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Influence of Molasses as an Admixture on Concrete

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ABSTRACT

This paper emphasizes the effect of molasses on properties of concrete. The experimental analysis has been carried out for evaluating various properties such as workability, compressive and split tensile strength of concrete was carried out using molasses as admixtures. Based on the literature, the main function of using molasses is making concrete compatible, extending the initial setting time and final setting time of concrete. From the result, it was observed that all the properties of concrete were influenced by addition of this molasses in concrete and it is also found that the molases also serve as a water reducing agent.

1. INTRODUCTION

The use of waste products has become trending for the development of new technologies. It not only reduces environmental pollution but also ensures efficient use in various sectors. Molasses is a by-product of the sugar industry, which has its main component as sugar, which is taken as admixture in this study. There are nearly 571 sugar factories in India. Every industry produces molasses as a by-product. Therefore, its use in the construction industry proves efficient use of the by-product. The dark brown syrup obtained at the end of the refining process is called molasses. Molasses contains approximately 50% sarcose, 30% other sugars (ash and nitrous) and 20% water. Molasses acts as a water-reducing admixture, water cement ratio can be reduced by adding molasses. Molasses has air-entraining property, thus improving the durability of concrete by dispersing the particles in concrete, thus improving the durability of concrete during freezing and thawing.

2. OBJECTIVE

To conduct consistency, initial and final setting time test with optimum dosage of superplasticizer with molasses and to estimate extension in setting time. To conduct the marsh cone test with conventional superplasticizer with molasses, workability of concrete was measured. To determine the compressive and split tensile strength of concrete using molasses as admixture.

3. LITERATURE SUMMARY

The aim of the investigation was to study the effect of molasses of various properties of concrete containing molasses as an admixture.

3.1. Collection of Sample

The sample is collected form co-operative sugar industry located near Rajahmundry.

3.2. Analysis of Sample

The sample of molasses, which is obtained from sugar industry, is analysed to determine the chemical composition using EDAX analysis.

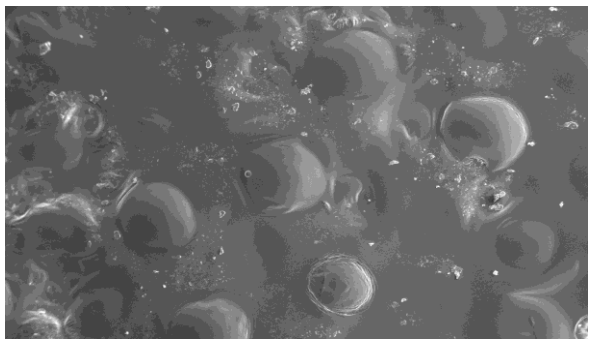

Figure 1. SEM Image of molecules

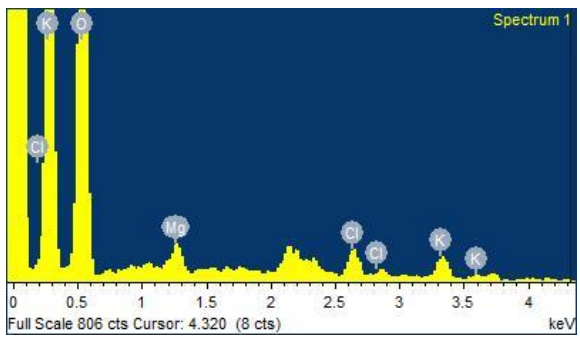

Figure 2. Concentration of chemicals

After analyzing this sample the following chemical composition have been obtained from EDAX analysis.

Table 1. Chemical content of molasses

Element	Weight %	Atomic %
Oxygen	84.34	91.99
Magnesium	2.69	1.93
Chloride	6.25	3.08
Potassium	6.72	3.00

4. EXPERIMENTAL INVESTIGATION

In order to evaluate the performance of molasses the following tests were conducted.

4.1 Marsh cone test

As molasses is to be used as a plasticizer in concrete, its optimum dosage needs to be found. Marsh cone test is done with molasses and ordinary Portland cement of 53 grades. From the experiment, the optimum dosage of molasses was found to be 1.25 percent by weight of cement, a test is conducted with conventional superplasticizer to compare its results with molasses.

Table 2. Marsh cone test

Super-plasticizer (% by weight of cement)	Marsh cone Time in Sec	Molasses (% by weight of cement)	Marsh Cone Time in Sec
0.5	37	0.5	24
0.75	29	0.75	16
1	24	1	12
1.25	20	1.25	11
1.5	17.2	1.5	10.8
1.75	17	1.75	10.6
2	16.7	2	10.1
2.5	16.2	2.5	9.8

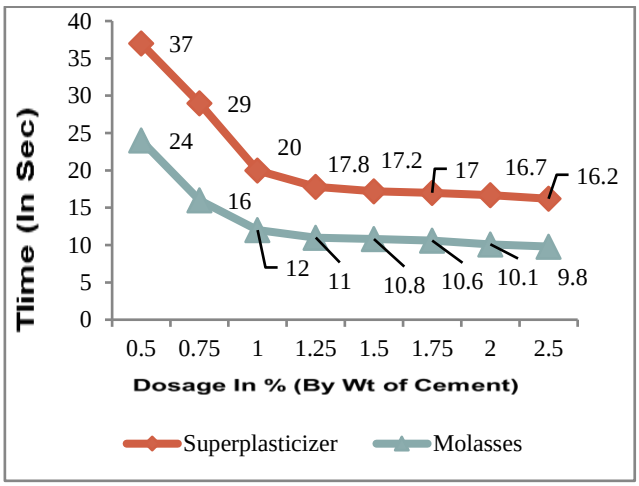

Figure 3. Graphical representation of marsh cone result

4.2 Split Tensile Test

Consistency is observed for cement paste mixed with molasses with varying percentage by weight of cement. Standard consistency and setting time for various doses are given in the table below.

Table 3. Consistency and Setting time

S.No	Dosage of molasses	Standard Consistency	Setting time (minutes)	
			Initial	Final
1	0.25	26.85	60	135
2	0.5	26.77	88	190
3	0.75	26.69	111	230
4	1	26.57	130	285

4.3 Mix Design

A concrete mix design for M25 grade concrete was prepared for four trail mixes namely control mix, 5% water reduction, 10% water reduction, 15% water reduction.

Table 4. Trial proportions

S.No	Materials	Control mix	Reduction (lts)		
			5%	10%	15%
1	Cement	6.64	6.31	6.00	5.64
2	F. A	11.10	11.33	11.50	11.89
3	C.A	17.60	18.00	18.25	1.87
4	Water	3.00	2.84	2.69	2.54

4.4 Tests on Fresh Concrete

Workability for different trial mixes was measured by slip cone test and compaction factor test.

Table 5. Slump cone value

S.No	Trial mix	Slump in mm
1	Control mix	45
2	5% water reduction	165
3	10% water reduction	145
4	15% water reduction	125

Figure 4. Slump test

Table 6. Compaction factor test result

S.No	Mix	Compaction factor
1.	Control mix	0.82
2.	5% water reduction	0.94
3.	10% water reduction	0.90
4.	15% water reduction	0.87

4.5 Compressive test

Cube compressive strength test for trial mixes were conducted for 7 days and 28 days.

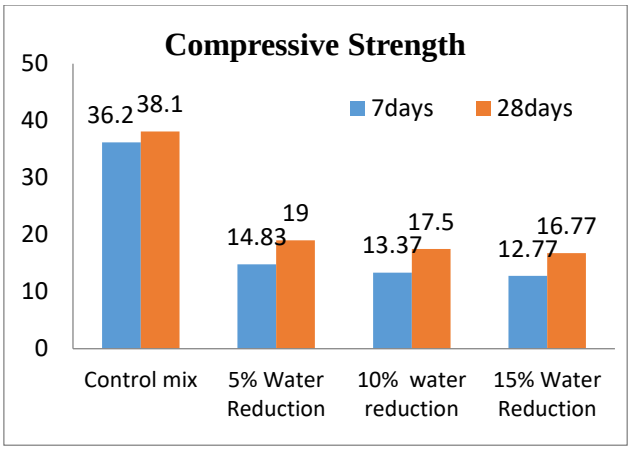

Figure 5. Graphical representation of compressive strength

4.6 Split tensile test

Split tensile strength test for trial mixes were conducted for 7 days and 28 days.

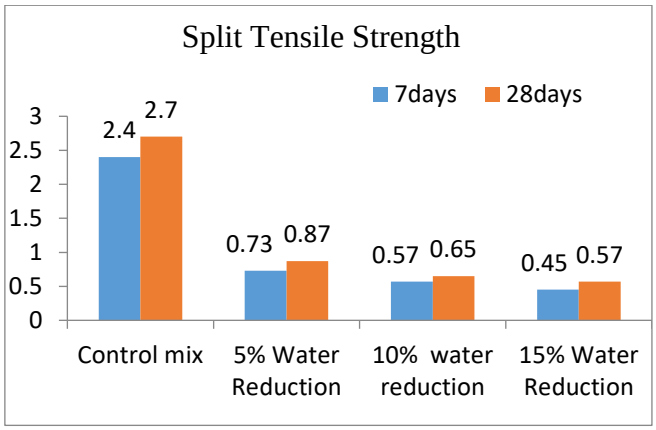

Figure 6. Graphical representation of split tensile strength

5. CONCLUSION

- Molasses act as water reducing compounds as well as retarding mixtures. Thus the workability of fresh concrete is significantly increased and the water cement ratio is reduced.
- Initial setting and final setting time after mixing molasses in concrete molasses act to entrain air
- The compressive strength at 7 days and 28 days was found to be 15 N/mm2 and 15 N/mm2.
- Addition of molasses has been observed to increase the workability of fresh concrete, but studies have shown that reduction in initial strength of concrete and gain of strength can be achieved in later stages.
- Compared to conventional superplasticizer molasses, it is cheaper and offers considerable workability and also acts as a retarding agent so that it can be used in hot weather conditions.

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