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EXPERIMENTAL STUDY ON SELF CURING FIBER CONCRETE

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Abstract---Water is the most required substance in the construction field. In generally internal water curing can be used to mitigate self-desiccation and self-desiccation shrinkage. This investigation is mainly contributed on the Self-Curing Concrete which doesn't need any necessity of water. The Super absorbent Polymer is used as the curing agent. The percentage of curing agent is 0.3 from the cementitious material. The grade of concrete is M40.It was found that SAP could help in self-curing of concrete. The Super Absorbent Polymer is used as the curing agent. Sisal Fiber of 0.1%, 0.2%, 0.3% and 0.4% by volume of cement was added and it is compared with the conventional mix. The effect of variation in strength parameters such as Compressive Strength, Splitting Tensile Strength and flexural strength were studied for different dosage of fiber/self-curing agent and compared with conventional concrete.

Key words— Curing, Self-curing Concrete, Self-curing Agent, Fibrous Self-curing Concrete, super-absorbent polymer, sisal Fiber.

I.INTRODUCTION

Generally Curing is the process of preventing the loss of moisture from the concrete as well as maintaining a satisfactory temperature regime. The concept of self-curing is to reduce the water evaporation from concrete and hence increase the water retention capacity of the concrete and also to attain desirable strength and other properties, curing is necessary. Now a day proper curing of concrete seems to be difficult due to scarcity of water in our country. Curing is essential for concrete to obtain advanced structural and durability properties and therefore is one of the most important requirements for optimum concrete performance in any environment or application. For that self curing concrete is introduced for internal curing of concrete itself without any need for external curing. In this project self curing concrete is used in addition with sisal fiber to increase the strength of concrete. Sisal fiber is one type of natural fiber which is highly durable and has high impact absorption properties.

II.MATERIALS USED

A. Cement: Ordinary Portland cement, 43 Grade conforming to IS 12269 – 1987.

B. Fine aggregate: available sand conforming to grade zone II.

C.Coarse aggregate: Locally available crushed blue granite stones conforming to graded aggregate of nominal size 20 mm as per IS 383 – 1970.

D. Super plasticizer: CONPLAST SP 430 used commonly.

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TABLE I

PROPERTIES OF SUPER PLASTICIZER

Specification	Value
Specific gravity	1.20 to 1.21 at 300 C
air entrainment	Approx. 1.5% additional air over control
Chloride content	Nil. to IS:9103-1999 and BS:5075

E.Super-absorbent polymer: sodium polyacrylate,it absorbs 5000 times by its weight

TABLE II

PROPERTIES OF SAP

Appearance/Odour	White Granular Powder, no odour
PH	5.5 – 6.5 (1% in water)
Specific Gravity (Bulk density)	0.4 – 0.7 g/ml
Vapour Pressure	< 10 mm Hg
Vapour Density	NE
Melting Point	> 390 ºF
Freezing Point	NA
Boiling Point	NA

F. SISAL FIBER

Sisal fiber is a type of natural fiber which is entirely different from synthetic fibers. Unlike man made synthetic fibers it is odourless and has high strength.

TABLE III

PROPERTIES OF SISAL FIBER

Cellulose	65%
Colour	Soft Gray Ash
Hemi cellulose	12%
Recyclable	Yes

G. WATER: Casting and curing of specimens were done with the portable well and bore water in the college.

III. MIX DESIGN

Mix design is the process of selecting suitable ingredients of concrete and determining their relative proportion with the object of producing concrete of certain minimum strength and durability as economically as possible.

TABLE IV

MIX PROPORTION OF CONCRETE

Mix	Cement (kg/m	F A (kg/m	C A (kg/m	SAP (%)	Fiber (%)	Water (litre/	S . P (%)
C M	438	770.6	1061.6	-----	-----	158	0 . 5
SCC	438	770.6	1061.6	0 . 3	-----	211.32	0 . 5
FSCC1	438	770.6	1061.6	0 . 3	0 . 1	211.32	0 . 5
FSCC2	438	770.6	1061.6	0 . 3	0 . 2	211.32	0 . 5
FSCC3	438	770.6	1061.6	0 . 3	0 . 3	211.32	0 . 5
FSCC4	438	770.6	1061.6	0 . 3	0 . 4	211.32	0 . 5

CA = Coarse aggregate, FA = fine aggregate, SAP = Super absorbent polymer, SP = Super plasticizer, SCC=self curing concrete, FSCC=sisal fiber self curing concrete.

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IV. METHOD OF EXPERIMENT

The concrete was cast as per Mix Design (IS 10262:2009). The obtained concrete was tested for strength properties. The different strength tests which include compression test and split tensile test were studied. The concrete was cast by adding different dosage of self-curing agent to the concrete mix and compared the test result with the cured concrete. The tests were carried out in accordance with relevant IS Standards. The aggregates were tested for physical properties such as: specific gravity and particle distribution test. The fresh concrete was subjected to the slump test followed by casting of concrete in moulds for further investigations. All the mixes were prepared by mixing the concrete in laboratory mixer along with water and super plasticizer. For compressive strength studies 36 cube specimens of size 150 mm x 150 mm x 150 mm, for flexural strength studies, 36 prism specimens of size 100 mm x 100 mm x 500 mm and 36 cylinder specimens of size 300 mm height and 150 mm diameter for split tensile strength studies were prepared. All the specimens were cast and cured for 28 days as per standard curing methods.

V. RESEARCH PROGRAM

The strength of Self Curing concrete was obtain by adding super absorbent polymer and sisal fiber at 0.1%, 0.2%, 0.3%, and 0.4% by weight of cement to the concrete. It was aimed to study the workability, compressive strength, split tensile strength and flexural strength.

A. SLUMP CONE TEST

Slump test is carried out to assess and compare the consistency that indicated the ease of flow or freshly mixed concrete. A higher slump implied better consistency and workability. Slump test is the most commonly used method of measuring consistency of concrete. The apparatus for conducting the slump test essential consists of a metallic mould in the form of a cone having the internal dimensions as under.

Top diameter	: 10 cm
Height	: 30 cm

B. COMPRESSIVE STRENGTH TEST

After 7, 28 days of curing, three 150mm cubes of a concrete mixture were tested using a compression machine. These cubes were loaded on their sides during compression testing such that the load was exerted perpendicularly to the direction of casting. The average value of the three cubes was taken as the compressive strength. The maximum load is noted in KN and the compressive strength is calculated by using the formula.

$$\text{Compressive strength} = \text{Load / Area N/mm}^2$$

C. SPLIT TENSILE TEST

The cylinders are placed in the compression testing machine horizontally load is applied gradually. The load is increased at a uniform rate until the specimen fails and the maximum load applied to the specimen during the test is recorded. The tensile Strength of the specimen is calculated using the below mentioned formula.

$$\text{Split Tensile Strength} = \frac{2P}{\pi LD}$$

D. FLEXURAL STRENGTH

The bearing surfaces of the supporting and loading rollers are wiped clean and any other loose sand or other Material is removed from the surface of the specimen where they are to make contact with the rollers. The Specimen is then placed in the machine such that the load is applied to the upper most surface as cast in the mould along two lines spaced 20cm apart. The load is increased until the specimen fails and the maximum load applied to the specimen during the test is recorded.

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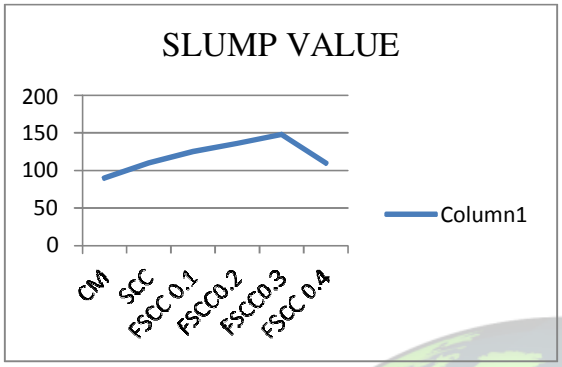
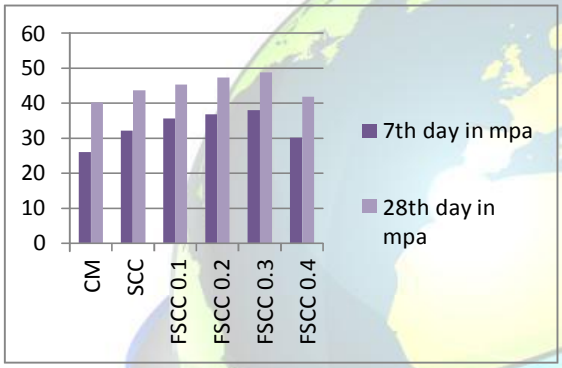
VI. RESULTS AND DISCUSSION

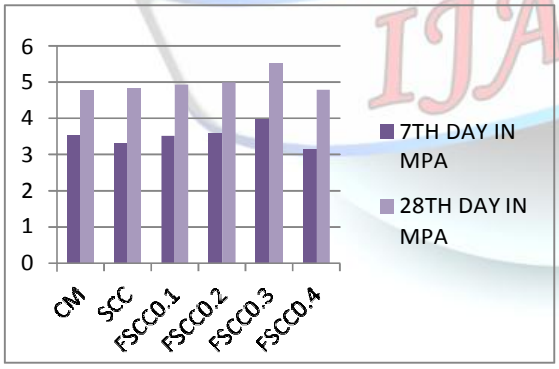
E. SLUMP TEST



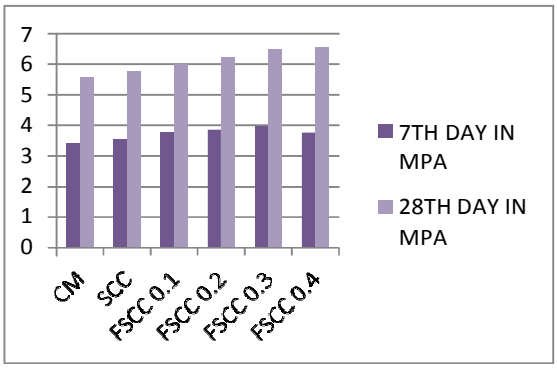
F. COMPRESSIVE STRENGTH



G. SPLIT TENSILE STRENGTH



H. Flexural strength



VII. CONCLUSION

Super Absorbent Polymer (SAP) was used as self-curing agents. M40 grade of concrete is adopted for the investigation. Based on the experimental investigation carried out, the following conclusions were drawn. The optimum dosage is 0.3%. Leads to a significant increase of mechanical strength (Compressive and Split tensile). The Self cured concrete using SAP was more economical than conventional cured concrete. From the durability study Self-curing concrete and fibrous self-curing concrete shows better performance for 28, 56 and 90days.

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