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An Experimental Investigation on the Combine Effect of Bagasse Ash and Rubber Tyre in Production of Bricks

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ABSTRACT

This work carried out partial replacement of fly ash by bagasse ash with waste rubber tyre in order to reduce industrial waste. The effective use of these waste products is challenging task for researcher through environmental impact. Bagasse is often used as a primary fuel source for sugar mills. When burned in quantity, it produces sufficient heat energy to supply all the needs of a typical sugar mill, with energy to spare. This sugar manufacturing industries produces a lot of sugarcane bagasse ash which is disposed of in an open land. Huge quantity of ash which is a waste product, available at very negligible rate. This sugarcane bagasse ash is a fibrous waste product and has pozzolanic properties which can be made use in construction industry. Pozzolanic materials can be used as a partial replacement in the production of low cost fly ash bricks. Bagasse ash is utilized by replacing it with fly ash in bricks. Trial bricks were tested with different proportions of 10%, 20%, 30%, 40% and 50% with replacement of BA. These bricks were tested in Compression test and Water absorption test as per Indian Standards. The aim of this research was to make economical and green bricks to maintain environmental balance, and avoid problem of ash disposal.

Keywords: *Ordinary Portland cement, Sugar cane bagasse ash, Chemical properties, Compressive strength*

1. INTRODUCTION

Population scenario comes towards India by means of increasing industries. The fruitful efforts of industries lead to develop India. As the industries increases also the waste coming from them at the end of product increases. At the end of survey result coming that the amount of the approximately 250 to 300 million tons of industrial wastes are being produced every year by chemical and agricultural process in India. It is very essential to dispose these wastes safely without affecting health of human being, environment, fertile land, sources of water bodies; etc. Sugar cane bagasse, the fibrous residue after crushing and juice extraction of sugar cane, is a major industrial waste product from the sugar industry.

Nowadays, it is commonplace to reutilize sugar cane bagasse as a biomass fuel in boilers for vapour and power generation in sugar factories. Depending on the conditions, the resulting sugarcane bagasse ash (SCBA) may contain high levels of SiO_2 and Al_2O_3, enabling its use as a supplementary cementious material (SCM) in blended cement systems. Uses of Sugarcane bagasse ash waste in brick can save the sugarcane industry disposal costs and produce a 'greener' bricks for construction [1].

Industrial Waste as sugarcane bagasse ash needs to be handled and disposed of properly, so that the aesthetics of the place is maintained. Landfill method is not the most efficient method for the disposal, as precious land is used up as landfill site. Also, with the growing demand, landfill sites of proper size and at proper location are not available further there management is also becoming difficult. Development of a novel method for the disposal is required so that waste could be manage and disposed economically. There use as construction materials, would help in disposal by proper utilization. Further it will thereby lower the price of construction [2].

Various problems of industrial waste and sugarcane bagasse ash waste are as follows [3]:

1. Preserve the natural resources: It is necessary to preserve the natural resources like fine particles (river sand)
2. Shortages of dumping sites: The major important thing land gets wasted due to dumping of these wastes.
3. Reducing the construction cost: to reduce the construction cost thus resolving housing problems faced by the low income society of India.

2. DEVELOPMENT OF BRICKS FROM WASTE MATERIALS

The conventional method of bricks manufacturing has left the important material lots of in advancement. The infrastructure such as buildings for housing and industry, and the facilities for handling water and sewage requires large amounts of construction

material. Since the large demand has been placed on building material industry especially in the last decade owing to the increasing population, there is a mismatch between demand-supply management of these materials. Hence to meet the continuously increasing demand, researchers are attempting to design and develop sustainable alternative solutions for the construction material.

Brick is one of the most accommodating masonry units as a building material due to its properties. Attempts had been made to incorporate wholly waste in the production of bricks without the use of virgin resources as clay, shale or sand in the production process. Hence, the natural resources besides the engineering properties and the durability will be developed. Thermal conductivity was reduced in bricks by addition of waste material to the bricks before firing. Another advantage of lightweight bricks is reduced transportation costs. The cementitious binder, fly ash–lime–gypsum (FaL–G), finds extensive application in the manufacturing of bricks, hollow bricks and structural concretes. The needs to conserve traditional building materials that are facing depletion have obliged civil engineers to look for alternative material. Recycling of such waste by incorporating them into building material is a practical solution to the pollution problem.

3. MATERIALS AND METHODS

3.1 Sugarcane bagasse ash

The burning of bagasse which is a waste of sugarcane produces bagasse ash. Presently in sugar factories bagasse is burnt as a fuel so as to run their boilers. This bagasse ash is generally spread over farms and dump in ash pond which causes environmental problems also research states that Workplace exposure to dusts from the processing of bagasse can cause the chronic lung condition pulmonary fibrosis, more specifically referred to as bagassosis. In this experimental work SCBA was collected from the Jawaharlal Nehru Sahakari Agricultural Produce Processing Society Limited near Sarvar deola, Borawan, Kasarawad, Khargone, Madhya Pradesh, India.

Fig. 1: Sugarcane bagasse ash

3.2 Acetylene carbide lime

Pure calcium oxide is fused with coke in order to render the highest yield in the manufacture of acetylene. The quality of the resultant carbide lime is a direct result of the excellent quality raw materials. Carbide lime is finer in particle size, and physically, having a very finely divided particle size makes carbide lime better. A finer particle size means faster and more reactivity.

Fig. 2: Lime

3.3 Quarry dust

It is residue taken from granite quarry. Due to excessive cost of transportation from natural sources locally available river sand is expensive. Also creates environmental problems of large-scale depletion of these sources.

Fig. 3: Quarry dust

3.4 Fly ash

Fly ash, otherwise called a flue- ash, is one of the residual substances that is produced during combustion and comprises of the fine particles that are produced by the flue gases. In an industrial context, fly ash generally refers to ash produced during the combustion of coal. Fly ash was collected from SS bricks, Raisen Road Bhopal, Madhya Pradesh.

Fig. 4: Fly ash

3.5 Water

Locally available water has been used in brick manufacturing.

3.6 Cement

Ordinary Portland cement was used for making the brick mortar. The quality of cement was checked through various tests and was compared with specifications given IS 269-1976 for OPC.

Fig. 5: Cement used

3.7 Waste rubber tyre

It is prepared locally from waste tyre.

Fig. 6: Waste rubber tyre

4. MIX DESIGN

Six samples using various proportion have been prepared according to brick with nominal dimensions of 19 x 9 x 8 cm are shown in below table.

Table 1: Mix Design for Bricks (in %)

Sample	% Replacement of fly ash with SCBA	Cement	FA	SCBA	Lime	Q.D	WRT
Standard	-	5	75	-	10	10	-
S1	10	5	60	10	10	10	5
S2	20	5	50	20	10	10	5
S3	30	5	40	30	10	10	5
S4	40	5	30	40	10	10	5
S5	50	5	20	50	10	10	5

5. MAKING OF BRICK

In the present study brick contains fly ash, Lime, water, quarry dust, SCBA and waste rubber tyre. Certain amount of the fly ash is substituted with Bagasse ash (Table 3), this data from the Bagasse ash fly ash brick is than compared with that from a standard fly ash brick without bagasse ash. Five bricks samples of size 19 cm × 9 cm × 8 cm were cast. The industrialized manufacturing procedure of bricks generally involves of three steps:

- Mixing the ingredients
- Placing the mix in the mould
- Curing the bricks for a stipulated period

6. TEST CONDUCTED ON BRICKS

Following tests shall have conduct on brick sample.

1. Compressibility test
2. Water absorption test
3. Soundness test
4. Hardness Test

6.1 Compressibility test

Compressive strength test was carried out for bricks with different mix proportion of carbon buster. The specimen is placed between two plywood sheets of each having 3mm thick and carefully centred in compression testing machine. The ultimate load is noted. The compressive strength is the ratio of ultimate load to the resisting area of brick loaded.

The compressive strength of the brick is obtained by using the formula,

Compressive strength = Ultimate load/ Resisting Area

Fig. 7: Compressive strength test

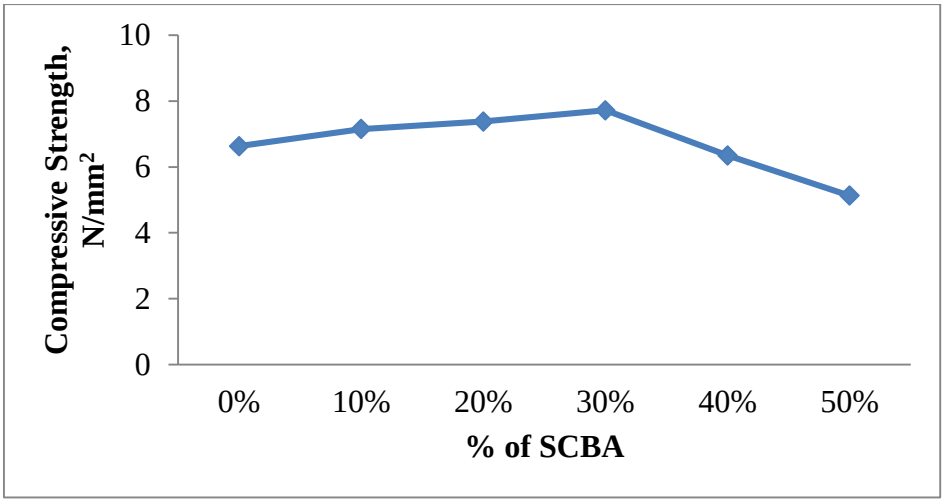

Fig.8: Variation of compressive strength with % of SCBA

From the experimental results sample S4 shows the maximum compressive strength value. So that proportion was taken as an optimal mix percentage of SCBA brick (Fly ash-40 % Lime-10 %, Quarry dust- 10%, waste rubber tyre- 5 %, SCBA- 30% and cement- 5%). The compressive strength decreases with increases of SCBA content upto replacement of SCBA 30 %.

6.2 Water absorption test

In water absorption test, the dry weight of brick was noted as weight (M_1). Then the dry brick was completely immersed in water at room temperature for 24 hours. After 24 hours bricks were removed from the water and allowed to drain for 3 minutes and wipe out any traces of water with damp cloth. Now the weight was noted as (M_2). The water absorption was calculated in percentage and tabulated in table and shown in next table.

Water absorption % = (wet weight – dry weight)/ dry weight

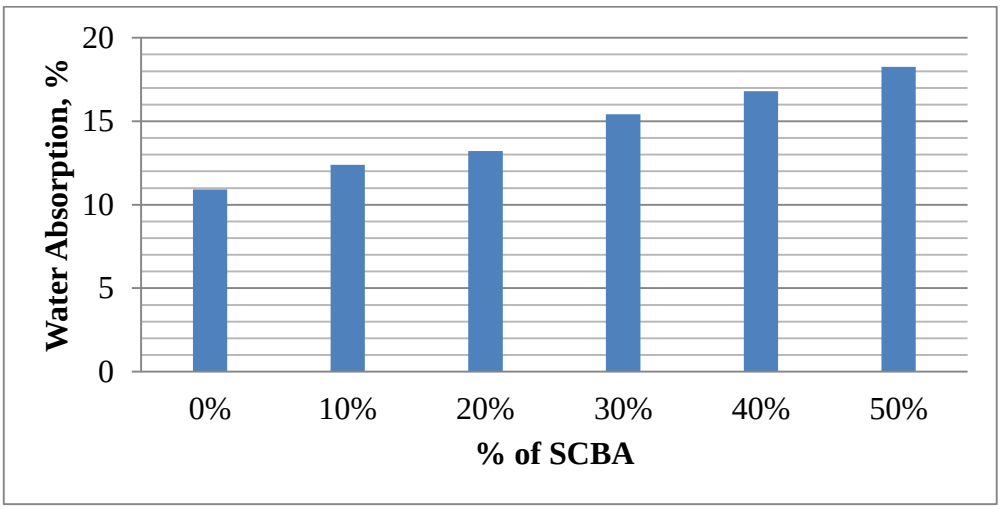

Fig. 9: Water absorption.

Fig. 9 shows that water absorption for the fact that, water absorption increases with increase in SCBA addition. This may be attributed to the addition of ash lowers the plastic nature of the mixture and also decreases the bonding ability of the mixture. When the mixture contain a rather high amount of SCBA then the adhesiveness of the mixture decrease, but the internal pore size of the brick increase. From the test results, the percentage of water absorption increases with increase with SCBA content due to presence of pores.

6.3 Soundness test

In this test, we have checked the bricks to check its soundness in case of the sudden impact. The two bricks are taken and made struck with each other. Brick of good quality should not break and produce a ringing sound. Ringing sound of brick goes on decreasing with increase in the amount of SCBA content. Ringing sound is excellent for conventional bricks with 0% SCBA. For bricks up to 20% SCBA addition has good ringing sound. This is due to increased porosity of the bricks.

6.4 Hardness test

Scratch is made on the brick surface with the help of finger nail. If no impression on the surface, the brick is sufficiently hard. First three samples show good results and last two samples do not show good results.

7. CONCLUSION

Based on the experimental study, following conclusions can be drawn regarding the strength behaviour of flyash brick with SCBA:

The following observations or what can be concluded after performing experiments and various tests have been discussed below.

1. Sugar cane bagasse ash can used as Class F fly ash in construction of brick.
2. As the percentage of fly ash replaced by the bagasse ash compressive strength of sample was decreased after 30%. Minimum 30% utilization of SCBA can satisfied both the compressive strength and water absorption test of IS code provision.
3. Bagasse ash bricks are lighter in weight and more compressive strength at 30 % replacement.
4. At 30% bagasse ash adding shows more compressive strength in all the samples having compressive strength 7.72 N/mm^2.
5. As the percentage of sugarcane bagasse ash increases the compressive strength of concrete tends to increase up to certain percentage and then start's decreasing with the increase of ash content.
6. This could reduce the environmental problems and minimize the requirement of land fill area to dispose SCBA.
7. Bagasse ash is a valuable pozzolanic material and it can potentially be used as a partial replacement for fly ash and make construction cheaper.
8. Water requirement increased as the percentage of BA increased.
9. A more appreciable use of sugarcane bagasse ash is found through this research.
10. Environmental effects of wastes and disposal problems of waste can be reduced through this research.
11. A better degree of non-conventional Construction Material is designed through this study.

8. REFERENCES

[1] Moin ul Haq, Tabassum Naqvi, Fuzail Hashmi (2018), "Stabilization of Concrete using Rubber Tyre Waste", International Journal for Research in Applied Science & Engineering Technology, Volume 6 Issue I, PP: 995-1001.

[2] Bangar Sayali S., Phalke Shubhangi N., Gawade Anjali Y., Tambe Rutuja S., Rahane A. B. (2017), "A Review Paper on Replacement of Cement with Bagasse Ash", International Journal of Engineering Sciences & Management, Vol. 4, Issue 6, PP: 127-131.

[3] L. Vignesh Kumar, B. Jai Vignesh (2017), "Experimental Investigation on Replacement of Bagasse Ash in Bricks", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 6, Issue 5, PP: 8302-8309.
[4] Pravesh Shukla, R.C. Singh (2018), "A Review on the Effect of Baggase ash And Rubber Tyre Waste in Strength of Concrete", International Research Journal of Engineering and Technology, Vol. 4, Issue 12, PP: 442-445.
[5] R.V. Shinde, S.D. VIkhe, S.N. Pawar, D.D. Tekale (2016), "Study of Engineering Properties of Fly Ash Bricks for Construction", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 5, issue 5, PP: 8022-8025.
[6] M. Pravisha, V. Anandhi (2016), "Experimental Investigation on the Effect of Bagasse Ash and Rubber tyre waste in Concrete", International Journal of Advanced Research , Volume 4, Issue 4, PP: 1076-1081.
[7] S.D.Charkha (2016), "Experimental Investigation of HSC with Partial Replacement of Cement with Bagasse Ash", International Journal of Advanced Research , Volume 2, Issue 2, PP: 386-394.
[8] Surya Bhushan singh, Ayush Bhardwaj (2016), "Use of sugarcane bagasse ash as brick Material", International Journal for Scientific Research & Development, Vol. 4, Issue 06, PP: 83-85.
[9] Rohan Rajput, Mayank Gupta (2016), "Utilization of Bagasse Ash as A Brick Material, A Review", International Research Journal of Engineering and Technology, Vol. 3, Issue 8, PP: 1893-1896.
[10] Jakeer Hussain, P Raja Sekhar, K Jayanth, G Hemanth, Siddhardha, A Raghavendra (2015), "Experimental Investigation on Spent Carbon development of Bricks", International Journal of Earth Sciences, Vol. 8, Issue 2, PP: 354-357.
[11] Sumathi, K. Saravana Raja Mohan (2015), "Compressive Strength of Fly Ash Brick with Addition of Lime, Gypsum and Quarry Dust", International Journal of ChemTech Research, Vol.7, No.01, PP: 28-36.
[12] Maneesh kumar CS, Ashik moulana S, venkateshan M (2015), "An Experimental Study on Use of Recycle Paper Mill Waste in Light Weight Brick", International Journal of Advanced Research in Engineering & Management, Vol. 1, Issue 2, PP: 43-50.
[13] Jayminkumar A. Patel, Dr. D. B. Raijiwala (2015), "Experimental Study on Use of Sugar Cane Bagasse Ash in Concrete by Partially Replacement with Cement", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Issue 4, PP: 2228-2232.
[14] T. Shafana, R. Venkatasubramani (2014), "A study on the Mechanical Properties of Concrete with partial replacement of Fine aggregate with Sugarcane bagasse ash", International Journal of Advanced Structures and Geotechnical Engineering, Vol. 03, No. 01, PP: 34-39.
[15] Kotresh K.M, Shimelis Berihe, Mesfin Getahun, Madan L Honnappanavar (2015), "Study on Performance of Sugarcane Bagasse Ash Waste as a Concrete Cement", International Journal of Research in Engineering & Advanced Technology, Volume 2, Issue 5, PP: 1-6.
[16] Apurva Kulkarni, Samruddha Raje, Mamta Rajgor (2013), "Bagasse Ash as An Effective Replacement in Fly Ash Bricks", International Journal of Engineering Trends and Technology, Vol. 4, Issue 10, PP: 4484-4489.
[17] Rakesh Kumara, A. D. Kulkarnib, S. J. Attarc, K. S. Kulkarnid (2011), "Utilization of Fly Ash for Bricks Manufacturing", International Journal of Advanced Engineering Technology, Vol. 2, Issue 3, PP: 359-362.
[18] T. C. Ling, H. M. Nor, S. K. Lim (2010), "Using recycled waste tyre in concrete paving blocks", Proceedings of the ICE-Waste and Resources Management, 163 (1): 37-45.

