

Hydro tropes as promoters in soap flotation

Abubakar Khadri, Vijay Kumar.P, Yasser Dassin, Prabhulingaiah.G, Sekhar DMR

JPMC Plc, Eshidiya Mines, Jordan

Abstract

Soaps, the salts of fatty acids are generally used as collectors in the flotation process to separate salt type minerals. Some times light diesel oil is mixed with soaps and the emulsion is used as collector. Addition of detergents to soaps not only enhances the collector efficiency but also reduces the consumption of soap. Urea a known hydro trope is found to improve the flotation efficiency of soaps. Our current testing is indicating that other hydro tropes such as tri sodium citrate and sodium salicylate are also effective in improving the flotation efficiency of soap and also the soap-LDO emulsion.

Keywords: Hydro tropes, Sodium Salicylate, Soap flotation.

Introduction

Jordan is blessed with huge phosphate ore deposits covering an area about 125 square kilometers. Eshidiya mine is located in the southern part of Jordanian plateau. The phosphate ore deposition occurred in three layers marked as A1, A2 and A3. A1 layer with a thickness of 2.6 meters has an over burden of 14 meters followed by an inter burden of 2 meters below which A2 layer of thickness 1 meter is located. Below the A2 layer there is an inter burden of 0.3 meters followed by A3 layer of 1.7 meters. A1 ore analyses 40 to 50% Tri Calcium Phosphate [TCP]. The gangue minerals are clay, marl, detrital quartz. A2 ore analyses 73 to 75% TCP and hence is marketed directly. Where as A3 ore analyses 25 to 45% TCP with gangue minerals such as clay and high silica. Thus A1 and A3 ores need to be beneficiated. A1 ore beneficiation involves scrubbing and de sliming by cyclones and A3 ore is scrubbed, de slimed and then fed to a flotation circuit.

The reagents used in the flotation circuit are tall oil, light diesel oil (LDO), sodium silicate and sodium hydroxide (to soapanify tall oil while preparing oleate - LDO emulsion). This is a conventional process.

Experimental

In the present study sodium salicylate is tested at bench scale experiments with doses of 0.145 and 0.58, 1.16 Kgs per ton of ore and compared with plant conditions that is tall oil at 0.97 Kg per ton of ore, light diesel oil at 1.16 Kg per ton of ore and sodium silicate 0.35 Kg per ton of ore. The bench scale tests were of kinetics studies where incremental floats were taken. All reagents used in this study are of commercial grade that are being used in the Eshidiya plant except sodium salicylate which is of AR grade assaying 99.5%.

Discussion

Process Engineers at Eshidiya Beneficiation Plant have been attempting to improve the process and one of the areas is introducing new reagents for improved grade without reducing the TCP recovery. Hydrotropes² which are known reagents that enhance the solubility of non polar solutes in water were tried. So far urea³, linear alkyl benzene sulfonate⁴, Alfa olefin sulfonate⁴ and sodium benzoate⁵ were successfully tested. We are presenting preliminary test results of sodium salicylate. Testing of tri sodium citrate is in progress..

The tests were conducted using Denver flotation cell of 2 liters. The results are presented in Table 1 which are also plotted as shown in figure 1. It is obvious from figure 1 that sodium salicylate improves the soap flotation performance at a dose of 0.145 Kg per ton of ore and a higher dose may not be useful. The results presented here are preliminary and needs further detailed testing to see if still lower doses of salicylate are effective.

Table 1

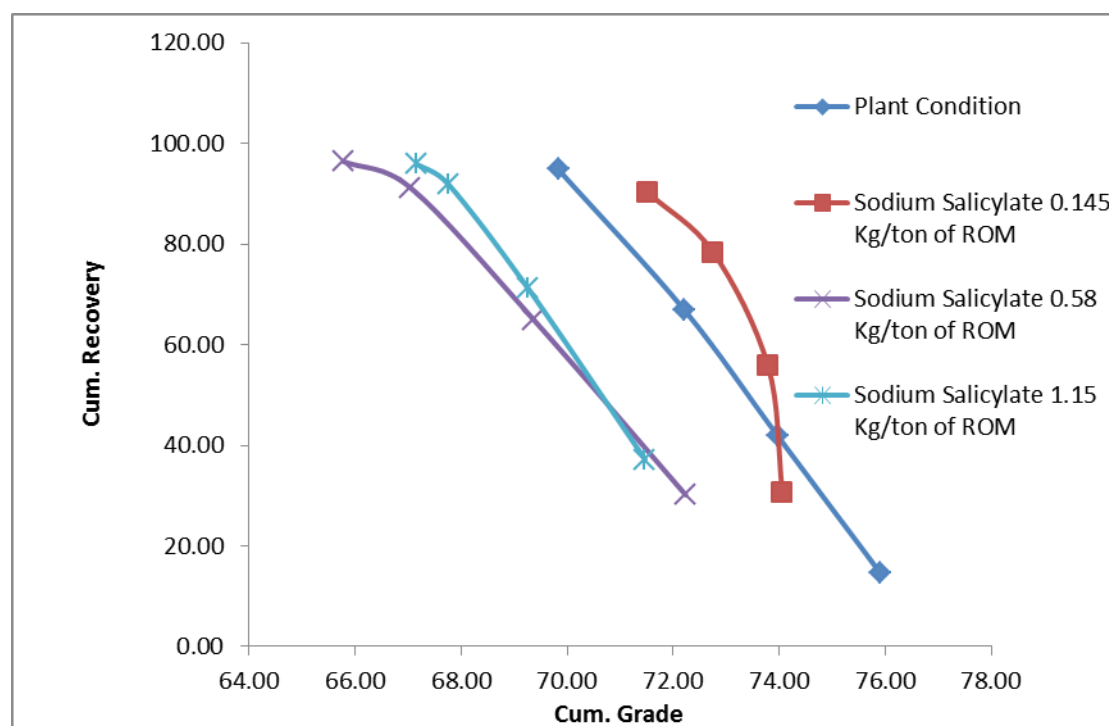
.Results of the kinetic experiments

F1=Float 1 (15Sec), F2=Float 2 (30Sec), F3=Float 3 (45Sec), F4=Float 4 (60Sec) and RT= rougher .tails

Fracti-on	Test 1			Test 2			Test 3			Test 4		
	Wt.%	Cum. Grade % TCP	% Cum. TCP Rec.	Wt.%	Cum. Grade % TCP	% Cum. TCP Rec.	Wt.%	Cum. Grade % TCP	% Cum. TCP Rec.	Wt.%	Cum. Grade % TCP	% Cum. TCP Rec.
F1	9.72	75.91	14.60	21.06	74.06	30.81	20.42	72.24	30.12	25.79	71.47	37.18
F2	18.84	73.98	41.79	17.26	73.79	55.85	25.45	69.37	64.97	25.10	69.27	71.11
F3	18.23	72.22	66.83	16.27	72.75	78.45	20.76	67.05	91.20	16.40	67.75	91.96
F4	21.86	69.84	94.82	9.42	71.51	90.41	5.17	65.78	96.42	3.47	67.17	95.85
RT	31.25	50.56	100	36.00	50.62	100	28.20	48.99	100	29.24	49.58	100
Calc. Feed	100	50.56	100	100	50.62	100	100	48.99	100	100	49.58	100

Test 1: Plant condition (PC), Test 2: PC+ Sodium salicylate. 0.145 kg/ton of ROM, Test 3: PC+ .Sodium salicylate. 0.58 kg/ton of ROM, Test 4: PC+ Sodium salicylate. 1.16 kg/ton of ROM

Figure 1



Closing Remarks

The results presented here clearly indicate that sodium salicylate at the dose of 0.145 Kg per ton of ore improves the flotation performance of oleate – LDO collector for phosphate mineral. Further tests are in progress.

References

- [1] Sekhar, DMR., Ranga Rajan, VS., Ramana Murthy, VS., and Jain VK., Processing low grade silica based rock phosphate ore, Fertiliser News, 31(6), 1986.
- [2] Roy, BK and Moulik, SP, Effect of hydrotropes on solution behavior of amphiphiles, Current Science, 85(8), 25 October, 2003, P 1148-1155.
- [3] Sekhar, DMR., Srinivas, K., Prabhulingaiah, G. and Yasser Dassin, Urea as promoter in the soap flotation of phosphate ores, Trans. IIM Vol.62, issue 6, December 2009, p 555-557.
- [4] Sekhar, DMR, Srinivas, K., Prabhulingaiah, G., Dassin, Y. and Alftinah, A., Promoters for soap flotation of Phosphate minerals, Proceedings of the International Mineral Processing Congress 2010, P 2345 – 2349.
- [5] Mihir, DM, Vijay Kumar, P, and Prabhulingaiah, G., Sodium Benzoate as Promoter in the Soap Flotation of Phosphate Minerals, accepted for presentation during Mineral Processing Technology – 2011, being organized by Indian Institute of Mineral Engineers, at Udaipur during 20-22, October, 2011.