EFFECTIVE UTILIZATION OF SAW DUST AND CRUMB RUBBER AS PARTIAL REPLACEMENT FOR FINE AND COARSE AGGREGATE IN CONCRETE

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ABSTRACT

In our project, we focus on the possibilities of using waste materials from different manufacturing activities in the preparation of innovative concrete. The saw dust and crumb rubber from processing is a waste utilized. The use of this waste was proposed in different percentages both as an addition to and instead of fine and coarse aggregate for the production of concrete mixtures. In the study, the use of saw dust and crumb rubber are collected during the shaping process of fine material has been investigated in the concrete mixtures as sand material .The management of waste tyre rubber is very difficult for municipalities to handle because the waste tyre is not easily biodegradable even after long-period of landfill treatment Use of the waste materials not only helps in receiving them utilized in concrete, cement and other construction materials, but also has numerous oblique benefits such as reduction in earth fill cost, saving in power, and protecting environment from possible pollution effect. The concrete is prepared containing 0,2,4,6,8% waste of saw dust and crumb rubber with fine and coarse aggregate compared to the total quantity of normal concrete. The feature properties of concrete such as compressive strength & split tensile strength using the merge made by replacing crude aggregate with compressed saw dust and crumb rubber aggregate at 7 and 28days will be reviewed in the current work. Test results of compressive strength, split tensile strength of replace concrete 2% to 8% coarse aggregate replacement (C.A.R) by saw dust and crumb rubber at the end of 7, 14 and 28days.

Keywords: saw dust, crumb rubber, fine aggregate, coarse aggregate, concrete, fresh concrete test, and hardened test.

INTRODUCTION

Concrete is the most important materials in the world. Concrete containing saw dust as fine aggregate and crumb rubber as coarse aggregate is promising greater strength, greater density, low permeability which enable it.

Concrete is widely used in the buildings industry of India and other countries of the world since a long time

because of its varies advantages related to low cost, durability, availability and less time for strength in recent years, the construction industries have identified some waste materials like quarry dust or M- sand, saw dust, limestone powder etc.., for use in traditional concrete.

In the construction industry, river sand is used as an important building material, and the world consumption of sand in concrete generation alone is around 1000 tons per year, scarce and limited.

Saw dust had been proposed as an alternative to river sand that gives additional benefit to concrete.

Sand had been most important material for construction industries. Increase the cost of sand and decreasing the sand resources we replaced the sand instead of by-product materials. They are saw dust.

Concrete is a composite material composed of aggregate bonded together with fluid cement which hardens over time. Most use of the term "Concrete" refers to Portland cement concrete.

The use of rubber product is increasing every year in worldwide. Waste tires are major environmental problem for many metropolitan areas in the India. There are more than 1 billion scrap tires, approximately one tire per person, generated each year in the India.

This creates a major problem for the earth and their livings. For this issue, the easiest and cheapest way of decomposing of the rubber is by burning it. This creates smoke pollution and other toxic emission and it create global warming. Currently 75-80% of scrap tyres are buried in landfills. Burying scrap tyres in landfills is not only wasteful, but also costly.

This crumb and chipped waste tires are different to other wastes materials with a potential for re-use because there production method is now well developed, the reuse of this material in concrete could have both environmental advantage and at the same time ensure economic viability with improvement the characteristic design properties of concrete mix. It is used in many works such as Road construction, light weight construction, flooring, Mold making etc. in the form of rubber concrete.

METHODOLOGY

CEMENT

Cement is the binding material in concrete. Portland pozzolonic Cement of 53 grades was purchased from the local seller and used thought this project. Low heats Portland cement conforming to IS 12600 shall be used with adequate precaution with observe to removal of frame worked.

FINE AGGREGATE

In this project, river sand was used as fine aggregate. The size of the sand is used as 4.75mm. The specific gravity of sand using pycnometer is found to be 2.60.By conducting sieve analysis, It is found that can confirms to grading zone-II as per table IS 383-1970.

COARSE AGGREGATE

The nominal maximum size of coarse aggregate should be as large as possible within the restricted specified but

in no case greater than one-fourth of minimum thickness of the member, provided to the concrete can be placed lacking difficulty so as to surround all reinforcement thoroughly and fill concrete of the form. For most work, 20 mm aggregate is suitable.

WATER

Water used for integration and curing shall be fresh and free from injurious amount of acids, alkalis, oil, salts, sugar , nature material or other substances that may be toxic to concrete or steel .Portland water normally careful acceptable for mixing concrete .PH value of water shall be not less than 6.

SAW DUST

The saw dust is collected from Moongilthuripattu near Kalakurichi. The crumb rubber is these by-product which is formed in the processing of rocks which broken down into the coarse aggregate of different sizes.

CRUMB RUBBER

The properties of concrete using crumb rubber as coarse aggregate were investigated in an investigational learn. Compressive, split tensile, flexural strength, impact resistance and bond strength were calculated and compared with the hypothetical values as recommended by the standards.

PROPERTIES OF CEMENT

The Portland Pozzolana Cement is a kind of blended cement which is produced by either intergrading old OPC clinker along with gypsum and Pozzolanic material in certain proportion or grinding the OPC clinker, gypsum and Pozzolanic material separately blending them in certain Proportions.

Pozzolana is a natural or artificial material containing silica in a reactive form. It may be further discussion as siliceous or siliceous and aluminous material which in itself possesses little, or no cementations properties but will in finely divided from and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperature to form compounds possessing cementations properties.

SI.NO	Property	Value
1	Specific gravity	3.15
2	Fineness	Not less than225 m^2/kg
3	Initial setting time	Not less than 30mm
4	Final setting time	Not less than 600mm
5	Standard consistency	300%
6	Fineness modulus	6

The Indian standards for Portland Pozzolana Cement have been issued in two parts based on the type of Pozzolana material to be used in manufacture of Portland Pozzolana Cement as given below:

1. IS 1489 (Part I) 1991,Portland Pozzolana Cement –specification (fly ash based)
2. IS 1489 (Part 2) 1991,Portland Pozzolana Cement –specification (Calcined clay based)

   The quality of fresh or calcined clay to be used in manufacturing of PPC

is also specified by following standards:

Low heat Portland cement conforming to IS 12600: 1989 shall be used with adequate precautions with Observe to removal of frame work, etc.,

- Setting Time
- Soundness
- Fineness and strength

PROPERTIES OF FINE AGGREGATE(SAND)

These particles passing the 9.5 mm (3/8 in) sieve, almost entirely passing the 4.75 mm (No.4) sieve, and predominantly retained on the 75 µm (No.200) sieve are called fine aggregate .

PROPERTIES OF FINE AGGREGATE(SAND)

SI.NO	Property	Value
1	Water absorption	0.5%
2	Fineness Modulus	3.1
3	Specific gravity	2.8
4	Surface Texture	Smooth

PROPERTIES OF FINE AGGREGATE (SAND)

These particles passing the 9.5 mm (3/8 in) sieve, almost entirely passing the 4.75 mm (No.4) sieve, and predominantly retained on the 75 µm (No.200) sieve are called fine aggregate

PROPERTIES OF FINE AGGREGATE (SAW AGGREGATE)

SI.No	Property	Value
1	Water absorption	0.5%
2	Fineness Modulus	3.1
3	Specific gravity	2.8
4	Surface Texture	Smooth

PROPERTIES OF COARES AGGREGATE

Those particles that are predominantly retained on the 4.75 mm sieve, are called aggregate. Aggregates make up or occupy 60% to 80% of concrete volume making its highly important.

PHYSICAL PROPERTIES OF COURSE AGGREGATE (AGGREGATE & CRUMB RUBBER)

SI.NO	Property	Value of Aggregate	Crumb Rubber
1	Water absorption	0.5%	0.45%
2	Fineness Modulus	7.5	7.3
3	Specific gravity	2.8	2.78
4	Particle shape	Angular	Angular
5	Impact value	15.2	16.02
6	Crushing Value	18.6	20

PROPERTIES OF CRUMB RUBBER

I. Crumb rubber shell has high strength and modulus properties

II. It has added advantages of high lignin content. High lignin content makes the composites more weather resistance.

III. It has low cellulose content due to which it disturb less moisture as compare to other agriculture waste.

IV. Crumb rubber being naturally available in nature and since its shells are non-biodegradable.

V. They can be used readily in which may fulfill almost all the qualities of the original form of concrete.

PROPERTIES OF WATER

Water is an important ingredient of concrete as it actively participated in the chemical reaction with cement. The strength of cement concrete comes mainly from the binding action of the hydration of cement get the requirement of the water should be reduced to the required chemical reaction of un-hydrates cement as the excess water would end up in only formation undesirable voids in the hardened cement paste in water. Water mainly used for mixing the concrete.

TESTS ON FRESH AND HARDENED CONCRETE

TESTS ON FRESH CONCRETE

MEASUREMENT OF WORKABILITY

The following tests are commonly used to measure workability .The tests are

i. Slump cone tests

ii. Compaction factor

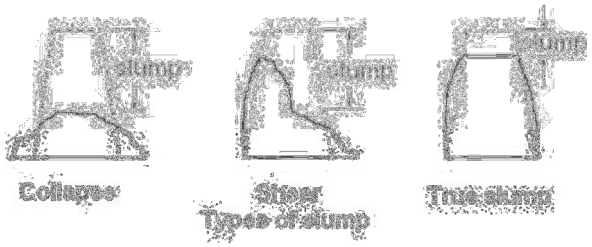
iii. Flow table

SLUMP CONE TEST

Types of slump

The slump concrete takes various shapes, and according to the profile of slumped, the slump is termed as;

- Collapse slump
- Shear slump
- True slump



Type of Slump Cone

SLUMP CONE ON FRESH CONCRETE

W/c ratio	**% of waste material added in (%)**	**Slump value in mm**
0.5	0	85
0.5	2	135
0.5	4	150
0.5	6	185
0.5	8	220

COMPACTION FACTOR TEST

Compaction factor of fresh concrete is done to determine the workability of fresh Concrete by compaction factor test. When size is about 40 mm maximum. The test is carried out as per specification of IS: 1199-1959.

COMPACTION FACTOR VALUE ON FRESH CONCRETE

w/c ratio	Percentage of waste Material added in (%)	Compaction Factor value
0.45	0	0.75
045	2	0.84
0.45	4	0.88
0.45	6	0.89
0.45	8	0.91

RESULT AND DISCUSSION

TEST ON HARDENED CONCRETE

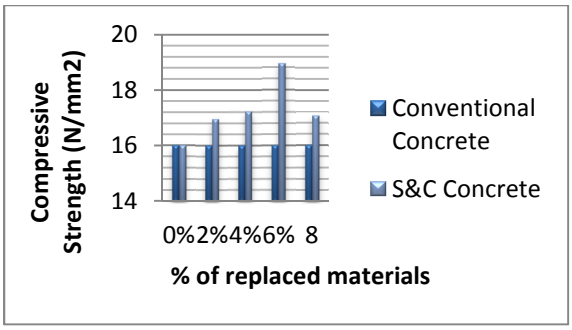
The following strength of concrete is generally determined.

1. Compressive strength of concrete
2. Split tensile strength of concrete
3. Flexural strength of concrete

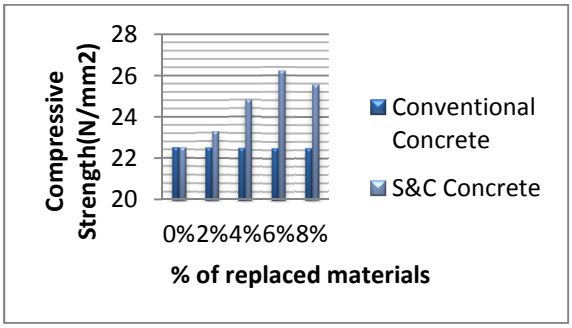
COMPRESSIVE STRENGTH TEST

Compression strength test in different percentages of Saw Dust and Crumb Rubber for 7, 14 and 28 days are shown in tables and bar chart

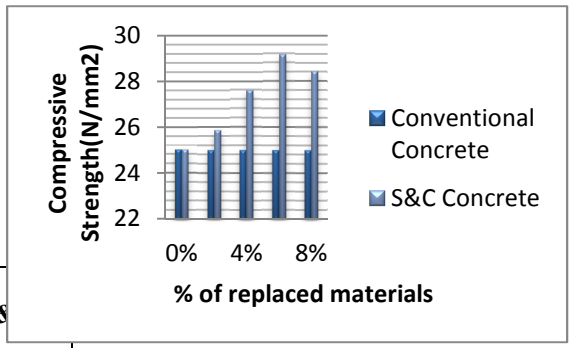
M_{25} Mix / No.of days	Conventional Concrete (N/mm^2)	2% SD& CR (N/mm^2)	4% SD& CR (N/mm^2)	6% SD& CR (N/mm^2)	8% SD& CR (N/m
7	16	**16.95**	**17.23**	**18.95**	**17.06**
14	22.5	**23.274**	**24.822**	**26.244**	**25.578**
28	25	**25.86**	**27.58**	**29.16**	**28.42**



Comparative Results in Compressive Strength of Partial Replacement with Saw Dust & Crumb Rubber of Cubes at 7 Days



Comparative Results in Compressive Strength of Partial Replacement with Saw Dust & Crumb Rubber of Cubes at 14 Days

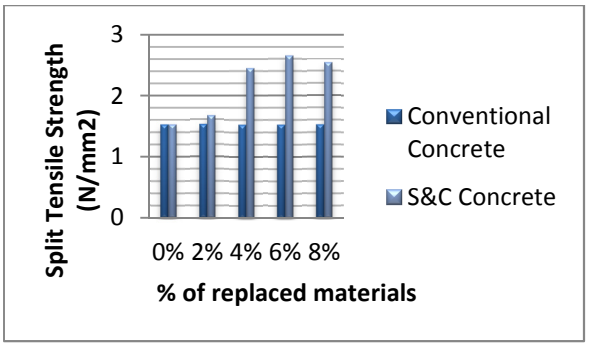


Comparative Results in Compressive Strength of Partial Replacement with Saw Dust & Crumb Rubber of Cubes at 28 Days

SPLIT TENSILE STRENGTH TEST

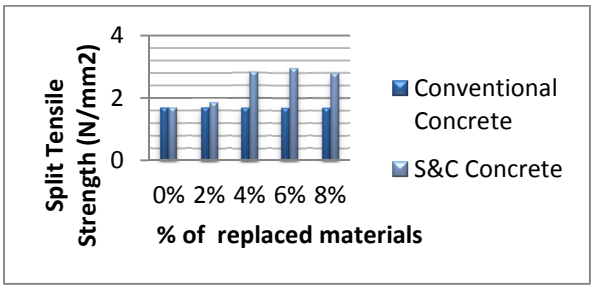
Split tensile strength test in different percentages of Saw Dust and Crumb Rubber for 7, 14 and 28 days are shown in tables and bar chart

M_{25} Mix` No. of days	Conventional concrete	2% SD& CR N/mm^2	4% SD& CR N/mm^2	6% SD& CR N/mm^2	8% SD& CR N/mm^2
7	0.848	0.986	1.827	**2.980**	2.515
14	1.527	1.667	2.447	**2.665**	2.536
28	1.697	1.852	2.83	**2.65**	2.786

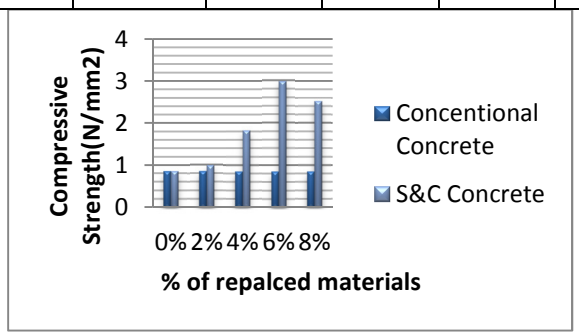


Comparative Results in Split Tensile Strength of Partial Replacement with Saw Dust & Crumb Rubber of Cubes at 14 Days

M_{25} Mix` No. of days	Conventional concrete	2% SD& CR N/mm^2	4% SD& CR N/mm^2	6% SD& CR N/mm^2	8% SD& CR N/mm^2
7	16	16.95	17.23	**18.95**	17.06
14	22.5	23.274	24.822	**26.244**	25.578
28	25	25.86	27.58	**29.16**	28.42



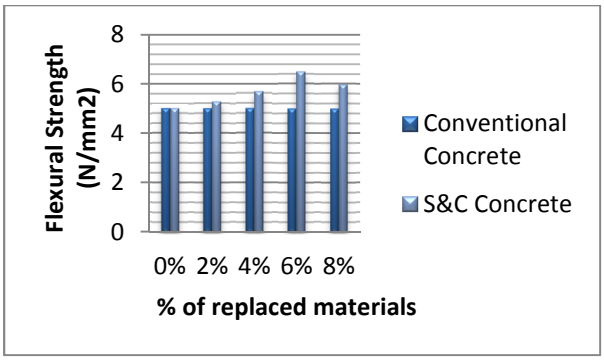
Comparative Results in Split Tensile Strength of Partial Replacement with Saw Dust & Crumb Rubber of Cubes at 28 Days



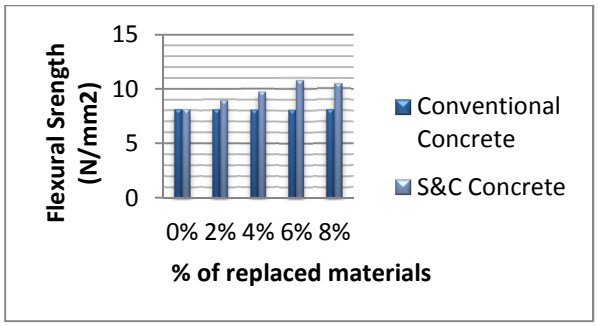
Comparative Results in Split Tensile Strength of Partial Replacement with Saw Dust & Crumb Rubber of Cubes at 7 Days

FLEXURAL STRENGTH TEST

Flexural strength test in different percentages of Saw Dust and Crumb Rubber for 7, 14 and 28 days are shown in tables and bar chart

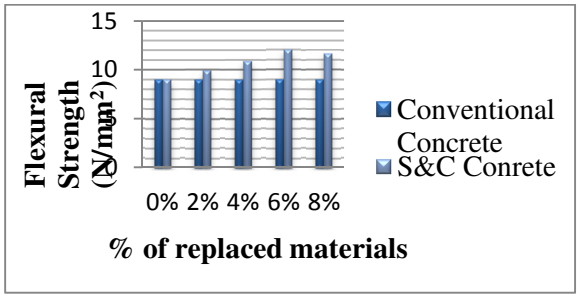


Comparative Results in Flexural Strength of Partial Replacement with Saw Dust & Crumb Rubber of Cubes at 7 Days



Comparative Results in Flexural Strength of Partial Replacement with Saw Dust & Crumb Rubber of Cubes at 14 Days

Comparative Results in Flexural Strength of



Partial Replacement with Saw Dust & Crumb Rubber of Cubes at 28 Days

CONCLUSION

- From the results of experimental investigation conducted it is concluded that the saw dust and crumb rubber can be used as a replacement for fine and coarse aggregate.
- It is found that 6% replacement of fine and coarse aggregate industrial waste give maximum result in strength and quality aspects than the conventional concrete.
- The results proved that the replacement of 6% of fine and coarse aggregate by the industrial waste induced compressive strength, split tensile strength and flexural strength is higher.

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