EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF FINE AGGREGATE WITH QUARRY DUST AND SAW DUST

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Abstract – The fine aggregate is one of the predominant contents of concrete, usually natural river sand is used as the fine aggregate. Scarcity of good quality natural river sand due to depletion of resources and restriction due to environmental consideration, to make concrete manufacturing to look for suitable alternative fine aggregate. This project deals with the experimental study on partial replacement of fine aggregate with quarry dust and sawdust. Quarry dust and sawdust which are by-products generated from stone crushers and wood processing work abundantly available all over the regions. Generally the availability of sand becomes a difficult task, especially in Kerala. In preparing concrete fine aggregate is partially replaced by quarry dust and saw dust the present investigation has been under taken to study the effect of sawdust and quarry dust, by adding quarry dust 50%,45%,40%,35% and sawdust of 0%,5%,10%,15% with replacement of fine aggregate.

Key Words: Cement, Sawdust, Quarry dust, Fine aggregate.

1. INTRODUCTION

Concrete is that probable mix of cement, water, sand and coarse aggregate that hardens into a super strong building material. River sand used as fine aggregate in concrete is derived from river bank. River sand has been the most popular choice for the fine aggregate component of concrete in the past. But over use of materials led to environmental concerns, the depleting of the river sand in the river sand deposit and an increase in the price of the material. Sawdust is an organic waste resulting from the mechanical milling or processing of timber (wood) into various shapes and sizes the dust is usually used as domestic fuel. The cost of construction material is increasing high because of high demand, scarcity of raw materials so we use alternative material for fine aggregate from the by product of crushing process of stones(quarry dust). Quarry dust has been used for different activities in the construction industry such has road construction and manufacture of building materials like lightweight aggregates, brick etc.

1.1 QUARRY DUST

Quarry dust is a waste obtained during quarrying process. It has very recently gained good attention to be used as an effective filer material instead of fine aggregate. It is defined as residue, paling or other non valuable waste material after the extraction and particals less than 4.75mm. This product can be use for asphalt, substitute for sand and filling around pipes. Quarry dust be an economic alternative to the river sand.

1.2. SAW DUST

Sawdust or wood dust is a by product of cutting, grinding, drilling, sanding, or otherwise pulverizing wood or any other material with the saw or other too ; it is composed of fine particles of wood. It is also the by product of certain animals, birds and insects which live in wood, such has woodpecker and carpenter ant. It can present a hazard in manufacturing industries, especially in terms of flammability.

1.2 SCOPE OF STUDY

- To study the influence of quarry dust and saw dust the mechanical properties of concrete.
- To compare the compressive, split tensile strength and flexural strength using quarry dust and saw dust with the conventional mix.
- Internal curing due to the absorbed water in the saw dust.
- Better heat dissipation and heat insulation property.
- Lower pollution from the disposal of sawdust.
- Decrease in the self weight as compared to the normal concrete.
- Efficient disposal of saw dust is possible.
- Lack of availability of fine aggregate can be compensated.

2. OBJECTIVES

- To evaluate the concrete specimens by replacing fine aggregate into partial replacement of quarry dust and sawdust.
- To compare the strength characteristics of normal concrete with quarry dust and sawdust.
- To achieve economy in construction.
- To ensure waste and reduce the carbon footprints.

3. LITERATURE REVIEW

Dr.Suji.D,Narayanan.A.M,etal (June 2016), "Experimental Study on Partial Replacement of Fine Aggregates with Quarry dust and Sawdust". In this study the effect of quarry dust and sawdust, by adding quarry dust of 0%,10%,20%,30% and 40%. And sawdust of 0%,5%,10%,15% and 20% with fine aggregate, a matured fine aggregate has prepared.

K.Gopinath,K.Anuratha (August 2015). "Utilization of Sawdust in Cement mortar and Cement Concrete". In this study as the percentage sawdust increase the density is found to decrease. Wastage of sawdust is minimized and recycled for construction work.

Shoab Hussain, Savinth Kumar (may 2017). "Experimental Study on Partial replacement of fine aggregate with Sawdust and Quarry dust. In this study the effect of quarry dust and sawdust, by adding 10%,15% and 20% with the fine aggregate, a matured fine aggregate has prepared.

Vignesh b, Lingaraju D (Dec 2016). "Experimental study on partial replacement of quarry dust and saw dust in fine aggregate". In this research was experimentally carried out to investigate properties of both sawdust and quarry dust when used as partial replacement in brick.

4. MATERIALS AND METHODOLOGY

4.1. MATERIALS.

4.1.1. QUARRY DUST.

Fig 4.1.1

It is obtained in quarrying process and it has a size of less than 4.75 mm.

4.1.2. SAWDUST.

Fig 4.1.2

It is obtained in sawmill during drilling, cutting of wood with a saw tool. And the size of the saw dust is less than 4.75 mm.

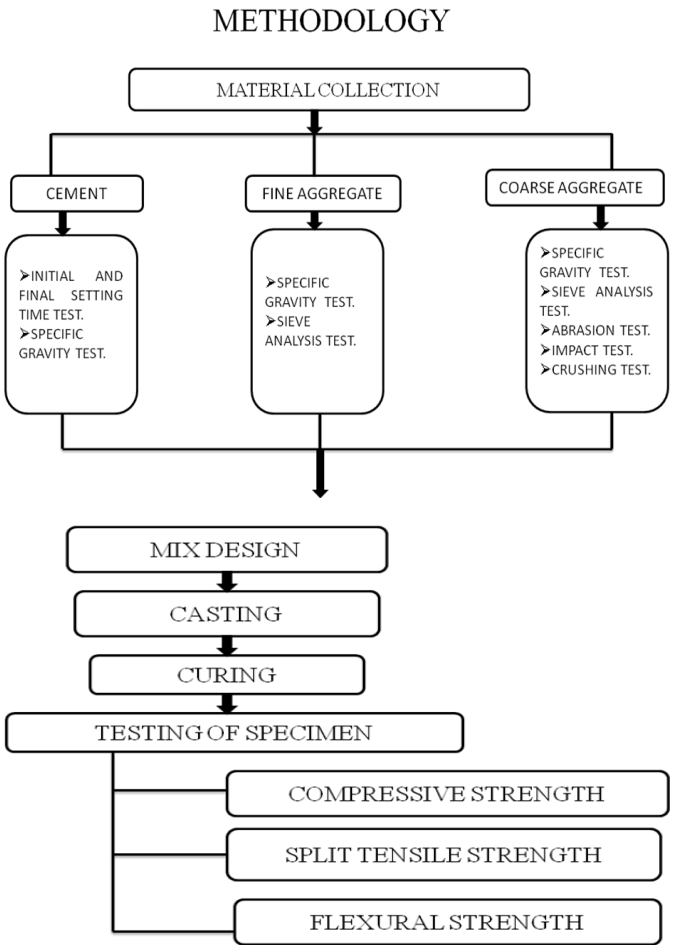
And the other materials and its properties are listed below

MATERIALS	PROPERTIES
Cement	43 grade[OPC]
Fine aggregate	Less than 4.75mm size[Natural sand]
Coarse aggregate	<20mm down size [angular]
Water	Suitable for drinking, free from suspended solids

4.1.3 Mix Proportion

Notation	Quarry dust	Saw dust	Natural sand
M_0	0%	0%	100%
M_1	50%	0%	50%
M_2	45%	5%	50%
M_3	40%	10%	50%

4.2. METHODOLOGY



TESTS:

1. Cement: Initial & final setting time, Standard & normal consistency, Fineness test, Specific gravity.
2. Fine & coarse aggregate: Specific gravity, Moisture content, Particle size distribution.
3. Concrete:

   a)Fresh concrete: Slump test.

   b)Harden concrete: Compression test, Spilt tensile test and flexural test.

5. RESULTS AND DICUSSION

5.1 Compression test

Experimental results for cube compression strength for mix M0,M1,M2 and M3 for 7 and 28 days are tabulated in Table 5.1. The graphical representation of compressive strength for various mixes at 7 and 28 days is shown in fig 5.1.

Table 5.1 7th and 28th day compression test values

Concrete Mix design	7th day N/mm2	28th day N/mm2
M_0	22	31
M_1	24.94	32.14
M_2	17.44	26
M_3	15.69	19

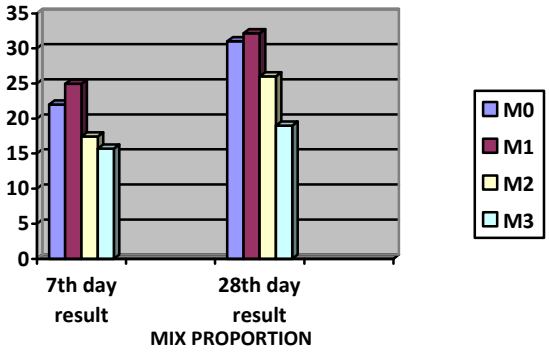


Fig 5.1 Comparison of compressive test values

5.2. Split Tensile Test

Experimental results for split tensile strength for mix M0,M1,M2 and M3 for 7 and 28 days are tabulated in Table 5.2. The graphical representation of split tensile strength for various mixes at 7and 28 days is shown in fig 5.2

Table 5.2 7th and 28th day compression test values

Concrete Mix design	7th day N/mm2	28th day N/mm2
M_0	5.27	7.36
M_1	6.93	7.77
M_2	4.86	6.8
M_3	3.46	5.56

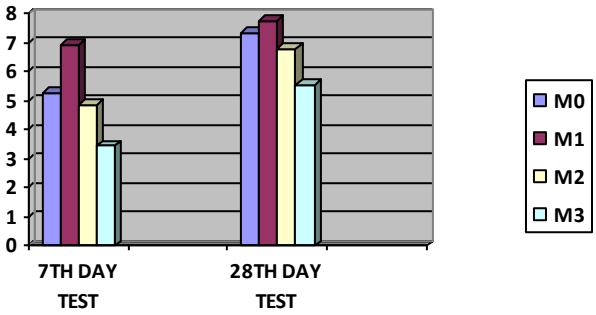


Fig 5.2 Comparison of split tensile test values

5.3 Flexural strength

Experimental results for beam flexural strength for mix M0,M1,M2 and M3 for 7 and 28 days are tabulated in table 5.3.

Table 5.3 7th and 28th day compression test values

Concrete Mix design	7th day N/mm2	28 day N/mm2
M_0	1.27	1.76
M_1	1.55	1.96
M_2	1.13	1.6
M_3	1.05	1.45

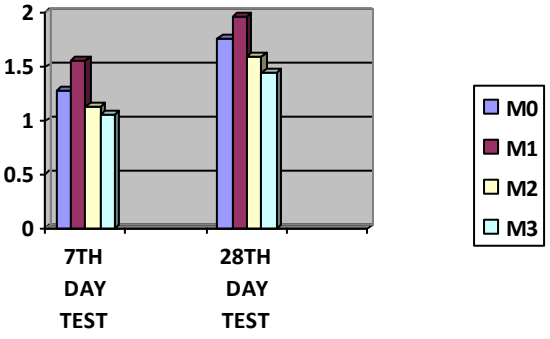


Fig 5.3 Comparison of flexural test values

6. CONCLUSIONS

The concrete mix planned for this study with partial replacement of saw dust and quarry dust found possible and economic based on previous studied. In this study sand is partially replaced by industrial by product sawdust and quarry dust. The following points are arrived from the present study.

- Testing of concrete moulds with various percentage replacement of o%,5%,10% and 15% of saw dust and 50%,45%,40% and 35% of quarry dust.
- The compressive strength has been increased for 50% replacement of quarry dust alone for a 28 days strength compared to conventional mix. So upto 50% of fine aggregate can be replaced by quarry dust.
- Further testing shown as that the design with 5% of saw dust, 45% quarry dust and 50% of sand also archived the desirable strength proving it economical then the other mixes due to more quantity of material replacement thus reducing the cost compare the conventional mix`
- By replacement of quarry dust and saw dust the cost of construction will be minimized by effective utilization of waste product and also reduce the environmental effect.

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IS 10262-2009 (Concrete mix proportioning-guidelines.)

IS 383-1970 (Specifications for fine & coarse aggregate from natural sources for concrete.)