An Analysis on Strength Properties of Concrete Utilizing Natural Waste

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Abstract— Over recent years a rapid development in the field of concrete technology has taken place. Concrete has become the most popular construction material. Even common people have started using concrete in a big way. Thus, based on natural minerals aggregate it is now possible to produce concrete with compressive strengths of up to 230 MPa. If natural mineral aggregate is replaced by high quality ceramic aggregate, compressive strengths up to 500 MPa can be achieved. Also, over recent years however many relatively new concrete structures and industrial products have shown a poor performance. It is great challenge, therefore both to utilize and apply and also further develop existing technology on high performance concrete to the benefit of both the concrete industry and the society. In recent study many new materials are used as a partial replacement material in concrete which can increase its properties of the concrete such material as limestone, marble dust, wooden husk, rice husk etc.

Keywords: Concrete, Natural Waste, Aggregate, Compressive strength, Tensile strength, Cement

I. INTRODUCTION

Engineers and researchers currently center around the utilization of normal materials for the advancement of composite materials. Composites are materials with predominant properties for instance glass fiber composites, which made conceivable the development of designs, which are light weight yet exceptionally solid. Kevlar, Glass and Carbon fiber built up composites are broadly utilized for super advanced applications and are pricey and unsatisfactory for low-tech applications. The expansion in cost and impact on climate because of composite strandshave constrained the researcher and designers to incorporate new materials and composites which other than having their required explicit actual properties are financially savvy as well as harmless to the ecosystem. The utilization of Natural filaments over engineered strands as fortifications in tar grid has acquired energy in last ten years.

A. CONCRETE

In construction field concrete is main construction material across the world and is mostly used in all types of civil engineering works. An aggregate represents about 70-80% of concrete components so it will be beneficial to recycle the aggregate for construction works and also to solve the environmental problems. To minimize the problem of excess of waste material it is a good step to utilize the recycled aggregates provide that the desired final product will meet the standards. The Cost of Recycled Concrete Aggregate may be less than 20 to 30 % less than natural aggregate in some Regions. Protection of environment is a basic factor which is directly connected with the survival of the human race. Parameters like environmental consciousness, protection of natural resources, sustainable development, play an important role in modern requirements of construction works.

B. Objectives

- Effect of use of wooden dust on workability.
- wooden powder in concrete that makes the structure lighter inweight.
- Effect on compression strength of concrete by using wooden dust.
- To give a solution regarding disposal of wooden dust whichcreates environmental
- pollution mainly landfill.
- Utilization of used coarse aggregate.
- Minimizing the cost of concrete.

II. LITERATUREREVIEW

Dilip Kumar, Smita Singh, Neetesh Kumar and Ashish Gupta: In this Research paper, it was experimentally carried out to investigate the effects of introducing the cost between sand used concrete block and sawdust used concrete block. For preparation of the concrete cube blocks we are using coarse aggregate, sand (fine aggregate), cement, water and sawdust to mix it. Using some percentage of sawdust in place of sand in concrete is used. they replace 10%, 15% and 20% of sawdust instead of sand while other things are same. After moulding of the cube they are going to see the variation in weight between the initially concrete block and the sawdust concrete block. The unit density of the concrete block is also tested.

Ushama Z. Laliwala and Asst. Prof. Paresh N. Nimodiya: As per author the partial replacement of the Limestone and Wooden Dust with the different percentage in the concrete and to check the properties of the concrete by comparing with the conventional concrete. The most important properties of concrete are the strength in compression. When increasing the limestone and the wooden dust incorporation caused decreases in unit weights and compressive strength of specimen with an equivalent increase in water absorption values at all ages.

Goudappa Biradar: As per Mr. Goudappa recycled aggregates concrete utilizes materials from concrete and masonry constructions. Reuse of demolition waste avoids the problem of waste disposal and is also helpful in reducing the gap between demand and supply of fresh aggregate. Mix designs can be made using recycled aggregate for structural concrete elements instead of disposing off the recycled concrete to achieve economy .Based on the results Mr. Goudappa obtained from the experiment, the compressive of the recycled aggregate concrete is found to be lower than the natural aggregate and the strength of recycled aggregate concrete can be improved by the water and acid treatments.

Mrs.J.Thivya, Yokesh Ram.B: As per Mrs. Yokesh Ram, etal recycling of concrete wastes will show the way to reduction in landfill places and preserves ordinary resources.

Not only that, concrete which is a brittle material tends to crack which exposes the reinforcement to atmosphere which inturn induce problems and affect the structural integrity of the structure. Self-Healing concrete in general rectifies these flaws. As per the test results it was contingent, which percentage gave better results than the conventional concrete with respect to 7,14 and28 days Compressive strength, Split tensile strength and Flexural strength when replaced with Recycled Aggregates.

III. METHODOLOGY

A. Initial and Final Setting Time

1) INITIAL SETTING TIME: (AS per IS: 4031 (part 5)1988)

Initial setting time of cement experiment calculate duration in which cement loses its plasticity. This test is to be conducted on the same mould in continuation. This test is to be conducted to determine the total time taken for the setting of cement. After the initial setting of cement is complete minor external disturbances will not produce any change in the shape of concrete. Initial setting time should not be less than 30 minutes.

2) FINAL SETTING TIME: (As per IS: 269-1958)

This time should not be more than 10 hours which is referred to as final setting time. Prepare a paste of 300gm of cement with 0.85 times the water required to a give a paste of standard consistency IS 4031(part 4) 1988.

B. SPECIFIC GRAVITY TEST (According to IS 4031-1988)

The specific gravity is defined as the ratio of the mass of the cement to the mass of an equal volume of kerosene. Clean and dry the lee chattier flask.

Specific gravity = weight of cement / volume of kerosene read from the flask

C. Sieve Analysis for Dry TWD

APPARATUS REQUIRED

1) IS Sieves of various sizes

PROCEDURE

1) About 1kg of Dry TWD sample is taken in the set of IS sieve from 4.75mm trough 150 micron and
2) sieved in a sieve for 15 min.
3) The weight of Dry TWD retained on each sieve is noted.
4) The cumulative percentage passing in determined.
5) This is compared with the following table and the sand is zoned accordingly.

D. Sieve Analysis of Aggregate

- The aggregate which pass through 75 mm IS sieve and entirely retain on 4.75 mm
- IS sieve is known as coarse aggregate. It may be crushed gravel or stone.
- IS sieve of coarse Aggregate 40mm, 25mm, 20mm, 16mm, 10mm, 4.75mm.
- Fineness Modulus of Coarse Aggregates:

$$FM = \frac{Sum\ of\ cumulative\ \%retained}{100}$$

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IV. TEST RESULT

A. Sand replaced by Teak Wood Dust with different percentage

Name	N1	TW1	TW2	TW3	TW4
% Teak Wood Dust particle	0	15	25	35	45
Slump Value(mm)	255	258	264	272	278
Slump (mm)	45	42	36	28	22

Table 1: Slump Cone Test Results

B. Coarse Aggregate replaced by Recycled Aggregate with different percentage

S.No	Name	Quantity per cubic meter (Kg)					Average Compressive strength In N/mm sq		
		Cement	Sand	Aggregate	Teak Wood Dust		7 Days	14 Days	28 Days
					%	Amount			
1	N1	384.35	614.0	1264	0	-	23.10	28.45	32.67
2	TW 1	384.35	521.9	1264	15	92.1	23.59	29.78	33.48
3	TW 2	384.35	460.5	1264	25	153.5	24.08	30.25	33.78
4	TW 3	384.35	399.1	1264	35	214.9	23.96	28.45	32.33
5	TW 4	384.35	337.7	1264	45	276.3	23.45	27.20	28.92

Table 2: Compressive Strength of Sample – 1

C. Coarse Aggregate replaced by Recycled Aggregate with different percentage

S.No	Name	Quantity per cubic meter (Kg)					Average Compressive strength In N/mm sq		
		Cement	Sand	Aggregate	RCA		7 Days	14 Days	28 Days
					%	Amount			
1	N1	433	614	1264.00	0	0	23.10	28.45	32.67
2	RCA 1	433	614	1074.40	15	189.60	24.05	30.20	33.87

3	RCA 2	433	614	948.00	25	316.00	24.56	31.25	34.47
4	RCA 3	433	614	821.60	35	442.40	24.11	30.67	33.34
5	RCA 4	433	614	695.20	45	568.80	24.05	29.96	33.18

Table 3: Compressive Strength of Sample - 2

D. Coarse Aggregate replaced by Recycled Aggregate with different percentage

S.No	Name	Quantity per cubic meter (Kg)					Average Compressive strength In MPa		
		Cement	Sand	Aggregate	Teak Wood Dust	RCA	7 Days	14 Days	28 Days
1	N	433	614	1264.00	0	0	23.10	28.45	32.67
2	RATD	433	460.5	948.00	153.5	316.00	25.30	30.28	34.82

Table 4: Compressive Strength of Sample – 3

E. Tensile Strength of Concrete (Split Tensile Strength)

Dust with different percentage AGGREGATE REPLACED WITH RECYCLED AGGREGATE

S.No	Nam e	Quantity per cubic meter (Kg)					Average Split Tensile strength In MPa		
		Cement	Sand	Aggregate	Teak Wood Dust		7 Days	14 Days	28 Days
					%	Amount			
1.	N1	433	614	1192	0	-	0.94	1.58	2.43
2.	TW 1	433	583.3	1192	15	30.7	1.08	1.66	2.72
3.	TW 2	433	552.6	1192	25	61.4	1.40	1.72	2.94
4.	TW 3	433	521.9	1192	35	92.1	1.28	1.64	2.14
5.	TW 4	433	491.2	1192	45	122.8	1.10	1.47	2.09

Table 5: Split Tensile Strength of Sample - 1: Sand replaced by Teak Wood

Dust with different percentage AGGREGATE REPLACED WITH RECYCLED AGGREGATE

S.No	Name	Quantity per cubic meter (Kg)					Average Split Tensile strength In MPa		
		Cement	Sand	Aggregate	RCA		7 Days	14 Days	28 Days
					%	Amount			
1.	N1	433	614	1192	0	-	0.94	1.58	2.43
2.	RCA1	433	583.3	1192	15	30.7	1.08	1.66	2.72
3.	RCA2	433	552.6	1192	25	61.4	1.40	1.72	2.94
4.	RCA3	433	521.9	1192	35	92.1	1.38	1.64	2.64
5.	RCA4	433	491.2	1192	45	122.8	1.20	1.47	2.39

Table 6: Split Tensile Strength of Sample - 2: Sand replaced by Teak Wood

S.No	Name	Quantity per cubic meter (Kg)					Average Split Tensile strength In MPa (Days)		
		Cement	Sand	Aggregate	TWD	RCA	7	14	28
1	N	433	614	1264.00	0	0	0.94	1.58	2.43
2	RATD	433	460.5	948.00	153.5	316.00	1.52	2.04	3.22

Table 7: Split Tensile Strength of Sample - 3: Sand Replaced By Teak Wood Dust and Coarse Aggregate Replaced By Recycled

V. CONCLUSION

From the test results, graph sand the relative -chemical composition of the specimen a number of conclusions can be drawn. The conclusions drawn are:

1) From the test result it is observed that the Workability of concrete with partial use of teak wood increases.
2) The Compressive Strength of partially replaced sand by teak wood in concrete of grade M 20 for proportions of 0%, 15%, 25%, 35% and 45% are 32.67 MPa, 33.48 MPa, 33.78 MPa, 32.33MPa and 28.92 MPa respectively at 28th day of curing. The Compressive Strength increases up to 35% of use of teak wood further it starts decreasing.
3) The Compressive Strength of recycled aggregate by aggregate in concrete of grade M 20 for proportions of 0%, 15%, 25%, 35% and 45% are 32.67 MPa, 33.87 MPa, 34.47 MPa, 35.34MPa and 34.18 MPa respectively at 28th day of curing. The Compressive Strength increases upto 35% of use of recycled aggregate further it starts decreasing.
4) The Split Tensile strength of partially replaced sand by teak wood in concrete of grade M 20 for proportions of 0%, 15%, 25%, 35% and 45% are 2.43MPa, 2.76MPa, 2.85MPa, 2.64MPa and 2.39MPa respectively at 28th day of curing. The Split tensile Strength increases upto 25%.
5) The Split Tensile strength of partially replaced aggregate by recycled aggregate in concrete of grade M 20 for proportions of 0%, 15%, 25%, 35% and 45% are 2.43MPa, 2.72MPa,2.94MPa, 2.14MPa and 2.09MPa

respectively at 28th day of curing. The Split tensile Strength increases upto 25%.

6) From the above result, we understood that 25% of partial replacement of teak wood dust as well as recycled aggregate gives good result. Thus by using both material with 25% replacement is compared with conventional concrete.
7) The compressive strength of concrete with new combination is 34.82MPa whereas the strength of conventional concrete is 32.67MPa. The strength is increased by 6.17%.
8) The Split tensile strength of concrete with new combination is 3.22MPa whereas the strength of conventional concrete is 2.43MPa. The strength is increased by 24.53%.
9) Water absorption capacity increases with increasing percentage of wooden powder. Larger absorption of water causes the reduction in the strength.
10) Teak wood is obtained at very low no cost, the cost of concrete can potentially be reduced by replacing sand with TWD in concrete.

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