

# Study on Red Mud Incorporated Building Bricks

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**Abstract**—“Red mud” or “bauxite residue” is a highly alkaline waste generated from alumina refinery with a pH of 10.5–12.5 which poses serious environmental problems. Neutralization or its treatment by sintering in presence of additives is one of the methods for overcoming the caustic problem as it fixes nearly all the leachable free caustic soda present in red mud. Red mud is the solid waste residue of the digestion of bauxite ores with caustic soda for alumina (Al<sub>2</sub>O<sub>3</sub>) production. The characteristic red color is caused by the iron oxides present which comprise up to 60% of the mass. Approximately 35-40% of the processed bauxite ore goes into the waste as alkaline red mud slurry approximately 0.8-1.5 tons of red mud is generated per ton of alumina produced Around 70 million tons of red mud is produced annually all over the world with 2 million tons in India. Since the bauxite has been subjected to sodium hydroxide treatment during bayer’s process, the red mud is highly caustic. So it will be economically beneficially in using a waste material such as Red mud as a building material.

**Index Terms**—bayers process, red mud

## I. INTRODUCTION

Red mud is the industrial waste that is generated while producing the aluminium from the bauxite ore by the bayer’s method. Over the world bauxite production was 206 million tons in 2009. Red mud generated is discharged from the industry is very basic i.e. pH worth varies from 10 - 13.4 it contains fifteen to four proportion solids. The mineralogical and chemical composition won’t stay same everywhere the world. It’ll vary consequently because the bauxite supply varies.

So, it’ll be sensible if we have a tendency to move towards the number of the alternative building materials that are sustainable and have the less embodied energy. The replacement of the naturally accessible raw material by the commercial wastes reduces the waste management within the present situation. Although the replacement is in little proportion higher manufacture rates can successively rework into the noteworthy consumption of the industrial waste. Among the varied various building materials red mud is one which may be used as partial replacement to cement. Red mud doesn’t mean the red mud, it’s a waste residue left when extracting aluminium from the bauxite ore by the bayer’s method. Nearly one ton of red mud is generated by extracting one ton of aluminium from the bauxite ore. Literature Review

### A. Fresh and Hardened properties

Several works have been carried out to study the effect of red mud as a building material. It has been observed by Xing,

Yang, Zhang, Nevin et al. separately reported the production of non-steam-cured and non-fired brick, fly ash brick, black pellet decorative brick and ceramic glazed tile. For instance, non-steam-cured and non-fired brick is developed by using industrial residues as raw materials, by Materials 2012, 5 1239 adding cement and lime as binder and by pressing and natural curing technology.

### B. Objectives

From the literature review the following objectives have been framed.

- To study physical, chemical and mineralogical property of red mud.
- To study the fresh and hardened property of red mud bricks incorporated with other waste materials.
- To study the reachability characteristics of hazardous materials of red mud incorporated bricks.

### C. Workdone

- 250 kg of Red mud is collected from HINDALCO Aluminium production plant, Belagavi.
- White Ordinary Portland cement procured.
- Physical tests on red mud are conducted which are specific gravity, sieve analysis and pH.
- Bricks are prepared in laboratory for different mix proportions.
- Laboratory civil tests are conducted on the brick samples and values recorded.

## II. TEST RESULTS

1. pH of red mud=10.96
2. Specific gravity of red mud=2.676

TABLE I  
SIEVE ANALYSIS OF RED MUD

IS sieve (mm)	Soil retained (gm)	Soil retained (%)	Soil passing (%)
4.75	0	0	100
2.36	100	20	80
1.18	124	24.8	55.2
0.6	74	14.8	40.4
0.3	157	31.4	9
0.15	38	7.6	1.4
Pan	0	0	0
Total	493	98.6	

*A. Works to be carried out*

- Preparation of clay by mixing red mud with water and other waste material.
- Hand molding of bricks.
- Drying of RM bricks.
- Carrying out engineering tests on RM bricks

*B. Test to justify Red Mud brick quality*

- Alkalinity test on red mud clay mix.
- Compressive strength test
- Water Absorption test
- Efflorescence test
- Hardness test
- Size, Shape and Color test
- Soundness test
- Structure test

**III. CONCLUSION**

Red mud is a fine grained Industrial waste, dominated by fines (<75 $\mu$ particles) with high specific gravity (2.9). Cement is added to Red Mud in varying percentages and it is cured for 3, 7 and 28 days with 100% humidity. Increase in red mud with decrease in cement in percentages, the OMC and MDD values are also increasing.

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