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Study on Partial Replacement of Cement with Red Mud in Mortar

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Abstract: ***An investigation is carried out on red-mud based cement mortar to understand its mechanical property performance. A proportionate replacement of cement is done to the range of 0% to 20% with 5% intervals with red mud. The mortar was prepared with a proportion of 1:4 and the behavioral performance of mortar were studied as concern towards its compressive strength. The results we would expect that the mortar exhibited better performance at 0% to 20% replacement and as well as red mud mortar is denser than normal cement mortar.***
Keywords: Red mud and Compressive strength.

I. INTRODUCTION

Red mud is the economic waste generated for the duration of the production of alumina. According to the grade of raw cloth bauxite and the production process of alumina, red mud may be divided into Bayer red mud and sintering red mud based on gift technology, there's 0.8t~ 1.76t red muds generated via every 1t alumina produced. it is said that, there are up to three million tons of pink dust produced with the aid of china„s biggest 3 alumina production bases (Shandong and Henan) the main response that happens within the Bayer technique (the conversion of bauxite to sodium aluminate) can be schematized as follows:

$2NaOH + Al_2O_3 .3H_2O \rightarrow Na_2O.Al_2O_3 + 4H_2O$ + Red Mud

II. MATERIALS

A. Cement

Cement is a binder, a substance used in construction that sets and hardens and can bind other materials together. The most important types of cement are used as a component in the production of mortar in masonry, and of concrete which is a combination of cement and an aggregate to form a strong building material. Ordinary Portland Cement (53 Grade) confirming to IS: 269- 1976 was used throughout the investigation. Different tests were performed on the cement to ensure that it confirms to the requirements of the IS specifications.

B. Fine Aggregates

It is the aggregate most of which passes 4.75 mm IS sieve and contains only so much coarser as is permitted by specification. According to source fine aggregate may be described as:

1) Natural sand-it is the aggregate resulting from the natural disintegration of rock and which has been deposited by streams or glacial agencies.
2) Crushed stone sand-it is the fine aggregate produced by crushing hard stone.
3) Crushed gravel sand-it is the fine aggregate produced by crushing natural gravel.

C. Water

Fresh and clean water is used for casting and curing of specimen. The water is relatively free from organic matters, silt, oil, sugar, chloride and acidic material as per requirements of Indian standard. Combining water with a cementitious material forms a cement paste by the hydration. A cement paste glues the aggregate together fills voids within it, and makes floor freely.

D. Red Mud

A solid- waste generated at the Aluminum plants all over the world. In Western countries; about 35 million tons of red mud is produced yearly. Because of the complex physico- chemical properties of red mud it is very challenging task for the designers to find out the economical utilization and safe disposal of red mud. Disposal of this waste was the first major problem encountered by the alumina industry after the adoption of the Bayer process. The specific gravity is 2.64.

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III. TEST PROCEDURE COMPRESSIVE STRENGTH

A. *Test Specimens*

Totally 45 cubes of size 70 mm x 70 mm x 70 mm and were cast to study the compressive strength of red mud mortar. Standard cast iron moulds were used for casting the test specimens. Before casting, machine oil was smeared on the inner surfaces of moulds. Red mud concrete was mixed using a horizontal pan mixer machine and was poured into the moulds in layers. Each layer of mortar was compacted using a table vibrator.

B. *Test Procedure*

For the evaluation of compressive strength, all the cube specimens were subjected to a compressive load in a digital Compression Testing Machine with a loading capacity of 2000kN. Specimens were tested as per the procedure given in Indian Standards I.S.516. The maximum load applied to the specimen was recorded. The compressive strength of the specimen was calculated by dividing the maximum load applied to the specimen by the cross-sectional area.

C. *Procedure*

1) Remove the specimen from water after specified curing time and wipe out excess water from the surface.
2) Clean the bearing surface of the testing machine
3) Place the specimen in the machine in such a manner that the load shall be applied to the opposite sides of the cube cast.
4) Align the specimen centrally on the base plate of the machine.
5) Rotate the movable portion gently by hand so that it touches the top surface of the specimen.
6) Apply the load gradually without shock and continuously till the specimen fails.
7) Record the maximum load and note any unusual features in the type of failure.

As per IS 516:1959
Compressive strength of specimen = P/A P= maximum load applied on the specimen A=area of the specimen
Note down the breaking load(P) As per IS 5816:1999
Split tensile stress=2P/πDL Where
P=the compressive load on the cylinder. L=length of the cylinder
D=diameter of cylinder

IV. RESULTS AND DISCUSSIONS

TABLE 1. Cube Compressive Strength Of Mortar With % Of Red Mud

S.No	%of Red mud	@7days (N/mm^2)	@14 days (N/mm^2)	@28days (N/mm^2)
1	0	19.40	19.90	19.83
2	5	20.60	21.40	20.60
3	10	15.13	15.90	15.93
4	15	11.73	12.50	12.27
5	20	9.31	9.76	9.57

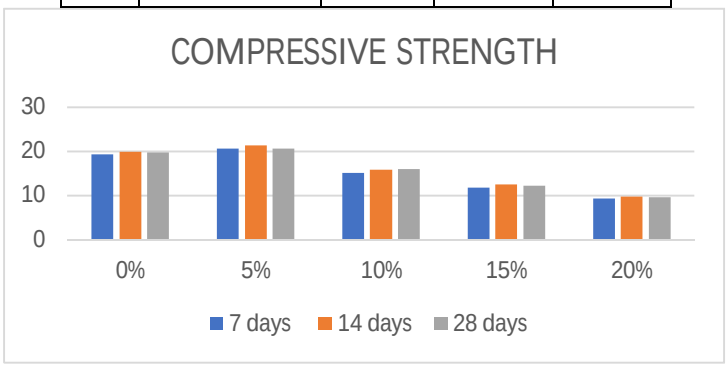


Fig 1. Cube Compressive Strength of Mortar with % of RED MUD

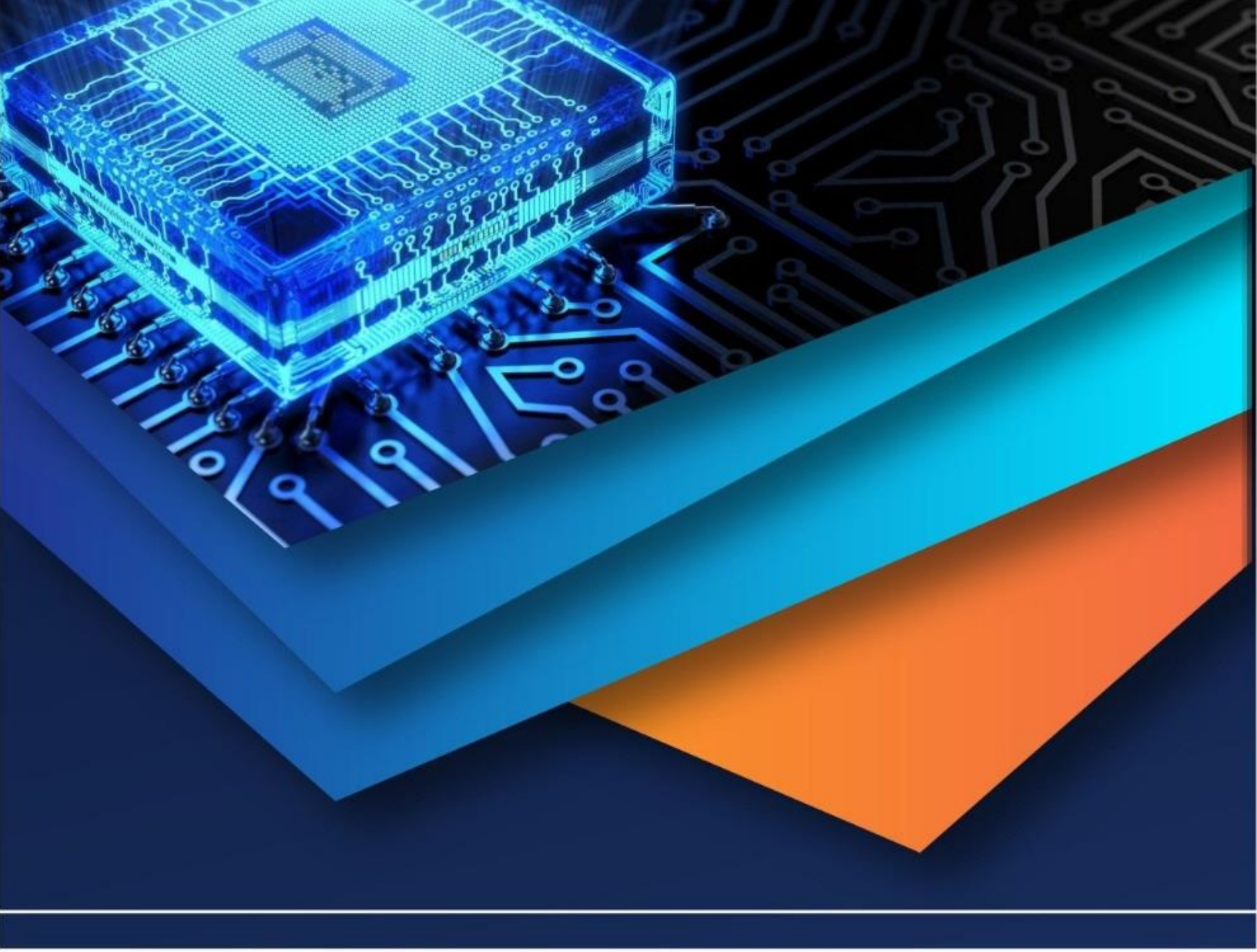
V. CONCLUSION

1) The compressive strengths were increased upto 5% usage of red mud and then decreased.
2) The usage of red mud up to 5% is beneficial to the mortar works.
3) The slump value is increasing with increase in the percentage of red mud in mortar.

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