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STRENGTH CHARACTERISTICS OF RECRON 3S FIBER REINFORCED CONCRETE OF DIFFERENT GRADES EXPOSED TO ELEVATED TEMPERATURES

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ABSTRACT:

The concrete being widely consumed material in the construction industry has severe concern with the environment. The need of the time is to find some alternative material to save the environment.

The concrete has to sustain a very high temperature, when any fire accident occurs. The properties of the concrete are to be studied when exposed to the heat in order to understand effect of temperature on the concrete. Authors have presented the experimental results for the reinforced concrete of different grades at different temperatures.

KEYWORDS: Concrete, fiber reinforced concrete, strength.

1. INTRODUCTION:

The concrete when subjected to the high heat is experiencing the change in the properties. The effect of the heat is especially on the strength of the concrete.

Fire incidences are very common in the residential buildings. The building when facing the fire is always subjected to the high temperature. The strength characteristics study is the scope of this paper. The experiment is carried out at different temperatures on the concrete fiber mixture material. The mixture is subjected to the very high temperature of 300 degree Celsius. The material selected for the experiment is of the grade M30 to M40.

General In general constructions of buildings in addition to the strength of the construction it should be able to withstand the damage causes by the fire. To avoid the rapid spread of fire which would cause both structural and human damage in addition to the concrete which we use some of the new admixtures has to be used.

Authors have performed the experiment on the fiber mixed concrete material for the period of the 56 days and the results are presented in the paper.

SCOPE OF WORK:

The present study is to investigate the effect of high temperatures on the properties of Conventional concrete by adding Recron 3s fiber. After casting, the moulds are cured in portable water tank for 7, 28, and 56 days. After curing, the specimens were removed and allowed for drying at room temperatures and some specimens were tested in room temperature and some specimens are kept in electric ovens and heated to different temperatures and for different exposure times. The parameters studied are

1) Elevated temperatures 150^0C, 250^0C, 300^0C.
2) Exposure duration1hr, 2hrs, 3hrs.

For M_{30}, M_{35} and M_{40} grades mix, Concrete cubes each of size 150x150x150mm and cylinders each of size 150mm diameter and 300mm height have been casted. Some of these casted specimens are tested at both room and high temperatures and after heating as per the prescribed temperatures the specimens are tested.

To study the characteristics the recron 3s fiber was added to the concrete.

Fig.1: Recron 3S Fiber

2. EXPERIMENTAL INVESTIGATIONS ON MATERIALS:

The strength of the concrete is better understood by the carrying capacity of the load. Authors have carried out the test on the mixture in order to understand the results related to the strength of the mixture. 516-1959 IS standards are followed during the testing of the mixture.

COMPRESSIVE STRENGTH TEST:

The compressive strength of concrete was calculated using the following formula.

$F_C = P/A$ Where,

F_C = Compressive Strength

P = Maximum Load applied (Nw)

A= Cross sectional Area (mm^2)

SPLIT TENSILE STRENGTH TEST:

The split tensile strength of concrete was calculated using the following formula:

$F_S = \frac{2P}{\pi dl}$

Where,

F_C = Split Tensile strength

P = maximum load (Nw)

d = diameter of the cylinder (i.e, 150mm).

l = length of the cylinder (i.e, 300mm)

The tests were carried out in the Muffle furnace as the testing needs the very high temperature to study the characteristics.

3. METHODOLOGY:

A mix design of M30, M35, M40 grade concrete was done according to the guidelines given in IS: 10262 - 2009. The samples are mixed with some percentages of 0.10%, 0.15% to 0.40% of the weight of concrete.

After the mixing the compressive strength and split tensile strength are conducted at high temperatures at different durations for 7 to 56 days.

The Mix Proportions are taken as below

Mix Proportions by Weight for M30:

Cement	Fine Aggregate	Coarse Aggregate	Water cement ratio
406.4kg	732.4kg	1167kg	178litres
1.00	1.80	2.87	0.438

Mix Proportions by Weight for M35:

Cement	Fine Aggregate	Coarse Aggregate	Water cement ratio
409.091kg	730.31kg	1163.36kg	180litres
1.00	1.78	2.84	0.44

Mix Proportions by Weight for M40:

Cement	Fine Aggregate	Coarse Aggregate	Water cement ratio
415.09 kg	732.43 kg	1167kg	176 litres
1.00	1.76	2.81	0.424

Terminology for Sample Mixes:

S.No	Sample mix name	Description
1	S_1	M30 Grade Conventional Concrete
2	S_{M30}	Cement + Sand + Coarse Aggregate + 0.3% Recron 3S Fiber
3	S_2	M35 Grade Conventional Concrete
4	S_{M35}	Cement + Sand + Coarse Aggregate + 0.3% Recron 3S Fiber
5	S_3	M40 Grade Conventional Concrete
6	S_{M40}	Cement + Sand + Coarse Aggregate + 0.3% Recron 3S Fiber

TESTING PROCEDURE:

Remove the specimen from water after specified curing time. After curing of specimens tests were conducted on the cubes and cylinders. Cubes and Cylinders are tested at elevated temperatures 150^{0}C, 250^{0}C, and 300^{0}C. Cubes are placed in oven. The temperature is controlled in the control panel in which the temperature can be set to required magnitude and can be maintained for the required time without any changes in the temperature. The specimens that were heated in the electric oven in such a way, until the required temperature and every side of the sample has to be exposed to temperature, the temperature is maintained constantly for a period of 1hour at 150^{0}C. After exposing the samples to required temperature and for the required duration, the heating of the samples was stopped and was allowed to cool. After cooling, compressive and tensile strength are tested to the samples.

4. RESULTS AND DISCUSSIONS

Variation of Compressive Strength results:

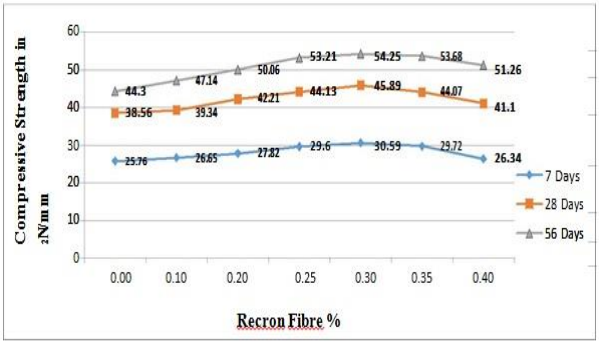

Fig 2. M_{30} Grade of concrete

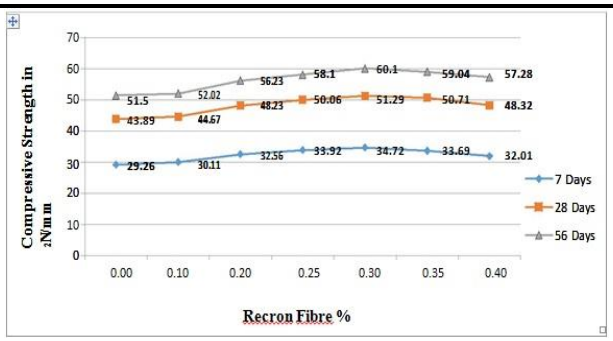

Fig 3. M35 Grade of Concrete

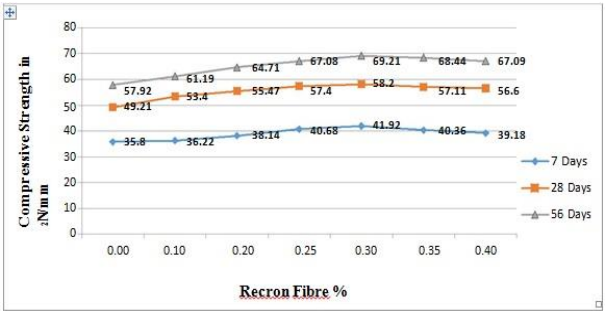

Fig 4. M40 Grade of Concrete

Variation of Split Tensile Strength:

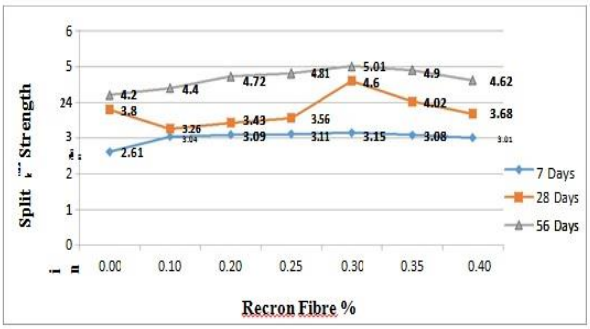

Fig 5. M30 Grade of Concrete

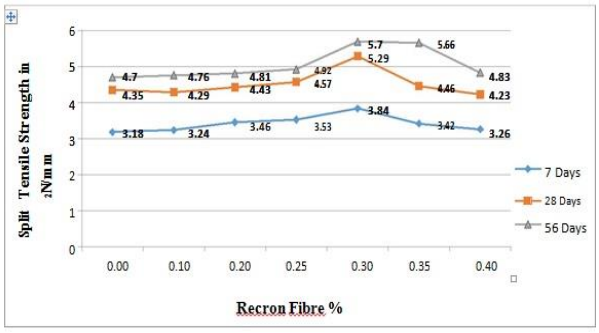

Fig 6. M35 Grade of Concrete

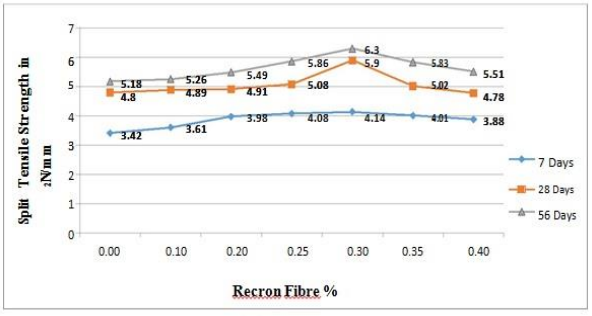

Fig 7. M40 Grade of Concrete

5. CONCLUSION:

The main objective achieved with this study is the study of the strength characteristics of the mixture. We have observed that when the mixture is subjected to the high temperature, the tensile strength is best with 19 to 22% of mixture is added with 81 to 78 % concrete. The observations are taken over the period of 56 days. The drawback of the mixture is low strength at the temperature above 300^0 C as Recron 3s get melts at 250^0 C.

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