COMPARING STRENGTH CHARACTERISTICS OF CONCRETE BY ADDING SUGAR, STARCH, JIGGERY WATER

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ABSTRACT

The significance of study of the performance and properties of concrete can be decorated by making an allowance for the fact that concrete is the most used man-made material in the world. The incredibly first step of making concrete is its mix design and deciding the type and amount of constitutes used in the making of concrete which should accomplish the necessities of the final manufactured goods. Mix design models are normally used for the function of proportioning concrete ingredients while anticipating the properties of the final product. The work executed in this thesis deals with the commonly used principals in mix design models namely particle packing theory and excess water/paste layer theories. The conducted studies includes an investigation on accuracy of particle packing models (Toufar, 4C, CPM) and also tries to address the issue with measurement of specific surface area of particles as an essential input to water/paste layer theories.It has been observed that the particle packing models can predict the packing density with acceptable margin.

Keywords— *Compressive strength, Flexural strength, Tensile strength*

INTRODUCTION

Concrete has the binder properties because of this can be a greatest material for the structural purpose that is formed up by the numerous chemical composition. usually this cementing medium is that the product of reaction between cement and water. once water combine with cement heat release because of the reaction. Concrete is formed with many styles of cement and conjointly containing pozzolana, fly ash, furnace slag, etc, the most parts of concrete are a combination of cement, water, mixture (fine and coarse) and generally admixtures correspondence between ingredients of concrete. The cement is act because the essential in construction and that is additional cheaper once it's combine with mixture fulfilling the demand of the structure needed. [1] Cement is that the main binder material within the construction work and in these days situation it's the prime medium for the development purpose whether or not the development of the straightforward house or the high strength structure of the bridges cannels etc. [2] The coarse mixture act as assort of mini-Masonry that is joined along by mortar i.e. by a mixing of hydrous cement and fine mixture.

Construction with cement and also procedure of reinforcement in the structural design finally led to creation concrete the most used man made material. [3] As the primary knowledge of manufacture cement and concrete residential and was able to cover the constitutes of concrete, researchers have been constantly working with the ways of optimizing mix design recipes. [4] Optimization can be achieved by means of research on the ingredients of concrete mixes with the testing to enhance the properties of concrete in both fresh and hardened state while keeping a low cost of production and limiting the pollutants released in the air due to cement production. Consider the role of composition in fresh concrete is essential to the making of high quality concrete at fresh state. Fresh concrete can be characterized by several aspects in the middle of which workability is the most important one and is mainly partial by the water condition, which in turn is a function of aggregates' shape, grading, and fine content. As for the

presentation of the hardened concrete, the crucial factors are water to cement ratio which influences strength and permeability and cement characteristics and performance.

LITERATURE REVIEW

The applications of recycled aggregate and high performance concrete in the construction area are very wide. There are many testing based on the recycled aggregate and high performance concrete have been carried out all around the world.

Moriconi [December 2004], presented a beneficial use of natural resources, for that they use the recyclable aggregate, which has very less environmental impact. It reduces the carbon dioxide emission and also reduces the extraction of natural aggregate. He suggested that a concrete structure would be environment friendly if that structure created minimum environmental impact during its total life cycle. He gave an example of such type of concrete that is recycled-aggregate concrete containing fly ash. By which sustainable construction development is better in terms of both safety and serviceability of structures and also cost of structure reduced and with environmental gain over normal concrete.

Tam et al. [July 2006], made a research on recycled aggregate that how we can use recycled aggregate in concrete of higher grade. For application of recycled aggregate in higher grade concrete they developed the two stage mixing approach. While they improved in strength by the two stages mixing approach had been proved. But the long term effect, in terms of deformation and permeability, were not verified. They suggested that strength can be increased by this two stage mixing approach. They also investigate that on increasing the percentage of recycled aggregate, lowering the performance of recycled aggregate concrete.

Adnan et al. [May 2008], compared the strength properties of natural aggregate and recycled aggregate. For this purpose they investigate compressive strength of recycled aggregate concrete with various percentages (0%, 25%, 50%, 75%, and 100%). Their research also covered recycled aggregate concrete mixtures at different water-cement ratio (0.4, 0.5, and 0.6). They found that recycled aggregate concrete had lower compressive strength as compare to natural aggregate concrete. They also find that 28 days compressive strength of recycled aggregate concrete with water-cement ratio 0.4 had the highest compressive strength.

Abdur et al. [June 2008], focus on that parameter which use in making high performance concrete. They suggested that high performance concrete can be achieved by the use of superior materials, with a lower water-cement ratio and smaller size of coarse aggregate, a small ratio of fine aggregate to coarse aggregate and also a suitable chemical admixture with their optimal dosage. In their research study, his aimed was to design concretes of strength were from 60 Mpa to 130 Mpa. For this purpose they used larger ratio of coarse aggregate to fine aggregate in their study. Their test results were showed that it will support the characteristics of high performance concrete production. In their research, the most effective parameters were found water-binder ratio and the chemical admixtures with their optimal dosage for producing high performance concrete.

Rahman et al. [October 2009], described environmental protection and economical terms, using recycled coarse aggregate in concrete. They reported an experimental study in which they analyzed the different mechanical properties of concrete which is made by recycled aggregate and natural aggregate. They described that compressive strength of concrete is also differ when size of recycled aggregate differ. In their design they replace 100% natural aggregate by recycled aggregate and cast a cube of 100 x 100 x 100 mm. They found that the 10mm and 14mm recycled coarse aggregate in concrete showed the similar properties with same size of natural coarse aggregate to a certain extent.

Younus et al [June 2010] made a research on high performance concrete using recycled aggregate. The aim for their project is to determine the strength characteristics of recycle aggregate for application in high performance concrete. They replace natural aggregate by recycled aggregate by 100%. In their research they investigate that the compressive and split tensile strength of high performance concrete using recycled aggregate after 28 days will be more than the high performance concrete using natural aggregate. And they also find that the high performance

concrete using recycled aggregate is better resistance to acid exposure than the high performance concrete using natural aggregate.

Safiuddin et al. [September 2010] made an investigation on the potential use of various recycled material for producing construction materials. It is found that at lower percentage of recycled coarse aggregate strength is more as compared to the higher percentage of recycled coarse aggregate. Water requirement will be increased when the percentage of recycled aggregate will increase.

Concrete used as a construction material has the following advantages:

1. It is practically priced in the long run as compared to other engineering materials, except cement, it can be made from close by obtainable coarse and fine aggregate.

2. Concrete having high compressive strength, and there are smallest amount corrosion and weathering effect. When correctly make up its strength is equal to that of a hard natural stone.

3. The green concrete can be without complexity handle and shape into size according to requirement.

4. It is strong in compression and has no of structural applications in arrangement with steel reinforcement, the concrete and steel have in the region of equal coefficients of thermal expansion.

5. The concrete is comprehensively used in the construction of foundations, walls roads, airfields, buildings, water retaining structures, docks and harbors, dams' bridges, silos, etc.

6. Concrete can be used to filled into fine cracks for preservation by the grunting process.

7. The concrete can be pumped and hence it can be place in the difficult positions also.

8. It is tough and fire confrontation and requires very less maintenance.

The disadvantages of concrete can be as follow:

1. Concrete has low tensile strength and hence cracks simply. Therefore it is to be reinforced with the steel bars or meshes.

2. On drying, Fresh concrete shrink and on wetting, hardened concrete expands.

3. Concrete under given loading undergoes creep consequential in decrease of priestess of the prestressed concrete construction.

4.Concrete is responsible to fragmented by alkali and sulphate attack.

5. The insufficiency of ductility inherent in concrete is disadvantages with respect to earthquake resistance.

Theory

Preamble

Present chapter tells about the test procedures used in the present research work, the details of which are presented in upcoming sections.

Compressive Test

The compressive strength of hardened cement is the most important property in all. Therefore, it is not surprising

that the cement is always tested for its strength(compressive) at the laboratory before the cement is used in important works. Strength tests are not made on neat cement paste because of complication of excessive shrinkage and subsequent cracking of neat cement. Figure 3.1 shows a compressive testing machine(CTM).

Figure 1.1: Compressive testing Machine

Slump Cone Test

The word -workability‖ or workable concrete referred much wider and deeper meaning than the other terminology - consistency often used loosely for workability. Consistency is a general term to indicate the change of phase or degree of fluidity or the degree of mobility. That factors which helping concrete to have more lubricating effect to decrease internal friction for helping easy compaction are given below: (a) Water Content(W) (b) Mix Proportions (c) Size of Aggregates (d) Shape of Aggregates (e) Surface Texture of Aggregate (f) Grading of Aggregate (g) Use of Admixtures. Slump test is the most commonly used method of measuring consistency of concrete which can be done either in laboratory or at site of work. It is not a suitable method for very wet nor very dry concrete. It does not observe all factors contributing to workability, nor is it always representative of the playability of the concrete.
The Slump Cone apparatus essentially consists of a metallic mould in the form of a frustum of a cone having the internal dimensions as under: Bottom diameter : 20 cm, Top diameter : 10 cm, Height : 30 cm and the thickness of the metallic sheet for the mould should not be thinner than 1.6mm, Weights and weighing device, Tamper rod (16 mm in diameter and 600 mm length), Ruler, Tools and containers for mixing, or concrete mixer etc.

Procedure of the test

Following are the details of procedures used to conduct slump cone test.

1. Dampen the mould and place it on a flat, moist, nonabsorbent (rigid) surface. It shall be held sharply in place during filling by the operator standing on the two foot pieces. Immediately fill the mould in three layers, each layer approximately one third the volume of the mould.

2. Each layer is compacted with 25 no. of strokes by tamping rod. the strokes are Uniformly distribute over the cross section of each layer.

3. In filling and temping the top layer, heap the concrete above the mould before temping start. If the temping operation results in subsidence of the concrete below the top edge of the mould, add additional concrete to keep an excess of concrete above the top of the mould at all time.

4. After the top layer has been tempered, strike off the surface of the concrete by means of screening and rolling motion of the tamping rod.

5. Remove the mould immediately from the concrete by raising up it carefully in the vertical direction. Raise the mould a distance of 300 mm in 5 ± 2 sec by a steady upward lift with no lateral or torsional motion.

EXPERMENTAL WORK

Following are the details of experimental procedure adopted for the purpose of research work.

1. First of all M-30 concrete was prepared in the lab. Following are the details of mix design.
Mix design: 1: 1.857:2.890 (cement: aggregate: sand)
Cement = 53 grade
Aggregate = 10 mm – 20mm

2. In next step natural plasticizers were added to the concrete for 2.5%, 5% and 7.5% of concentration. The natural plasticizers (CONPLAST SP 430) used were jiggery water, sugar water and starch water. Figure 3.1 shows the procedure of mix design in a concrete mixer.

(a)Aggregate Mixing **(b)Concrete Mixing**

Figure 3.1 (a,b): Concrete preparation procedure

3. In next step, slump cone tests for different combinations of natural plasticizers and concrete alone was conducted. Figure 4.2 shows the details of slump cone testing.

(a) **(b)**

Figure 3.2(a,b): Slump cone testing

4.After slump cone testing, standard cubes were casted for different combinations for compression testing of 7, 14 and 28 days;

5. In next step results of compression testing were investigated;

6.In next step effects of natural plasticizers on the super plasterers were Investigated using slump cone testing procedure

7.In next step, compaction test of different samples was conducted is association of a plasticizer; and

8.In the last step of research work, comparison of different investigated properties was made, and rankings of alternatives were proposed.

RESULTS AND DISCUSSION

Preamble

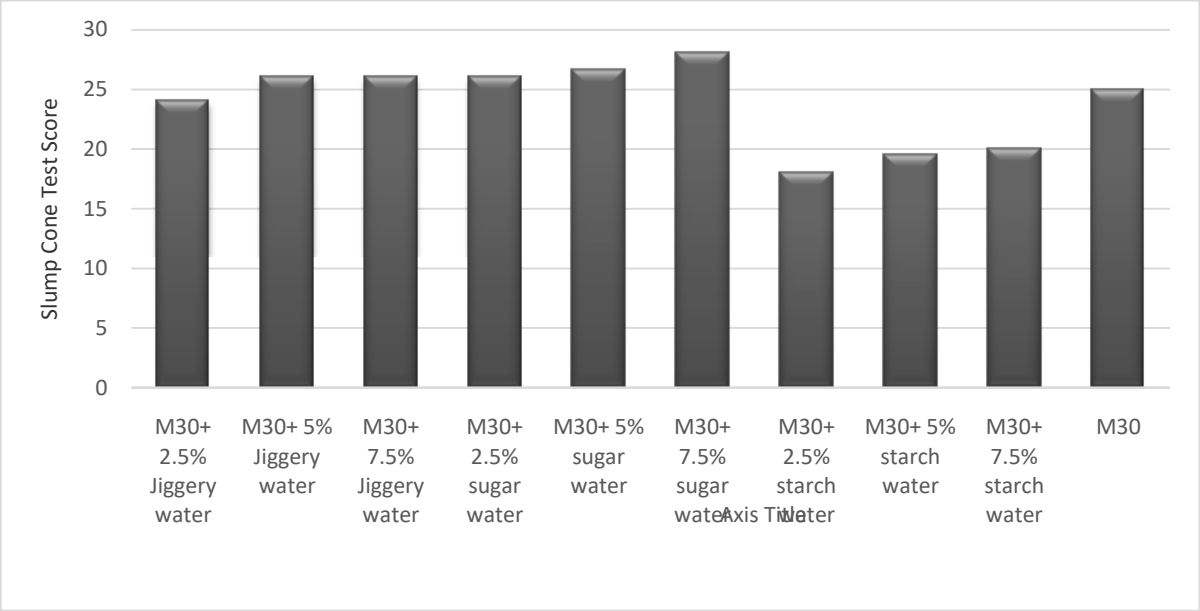
Present chapter is devoted to the details of results obtained and discussion made in accordance with the results, the details of which are presented in upcoming sections.

Results

Following are the details obtained from the research work.

S.No	Particulars	Height (cms)
	M30+ 2.5% Jiggery water	24
	M30+ 5% Jiggery water	26
	M30+ 7.5% Jiggery water	26
	M30+ 2.5% sugar water	26
	M30+ 5% sugar water	26.5
	M30+ 7.5% sugar water	28
	M30+ 2.5% starch water	18
	M30+ 5% starch water	19.5
	M30+ 7.5% starch water	20
	M30	25

shows the graphical version of above mentioned results.



Summary of Results obtained

S. No	Alternative	Slump cone test results		Compaction test results			7 – Day compression test results	14 – Day compression test results	28 – Day compression test results
		Without plasticizer	With plasticizer	Without plasticizer	With plasticizer	[illegible] +add plasticizers(40gm)			
	Jiggery	25.33	51	0.934	0.968	0.894	21.33	27.26	37.73
	Sugar	26.383	60	0.931	0.966	0.894	19.66	25.26	34.7
	Starch	19.67	42.333	0.913	0.942	0.908	17.5	20.1	30.3
	M 30	25	29	0.902	0.928	0.877	15	17	21

shows the graphical version of above mentioned results.

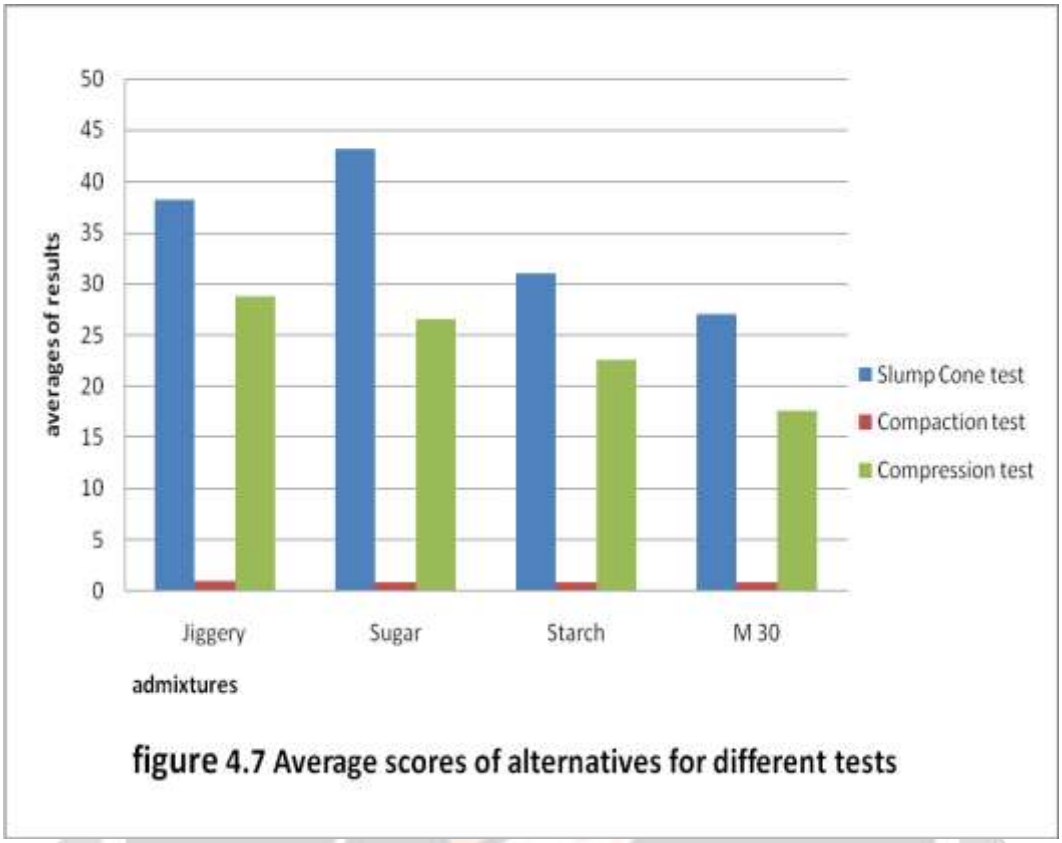


figure 4.7 Average scores of alternatives for different tests

Conclusion

Present research work is based on effect of natural admixtures on the performance of concrete. For this purpose a M30 concrete was prepared in association of different admixtures, Jiggery, Sugar and Starch, and different tests, Slump cone test, Compaction test (with and without artificial plasticizer) and Compression test (7 days, 14 days and 28 days) were performed on the samples along with the sample of M30, and finally rankings of admixtures were carried out.

Following are the results obtained.
sugar scores rank 1 on the slump test and rank 2 for compressive strength;
jiggery scores rank 2 on the slump test and rank 1 for compressive strength;
Starch scores rank 3 on the slump test and rank 3 for compressive strength.
So sugar admixture increase workability more then other two admixtures and jiggery admixture increase compressive strength more then other two.

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