

LOCAL MANUFACTURE OF COPPER SULPHATE

Copper sulphate solution was previously made at Britannia in 1933. The procedure involved oxidation of the copper precipitate (from mine water) in sacks for thirty days and dissolution of the oxidized copper in dilute sulphuric acid. This method gave satisfactory results - some thirty percent of the copper in the precipitate being converted into copper sulphate.

When the use of copper sulphate became necessary again in the mill in 1947, the above procedure was tested but difficulty was experienced in getting the copper to dissolve in the acid. This was due to the copper in the precipitate not oxidizing to the same extent as previously.

Laboratory study of the oxidation of the copper precipitate showed that the addition of a small amount of ammonium hydroxide to the precipitate greatly affected the rate of oxidation of the copper. After twenty-four hours treatment with ammonium hydroxide, the precipitate was oxidized to such an extent that 75-80 percent of the copper was soluble in sulphuric acid.

PROPOSED METHOD OF MAKING COPPER SULPHATE

Tests using the ammonia - air oxidation and sulphuric acid leaching indicated that to make a copper sulphate solution equivalent to the present daily consumption of 2000 lb. of copper sulphate crystals would involve the following:

- (1) To 1500 lbs of moist precipitate (60% Cu.) add 30 lbs of ammonium hydroxide (26 Be°) and 30 lbs of water.

- (2) Mix and spread charge out in tray 2" deep
- (3) Leave to oxidize at room temperature for 24 hours
- (4) Grind oxidized product (soft sinter)
- (5) Leach ground oxidized precipitate with 10 per cent sulphuric acid solution for 2 hours. Agitate pulp with air
- (6) Let residue settle, decant leach liquor and wash leach residue to copper concentrate tank.

COST OF MANUFACTURE

COPPER REQUIRED	=	0.255 LB @ 20 c / LB	=	5.10c	
ACID	"	=	0.60 LB @ 1.25 c / LB	=	0.75c
AMMONIUM HYDROXIDE		30LB/TON OF CRYSTALS AT 6.1 c / LB		=	0.10c
TOTAL COST OF REAGENTS				=	5.95c
		Labor @ \$500 per ton of capitals		=	0.25c
TOTAL COST				=	6.20c
PRESENT COST OF LB. OF COPPER SULPHATE CRYSTALS				=	8.60c
POSSIBLE PROFIT PER LB. OF COPPER SULPHATE CRYSTALS				=	2.40c
		Monthly Saving on Current Mill Tonnage		=	\$900 to 1000

It is proposed to construct a small plant outside the mill building on the Beach level, adjacent to the railway tracks. This will avoid the handling of raw materials to the lower ball mill floor, as when previously making copper sulphate solution in the years 1932 to 1936 for the treatment of East Bluff ores. The plant will consist of trays for oxidizing the raw precipitate, a vat or tower in which sulphuric acid will be applied to the oxidized precipitate, a stock tank, necessary pumping equipment and possibly, a small grinding mill for breaking up small chunks formed in the ammonium hydroxide treatment. The final solution product will be elevated to the present stock tank above the zinc agitation for use in the flotation circuits.

COPPER SULPHATE PLANT

The Copper Sulphate Plant was operated for 294 days in 1950, producing an equivalent of 582,093 pounds of copper sulphate crystals and showing a substantial saving in the cost of this reagent. Plant equipment is as follows: wooden oxidizing tray, 6' x 22'; small grinding unit; wooden leaching tower, 7' diameter x 9'; wooden storage tank, 8' diameter x 7'; 2 centrifugal pump; Worthite Pump; air lines; and water lines; all housed in a 28' x 40' building located near the large blanket plant. Outside this building is a wooden storage tank, 7' diameter x 6'; two wooden storage tanks, 10' diameter x 10'; a large steel tank for sulphuric acid storage, 10' diameter x 12'; and a small steel tank for controlling the amount of acid used in each leach. The two large (10' diameter x 10') wooden storage tanks were built during this year.

The daily production of the plant is equivalent to 2400 2700 pounds of copper sulphate crystals. One man operates the plant, and his daily work consists of (1) pumping to storage and then diluting to 15 percent strength the solution from the previous day's leach (leached for 10 hours); (2) grinding and preparing the leach, by adding water and 1300 pounds of sulphuric acid, one batch of oxidized (for 15 hours) copper precipitates; and (3) preparing 2000 pounds of copper precipitates for oxidation by mixing with 80 pounds of water and 80 pounds of 260 Be ammonium hydroxide.

The precipitates are brought to the plant in boxes holding 3 tons each; the ammonium hydroxide in barrels holding 280 pounds each. The acid storage tank is filled by air pressure through a 2 pipe line from tank cars which dock at the freight wharf.

The following are the figures for the Copper Sulphate Plant performance during the year:

	Total	Per Pound of Crystals Produced
Copper Precipitates Used	530,000 Pounds	0.777 pounds
Sulphuric Acid Used	386,195	0.566
Ammonium Hydroxide Used	20,510	0.030
Total Production (Equivalent Pounds of Copper Sulphate Crystals)		682,093 Pounds
Total Cost (Including Labor)		\$45,689.76
Average Cost per Pound of Crystals - Local Manufacture		6.70c
Average Cost Per Pound of Crystals - If Purchased (Incl. Handling charges)		9.06c
Saving per Pound of Copper Sulphate Crystals		2.36c
Total Savings for the Year		\$16,087.39

COPPER SULPHATE PLANT

In 1951, the Copper Sulphate Plant produced the equivalent of 725,759 pounds of copper sulphate crystals and showed a considerable saving in the cost of this reagent. Because of the high copper sulphate consumption during the early part of this year, it was necessary to add to the capacity of the copper sulphate plant; another leaching tower was built, the 8' diameter x 7' storage tank was replaced by one 10' diameter x 10', and the oxidation tray was enlarged. The plant equipment is now as follows: wooden oxidizing tray, 9' x 22'; small grinding unit; two wooden leaching towers 7' diameter x 9'; 2 centrifugal pump; 3/4 Worthite pump, air lines; and water lines, all house in a 28' x 40' building located near the large blanket plant. Outside this building is a wooden storage tank, 7' diameter x 6', three wooden storage tanks, 10' diameter x 10'; a large steel tank for sulphuric acid storage, 10' diameter x 12'; and a small steel tank for controlling the amount of acid used in each leach.

The daily production of the plant varies with the mill consumption and this year varied from 1800 pounds equivalent pounds of copper sulphate crystals (average for September) to 3100 equivalent pounds of crystals (average for January and May).

One man operates the plant, and his daily work consists of (1) pumping to storage and then diluting to 15 percent strength the solution from the previous day's leach (leached for 10 hours); (2) grinding and preparing for leach, by adding water sulphuric acid, a batch of oxidized (for 15 hours) copper precipitates; and (3) preparing copper precipitates for oxidation by mixing with water and ammonium hydroxide.

The precipitates are brought to the plant in boxes holding 3 tons each; the ammonium hydroxide in barrels holding 280 pounds each. The acid storage tank is filled by air pressure through a 2 pipe line from tank cars which dock at the freight wharf.

The following are the figures for the Copper Sulphate Plant performance during the year:

	Total	Per Pound of Crystals Produced
Copper Precipitates Used	531,020	0.732
Sulphuric Acid Used	392,021	0.540
Ammonium Hydroxide Used	21,230	0.029

COPPER SULPHATE PLANT (Cont'd)

Total Production (Equivalent Pounds of Copper Sulphate Crystals)	725,759
Total Cost (Including Labor)	\$55,074.63
Average Cost per Pound of Crystals - Local Manufacture	7.59c
Average Cost Per Pound of Crystals - If Purchased (Incl. Handling charges)	11.87c
Saving per Pound of Copper Sulphate Crystals	4.28c
Total Savings for the Year	\$31,062.49