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Effect of water quality on flotation performance case study gol-E-gohar iron mine Iran

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ABSTRACT

A study was carried out to determine the effect of water quality on flotation performance. As water resources become scarcer and society's demands to reduce freshwater extraction haveincreased, mine sites have been increasing water reuse and accessing multiple water sources for mineral processing to save freshwater, particularly in froth flotation. Implementation of either strategy may lead to water quality variation that may impact flotation efficiency. In this paper, a review of the existing studies on water quality variation in flotation is given in three aspects: causes of water quality variation, consequences of water quality variation and solutions for problems caused by water quality variation. Based on the three aspects, a framework was developed, with which these studies were categorized and structured. Organizing literature in this way makes it possible to identify gaps in current research and future research directions.

KEYWORDS

Water consumption;
Flotation;
Recycling water.

INTRODUCTION

In many areas water is scarce and its control has become an increasing requirement[1]. This has led to the use of relatively impure primary water supplies and high proportions of recycle from tailings dams, thickener overflow, dewatering and filters products in minerals processing[2,3]. It is well known that there are now minerals processing operations in which zero water release is required by environmental regulations[4]. Primary water supplies from bore holes containing high levels of salinity including calcium, magnesium and iron salts as potential precipitates are being used in several areas in minerals processing operations. Treated sewage effluent water with relatively high levels of total organic carbon is being used at some sites for make – up water supply[5-7]. In many cases recycling waters within flotation plants is advantageous as; it lowers the need to receive new waters into the system, it lowers the amount of discharge and it allows retention of some reagents, lowering reagent consumption[8]. Two important strategies being implemented to improve water efficiency are increasing water reuse and accessing alternatives to freshwater for mineral process-

TABLE 1 : Operating conditions applied in flotation experiments

Retrieval Fe (%)	Elimination OF Sulfur (%)	Efficiency OF Seperation S(%)	Cutie Concentrate			Cutie feed			Weight Concentrate	Kind of water
			S	FeO	Fe	S	FeO	Fe		
97.68	71.67	57.23	0.21	26/7	67/54	0/70	26/45	67.01	576.24	Salty water
96.46	69.61	55.67	0.27	26/8	67/9	0/70	26/45	67.01	575.35	Brackish water
97.69	57.02	53.21	0.32	26/7	67/7	0/70	26/45	67.01	573.5	fresh water

TABLE 2 : Operating conditions applied in flotation experiments

Retrieval Fe (%)	Elimination OF Sulfur (%)	Efficiency OF Seperation S(%)	Cutie Concentrate			Cutie feed			Weight Concentrate	Grading Feed Floatation (d_{80}) µm
			S	FeO	Fe	S	FeO	Fe		
82.66	62.29	51.32	0.29	27.91	68.96	0.71	26.45	67.01	550.32	Salty water
73.03	62.01	50.21	0.32	28.14	70.10	0.71	26.45	67.01	565.9	Brackish water
98.17	63.45	54.23	0.23	26.67	67/23	0.71	26.45	67.01	580.1	fresh water

ing, particularly in flotation. Implementation of either strategy has been shown to increase the tendency for water quality to change, which, in turn, may affect flotation efficiency. In general, flotation is most effectively undertaken with clean water. As a second preference, metallurgists seeka consistent water quality so that reagent regimes for flotation can be developed and applied consistently. Variation in water quality is undesirable because it could complicate operating conditions and compromise flotation performance (TABLE 1 and 2).

EXPERIMENTAL

Flotation experiments were planned for three d_{80} 58 and 82 micron to investigate effect of water quality on flotation performance. An amount of hematit of …. g was conditioned with 140 ml of de-ionised water (percent solid = 25 wt per cent). For each experiment, hematit was depressed before any other conditioning step: the pH was fixed at 6.8 with NaOH and the pulp was agitated in the flotation cell without aeration during 30 minutes

RESULT AND DISCUSSION

The examination of water quality and its effecton batch flotation results should be consideredwhen optimal conditions for colemanite flotation aredetermined.

To understand the observed water qualityphdependency of flotation stability. Tab. 1 shows the effect of water quality on flotation performance in d_{80} =58. The pH had a strong effect on froth stability (Figure 1). The froth maximum height at equilibrium increased from 400 to 750 mm, when the pH decreased from 11 to 6, and the half-life from 13 to 18 s. A further decreasing of the pH to 4 caused the slurry to overflow from the column, meaning that the froth height was more than 900 mm (which is the limit of the instrument) (Figure 2). Therefore, the froth stability is pH dependent.

$$S.E. = \frac{c(f-t)(c-f)(100-t)}{f(c-t)^2(100-f)} \times 100$$

In a first set of experiments, amine from residual water was theonly source of collector. Later, experiments were performed withthe addition of amine dosages of 20 g/t, 35 g/t, and 50 g/t. For thissequence a composition water was prepared taking into account theproportion of tailings from each circuit. Another series of experimentssimulated an operation with the use of only residual aminein the rougher flotation and amine solution addition in a cleanerstage at dosages of 20 g/t, 35 g/t, and 50 g/t. The results of the tests with water containing residual aminewere compared with those from the standard test, performed withdistilled water and amine solution pre-

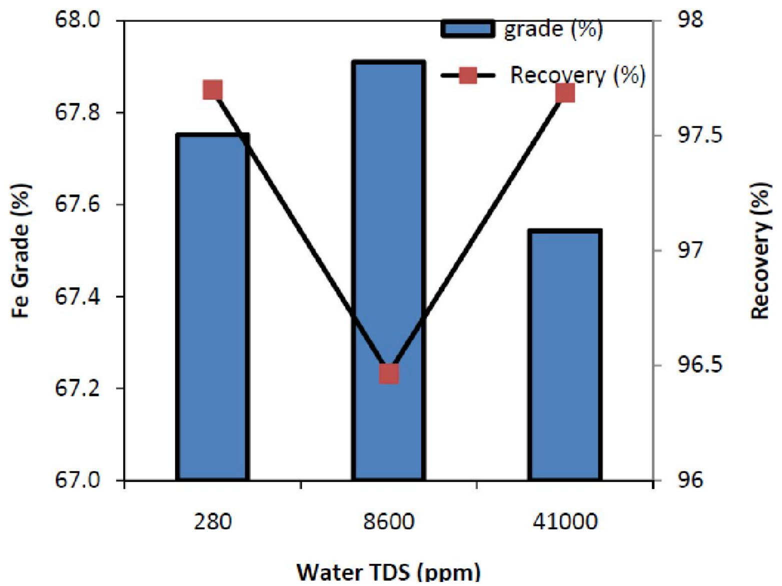

Figure 1

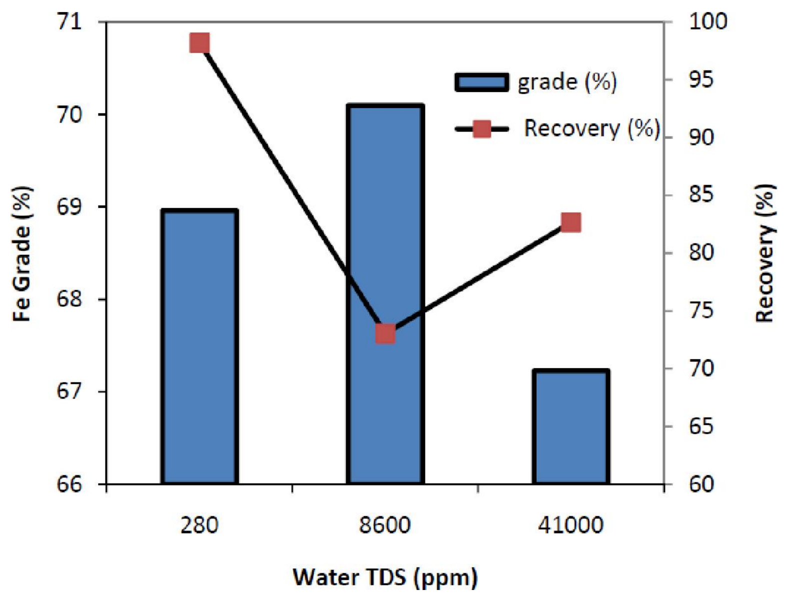

Figure 2

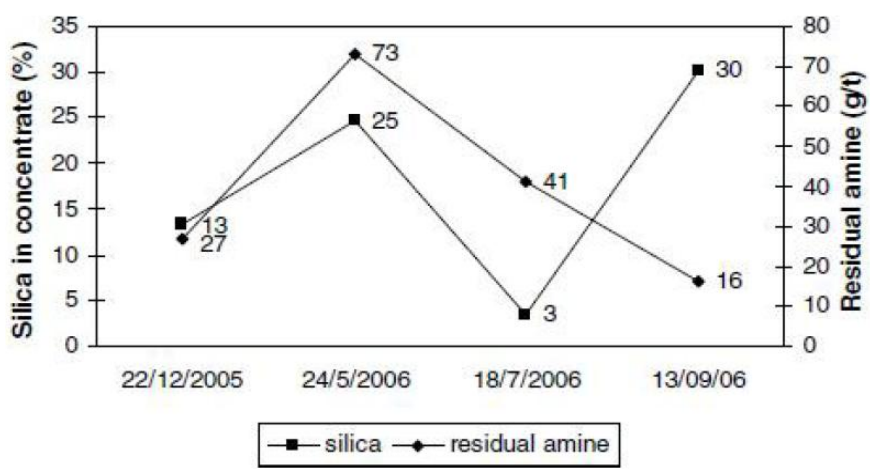

Figure 3

pared in the laboratory. The control parameter was silica content in the concentrate (Figure 3).

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