International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 6 Issue 5, July-August 2022 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

An Investigational Properties of Concrete using Jaggery

Abhishek Dandotiya[1], Rajeev Singh Parihar[2], Abhay Kumar Jha[2]

[1]Research Scholar, Department of Civil Engineering, LNCT, Bhopal, Madhya Pradesh, India
[2]Professor, Department of Civil Engineering, LNCT, Bhopal, Madhya Pradesh, India

ABSTRACT

Concrete is effectively used for construction work on a large scale, as it has basic characteristics such as high compressive strength, high flexural strength, tensile strength, durability. Concrete may get easily hardened as it required a proper water-cement ratio. The durability, workability, and compressive strength of the concrete are the focused properties if the quality of the construction is taken into view. The concrete gets hardened due to the exothermic process that takes place due to the reaction between water and ingredients in the concrete mix. As the concrete age grows strength also increases. The cost of the cement is touching the sky every passing day. So, it is essential to replace the cement partially also an application of cement is not eco-friendly and harms the environment during the manufacturing of cement. This review paper expressed the significance of jaggery on strength behavior of a new concrete composition. Experimentation carried out for determining strength properties of a new concrete for M30 grade nominal concrete using jaggery as admixture. Based on previous study, jaggery is an unrefined sugar product and it is easily available market; the main function of jaggery is to increase the initial setting time of concrete and it also influencing the properties of concrete. Preferably this type of admixture is used in different construction sites like deep foundations, piers and long piles. Six different percentages of admixture was chosen into the experimentation at 0, 0.05, 0.1, 0.25, 0.50 and 0.75% by weight of cement, finally it is accomplished that the workability of concrete is being superior with jiggery as admixture.

KEYWORDS: *construction, work, Jaggery, Concrete, Slump Value, Workability, Compaction Factor*

How to cite this paper: Abhishek Dandotiya | Rajeev Singh Parihar | Abhay Kumar Jha "An Investigational Properties of Concrete using Jaggery" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-6 | Issue-5, August 2022, pp.1282-1286, URL: www.ijtsrd.com/papers/ijtsrd50626.pdf

IJTSRD50626

INTRODUCTION

Jaggery is a natural product that does not cause any harm to nature. The jaggery as the admixture is very beneficial to the progress of the construction industry as these are affordable and locally available materials. The chemical admixtures get added to the environment after the dumping when the structure gets demolished. So it is required to find an alternate option for admixtures that enhances the properties of concrete in a better way and does not impact adversely on environmental factors. Jaggery does not cause any environmental harm. Jaggery is used in construction work since ancient times as it has excellent binding properties. In ancient times various countries such as India; China used jaggery for the construction several of structures. Jaggery is used on large scale for repairing cracks of various constructions such as dams, canals, roof slabs, etc. The combination of jaggery in proper proportions can enhance the strength of concrete. Jaggery is having good shrinkage property by the applications of jaggery development of cracks in concrete is reduced in a certain percentage. In general, in the preparation of concrete various types of admixtures are used to enhance the strength of concrete. From a literature search, it is found that jaggery has a profound effect on the concrete environment. Giridhar et al. (2013) revealed that the slump value, compaction factor, and compressive strength are having maximum value at the dose of 0.1% of sugar and jaggery. Which elaborate that excellent workability and compressive strength is obtained by the addition of jaggery and sugar. Pavan Kumar et al., (2015) discovered that

with an increase in admixtures the properties are also enhanced. A collapse slump is observed at the dose of 0.1%. The optimum slump value, compaction factor & setting time are obtained at the dose of 0.125% of sugar & jaggery. The maximum value of compressive strength is achieved at 0.075% of sugar and jaggery. Fouziya Qureshi et al., (2017) insights that Ideal consistency, slump value, compaction factor & compressive strength are obtained at the dose of 0.4% of jaggery. The highest values of flexural & split tensile are obtained with a volume of 0.1% jaggery workability and compressive strength increased and segregation are less. Kokila et al., (2017) explained that the strength of fly ash concrete increases with replacing the quantity of palm jaggery up to 4.5%. Shah et al., (2018) applied the 1% dose of jaggery to the slump value also the compressive strength on 7 days and 28 days is obtained maximum than the 1% dose of sugar. The jaggery can be used as a retarder and increases the setting time of concrete. Giridhar et al., (2019) exposed that the slump value and compaction factor are maximum at the dose of 0.75% of jaggery. The flexural & shear strength are obtained maximum at the dose of 0% of jaggery. The workability and strength of the concrete were enhanced. The setting also increases and the separation is also smaller. Mani Raj et al., (2019) The investigated results shows that concrete attains more than 100% strengthup to 30% of replacement and 90% of compressive strength is achieved at 40% and 50% substitute. Eggshell, jaggery, aloe Vera are implemented for experimental investigation, and found properties of concrete can be enhanced. Shamsad Ahmad et al., (2020) Added 0.05% of sugar by weight of cement increases the drying time significantly, however, the addition of added sugar reduces the setting time. The sugar content of 0.05% increased the setting time but after the addition of sugar decreased the concrete setting time.

- The concentrated product obtained after concentration of juice is cooled and molded. During molding finished product is obtained in different shapes and sizes according to its final use. The shape of the final jaggery may becubic, rectangular, trapezoidal or bucket size in different weights according to use Shiralkar et al. (2014). The process flow chart of conventionally operated jiggery production plantis shown in Fig.1.

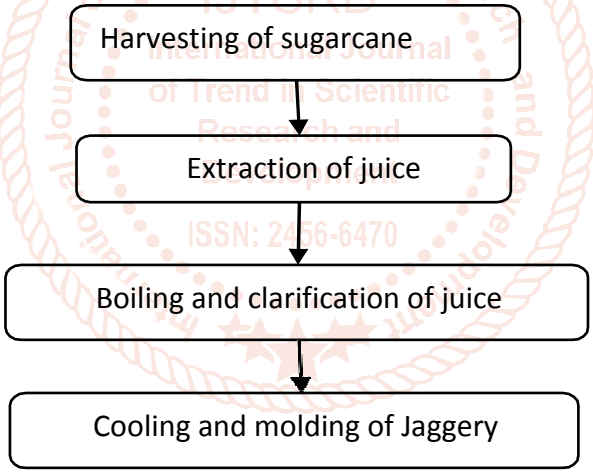


Fig.1.Processflow chart for jaggery production

- The hydrolysis process gets slow down due to the formation of protective skin of retarding compound on the top of cement particles.
- Increment in solubility and generation of the nuclei of calcium hydroxide gets discouraged due to the formation of complexes with calcium ions.

OBJECTIVES

- To improve the present properties of the concrete by adding jaggery as the admixtures in the concrete in a particular proportion.
- To explore the environmentally friendly properties of the jaggery which is an easily available and natural material that makes the structures economical.
- To assess the increase in the performance of concrete without much reduction in the strength of the concrete.

LITERATURE SURVEY

Mani Raj et al. (2019) in their project lead to the retired traditional concept of additional admixture of concrete. Their project helps the construction industry towards the sustainable development. Portland cement was first used in place of lime during the nineteenth century due to the easy use, quick setting and compressive strength. The rapid development of construction industry lead to huge utilization of cement, this leads to emission of

greenhouse gas (CO2) into environment and that causes the global warming. To reduce the emission of CO2, the supplementary cementatious material was introduced and vast investigation is going on over those materials. In the ancient times they had utilized the materials like egg, blood, animal fat, cactus extract in the concrete as admixtures. Generally the admixtures having specific characteristics as accelerating, retarding, air entraining and water reducing abilities. In this study we utilized the ancient admixture such as egg albumen, jaggery powder,

Ahmad et al. (2020)aimed to study the influence of sugar dosage on the setting time and strength of two types of Portland cements (Type I and Type V) widely used in Saudi Arabia, leading towards selection of an optimal dosage of sugar as an alternative set retarder. Paste and mortar specimens were prepared with different dosages of sugar and tested for initial and final setting times, compressive strength and microstructural examination of set cements

METHODOLOGYFORCOMPRESSIVESTRENGTHTEST

- Cube size15cm X 15cm X 15cm or 10cm X 10cm x10cm used.
- Prepared concrete mixture is poured in to molds of appropriate sizes. Proper tamping is done to remove voids and bubbles in the air.
- After 24hours them old is removed and the template is immersed in water to cure it. The upper extremities of the specimen are made smooth and evenly spaced.
- These samples are tested on a pressure test machine after7days of healing or 28days of treatment.
- Slow load is applied at a rate of 140kg/cm^2 per minute until the template fails. This load failure is divided by the specimen cross area and the compression strength of the concrete is obtained.
- This process is repeated by taking the different doses of jaggery in percentage in concrete as 0, 0.05, 0.1, 0.25, 0.5, and 0.75 and notes the values in tabulated form.

Test procedure of flexural strength:

This test has been performed under symmetrical third point loading system. It is determined from the moment at failure. Flexural strength of the beam specimen is determined according to IS516-1959 with

$fb = 3 P a / bd2$ (1)

Where “a” is less than 20 cm but more than 17 cm for 150x150x700 cm specimen

Fig 1: Testing of Double L **Fig.2: Testing of beam**

Flexural Strength of Concrete with Jaggery as Admixture

With reference from the above experimental results, as the percentage of admixture increases, flexural strength decreased. From table 2 it is clear that, as replacement ratio increases flexural strength decreased. This is due to increase in the fluidity of concrete structure. Excess replacement of admixture jiggery may reduce the flexural strength of concrete due to the more fluidity and flaws.

Table 1: Flexural Strength of Concrete with Jaggery as Admixture

S. No	% of admixture	28 days flexural strength
1	0	11.76
2	0.05	12.22
3	0.1	13.13
4	0.25	13.45
5	0.5	12.97
6	0.75	11.98

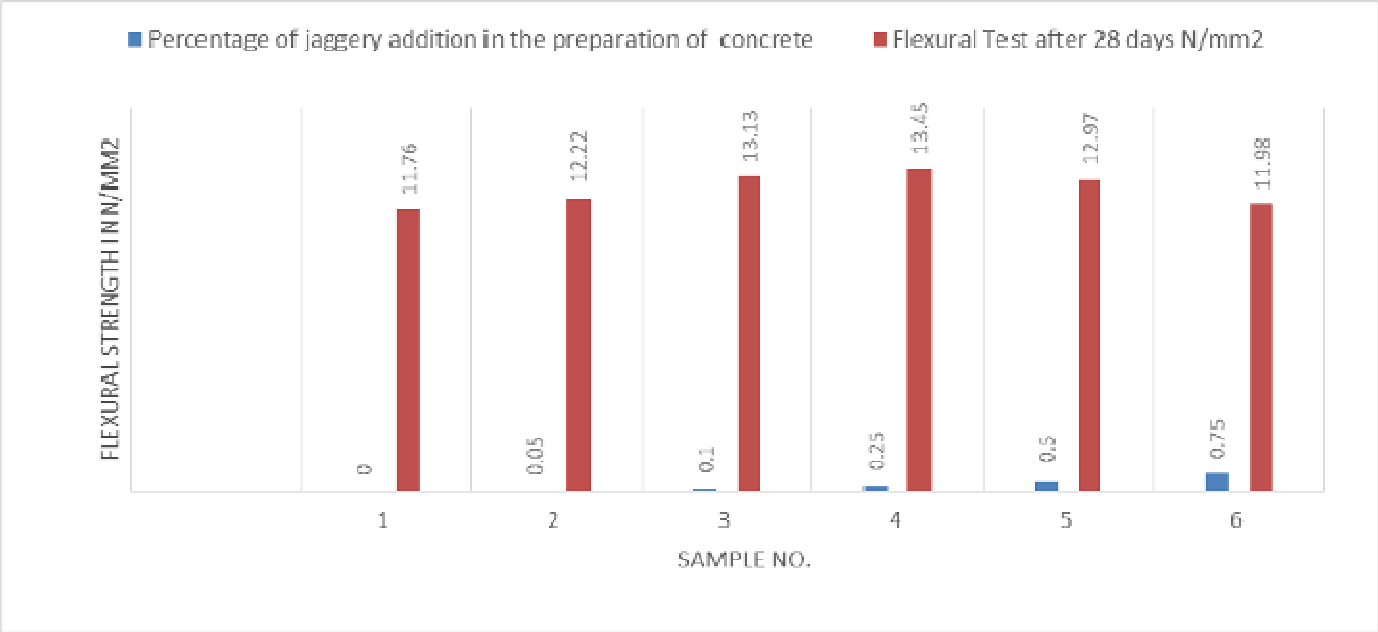
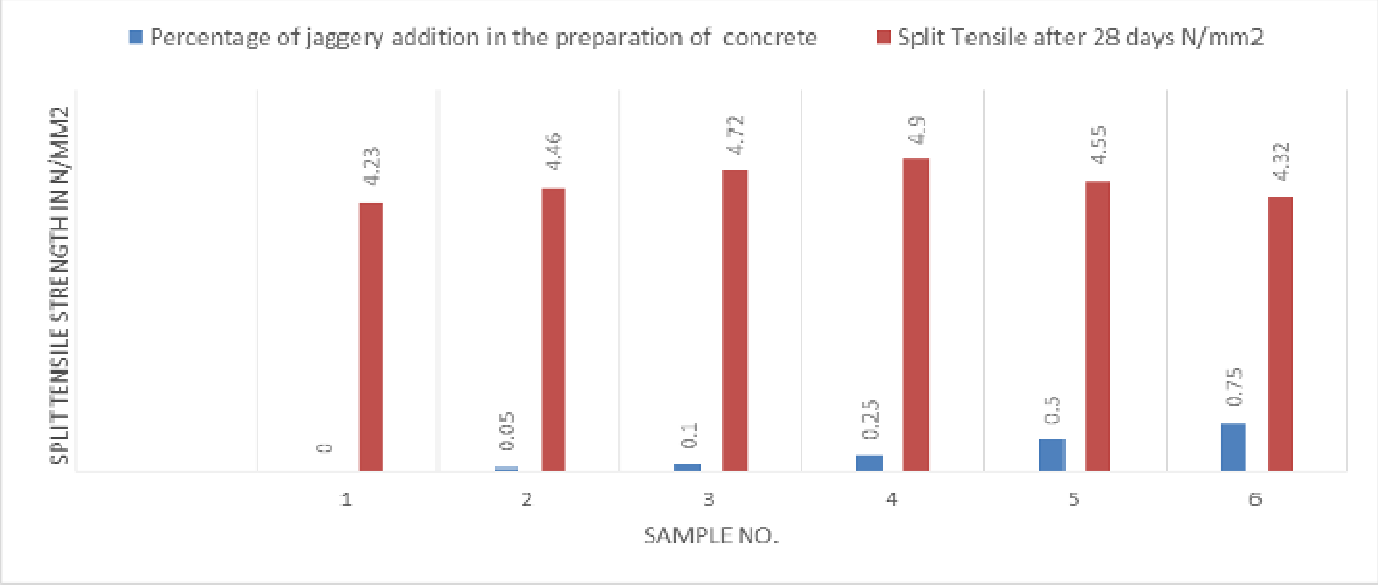


Table 2: Split Tensile Test

Sample no.	Percentage of jaggery addition in the preparation of concrete	Split Tensile after 28 days N/mm2
1	0	4.23
2	0.05	4.46
3	0.1	4.72
4	0.25	4.9
5	0.5	4.55
6	0.75	4.32



CONCLUSION

- At the dose of 0.1%, there is an observation of Collapse Slump.
- As the volume of the mixture increases the efficiency also increases.
- As the volume of the mixture increases so the compressive strength of the concrete increases.
- When jaggery is used as an admixture in concrete it gives better strength.
- Due to the use of this compound, these parathion and bleeding were significantly reduced.
- As the mixing percentage increases Concrete Setting Time increases.
- Properties of concrete like compressive strength, flexure strength and split tensile strength improved by the addition of jaggery in the concrete.

REFERENCES

[1] Akogu Elijah Abalaka, Effects Of Sugar On Physical Properties Of Ordinary Portland Cement Paste And Concrete. (2011).

[2] Annual report of Agricultural and Processes Food Products Export Development. http://apeda.gov.in/apedawebsite/SubHead_Products/Jaggery_and_Confectionary. htm

[3] Anonymous. Ingredients for sweet success. Food Technology 1990; 43: 94–119.

[4] Anwar A., "Industrial and policy issues including export potential of Jaggery and khandsari." In: Proceeding of Ntl Seminar Status, Problems and Prospectus of Jaggery and Khandsari Industry in India, Lucknow; 1999. 7–12.

[5] Baboo, B., Anwar, S. I. Recent developments in jaggery (Gur) research. Indian Institute of Sugarcane Research, Technical Bulletin No. IISR/JKS/94/9, IISR, Lucknow (UP), India. 1994.

[6] Giridhar, P. Rajendra Kumar, P. Kishore Kumar Reddy (2019) "Behavior of a New Concrete Composition with Jaggery as Admixture." International Journal of Innovative Technology and Exploring Engineering (IJITEE), vol 8, issue 10, pp. Aug. 2019.

[7] 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, pp. 01-06, 2319-1805, Oct. 2013.

[8] International Journal of Engineering and Manufacturing Science. 2017, ISSN 2249-3115 7, 77-85.

[9] Jaibeerchand and Sangeet Dhyani." Effect of Sugar on Compressive Strength of Concrete" International Journal of Advanced Technology and Engineering Research, Vol-5, Issue-4, July 2015.

[10] Khan Bazid and Ulla Muhammad Effect Of A Retarding Admixture On The Setting Time Of Cement Pastes In Hot Weather, (2004).

[11] Kumar, R. and Kumar, M., Issues, problems and amelioration in jaggery making process and plants. ICRITSEHM-2021, ISBN: 978-81-948668-8-6.

[12] Kumar, R., Kumar, M. Up gradation of jaggery production and preservation technologies. *Renewable and Sustainable Energy Reviews (Elsevier). 2018, 96,* 167-180.

[13] Lavhare Rajendra et al., "Effect of sugar and jaggery (molasses) on strength properties of concrete". ||ISSN2277-5528||jan-mar 2017||.

[14] Manjare, A., Hole, J. Exhaust heat recovery of jaggery making furnace. International journal of science and research. 2013, 5(4), 1349–1351.

[15] Manjunatha. M "An experimental study on partial replacement of cement by cementitious materials, sand by copper slag and the use of jaggery, egg albumen and human hairs in concrete" ||ISSN 2455-7137||PP 47-56||volume 02||Issue 08||August||2017||