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UTILIZATION OF SAW DUST FOR DEVELOPMENT OF LIGHT WEIGHT CONCRETE

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ABSTRACT

In the current situation, a variety of constructions, from standard residential buildings to skyscraper structures, are under construction. Concrete is always used extensively in the building of all the structures. Cement, fine aggregate (River sand), coarse aggregate, water, and admixtures of various kinds, depending on the circumstances, are the usual ingredients of concrete. Good sand is currently taken out of riverbeds and moved over great distances. Sand mining has grown to be a significant problem that is endangering the ecosystem and increasing the risk of flooding and water flow disruption. However, the resources are also running out quite quickly and cheaply. The purpose of this experimental investigation is to substitute sawdust for fine aggregate in a concrete mixture. It is also used to examine how sawdust concrete affects workability, aggregate adhesion, and other factors. The weight differential between the initial concrete and the sawdust concrete block is also measured after the concrete block has been prepared. The percentages of sawdust added to M20 concrete are as follows: 0%, 2.5%, 5.0%, 7.5%, 10%, and 12.5%. Following that, different tests are carried out on both freshly laid concrete (slump cone test) and hardened concrete (compressive strength).

Keywords: compaction factor test, slump cone test, sawdust, M20 concrete, and compressive strength

1. INTRODUCTION

1.1 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, aggregates, water in definite water cement ratio for better performance of concrete. Use of waste material (saw dust) in place of sand up to a certain proportion with all other ingredients modifies the properties of concrete. However, by reducing content of sand and using waste material makes concrete light in weight. Generally concrete is a composite mixture of binding material, filler material (coarse & fine aggregate) & water; which combines the whole mass. The aim of concrete mix design is to achieve maximum durability and compressive strength as possible as without any compromise with the quality. Engineers and scientists are further trying to increase its limits with the help of innovative chemical admixtures and various supplementary binding & filler materials along with modified manufacturing techniques. Now a day's lots of technology is used in the field

of concrete technology that modifies concrete properties. 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. Thus, the properties such as workability, compression test, elongation index etc. of concrete changes.

1.2 Sawdust

Sawdust is obtained from wood. The sawdust consists of chippings from various hardwoods. The small particles of wood or other material that fall from an object being sawed. Sawdust or wood dust is a by-product of cutting, grinding, drilling, sanding, or otherwise pulverizing wood with a saw or other tool 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 as the woodpecker and carpenter ant. It was sundried and kept in waterproof bags.

Fig. 1: Saw dust.

2. LITERATURE REVIEW

Partial Replacement of Fine Aggregate with Sawdust for Concrete - Albert M Joy, Aayena K Jolly, Anju Merin Raju, Bobina Elizabeth Joseph

- 28-day compressive strength and splitting tensile strength of the concrete is not increased to large extent but it almost matches with the compressive and splitting tensile strength of nominal mix concrete.
- The compressive strength obtained for the replacement of fine aggregate with 25% sawdust was proved to be the optimum mix to get M25 grade of concrete
- The flexural strength of sawdust-cement-concrete are gradually increasing as the percentage of partial replacement of fine aggregate with sawdust increases as the fibre content in sawdust is very high and is responsible for the increase of strength.
- Weight of the sawdust concrete was reduced as compared with normal concrete and also become more economical.

- Every percentage of increase of saw dust replaced by fine aggregates; increases the compressive, tensile and flexural strength.
- Ultimate increase in compressive, tensile and flexural strengths of saw dust concrete is identified as 35.92, 4.01 and 3.65 respectively.
- The result concluded the saw dust increases 30% of characteristic strength of concrete.
- It is clearly identified that the saw dust increases the crack arresting property of the concrete with the increment of saw dust. Hence it proves that the added percentage of saw dust controls the cracks and arrests the porous available in concrete.
- Addition of minimal percentage saw dust itself increases the compressive strength in higher manner. So, it is preferable and economical when the places required high compressive strength instead of going special cements.

3. OBJECTIVE AND METHODOLOGY

3.1 Objective of The Project

The experiment was carried out to overcome the problems created due to huge requirement of the raw material for manufacturing of conventional building material and also to minimize hazards caused by industrial waste on the environment, some other objectives are:

- To use the saw dust in the new concrete as this type of concrete aggregate reduces the environmental pollution as well as providing an economic value for the waste material.
- To study the utilization of saw dust as a partial replacement in the fine aggregate.
- Our experimental research tries to implicate that sawdust-cement-gravel mix has an equal advantage like the standard mix of cement-sand-grave
- To study the physical properties of saw dust by conducting experimental work.
- To cast specified number of cubes, cylinders by replacing fine aggregate with sawdust by 2.5%, 5%, 7.5%, 10% & 12.5% and to compare their property with standard mix(M20).
- To development of alternate low cost and environment suitable building materials from industrial wastes in an economical way.
- Importance must be given to cheap and locally available building materials and hence it is necessary to check and utilize the suitable waste products to replace some of the coarse aggregate.

3.2 METHODOLOGY

The methodology we follow for recycling of concrete are as follows

- Select a grade of concrete for which a conventional mix is to be done.
- Now, materials required for preparation for conventional concrete must be brought and material testing must be done in the laboratory before mix is prepared.
- All the physical tests on the aggregates have to be done are
- IS:2386 (PART I) - Particle size and shape

- IS:2386 (PART III) – Specific gravity, Water Absorption
- Also find the properties of the cement which is used in the mix
- Now, using IS 10262:2009 design the suitable mix for required grade of a conventional concrete by considering the physical properties of the material.
- Using the above mix design prepare the mix and workability test has been done and 9 cubes for each mix and casted to find the 7days, 14 days and 28 days strength of the concrete.
- Physical properties of this saw dust are been found and accordingly we adjust the water content for the new mix design and we find strength of the concrete by preparing the cubes of different proportions
- Now, the cubes are tested for compressive strength and compare for best combination of saw dust and fine aggregate.

3.2.1 Mix design

In this project we are adopted M20 (1:1.5:3) grade of concrete

Table. 1: Weight of materials M20 grade for 1 cube.

MIX %	CEMENT (kg)	FA (kg)	SAW DUST (kg)	CA (kg)	WATER (kg)
0	1.496	2.49	0	5.61	0.823
2.5		2.427	0.062		
5		2.366	0.124		
7.5		2.304	0.186		
10		2.241	0.249		
12.5		2.179	0.311		

4. EXPERIMENTAL INVESTIGATION

The required quantities of materials weighed as per mix design mix it upto uniform color. The fine aggregate replacing with saw dust by 0% to 12.5% with an internal of 2.5% and all other materials in the concrete kept constant i.e: cement, coarse aggregate and water. Freshly prepared concrete tested by slump test. The cube samples are prepared to check compressive strength value of the mixes.

Fig. 2: Mixing of ingredients.

Fig. 3: Cube casting.

Fig. 4: Water curing.

4.1 FRESH PROPERTIES OF CONCRETE (WORKABILITY TEST)

4.1.1 Slump Test

which can be employed either in laboratory or at site of work. It is not a suitable method for very wet or very dry concrete. It does not measure all factors contributing to workability, nor

is it always representative of the placability of the concrete. It is not a suitable method for very wet or very dry concrete. It does not measure all factor contributing to workability. The slump test was carried in accordance with B.S:1882 PART2:1970.

Fig. 5: Slump cone test.

4.2 HARDEN PROPERTIES OF CONCRETE

4.2.1 Compressive Test

Out of many tests applied to the concrete, this is the utmost important which gives an idea about all the characteristics of concrete. By this single test one judge that whether Concreting has been done properly or not. For cube test two types of specimens either cubes of 15 cm X 15 cm X 15 cm or 10cm X 10 cm x 10 cm depending upon the size of aggregate are used. For most of the works cubical moulds of size 15 cm x 15cm x 15 cm are commonly used.This concrete is poured in the mould and tempered properly so as not to have any voids. After 24 hours these moulds are removed and test specimens are put in water for curing. The top surface of these specimen should be made even and smooth. This is done by putting cement paste and spreading smoothly on whole area of specimen. These specimens are tested by compression testing machine after 7 days curing or 28 days curing. Load should be applied gradually at the rate of 140 kg/cm2 per minute till the Specimens fails. Load at the failure divided by area of specimen gives the compressive strength of concrete.

Fig. 6: Compressive strength test of cube sample.

5. RESULTS AND DISCUSSION

5.1 Introduction

This chapter deals with the compressive and tensile strength test results, cubes of different mixes which are discussed earlier are prepared, for each mix design 9 cubes and. The average of 3samples values mentioned below.

5.2 Fresh Properties of Concrete (Workability Test)

5.2.1 Slump Test

Table. 2: Results of slump test.

S. No	% Of sawdust	Slump value (mm)
1	0%	70
2	2.5%	65
3	5%	55
4	7.5%	50
5	10%	43
6	12.5%	35

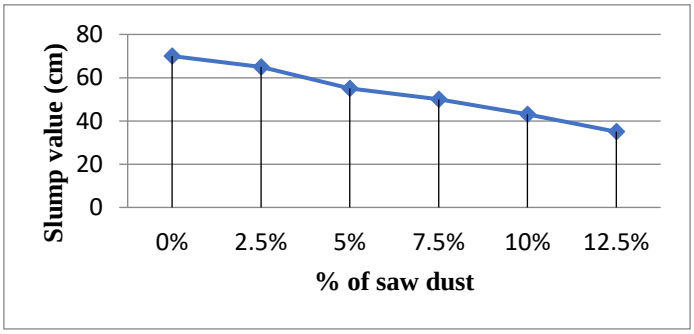

Fig. 6: Slump test results.

The above Fig. 6 shows the slump results. It was observed that, the slumps decreased as the saw dust content were increased in the mix. It was suitable for Low Workability mixes used for foundations with light reinforcement.

5.3 HARDEN PROPERTIES OF CONCRETE

5.3.1 Compressive Test Results

Table. 3: Compressive strength.

Sawdust (%)	7 days	14 days	28 days
0	16.38	23.25	26.46
2.5	15.72	22.66	25.13
5	15.06	22.08	22.15

7.5	13.20	20.65	18.69
10	11.34	19.22	15.24
12.5	9.93	14.86	14.07

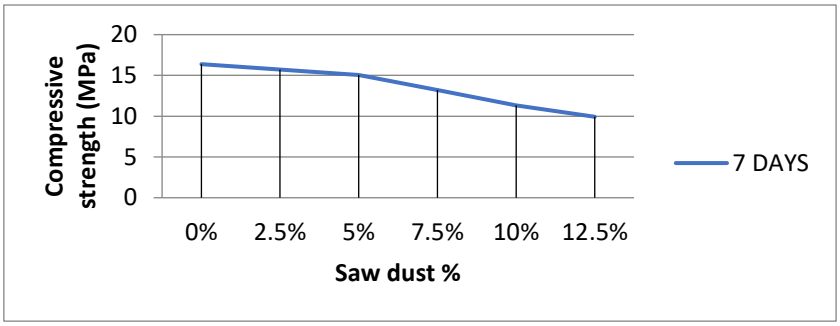

Fig. 7: 7 Days strength of different proportions of concrete.

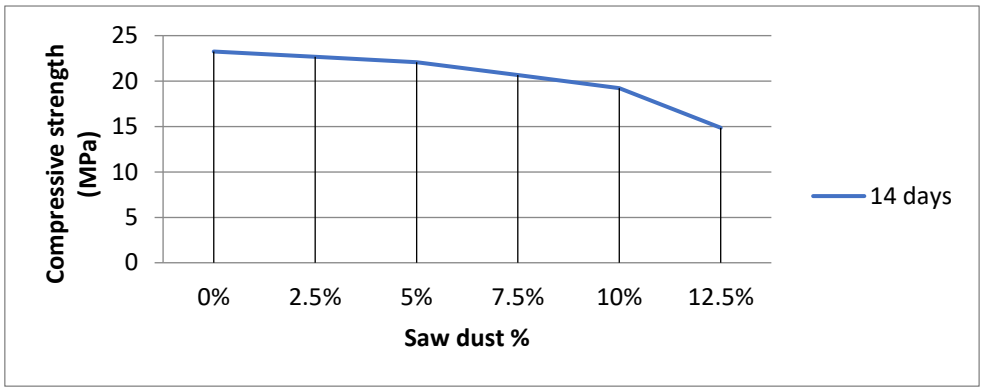

Fig. 8: 14 days strength of different proportions of concrete.

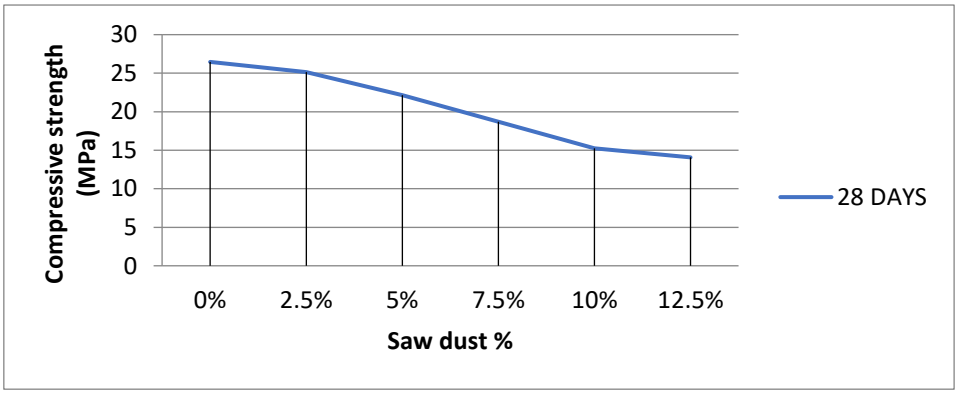

Fig. 9: 28 days strength of different proportions of concrete.

From the graphs clearly knowing that the compressive strength decreasing with increasing sawdust replacement in the fine aggregates.

5.3.2 Water absorption test results

Table. 4: Water absorption.

Sawdust (%)	A (kg)	B (kg)	Water absorption (%)

0	8.23	8.94	8.62
2.5	8.03	8.80	9.58
5	7.84	8.67	10.58
7.5	7.63	8.48	11.14
10	7.42	8.30	11.85
12.5	7.12	7.99	12.21

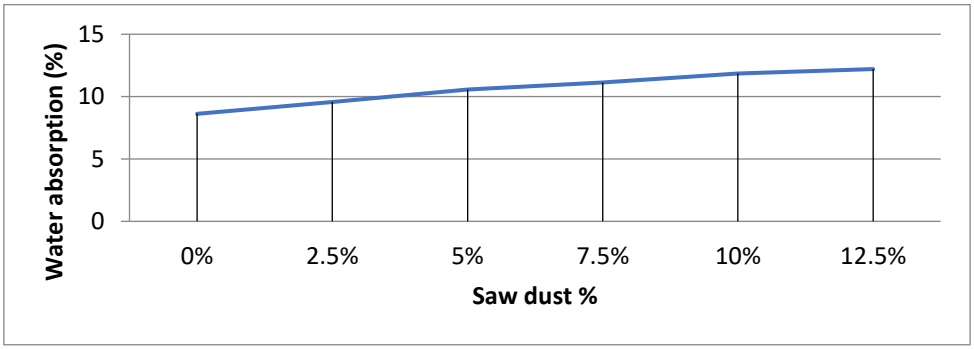

Fig. 10: Water absorption test graph.

From the Fig. 10**,** the water absorption value decreasing with increasing sawdust replacement in the fine aggregates and the weight of concrete is decreasing with increasing sawdust content.

6. CONCLUSION

1. 1. In this project, the proportion of sawdust decreased with increasing workability; therefore, it is appropriate for low-loading regions such as foundations with minimal reinforcement. Hand-operated machinery vibrated the roads.
2. 2. The compressive and tensile strength test results for this project, with a 2.5% weight replacement, are satisfactory.
3. 3. The water absorption values of sawdust-based concrete show that the water absorption value increases as the sawdust concentration does.
4. 4. The cost of production falls dramatically.
5. When sawdust is utilized as a waste in concrete, the pollution that results from burning it is reduced.

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