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STUDY ON STRENGTH OF TIMBERCRETE BLOCKS

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Abstract - *This experiment is aimed to investigate the properties of the timbercrete blocks. Due to rapid growth in civil engineering field, the demand for the river sand is increasing day by day. So the world needs an alternate for the fine aggregate. The partial replacement for the sand is to be done with sawdust. Sawdust replacement is done as 10%, 20%, 30%, 40%, 50% for the fine aggregate by weight and their effects are observed. Saw dust usage in concrete allows disposal of water and make concrete light in weight. Solid blocks of size 400mm x 160mm x 190mm were casted and compressive strength test, water absorption test were carried out on blocks after 28 days of curing. No admixtures were used for bonding of saw dust with the ingredients of concrete. Saw dust usage in concrete allows disposal of water and make concrete light in weight. Solid blocks of size 400mm x 160mm x 190mm were casted and compressive strength test, water absorption test were carried out on blocks after 28 days of curing. No admixtures were used for bonding of saw dust with the ingredients of concrete.*

Keywords: Saw dust, Concrete, Compressive strength, Water absorption, Light weight concrete, Fine aggregate

1. INTRODUCTION

Timbercrete is an award-winning, environmentally sensitive building material that has many advantages over clay and concrete bricks. Whether used as bricks, blocks, panels or pavers, its comprehensive performance and benefits to the environment are impressive. This unique product can be moulded or pressed into a vast range of sizes, shapes, colours and textures. It can be used for residential, industrial and commercial construction, as well as landscaping and a range of other applications. Timbercrete is the only structural brick or block product on Australian market that traps carbon which would normally end up as greenhouses gases in our atmosphere.

In developing countries construction is the first priority. Everyday there is new proposal for a new project. There is a massive demand of residential as well as non residential or commercial buildings. The day the construction starts the value of the project keeps on increasing because of the material that is being used. There are such materials that are used very commonly in a construction project which can be taken in consideration for low cost type of construction. Many attempts have been made earlier to reduce the cost by replacing many materials that are to be used with agricultural wastes, disposed materials, etc. One of the materials that can be used for replacement of certain raw materials for the production of main component can be raw sawdust which can easily be obtained from various furniture and wood industries. On the other hand this waste product of wood industry will be well utilised rather than disposing it off by burning. There is an increase in the demand of concrete everywhere where the construction is required. The ingredients that are required for concreting includes fine aggregate which is being used very effectively almost in each construction work. Even today the blocks for partitions are made of concrete. This can lead to the scarcity of the fine aggregate. As the time passes the demand of the sand will increase, a second alternative is required that can fulfil the demand up to some extent in various research studies saw dust has also been used in the form of ashes, but to convert the saw dust into ashes the sawdust has to be burnt, which will lead to emitting of carbon dioxide, carbon mono oxide etc. Excess of carbon in the atmosphere leads to various health hazards. For the timber industry it becomes a big problem to dispose of the timber waste without burning, as larger the industry larger will be the waste product. The remedy for such type of problems is to use the sawdust in such a way that the solution should not be harmful to anyone and should be useful to the industries relating. The sawdust can be used in place of fine aggregate while making solid blocks. The weight of which is then reduced as sawdust is very light in weight. Being light the load on the structure due to the blocks would reduce resulting in more efficient as the floors of building can be increased as per demand. In this study attempts were made to produce a new product 'timbercrete' by utilization of sawdust in concrete in the place of fine aggregates.

2. OBJECTIVES

- To utilize the saw dust produced from saw mill other than energy production.
- To make the comparative study of the strength and nature of conventional and timbercrete blocks made using saw dust.

3. MATERIAL USED

The materials that are to be used have to be checked as per IS Code recommendations.

Cement: It is Chettinad cement of 53 grade. All the tests are to be performed as per IS Standard, to ensure the quality of the cement.

Fine Aggregate: The fine aggregate is locally available m-sand tested as per the requirements of the IS code.

Sawdust: The locally available sawdust obtained from the furniture industries which use trees such as teak and eucalyptus. To maintain the standards the sawdust is passed from 2.36mm and retained on 1.18mm IS sieve. It is done so that the dry material can be homogeneously mixed with ease.

Water: Portable water or tap water is used.

Table 1: Properties of cement

	Test conducted	Attained value	Allowable value
Cement (OPC 53 Grade)	Fineness test	4.3%	3% - 6%
	Standard consistency test	29%	26% - 33%
	Setting time test	24 minutes	30 minutes

Table 2: Mix proportion

Saw dust %	Cement (kg)	M-Sand (kg)	Aggregate chips (kg)	Saw dust (kg)
Conventional (0)	12.5	30	45	0
10	12.5	27	45	3
20	12.5	24	45	6
30	12.5	21	45	9
40	12.5	18	45	12
50	12.5	15	45	15

Table 3: Sieve analysis of saw dust

Sieve size	Weight retained (g)	% weight retained	Cumulative retained %	Cumulative passing %
4.75 mm	14	14	14	86
2.36 mm	20	20	34	66
1.18 mm	22	22	56	44
600 µm	16	16	72	28
425 µm	08	08	80	20
300 µm	04	04	84	16
150 µm	06	06	90	10
75 µm	04	04	94	06
Pan	06	-	-	-

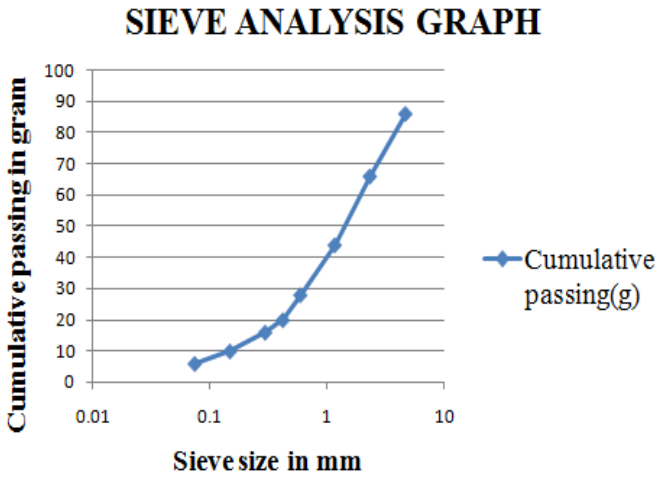

Fig 1. Graphical Representation

4. EXPERIMENTAL WORK

The experimental work carried out in this research work involves, evaluation of material properties, casting of solid blocks, for compressive strength determination and testing of solid blocks.

Fig 2. Dry mix for casting of solid blocks

Fig 3. Casting of solid blocks

Fig 4. Casted solid blocks

5. METHOD

The mix contains ingredients such as cement (OPC), fine aggregate, sawdust.The fine aggregate, cementand sawdust are mixed. The mixtures are together mixed vigorously. Water is added as per study and mixed. For this work standard sized blocks of 400mm X 160mm X 190mm are made of nominal mix of 1:6, first with fine aggregate and then by replacing the same with sawdust of different proportions (10, 20, 30, 40, and 50 %). The sawdust to be added is in the percentage of the weight of the dry mix. The water to be added in such a way that the mix should not remain dry or else there can be failure in bonding. As the quantity of the sawdust increases the water increases causing failure in the bonding of the sawdust with rest of the mix. The time consumption on making the moulds is very less. Due to which there are number of lumps that result in voids and further in failure of the blocks while testing for compressive strength. Solid blocks are casted and they are kept for curing under moist conditions. The cubes will be air dried before testing. The test of the compressive strength and self weight after 28 days is performed

6. TESTING

After the curing period of 28 days, the solid blocks were kept for 24 hours in a dry state and then they were cleanoced to remove grit and dirt. The solid blocks were tested in compressive testing machine (CTM) to evaluate the compressive strength of solid blocks and water absorption test was also conducted for solid blocks by immersing it into the water for 24 hours.

Fig 5. Solid blocks immersed in water for absorption test

Fig 6. Compressive loading on solid block

Fig 7. Failure on solid block

7. RESULTS AND DISCUSSION

The SAMPLE 1 is made of the nominal mix 1:6 i.e., 1 part of cement and 6 parts of mixed aggregates(60% of coarse aggregate and 40% of fine aggregate) and the other samples are made consecutively by replacing the fine aggregate as per the different percentages (10, 20, 30, 40, 50). The compressive strength is checked after 28 days after the casting of the blocks. At the time of mixing it is taken care that the water is added in such a way that firstly half of the mix ix prepared by adding water and then the remaining water is added the previous amount of water is thoroughly mixed. This is done to avoid the use of by the cement in first attempt. If this happens then the sawdust will not get mixed with ingredients properly. The curing is done continuously in a moist condition. Curing can be done by wrapping the sample with a jute bag and keeping it moist by adding water after some interval of time before it gets dry or submerge the sample in a bucket full of saturated sand. It is to be taken under consideration that sand has to be same that is being used for making the samples. At the time of the testing it has been observed that the samples made of sawdust gives up to 90 % value of compression on the 28th day of testing. The observations are given in the tabular form. The data clearly concludes the desired amount of the sawdust for the required result. The graphical presentation gives the clear view of the experimental study.

Compressive strength as per the sawdust percentage:

Table 1: Compressive strength comparison

Sawdust %	Compressive strength for 28 days (N/mm²)			
	Trial 1	Trial 2	Trial 3	Mean
0	5.65	5.53	5.9	5.69
10	5.14	5.21	5.15	5.16
20	3.2	3.25	3.12	3.2
30	1.87	1.96	1.79	1.87
40	0.93	0.85	0.81	0.85
50	0.3	0.4	0.31	0.33

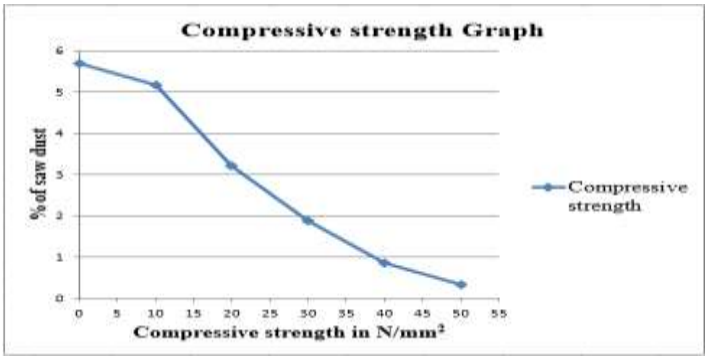

Fig 1. Graphical Representation

Water absorption as per the sawdust percentage:

Table 2: Water absorption comparison

Sawdust %	Water absorption (%)
0	0.41
10	3.88
20	5.00
30	6.30
40	7.00
50	8.20

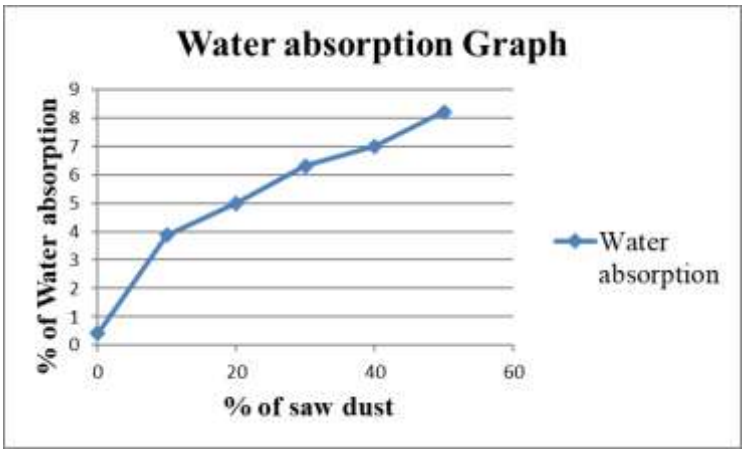

Fig 2. Graphical Representation

8. CONCLUSIONS

The experimental study helped to gain certain points of conclusion:

1. This project interprets the test results of the strength of the timbercrete blocks.
2. From this project we have learned the properties of the timbercrete blocks.
3. Major advantage seen is that it absorbs heat during daytime and makes the surface cooler.
4. The major part of this project is to test the compressive strength of the casted timbercrete blocks.
5. From the result, we have obtained appropriate replacement percentage for sawdust. It is around 10%.
6. However more than 10 percentage replacement is not satisfactory as it affects the strength of the blocks.
7. Another problem yet to be faced is that the usage of water increases with the increase in sawdust replacement.

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