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## Effect of Jaggery on Strength of Concrete

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**Abstract:** Concrete is a composite material used on the grounds that all considerate designing structures are developed with concrete. This report accentuation that by utilizing locally accessible materials like jaggery, may enhance the properties of concrete. The experiment has been completed for assessing the quality properties of concrete utilizing Jaggery as admixtures into the concrete creation. Normally these sorts of admixtures utilized as a part of the extraordinary cases like huge wharfs and long heaps. Four unique rates of admixtures (Jaggery) are picked in the experimentation as, 0.1%, 0.2%, 0.3% and 0.4% by weight of cement with M20 and M25 grade, mix design of concrete. At last, it was presumed that workability and compressive strength of concrete upgraded when admixtures Jaggery included into the concrete synthesis.

**Keywords:** Jaggery, Compressive Strength, Split Tensile Strength, Flexural Strength, Workability

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### I. INTRODUCTION

Concrete is the most commonly used man-made construction material in the world. A good quality of concrete is directly related to the high quality of material used in the mixing process. In construction normally the workability, durability, and strength of concrete will be the first characteristic that will focus on to ensure the quality in construction. Hardened concrete can be obtained by the chemical reaction between different ingredients in mixing concrete. The strength of concrete will increase due to the age of concrete itself. The majority of the cementitious binder used in concrete is based on Portland cement clinker which is an energy-intensive process. Retarders are utilized as a part of the concrete synthesis to enhance the setting time and furthermore to expand the temperature of the structure with various kind of admixtures. It is watched that an old Monuments in Gandikota at Kadapa dist, where holding between the stones was accomplished by mortar with a blend of lime, sand and jaggery juice. Concrete made with admixtures like jaggery can be used specifically circumstances. Utilization of these admixtures will diminish the isolation and drying.

Jaggery is produced using the result of sugar stick. Along these lines, jaggery is valuable to include as an admixture in the concrete piece. In view of the exploratory outcomes, it was refined that, as the substitution proportion builds, workability and noteworthy esteems were expanded.

### II. LITERATURE REVIEW

- A. A. V. Pavan Kumar (2015) [1] Perform about the impact of Sugar, Jaggery and Sugar Cane Ash on Properties of Concrete. The admixtures (sugar and jaggery) are included into concrete at the measurement levels of 0, 0.025, 0.05, and 0.1% and check the properties enhancements in concrete. At various extents like 5%, 10%, 15%, 20%, 25% sugar cane Ash is supplant with cement. The compressive strength of concrete is increased by 8.93% for 15% partial replacement of sugar cane ash. The compressive strength of concrete has been higher than by 15.57% at the dosage level of 0.075% for sugar, such beyond to that there will be diminished in compressive strength of concrete for 7 days.
- B. Akogu Elijah Abalaka (2011) [2] Impact of sugar on physical properties of conventional Portland bond glue and concrete. Effect of sugar at centralizations of 0, 0.05, 0.06, 0.08, 0.10, 0.20, 0.40, 0.60, 0.80 and 1% by weight of bond on bond glue and grade M 35 concrete cured at 3, 7, 14 and 28 days was researched utilizing normal Portland bond in the lab. The underlying setting time of bond glue was longest at 0.06% sugar content with soundness estimation of 0.35 mm. Streak

setting with no expansion in quality was seen at sugar substance of 0.2-1%.The compressive quality test outcomes demonstrate some minimal quality picks up at all ages, however, tops at 11.84% at 3 days at 0.05% sugar content.

C. *Lavanya M.R(2012)* [3] The tests were directed a to assess the appropriateness of sugar stick baggese fiery remains for incomplete substitutions up to 30% of bond with shifting water concrete (w/c) proportion. The outcomes demonstrated that the expansion of sugarcane bagasse slag enhances the qualities in all cases. The greatest quality increment occurs at 15% with 0.35 w/c proportion.

D. *S. Deepika et. al. (2017)* [4]. Sugarcane bagasse ash and slag-based encompassing cured geo-polymer examples demonstrated improvement in compressive quality and workability in the examination with slag-based geo-polymer. No blossoming was seen in SCBA-based unburnt blocks, however, water ingestion in SCBA unburnt blocks was higher contrasted and fly fiery debris blocks. Sugarcane bagasse cinder mixed paver piece examples displayed noteworthy protection against water infiltration and sorption contrasted and control examples.

### III.OBJECTIVE

To determine ‘An Experimental Study on the effect of jaggery on strength properties of concrete.’ The experimentation has been done for assessing the quality properties of concrete utilizing Jaggery as admixtures into the concrete creation.

The main objectives of this study are:-

- Study on effect of jaggery on strength properties of concrete for M20 and M25 grade.
- To determine the optimum quantity of jaggery to enhance the strength of concrete by performing various test compressive strength, split tensile strength and flexure strength at the various percentage of jaggery.

### IV.MATERIALS USED & TESTS CONDUCTED

In the present study, an endeavour has been made to think about the impact of jaggery on properties of concrete. The methodology took after, tests directed for determination of configuration blend is examined in this part.The properties considered in this investigation are a zone of sand, assimilation limits of aggregates, surface dampness of aggregates , mass thickness of aggregates, fineness of concrete. The materials utilized as a part of this study are fine aggregates (stream sand), Ordinary Portland concrete (Ultratech), 10 and 20 mm pounded coarse aggregates which is accessible locally.

- A. *Ordinary Portland cement*: 43 Grade common Portland cement fitting in with IS: 12269 was utilized. The Specific gravity of the cement was 3.15, the underlying and final setting circumstances were found as 35 minutes and 450 minutes separately.
- B. *Fine Aggregates*: Locally accessible stream sand going through 4.75mm IS Sieve was utilized. The particular gravity of the sand was found as 2.65 and affirming to zone III of table 3.15 of IS 383-1970.
- C. *Coarse Aggregate*: Crushed shake aggregate accessible from nearby sources has been utilized. The measure of coarse aggregate was 20mm and 10mm. its particular specific gravity is 2.8.



**Fig. 1 Jaggery (Admixture)**

D. *Admixtures (Jaggery)*: Jaggery was the admixture used to enhance the properties of concrete. The fundamental motivation behind this report is to recommend the locally accessible materials (Which are notable to individuals like sugar, jaggery and sugar stick fiery debris) to enhance the properties of concrete and to lessen the cost of development. Properties enhanced amid the tests are setting time of concrete. The trial program is comprehensively grouped into different tests:-

- 1)Sieve analysis
- 2)Specific gravity Test
- 3)Water Absorption Test
- 4)Fineness of cement Test

V. MATERIALS USED & TESTS CONDUCTED

A. Consistency of Cement

TABLE I Consistency of Cement Containing Jaggery

S.No.	Percentage of Jaggery	Consistency %
1	0	33.5
2	0.1	33.0
3	0.2	33.5
4	0.3	32.5
5	0.4	33.0

It is observed that the usual range of water to cement ratio for normal consistency is between 26% and 34%. The pastes with utilize as admixture composition of 0.1%, 0.2%, 0.3% and 0.4% showed a consistency mostly similar of normal consistency.

B. Initial and Final setting time of cement:

TABLE II Initial and Final Setting time of Cement Containing Jaggery

S.No.	Percentage of Jaggery	Initial Setting Time	Final Setting Time
1	0	35	450
2	0.1	40	480
3	0.2	45	530
4	0.3	55	580
5	0.4	65	630

The Indian standard confines the initial setting time of concrete not to be under 30 minutes and the last set time not to surpass 10hrs. The outcomes for the setting time in Table.2 showed that expansion of jaggery impeded the setting; however, this hindrance was inside breaking points as indicated by the Indian standard. As the jaggery content expands the setting time has likewise demonstrated a pattern of addition, despite the fact that there are a few special cases.

TABLE III Workability of Concrete Containing Jaggery M-20 and M-25

S.No.	Percentage of Variation	Slump in [mm] M-20	Compaction Factor M-20	Slump in [mm] M-25	Compaction Factor M-25
1	0	100	0.93	75	0.91
2	0.1	160	0.94	82	0.92
3	0.2	174	0.95	91	0.92
4	0.3	190	0.96	95	0.94
5	0.4	202	0.97	105	0.97

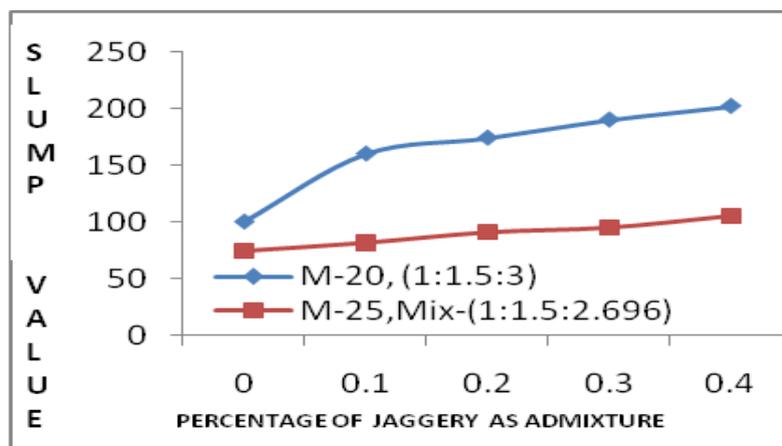


Fig.2 Slump Test of Concrete having Different Composition of Jaggery

A high-quality concrete is one which has acceptable workability. The above results for slump show that the workability increases with the increase in the percentages of Jaggery. All investigated Jaggery mixtures had High slump values and acceptable workability.

C. Compressive strength of concrete

TABLE IV: Compressive Strength [N/mm<sup>2</sup>] for M-20 Grade with Jaggery

Day's/ %	0 %	0.1%	0.2%	0.3%	0.4%
7	13.72	15.56	14.14	9.05	8.03
14	18.68	19.85	19.01	9.48	8.50
28	21.77	25.08	22.88	13.2	10.68
50	26.73	29.77	28.10	22.56	20.62

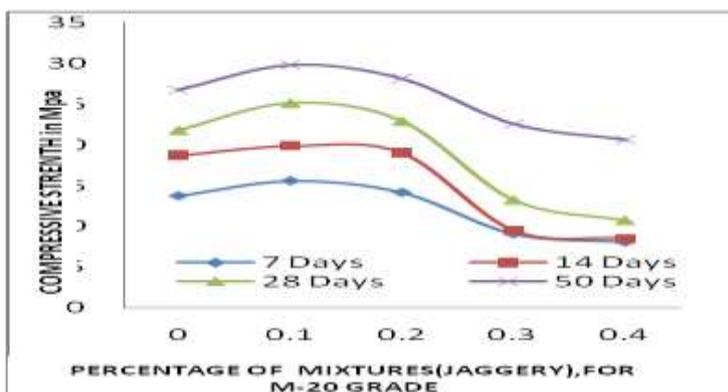


Fig.3 Compressive Strength Reading for M-20 Grade with Jaggery

TABLE V: Compressive Strength for M-25 Grade with Jaggery

Day's/% of Jaggery	0 %	0.1%	0.2%	0.3%	0.4%
7	17.35	20.68	18.56	11.56	10.56
14	23.56	24.9	24.0	16.51	13.8
28	26.1	30.25	27.56	16.85	13.73
50	36.66	41.66	38.56	31.83	28.3

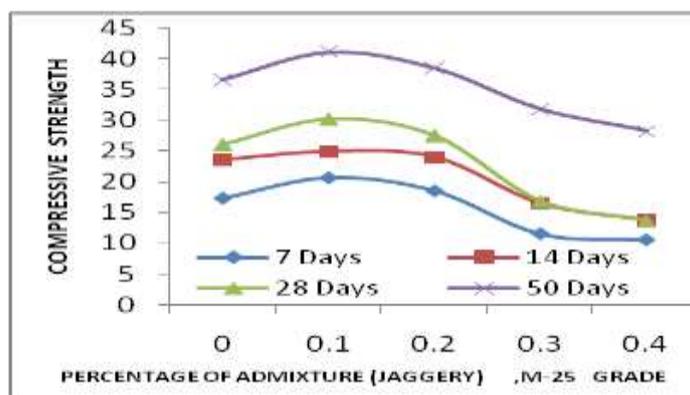


Fig.4 Compressive Strength Reading for M-25 Grade Jaggery

Compressive Strength (for the typical estimation of three cube test) at 7, 14, 28 and 50 days are higher than with the utilization as admixture 0.1% and 0.2% of piece jaggery and lower than 0.3% and 0.4% of jaggery appear differently in relation to different synthesis cube cases for M20 and M25 of concrete.

D. Flexural strength

TABLE VI: Flexural Strength for M-20 and M-25 Grade with Jaggery

Admixture of Jaggery	Flexural Strength [N/mm <sup>2</sup> ]	
	M-20	M-25
0%	3.11	3.94
0.1%	3.62	4.35
0.2%	3.31	4.148
0.3%	1.97	2.1
0.4%	1.659	1.762

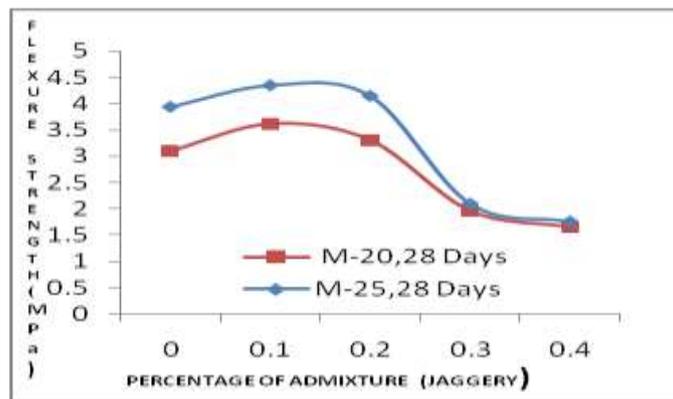


Fig. 5 Flexure Strength results of M-20 and M-25 Grade of Jaggery

Flexure strength has expanded contain jaggery with 0.1 and 0.2 % and abatement with 0.3 and 0.4% of containing jaggery. Contrast with typical cement with the M-20 and M-25 review other jaggery structure with the age of 28 days.

D. Split Tensile Strength

Table VII: Spit Tensile Strength for M-20 and M-25 Grade with Jaggery

Admixture of Jaggery	Split Tensile Strength [N/mm <sup>2</sup> ]	
	M-20	M-25
0%	4.10	4.856
0.1%	5.123	5.364
0.2%	4.745	4.995
0.3%	3.215	3.5627
0.4%	3.05	3.26

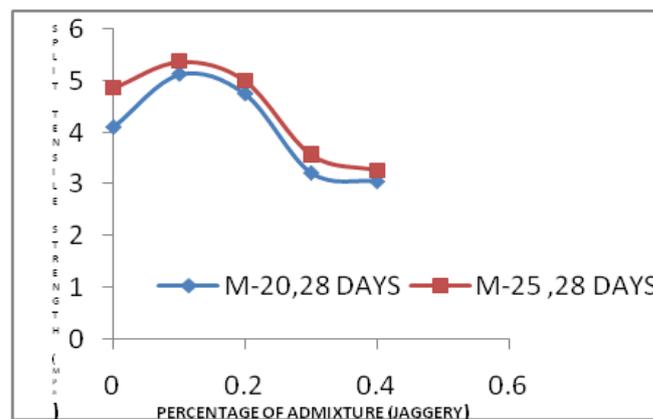


Fig.6 Split Tensile Strength Results of M-20 and M-25 of Jaggery

Split Tensile strength has expanded with the 0.1% and 0.2% jaggery as admixture and decline with 0.3 and 0.4% of containing jaggery with M-20 and M-25 review at 28 days.

### CONCLUSION

The results for different grades of concrete slump show that the workability increases with the increase in the percentages of Jaggery. Jaggery as an admixture, gives better strength values than the Sugar Segregation and bleeding was very less due to the usage of these admixtures. Setting time of the concrete increases as the dosage of admixture was increased. Compressive Strength (for the typical estimation of three cube test) at 7, 14, 28 and 50 days are higher than with the utilization as admixture 0.1% and 0.2% of piece jaggery and lower than 0.3% and 0.4% of jaggery appear differently in relation to different synthesis cube cases for M20 and M25 of concrete. Flexure strength has expanded contain jaggery with 0.1 and 0.2 % and abatement with 0.3 and 0.4% of containing jaggery. Contrast with typical cement with the M-20 and M-25 review other jaggery structure with the age of 28 days. Split Tensile strength has expanded with the 0.1% and 0.2% jaggery as admixture and decline with 0.3 and 0.4% of containing jaggery with M-20 and M-25 review at 28 days.

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