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Evaluating compressive strength of bagasse ash bricks in combination with coconut fibers

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Abstract - This paper deals with the effective use of bagasse ash in bricks. Bagasse ash contains more amount of silica and has pozzolanic properties. Addition of baggass ash with binding materials like lime or cement in combination with water causes secondary reaction and it gains cementitious properties. Baggasse is by product of sugar industry. Formation of bagasse ash increasing day by day and it has disposal issues. Therefore utilization of bagasse ash in manufacturing bricks could be the better option of disposal and recycling. Many researchers stated that bricks manufactured using 10-50% of bagasse ash in combination with lime, quarry dust and fly ash provides better compressive strength. The use of bagasse ash more than 50% would results in cracking and strength of such a bricks found to be declined. So in this study bricks were manufactured using dose of baggasse ash more than 50% in combination with coconut fibers. From the results it is found that at 60% addition of bagasses ash along with 2% coconut fibers considerably reduces surface cracking. The compressive strength obtained at 28days is 8.52MPa.

Key Words: Bagasse ash, Pozzolanic reaction, lime, cementitious materials, compressive strength etc

1.INTRODUCTION

The construction industry occupies the second most important place in the Indian economic and industrial sector. The contribution of the sector to the country's GDP is almost 9% [10]. Bricks has wide applications in construction industry. India is estimated to produce more than 14000 crores of bricks annually [11]. But government has restricted on clay brick because of agricultural clay require for the manufacturing of bricks[12]. Therefore government encouraging alternative materials for manufacturing of bricks. India produces 300 million tons of sugarcane per year. Out of which a thousand tons sugarcane produces 26% of bagasse and 0.62% of bagasse ash [13]. Sugar industries are haphazardly grows in country but the bagasse ash produced from this has no any future scope. In most of industry bagasse is a main constituent as a fuel and lots of bagasse ash formed by this. Disposal of ash is very rare.

Bagasse ash is one of the major solid waste which is produced by industries, its impact is more dangerous on environment, air pollution is occur or also soil pollution is due to residue of ash, ash is dumped on land directly so it causes chemically and physically impact on the soil. This could be a troubling environmental hazard. Researches also stated that from the bagasse ash can cause the lung diseases. It was found that bagasse ash has pozzolanic properties hence it can be used to produce an cost effective construction material like bricks.

It was found that bricks produced by using bagasse ash from 10% to 50% in combination with fly ash, quarry dust and lime, produce desirable results. But increase in the bagasse ash content above 50% results in formation of cracks on the surface. The strength obtained is also found to be declined [1, 2-9]. The cracks occurred on the surface due to lack of adhesion property between materials. Bagasse ash contains only 2%-3% calcium oxide and aluminum oxide is about 7%-8%. Therefore bond strength of bricks reduces and setting time will increase. In this paper bricks are manufactured by using bagasse ash, fiy ash, quarry dust and lime in order to increase the compressive strength. It also aimed to utilize bagasse ash more than 50% and its effects on the compressive strength will be examined. To increase bond strength and to reduce surface cracking application of coconut fibers has been tried.

1.1 Bagasse Ash

Bagasse is a waste material comes after extraction of juice from sugarcane. Bagasse is a main constituent which is used in boiler for generating heat in many industries. By this bagasse ash is produced in large amount. Constituents of bagasse ash are shown in the Table No. 1

Table -1: Composition of bagasse ash

Sr. No.	Description	Percentage of Constituents (%)
1.	Aluminium Oxide(Al_2O_3)	8.06
2.	Calcium Oxide	2.75
3.	Silica Oxide	63.25
4.	Iron Oxide	3.09
5.	Sulphide	1.06
6.	Other Constituents	21.79

1.2 Lime

Hydrated lime is a white crystalline powder. Lime is used in mortars, plasters, cements and paints. Bagasse ash gains cementitious properties when it combines with lime and cement.

1.3 Quarry dust

It is obtained during crushing of stone which is waste product from quarrying process. It is a simple filler material which has not any binding properties but recently it is used in bricks as a filler material which gets good recognition.

1.4 Fly ash

Fly ash is a fine gray powder produced from coal-fired power stations. It has pozzolanic properties, it reacts with lime to form cementitious compounds. It is a supplementary cementitious material. Fly ash used confirms IS 3812 Part I.

1.5 NaOH (Sodium hydroxide)

Sodium hydroxide is a strong base material. Sodium hydroxide is used in some admixtures. This helps homogenize cement mixes, preventing segregation of sands and cement, decreases the amount of water required in a mix and increases workability of the cement products.

1.6 Coconut Fibers

Coconut fibers are a natural fibers extracted from the outer husk of coconut. Coconut fiber is resistant to thermal conductivity, is very tough, ductile, durable, renewable and inexpensive. It was observed in an experimental study that addition of 2% of coconut fibers with bagasse ash increases compressive strength.

1.7 Water

Water is main factor for manufacturing of bricks because its homogeneity is totally depending on quantity of water. In this study used water is potable and free from all impurities.

2. MIX DESIGN

Mix design was prepared by using two combinations. Based on trial and erroe method first combination was prepared for 50% of bagasse ash, 30% fly ash, 10% lime and quarry dust and second combination was prepared for 60% of bagasse ash 20% fly ash , 10% lime and quarry dust. The percentages of materials for both combinations shown in Table No. 2.

Table -2: Replacement of Fly ash by Bagasse ash.

Sr.No.	Sample	Fly ash (%)	Bagasse ash (%)	Lime (%)	Quarry dust (%)
1.	S1	30	50	10	10
2.	S2	20	60	10	10

The next attempt was made by adding 2% of coconut fiber in S3 sample.

Table -3: Percentages of materials in S3 sample with addition of coconut fibers.

Sr. No.	Sample	Fly ash (%)	Bagasse ash (%)	Lime (%)	Quarry dust (%)	Coconut fibers (%)
1.	S3	20	60	10	10	2

3. EXPERIMENTAL METHODOLOGY

3.1 Treatment to coconut fibers

Coconut fibers were soaked for 3 hours in sodium hydroxide solution with concentrations of 20%. After that, coconut fibers are rinsed with distilled water and then dried at room temperature.

3.2 Manufacturing process

For manufacturing it consists of 4 steps :

1. Batching
2. Mixing
3. Handling and pressing of mix
4. Curing

3.3 Test on bricks

Compression test on brick gives idea about its crushing or compressive strength, it was found by following formula:

The size of brick mould = 230mmx100mmx80mm

Compressive strength = Maximum load at failure/ Average area of bed face (230mm x 100mm)

4. RESULT AND DISCUSSION

The compressive strength obtain of sample (S1), containing bagasse ash (50%) is 5.31MPa and 6.32MPa for 7 and 28 days respectively. The compressive strength obtain for sample (S2), containing bagasse ash (60%) is 3.40MPa and 4.64MPa for 7 and 28 days respectively. Similarly the compressive strength for sample (S3), containing bagasse ash (60%) and coconut fiber (2%) is 6.12MPa and 8.52MPa for 7 and 28 days respectively.

It was found from literature increasing bagasse ash percentage more than 50% reduces compressive strength and also shows surface cracking [2]. The similar result has been obtained by the experimentation. In order to reduce surface cracking and to increase compressive strength coconut fibers has been tried and result show that for sample (S3) there is reduction in surface cracking and increase in the compressive strength. The compressive strength results obtain for 7 and 28 days are shown in Table no. 4 and graphical representation shows in Fig. No. 1.

Table-4:Compressive strength results

Sr. No.	Samples	7 days Compressive strength (MPa)	28 days compressive strength (MPa)
1.	S1	5.31	6.32
2.	S2	3.40	4.64
3.	S3	6.12	8.52

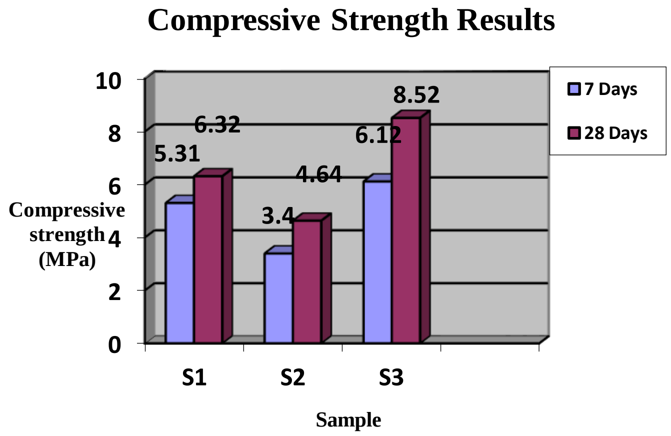

Fig. No.1 : Compressive strength results

5. CONCLUSIONS

From the experimental work conducted the following conclusions can be drawn:

1. The use of bagasse ash 60% along with 2% coconut fibers increases compressive strength and reduces surface cracking.
2. The compressive strength obtain is more than the compressive strength of conventional clay bricks.

FUTURE SCOPE

The effect on a compressive strength by increasing bagasse ash more than 60% is need to be investigate.

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