EXPERIMENTAL INVESTIGATION ON PLASTICIZING AGENT IN CONCRETE

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Abstract: This paper presents experimental investigation carried out to evaluate effects of replacing cement with that of molasses. Preventing the depletion of natural resources and enhancing the usage of waste material has become a challenge to the scientist and engineers. This replacement partially with 0.8% and 0.9% of the sugarcane molasses by cement. The fresh concrete test slump test, compacting factor test, split tensile strength test will be conducted. For conventional concrete and our molasses concrete cylinder and cubes will be casted. All the specimens will be cured in a curing tank. The conventional and our molasses concrete will be compression strength and split tensile strength tested for 7 days, 14 days and 28 days strength. This paper presents experimental investigation carried out to evaluate effects of replacing cement with that of molasses. Preventing the depletion of natural resources and enhancing the usage of waste material has become a challenge to the scientist and engineers. This replacement partially with 0.8% and 0.9% of the sugarcane molasses by cement. The fresh concrete test slump test, compacting factor test, split tensile strength test will be conducted. For conventional concrete and our molasses concrete cylinder and cubes will be casted. All the specimens will be cured in a curing tank. The conventional and our molasses concrete will be compression strength and split tensile strength tested for 7 days, 14 days and 28 days strength.

KEY WORDS: compressive strength, split tensile strength, flexural strength.

1 .INTRODUCTION

Concrete is the most versatile construction material because it can be designed to withstand the harshest environments while taking on the most inspirational forms. Engineers are continually pushing the limits to improve its performance with the help of innovative chemical admixtures and supplementary cementations materials. Concrete is the most widely used material on earth after water. Many aspects of our daily life depend directly or indirectly on concrete. Concrete is prepared by mixing various constituents like cement, aggregates, water, etc. which are economically available. Concrete is unique among major construction materials because it is designed specifically for particular civil engineering projects. Concrete is a composite material composed of granular materials like coarse aggregates embedded in a matrix and bound together with cement or binder which fills the space between the particles and glues those together. Concrete plays a critical role in the design and construction of the nation's infrastructure.

2. MOLASSES

Molasses is a by-product of sugar industries, which used beet in the production. Like Lignosulphonate, which is a by-product paper industry, Molasses also shoes plasticizing in concrete. Furthermore, due to the existence of sugar in Molasses, it exhibits retarding effect in fresh concrete. Molasses can be used as a type D and type a admixture. Molasses has been used in many industries are raw material, like animal food industry in the production of alcohol, ferment and glycerin1-3.

2.1 Constituents of molasses

At the end of various refining processes a dark-brown syrup, which is called Molasses is obtained sugar. Industry .molasses consist of 50% sucrose, 30% of other sugar (ash and nitrous materials) and 20% water approximately. About 4-8%of beet remains as molasses after the process. The composition of molasses differs depending on the source it has been obtained, such as from need or beet. Reed molasses, which have invert sugar, has lower nitrogenous materials then molasses of beet.

3. MATERIALS AND MIX PROPORTIONS

The materials used for the preparation of concrete mix are cement paste, coarse and fine aggregates, water, superplasticizers and water.

Mix design of M_{20} grade of concrete is designed using IS 10262:2009. A mix proportion of 1:1.48:2.97:0.4(cement: fine aggregates: coarse aggregates 20mm: water) for M_{20} grade was calculated. Portland cement of grade 53 was used confirming to IS 12269:2013, water cement ratio of 0.4 was maintained for all mixes. Basalt fiber of dosages 0%, 0.8%, 0.9% by volume fraction of concrete.

4. EXPERIMENTAL SETUP

Cube of mould size 150mm x 150mm x 150mm, cylinders of mould size 100mm x 200mm and beam mould of size 100mm x 150mm were cast and cured.

5. TESTS ON CONCRETE
5.1 Basic Tests on Materials

Specific gravity test was done on fine and coarse aggregates using pycnometer. The fineness modulus was calculated using sieve analysis test.

The impact test was done to determine the toughness using impact testing machine, abrasion test was done using Los Angeles abrasion machine. The consistency of cement was found using VI cat's Apparatus. The results of these tests are tabulated in Table-III.

5.1 Tests on Fresh Concrete

The workability of fresh concrete is measured using the Vie Bee Consist meter apparatus. This test is used to measure the change in the concrete shape from slump cone to cylinder by mode of vibration.

5.2 Tests on Hardened Concrete
Compressive strength

Compressive strength tests were carried out on concrete cubes in Universal Testing Machine (UTM) of capacity 2000kN under 140kg/sq.cm/min loading rate, until the resistance of the specimen to the increasing load can be sustained. The results are shown in Table-IV. The compressive strength of concrete can be calculated using Equation (1).

$$f_{cu} = P / A \ (N/mm^2) \ (1)$$
Where,
f_{cu} = compressive strength of concrete (N/mm^2)
P = load applied (N)
A = cross sectional area (mm^2)

Flexural strength

The flexural strength or modulus of rupture of concrete was determined for the beams cast. The results are shown in Table-V. The flexural strength of concrete can be calculated using Equation (2).

$$f_{cr} = PL / bd^2 \ (N/mm^2) \ (2)$$
Where,
f_{cr} = flexural strength of concrete (N/mm$^{2)}$
P = load applied (N)
L = effective span (mm)
b = breadth (mm)
d = depth (mm)

Split tensile strength

Cylindrical specimens were cast and cured to determine the split tensile strength of concrete. They were loaded in compression side along the diameter plane. The results of the split tensile strength are tabulated in Table-VI. the formula to calculate the split tensile strength is given in equation (3).

$$f_t = 2P / \Pi DL (N/mm^2) \ (3)$$
Where,
f_t = split Tensile strength of concrete (N/mm^2)
P = load applied (N)
D = diameter (mm)
L = effective span (mm)

6. RESULTS AND DISCUSSION

- From the results it is seen that with increase in molasses content the workability reduces i.e., the vee bee time increases.
- The compressive strength of concrete increases with increase in molasses content upto a certain level.
- The flexural and the split tensile strengths of concrete increases with increase in molasses.

The results of the basic tests, compressive strength, flexural strength and split tensile strength are shown in Tables -I, II, III, below.

A. BASIC TEST ON MATERIALS

Table-I: Basic tests on materials

S.NO	PROPERTIES	VALUE
1	Specific gravity of coarse aggregates	3.5
2	Specific gravity of fine aggregates	3.07
3	Fineness modulus	2.25
4	Impact value	14.9%
5	Abrasion value	34
6	Consistency of cement	30%

B. COMPERSSIVE STRENGTH
Table-II: Compressive strength value

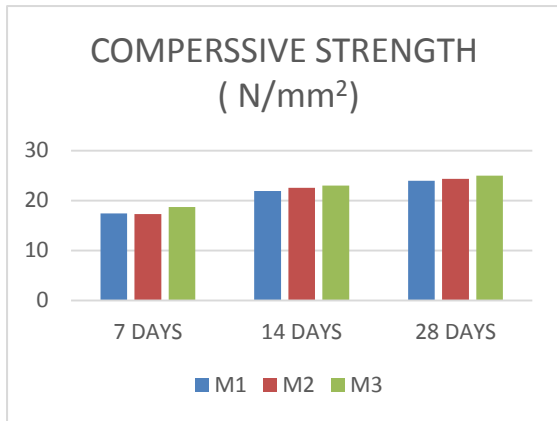| Percentage of Molasses	Compressive strength(N/mm^2)		
	7 days	14 days	28 days
M1 (0.0)	17.40	21.90	23.93
M2 (0.8)	17.30	22.56	24.32
M3 (0.9)	18.67	22.98	24.98

Chart-1: Compressive strength

C. FLEXURAL STRENGTH

Table-III: Flexural strength value

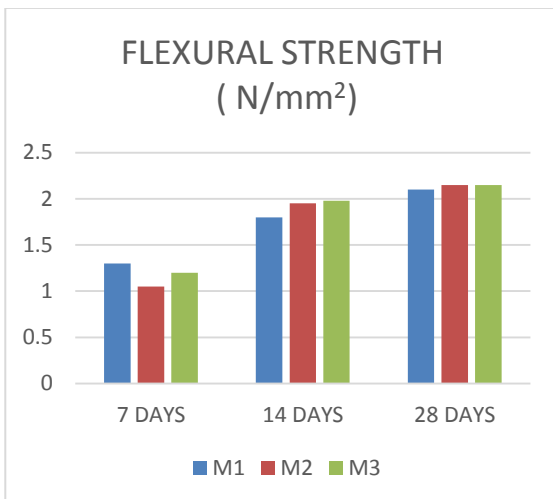| Percentage of Molasses	Flexural strength(N/mm^2)		
	7 days	14 days	28 days
M1 (0.0)	1.3	1.8	2.1
M2(0.8)	1.05	1.95	2.15
M3(0.9)	1.2	1.98	2.15

Chart-2: Flexural strength

D. SPLIT TENSILE STRENGTH

Table-IV: Split tensile strength value

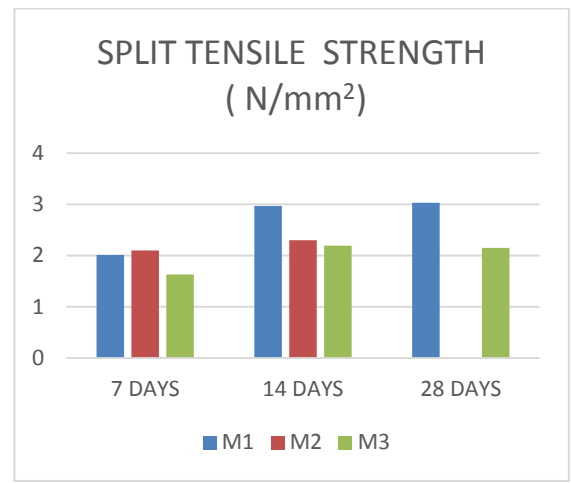| Percentage of Molasses	Split tensile strength (N/mm^2)		
	7 days	14 days	28 days
M1 (0.0)	2.01	2.97	3.03
M2(0.8)	2.10	2.3	2.4
M3(0.9)	1.63	2.19	2.38

Chart-3: Split tensile strength

7. CONCLUSIONS

1. The various experiments conducted in concrete by adding molasses reflecting that, molasses can be used as a time retarding and water reducing admixture.
2. It increases both initial and final setting time of a concrete to a greater extent. It also enhances the workability of fresh concrete. At the same time, the target strength of 20N/mm^2 is achieved for all the samples of concrete.
3. Therefore, using molasses as a plasticizer will be very handy instead of using very costly chemical plasticizers. Water content in M_{20} grade concrete can be reduced up 15% by adding molasses at 0.9 percentage.
4. Modification of mix design due to reduction in water content results in reduction of cement content. Quantity of cement used in control sample is 375 kg/m^3. While adding molasses by 0.9% it reduced to 318.75kg/m^3. Reduction in cement content did not caused any aggressive effect in strength parameters.

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