EFFECTIVE UTILIZATION OF MOLASSES FOR IMPROVEMENT OF WORKABILITY OF CONCRETE

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ABSTRACT

Molasses is a by-product recovered from the sugar refining process, due to molasses increases the fluidity of fresh concrete and also delays the hardening time of cement paste. In this study the molasses were determined from sugar production factories. Setting times of concrete prepared with molasses at three different dosage (0.40, 0.60, and 0.80 wt. % of cement content) were determined and it was found that molasses addition causes a considerable increase in both initial and final setting time. Also treated waste water used in concrete with different dosages of molasses (0.40, .60, and 0.80 wt. % of cement content) were determined and it was found that no harmful effect on the strength although the strength near about same slight increase. High performance concrete is prepared with molasses of different dosage (0.4, 0.6, and 0.8 wt. % of cement content) in this case also found that molasses of addition cause a considerable increase in both initial and final setting times. Workability test was carried out on fresh concrete prepared with three molasses. Compressive strength test are carried on (7, 14, and 28 days) prepared block and on hardening concrete (28 days) flexural, split test carried out. The strength of concrete with molasses showed slight increase at all ages, except early age, with respect to the control mix.

Keyword: - *Molasses treated waste water, raff nose, and sucrose.*

1. INTRODUCTION

Nowadays in civil industry concrete is widely used for construction. But in certain situation concrete can be used in all places because of its setting time. So that retarders are used in the concrete composition to improve the setting time with different type of admixtures. In this context we will try to use sugar industry by- the product of molasses in the concrete as a water reducing and time retarding admixture.

Molasses can be produced from sugar beet and sugarcane; it is the waste floating on the surface of boiling sugar juice during the processes of production of sugar is taken. When sugar is extracting from the sugar juice some amount of sugar is remain the waste liquid material which is called as molasses, and sugar includes carbohydrates and functions as a retarder. So much molasses slow down the hydration process in cement. This phenomenon increases the setting time of the concrete mix, along the quality of water added to concrete.

Therefore large-scale admixture replacement in concrete by molasses will be highly advantageous from standpoint of cost, economy, energy efficiency, durability and overall ecological and environmental benefits. Due to the existence of sugar in molasses its shows retarding setting time in fresh concrete.

2. METHODOLOGY

2.1 Description of molasses

The boiling of the sugar syrup yield dark, viscous blackstrap molasses, known for its robust flavor. The majority of sucrose from the original juice has been crystallized and removed. The calorific content of blackstrap molasses is mostly due to the small remaining sugars, it contains significant amounts of vitamin B6 and minerals, including calcium, magnesium, iron, and manganese.

Table 1 shows material and nutritional value

Sr. No.	Material	Nutritional Value per 100g
01	Calcium	21%
02	Iron	36%
03	Magnesium	68%
04	Mangan CSC	73%
05	Phosphorus	04%
06	Potassium	31%
07	Zinc	03%

Fig 1 Sugarcane syrup

These block with specifications prepared to analyze experimentally with normal concrete of grade M30 & M60 by adopting conventional methods of the design according to IS 456:2000 & IS 10262:2009.

2.2 Concrete mixes with varying percentage of molasses in block

These block with specifications prepared to analyze experimentally with the percentage of Molasses 0.4%, 0.6%, 0.8% mix with concrete of grade M30 & M60 by adopting the design according to the design according to IS 456:2000 & IS 10262:2009.

2.3 Concrete mixes with varying percentage of molasses with treated waste water in block

These block with specifications prepared to analyze experimentally with the percentage of molasses 0.4%, 0.6%, 0.8% mix with concrete of grade M30 & M60 by adopting the design according to IS 456:2000 to IS 10262:2009.

2.4 Casted specimen

a) Cube moulds

The mould used is of 150mm x 150mm x 150mm size conforming to IS: 10086-1982. In assembling the mould for use, the joints between the sections of mould was thinly coated with mould oil and a similar coating of mould oil was applied to the contact surfaces of the bottom of the mould and the base plate in order to ensure that no water escapes during the filling. The interior surfaces of the assembled mould were thinly coated with mould oil to prevent adhesion of the concrete.

b) Cylinders

The cylindrical mould used are of size 150mm diameter and 300mm height conforming to IS: 10086-1982. The mould and base plate was coated with a thin film of mould oil before use, in order to prevent adhesion of the concrete.

c) Beams

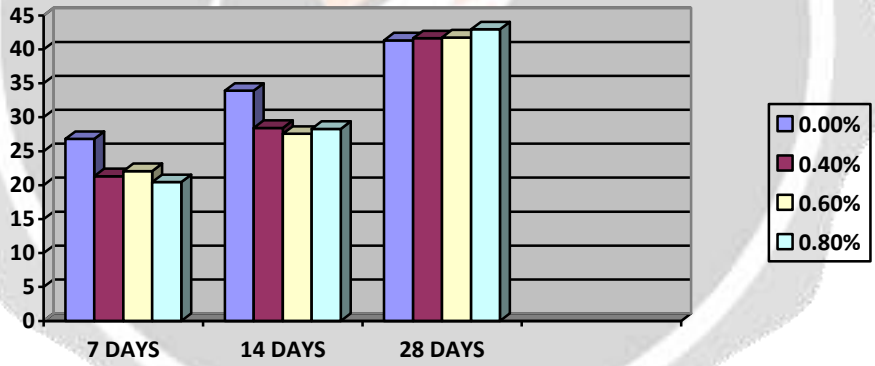
The beam moulds used are of size 150mm x 150mm x 1000mm conforming to IS: 10086-1982. Used for making cement concrete prisms or bars of the square cross-section for the flexural strength test. Inside faces are machined flat to within + 0.02mm tolerance and inside dimensions are accurate to + 0.2mm made of caste iron or steel, supplied complete with the base plate.

3. RESULTS AND DISCUSSION

3.1 The test was carried out as per I: 516-1959. Compressive strength tests were performed on cube samples using compression testing machine. Three samples per batch were tested with the average strength values reported in the table.

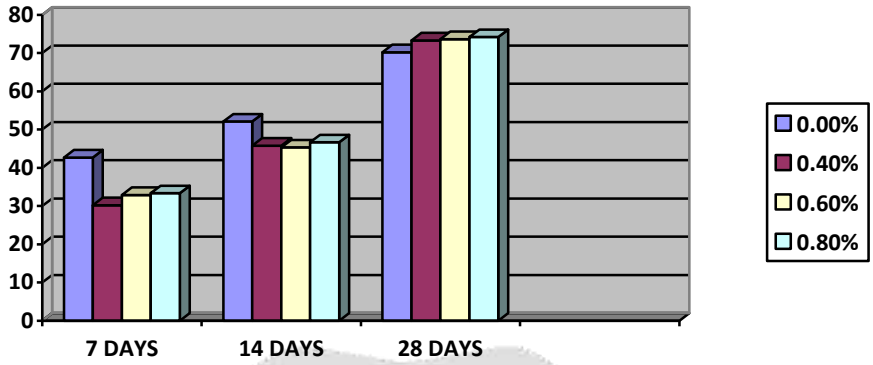
1. Table 2 For M30 grade of concrete using molasses

Specimen	No. of days	0%	0.4%	0.6%	0.8%
Cubes	7	26.82	21.33	22.07	20.44
	14	33.92	28.44	27.55	28.29
	28	41.33	41.63	41.77	42.96



2. Table 3 For or M60 grade of concrete using molasses

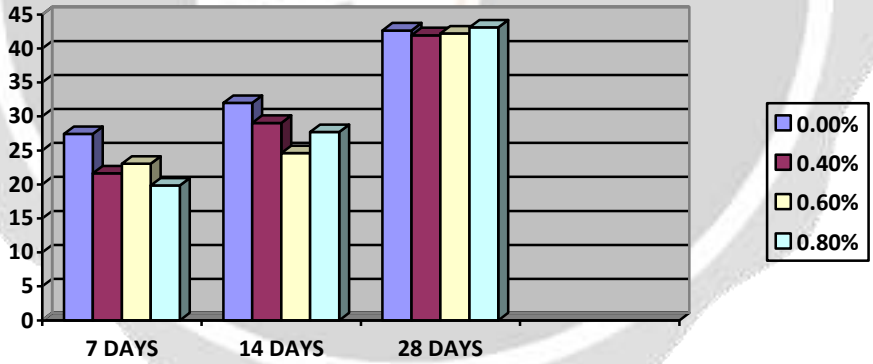
Specimen	No. of days	0%	0.4%	0.6%	0.8%
Cubes	7	42.67	30.22	32.88	33.33
	14	52.11	45.77	45.33	46.67
	28	70.22	73.33	73.67	74.22



3.2 Treated waste water used in concrete with molasses

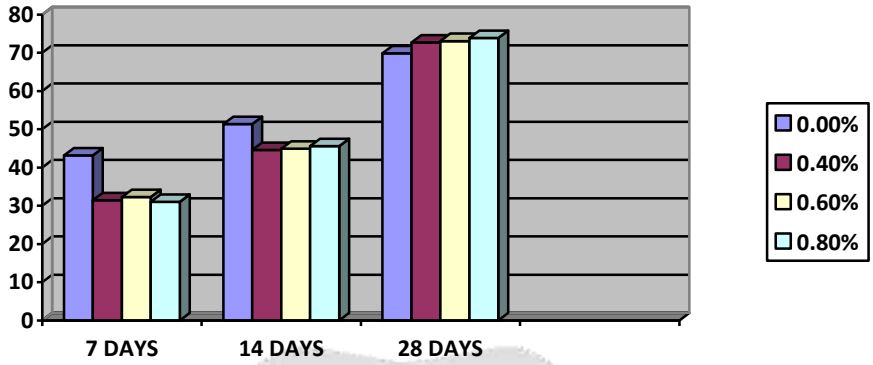
1. Table 4 For M30 grade of concrete using molasses with treated waste water

Specimen	No. of days	0%	0.4%	0.6%	0.8%
Cubes	7	27.41	21.63	23.03	19.85
	14	31.99	29.04	24.59	27.70
	28	42.66	41.96	42.22	43.11



2. Table 5 For M60 grade of concrete using molasses with treated waste water

Specimen	No. of days	0%	0.4%	0.6%	0.8%
Cubes	7	43.12	31.42	32.26	31.02
	14	51.36	44.54	44.91	45.57
	28	69.86	72.68	73.06	73.86



4. RESULT AND DISCUSSION

Concrete has been prepared with the addition of three different dosages with three different percentages as 0.4%, 0.6% and 0.8%. Based on the experimental results, as the percentage of admixtures increased, consequently, slump also increased. The addition of molasses to the concrete greatly influenced the setting properly and clear collapse of slum witnessed during the experimentation. The setting of cube specimens after 24hrs was difficult. During the demoulding after 24hrs, cube specimens were exhibit cracks. So, demoulding of specimens carried out after 48hrs for 0.4% and above. So, the concentration of molasses is reducing by adding 50% of water. After reduce the concentration of molasses in concrete is more feasible. The basic reason for extending the setting of time slow down the hydration process. But during the testing of slump value, it was clearly observed that collapse of slump, when molasses added at a dosage of 0.4%, 0.6% and 0.8%.

Molasses used in concrete the initial and final setting time of this concrete is an increase. Subsequently, the compressive strength of the concrete also slightly increases in all ages except early days. When treated waste water is used along with the molasses in concrete then on the strength no any abrupt negative impact. This compressive strength result is same for the high-performance concrete. In the split and flexural test also slightly increase at 28 days even after using treated waste water in the concrete also shows slightly increase in strength. so that in this experiment found that the treated waste water is using suitable for the concrete.

Fig 2 Slump cone and collapse of concrete after lifting

5. CONCLUSIONS

1. The concrete prepared with molasses show a slight increase in compressive strength at all ages.
2. Workability increased when the dosage of admixture was increased.
3. The setting time of the concrete increased as the dosage of admixture was increased.
4. Low cost and environment-friendly concrete can be produced by using molasses.

5. Concrete cost can be reduced by using molasses that also provides a green production.
6. The molasses-added cement pastes show expanded setting times even in 0.4% dosage, and the higher the molasses dosage, the longer the setting time.

6. REFERENCES

[1] HasanYildirim and BarisAltun "Usage of Molasses in concrete as a water reducing and retarding admixture", Indian Journal of Engineering and Materials Sciences, 19, 2012, PP 421-426.
[2] Bazid Khan and BulentBaradan "The Effect of Sugar on Setting –Time of Various type of Cements", Science Vision, 8(1), 2002, PP71-78.
[3] Jumadurdiyev A., Ozkul M. H., Saglam A. R. and Parlak, N The utilization of beet molasses as a retarding and water-reducing admixture for concrete. Cement and concrete research, 35 (5), 874-882, (2005).
[4] Liu W, Liu Y, Liu S &Jiang X. The progress of research on treating molasses waste water and resources. China Res ComprUtil 2009;27:39–41
[5] Shetty, M.S. Concrete technology – theory and practice. 5th ed., S. Chand and Co. Ltd., Ram Nagar, New Delhi, India, 2004.
[6] Young, J.F. A review of the mechanisms of setretardation in Portland cement pastes containing organic admixtures, Cement and Concrete Research 2(4): 41533, July1972.
[7] GarciJuengerand Jennings H.M. New insights into theeffects of sugar on the hydration and microstructure of cement pastes. Cement and Concrete Research 32(3): 393-9, March 2002.
[8] Giridhar.V, Gnaneswar K, and Kishore Kumar Reddy Effect of Sugar and Jaggery on Strength Properties of Concrete, The International Journal of Engineering And Science (IJES), Volume 2, Issue 1, Pages 01-06, 2013. ISSN (e): 2319 –1813 ISSN (p): 2319 – 1805.
[9] XiaojianGao, Yingzi Yang, Hongwei Deng Utilization of beet molasses as a grinding aid in blended cements, Construction and Building Materials 25 (2011) 3782– 3789, 2011 Elsevier Ltd.
[10] Dinesh Kumar Sugarcane Molasses in Concrete as a Water Reducing-Retarding Admixture, SSRG International Journal of Civil Engineering (SSRG-IJCE) – EFES April 2015, ISSN: 2348 – 8352.
[11] AmanmyratJumadurdiyeva,M. HulusiOzkula, AliR. Saglamb&NazmiyeParlak The utilization of beet molasses as a retarding and water-reducing admixture for concrete, Cement and Concrete Research 35 (2005) 874–882, 2004 Elsevier Ltd.