EXPERIMENTAL STUDY ON TENSILE STRENGTH OF CONCRETE BY PARTIAL REPLACEMENT OF CEMENT BY MARBLE DUST POWDER AND COARSE AGGREGATE BY SAW DUST

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ABSTRACT:

Nowadays marble dust and saw dust is the source that causes environmental pollution so this investigation includes the use of those pollutants in the field of construction. The marble dust consists of Calcite ($CaCo_3$) and quartz (Sio_2) and the sawdust consists of Al_2O_3. This paper characterize the performance of partial replacement of cement with Marble Dust Powder and fine aggregate with saw dust in Tensile strength of concrete. In this project we use marble dust with specified ratio of 15% as constant for partial replacement of cement and gradually increasimg ratio of saw dust as 2%, 4% and 6% for the replacement of fine aggregate. The optimum percentage was found as 15% of marble dust and 4% of saw dust. The project result reveals that 4% of sawdust and 15% of marble dust provides better tensile strength. Appropriate use of those two waste materials as a partial replacement for cement and fine aggregate can lead to the reduction of waste disposal and controls environmental pollution and promotes low cost concrete.

Keywords: *Marble dust, sawdust, cement, fine aggregate, Tensile strength, waste disposal.*

1. INTRODUCTION

GENERAL

Concrete is used in worldwide in all major and minor civil engineering projects. The ingredients which are used for making concrete provides durability and strength to concrete. These ingredients are sand, cement, aggregate and water in definite water cement ratio for better performance of concrete. Use of waste material to a certain proportion with all other ingredients modifies the properties of concrete. However, by reducing content of fine aggregate and cement and using waste material makes concrete light in weight.

Nowadays marble powder is the source that causes of environmental troubles in the world. Therefore, maximum utilization of marble waste in various powderrial sectors, especially the construction, agriculture, glass and paper inpowderries would help to protect the environment. Concrete generally used in construction projects in the civil construction work because of its large structural strength and constancy. Waste powder of marble can be used to enhance the mechanical and physical functions of the conventional concrete. The chance of utilizing waste powder of marble as cementitious material in the preparation of concrete will also induce a relief on waste disposal issues. Currently the requirement for

cement is quite high in developing countries because of rapid infrastructural enlargement which consequences in supply storage and augment in the rate of material.

Environmental problems can be issued due to dumping of waste materials. The industrial marble stone generate both solid waste and stone slurry. It was found that marble dust available at every processing plant in huge quantity and its cost is very less compared to cement. So with the replacement of cement by marble dust a cost effective concrete can be achieved.

Saw dust is waste which when burnt, produce lot of carbon emissions which pollutes the environment. If this waste is used in concrete, then there will be less emissions of carbon dioxide in environment; as we are using the saw dust material in concrete. The replacement of fine aggregates with saw dust can be beneficial for the building components.

2. SCOPE AND OBJECTIVES

OBJECTIVES:

- The main objective of this study is to investigate the potential of marble dust powder as partial replacement of cement and saw dust as replacement of fine aggregate in the production of concrete.
- To investigate the effect of using Marble Dust Powder and Saw dust as partial replacement in concrete towards workability and Tensile strength of concrete.

SCOPE:

- To provide an economical concrete.
- To provide low housing delivery. To use the wastes such as MDP and Saw Dust in useful manner.
- To be easily adopted in construction field and balance both cost of concrete and waste disposal problem.

3.MATERIALS

CEMENT:

The cement used for this study is Ordinary Portland cement conforming to IS 12269 – 1987 of grade 53. Cement is one of the most commonly used products in construction. The major dis- advantages in cement production is emission Co_2 into the atmosphere. It causes Global warming effect hence it should be reduced.

SI.No	Test	Results
1	Fineness	90.02%
2	Normal consistency	30.5%
3	Specific gravity	3.75
4	Initial setting time	34 min
5	Final setting time	544 min

Table 3.1 Preliminary test on cement

FINE AGGREGATE:

The sand is used as fine aggregate and it is collected from nearby area. The sand has been sieved in 4.75 mm sieve. Aggregate is considered unsound when volume changes in the aggregate induced by weather such as alternate cycles of wetting and drying or freezing and thawing result in concrete deterioration. Depends on: porosity, flaws and contaminants pumice. Some variation in the type, quality, cleanliness, grading, moisture content and other properties is expected.

SI.No	Test	Results
1	Fineness Test	ZoneII
2	Specific gravity of fine aggregate	2.74
3	Water absorption of fine aggregate	1.25

Table 3.2 Preliminary test on fine aggregate

COARSEAGGREGATE:

Naturally occurring concrete aggregates are a mixture of rocks and mineral. Rocks which are classified as igneous, sedimentary or metamorphic depending on origin are generally composed of several minerals. For example, granite contains quartz, feldspar, mica and a few amounts of quartz, feldspar and clay.

SI.No	Test	Results
1	Fineness modulus	3.28
2	Specific gravity of coarse aggregate	2.91
3	Water absorption of coarse aggregate	0.8

Table 3.3 Preliminary test on Coarse aggregate

MARBLE DUST POWDER:

Marble has been commonly used as a building material since the ancient times. Marble industries are grown widely in recent few years. These extract marble dust which is harmful polluting waste due to its highly alkaline property. So aim objective is waste management and use of marble dust in making low cost concrete. Marble dust is waste pollute which damage environment due to manufacturing and processing techniques because of its lower cost versatility. This waste is used for making marble dust concrete. Marble dust can be used as filler in concrete is helps to reduced total void content in concrete. For the study of marble dust concrete, we used M25 grade concrete.

SI.No	Test	Results
1	Fineness of Marble Dust Powder	88.2%
2	Specific gravity of Marble Dust Powder	3.41

Table 3.4 Preliminary test on Marble dust powder

Fig 3.1 Marble Dust Powder

SAW DUST:

Saw dust or wood dust is a by-product or waste product of woodworking operations such as sawing, milling, planning, routing, drilling and sanding. It is composed of fine particles of wood. These operations can be performed by woodworking machinery portable power tools or by use of hand tools. Sawdust is the main component of particle board. Wood dust is a form of particulate matter or particulates.

SI.No	Test	Results
1	Water absorption	2%
2	Specific gravity	0.94

Table 3.5 Preliminary test on saw dust

Fig 3.2 Saw Dust

4.EXPERIMANTAL INVESTIGATION

DESIGN MIX:

- Water cement ratio = 0.4
- Mix ratio = 1:1.46:2.4

Based on preliminary test value, the design mix is prepared as per IS: 10262-2009 with the w/c ratio of 0.4 & superplasticizer of 10%, we got the mix proportion 0f **1:1.46:2.4** for **M25** grade of concrete.

SI.NO	Material	Ratio
1	Water	0.4
2	Cement	1
3	Fine aggregate	1.46
4	Coarse aggregate	2.4

Table 4.1 Mix proportion

WORKABILITY TEST:

Workability is one of the physical parameters which provides the ease to handle and is determined by using slump cone test

Slump cone test:

The slump test is a means of assessing the consistency of fresh concrete. For the calculated mix ratio the slump test was conducted. The slump value for ordinary concrete with superplasticizer is 75mm.The figure 5.7shows the slump test carried for conventional concrete and their replacements.

Fig 4.2 Slump cone.

Tensile Strength of Cylinder

the total number of 30 cylinders were prepared of size 150x300mm.The specimens were casted by using mixture as 1:1.46:2.4 and cured for 28 days at normal temperature to determine the split tensile strength of concrete.

5.RESULTS AND DISCUSSION

SLUMP TEST

The slump value to determine various partially replaced concrete mixtures is assured and discussed for water cement ratio of 0.4. (in mm)

SI.NO	Concrete Type	Slump value
1	Conventional concrete	75
2	2% of MDP& 15% of SD	74.4
3	4% of MDP & 15% of SD	74
4	6% of MDP& 15% of SD	72

Table 5.1 Results of various slump values obtained

Tensile Strength of Cylinder

The tensile strength of concrete is one of the basic and chief properties. Splitting tensile strength on concrete is a method to determine the tensile strength of concrete (i.e)., a measure of the ability of material to resist a force that tends to pull it apart. A cylindrical mould of 150mm diameter and 300mm height is subjected to a axial load on the specimen surface until it fails. The split tensile strength was computed by using formula

$$T = 2P/ \pi LD \ (N/mm^2)$$

Where,

P- ultimate load (KN)

L -depth of the cylinder (m)

D -diameter of the cylinder (m).

SI.NO	% Replacement of DP&SD	Tensile strength (N/mm^2)
1.	Conventional concrete (CC)	3.58
2.	2% of MDP & 15%of SD	3.38
3.	4% of MDP & 15% of SD	3.46
4.	6% of MDP & 15% of SD	3.12

Table 5.2 Tensile strength of concrete

OVERALL COMPARISON OF TENSILE STRENGTH OF CONCRETE

The graph shows the overall comparison of Tensile strength of concrete with conventional concrete and Concrete made by 15% of MDP & 2% of Sawdust, 15% of MDP & 4% of Sawdust, 15% of MDP & 6% of Sawdust of replacements.

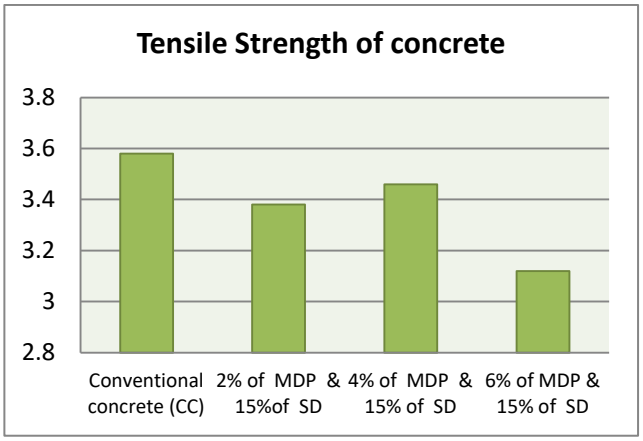

Chart5.1Overall comparison of Tensile strength of concrete

1. CONCLUSION

- In this project we tried to replace the cement and fine aggregate partially by marble dust powder (15%) and sawdust (2%, 4%, & 6%) respectively to increase the Tensile strength of concrete.
- The mechanical behavior (Tensile strength) of concrete with partial replacement of cement by marble dust powder and sawdust as fine aggregate were investigated and presented.
- MDP can be used to partially replace cement in the production of concrete to a maximum of 15%, because replacement beyond this reduces the concrete strength beyond the control and sawdust is replaced up to 6%,but it give better strength up to 4% and it has the strength nearly equal to fine aggregate.
- More than 6% of sawdust produces dry mix which leads to increase in water cement ratio thus disrupt the strength performance. The workability reduces as the sawdust are replaced due to their water absorbing nature.
- So we conclude that the cement and fine aggregate replaced with MDP at 15% and sawdust at 4% in concrete is suitable for construction. Moreover it reduces the construction cost by reducing the cost of cement and fine aggregate and it also reduces the environmental pollution due to waste disposal due to the marble dust and sawdust.

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