

“Development of the Bricks with utilized Industrial waste Red mud”

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Abstract

Red mud is a waste material generated by the Bayer's Process widely used to produce alumina from bauxite throughout the world.[1] Red mud consists mainly of the oxides of aluminum, silica, titanium etc. The average 4 million tonnes of red mud produce per annum. The present research work was to investigate the possibility of replacing the soil by red mud. Because the waste material of alumina, the waste negatively affect the environment. To solve this problem, lime and sand was used with red mud up to 85% Red mud by the weight of lime/gypsum and evaluating its Compressive strength of Red mud bricks. This study examines the effect of red mud on the properties of hardened material.

There is no commercial use of Red mud and the Utilization of red mud is still on experimental basis. Red mud is the Bayer's process method of aluminum extraction in this process obtained from alumina plants industries i.e. HINDALCO, NALCO, BALCO, INDALCO etc.

Keyword- Red mud, Industrial waste, Bayer's Process, Mud disposal Technique.

Introduction

Development of Bricks of Red mud is very desirable achievement in development of Industries. Red mud is waste from Bauxite with Bayer's technique. It is the most abundant metallic elements. It makes up about 8-10 % of Earth Crust.[2] Red mud is a mixture of Iron, aluminum, Silica, Magnesia. Its composition is extent source of its production.[3]

Bauxite residue, commonly called red mud after its color, is the main by-product of alumina by the Bayer's process. The quantity and quality of red mud, the amount and the caustic content of the adherent liquor differ widely in various refineries. The amount of red mud (as dry matter) varies from 0.4 ton to 2 ton of alumina product, depending first of all on the quality of the bauxite feedstock.

Extrusion of red mud bricks is suitable mix of red mud, hydrated lime, and sand have been made in commercial kiln. And it have found to possess very high compressive strength of 45 kg/cm^2 to 60 kg/cm^2 . When fired at temperature of 1000°C to 1100°C these bricks in optimally colour, texture, and their density are suitable for the facing purpose.

GENERAL

The main aim of this Experimental is to find out the effect of red mud, which is a waste product of Alumina Industries. The Sample of red mud used in the Experiment was collected from HINDALCO, Renukoot, Sonbhadra, U.P. Chemical Analysis of Red mud is given as, Some important physical characteristics of red mud are density: 2.6-3.5 t/m³, pH: 12-13.5 (Sometimes up to 14), settling rate 0.014-35.9 cm/kg (the highvalue relates likely to sand).

PROPERETIES OF RED MUD

PHYSICAL PROPERTIES OF RED MUD:

Generally Fineness of Red mud is varies in between 1000-3000 cm²/gm. We collected red mud from HINDALCO Industries Limited, Renukoot, U.P. (INDIA). In our study we have to take red mud passing through 300 micron I.S.Sieve.

Its pH is varies in between 10.5 to 12.5 hence Alkaline in nature.
Specific gravity of Red mud is found to be 2.51.

CHEMICAL PROPERTIES

RED MUD

Chemical properties of red mud are shown in **Table -1** it indicates that percentage of CaO is very less hence it has no cementitious properties but when it react with water and fly ash it starts gaining cementitious properties. Also Percentages of Silica available contributes to strength.

EFFECT OF RED MUD ON ENVIRONMENT

- Ground water pollution, when Red mud gets mix with water.
- Alkali seepage into underground water, underground water gets polluted. Like wells, aquifer may get polluted.
- Harmful of plant Life, Alkaline air born dust in air and affects on transpiration process of plants Result in reduction of plant life.

EXPERIMENTAL WORKS

MATERIAL USED:

Red mud: (Sp. Gravity = 2.51)

Lime: (Sp. Gravity = 0.48)

Sand: (Sp. Gravity = 1.60)

In the experimentation Red mud was used. Locally available lime and sand were used.

To study the replacement of yellow soil by red mud and lime with sand in varying percentages 65% , 70% , 75 % , 80 % , 85 % . **Figure 1** shows the red mud powder and the red mud Bricks. These composites material specimens were tested after drying process.

EXPERIMENTAL PROCEDURE

In our project the Experimental procedures is to be complete i.e. Water Absorption, Efflorescence test and Compressive Strength of Bricks. Its Ratios is given in **Table: 2**

To mix all the raw material with 30% water was added & thoroughly mixed. To Clay Guard was added at the rate of 150 ml/100 kg Raw material. After poured into the mould.

RESULT AND ANALYSIS

It will dry with 10-20 days in natural temperature of 30-40⁰Cand then they tests,

Table 1 Chemical Composition of Red mud

Ingredients	Red mud
Fe ₂ O ₃	38.3
Al ₂ O ₃	21.6
SiO ₂	11.4
CaO	1.47
Na ₂ O	6.87

Table 2: Ratio of Raw Material to be used

Red mud (%)	Lime (%)	Sand
65	25	10
70	20	10
75	15	10
80	10	10
85	5	10

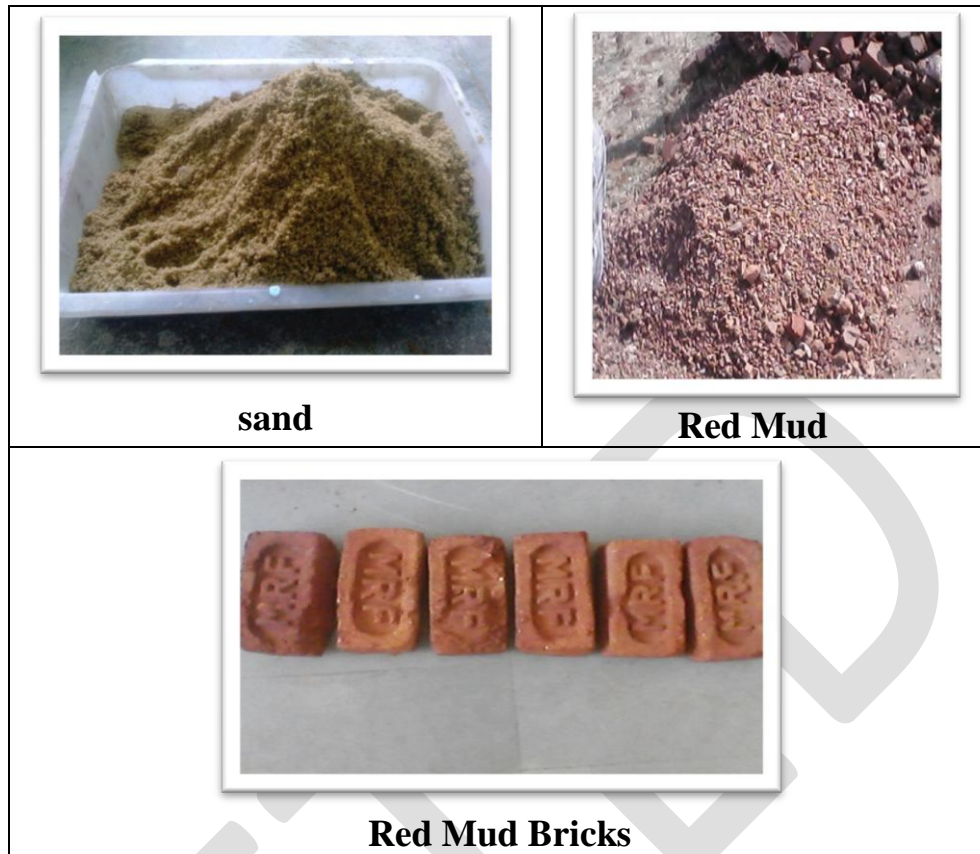
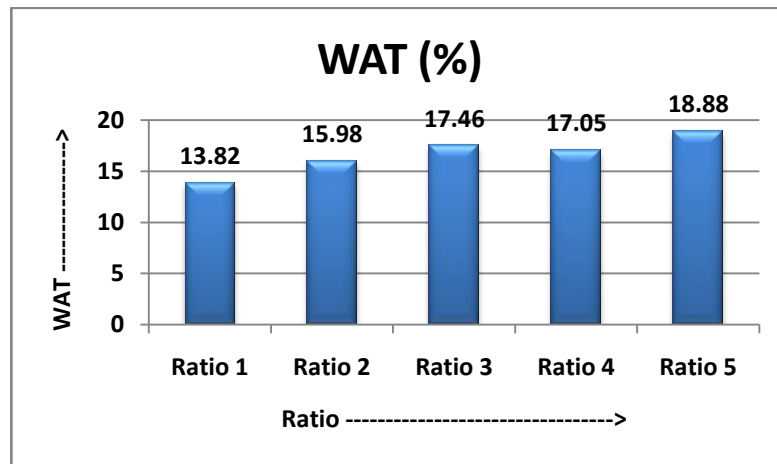


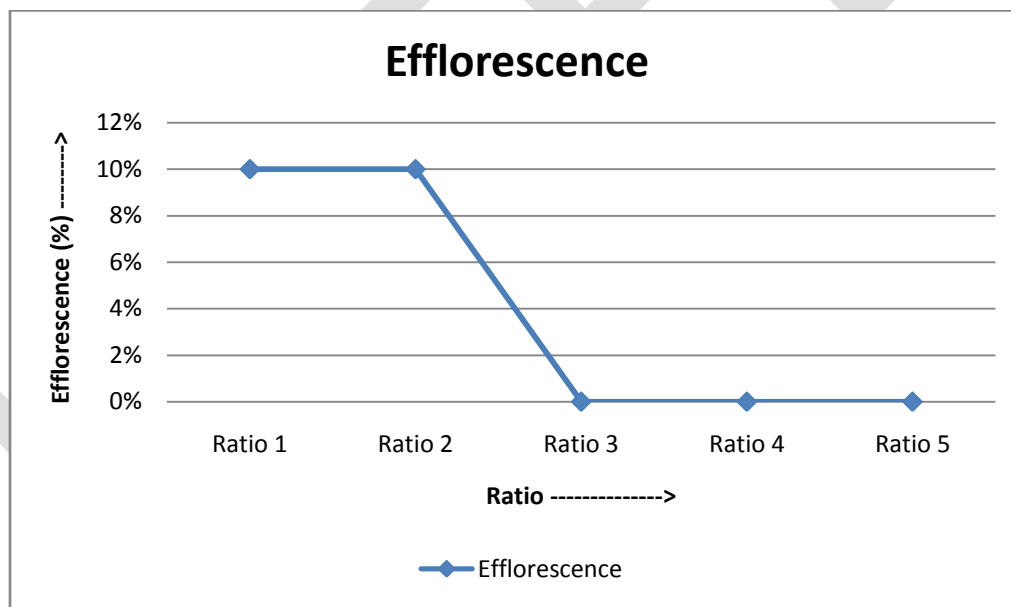
Table 4: RESULTS

Ratio no.	Water absorption (%)	RESULT	
		Efflorescence	Compressive Strength (kg/cm ²)
1	13.82	10% Slight-Efflorescence	60.95
2	15.98	10% Slight-Efflorescence	58.64
3	17.46	No perceptible deposits Nil-Efflorescence	55.26
4	17.05	No perceptible deposits Nil-Efflorescence	39.12
5	18.88	No perceptible deposits Nil-Efflorescence	35.26

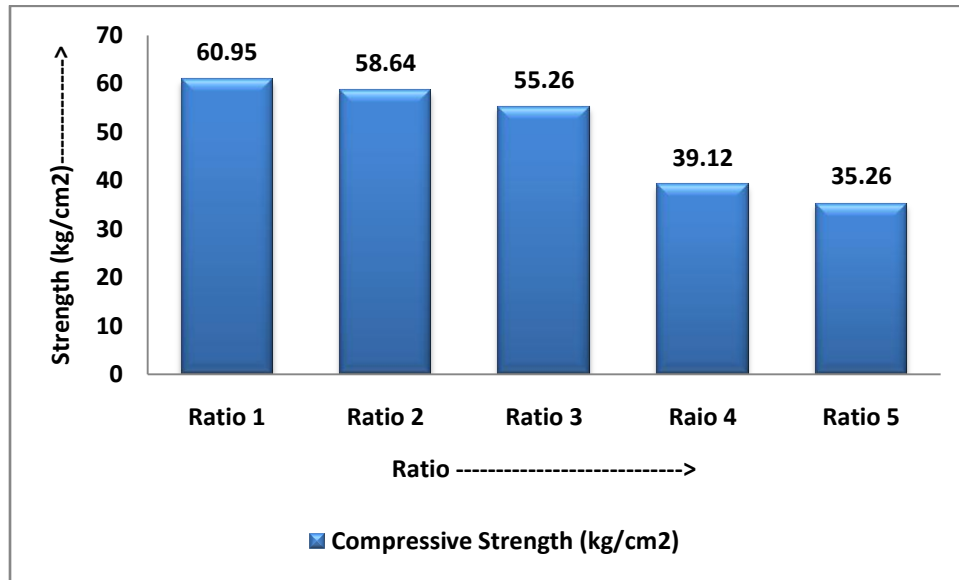
GRAPH 01 Chart of Water absorption capacity of Bricks



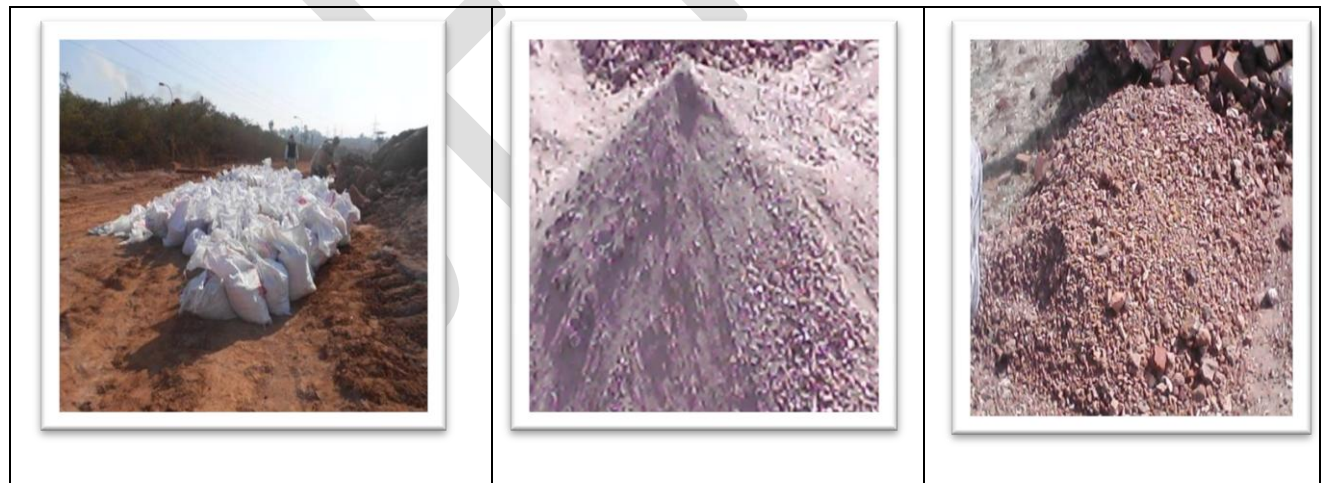
GRAPH 02 Chart of Efflorescence of Bricks



GRAPH 03 Chart of Compressive Strength of Bricks



Experimental Photos:





LIST OF IMPORTANT IS CODES RELATED TO BRICKS

IS: 3495-1976 Method of test for burnt clay building bricks (Part I to IV).

IS: 1077-1976 Specification for common burnt clay building bricks.

CONCLUSION

The reuse of red mud for any application should have following four criteria:

- _ Volume: The application should have **high volume usage**
- _ Performance: It should be a **low cost substitute** with same performance
- _ Cost: It should be **cost effective**
- _ Risk: There should be **no environmental, health or safety risk** associated with its use.

From Experimental works, It was found that by increasing the red mud content in the brick formation process will increase the strength of the bricks.

Mean density of the red mud is 3.05 g/cm^3 . The ignition loss was 4.93% for the temperature of 900°C and 5% for the temperature of 950°C . Red mud acquired the characteristic red colour that

makes it usable as a pigment after its calcination and the conversion of lower into higher oxides and after the decomposition of carbonates.

Red mud consists of very fine particles (on-sieve size 0.147 mm up to 4%, size 0.058 mm up to 25%, and the prevailing ten microns size class) and has a characteristic red colour, which were the reasons for its testing for use in the industry of building materials as a pigment for standard concrete mixtures.

The bricks were tested for compressive strength after having rested 7, 14, 21 or 28 days at the room temperature (18 to 35°C). Compressive strengths from 35 kg/cm² to 60 kg/cm² of the bricks that contained red mud from 30 to 70% were satisfactory.

Red Mud use (lab scale and plant scale) has been successful for making cement, ceramics, bricks, catalysts and for recovery of metals.

Using Red mud is suitable in ornamental works and gives aesthetically pleasant appearance.

We use mixture of red mud and fly ash for non structural works. There is future scope for the use of red mud and fly ash in waste product point of view.

REFERENCE

1. Evaluation of the properties of Red mud Concrete, Ramesh R. Rathod, Mr. Suryavanshi,,S.B.Patil College of Engineering, Pune University, India.
2. Thakur, R.S. and Das, S.N., Red Mud-Analysis and Utilization- Publication & Information Directorate, New Delhi and Wiley Eastern Limited, New Delhi, India (1994).
3. Flyash lime gypsum bricks - A boon for Vidarbha region, R. R DIGHADE, S.V. AMBEKAR and A. M. PANDE,1999, NML. Jamshedpur, pp. 54-58
4. Neutralization & utilization of Red mud for its better waste management, (2012).
5. Studies for metal processing hazardous waste, CSIR- Advanced Materials Processes and Research Institute (AMPRI), Bhopal, 2012.
6. Investigation on fly ash as a partial cement replacement in concrete, Faseyemi,V.A. Technical Manager, Al Andalus Factory for Cement Products, DOHA-QATAR
7. High performance bricks from fly ash, ObadaKayali, April 11-15, 2005, Lexington, Kentucky, USA.