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Strength Analysis of Concrete Using Marble Waste and Coconut Waste

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Abstract- In building, concrete is used to cover the reinforcing elements of an element. They are manufactured from inert mineral material, cement content, water, and admixtures, among other ingredients. As a result, the purpose of this inquiry is to identify those component elements that may partly replace the ingredient of concrete. As a result, we recycle waste materials from our business, such as marble dust and coconut coir. Additionally, the strength of concrete may be determined by partly replacing cement with marble dust and adding coconut coir in various percentages with varied variations of percentages.

Keywords- Compressive strength, Workability, Coir Fiber, Marble dust (powder).

I. INTRODUCTION

Nowadays, concrete structures in India are very expensive to construct due to the high cost of materials, resources, and transportation. As a result, we make use of waste marble and waste coconut coir fibre to reduce the cost of construction. Concrete is a composite material that is used as an element in the production of concrete. Concrete is made up of several ingredients such as aggregate, sand, water, chemical admixtures, and other additives.

In this experimental inquiry, we Design M: 30 for infrastructures in accordance with Indian standards codes and codes of practise. Before beginning the design of concrete, we thoroughly researched and followed all of the parameters, guidelines, and aspects, formulas, and other specifications provided by the Bureau of Indian Standards.

Our experiments for design M30 are completed in this experiment, which includes 20mm aggregate, fine sand (10mm aggregate), fresh water (with marble dust (powder), and coconut coir fibre (with coconut coir fibre). We create four separate trial mix samples M30, each with a different modification. See Table 1 for further information.

Table 1. Mix design of waste content in Concrete

Trial Mix	% of cement	% of coconut coir	% marble dust
sample 1	100	0%	0%
sample 2	95	1% from wt. of cement	5% from wt. of cement
sample 3	90	2% from wt. of cement	10% from wt. of cement
sample 4	85	3% from wt. of cement	15% from wt. of cement

II. LITERATURE REVIEW

Saravana Raja Mohan - The effects of replacing cement (by weight) with a few percent of fly ash and adding processed organic coconut fibre on comp were investigated using an experimental probe. Strength, split tensile force, flexure intensity, and elasticity modulus were all investigated. For the commonly used M20 concrete, a balanced ratio mix (1:1.49:2.79) with a w/c of 0.45 was developed. Five parts of fine fly ash (10 to 30%) were substituted for cement.

A total of four portions of coconut fibres (0.15 percent to 0.60 percent) were consumed at a distance of 40 mm. For the recommended blend ratio, test results reveal that replacing 43 grades of regular Portland cement with fly powder increased compressive strength, split tensile intensity, flexure intensity, and modulus of elasticity. The addition of coconut fibres, which resulted in a fly residue mixed concrete composite –FMCC, improved the mechanical characteristics of the material while also increasing the strength levels, as seen by a larger collapse strain, making it suitable for seismic use.

Rajan Shikha and Saxena A.K- The behavioural search for coconut fibre in a concrete structure is described in this study. The addition of coconut fibre to concrete results in the development of many engineering features. Because it has excellent qualities for tying together properties in concrete. When coir fibre was formerly used in concrete, it was treated as organic latex. So that it is not harmed by moisture in concrete the addition of coconut fibre to concrete improves its compressive, flexural, and tensile strength.

According to the study, the ideal fibre level is 1%, 2%, or 3%. (By weight of cement). 27 cubes of Trial Mix 25 and Trial Mix 30 Grade concrete were cast, with the cured

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concrete's comp. strength estimated to be 7, 14, and 28 days.

This study's findings suggest that coconut coir concert may be utilised in building, and coconut fibre improves west fibre management while also being environmentally friendly.

Sanjay sen and Rajeev - This work shows the findings of a laboratory test involving the consumption of coconut fibre ash, which may be used to partly substitute cement in concrete manufacturing. Concrete cubes are cast and evaluated after 7.0, 28.0, 60.0, and 90.0 days of curing utilising 00, 5.0, 10.00, 15.00, 20.00, and 25% replacement flattening out. The workability of the concrete decreased as the percentage of coconut fibre ash increased, and the compressive force of coconut fibre ash concrete increased with age but decreased as the amount of coconut fibre ash increased.

At 90 days, the percentage strength acquired for 5% and 10% for the control of 0% is 96.220 percent and 86.120 percent, respectively. At 90 days old, the optimal compressive strength of 59.250 N/mm2 was attained at 5% replacement. At the best point of the control, the percentage strength is 96.220 percent.

Bhupendra Kumar (2015) - The article compares and contrasts Fly ash-based coconut fibre concrete with M40-grade basic cement concrete. This study article proposes the incorporation of agricultural and commercial waste materials into concrete, which benefits concrete dwellings while also being environmentally beneficial. The fly ash is changed with the cement as 10, 20, and 30 percent and coconut fibres are provided additionally by weight of cement inside the proportions of 0, 1, 1.5, 2 2.5, 3 percent.

Coconut fibre has a diameter ranging from 0.25 to 1.0 cm and a length of 4 cm. The findings reveal that by combining fly ash and coconut fibre in concrete, the compressive strength of the concrete increases. Adding coconut fibre and fly ash separately does not provide good results.

III. METHODOLOGY

According to Indian standard codes 456 – 2000, 10262-2009, 516-1959, 383-1970, 2386, 9103-1999, 3025, a concrete mix has been created to attain a minimum f_{ck} of M30. Coconut fibre was added to the concrete mix at 1%, 2%, and 3% (by weight of cement) for the study. Coconut fibres were purchased from a nearby market.

The water-cement ratio is determined for the desired strength using empirical relationships, and the water content is determined for the aggregate's needed workability in a saturated surface dry state. The volume of dry rodded coarse aggregate in the concrete mix is determined first in the Indian method and IS guideline, based on the maximum size of aggregates and the particle distribution of fine aggregates.

On the relevant specimens, the following tests were performed: material test, compressive strength on cubes. Preliminary tests are tests carried out in a laboratory on a sample mix of concrete to determine its strength. The test aids in determining the adjustments that must be made to the mix design in order to achieve the desired concrete performance. We evaluate the strength of concrete cubes for 7 days, 14 days, and 28 days, as well as a variety of compressive strength tests. We also use a slump test to determine the feasibility of the trial mix design.

The fundamental requirement is the minimum compressive strength necessary from structural considerations, which is dictated by the w/c ratio. The nominal water-cement ratios of the mix are determined by the suggested compressive strength necessary at a certain age, usually 28 days. As a result, the objective of the mix design should always be to produce concrete with gold standard electrical properties while maintaining a low cement concentration and appropriate workability. Three factors influence the degree of workability necessary. These are the dimensions of the concreted phase.

The preferred workability is determined by the available compacting device. Slump is a measurement of clean cement concrete's consistency or workability. This test may also be used to determine the water content of a material in order to achieve a certain droop rate. The supporting mildew is removed, and sparkling concrete is poured into a mildew of specific form and size. The height of the unsupported new concrete cone sinks as it flows to the edges. More than 36 cubes specimens are tested for compressive strength.

Fig 1. Crushed cube specimen.

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Fig 2. Slump Test.

IV. MATERIALS (INGREDIENTS OF CONCRETE)

(1)Ordinary Portland cement 43 grade –conforming IS 8112, (2) Coarse aggregate 20 mm from Gwalior India quarry –conforming IS 383-1970, (3) Fine aggregate 10 mm from Gwalior India quarry- conforming IS 383-1970 (4) Sand conforming IS 383-1970,(5) fresh water IS 3025, (6) Marble dust passed from 90 micron sieves.

Fig 3. Coconut coir fiber and marble dust (powder)

V. RESULTS AND DISCUSSION

Table 2. Average results of compressive strength.

Design M 30	% of OPC 43 Grade	% of Coconut coir	% of Marble dust powder	Average Comp. Strength of cubes For 7days (N/mm2)	Average Comp. strength of cubes For 14days (N/mm2)	Average Comp. strength of cubes For 28days (N/mm2)
Trial Mix 1	95%	1%	5%	24.67	33.65	37.40
Trial Mix 2	90%	2%	10%	18.83	25.69	28.55
Trial Mix 3	85%	3%	15%	14.48	19.75	21.95
Trial Mix 4	100 %	0%	0%	19.98	27.25	30.29

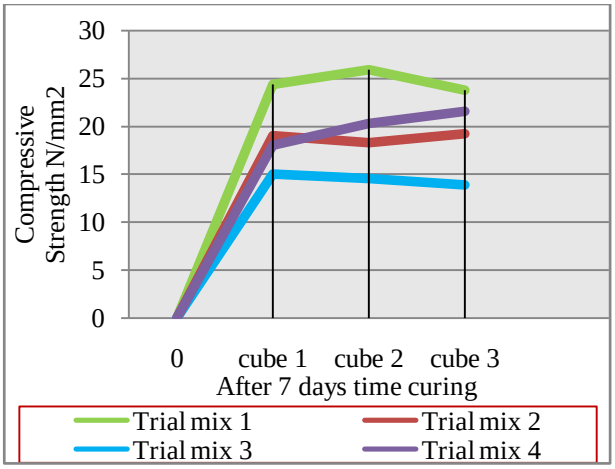

Fig 4. Compressive test for 7 days strength.

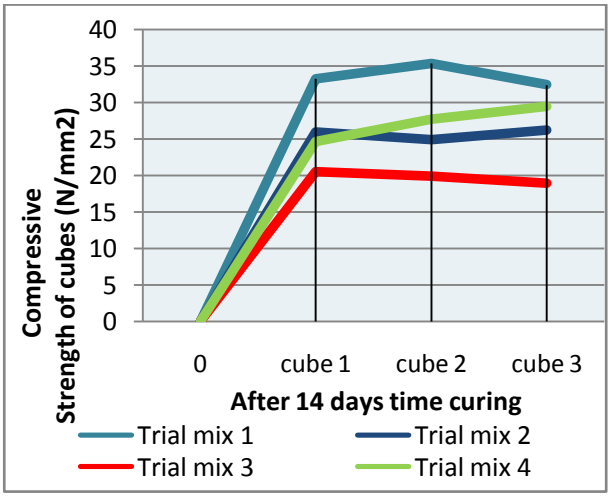

Fig 5. Compressive test for 14 days strength.

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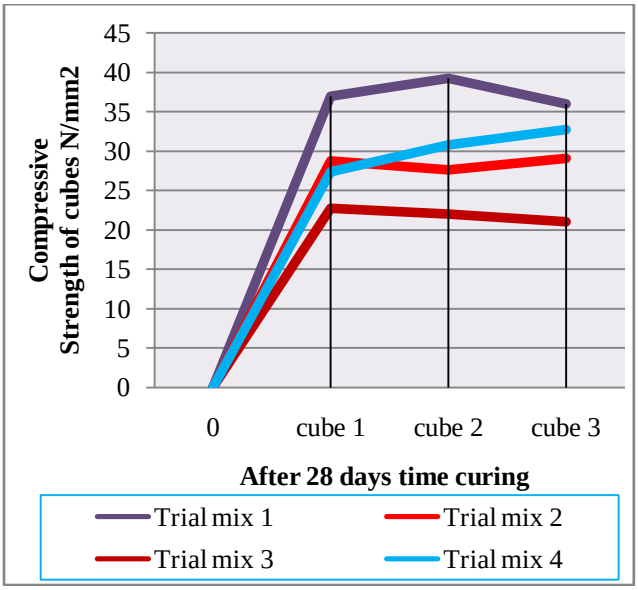

Fig 6. Compressive test for 28 day strength.

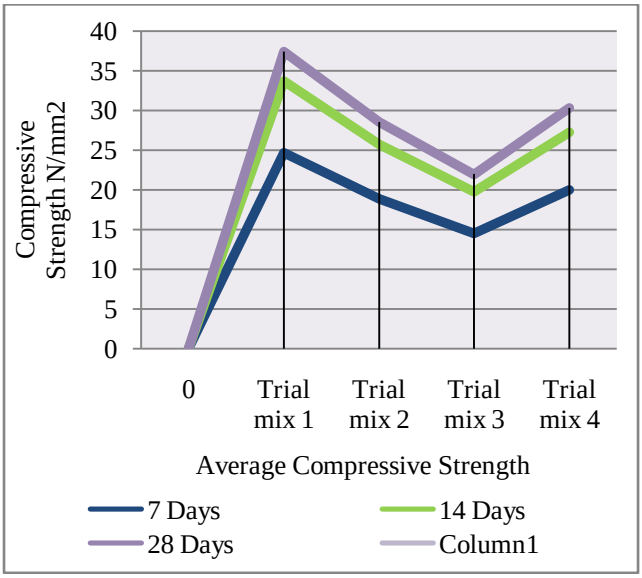

Fig 7. Shows the average compressive strength.

Table 3. Shows the workability of the concrete by the slump test.

S. no.	Slump value	Trial mix 1	Trial mix 2	Trial mix 3	Trial mix 4
1	Slump value 1 (Batch 1) m m	25	10	5	45
2	Slump value 2 (Batch 2) m m	30	5	0	40
3	Slump value 3 (Batch 3) m m	25	5	0	50

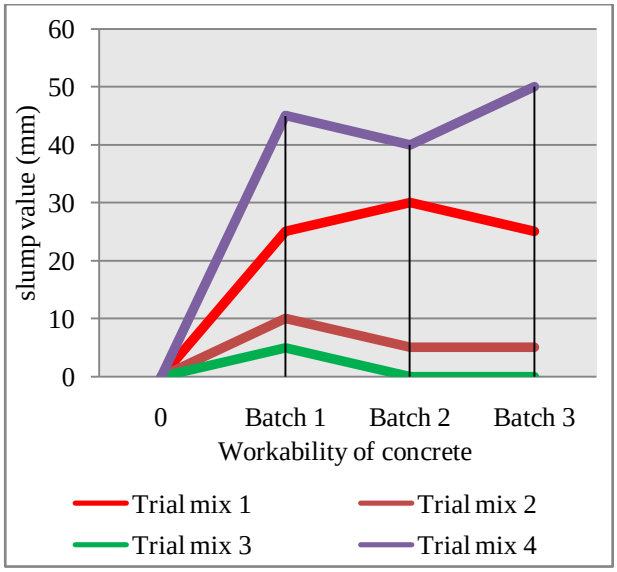

Fig 8. Shows the slump value of trial mix

VI. CONCLUSION

The investigation's result is near to the concrete's goal strength of 38.25 N/mm2 and archives the design M30's distinctive strength. The workability of concrete is calculated in this experiment. The concrete from IS 456: 2000 has a poor degree of workability.

Trial mix 1 has a low degree of workability and has a characteristic strength of concrete and a goal strength of M30. These concrete varieties are utilised in highway construction. Because of the influence on concrete qualities, as the amount of coir fibre grows, the strength of the concrete decreases.

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