Effect of Cotton and Flyash on Concrete

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Abstract— Aim of this study to determine Compressive strength, Flexural strength and Split Tensile strength of M40 grade concrete with use of cotton and fly ash. SIKAPLAST 5223 NS is used to improve the workability of concrete which is a unique multipurpose super plasticizer that is particularly suitable for the production of ready mixed concrete. Additionally, it provides high water reduction and improved fresh concrete characteristics. Fly ash can be utilized to produce high strength and durable concrete composites. The Concrete specimens were cured on normal tank curing under normal atmospheric temperature. The strength determined at 7, 14 and 28 days, Flexural, Compressive and Split Tensile. The addition of Cotton by the weight of concrete shows an increase strength property and fly ash as cement replacement material shows early long-term strength. This system that is Ordinary Portland Cement – Cotton – fly ash concrete was found to increase the Compressive, Flexural strength and Split Tensile strength of concrete on all ages when compared to concrete made with Cotton and fly ash.

Key words: SIKAPLAST, Fly Ash, Split Tensile Strength

I. INTRODUCTION

Cotton is a mainly physically processed product of textile industry. Large amount of cotton wastes accumulated from countries all over the world. The majority large amount of cotton wastes is abandoned and cause certain serious environmental problems and health hazards. The light weight construction materials in building industry brought to the use of cotton. Use of cotton in concrete increase in strength of concrete and cotton economically lower in cost compared to other used in concrete. Fly Ash is produced in small dark flecks by the burning of powdered coal or other materials and carried into the air. With increase environmental awareness and its potential hazardous effects, Utilization of industrial by product has become attractive alternative to disposal. Fly ash is the notorious waste product of coal based

Fly ash is used in concrete which significantly improves the properties of fresh and hardened concrete. SIKAPLAST 5223 NS (Super Plasticizer) used to satisfy the workability of concrete. This paper reports the results of an experimental investigation of compressive strength of concrete cubes and flexural Strength of concrete beams. The cotton 0.1%, 0.2%, 0.5%, 1%, 1.5%, 2% added by wt. of concrete. Fly ash used in 29 % replacement of cement develops effective strength. A Large number of specimens were cast and subjected to normal curing at atmospheric temperature. The strength determined at 7, 14 and 28 days, Flexural, Compressive and Split Tensile.

II. EXPERIMENTAL PROGRAM

Experimental Program has been designed to provide results of Cotton and Fly ash with SIKAPLAST 5223 NS super plasticizer. To study effect of cotton and Fly ash on the strength of concrete have been studied in this investigation.

A. Material Used

1) Cement

Ordinary Portland cement 43 grade (ACC Cement) have used in investigation. The cement was tested according to IS 4031:1988. It confirmed to IS 12269:1987. Its Properties is given in Table.

Sr. No.	Properties	Value	As per IS:12269-1976
1	Specific Gravity	3.15	3.15
2	Normal Consistency	31.5%	30-35%
3	Initial Setting Time	38	>30
4	Final Setting Time	220	<600
5	Compressive Strength	28 (3 days)	>27
40 (7 days)			>37
54.9 (28 days)			>53

2) Fine Aggregate

Locally available crushed sand which is free from organic impurities is used. Sand passing through IS sieve 4.75mm and retaining on IS sieve 150µ is used in the investigation.

The sample shall be brought to an air-dry condition before weighting and sieving. This may be achieved either by drying at room temperature or by heating at a temperature of 100° C to 1100 C. The air-dry sample shall be weighted and sieved successively on the appropriate sieves starting with the maximum size. Care shall be taken to ensure that the sieve is clean before use. (IS 2386 part-I -1963).

Sr. No.	Sieve size	Weight retained In grams	% Wt. retained	Cumulative % retained	% passing
1	4.75 mm	0	0	0	100
2	2.36 mm	439	21.95	21.95	78.05
3	2.00 mm	234	11.70	33.62	66.35
4	600 µ	1039	51.95	85.60	14.40
5	300 µ	227	11.35	96.95	3.05
6	150 µ	45	2.25	99.2	0.8

Sieve analysis of fine aggregate

3) Coarse Aggregate

The size of aggregate bigger than 4.75 mm is considered as coarse aggregate. There are different types of shape of coarse aggregates like rounded aggregate, flaky aggregate and angular or crushed aggregate. In this experimental programme crushed aggregates were used. For this study 12.5mm coarse aggregates were used. The physical properties

of coarse aggregate like specific gravity, bulk density, gradation and fineness modulus are tested in accordance with IS: 2386.

4) Cotton

Cotton is mainly physically processed product of textile industry. Physical Properties of Cotton is given in Table.

Sr. No	Properties	
1.	Length	30mm
2.	Dia.	0.2mm
3.	Density	1.54g/cm3
4.	Water Absorption	8.5 %

Properties of cotton

5) Fly ash

Fly ash is the best known, and one of the most commonly used, pozzolanas in the world. Fly ash is the notorious waste Product of coal-based electricity generating thermal power plants, known for its ill effects on agricultural land, surface and sub-surface water pollution, soil and air pollution and diseases to mankind. Researchers have proposed few ways of reusing fly ash for variety of application. One of the most common reuse of fly ash is in cement concrete.

Parameter	**Observed value**	**Permissible value as per IS 3812-2003**
Specific surface area	340 – 360 m^2/kg	> 250 m^2/kg
Particle retained on 45 micron sieve	28.9%	< 35%
Compressive strength at 28 days	44 – 48 N/mm^2	> 39 – 43 N/mm^2
Soundness	0.014 to 0.018%	< 8%
Silica + alumina + iron oxide content	88 – 91%	> 70%
Silica	58 – 60%	35%
Sulfur as SO_3	0.26 – 0.32%	< 0.3%
MgO	0.26 – 0.34%	< 0.5%
Loss on ignition	0.9 – 1.05%	< 1.5%
Available alkalies as Na_2O	0.16 – 0.02%	1.5%
Chlorides	0.016 – 0.02%	0.05%

Properties of Fly Ash

6) Sika last® 5223 NS

SikaPlast 5223 NS is a unique multipurpose super plasticiser that is particularly suitable for the production of ready mixed concrete. Additionally, it provides high water reduction and improved fresh concrete characteristics. With its outstanding cost/performance SikaPlast 5223 NS is used for the following: A wide range of applications where excellent workability is requested concrete with high water reduction high efficient concrete applications variable use in different concrete systems with different raw materials.

B. Mix Design

Cotton varies from 0.1 to 2% and fly ash 29 %. SikaPlast 5223 NS will be constant 1% by the wt. of cement. Finally, as optimum dosage of Cotton 0.5 to 1% added fly ash of 29 % in replacement.

Material	Volume (Kg/m3)
Cement	510
F.A.	834
C.A.	972
Water	194
SikaPlast 5223 NS	5.10
Proportion Ratio	(1:1.64:1.90)

Mix proportion of M40

C. Experimental Process

The Specimen of standard cube (150mmX150mmX150mm) for Compressive strength and (100X100X500mm) used for Flexural strength. The binder ratio adopted was 0.38. Concrete cubes and beams of actual size dimension were casting for Compressive and Flexural strength. They have tested for Compressive strength after 7, 14 and 28 days of water curing and Flexural Strength after 7,14 and28 days and Split Tensile strength at the 7,14 and 28 days of water curing.

III. RESULTS OBTAINED

The result of maximum compressive strength and flexural Strength is given in Table 7. The test has carries out conforming to IS: 516 – 1959 to obtain compressive strength and flexural strength Split Tensile strength.

STRENGTH (MPA)	0.1 % COTTON	0.2 % COTTON	0.5 % COTTON	1 % COTTON	1.5 % COTTON	2 % COTTON
7 Days	22.75	25.35	30.35	34.45	28.6	26.65
14 Days	28	31.25	37.6	42.4	35.2	32.8
28 Days	35	39	48	54	44	41

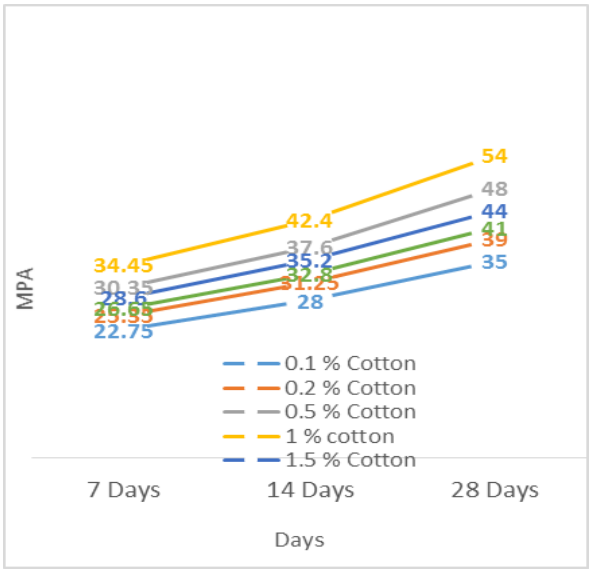
Compression strength

STRENGTH MPA	0.1 % cotton	0.2 % cotton	0.5 % cotton	1 % cotton	1.5 % cotton	2 % cotton
7 Days	3.34	3.54	3.86	4.11	3.25	3.61
14 Days	3.70	3.9	4.29	4.59	4.15	4.01
28 Days	4.14	4.37	4.85	5.14	4.64	4.48

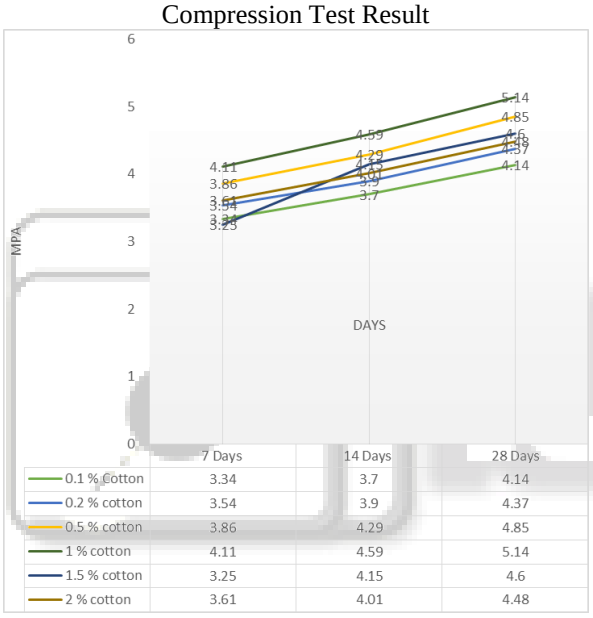
Flexural Strength

STRENGTH (MPA)	0.1 % cotton	0.2 % cotton	0.5 % cotton	1 % cotton	1.5 % cotton	2 % cotton
7 Days	15.93	17.85	21.25	24.08	20.02	18.66
14 Days	19.6	21.88	26.6	29.68	24.64	22.96
28 Days	24.5	27.3	32.9	37.1	30.8	28.7

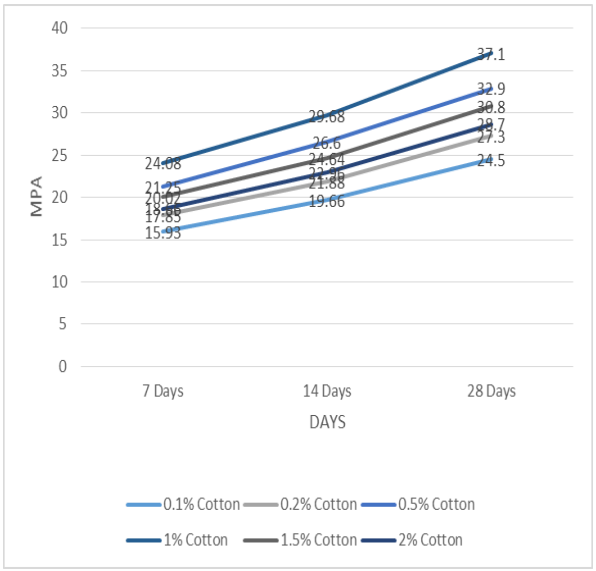
Split Tensile Strength



Compression Test Result



Flexural Test Result



Split Tensile Strength

IV. Conclusions

In this study, Addition of Cotton 1% increase maximum compressive strength 11.57% and flexural strength 10.4% higher than normal concrete and increase of Split tensile strength at 28 days.

Addition of fly ash 29% increase compressive strength 18% and flexural strength 19.5% higher than normal concrete at 28 days.

Use of cotton increase maximum compressive strength at 7days is marginal compare to the strength at 28days.

Combine use of Cotton 0.5% & fly ash 29% increase maximum compressive strength 9.09% at 28days.

Increasing the content more than 1 % causes the fall in the strength of concrete.

Combination of Cotton and fly ash increases, workability of concrete decreases but use of super plasticizer satisfy the workability.

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