

An Experimental Investigation on Effect of Jute Fiber With Fly Ash In Concrete

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Abstract: The purpose of this study to the addition of jute fibers and fly ash in higher grade M50 and M60 concrete and investigate the fresh and hardened properties of concrete. Locally produced jute fibers different weight of 0.1%, 0.2%, 0.3%, 0.4%, 0.5% were added and fly ash 20%, 30% replace by cement to prepare concrete cubes. The cubes compressive test was carried out at concrete ages of 7 and 28 days, Additionally various factorial analyses were conducted on the experimental results to detect the effect of the of jute fibers and fly ash on concrete properties. Find optimum percentage of jute fiber and fly ash add in concrete. Comparing the result M50 and M60 grade concrete.

Index Terms - Jute fiber, fly ash, M50 grade, M60 grade, Workability, and Optimum percentage of jute fiber.

I. INTRODUCTION

Concrete is the most consumed construction material in the world. In recent, the World's increasing need is to develop green and sustainable construction material utilizing natural fiber. The natural fibers are primarily composed of cellulose, and lignin with very small quantity of pectin. Although lignin and pectin enhance the primary dimensional stability of the jute fibers, however they are brittle and often prevent to transfer the mechanical load. They low-density, resulting in relatively light weight composite having higher specific properties. Natural fibers have significant cost advantages when compared with synthetic fibers such as glass, carbon, nylon, etc. Among all the natural fibers used as reinforcement in composite materials, jute seems to be a promising material because of its relatively low cost and commercial availability. It also has higher strength and modulus upon comparing with plastic and is a good replacement for conventional fibers in many applications.

II. OBJECTIVES

- ✚ To Prepare Concrete Grade M50 & M60 with add proportion of 0.1%, 0.2%, 0.3%, 0.4 %, 0.5% of jute fiber by Weight, and 20%, 30% fly ash replace with cement.
- ✚ To study workability and compressive strength of concrete using jute fiber and fly ash
- ✚ To get optimum percentage of jute fiber + fly ash for M50, M60 grade concrete.

III. LITERATURE REVIEW

¹ Mohammad S. Islam, Syed Ju Ahmed investigated that addition of jute fiber 0.25% and 0.50% on concrete mixture result in increased the compressive strength, split tensile strength, flexural strength of concrete.

² A. Razmi, M.M. Mirsayar investigated that concrete with fiber percentages of 0.1%, 0.3%, and 0.5% by weight, led to an increase in the compressive strength, tensile and the flexural strength. The improvement of the concrete strength becomes more considerable as the curing age increases.

⁷ M.S. Krishna Hygrive, I. Siva Kishore, KJB Chari investigated that on optimum 30% of fly ash in concrete to improve compressive strength of concrete.

⁶ R M Faysal , M R Karim investigated maximum 25 % fly ash with fulfilling target strength 10600 psi (73 MPa). So, the Portland composite cement (PCC) containing 25 % fly ash is perfectly suitable for producing this particular high strength concrete.

⁵ Pooja Warke, Shrinkhala Dewangan investigated the addition of jute fibers to increased compressive strength higher with the 0.2% fiber and little decreases compressive strength with 0.3% fiber and 0.4% fiber compressive strength little decreases as compared to 0.3% of fiber

IV. MATERIAL AND METHODOLOGY

Materials list: (1) cement, (2) Fine Aggregate, (3) Coarse aggregate 10 and 20 mm, (4) fly ash, (5) jute fiber, (6) Super plasticizers, (7) water

Cement: Ordinary Portland Cement 53 Grade used in this study.

Fine Aggregate: The properties of sand were determined by tests as per IS 2386 (Part- I).

Table 1 Properties of Fine Aggregate

Properties	Sand
Sieve analysis	Zone II
Fineness modulus	2.83
Specific Gravity	2.65
Water Absorption	1.76
Bulk Density	1.61 (Loose) 1.74 (Compacted)

Coarse aggregate: Coarse aggregate of 10 and 20 mm were used. Coarse aggregate conforming to IS 383-1987 was used.

Table 2 Physical Properties of Coarse Aggregate

Properties	20mm	10mm
Specific Gravity	2.89	2.98
Water Absorption	1.42%	0.27%
Aggregate Impact Value	12.43%	14.25%
Aggregate Crushing Value	11.68%	9.88%
Flakiness Index	13.74%	12.65%
Elongation Index	21.74%	14.88%
Bulk Density	1.657 (Loose) 1.73 (Compacted)	1.540 (Loose) 1.66 (Compacted)

Fly ash: The fly ash Physical properties are tested as per standard procedure of IS: 1727:1967-2008

Table 3 Physical Properties of fly ash

Property	Result	Unit
Amount Retained on 45u wet sieve	10.62	%
lime reactivity	4.61	n/mm ²
Soundness by autoclave	0.02	mm
Specific Gravity	2.33	-
Fineness	358	M2/kg



Fig. 1 Fly ash

Jute fiber: Physical Properties of jute fiber

Table 4 Physical Properties of jute fiber

Property	Result
Length	10.02 mm
Diameter	0.1 mm
Density	1.32 gm/cm ³
Color	Brown



Fig. 2 Jute fiber

Super plasticizers: Super plasticizer BASF Master Glenium SKY 8986

Table 5 Physical Properties of BASF Master Glenium SKY 8986

Properties	value
Aspect	Reddish brown liquid
Density	1.10 at 25 C
PH	> 6 at 25 C
Chloride ion content	< 0.2 %

Table 6 Mix Proportion for M50 Grade of Concrete by weight

Water	Cement	Sand	Aggregate. Proportions as per table 2 of IS 383		Admixture
			(20mm)	(10mm)	
180	450	661.5	630	652.5	4.5
0.40	1	1.47	1.40	1.45	0.01

Table 7 Mix Proportion for M60 Grade of Concrete by weight

Water	Cement	Sand	Aggregate. Proportions as per table 2 of IS 383		Admixture
			(20mm)	(10mm)	
177.6	480	676.8	686.4	556.8	4.8
0.37	1	1.41	1.43	1.16	0.01

V. RESULTS

Workability:

- The slump test is used for the measurement of a property of fresh concrete as per IS: 1199 - 1959.

Table 8 Slump Test Results

Type	J ₀ N ₀	J _{0.1} N ₂₀	J _{0.2} N ₂₀	J _{0.3} N ₂₀	J _{0.4} N ₂₀	J _{0.5} N ₂₀	J _{0.1} N ₃₀	J _{0.2} N ₃₀	J _{0.3} N ₃₀	J _{0.4} N ₃₀	J _{0.5} N ₃₀
M50	105	102	96	92	85	80	100	96	90	86	75
M60	102	97	90	84	80	72	95	88	80	68	65

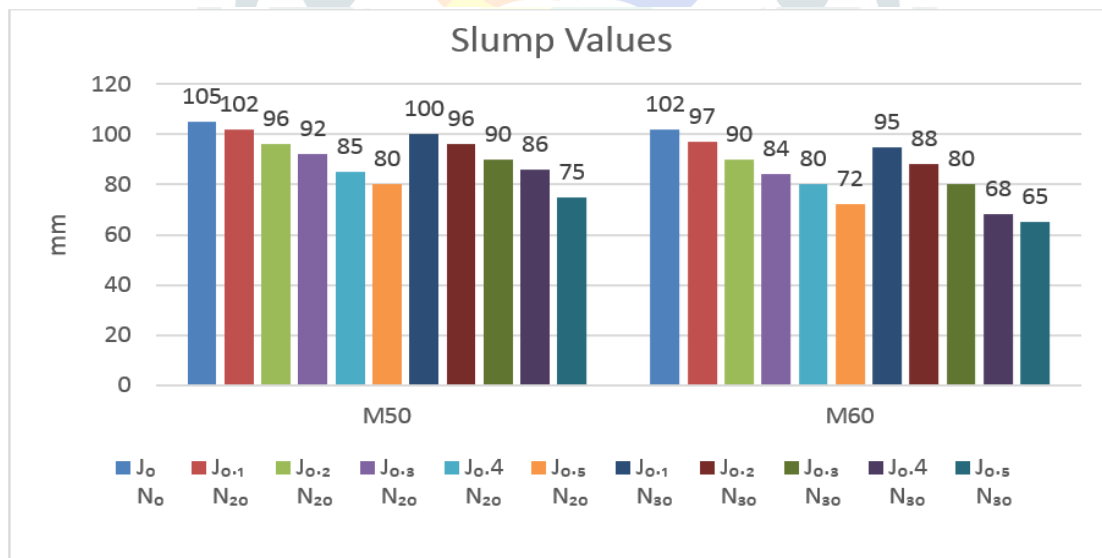


Fig. 3 Slump Values Comparison

Compressive Strength Test:

- Determination of compressive strength using by cube, a cube size is 150×150×150 mm and this test was performed on a 2000 KN capacity compression testing machine.
- Bureau of Indian Standards suggests that the compressive strength of concrete be considered as the basis for determining all properties and studying response of concrete. As such more emphasis was given on this test. The compressive strength of concrete was evaluated at the age of 7 days, 14 days and 28 days.
- The compressive strength of cube specimen is calculated using the following formula:

$$\sigma = P/A$$

Where, P = failure load
A = cross sectional area of cube in mm

Table 9 M50 grade Compressive Strength Test Result

Type	J ₀ N ₀	J ₀₋₁ N ₂₀	J ₀₋₂ N ₂₀	J ₀₋₃ N ₂₀	J ₀₋₄ N ₂₀	J ₀₋₅ N ₂₀	J ₀₋₁ N ₃₀	J ₀₋₂ N ₃₀	J ₀₋₃ N ₃₀	J ₀₋₄ N ₃₀	J ₀₋₅ N ₃₀
Jute fiber %	0 %	0.1 %	0.2 %	0.3 %	0.4 %	0.5 %	0.1 %	0.2 %	0.3 %	0.4 %	0.5 %
Fly ash %	0 %	20%	20%	20%	20%	20%	30 %	30 %	30 %	30 %	30 %
7 Days	38.33	38.66	39.01	39.44	38.78	38.21	36.27	36.43	35.95	33.89	33.80
28 Days	58.98	59.19	60.32	60.07	59.67	58.79	57.25	58.47	58.30	57.43	56.92

Fig. 3 M50 Grade Compressive Strength Values Comparison

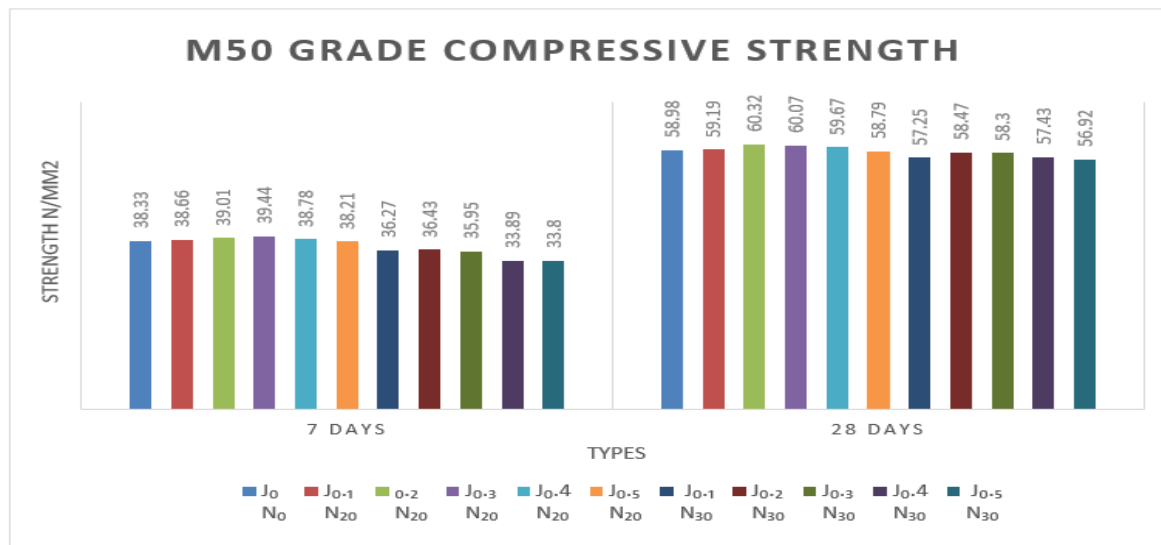


Fig. 4 M60 Grade Compressive Strength Values Comparison

Table 10 M60 grade Compressive Strength Test Result

Type	J ₀ N ₀	J ₀₋₁ N ₂₀	J ₀₋₂ N ₂₀	J ₀₋₃ N ₂₀	J ₀₋₄ N ₂₀	J ₀₋₅ N ₂₀	J ₀₋₁ N ₃₀	J ₀₋₂ N ₃₀	J ₀₋₃ N ₃₀	J ₀₋₄ N ₃₀	J ₀₋₅ N ₃₀
Jute fiber %	0 %	0.1 %	0.2 %	0.3 %	0.4 %	0.5 %	0.1 %	0.2 %	0.3 %	0.4 %	0.5 %
Fly ash %	0 %	20%	20%	20%	20%	20%	30 %	30 %	30 %	30 %	30 %
7 Days	44.57	45.37	45.59	44.07	43.16	44.09	43.13	42.72	41.71	39.46	39.46
28 Days	68.58	69.45	70.51	69.95	68.52	67.84	68.10	68.53	67.63	66.88	66.37

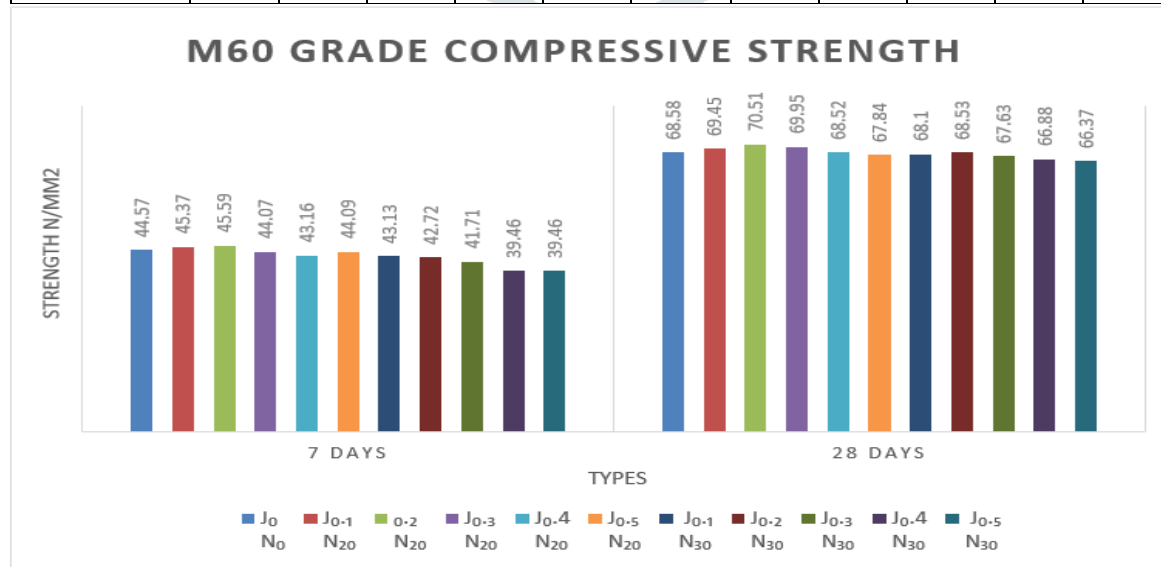


Fig. 5 M60 Grade Compressive Strength Values Comparison

VI. CONCLUSION

- ✚ It is found that Workability of concrete is decreased in increased with fiber content of jute fiber.
- ✚ Maximum Compressive strength of M50 grade of concrete After 28 day of Conventional concrete is **58.98 Mpa** and of fiber 0.2 % and fly ash 20% mix concrete is **60.32 Mpa**.
- ✚ Maximum Compressive strength of M60 grade of concrete After 28 day of Conventional concrete is **68.58 Mpa** and of fiber 0.2 % and fly ash 20% mix concrete is **70.51 Mpa**.
- ✚ It is found that there is increase in strength by **2.22% and 2.74%** for the M50 and M60 grade respectively with combination of **fly ash 20% and jute fibre 0.2%**
- ✚ It is found Optimum percentage of jute fiber **0.2%** and fly ash **20 %**

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