

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

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.

Keywords: Concrete, cement and coconut shell.

INTRODUCTION

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].

It is conventional that sand is being used as fine aggregate in concrete. For the past some years, the escalation in cost of sand due to administrative restrictions in India, demands comparatively greater cost at around two to three times the cost of quarry dust even in places where river sand is available nearby. To achieve economy, it is proposed to study with the use of crusher powder, a quarry waste as an alternative material to replace sand by crusher powder because quarry dust is an industrial waste [2-3].

Coconut shell is an agricultural waste. In developing countries, where abundant coconut shell waste is discharged. Coconut is grown in more than 93 countries. India is the third largest, having cultivation on an area of about 1.78 million hectares. Coconut shell is one of the waste material can also be used as a aggregate in concrete due to some reasons like large scale cultivation of coconut remain as solid waste for years [4].

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.

METHODOLOGY

The step by step methodology for the work to be carried out and the future work to be done further has been provided as a theory explaining the whole process. The flow chart has been included in the form of a flow chart for the better understanding of the process in a precise manner.

The methodology for this project is given in flow chart form. The initial stage of this project is to get approval of topic and then the collection of literature reviews from various sources as much as sufficient. A thorough study is made on the available literatures as per the need of the project and the specification should be noted down. Then the process of collection of raw materials for

the project is to be done. Then there comes the process of testing the collected materials said as initial testing of materials or preliminary tests. Based on the test results, the mix design calculations will be carried out as per need. Then the major laboratory process of casting of specimens will be done as per the mix calculations obtained. Tests will be done on 7th, 14th & 28th days from the casted day. Based on the analysis of results the conclusion will be made. The following flow chart fig.3.1 gives the stage by stage working process on the project

EXPERIMENTAL INVESTIGATION

The materials used for the project is collected and made sun dried before as initial testing and for further usage. The amount of material to be used should be noted in advance based on the preparation of mix design. From the results of mix design the quantity of each component such as cement, FA, CA and water will be finalized, then the collection of materials to be done and to be stored in a specified place free from impurities. Based on the availability of the materials and its condition the following tests were performed [4].

CEMENT

Ordinary Portland cement of 53 grade having specific gravity of 3.15 and fineness modulus of 4.62% was used. The Cement used has been tested for various proportions as per IS 4031-1988 and found to be confirming to various specifications of 12269- 1987.

Table 1: Physical properties Of OPC

PROPERTY	VALUE
Specific gravity	3.15
Fineness (m ² /kg)	0.225
Initial Setting Time	45 min
Final Setting Time	385 min

Table 2: Chemical Composition Of OPC

Constituents	Quarry Dust (%)
SiO ₂	20.25
Al ₂ O ₃	5.04
Fe ₂ O ₃	3.16
CaO	63.61
MgO	4.56

Na ₂ O	0.08
K ₂ O	0.51
Loss of ignition	3.12

FINE AGGREGATE

Fine aggregates are termed as “filler” which fills the voids in concrete. The fractions of aggregates less than 4.75mm are known as fine aggregates. The river sand is used as fine aggregate conforming to requirements of IS: 383-1970 comes under zone II.

Table 3: Properties of Fine Aggregate

PROPERTY	VALUE
Specific Gravity	2.55
Fineness Modulus(%)	3.9
Bulk Density (kg/m ³)	1736.67
Water Absorption (%)	1.69

COARSE AGGREGATE

Aggregates fractions larger than 4.75mm are termed as coarse aggregates. The fraction of aggregates used in the experimental work passed in 20mm sieve and retained on 10mm IS sieve comes under Zone II aggregates conforming to IS: 383- 1970.

Table 4.: Properties of Coarse Aggregate

PROPERTY	VALUE
Specific Gravity	2.71
Fineness Modulus(%)	3.18
Bulk Density (kg/m ³)	1612.67
Water Absorption (%)	0.33

MARBLE DUST POWDER

Marble dust powder were obtained during polishing, shaping and cutting of marble. This marble powder is used for this study .During this process, about 20-25% of the process marble is turn into the powder form. Marble powder can be used as an admixture in concrete, so that strength of the concrete can be increased. We can reduce the environmental pollution by utilizing this marble

powder .Hence it is possible to use marble powder as a replacement material for cement [5].

Table 5: Physical Properties of Marble Powder

PROPERTY	VALUE
Color	White
Form	Powder
Odor	Odorless
Specific Gravity	2.66

Table 6: Chemical Composition of Marble Powder

CONSTITUENTS	MARBLE DUST POWDER(%)
CaO	42.14
Loss on Ignition	34.5
SiO ₂	14.08
MgO	2.77
Al ₂ O ₃	2.69
Fe ₂ O ₃	1.94
Na ₂ O	0.91
K ₂ O	0.63
CL	0.04
S O ₃	0.08



Figure 1: Marble Dust Powder

QUARRY DUST

Quarry dust is fine rock particles. When boulders are broken into small pieces quarry dust is formed. It is grey in color and it is like fine aggregate. It is the residue material which is the extraction of rocks to form the fine particles less than 4.75mm through the IS sieve. Locally available quarry dust was used in the present study for replacement of fine aggregate [6].

Table 7: Physical Properties of Quarry Dust

PROPERTY	VALUES
Specific gravity	2.6
Water Absorption (%)	1.3%
Fineness modulus	3.6

Table 8: Chemical Composition of Quarry Dust

CONSTITUENTS	QUARRY DUST (%)
SiO ₂	62.48
Al ₂ O ₃	18.72
Fe ₂ O ₃	6.54
CaO	4.83
MgO	2.56
Na ₂ O	Nil
K ₂ O	3.18
TiO ₂	1.21
Loss of ignition	0.48



Figure 2: Quarry Dust

COCONUT SHELL

Coconut shell is obtained from houses, temples etc. They were sun dried for minimum 1 month

before using crushed manually. The particle size of the coconutshell range from 10mm to 20mm. Cement- Ordinary Portland cement of 53 grade conforming to Indian Standard IS 12269-19879 was used throughout the experimental program [7].

Table 9 Physical Properties of Coconut Shell

PROPERTY	VALUE
Specific Gravity	1.33
Water Absorption (%)	24
Bulk Density(kg/m ³)	800
Shell Thickness	(2-7)mm



Figure 3: Coconut Shell

CONCLUSION

The Literatures were collected and was reviewed. Based on the study of literature reviews an knowledge of partial replacement of waste materials are achieved. Materials are tested in this phase1 and further works such as compressive strength, splittensile test, flexural test are done in phase 2 with respect to the design mix M30 and arecompared.

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