

# Performance of Concrete using Red Mud as Replacement Material with Basalt Fiber

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**Abstract:** The present study was conducted to study the properties of concrete using red mud as replacement with basalt fiber. The addition of fibers & red mud in concrete matrix has significant effects on strength of concrete under all modes of loading which include, direct tension, shear, flexural and torsion loading. Experiments have been conducted under laboratory condition to assess the strength characteristics of the red mud with basalt fiber. The project work focuses on the suitability of red mud obtained for construction. Five test groups were constituted with the replacement percentages 0%, 5%, 10%, 15%, 20% of red mud with 6% of basalt fiber in series of M-25, to achieve better performance of concrete.

**Key words:** Red Mud, Basalt fiber, compressive strength, Flexural strength.

**Introduction:** Red mud is solid waste material generated from aluminum industry. In recent year the disposal of red mud increase, with the growth of aluminum output. The amount of the red mud generated, per ton of the alumina processed, varies greatly with the type of the bauxite ore used from 0.3 ton to 2.5 tons for high and very low grade bauxites respectively [1]. As it is generated during alumina process, it is highly alkaline in nature having ph value range from 10-13. Due to environmental problem, it makes a great challenge to develop new method for disposal and utilization of red mud.

## Properties of Red Mud: Physical Properties of Red Mud:

**Color** The usual color of red mud is pink but if there is lower iron content it may be of white color and if it have more iron the color may be reddish brown.

**A.** Specific Gravity Property Red Mud Have Specific Gravity between  $2.6 \text{ kg/m}^3$  to  $3.6 \text{ kg/m}^3$ . Red Mud is used in our experiment was taken from BALCO aluminum plant and the specific gravity of this material was found to be  $2.7 \text{ kg/m}^3$ .

**B.** Chemical Property -The chemical composition of red mud contains six major constituent. As per chemical analysis done for red mud contains iron oxide, aluminum oxide, siliceous oxide, titanium oxide, Sodium oxide and

calcium oxide. Typical chemical composition of red mud taken from BALCO.

## Effects of Red Mud on Environment

- A.** Ground water pollution-when the red mud gets mix with water.
- B.** Alkali seepage in to underground water-Underground water resources such as wells, aquifer may get polluted.
- C.** Impact on plant life-Alkaline air born dust fly with air and affects on transpiration process of plant Result in reduction of plant life.

## Experimental work

Concrete mix design was carried out by using Indian Standard Method (IS: 10262-1982). Mix design of grade M25 is used.

## Material Used:

Cement: OPC, Red mud, Coarse Aggregates- 20 mm, Fine Aggregates (Natural sand)

As per the mix design control mix was prepared. Cubes and cylinders were casted. After 28 days the compressive and split tensile strength was found out. Compressive and splitting tensile strength of Control mix was found to be 24.90 and 5.50 respectively.

Study includes replacement of cement by red mud in varying percentages 5%, 10%, 15%, 20%, and 06% of basalt fiber in each series of M-25. These composite concrete specimens were tested after 28 days water curing. The compressive and split tensile strength of resultant concrete was found out and compared with controlled concrete results.

## Test Procedure

- 1.** Samples of concrete shall be taken for casting cubes  $15 \text{ cm} \times 15 \text{ cm} \times 15 \text{ cm}$  or cylindrical specimens of  $15 \text{ cm}$  dia  $\times$   $30 \text{ cm}$  long.
- 2.** The concrete shall be filled into the moulds in layers. It would be evenly distributed and compacted.

3. The specimen shall be stored at site for 24+ ½ h under damp matting or sack. After that, the samples shall be stored in clean water at 27+20C; until the time of test. The ends of all cylindrical specimens that are not plane within 0.05 mm shall be capped.

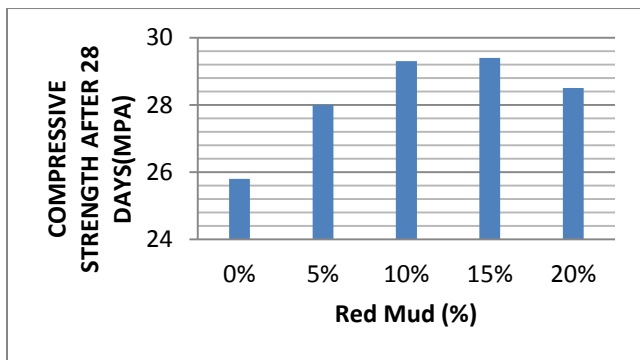
4. Just prior to testing, the cylindrical specimen shall be capped with sulphur mixture comprising 3 parts sulphur to 1 part of inert filler such as fire clay.

5. Sample of specimen shall be tested immediately on removal from water.

6. The bearing surface of the testing specimen shall be wiped and cleaned. In the case of cubes, the specimen shall be placed in the machine in such a manner that the load cube as cast, that is, not to the top and bottom. The maximum load applied to the specimen shall then be recorded and noted at the time of failure brought out in the report.

**Compressive Strength Result**

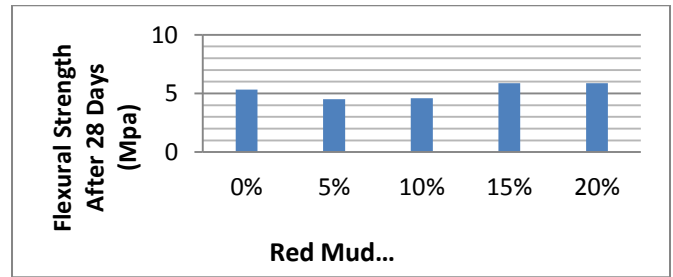
Red Mud (%)	Basalt Fiber	Slump Value in Mm	Compressive Strength After 28 Days (Mpa)
0%	06 %	58	25.80
5%	06 %	63	28.00
10%	06 %	69	29.30
15%	06 %	75	29.40
20%	06 %	82	28.50



Graph- Value of Compressive Strength with Different % of Red Mud

**Flexural Strength result:**

Red Mud (%)	Basalt Fiber	Slump Value in mm	Flexural Strength After 28 Days (Mpa)
0%	06 %	58	5.33
05%	06 %	63	4.50
10%	06 %	69	4.60
15%	06 %	75	5.86
20%	06 %	82	5.86



Graph- Value of Flexural Strength with Different % of Red Mud

**Conclusion:** From this research the following conclusions were made:

1. Improves the compressive strength with increase of red mud up to 15%, increase of red mud beyond 15% makes reduction in strength.
2. Improves the compressive strength with increase of basalt fiber.
3. Improves flexural strength of concrete with increase of red mud up to 15%.
4. We got optimum compressive strength flexural strength and i.e. 29.40 N/mm<sup>2</sup> with 15% of red mud and use of basalt fiber 06 % of cement.

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