A SIMPLE METHOD OF EVALUATION OF BAUXITE FOR METALLURGICAL PURPOSES

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Bauxite is the principal ore of Aluminium extraction. Bauxite is generally a mixture of oxides and hydroxides of Al, Fe and Ti contaminated with Silica. Depending on the constituents, Bauxites can be classified as emergy grade, refractory grade, metallurgical grade etc. To evaluate the suitability for metallurgical grade, a simple and quick method is attempted in this paper. This method is not only quick but highly reliable.

INTRODUCTION

Bauxite is mainly a mixture of hydroxides of Aluminium, Iron and Silica, oxides of Titanium. Bayer process is widely used for the extraction of alumina. Alumina is present in the Bauxite in the form of trihydrate, monohydrate namely Gibbsite, Boehmite and Diaspore, Kaolinite Alumina present in the form of hydroxides of aluminium and silicon. The major chemical constituents present in bauxite are Al_2O_3, SiO_2, Fe_2O_3, TiO_2 and L.O.I. These radicals are estimated by conventional wet chemical methods. The mineralogical compositions are estimated by X-ray diffraction, Thermogravimetric methods etc. However these estimations are indicative only. In addition they are time consuming as well as cost prohibitive. So in order to quickly asses the suitability of the bauxite for metallurgical purposes the "Maximum Extractable Alumina Test" otherwise known as MEA Test, under Bayer conditions is conducted.

EXPERIMENT

Bauxite is digested in autoclaves, with fresh caustic at a temp. of 240-243 °C. for 30 minutes. The quantity of bauxite is charged so as to give 55 gm/l Al_2O_3 with 143 gm/l NaOH. After digestion, the bomb is cooled. The digested liquor is filtered and the conc. of Na_2O, Al_2O_3, SiO_2 are estimated. The Al_2O_3 that is dissolved is calculated to give the M.E.A. after making necessary corrections for SiO_2, because SiO_2 combines with Al_2O_3 to form Sodalite, zeolite etc. The results obtained under this test are given in the Table I.

Table 1

	Amarkantak	Bauxite		Satna	
		PPM	Ranchi	I	II
%					
LOI	21.10	23.05	21.04	23.22	22.02
SiO_2	4.32	4.25	4.11	5.01	7.24
Fe_2O_3	19.02	18.00	19.20	12.18	15.45
TiO_2	9.10	7.60	8.80	8.12	8.08
Al_2O_3	46.51	46.10	44.37	50.74	46.36
MEA	91.24	91.05	94.07	92.54	87.04

DISCUSSIONS

The analytical tools available for the estimation of the mineral phases are having their limitations in making an accurate estimation.

The Thermogravimetric methods are affected because of the narrowness of the decomposition temperature of different minerals present in Bauxite e.g. Alumina goethite interfering with gibbsite. Boehmite, Diaspore and kaolinite interfere with each other. The decomposition temp. of each phases is given in the Table II.

Table - II :Decomposition Ranges of Various Minerals Present in Bauxite

	Temp. range	Decomposition peak temp.
Gibbsite	280-380	320-340
Goethite	340-420	360-380
Boehmite	500-600	540-560
Diaspore & kaolinite	560-640	590-610

Similarly, in the X-ray diffraction the matrix effect, crystallinity effect due to improper growth of the phase during geological formations, interference from diffraction peaks of various planes in the polycrystalline mixture like Bauxite etc. render it difficult to quantify the minerals precisely and accurately.

Further the above methods will not be able to explain the reason for widely varying extraction efficiencies of Al_2O_3 under Bayer process, though the bauxite is from the same locality and plateau.

The M.E.A. test will give fairly accurate information about the utility of Bauxite for metallurgical purpose. By carrying out the test at two temperatures at 140 and 240 °C. the gibbsite Al_2O_3 and boehmite alumina can as well be estimated.

Boehmite Al_2O_3 = % MEA at 240 - % gibbsite Al_2O_3 at 140

To confirm the values obtained from MEA test, the mud left over, after digestion with caustic, can also be analysed and the actual non extractable Al_2O_3 can be found out.

It will also help to optimize the conditions so as to achieve the maximum extraction by carrying out the experiments with varying molar ratios (Caustic / Alumina) concentration of digestion tests. The extraction efficiency actually achieved against the M.E.A. at 1.55 m/r 240 °C. for 20 minutes digestion time is given in Table III.

Table III

	A	P	R	S-1	S-II
% M.E.A.	91.24	91.05	94.07	92.54	87.04
% Extraction efficiency at 1.55 m/r Caustic/ Al_2O_3 ratio	86.13	86.82	86.91	84.93	78.22
Ratio E.E./MEA	94.34	95.35	92.39	91.78	89.87

CONCLUSION

The M.E.A. test is a very simple & reliable one for evaluating the suitability of bauxite for metallurgical grade. This will also give an idea about Caustic soda loss in utilising the bauxite for extraction of Alumina.

REFERENCE

1. Steven R. Sanders, "Determination of Alumina & Iron phases in Bauxite by DTG Analysis" Light Metals, 1981, pp 29-41.

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