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EXPERIMENTAL STUDY ON CONCRETE BY PARTIAL REPLACEMENT OF MARBLE DUST POWDER WITH CEMENT,QUARRY DUST WITH FINE AGGREGATE AND COCONUT SHELL WITH COARSE AGGREGATE

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***Abstract*— Concrete is the most important component used in the construction industry throughout the world, where the fine aggregate is generally natural sand. The demand for natural sand in the construction industry has consecutively increased which has resulted in the reduction of sources and an increase in price. As the demand for more and more infrastructures is increasing day by day, the quantity of concrete requirements is also increasing. In this project, concrete will be casted for M_{30} grade and the partial replacement of concrete material were decided to reuse industrial waste such as waste marble dust powder as cement replacement in range of 5%,10%,15% by weight of cement, the quarry dust as fine aggregate replacement in range of 20%,25%,30% by weight of sand and the coconut shell as coarse aggregate replacement in range of 15%,20%,25% by weight of aggregate. In this study Compressive Strength, Split Tensile Strength and Flexural Strength were obtained for mixes of concrete at 7,14,28 days. The optimum percentage for partial replacement of Marble Dust Powder with Cement is 10%, Quarry Dust with Sand is 25% and Coconut Shell with Coarse Aggregate is 15%.Henceforth, Use of these alternate waste material wisely in civil works will yields to cost reduction in construction material.**

***Index Terms*— Reuse Of Waste ,Partial Replacement, Compressive Strength, Split Tensile Strength, Flexural Strength, Marble Dust Powder, Quarry Dust, Coconut Shell.**

I. INTRODUCTION

Now time has come to think of some alternative materials for sustainable use in concrete mix. Day by day amount and type of waste materials has increased accordingly creating environmental issues. Civil engineering is a professional engineering discipline that deals with the design, construction and maintenance of the physical and naturally built environment, including works like roads, dams, parks and recreation, bridges etc. Rapid increase in construction activities leads to acute shortage of conventional construction materials.

Concrete is the vital civil engineering material. Its manufacturing involves utilization of ingredients like cement, sand, aggregates, water and required admixtures. Demand of construction material is increased due to infrastructural development across the world. The possibility of a complete depletion of concrete ingredients has rendered continued use of natural materials for construction unsustainable. In view of this challenge, researchers throughout the world have been investigating ways of replacing concrete ingredients to make construction sustainable and less expensive.

Using alternative materials place of natural material.concrete production makes concrete as sustainable and environment friendly Construction material. Now a days most of the researchers have focus on use of the waste materials in concrete according to their properties.wastes generated by industrial and agricultural processes have created disposal and management problems which pose serious challenges to efforts towards environmental conservation, their use contributes to resource conservation, environmental protection and the reduction of construction costs.

1.1 OBJECTIVES AND SCOPE OF STUDY

The main objective of this present work is

1) To study the influence of partial replacement of cement with marble dust powder, fine aggregate with quarry dust, coarse aggregate with coconut shell.
2) To compare the compressive strength, flexural strength and split tensile strength with normal concrete.

3) To find the optimum percentage of waste marble dust powder replaced in cement partially, quarry dust replaced in fine aggregate partially and coconut shell replaced in coarse aggregate partially that makes the strength of the concrete maximum.
4) To determine the reduction in cost with efficient partial replacement of these waste marble dust powder, quarry dust and coconut shell.

1.2 NEED AND FUTURE WORK OF THE STUDY

- To know how these wastes can be used as potential material or replacement material in the construction industry.
- This study will have the double advantage of reduction in the cost of construction material and also as a means of effective disposal of waste as reusable one.
- Using alternative material in place of natural aggregate in concrete production makes concrete as sustainable and environment friendly Construction material.

2 LITERATURE REVIEW

2.1 LITERATURE REVIEW ON WASTE MARBLE DUST POWDER

BabooRai, Khan Naushad H , Abhishek Kr, TabinRushad S, Duggal S.K (2011)[International Journal Of Civil Engineering] studied the influence of marble powder in cement concrete mix. In this paper the effect of use of marble powder and granules has been studied by partially replacing with mortar and concrete constituents. And check the different properties like relative workability and compressive and flexure strengths. By partial replacing the constitution it reveals that increased waste powder or waste marble granules ratio result in increased workability and compressive strengths of the mortar and concrete.

Prof. P.A. Shirule, AtaurRahman, Rakesh D, Gupta (2011)[International Journal Of Advanced Engineering Research And Studies] investigated the effect of marble powder as partial replacement for cement on mortar. In this research paper with the inclusion of Marble powder the strength of concrete gradually increases up to a certain limit but the gradually decreases. With the inclusion of Marble powder up to 10% the initial strength gain in concrete is high. The optimum percentage for replacement of marble powder with cement and it is almost 10% cement for both cubes and cylinders.

2.2 LITERATURE REVIEW ON QUARRY DUST

M. Shukla and A K Sachan(2000)[International Journal Of Civil Engineering] studied environmental hazardous stone dust utilization in building construction. It is found that partial replacement will not affect the strength and also solve the problem of disposal of stone dust. The workability of concrete reduces with the increase in stone dust and this can be improved by adding suitable admixtures.

GaneshaMogaveera, G.Sarangapani and AnandV.R(2011)[International Journal Of Environmental Science And Development] investigated the effect of Partial Replacement of Sand by Quarry dust in Plain Cement Concrete for different mix proportions. They have concluded that sand can be replaced effectively by means of quarry dust up to 20% to 25%.

2.3 LITERATURE REVIEW ON COCONUT SHELL

Abdulfatah and Saleh(2011)[Journal of engineering and applied sciences] conducted experiments to determine the suitability of coconut shell as full replacement for coarse aggregate in concrete works. A total of 72 concrete cubes of size 150×150×150 mm with different mix ratios of 1:2:4, 1:1.5:3 and 1:3:6 were casted, tested and their physical and mechanical properties were determined. Compressive strengths comparable to that of plain concrete were observed. The study concluded that cost of producing concrete can be reduced up to 48%.

DewanshuAhlawat, L.G.Kalurkar(2014)[Journal Of Mechanical And Civil Engineering] investigated the Coconut Shell as Partial Replacement of Coarse Aggregate in Concrete. Forty five cubes were casted and their compressive strength and workability were evaluated at 7, 14 and 28 days. The compressive strength of concrete reduced as the percentage replacement increased. Concrete produced by 2.5%, 5%, 7.5%, 10% replacement attained 28 days compressive strength of 19.71,19.53,19.08,18.91 respectively. The results showed that Coconut shell concrete can be used in reinforced concrete construction. Its utilization is cost effective and eco-friendly.

RESULTS AND DISCUSSION

5.1 GENERAL

This chapter includes the testing of casted specimens. Cubes were tested for Compressive Strength, Cylinders were tested for Split Tension Strength and Prisms were tested for Flexural Strength. From the test results, discussions are carried out to interpret the conclusion.

5.2 COMPRESSIVE STRENGTH TEST

Compressive strength test on concrete is done by casting and curing of an standard cube mould of size 150mm x 150mm x 150mm. After curing, specimens were allowed to dry in air. The dried specimens were centered on a compression testing machine (CTM) of capacity 2000kN and testing were conducted as per IS 516-1959. To determine the compressive strength, cubes were casted with different percentage of Marble Dust Powder, Quarry Dust and Coconut Shell. After that, the casted specimen are tested at 7, 14 and 28 days. The optimum percentage of Marble Dust Powder, Quarry Dust and Coconut Shell were again casted and tested at 7, 14 and 28 days.

Table 5.1: Compressive Strength Result

MIX DESIGN	Compressive Strength		
	7 days	14 days	28 days
M_0(conventional)	15.14	20.82	26.03
M_1(5% MDP)	17.78	24.19	31.68
M_2(10% MDP)	**21.64**	**28.45**	**39.38**
M_3(15% MDP)	19.56	26.73	30.79
M_4(20% QD)	25.60	27.70	32.19
M_5(25% QD)	**29.22**	**33.53**	**38.26**
M_6(30% QD)	26.85	29.12	34.88

M_7(15% CS)	**19.03**	**26.83**	**31.58**
M_8(20% CS)	17.19	24.97	25.19
M_9(25% CS)	15.50	23.66	20.45
M_{10}(10%MDP, 25%QD&15%CS)	**25.09**	**30.60**	**37.17**

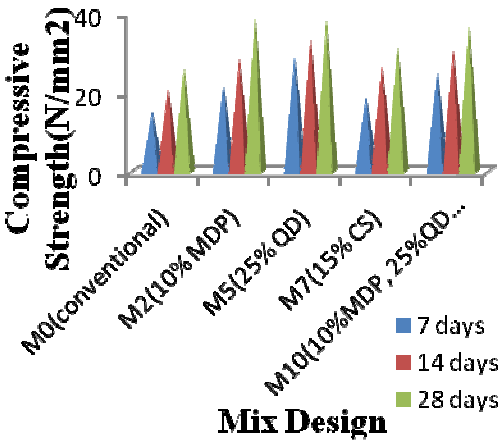

Fig.No 5.1: Compressive Strength Results

Fig.No 5.1: Compression Testing

5.3 Split Tensile Strength Test:

Cylinders of size 100mm x 200mm were used to determine the split tensile strength. The cylinders are casted with different percentage of Marble Dust Powder, Quarry Dust and Coconut Shell. After curing, the specimens were tested at 7, 14 and 28 days using a calibrated compression testing machine of 2000kN capacity as per I.S. 516-1959.The optimum percentage of Marble Dust Powder, Quarry Dust and Coconut Shell were again casted and tested at 7, 14 and 28 days.

Table 5.2: Split Tensile Strength Result

MIX DESIGN	Split Tensile Strength		
	7 days	**14 days**	**28 days**
M_0(conventional)	2.1	2.69	3.17
M_1(5% MDP)	2.33	2.78	3.38
M_2(10% MDP)	**2.68**	**3.25**	**4.03**
M_3(15% MDP)	2.49	2.90	3.5
M_4(20% QD)	3.01	3.45	4.04
M_5(25% QD)	**3.38**	**3.80**	**4.59**
M_6(30% QD)	3.2	3.62	4.19
M_7(15% CS)	**2.47**	**3.03**	**3.57**
M_8(20% CS)	2.39	2.88	3.34
M_9(25% CS)	2.28	2.75	3.26
M_{10}(5%MDP, 25%QD&15%CS)	**3.05**	**3.54**	**4.23**

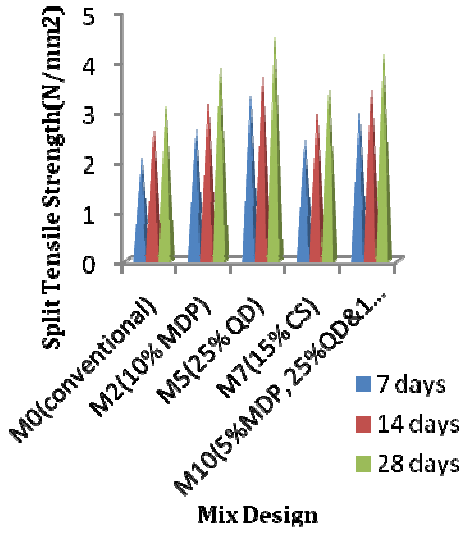

Fig.No 5.2: Split Tensile Strength Results

Fig.No 5.2: Split Tension Testing

5.3 Flexural Strength Test:

Beams of size 100mm × 100mm × 500mm under two-point load were used to determine the flexural strength. The beams are casted with different percentage of Marble Dust Powder, Quarry Dust and Coconut Shell content in concrete has been investigated. After curing, the specimens were tested at 7, 14 and 28 days. The optimum percentage of Marble Dust Powder, Quarry Dust and Coconut Shell were also again casted and tested at 7, 14 and 28 days.

Table 5.3: Flexural Strength Result

MIX DESIGN	Flexural Strength		
	7 days	14 days	28 days
M_0(conventional)	2.95	3.79	4.20
M_1(5% MDP)	3.14	4.28	5.25
M_2(10% MDP)	**3.28**	**4.31**	**5.39**
M_3(15% MDP)	3.20	4.25	5.10
M_4(20% QD)	3.54	4.27	5.12
M_5(25% QD)	**3.75**	**4.51**	**5.90**
M_6(30%QD)	3.62	4.33	5.64
M_7(15% CS)	**3.48**	**4.15**	**4.59**
M_8(20% CS)	3.36	3.85	4.41
M_9(25% CS)	3.20	3.68	4.37
M_{10}(10%MDP, 25%QD&15%CS)	**3.63**	**4.48**	**5.74**

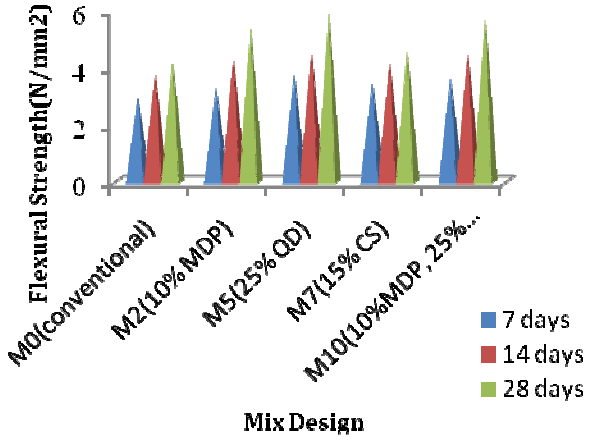

Fig.No 5.3: Flexural Strength Results

Fig.No 5.3: Flexural Testing

CONCLUSION

The present Experimental Investigation showed the following conclusions:

- The main aim of this paper is to convert the waste material into useful building material and also to avoid the waste material disposal problems and related to environmental issues.
- The Compressive strength of Cubes are increased with addition of Marble Dust Powder, Quarry Dust and Coconut Shell up to 10%MDP,25%QD and 15%CS partially replaced the Cement ,Sand and Coarse Aggregate in concrete and further any addition will decreases the compressive strength.
- The Split Tensile strength of Cylinders are increased with addition of Marble Dust Powder, Quarry Dust and Coconut Shell up to 10%MDP,25%QD and 15%CS partially replaced the Cement ,Sand and Coarse Aggregate in concrete and further any addition will decreases the Split Tensile strength.
- The Flexural strength of beams are increased with addition of Marble Dust Powder, Quarry Dust and Coconut Shell up to 10%MDP,25%QD and 15%CS partially replaced the Cement ,Sand and Coarse Aggregate in concrete and further any addition will decreases the flexural strength.
- Therefore, the optimum percentage for partial replacement of Marble Dust Powder with Cement is 10%, Quarry Dust with Sand is 25% and Coconut Shell with Coarse Aggregate is 15%.

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