International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

Strength and Durability Properties of Concrete by using Fluorescent Light Tube Waste Replacing as Fine Aggregate

P. Seenu
Student,
Department of Civil Engineering,
Jerusalem College of Engineering ,
Chennai, India

K. Kaviya
Assistant Professor,
Department of Civil Engineering,
Jerusalem College of Engineering ,
Chennai, India

***Abstract*—Experimental investigation an attempt has been made to find the suitability of the fluorescent tube light wastes as a possible substitute for conventional fine aggregate. In a district about40-60% of the fluorescent tube light are wasted due to various reasons. These wastes are not recycled at present. By utilizing this fluorescent tube light waste as a fine aggregate, safe disposal of waste materials can be achieved and construction costs are reduced. This investigation was carried out to evaluate the strength and durability properties ofM25 grade concrete with control specimen 10%, 20%, 30% replacement of fine aggregate with fluorescent tube light waste. Among the strength properties, compressive strength, split tensile strength and flexural strength were conducted. Under the durability properties porosity, acid attack, alkali attack and fire resistance test were conducted.**.

Keywords-Replacements, Fluorescent Light tube, Waste materials

I. INTRODUCTION

In order to address environmental effects associated with fine aggregate manufacturing, there is a need to develop alternative binders to make concrete.
Consequently extensive research is on going into the use of fine aggregate replacements, using many waste materials and industrial by products.

In this study, finely crushed fluorescent tube light waste are used as a partial replacement of fine aggregate in concrete and compared it with conventional concrete.

Fluorescent tube light waste was partially replaced as 10%, 20% and 30% tested for its compressive, Tensile and flexural strength up to 7,14 and 28 days of age and were compared with those of conventional concrete; from the results obtained, it is found that fluorescent tube light waste can be used as fine aggregate replacement material up to particle size less than 4.75mm.

The recycling of fluorescent tube light waste, within concrete, and the landfill-bound constituents of the municipal waste. It is suitable for sustainable construction practices

Ecological or environmental benefits of alternative materials include the diversion of non recycled waste from landfills for useful applications, the reduction in the negative effects of producing fine aggregate, namely the consumption of non-renewable natural resources

A. Scope and Objective

To achieve the aim of the investigation necessary and essential tests on cement , fine aggregate, coarse aggregate, fluorescent tube wastes & concrete of different mix to be carried out to increase the compressive strength, flexural strength and split tensile strength of the concrete by using fluorescent tube lights waste by replacing the fine aggregate to the following percentage 10%,20% and 30%.To conduct acid test, alkali test and fire resistant test for the specimen and to check their durability..

II. METHODOLOGY

A. Cement

Portland Pozzolana Cement (PPC)-53 grade was used for the investigation. It was tested for its physical properties in accordance with Indian Standard specifications.

B. Aggregate

Locally available fine and coarse aggregates are used in the investigation. and coarse aggregate sieved to the required quantity of volume to the maximum nominal size of 20 mm. Care is taken to arrive the size of coarse aggregate ranging from 4.75 mm to the maximum nominal size of 20 mm.

C. Water

Potable water available in Concrete and highway laboratory of department of civil engineering is used for mixing the concrete and curing the specimens.

D. *Fluorescent Light Tube*

It is crushed into powder by using single hand tool powder

Preliminary tests are carried as per IS standard on the material used for concrete like specific gravity, fineness, consistency, and initial setting time for cement. For fine and coarse aggregates tests such as sieve analysis, specific gravity, impact value, crushing value and abrasion value (Los Angeles) are conducted as per standards and results are tabulated.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

The ingredients of concrete such as cement, fine aggregate, coarse aggregate of maximum nominal size of 20mm are weighed accurately using the platform weighing machine. The ingredients are mixed manually and adequate amount of water is added to the constituents of concrete .The mixing is done till to get uniform mix of concrete is obtained

III. DURABILITY STUDIES

The durability of cement concrete is defined as its ability to resist weathering action, chemical attack, abrasion, or any other process of deterioration. Durable concrete will retain its original from, quality, and serviceability when exposed to its environment.

A. Acid Test

In order to assess the weight loss concrete cubes is exposed to chemical media. For acid test hydrochloric acid was prepared by mixing 5% of Hcl with one liter of water as per ASTM G20-8. After normal curing (28 days) cubes were taken out and weight of cube was noted. Than weighted cubes was immersed in the prepared hydrochloric acid for 30 days. After curing the cubes were taken out from acid and weight of cubes was noted. From this weight loss of cubes is calculated.

Weight loss = Weight of cube after Normal Curing − Weight of cube after taken from Acid

B. Alkaline Test

To assess the weight loss concrete cubes is exposed to chemical media. For alkaline test sodium hydroxide was prepared by mixing 5% of sodium hydroxide with one liter of water as per ASTM G20-8. After normal curing (28 days) cubes were taken out and weight was noted. Than weighted cubes was immersed in the prepared sodium hydroxide solution for 30 days. After curing the cubes were taken out and weighted. From this weight loss is calculated.

Weight loss = Weight of cube after Normal Curing − Weight of cube after taken from Acid

C. Fire Resistant

Three cubes of ceramic waste concrete in each percentage of replacement (0%, 10%, 20%, and 30%) are tested. After 28 days curing specimens are kept in an oven for about 120 hours at 250c

IV. RESULTS AND DISCUSSIONS

A. Compressive Strength of Concrete

The cube specimens tested for compressive strength of hardened concrete at the age of 28 days. This test is considered one of the most important properties and is often used as an index of the overall quality of concrete. The ceramic waste aggregate 10%, 20%, 30% replacement significant improvement in strength of concrete. But more than 30% replacement fluorescent tube light waste aggregate slightly affects the compressive strength of concrete

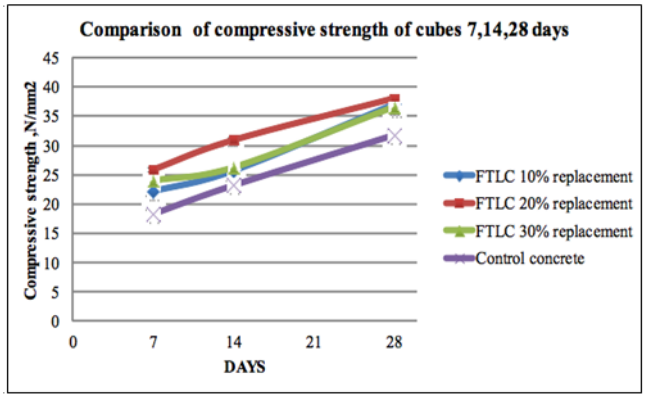

Fig. 1. Comparison of compressive strength of cubes 7,14,28 days

B. Split Tensile Strength of Concrete

The cylinder specimens tested for split tensile strength of hardened concrete at the age of 28 days. The test result revealed that the fluorescent tube light waste aggregate of different proportions decreased, when compared to normal convention concrete.

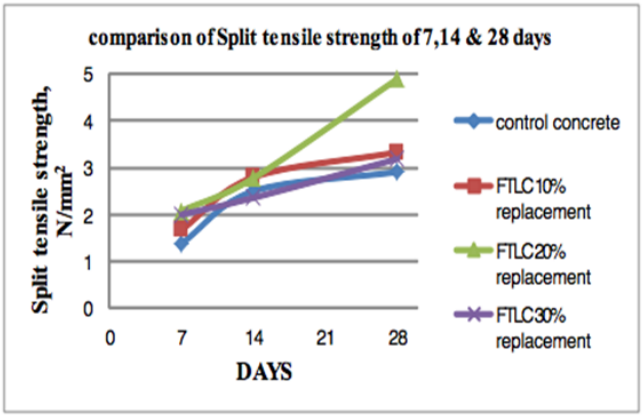

Fig. 2. Comparison of Split Tensile Strength of cylinder 7,14,28 days

C. Flexural Strength of Concrete

The beam specimens were tested for flexural strength of hardened concrete at the age of 28 days. The test carried to determine the ability of a beam to resist failure in bending. Flexural strength of ceramic waste concrete is increases for 10%, 20%, 30% replacement of fluorescent tube light waste aggregate decreases the flexural strength when compared to conventional concrete.

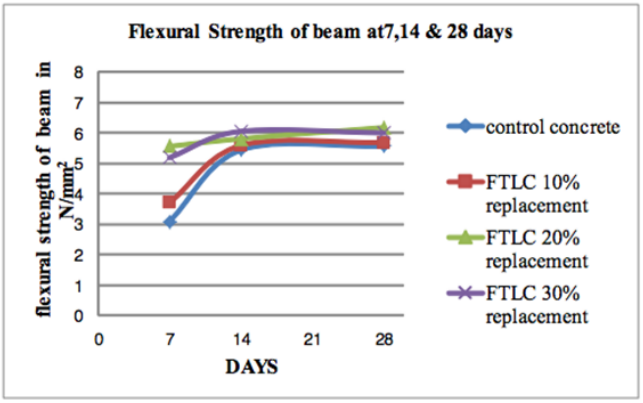

Fig. 3. Comparison of Flexural Strength of beams 7,14,28 days

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

From the fig 1,2 and 3 observed that the substitute of fluorescent light tube increases in 10% and slight variation in 20% and 30%.

E. Acid Test (Hydrochloric Acid)

Tests were carried out according to ASTM G20-8 to obtain weight loss of different type of concrete. From result it will be observed that 30 days Hydrochloric acid attack to the concrete decreases on 10%, 20%, 30% replacement and replacement of fluorescent tube light waste as coarse aggregate concrete. The acid attack variation with respect to the percentage of replacement of crushed stone as ceramic waste

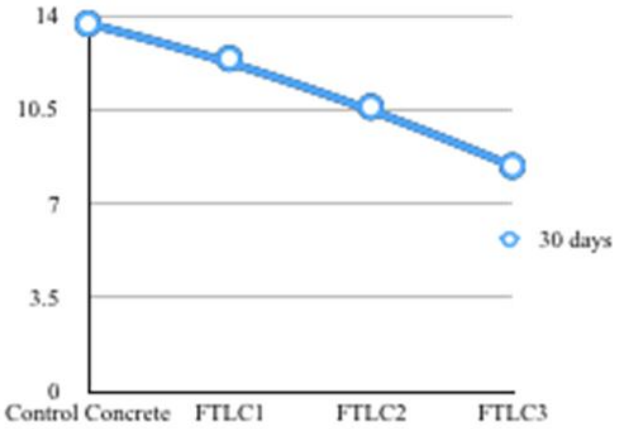

Fig 4. Variation due to Acid Attack

F. Alkaline Test (Sodium Hydroxide)

Tests were carried out according to ASTM G20-8 to obtain weight loss of different type of concrete. From result it will be observed that 30 days sodium hydroxide attack to the concrete decreases the weight loss on ceramic waste concrete. The alkaline attack variation with respect to the percentage of replacement of crushed stone as fluorescent tube light waste

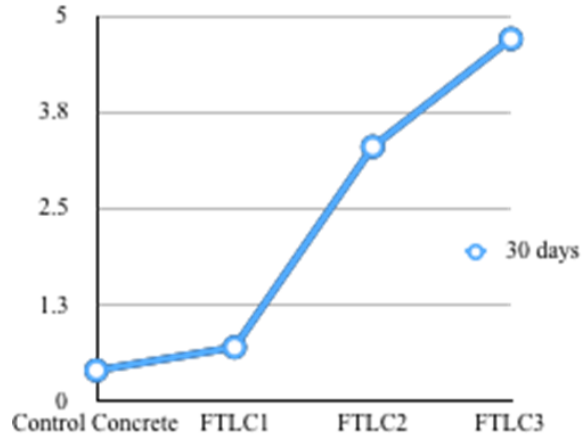

Fig. 5. Variation due to Alkaline Attack

G. Fire Resistant

Three cubes of ceramic waste concrete in each percentage of replacement (0%, 10%, 20%, and 30%) after 28 days curing was kept in an oven for about 120 hours at 250^0C.Under this exposure condition, no damage and no change in color observed to the specimen.

V. CONCLUSIONS

The following conclusions are drawn from the study on fluorescent tube light waste fine aggregate sand and they are applicable for the range of parameters and materials used in this study. Fluorescent tube light waste can be formed into useful fine aggregate. It is observed that there is a strength increase with addition of fluorescent tube light waste of 10% and beyond which there appears to be no specific enhancement in strength. This strength increase appears to be true for compressive and flexural strength.

A measurable increase in durability of the concrete with fluorescent tube light waste has been observed. The experimental study in total revealed a better performance of the concrete with respect to strength, acid resistance, alkali attack and sustainability under fire.

- The compressive strength of fluorescent tube light waste concrete with 10% replacement of fine aggregate is 22.20% higher than control concrete.
- The split tensile strength of fluorescent tube light waste concrete with 10% replacement of fine aggregate is .3% higher than control concrete.
- The flexural strength of fluorescent tube light waste concrete with 10% replacement of fine aggregate is 3.70% higher than control concrete.
- The weight loss due to acid attack of 10% replacement of fluorescent tube light waste concrete at 30 days were 1.3% respectively and hence low.
- The weight loss due to acid attack of 20% replacement of fluorescent tube light waste concrete at 30 days 1.8% respectively and hence very low.
- The weight loss due to acid attack of 30% replacement of fluorescent tube light waste concrete at 30 days 2.2% respectively and hence very low.
- The weight loss due to alkali attack of 10% replacement of fluorescent tube light waste concrete at 30 days .3% respectively and hence very low.
- The weight loss due to alkali attack of 20% replacement of fluorescent tube light waste concrete at 30 days 2.6% respectively and hence very low.
- The weight loss due to alkali attack of 30% replacement of fluorescent tube light waste concrete at 30 days 1.4% respectively and hence very low.
- The fluorescent tube light waste concrete specimen with different percentages of replacement of fine aggregate was exposed to a temperature of 250^0C for 120 hours continuously. It was observed that there was no damage and no change in color under this exposure condition.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

Thus, it concluded that the replacement of fine aggregate with fluorescent tube light waste up to 10% replacement reaches optimum level. However, more research studies are being made on the fluorescent tube light waste concrete necessary for the practical application as fine aggregate aggregate.

ACKNOWLEDGEMENT

The authors would like to thank the management and assistant prof. K.Kaviya, Jerusalem College of Engineering for providing all the technical, guided constant encouragement and suggestion throughout the project.

REFERENCES

[1] Shetty, M.S, (2002), "concrete Technology", Theory and Practice, Chand & Company Ltd. New Delhi.
[2] Meyer C, Baxter S, Use of recycled glass and fly ash for precast concrete. Rep. NYSERDA98-18(4292-IABR-IA-96) to New York State Energy Research and Development Authority, Dept of Civil Engineering and Mechanical Engineering, Columbia University, New York, 1998
[3] Pollery C, Cramer SM, De La Cruz RV, Potential for using waste glass in Portland cement concrete, J Mater, Civil Eng, 10(4), 1998, pp.210-9
[4] Bazant ZP, Zi G, Meyer C, Fracture mechanics of ARS in concretes with waste glass par.
[5] Malhotra VM, Mehta PK. *Pozzolanic and cementitious materials*. In: Advances in concrete technology. New York: Gordon and Breach Publishers; 1996.16]
[6] Siddique R. *Waste materials and by-products in concrete*. Springer, 2008, pp. 413.
[7] Shakhmenko G., Korjakins A., Bumanis G. *Concrete with microfilleobtained from recycled lamp glass*. Proceedings of the 10th international Akbarzadeh, H., and A. A. Maghsoudi. "Experimental and Analytical Investigation of Reinforced High Strength Concrete Continuous Beams Strengthened with Fiber Reinforced Polymer." *Materials & Design*, (2010)