

DEPARTMENT OF MINES AND RESOURCES

BUREAU OF MINES

CANADA

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Ottawa, January 3, 1947.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2161.

Bleaching of a Barytes Ore from Canadian Industrial
Minerals Limited, Walton, Nova Scotia.

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Note:

This report relates essentially to the samples as received. It shall not, nor any correspondence connected therewith, be used in part or in full as publicity or advertising matter for the sale of shares in any promotion.

(Copy No. 18.)

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Shipment:

Fifty pounds of crude barytes ore was received on October 21, 1946, from Mr. G. C. Campbell, manager of the Canadian Industrial Minerals property at Walton, Nova Scotia. The shipment was initiated by Mr. R. P. Opie, General Manager of the company, at 67 Yonge Street, Toronto, Ontario. Previously, Investigation Report No. 2106 (dated September 10, 1946) had been issued, consisting of a screen analysis investigation on ore from this property.

Location of Property:

The property of the Canadian Industrial Minerals Limited from which the present shipment originated is situated near Walton, Nova Scotia, and is adjacent to the railway station of Scotch Village, Nova Scotia.

Purpose of the Investigation:

As stated in Mr. Opie's letter of October 8, 1946, it was desired to ascertain "whether this material, containing impurities above specification, could be satisfactorily bleached with either sulphuric or hydrochloric acid in the manner normal for this process."

Characteristics of the Ore:

The shipment consisted of massive barytes with a small number of irregular patches of dark brown to black rock material and coated with reddish brown stains of iron oxide.

Sampling and Analysis:

The 50-pound sample was crushed to minus 14 mesh and a representative sample was obtained by standard procedures. This sample assayed:

BaSO ₄	-	96.72	per cent
Fe ₂ O ₃	-	1.46	"
Al ₂ O ₃	-	0.39	"
SiO ₂	-	0.43	"
CaO	-	0.34	"
MgO	-	Trace.	"
Loss on ignition	-	1.58	"

Results of Investigation:

The results obtained from the test work show that bleaching with 100 pounds of sulphuric acid per ton of ore gave a product assaying 99.1 per cent BaSO₄ and 0.03 per cent Fe₂O₃. The colour obtained should be an acceptable grade of white. Tests were also made with hydrochloric acid and with salt. These latter tests gave final products which did not conform either in analysis or colour to the desired specifications.

INVESTIGATIVE PROCEDURE:

Portions of the ore were ground to different sizes (generally to 98 per cent minus 325 mesh) and placed in large beakers. Distilled water was added in an amount necessary to produce a thick paste. Allotted quantities of sulphuric, hydrochloric acid or salt were added, and the whole was agitated to a smooth consistency. The beakers were then covered and placed in a constant temperature oven for 12 hours. The temperature used was from 70° to 83° C. The batch was then removed, cooled, distilled water added in the proportion of 3 of water to one of ore, and thoroughly mixed. The pulp was then settled for a 5-minute period and the solution decanted off. This solution was then titrated for acidity in order to determine the amount of acid consumption. Distilled water was again added to the residue, agitated, settled, and the overflow decanted. The process was repeated six times. The final decantation should leave just enough acid so that iron sulphate gives a slight blue with potassium ferrocyanide. This final product was then filtered and finally dried at a low temperature.

Results of Test Work:

Test No. 1 - Screen Test and Analysis.

A portion of the ore, crushed to minus 14 mesh, was screened to different sized products and these products were weighed and assayed for Fe_2O_3 .

(Continued on next page)

(Results of Test Work, cont'd) -

Results:			
Mesh	Weight, per cent	Assay, Fe ₂ O ₃ , per cent	Distribution of Fe ₂ O ₃ , per cent
- 14+ 28	6.5	1.24	7.2
- 28+ 48	9.3	1.21	9.5
- 48+ 65	9.1	1.16	8.9
- 65+100	8.8	1.10	8.1
-100+150	9.1	1.04	7.9
-150+200	9.4	0.96	7.5
-200+325	7.8	0.77	5.0
-325	40.0	1.37	45.9
Total	100.0	1.20	100.0

Test No. 2. - Bleaching the Sized Material.

Portions of the different sizes obtained in Test No. 1 were subjected to a sulphuric acid leach by the standard method at a temperature of 80° C. The quantity of acid used was 75 pounds per ton of ore. The results were as follows:

Mesh	Assay of Bleached Barytes, Fe ₂ O ₃ per cent	Colour
- 14+ 28	0.22	Red.
- 28+ 48	0.20	"
- 48+ 65	0.12	"
- 65+100	0.09	Pink
-100+150	0.09	Faint pink.
-150+200	0.09	" "
-200+325	0.08	" "
-325	0.06	Very faint pink.

A similar test was made using 100 pounds of H₂SO₄ per ton.

Results:		
Mesh	Assay of Bleached Barytes, Fe ₂ O ₃ per cent	Colour
- 14+ 28	0.26	Red.
- 28+ 48	0.10	Reddish.
- 48+ 65	0.07	Pink.
- 65+100	0.08	"
-100+150	0.07	Faint pink.
-150+200	0.05	" "
-200+325	0.05	Very faint pink.
-325	0.025	Dead white.

From the above tests it appears reasonable to assume

(Results of Test Work, cont'd) -

that a grind of minus 325 mesh and 100 lb. H_2SO_4 per ton ore necessary in order to obtain a suitable product of bleached barytes.

Test No. 3.

In this test portions of the ore were ground to 98 per cent minus 325 mesh and subjected to the standard procedure, using different quantities of H_2SO_4 in the process, at a temperature of 80° C. The results were as follows:

Test No.	H_2SO_4 Added, lb./ton	H_2SO_4 Consumed, lb./ton	Assay of Bleach, Fe_2O_3 per cent	Colour of Bleach
3A	25	8.2	0.75	Red.
3B	50	11.5	0.12	Pink.
3C	75	17.2	0.11	Faint pink.
3D	100	26.0	0.07	Extremely faint pink.

Test No. 4.

Five per cent of salt was added to the bleach prior to the heat treatment. Conditions otherwise were similar to Test No. 3, with a temperature of 80° C.

Results:

Test No.	H_2SO_4 Added, lb./ton	H_2SO_4 Consumed, lb./ton	NaCl Added, lb./ton	Assay of Bleach, Fe_2O_3 per cent	Colour of Bleach
4A	25	7.5	100.0	0.86	Red.
4B	50	18.0	100.0	0.24	"
4C	75	28.5	100.0	0.04	Faint pink.
4D	100	37.0	100.0	0.04	Extremely faint pink.

The addition of NaCl to the bleach seems to improve the colour of the final product in Tests Nos. 4C and 4D.

Test No. 5.

In this test a temperature of 70° C. was used for the heat treatment, replacing the 80° C. previously used. No

(Results of Test Work, cont'd) -

salt was added.

Results:

Test No.	H ₂ SO ₄ Added, lb./ton	H ₂ SO ₄ Consumed, lb./ton	Assay of Bleach, Fe ₂ O ₃ per cent	Colour of Bleach
5A	100	22.0	0.074	Faint pink.
5B	90	21.6	0.050	" "
5C	80	16.8	0.160	Pink.

Test No. 6.

The temperature was raised to 85° C. in this test.

Conditions otherwise were standard.

Results:

Test No.	H ₂ SO ₄ Added, lb./ton	H ₂ SO ₄ Consumed, lb./ton	Assay of Bleach, Fe ₂ O ₃ per cent	Colour of Bleach
6A	100	28.5	0.030	White.
6B	90	25.6	0.037	"
6C	80	22.8	0.037	Very faint pink.

It seems to be apparent from Tests Nos. 5 and 6 that the temperature used in the heat treatment is important.

Test No. 7. - Hydrochloric Acid Treatment.

In this test hydrochloric acid replaced the sulphuric acid used in the previous tests. Different amounts of hydrochloric were used in this test. The temperature was 80° C. The results were as follows:

Test No.	HCl Added, lb./ton	Assay of Bleach, Fe ₂ O ₃ per cent	Colour of Bleach
7A	25	1.15	Red.
7B	50	1.15	"
7C	75	0.96	"
7D	100	0.47	"

The acid consumption was high in this test, being 74.5 per cent loss in Test No. 7D.

Test No. 8. - HCl + NaCl Treatment.

100 lb./ton of salt was added in this test. Conditions

(Results of Test Work, cont'd) -

otherwise were similar to Test No. 7.

Test No.	HCl Added, lb./ton	NaCl Added, lb./ton	Assay of Bleach, Fe ₂ O ₃ per cent	Colour of Bleach
8A	25	100	1.22	Red.
8B	50	100	1.05	"
8C	75	100	0.78	"
8D	100	100	0.42	"

Test No. 9. - NaCl Treatment.

In this test different quantities of salt were added to the bleach. No sulphuric or hydrochloric acid was used in this test. A heating temperature of 80° C. was used.

Test No.	Salt Added, lb./ton	Assay of Bleach, Fe ₂ O ₃ per cent	Colour of Bleach
9A	100	1.17	Red.
9B	150	1.17	"
9C	200	1.14	"
9D	250	1.16	"

Test No. 10 (Final Test). - Straight Sulphuric Acid Bleach.

In this final test a temperature of 83° C. was used with 100 pounds of H₂SO₄ per ton. cent minus 325 mesh.

Results:

Test No.	H ₂ SO ₄ Added, lb./ton	H ₂ SO ₄ Consumed, lb./ton	Assay of Bleach, Fe ₂ O ₃ per cent	Colour of Bleach
10	100.0	32.0	0.03	Dead white.

The acid consumption was 32 pounds sulphuric acid per ton. This final bleached product assayed as follows:

BaSO ₄	-	99.16 per cent
Fe ₂ O ₃	-	0.03 "
SiO ₂	-	0.33 "
Al ₂ O ₃	-	Trace.

(Continued on next page)

(Results of Test Work, cont'd) -

CaO - Trace,
MgO - "
Loss on
Ignition - 0.55 per cent

Some 4 pounds of this material was processed and sent to Mr. Opie at Toronto.

In the different tests, temperatures of from 70° C. to 85° C. were used and a 12-hour heating period was considered essential for these temperatures. It would appear possible that in practice, where steam is used for heating purposes the temperature would be raised some ten or fifteen degrees and the time of operation could be consequently shortened.

Summary and Conclusions:

The test work followed the standard methods used for the bleaching of barytes ore as practised in plants in Missouri, U.S.A. This method was modified somewhat in order to conform with the small-scale tests. The procedure is described, in some detail, on Page 3, under "Investigative Procedure." It was found that a grind of 99 per cent minus 325 mesh, an acid addition of 100 pounds of sulphuric acid per ton of ore, a temperature of 85° C., and a bleaching period of 12 hours were required to produce a white product assaying 99 per cent BaSO₄ and 0.03 per cent Fe₂O₃. The sulphuric acid consumption was 32 pounds per ton of material treated. Tests were also made using hydrochloric acid replacing the sulphuric; these were not successful, the resultant bleached product being red in colour, with a high acid consumption. The addition of salt to the sulphuric acid bleach helped the bleaching process to a very slight extent. Test No. 9, in which salt was used without any

(Summary and Conclusions, cont'd) -

acid, gave hardly any beneficial results.

The A.S.T.M. standard specifications for barium sulphate pigments, A.S.T.M. Designation D-602-42, state that the maximum ferric oxide content for barytes is 0.05 per cent Fe_2O_3 . The bleached product, resulting from this test work, having an Fe_2O_3 analysis of 0.03 per cent, meets the above specifications. From the summary of the work done, it would appear reasonable to assume that the standard method bleaching, as shown by the sulphuric acid treatment, would produce a satisfactory product. However, since the A.S.T.M. specifications further state that the colour of the product should be as mutually agreed between purchaser and seller, it is recommended that if the sample of bleached barite, as submitted, is not satisfactory further laboratory test work be conducted.

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