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EXPERIMENTAL STUDY ON CONCRETE BY PARTIAL REPLACMENT OF CEMENT AND FINE AGGREGATE WITH BAGASSE ASH AND MARBLE POWDER

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Abstract - *The rapid growth of the construction sectors leads to high demand for construction material. Due to which there is increase in concrete demand which may leads to shortage of natural resource, which leads to the world to look for material that can be effectively used in construction without affecting the environment. The use of agro industrial waste as construction material will support in either way of waste handling and environmental conservation. Sugarcane Bagasse Ash (SCBA) is a by-product of sugar and alcohol factories mainly composed of silica. Similarly, the Marble Powder waste produced by marble factories during cutting of the marble stone whose disposal may effect the environment as per Abdul Ghani et al. The study focuses on the performance of bagasse ash and marble powder in concrete.*

Key Words*: *Concrete, Bagasse Ash(BA), Marble Powde (MP), Cement, Compressive Strength.

1. INTRODUCTION

Cement is an extensively used construction material worldwide. Due to the rapid urbanization, the demand for construction materials has been increasing significantly in recent times. Hence, the cost of construction materials has also substantially increased. In addition, the limited natural resources are extensively consumed as raw materials for the production of construction materials such as ordinary Portland cement, burnt clay bricks, etc. Besides, it consumes significant energy and pollutes the environment. As a result, the construction sector has been enforced to adopt appropriate new alternative materials which are cheap, sustainable and abundant in nature. Agro-wastes and other industrial by-products which contain reactive silica content are currently preferred for use as a source material in alkali activated concrete. The residual fibrous part after extracting sugar juice from sugarcane is termed as bagasse and it is used as a fuel feedstock in the cogeneration boiler in sugar industries to produce electricity Indian mines are disposing marble waste in large quantity. Rajasthan state has 4000 mines and 1100 marble processing plants. Six million metric tons of marble slurry is disposed per annum (Singh et al. 2017). Due to the demand for marble building products, the quarrying and production of marble stone are increased. Therefore, the disposal of marble waste has also increased to a greater extent and become problematic due to the restriction from environmental authorities. Better mechanical properties have been reported for self-compacting concrete with marble waste compared concrete with rivers sand. Marble waste was used as a partial replacement of fine aggregate

2. MATERIALS AND METHODOLOGY

2.1 Bagasse Ash

Sugarcane Bagasse Ash is the by- product of sugarcane bagasse when it is used as fuel in the manufacturing of jiggery and sugar in industries. Sugarcane bagasse ash is an agricultural waste which can transformed by incineration into cement replacement material for various cementing material.

Fig -1. Bagasse Ash

2.2 Marble Powder

It is a by- product of the marble industries, the powder lest out after cutting the marble stone into required size. We have used the by-product as replacement of fine aggregate in concrete.

Fig- 2. Marble Powder

2.3 Cement

Cement is a pozolonic material used in concrete as a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together.

2.4 M Sand

Manufactured Sand (M – Sand) is an Alternative of Encore of sand in concrete. M Sand is used as Fine aggregate in construction . M sand passing IS sieve conforming to grade II of IS 383 : 1970 was used.

2.5 Coarse Aggregate

Locally available 20 mm size aggregate were used.

2.6 Mix Design

The concrete mix is designed as per IS 10262-2009. The grade of concrete which we adopted was M 25 with the water cement ratio of 0.45. The mix proportion used for nominal concrete was 1 : 1.7 : 3.8. For this project we mix the bagasse ash and marble powder in two different ratios by taking constant of marble powder. For First case we took 40% marble powder as constant and varied the bagasse ash in % of 10,20 & 30 and for second case we took 50% marble powder as constant and varied the bagasse ash as percents of 10,20 & 30. For these mixes we took the fly ash design as reference mix design.

2.7 Specmen Preperation And Casting

Cubes of size 150 x150x150 mm were prepared using the standard moulds . The nominal concrete was prepared and casted. For first case we took 40% of marble powder as constant partial replacement of fine aggregate and 10% , 20%, & 30% bagasse ash was replaced the cement content in concrete mix. For first case 40% marble powder & 10% bagasse ash as replacement materials , for further 40% & 20% , 40% & 30% were taken .the calculated amounts of material were taken and the concrete mix was prepared and casted. For second case we took 50% marble powder as constant partial replacement of fine aggregate and 10%, 20%, & 30% of bagasse ash as replacement of cement. The mix was prepared like 50% & 10% , 50% & 20% and 50% & 30% variations of Marble powder and Bagasse ash respectively. The concrete mix was prepared and casted. The specimens were cured for 7 days ,14 days and 28 days.After curing compressive strength was calculated.

Fig – 3. Preperation of concrete mix

3 TEST SET UP

The cubes were tested under compressive strength testing machine. Specimens are tested in a loading frame 500 k N capacity. The load was increased till the failure of the specimen was occurred. The test setup was shown in Fig – 4.

Fig – 4. Test setup

4 RESULT AND DISCUSSION

4.1 Compression Strength

Compressive strength test were conducted on cubes of size 150 mm using compression testing machine.

4.1.1 Compressive Strength of Nominal concrete

Table – 1 Compressive strength of Nominal Concrete

Sl.No.	Compressive Strength in N / mm²		
	7 Days	14 Days	28 Days
1	13.78	12.3	13

4.1.2 Compressive strength of 40% MP and 10%, 20% & 30% BA

Table - 2

SL.No.	% MP & % BA	Compressive strength in N/mm²		
		7 days	14 days	28 days
1	40% & 10%	9	11	12
2	40% & 20%	8	11	13
3	40% & 30%	6.6	7	10

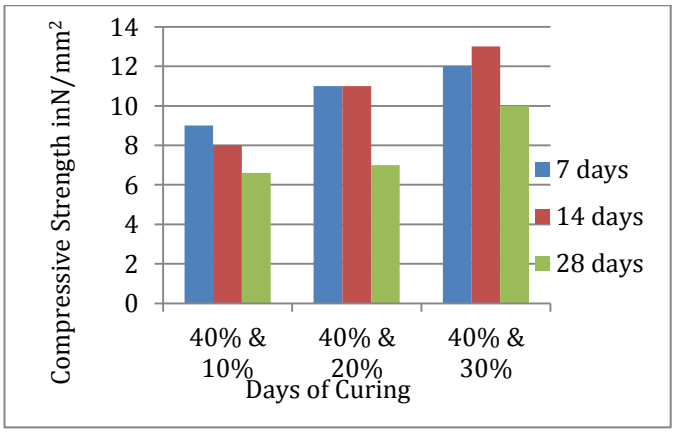

Chart -1 Compressive strength of 40% MP and 10%, 20% & 30% BA

4.1.3 Compressive strength of 50% MP and 10%, 20% & 30% BA

Table – 3

SL.No.	% MP & % BA	Compressive strength in N/mm²		
		7 days	14 days	28 days
1	50% & 10%	11.1	10.4	11.3
2	50% & 20%	10.2	10.8	13.3
3	50% & 30%	5.5	6.8	10.2

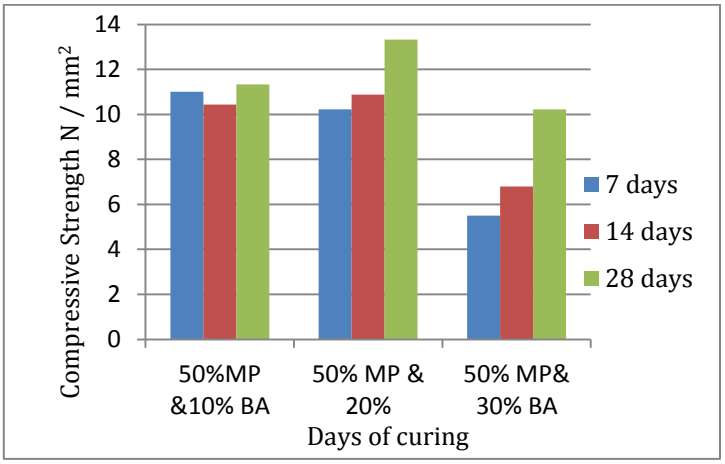

Chart -2 Compressive strength of 50% MP and 10%, 20% & 30% BA

4.2 Comparison graphs on the nominal concrete and the variations.

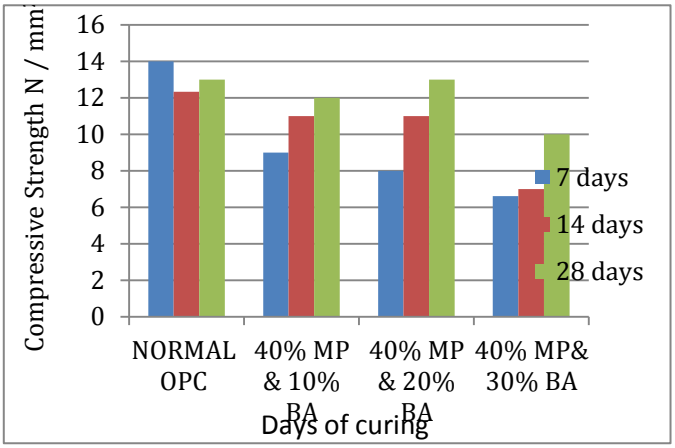

Chart – 3. Comparision of compressive strength of nominal concrete and 40% MP and 10,20 and 30 % BA

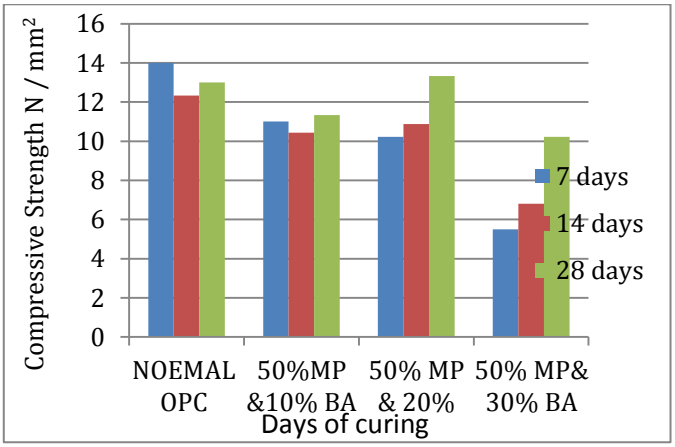

Chart – 4. Comparision of compressive strength of nominal concrete and 50% MP and 10,20 and 30 % BA

4.2 DISCUSSION

Chart – 1 shows that by replacement of 40% of MP and 10,20 and 30% of BA has lowest compressive strength of the test conducted. But the results are satisfying and have minimum strength required.

Chart -2 shows the results of the replacement of 50% of MP and 10, 20 and 30% of BA which provides the highest strength among the test conducted particularly the 50% of MP and 20% of BA has attained the highest strength.

Chart – 3 & 4 represents the comparision of compressive strength of variations and nominal concrete, though the nominal concrete has attained the highest compressive strength but the mix percentage replaced in chart-2 had good strength which can be replaced as concrete in small scale construction.

5 CONCLUSION

After the test conducted, we got a good result by the replacement of 20% BA and 50% MP. So it's the same percentage recommended for the better result.

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