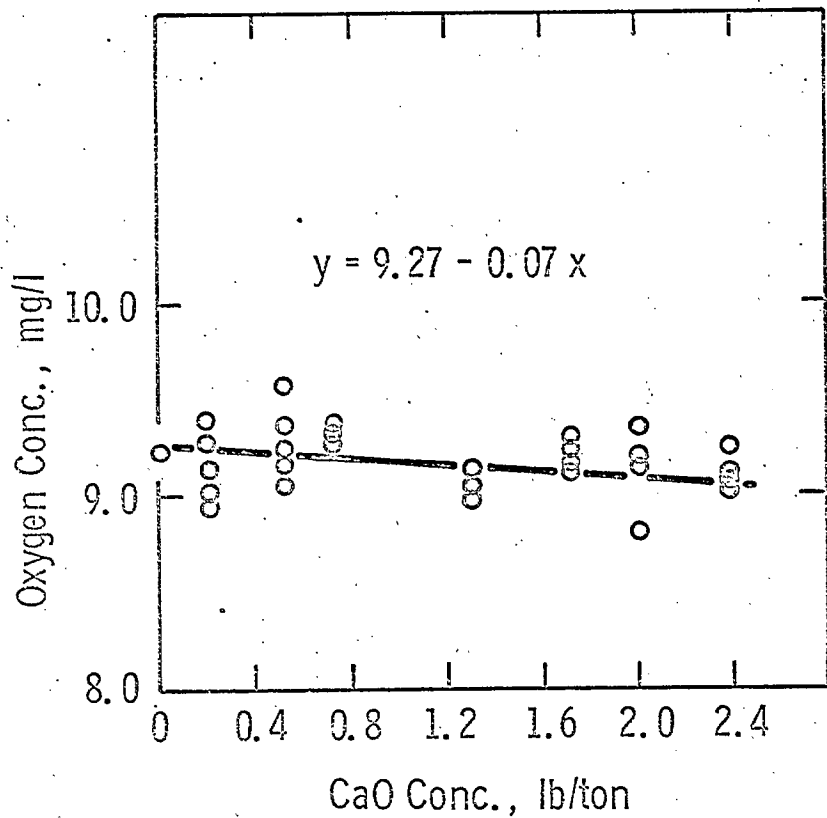


Figure 1A - Lime solutions

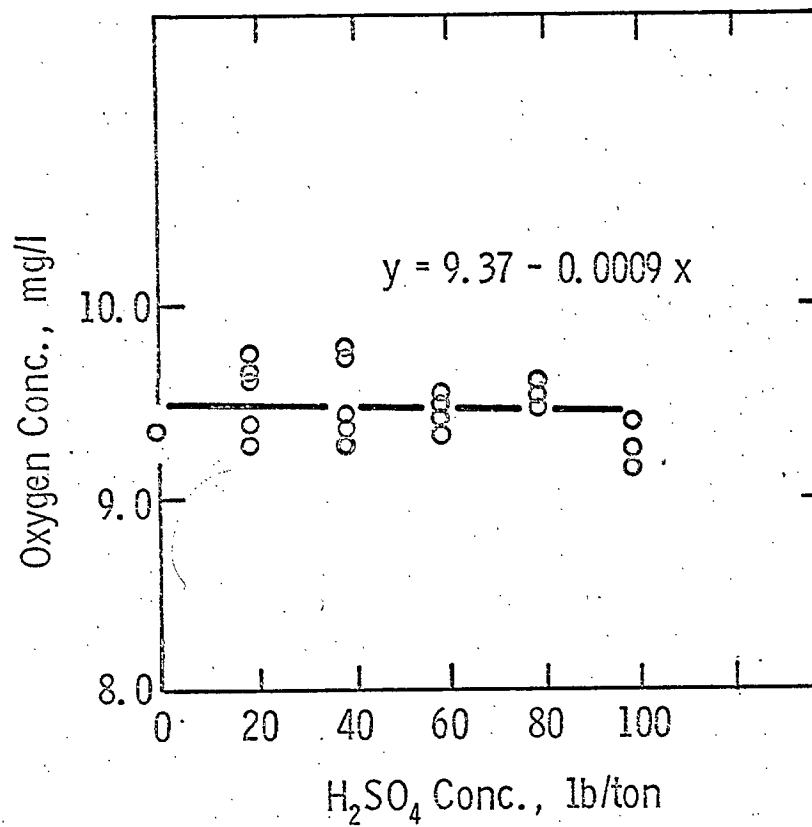


Figure 1B - Sulphuric acid solutions

Figure 1: Oxygen concentrations at saturation of aqueous solution of lime and sulphuric acid.

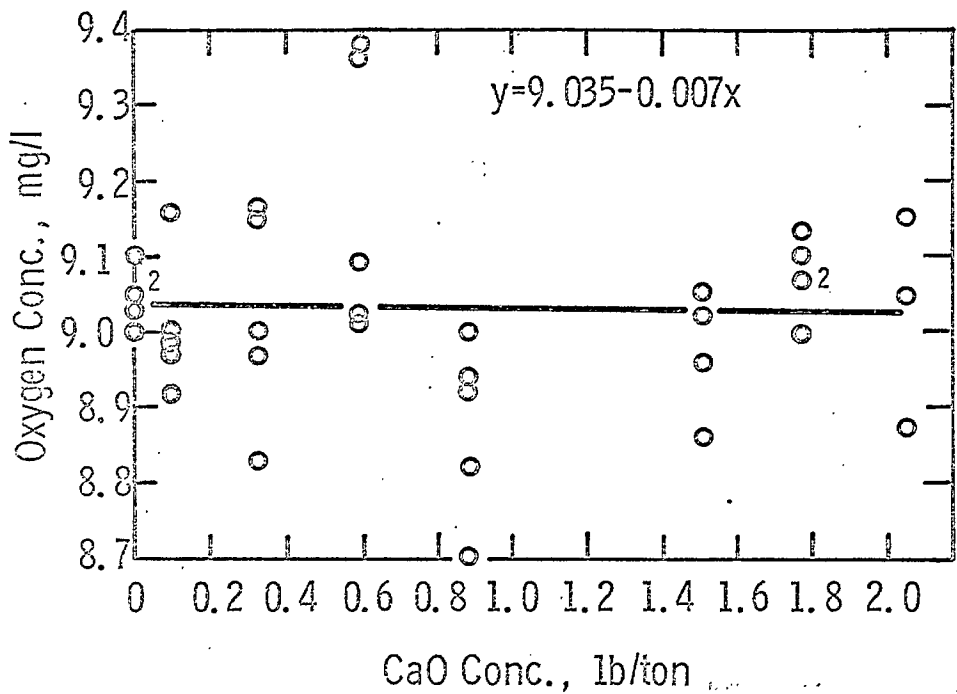


Figure 2A - Lime solution and quartz

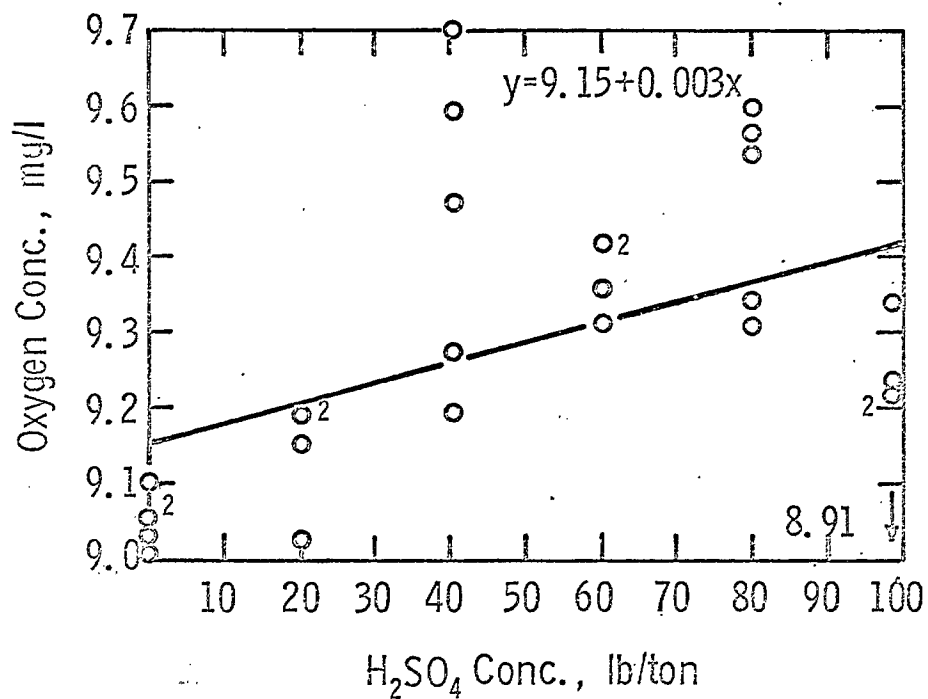


Figure 2B - Sulphuric acid solution and quartz

Figure 2: Oxygen concentration at saturation of aqueous solution/  
quartz slurries

TABLE 1

Comparison of Standard Deviations of Test Results  
and Regression Analyses

	Standard Deviation mg O <sub>2</sub> /l	
	Exp. Results	Regression
	±	±
CaO Solution	0.20	0.13
H <sub>2</sub> SO <sub>4</sub> "	0.23	0.16
CaO Slurry	0.15	0.14
H <sub>2</sub> SO <sub>4</sub> "	0.34	0.21

Table 1 shows that the experimental standard deviation is, in all cases, greater than the standard deviation of the regression analyses. This suggests that no correlation exists between the concentration of sulphuric acid or lime in aqueous solutions and the dissolved-oxygen concentrations at saturation of the solution under the conditions used in this test work.

#### DISCUSSION AND CONCLUSIONS

The experimental standard deviation, shown in Table 1, indicates an overall average error of  $\pm 2.6\%$ . A change of this size would have no practical importance to the operation and efficiency of a gold or uranium leaching plant. A variation in temperature of  $2^\circ$  would change the oxygen solubility by  $2.6\%$  (8). A change in pressure of 10 mm would change the oxygen solubility by  $2\%$  (9). For all practical purposes the oxygen solubility at  $20^\circ\text{C}$  of aqueous solutions under the conditions that would be encountered in gold and uranium leaching plants could be taken as  $9.24$  mg O<sub>2</sub>/l solution (10), which is the solubility of oxygen in distilled water under the conditions used in this work.

#### ACKNOWLEDGEMENTS

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