International Scholars Journals

African Journal of Chemistry ISSN 4391-3199 Vol. 4 (2), pp. 231-233, February, 2017. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Short Communication

Chemical oxides analysis from Azara Baryte

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Accepted 03 January, 2017

Physical and chemical analysis of the two samples A and B of Azara baryte were conducted, such as moisture content, loss on ignition and elemental composition by the use of atomic absorption spectrophotometer(ASS) and flame photometer. The oxides values in 1.000 g sample of each element were obtained. Sample A (lower layer): moisture content = 0.020, loss on ignition = 0.060, Na_2O = 0.250, K_2O = 0.015, CaO = 0.014, MgO = 0.018, Fe_2O_3 = 0.029, SiO_2 = 9.310, BaO = 89.630, Al_2O_3 = 6.200 Sample B (upper layer): moisture content = 0.030, loss on ignition = 0.040, Na_2O = 0.030, K_2O = 0.001, CaO = 0.006, MgO = 0.030, Fe_2O_3 = 0.028, SiO_2 =18.12, BaO = 65.020, Al_2O_3 = 16.120. The result of the analysis revealed that the Azara baryte could use as source of inorganic chemical oxides and for the production of some laboratory chemicals such as barium sulphate and aluminum oxides

Key words: Azara Baryte,Chemical oxides, analysis.

INTRODUCTION

Baryte ($BaSO_4$) – Barium sulphate is found naturally in the form of witherite (Othmer, 1964). It has various colours but mostly yellow, isomorphous orthorhombic crystals in shape associated with galena and of specific gravity 4.3, a Mohr’s hardness level of 3.00 – 3.75. The Raw Material Research and Development Council (RMRDC, 1989) revealed that extensive deposit of baryte occurs in Plateau and Benue states with an estimated reserve of over 500,000 metric tones in Nassarawa State. Nigeria is yet to be fully exploited. The ore appear to have had carbonate subjected to chemical weathering which resulted in two distinctive types of barite namely ;Baryte with quartz and limonite as gangue and Baryte with siderite and ankarite as gangue ((RMRDC,2005) varies from normal opaque to transparent crystals.

About 75-80% of baryte extracted is used to make drilling mud heavier; the rest is used in the chemical and pharmaceutical industry, in the production of colours (as white pigment) in the textile, paper, rubber and glass industries; it is also used as a starting material in the production of barium salts, and heavy concrete.

Baryte concrete is obtained by mixing concrete with the mineral; in the production of manufactured goods: cutaway shaped baryte concrete bricks; in cableways; in the production of ballasts for washing machines, cranes....(and similar items) small quantities are transformed into metal .Crystallized baryte is destined for the mineral collector's market (RMRDC, 2005) Natural barytes are chemically stable and highly temperature-resistant. Their high density, low Mohs hardness and low binder requirement make them suitable for a broad range of applications in the plastics industry, and also in the field of paints and coatings. They are also used as weighting elements for vertical-slat curtains and for noise reduction in piping systems.

In these studies the oxides content of barite were determined in an effort to see the possibilities of using it as sources of oxides for producing other chemicals (RMRDC, 2005)

MATERIALS AND METHODS

Sample collection

Based on the report obtained from the Nigerian Minning Corporation (World Metals and Minerals Review, 2005) the baryte deposit comprises of exposed surface layers and the underneath layer. Each layer varies in composition of some elements ranging from sandstones, calcite, ironstone and galena. The degree of purity varies with depth, because the purest form is found underneath, so the samples collected were from both layers. The sample was collected at various distances apart, across the site of the deposit on the surface and at a depth of 0.5 m this was done in such a way as to have representative sample from the site (Vogel, 1962). The samples were crushed and sieved with BSS 20 mesh to obtain the required grain sizes for quick melting of the composition.

Table 1. Result of baryte analysis samples A and B.

Oxides	Average Percentage Composition (%)	
	Sample A	Sample B
Moisture content	0.020	0.026
Loss of ignition	0.060	0.044
BaO	89.880	65.020
Na_2O	0.025	0.028
K_2O	0.015	0.001
MgO	0.040	0.024
CaO	0.014	0.006
Al_2O_3	0.620	16.620
Fe_2O_3	0.028	18.120
SiO_2	9.310	0.029

Determination of moisture content

1.0000 g of the sample was weighed and kept in an oven at a temperature of 110^O C for 2. The sample was removed, cooled in desiccators at room temperature. The process was repeated until constant weight was obtained (O'Brian et al., 1971)

Determination of loss on ignition

The sample after the moisture content determination was further heated in platinum crucible at 900^{O}C in a muffle furnace for an hour; similar method was adopted for heating and reweighing as in the moisture content until a constant weight was obtained (Hesse,1971)

Determination of silica content (SiO_2)

Determination of silica content of sand by gravimetric method after fusion of the sand (Snell (1973). A modified approach was applied and effective in this analysis. The difference of the sum total of other oxides, moisture content and loss on ignition form 100%. This gave the actual percentage of the SiO_2 content which is recorded in Table 1.

Determination of aluminum oxide (Al_2O_3)

50 ml of the aliquot was transferred to a beaker containing the filtrate. 100 ml of water was added and heated, 2 drops of methyl orange added as indicator to sodium hydroxide (NaOH). The solution was digested to boiling for 5 min, it was filtered and precipitate washed 5 times with 2% NH_4Cl and then transferred into a crucible, ignited at 900^{O}C for an hour and weighed. The value calculated as:

$$\% \, Al_2O_3 = \frac{\text{weight of residue x 100}}{\text{Sample weight}}$$

Determination barium oxide

The aliquot obtained from the result of the leaching was used for the determination using the flame photometer.The ppm of the element was obtained from a curve plotted by emission against concentration

$$BaO = \text{Percentage Barium} \times \frac{\text{Molar Mass BaO}}{\text{Atomic Mass Ba}}$$

Determination of sodium and potassium oxides

0.10 g of the sample was placed in a crucible and ignited at 1000^{O}C for 10 min to destroy the organic matter. The crucible was allowed to cool and 5 ml perchloric acid added and was then heated on a hot plate to dissolve the sample. The solution was transferred into a 50 ml volumetric flask and water added to mark. This served as the stock solution; the elements were determined using flame photometric method (O'Brian R.E, 1971).

Determination of calcium and magnesium oxides

The sample to be analyzed was brought into solution by digestion using perchloric acid. A stock solution was prepared and various concentrations (1 – 8 ppm) were made and the Atomic Absorption Spectrophotometer (AAS) was used to measure the absorbance (Hesse, 1971).

Determination of iron oxide (Fe_20_3)

A mixture of 10 ml stock solution with bromine water and 5 ml KSCN solution was obtained as the standard solution. It was aspirated and the absorbance noted at 380 mm, a stock solution of 25 ml was pipette into 250 ml beaker and to it 4.00 g of ammonium chloride (NH_4Cl) was added and a small quantity of ammonia solution (NH_4OH) was added with drops of methyl orange as indicator. The solution was warmed and content was ashed at 800^{O}C for an hour (Melnick, 1963).

Percentage of F_2O_3 was determined by the difference between the masses of empty crucible used and the crucible plus its content.

RESULTS AND DISCUSSIONS

Baryte is most commonly coarse grained; it also occurs as platy crystals or fine-grained compact masses that may be white, light yellow, light grey, brown, pink or blue. When pure, baryte contains up to 58.8% barium or 67.7% barium oxide, this show that the barium oxides content of azara (89.88 and 65.02% for samples A and B respectively), indicates the high level of purity of this important mineral deposit.

Baryte is used for both its physical attributes, such as relatively high specific gravity and/or chemical inertness (drilling mud additive, construction, functional filler), and for its chemical properties (source of BaO and chemical feedstock).The principle worldwide uses of barite are estimated as 88% for additive to drilling fluids; 6% for chemicals (Raymond, 1988)

The worldwide demand for barite will probably continue to grow as petroleum products continue to be the energy sources of choice (World Metals and Minerals Review, 2005)

The result of the analysis shows the oxides content especially Ba0 and Al_20_3 can be in production of some important chemicals for glass and ceramic industries (Keegan, 1997)

Conclusion

The availability of the two raw materials, their purity especially the high aluminum and barium oxide content can serve as a source of these oxides for producing other chemicals.

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