International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-4, November 2019

Effect of Partial Replacement of Cement by Quarry Dust, Rice Husk Ash with using Polyester Fiber in Concrete

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Abstract: ***Generally Portland cement is used as binding material in concrete which liberates large amount of co2 while manufacturing. Hence there is an urgent need for proper attention and to minimize their impact on the sustainability of our living environment. In this study quarry dust and Rice husk ash were partially replaced for cement material, And adding the polyester fiber to strengthening the rebar. In this investigation marble dust and rice husk ash are used as a replacement for cement in various proportions such as 0%, 10%, 15%, 20%, 30% in a total replacement of 30% of cement, Where in each proportion the remaining percentage is filled by the Rice husk ash. Marble dust contains more than 50% of silica content in it. Study of Index property and engineering property were obtained in laboratory. Cube casted along the polyester fiber with aspect ratio 100 is adding as reinforcement agent. Polyester had added as 0.1% .***

Keywords : Marble dust, Rice husk ash, Recron polyester fiber.

I. INTRODUCTION

Concrete is till now the most popular for construction on earth. To act as binder ordinary Portland cement (OPC) is most widely used with other materials like water and aggregates [2]. The increased production of Portland cement causes great concern of the environmental because of high carbon foot print. Quarry dust is the waste product it reduce the co_2 emission and adding the Rice husk ash for remaining replacement, the source of rice husk out come from rice-mill by burning of rice husk it changes to ash. This is produced due to the use of raw materials [1]. The marble is commonly used as a building material since ancient time. Disposal of the waste material of the marble industry, consisting of very fine powder. The process of marble dust polishing of marble blocks. Rice husk ash is an agricultural waste product collected from the parboiling plants is posing serious environmental threat and ways are being thought of to dispose them. This material is actually a super pozzolan it has rich silica content above 82%.

Manuscript published on November 30, 2019.
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II. MATERIALS AND METHODS

2.1 FINE AGGREGATE

Fine aggregate are basically consist of natural sand or crush stone with most particles passing through a 3/8-inch sieve. The particles greater than 0.19 inch, but generally range between 3/8 and 1.5 inches in diameter [12].

Table 1:Physical properties of fine aggregate

Description	Fine aggregate
Specific gravity	2.5
Finess modulus	4.25
D_{60}	0.63
D_{10}	0.375
Bulk density	1.811 g/cc

2.2 COARSE AGGREGATE

Coarse aggregate are components found in many areas of the construction industry. They have structural uses such as base layer or drainage layer below pavements and in mixtures like asphalt and concrete [10,11].

Table 2:Physical properties of Coarse aggregate

Description	Test results obtained
Specific gravity	2.63
Water absorption (%)	1.2%
Unit weight (kg/m3)	1658

2.3 MARBLE DUST

Marble dust is in the form of dust where it is used as the cementious materials in the concrete mixtures. The availability and the cost of construction is lower and cheaper than the ordinary concrete materials [6,7].

Table 3: Physical properties of Marble test

Description	Test results obtained
Specific gravity	2.66
Finess	12%
Unit weight	1570 kg/m^3

2.4 RICE HUSK ASH

Rice husk ash is the by-product of burning rice husk. Rice husk is extremely prevalent in milling of paddy which comes from the fields. This rice husk is mostly used as fuel in the boilers for processing of paddy. It has 54% calcium content[3-5].

Table 4 :Physical properties of rice huskash

Description	Test results obtained
Specific gravity	2.3
Bulk density	0.3272
Unit weight (kg/m3)	1.68

2.5 Polyester Fiber

Polyester is a category of polymers that contain the ester functional group in their main chain. As a specific material, it most commonly refers to a type called polyethylene. Polyester and a few synthetic ones are biodegradable. It would be Liquid crystalline polyesters are among the liquid crystal. They used for mechanical properties and heat resistance. These traits are also important in their application [8,9].

Table 5: Properties of Polyster Fiber

Tenacity	150-6000 denier
Fineness	1.3
Moisture regain	0.4%
Elongation	1.80mm
lignin	3.3

2.6 CEMENT

Cement is a binding material used in the concrete for binding all the material together present in the concrete. Cement is tested as per IS recommendations. The cement that is used in the project is tested in the laboratory as per IS 4031. Ordinary Portland Cement of grade 53 is used for the research purpose. The test data for the cement is listed in the table below.

Table 6: Properties of cement

S.No	Description	Values
1	Specific gravity	3.14
2	Fineness	1g
3	Soundness	1mm
4	Setting time	
5	(i) Initial	32 min
6	(ii) Final	486 min
7	Normal Consistency	30%

III. RESULTS AND DISCUSSION

3.1 DESTRUCTIVE STRENGTH

The Destructive strength of concrete is conducted by various methods in laboratory as well as in site places. This test were carried out in accordance with **IS 516-1999**. The standard size of specimens 150x150x150mm were casted and specimens were cured for a period of 7 days, 14 Days & 28 Days and then the specimens were taken out dried and tested in Compression Testing Machine. The strength is calculated in N/mm^2.

The compressive strength calculate by using formula

$$Fc = P/A$$

Fc = Compressive strength N/mm^2
P = Ultimate load kN
A = Loaded area mm

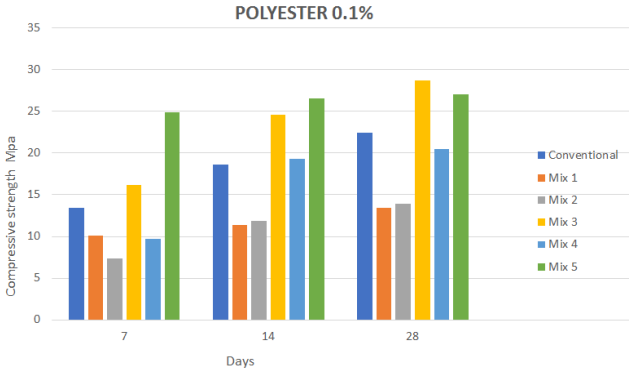

Figure 1 : Compressive strength

The compressive test results of cube specimen the mixes of marble dust is increased by 5% continuously and the remaining is filled with RHA in a total of 30% replacement for cement. after curing period of 7 days, 14 days and 28 days. A maximum value of 28.6 N/mm^2 is obtained in mix 3. Mix 1 comprises of 0% marble dust and 30% Rha.

3.2 NON DESTRUCTIVE STRENGTH

The Non Destructive strength test is generally the compressive strength of concrete without destructing it is carried out by using rebound Hammer Test.. The standard size of specimens 150x150x150mm were casted and specimens were cured for a period of 7 days, 14 Days & 28 Days.. This test were carried out in accordance with **IS 13311 (2) -1992** The surface is smoothened before testing. Now the test specimens were taken out and it is dried and then the rebound hammer is placed 90º to the surface of the specimen reading from the rebound hammer and the graph present were used to calculate.

Retrieval Number: D9796118419/2019©BEIESP
DOI:10.35940/ijrte.D9796.118419
Journal Website: www.ijrte.org

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

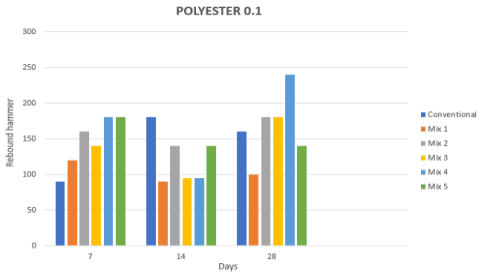

Figure 2: Rebound Hammer

This figure 2 shows the compressive strength of various mix proportions tested after the curing periods of 7 days, 14 days, 28 days tested by non destructive method. Normally the rebound hammer has used to fight the compressive strength result.

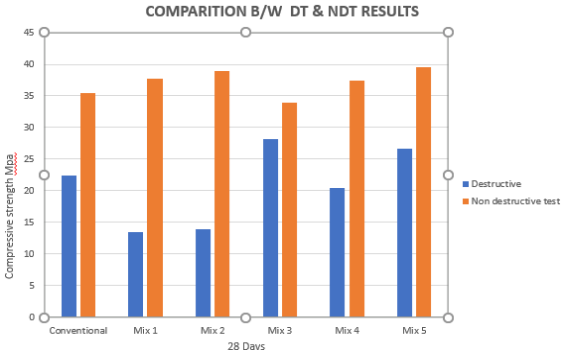

Figure 3: Comparition Result between DT & NDT

The comparison between the test of compressive strength of destructive and non destructive method after a curing period of 28 days. The result obtained from the non destructive test is slightly varied from the destructive test results. This figure 3 shows that a maximum value is obtained in Mix 3.

IV. CONCLUSION

Mix design for M20 grade concrete was studied and completed by using IS 10262 (2009). Test for materials are prepared and also satisfies as per IS code condition, The mechanical properties such as compressive strength and rebound hammer tested and compared between above the proportions. By this result it is concluded that the maximum strength is obtained in third mix proportion in which out of 30% cement replacement 15% is filled by RHA and the remaining 15% is by marble dust. 0.1% by weight of cement, polyester fiber is added as a reinforcing element. The minor cracks are arrested by the addition of poleyester fibre.

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