Enhancing the Properties of Hardened Cement in the Bag in Comparison with the Normal Cement

Jisha G S[1], Adeeba S[2], Aksharalal[3], Anupama R[4], Devananda S B[5]
[1]*Assisstant Professor, Civil Engineering, Vidya Academy of Science and Technology Technical Campus,Kilimanoor*
[2,3,4,5]*Btech Student, Civil Engineering, Vidya Academy of Science and Technology Technical Campus, Kilimanoor*

***Abstract*— Concrete is one of the most essential componentsin building construction. The durability and life of a concrete structure depend on the quality of the concrete, which in turn depends on the quality of the cement used to make it. If the cement is not stored in a moisture-free environment, it can be compromised. Cement plays a crucial role in binding the dryingredients of concrete or mortar when water is mixed and in giving concrete its strength. When mixed with water, cement undergoes a chemical reaction called hydration, due to which it hardens and acquires strength. Hence, when stored or not in use, even the atmospheric moisture reacts with the cement and causes it to harden. Thus, unwanted moisture is very dangerous for cement before use. If cement gets moist afterpacking, it forms lumps, and using such cement may result in poor-quality concrete or mortar, reducing the life of the building or house. Bagged hardened cement cannot be used in construction.**

In this paper, we determined the properties of bagged hardened cement and compared it with the same properties of the normal cement. Thereby we determined how much of the properties have been changed in the cement while hardening and which of them are need to be improved. By making a suitable comparison between them, we can select a suitable material that can be added to the bagged hardened cement for improving its properties and thereby making them suitable for various applications. The additive used inthe study is crushed jaggery. The test specimens were 70.6x70.6x70.6mm cement mortar cubes, 150x150x150mm concrete cubes and 150mm diameter and 300mm height concrete cylinders. The specimens are tested for their strength. Three mixes were prepared and the test values were compared.

***Index Terms*—Bagged hardened cement, Hydration, Lumps.**

I. INTRODUCTION

Concrete is used as a structural component in commercial/residential buildings, pavements, and driving surfaces of bridges and roads. Cement is the main component of concrete. Moisture is one of the major concrete system enemies. Bagged hardened cement cannot be used in construction. Bagged hardened cement is collected and crushed into standard cement powder. The properties of this cement were determined. It is observed that concrete made using jaggery as an additive will improve its strength, initial and final setting time. The jaggery as the admixture is very beneficial to the progress of the construction industry as these are affordable and locally available materials. Here we used jaggery as anadditive for hardened cement and its properties were determined.

II. OBJECTIVES

1. To analyses the properties of cement that get hardened in the bag.
2. Then compare those properties with normal cement.
3. Then selecting suitable additives which canbe used in various application.

III.MATERIALS USED

3.1 Cement hardened in the bag

Cement mix get hardened due to hydration process. Hydrated cement mix turn to dense concrete block. This often occurs if the bags are stored outdoors or in a humid, moist environment. Even without exposure to moisture, dry cement mix can still settle and bindtogether, forming lumpy concrete.

3.2 Normal cement

Finely milled mineral powder. Mixed with water cement serve as an adhesive to bind sand, graveland hard rock in concrete. The most important raw materials to produce cement are limestone, clay, and marl. Mixed with water,cement serves as an adhesive to bind sand, gravel, and hard rock in concrete.

3.3 Fine aggregate

Fine aggregates are natural sand or crushed stonethat are 6.35mm or smaller. The size of fine aggregate is defined as equal to or less than 4.75mm. The use of fine aggregates helps the mixtureto sustain its dimensions. The use of fine aggregate has the potential to affect both the elastic properties and the damage tolerance of theconcrete.

3.4 Coarse aggregate

Coarse aggregate refers to irregular and granular materials such as sand, gravel, or crushed stone.

Materials that are large enough to be retained on 4.75 mm sieve size.

3.5 Water

Water used for mixing and curing of concrete should be free from impurities. Presence of impurities reduce strength and durability of concrete

3.6 Jaggery

To improve concrete features such as performance and compressive strength, Jaggery mix is added. It improves efficiency, durability, compressive strength of concrete mix.

IV.MIX DESIGN AND MIX DESIGNATION

M_{15} grade concrete is prepared for the study

Sl. No.	Mix designation	Jaggery(%)	Water cementratio
1	Mix-1(Normal cement)	0	0.6
2	Mix-2 (Hardened cement)	0	0.6
3	Mix-3	2	0.6

V.DETAILS OF NO OF SPECIMEN

Specimen	Size	Number
Cement mortar cube	70.6X70.6X70.6	18
Concretecube	150X150X150	18
Cylinder	150mm dia, 300mm height	18
Beam	500X100X100	18

V.TEST RESULT AND DISCUSSIONS

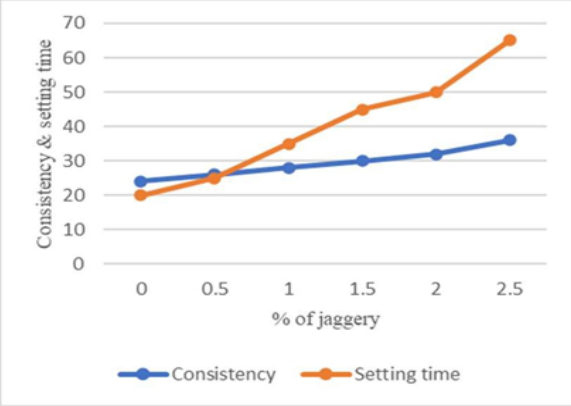
6.1 Tests on Cement

Sl. no.	*Items*	*Mix1*	*Mix2*	*Mix3*
1	*Standard consistency (%)*	*29*	*24*	*32*
2	*Initial setting time(minutes)*	*45*	*20*	*50*
3	*Specific gravity*	*3.12*	*2.16*	*2.9*
4	*Compressive strength(N/mm^2)* *7 days* *28 days*	 *32* *42*	 *16* *26*	 *22* *36*

6.1.1Graphical representation of standard consistency and setting time

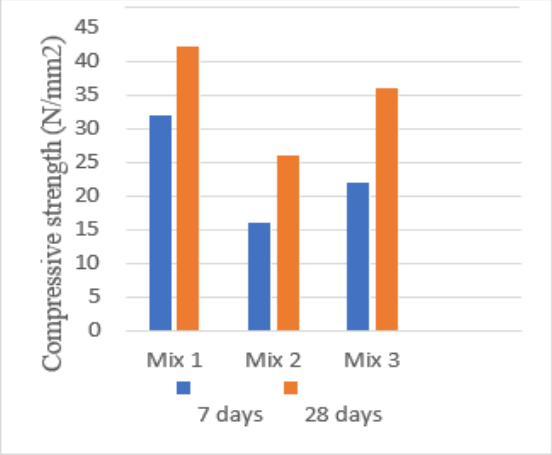
Jaggery	*Consistency*	*Setting*

		time
(%)	(%)	(minutes)
0	24	20
0.5	26	25
1	28	35
1.5	30	45
2	32	50
2.5	36	65



The figure shows a graphical representation of consistency and setting time of Mix 3. It shows that consistency and setting time increases gradually with increase in % of jaggery.

6.1.2 Graphical representation of compressivestrength of mortar cubes

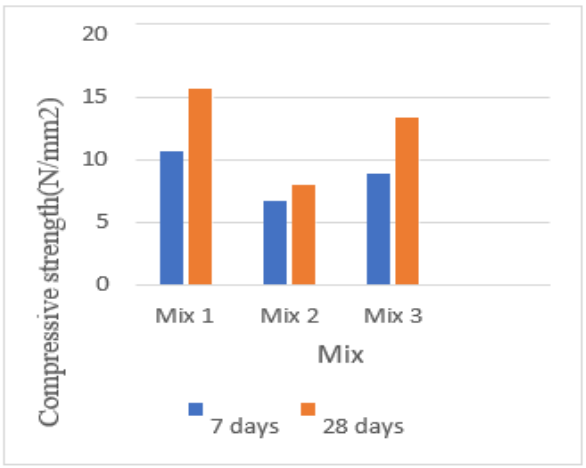


This graph shows that the compressive strength of Mix 2 is very low. Compared to Mix 2, Mix 3have high compressive strength value. It achievesby the addition of jaggery.

6.1 Tests on concrete

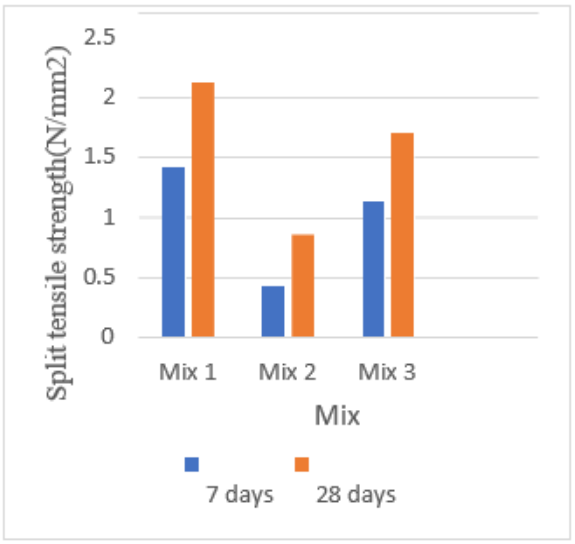
Sl. no.	Items	Mix1	Mix2	Mix3
1	Slump value(mm)	18	0	26
2	Compressive strength(N/mm^2) 7 days 28 days	10.67 15.57	6.67 8	8.89 13.33
3	Split tensile strength(N/mm^2) 7 days 28 days	1.41 2.12	0.42 0.85	1.13 1.7

6.1.3 Graphical representation of compressive strength of concrete cubes



This graph shows that the compressive strength of Mix 2 is very low. Compared to Mix 2, Mix 3have high compressive strength value. It achievesby the addition of jaggery.

6.1.4Graphical representation of split tensile strength of concrete cylinders



This graph shows split tensile strength of Mix 3 is relatively higher than Mix 2. By adding jaggery, strength value can be increased up to a certain limit.

VI.CONCLUSION

From this work it can be concluded that jaggery can be used to improve the properties of hardened cement in the bag.

1. Due to the addition of jaggery, the consistency and initial setting time of Mix-3 increases gradually when compared to the Mix-2.
2. Also, there is an increase in specific gravity, void ratio, porosity and bulk density in Mix-3 by the addition of jaggery.
3. The slump of Mix-2 was extremely dry. Slump value increased and changed to stiff plastic by the addition of jaggery for Mix- 3.
4. Maximum compressive strength and split tensile strength values were obtained for Mix-3 when compared with Mix-2.
5. Strength values obtained for Mix-3 is less than that of Mix-1. So, Mix-3 cannot be effectively used for all applications same as that of Mix-1.
6. That is, the addition of jaggery increases the workability and strength values of the hardened cement only up to a certainlimit.
7. Therefore, by adding jaggery as an additive in the hardened cement, we can reduce the wastage of these bagged hardened cement to some amount by making it suitable for certain applications that requires small load bearing capacity.

REFERENCE

[1] Ahsan Aziz1, “Effect of sugar and jaggery on properties of concrete”, International Research Journal of Modernization in Engineering Technology and Science (Vol.3, Issue:06, June-2021)

[2] A. K. Azad, S. Rahman & R. H. Chowdhury “Effect of sugar on setting time of cement and compressive strength of concrete”, Proceedings of 2nd International Conference on Research and Innovation in Civil Engineering (ICRICE), (January 2020)

[3] Giridhar. V, Gnaneswar. K, Kishore Kumar Reddy. P “Effect of Sugar and Jaggery on Strength Properties of Concrete,” The International Journal of Engineering and Science (IJES), vol 2, issue 10, (Oct. 2013).

[4] Ippei Maruyama1 and Go Igarashi2, “CementReaction and Resultant Physical Properties of Cement Paste”, Journal of Advanced Concrete Technology (Vol.12, June 2014).

[5] K. S. Elango, D. Vivek, G. Krishna prakash, M. J. Paranidharan, S. Pradeep, M. Kesavaraj “Strength and permeability studies on PPC binder pervious concrete using palm jaggery as an admixture”, vol 37, issue 2.

[6] Lavhare Rajendra D, Naikare Rahul G., Thopate Omkar V., Pavale Pranit A. andSonawane P.B. “Effect of sugar and jaggery (molasses) on strength properties of concrete", International journal of engineering sciences & management, vol 7, issue 1, (March 2017).

[7] Md. Riazul Haque1,Sumit Purkayastha2 and Md. Abdul Muktadir Khan3“Variation of Physical Properties of Cement over Time”, International Journal of Engineering and Technology (Vol.10,Dec 2018).

[8] Sayali Panditrao, Bende Manoj Wagh “Effect of Jaggery on Properties of Concrete - A Review” GRD Journal for Engineering, Volume7, Issue1,(December 2021).

[9] Shamsad Ahmad, Adamu Lawan, Mohammed Al-Osta "Effect of sugar dosage on setting time, microstructure and strength of Type I and Type VPortland cement", vol 13, (Dec 2020).

[10] Suraj V. Shah, Rupesh R. Kadam “Effect of sugar and jaggery on workability and compressive strength of concrete” International Journal of Advanced Research in Science & Engineering, vol 7, (Feb. 2018).

[11] Usman, N. D,Chom, H. A., Salisu, C , Abubakar, H. O.,Gyang, J. B. “The Impact of Sugar on Setting -Time of Ordinary Portland Cement (OPC) Paste and Compressive Strength of Concrete”, FUTY Journal of the Environment,vol 10, issue 1, (Nov. 2016).

[12] V. Pavan Kumar, B. Venkatesh, B. C. O. Prasad, “Effect of Sugar, Jaggery & Sugar CaneAsh on Properties of Concrete,” International Journal of Scientific Engineering and Technology Research, vol 4, issue 51,(Dec. 2015).

[13] Z. Li, W. Shen, Q. Lan, Z. Lu, L. Cao, Z. Xu,“Influence of sucrose on hydration process of Portland cement”, Key Eng. (2014).