"An Experimental Investigation on Mechanical Properties of Concrete with Red mud and Glass fiber"

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Abstract - *To study the role of glass fibre and Red mud on concrete strength characteristics of a high-strength test program has been accomplished. Different concrete mixtures were cast and tested with different levels of cement replacement, 20 % of red mud with Glass fibre as addition (0.1 %, 0.2 %, 0.3 %, 0.4%, 0.5% by volume of concrete). High performance concrete (HPC) is a concrete meeting special combinations of performance and uniformity requirements. This leads to examine the admixtures to improve the performance of the concrete. The usage of mineral admixtures in the concrete enhances the strength properties of concrete. The main objective of this study is to determine the optimal replacement percentages that can be appropriately used in Indian conditions. To find the optimal replacement of Red mud with the addition of Glass fibre in M30 grade concrete with maintaining water cement ratio of 0.43.It was observed that, 20% Red mud optimum percentage replacement of cement in concrete. and upto 0.5% of Glass fibre addition in concrete.*

Key Words: **Glass fibre, Red mud, compressive strength, split tensile strength, flexural strength, impact strength, chloride attack test.**

1. INTRODUCTION:

The development of major constructions is largely associated with resolving the problems of improving the efficiency of building industry, reducing cost and labour of technological processes, economic utilization of materials and power resources and adoption of new advanced material. Concrete lends itself to a variety of innovative designs as a result of its many desirable properties. During present era use of cement become very high because of urbanization so the natural resources are decreasing rapidly In order to reduce the usage of conventional material like cement some experiments are done for finding out alternate material for cement. Red mud is such one of the alternative material for cement. Concrete has a very low coefficient of thermal expansion and shrinks as it matures. All concrete structures crack to some extent, due to shrinkage and tension. Glass fiber concrete (GFC) consists basically of a matrix composed of cement, sand, water, and admixtures, in which short length glass fibers are dispersed. The effect of the fibers in this composite leads to an increase in the tension and impact strength of the material.

2. OBJECTIVES:

The objective of this work is to investigate the mechanical properties of the concrete with different materials like red mud and glass fibre.so the experiments is carried out.

1. To study the compressive, flexural strength impact of M30 concrete
2. To study the compressive strength of concrete by adding red mud and glass fiber
3. To study the split tensile strength of concrete by adding red mud and glass fiber
4. To study the flexural strength of concrete by adding red mud and glass fiber
5. To study the impact of concrete by adding red mud
6. To study the durability characteristics of concrete with red mud and glass fiber by chloride test

3. MATERIALS USED:

3.1. Cement:

In the present research work, ordinary Portland cement of 53 grades is used. The testes on cement were conducted in accordance with Indian standard confirming to IS 12269-1987.

Table -1: cement properties

Properties	Results
Grades	43
initial setting time	35min
final setting time	7:45 hours
normal consistency	34%
Specific Gravity	3.1

3.2 Fine Aggregates:

M sand is a substitute of the river sand for construction produced from hard granite stone by crushing.

Properties	Results
Grading of sand	Zone 3
Specific gravity	2.6
Water absorption	0.5%

3.3 Course aggregate:

Locally available crushed granite coarse aggregate having the maximum size of 20mm are used in this study. The aggregates are tested as per Is: 2386-1963.

Properties	Results
Specific gravity	2.8
Water absorption	1%

3.4 Red mud:

Red mud is a highly alkaline waste product composed mainly of iron oxide that is generated in the industrial production of alumina.

3.5 Glass fiber:

It is the material made from extremely fine fibres of glass. It is a light weight, extremely strong and robust material. There are distinctive sorts of fibre however in these we have taken E-glass fibre to show better resistance and a very good insulation to electricity.

3.4. WATER:

In this experiment work, Portable water is used.

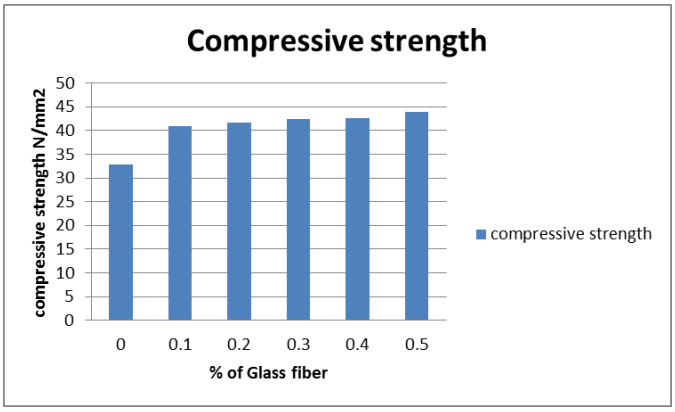
4. EXPERIMENTAL PROCEDURE:

M30 concrete is designed in accordance with the guidelines of code book IS 10262:2009 with replacement of cement by red mud with addition of glass fibre by volume. The mix proportion arrived is 1:1.28:2.75 (C:FA:CA) with water cement ratio of 0.43 and red mud dosage of 20% (by weight of cement). Glass fibre is added at varying percentages of 0%, 0.1%, 0.2%, 0.3%, 0.4% and 0.5% by volume of concrete. The specimen is cast for compressive strength, split tensile strength and flexural strength impact and chloride attack test. The specimens are cured in water for 28 days. The specimens are removed from water. Then they are tested for their respective strengths.

5. EXPERIMENTAL RESULTS:

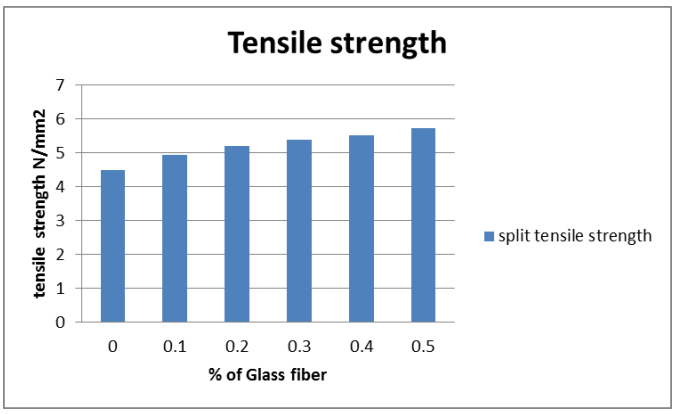
5.1Compressive strength

SL	Red mud in %	Glass fiber in %	Compressive strength N/mm2
1	0.0	0.0	32.91
2	20	0.1	40.97
3	20	0.2	41.67
4	20	0.3	42.39
5	20	0.4	42.57
6	20	0.5	43.89



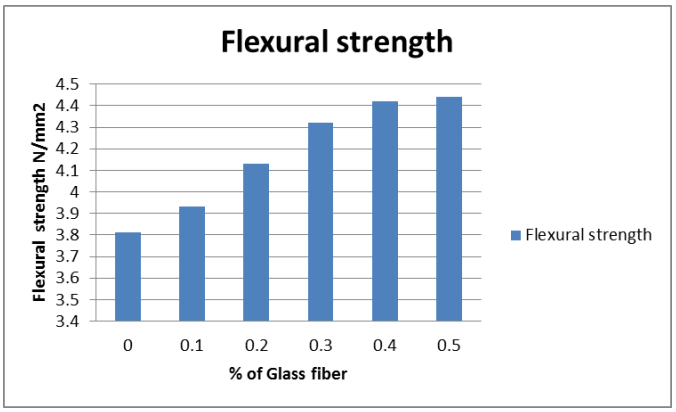
5.2 split tensile strength

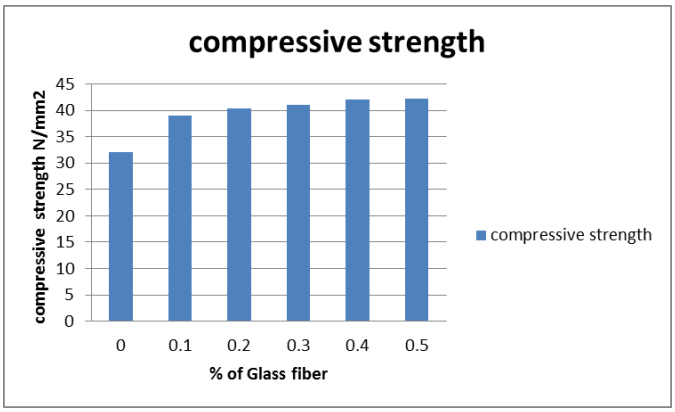
SL	Red mud in %	Glass fiber in %	Tensile strength N/mm2
1	0.0	0.0	4.5
2	20	0.1	4.95
3	20	0.2	5.205
4	20	0.3	5.38
5	20	0.4	5.52
6	20	0.5	5.735



5.3 Flexural strength

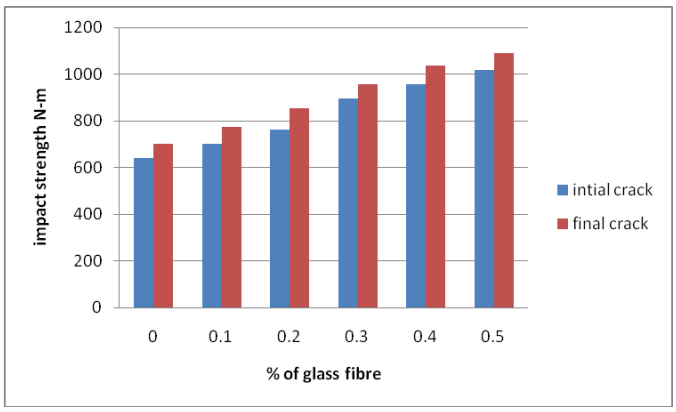
SL	Red mud in %	Glass fiber in %	Flexural strength N/mm2
1	0	0	3.81
2	20	0.1	3.93
3	20	0.2	4.13
4	20	0.3	4.32
5	20	0.4	4.42
6	20	0.5	4.44





5.4 Impact strength

SL	Red mud in %	Glass fiber in %	Impact strength N-m (For first crack)	Impact strength N-m (For final crack)
1	0.0	0.0	640.59	701.63
2	20	0.1	701.6	772.78
3	20	0.2	762.59	854.12
4	20	0.3	89408	955.81
5	20	0.4	955.815	1037.15
6	20	0.5	1016.82	1088.5



5.5 Chloride attack test

SL	Red mud in %	Glass fiber in %	Compressive strength N/mm2
1	0.0	0.0	32.04
2	20	0.1	39.02
3	20	0.2	40.32
4	20	0.3	40.98
5	20	0.4	42.07
6	20	0.5	42.28

6. OBSERVATION AND DISCUSSION:

It is observed that, the compressive strength of conventional mix for 28 day is 32.6 N/mm2 respectively, for split tensile strength is 4.5 N/mm2 and for Flexural strength is 3.81 N/mm2 respectively. Red mud has no cementitius properties but when it react with water and cements it starts gaining cementitious properties. Also Percentage of silica available, contributes to strength. It is observed that, the compressive strength of the concrete will increases as the percentage ofred mud and glass fibre is added. This is true for 28 days compressive strength is upto 43.89 N/mm2 with respect 20% of red mud and 0.5% of glass fibre It is observed that the split tensile strength will increase as the percentage of red mud and glass fibre. This is true for 28 days Split tensile strength is 5.73 N/mm2 with respect 20% of red mud and 0.5% of glass fibre,. Thus the higher value of tensile strength is obtained by using 0.5% of glass fibre. It is observed that the flexural strength will increases as the percentages of red mud and glass fibre. This is true for 28 days flexural strength is 4.44N/mm2 with respect 20% of red mud and 0.5% of glass fibre.

7. CONCLUSION

1. Optimum percentage of red mud to the replacement of cement by weight is found to be 20%. By the addition of glass fibre gives more strength than conventional.

2. It was observed that 24 to 33% of compressive strength was increased by its replacement of cement by 20% of red ud and various percentage of glass fibre .

3. By experimental investigation it was found that by the replacement of red mud and glass fibre the bending strength, tensile strength and impact strength was increased by 10 to 26% when compared to conventional concrete.

4. It was observed that there was no such noticeable increase in the mechanical properties of concrete when subjected to chloride attack.

5. by replacement of red mud in cement the cost of construction will be minimized by effective utilization of

waste product red mud and also reduce the environmental effect.

6. We can use mixture of red mud and cement for non-structural work. There is a future scope for the use of red mud concrete in structural point of view.

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