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Experimental Investigation on fired clay brick strength by using Baggase ash and fly ash – A Review

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Abstract: The present study is to manufacture Sugarcane bagasse ash bricks with the addition of one more waste materials i.e. Fly ash. In India population is increasing day by day and large quantity of waste is generated through many industries and agriculture which creates health hazards, disposal of this waste has become a major problem. Sugarcane bagasse is one among it which is produced due to burning of bagasse ash. In order to use waste material effectively we used bagasse ash in preparation of bricks in different proportions i.e. 5%-30%.Bricks are prepared and the tests carried out are Water absorption and Compressive strength as per Indian standards.

The present study carried out is to explore the potential of using bagasse ash in brick production. The outcome of this work indicates the maximum compressive strength obtained for optimal mix percentage. Henceforth we can conclude that addition of waste material in manufacturing of brick can minimize the environmental burden leading towards cost effective and green construction.

Keywords : Sugarcane bagasse ash, Fly ash bricks, Green bricks

1. INTRODUCTION

In both developed and developing countries, the problem of waste management has already become an issue to be addressed immediately. This problem is compounded by the rapidly increasing amounts of industrial wastes of a complex nature and composition [1].

Environmental energy also plays a crucial role in the growth of developing countries like India. An increasing interest in environmental issues has pressured industries to develop products and materials that are more environmental friendly[1].

In India there is a substantial increase in population due to increase in industries which leads to production of bagasse ash approximately 250 to 300 million tons of industry waste. It is very necessary to abandon this waste safely without affecting public health, environment and fertilize land.[2]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 [3].

For large production of bricks from waste materials, a further research and development is to be required not only on the technical, economic and environmental aspects but also on standardization, government policy and public education related to waste recycling and sustainable development. Due to the demand of bricks as a building material, many researchers have investigated the potential wastes that can be recycled or incorporated as an additive in the manufacturing process of bricks [1].

Therefore an attempt is made to reuse the sugarcane Bagasse ash in the preparation of bricks in different proportions to calculate its compressive strength and water consumption test [2].

What is SCBA ?

After the extraction of all economical sugar from sugarcane, about 40-45% fibrous residue was obtained, which is reused in the same industry as fuel in boilers for heat generation leaving behind 8 -10 % ash as waste, known as sugarcane bagasse ash (SCBA) [4].

2. LITERATURE REVIEW

Kulkarni Apurva et.al.(2013) studied that Utilization of industrial and agricultural waste products in the industry has been the focus of research for economic, environmental, and technical reasons. Bagasse ash can be utilized by replacing it with fly ash and lime in fly ash bricks. Trial bricks of size (230x100x75) mm were tested with different proportions of 0%, 10%, 20%, 30%, 40%, 50% and 60% with replacement of fly ash and 0%,5%, 10%, 15% and 20% with replacement of lime.

MadurwarMangesh, et.al. (2014)have studied that Application of bio-fuel by-product sugarcane bagasse ash (SBA) as a principal raw material for the manufacturing of bricks was studied. The bricks were developed using the quarry dust (QD) as a replacement to natural river sand and lime (L) as a binder. The bricks with 20% addition of lime to SBA and quarry dust exhibited a compressive strength of up to 6.59 MPa, which is almost double that of the conventional clay bricks (3.5 MPa). The optimum composition of SBA–QD–L brick is 15% and 25% lighter than the commercially available burnt clay and fly ash– cement bricks respectively. It was also observed that masonry bonding of SBA–QD–L bricks is stronger com- pared to commercially available fly ash and burnt clay bricks. Manufacturing process of SBA–QD–L bricks results in 50% and 6% reduction in energy consumption over the commercially available burnt clay and fly ash– cement building bricks. The results showed significant potential and scope for utilizing the agricultural solid waste for manufacturing of building materials that are energy-efficient, lightweight and sustainable.

Venkatesh et al. (2017) discussed on the implementation of Fly ash and quarry dust as an effective replacement for cement in the manufacturing of bricks. The author examined three trial mix proportions such as Cement (50%, 60%, 70%), Fly Ash (40%, 30%, 20%) and 10% of Quarry dust. Based on the test results, the author concluded that the percentage of cement content can be replaced with quarry dust up to 25% without much loss in compressive strength and other properties.

AratiShetkar et al. (2016) researched on fly ash bricks, which are a better alternative to conventional burnt clay bricks in structural, functional and economic aspects as these bricks are manufactured without the use of cement. The raw materials for these bricks are Fly ash (60% to 80%), lime (10% to 20%) and gypsum (10%), which are manually fed into a pan mixer and add sufficient water for intimate mixing. Based on the test results the FaL-G bricks are more safe, economical and having higher strength compare to conventional bricks. The author concludes that the FaL-G bricks are suitable for the construction of masonry structures.

Kumar Rinku and HoodaNaveen (2016) researched on the effect of fly ash bricks on the performance and the properties with the comparison between clay brick and fly ash brick. The different tests are conducted like crushing strength, water absorption, shape and size, soundness, hardness and efflorescence. Based on the test results, fly ash bricks are stronger, more durable and economical when compared to conventional clay bricks.

NaganathanSivakumar et al. (2015) an investigation carried out on manufacturing of bricks using fly ash and bottom ash through a non-conventional method. Bricks were cast using self-compacting mixtures of bottom ash, fly ash and cement eliminating both pressing and firing. Bricks are then tested for compressive strength, modulus of rupture, ultrasonic pulse velocity (UPV), and water absorption, initial rate of suction, fire resistance, and durability. The author concludes that the results showed better performance when compared to conventional

clay bricks and these bricks can be used as an alternative to conventional bricks and hence it contributes to sustainable development.

Kumar Mirtyunjay, DhriyanShivani Singh (2017) concluded that 10 to 20% of cement can be partially replaced by SCBA for higher strength, flexural strength and tensile strength .By addition of SCBA concrete had become more durable and requirement of super plasticizer is not needed. SCBA concrete mixture show good modulus of elasticity.

CetrojaManish (2018) demonstrated that addition of bagasse ash more than 20% causes more water absorption ,reduction in compressive strength less hardness under burnt.so he recommended that upto 20 to 25% bagasse ash can be replaced by clay in bricks.

KotteswaranKishor, concluded that bagasse ash can be added upto 50% ,further little addition of bagasse ash starts the formation of crack .

3. MANUFACTURING PROCESS

1. Preparation of Brick clay or Brick earth:

In this step the soil is excavated in steps & then laid on levelled ground. Then the soil is cleaned impurities such as vegetation matter, stones or pebbles etc.After removing impurities it is exposed to weather for new months. This is called the process of weathering. After completion of weathering process the soil is blended with other material to prepare good brick earth. Then the mixed soil is tempered by being thoroughly broken up, watered & kneaded. The tempering is usually done in pug mill.

2. Moulding of Bricks

Bricks are moulded in many ways depending on the quality of the product to be made. Generally the moulding is done in following two ways.

- Hand moulding
- Machine moulding

For hand moulding the tempered clay is forced in the mould in such a way that it fills all the corners of the mould. Extra clay is removed either by wooden strike or by frame with wire. Mould is then lifted up and raw brick is left on ground.

3. Drying of Bricks

Drying is usually done by placing the bricks in sheds with open sides so as toensure free circulation of air and protection from bad weather and rains. Thebricks are allowed to dry till they are left with 5 to 7 percent moisture content. Thedrying period usually varies from 7 to l4days. The moulded bricks are driedbecause of the following reasons.

- If damp bricks or green bricks are directly taken to burning then, they arelikely to be cracked and distorted.
- To remove maximum moisture from the brick so ‘as to save time and fuelduring burning.
- To increase the strength of raw bricks so that they can be handled and stacked in greater heights in the kiln for burning without damage.

4. Burning of the Bricks

It is the very important step in manufacture of bricks. Bricks may be burnt bytwo distinct methods given below.

- Burning in a clamp or Pazawah known as clamp burning

- Burning in a flame kiln or Bhatta known as kiln burning

In kiln burning, one batch of green bricks is heaped along with firewood, coal etc.and sealed with clay. It is then fired slowly to intense heat which may take manydays. However we know kilns are the permanent structures consisting of many layers.There are intermittent and continuous kilns. Moulded clay is stacked in thelayers. They are then slowly dried and burned to high temperature and cooled.One cycle of loading, drying, burning, cooling and emptying may take as much astwo weeks.

4. CONCLUSION

It is apparent from the above researches that various types of waste materials from the different industries have been used in different proportions and different methods are adopted to produce bricks. Based on the literature review, the researchers have revealed that many successful attempts are made to incorporate waste materials in the manufacturing of bricks. They have positively influenced and enhanced the performance in terms of making them environment friendly and manufacturing economical bricks leading to the design of green building.

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