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Research Article

Partial Replacement of Fine Aggregate with Fluorescent Light Tube waste in Concrete

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Abstract

Experimental research the applicability of fluorescent tube light wastes as a potential replacement for traditional fine aggregate has been investigated. Fluorescent lamp wastes are one of the discarded electrical devices. Extreme caution must be used when disposing of these lamp wastes in order to prevent any negative effects. Also, with the widespread use of energy efficient LED lamps for lighting purposes, environmental issues around the disposal of discarded fluorescent bulbs that contain mercury have grown in significance. This trash from fluorescent tube lights can be used as a fine aggregate to safely dispose of waste materials and lower construction expenses. This paper presents the results of a study on the partial replacement of fine aggregate with the fluorescent tube light waste in a range of 5 % to 15 % in the interval of 5 % in M25 grade of concrete. Effect of various percentages of replacements towards compressive strength of concrete. The results show that fluorescent tube light aggregate can effectively be used in concrete as partial replacement of sand with improve compressive strength.

Keywords: *Replacements, Fine Aggregate, Fluorescent lamp waste, Compressive strength.*

Introduction

Long utilized in the design of concrete mixes, cement, fine aggregates, and coarse aggregates are crucial to the planning of a specific grade of concrete. However, resources have become more expensive in recent years. To achieve the same strength as these fundamental materials, a few additional materials that are locally available at cheap cost must be introduced to replace fine aggregates. the components of municipal waste that are destined for landfills, concrete, and recycled fluorescent tube light waste. It is appropriate for green building techniques. The usage of non-recycled trash that would otherwise end up in landfills can be diverted for beneficial purposes thanks to alternative materials. They also lessen the negative impacts of generating fine aggregate, mainly the use of non-renewable natural resources.

In this investigation, the performance of normal concrete and concrete made with finely crushed fluorescent tube light waste was examined. The results show that fluorescent tube light waste with replacement percentage of 5,10 and 15 can be used as a fine aggregate replacement material up to a particle size less than 4.75mm. Fluorescent tube light waste was tested for its compressive strength up to 7, 14, and 28 days of age and were compared with those of conventional concrete.

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Methodology

Cement

Cement used for the experiment investigation was Ordinary Portland Cement (OPC) of grade 53.

Testing of cement

To avoid being affected by atmospheric conditions, care was taken to ensure that the purchase was done from single batching in airtight containers Chemical and physical requirements were satisfied by testing the cement in accordance with IS: 4032-1988 and IS: 169-1989, respectively.

Test result of properties of cement

S.No.	Material Properties	Cement test result
1.	Initial Setting Time	30 Minutes
2.	Final Setting Time	600 Minutes
3.	Standard Consistency Test	40%
4.	Specific Gravity	2.69
5.	Fineness	5%

Aggregate

Locally available coarse aggregates are used in the investigation, aggregates greater than 4.75mm are considered as a Coarse aggregate. Used aggregates were 20mm downsized crushed granite coarse

aggregate with a fineness modulus of 4.32 and a specific gravity of 2.63.

Test results of physical Properties of Coarse Aggregate

S.No.	Material Properties	Test Result
1	Specific Gravity	2.630
2	Water Absorption	1.52%
3	Fineness Modulus	4.32

Fine Aggregate

Fine aggregates are collected using locally accessible natural river sand that is taken from the Narmada river in Hoshangabad City. Manufactured sand with fraction passing the 4.75mm sieve and retained on the 600micron sieve was used and fineness modulus of 4.04 with the specific gravity of 2.64 was used. Zone 2 served as the aggregate grading zone.

The following tests have been carried out on the fine aggregate sample.

S.No	Material Properties	Test Results
1	Specific Gravity	2.64
2	Water Absorption	4.14%
3	Moisture Content	5.10%
4	Fineness Modulus	4.04

Fluorescent tube light waste

Broken fluorescent tube light were gathered from a tube light manufacturing unit's solid refuse and a destroyed structure. The discarded tube lights were manually and with the use of a crusher broken into tiny bits. Natural coarse material was partially replaced by crushed fluorescent tube light aggregate of the suitable size.

Crushed fluorescent tube light waste powder with fraction passing the 4.75mm sieve and retained on the 600-micron sieve was used. Crushed fluorescent tube light were used with replacement with fine aggregate in percentages of 5%,10%, 15%, respectively.

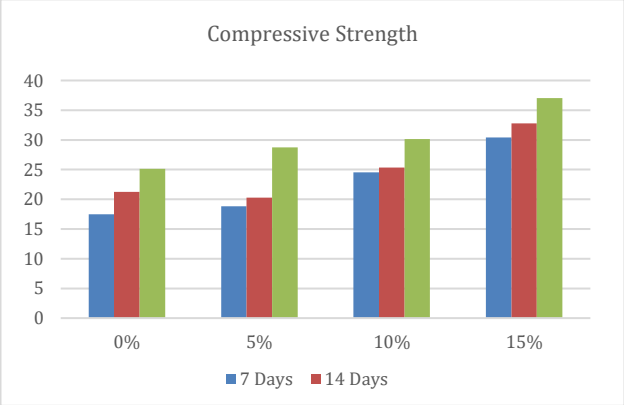
Results and discussions

Compressive Strength of Concrete

Compressive strength is the maximum compressive stress that, under a gradually applied load, a given solid material can sustain without fracture. In other words, compressive strength resists compression (being pushed together), whereas tensile strength resists tension. In the study of strength of materials, tensile strength, compressive strength, and shear strength can be analyzed independently. Some materials generate crakes at their compressive strength limit; others deform irreversibly, so a given amount of deformation may be considered as the limit for compressive load. Compressive strength is most important criteria for design of structures. The moulds after a fixed curing period of 7 days, 14 days and 28 days were being tested for compressive strength in 2000 KN compressive testing machine (UTM). The mould is placed on surface of the testing machine and compressive load was applied on opposite face axially and slowly.

The outcomes are summarized in the table below

S.No.	Percentage of replacement	Compressive Strength	Compressive Strength	Compressive Strength
		7 Days	14 Days	28 Days
1	0%	17.47	21.23	25.15
2	5%	18.84	20.30	28.72
3	10%	24.53	25.35	30.16
4	15%	30.40	32.80	37.01



Discussion

Based on various experiment, it is observed that 5%,10% and 15% partial replacement of sand with Fluorescent tube light waste generally gives higher strength compared to normal concrete. Above which it is equal to or below the normal concrete. Some researchers concluded the positive as well as negative changes in the properties. This study shows that within limit (replacement of 15%) we can use Fluorescent tube light waste as a replacement of fine sand. So, we can make concrete effective and environment friendly.

Conclusion

Grounded on the results of the experimental work carried out in this exploration, the following conclusions could be drawn. The workability of concrete improves as the percentage of fluorescent tube light aggregate replacement rises in the blend. The workability is further improved by the use of crushed fluorescent tube light powder, which, owing to its chemical characteristics, serves as an admixture.

The test results show clearly that the fluorescent tube light waste can be used as replacement materials for river sand in concrete. The use of fluorescent tube

light aggregates enhances some of the concrete properties like as compressive strength due to drop in free- water. On the other hand, a drop in workability was detected as the percentage of replacement increases since fluorescent tube light has high water absorption. Therefore, slump decreases as percentage of fluorescent tube light waste replacement increases for all cases. The decrease was remarkable in case of fine fluorescent tube light aggregate.

The concrete with 5%, 10%, and 15% replacement satisfies the compressive strength of M25.Hence the replacement of river sand using 15% fluorescent tube light waste in concrete gives the required strength and can be considered as optimum percentage.

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