



DEVELOPMENT AND CHARACTERIZATION OF FIRED CLAY BRICKS BY ADMIXTURE OF BAGASSE, PALM FRUIT FIBER AND PAPER RESIDUE

Kancharla Bullibabu¹, Dr.Md.Abidali²

¹Research scholar at KLEF, Guntur & Assistant professor at Anurag Engineering college, Kodad, Suryapet (Dt), T.S., India.

Professor at Ramachandra college of Engineering,

²Assistant professor at Anurag Engineering college, Eluru, West Godavari (Dt), A.P., India.

ABSTRACT

In this paper investigated about uncomfoting conditions of human beings in summer seasons due to high thermal conductivity through the walls of building which is constructed by the clay and cement bricks. So to decrease the heat transformation through the walls tends to study and investigate to change the composition of the construction materials. Presently in India clay bricks manufacturers are making composition for the production of bricks clay and water. Cement bricks also cement, fly ash and water. Minimum thermal conductivity of these construction materials are 0.8 W/mk. Hence construction materials are composed by bagasse from sugarcane industry, palm fruit fiber and paper residue from paper industry. Temperature and weight change, compressive strength and crystalline structure were investigated by the SEM, TGA and Compressive Test.

Keywords: Bagasse, Palm Fruit Fiber, Paper Residue, SEM and TGA.

1. INTRODUCTION

Human comfort is an important thing in the world, behind of every technology the main concept is human being with comfortable life. However some of the people are living uncomfortable conditions in summer seasons. Majority of the houses are built by fired clay bricks and cement bricks in the India. Mainly in the India human beings are unable to maintain air conditioning systems because of their poor

economical conditions. So these sustainable conditions are consideration in this research and focus on to decrease the heat transfer rate through the wall due to change the composition of the constructional material. Mainly in the India construction materials are clay and cement bricks. Commonly thermal conductivity of these materials is 0.8 W/mk. Hence the reductions of the construction materials are needed. It is lead to investigation on change of the composition of the construction materials by admixture of natural fibers and industrial waste. Here natural fiber from palm fruit fiber, Bagasse from sugar industry (madhukhan sugar industry at nellakodapalli in khammam, telangana state) and paper residue from ITC (bhadrachalem paper limited at kotagudem in telangana state). Generally in clay bricks main constrains are clay and water. In this investigation clay, water admixture with different portions of paper residue, bagasse and palm fruit fiber. Likewise in cement bricks also admixture with palm fiber, bagasse and paper residue. These admixture materials were preferred from industrial waste; due to this minimize the production cost of the composite bricks. Admire and encouragement behind this work is excellent in an investigation for reduction of heat transfer and improves the compressive strength of the composite bricks by the analyses of SEM, TGA and Compressive strength test.

2. EXPERIMENTAL PROCEDURE

In this investigation, brick raw material obtained from local brick manufacturers at khammam in telangana state. Paper residues obtained from

ITC Bhadrachalem Paper Limited at khammam in Telangana state and palm fruit fiber from palm oil factory at Asweraopet khammam in Telangana state. The all industrial waste were pretreatments done in the research and development centre at Anurag engineering college (Autonomous) kodad in telangana state.

2.1 PROCEDURE FOR CLAY BRICK PREPARATION



Figure 1: Paper Residue Dried at Atmosphere Temperature and Centrifugal Grinding



Figure 2: Clay and Paper Residue Composite Bricks

Brick raw material and paper residue dried at atmospheric temperature. Then they were powdered by centrifugal pulverized mill. Dewatered residue blended with fine soil in centrifugal mixing upto 850rpm for 40 min. these mixtures were compacted by manual force for rectangular shaped specimens (100mm x 70mm x 25mm). The prepared specimens were dried at room temperature up to one week. Dried specimens were fired in laboratory electrical furnace at the rate of 4.5°C/m until 800 °C and the at the rate of 6 °C/m until 1100 °C. Fired products were characterized for mechanical properties like compressive strength, microstructure varied by SEM analysis and Temperature and weight change by the TGA .

2.2 PROCEDURE FOR CEMENT BRICK PREPARATION

Fresh bagasse fibers were collected after they were crushed for extracting juice from Mzdhukan Sugar Company. The bagasse fibers were boiled in hot water for three hours. Lime (CaO) was then added during the heating and unwanted organic acids combined chemically

with the lime to form insoluble compounds. The insoluble compounds were then washed away in clean water. This also ensured sugar remains were removed. The reason for eliminating these impurities is that they would otherwise interfere with the bonding of the composite. Oil palm trunk fiber is very light and can absorb a lot of water without congealing. It can withstand extremes temperature and moisture conditions during food processing. These natural fibers have a wide range of applications in foods where fiber usually be added, such as yogurts, breads, pastries and other products using wheat.

A thin layer of wood jelly was the smeared on the inner surfaces of the moulds. The mixture of construction material was poured in the mould gradually and carefully spread with the help of a spatula about 2mm thick. Then the bagasse fibers were spread evenly as per the volume fraction required.

For particulate fiber composite, the particles were stirred together with the epoxy uniform mix. This process was repeated and it was made sure that there was even distribution of the fibers in the construction material. The mould was filled to the brim and care was taken to ensure that the mould laid on a flat surface. The excess bubbles were removed by pinching with a sharp needle and allowing breathing time of approximately 30 minutes. Finally the cover was put in place and pressure exerted on it by tightening the bolts and nuts assembly. The fresh composite was left to cure for 48 hours under normal atmospheric conditions. Finally the mould was then removed and the composite removed and stored safely for further test.



Figure 3: Bagasse Fiber and Palm Fruit Fiber composite cement brick

3. SEM ANALYSIS ON CLAY BRICKS

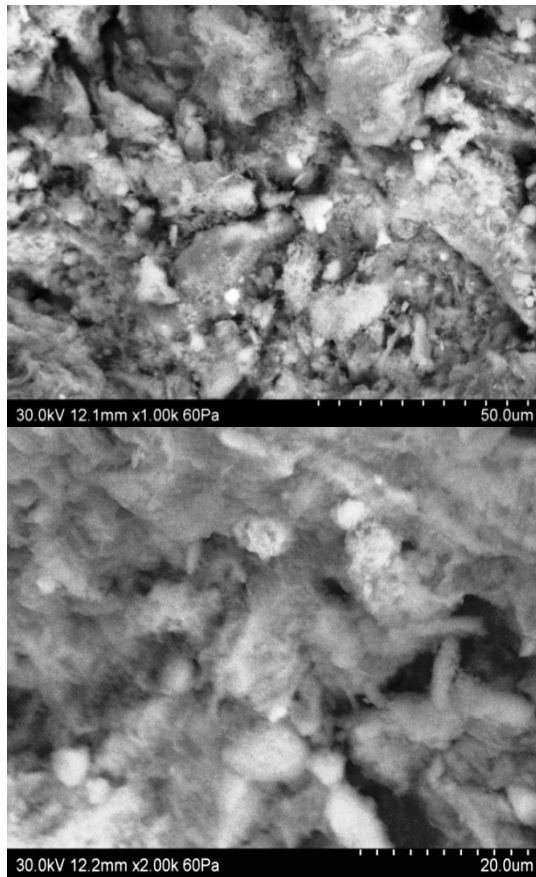


Figure 4: SEM image of clay and paper residue composed bricks crystalline structures at different magnifications

4. SEM ANALYSIS ON CEMENT BRICKS

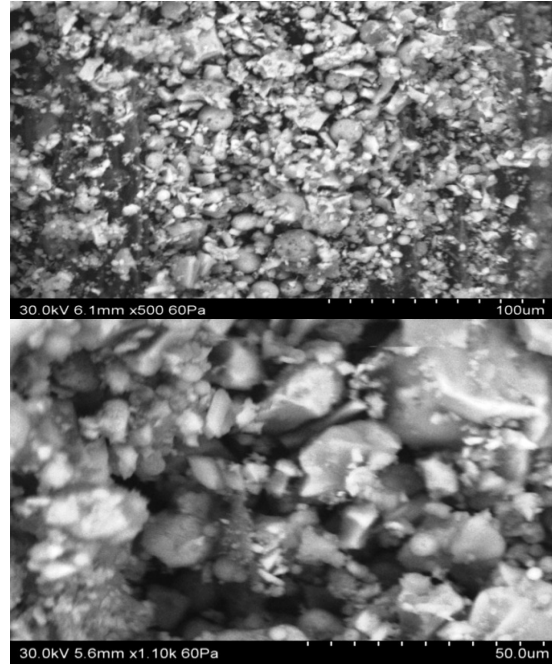
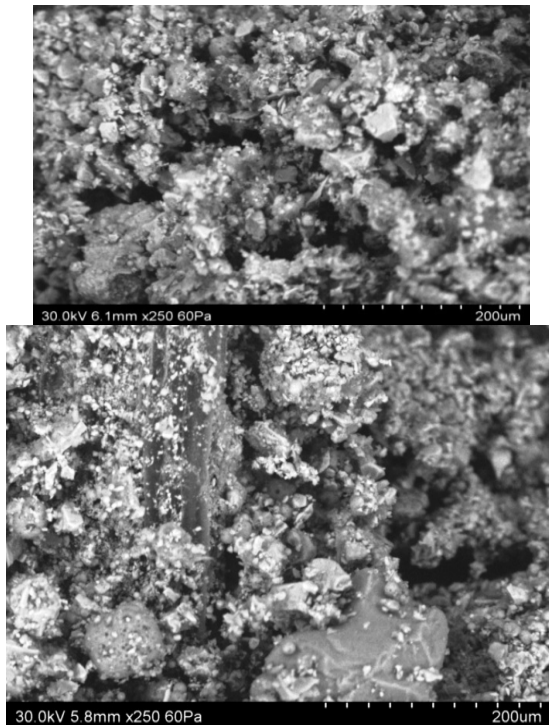


Figure 5: SEM image of bagasse and palm fruit fiber composed cement bricks crystalline structures at different magnifications.

5. TGA ANALYSIS ON CLAY BRICKS

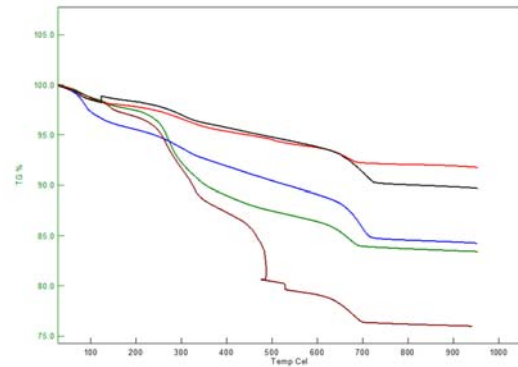


Figure 6: TGA image of clay and paper residue composed bricks

6. TGA ANALYSIS ON CEMENT BRICKS

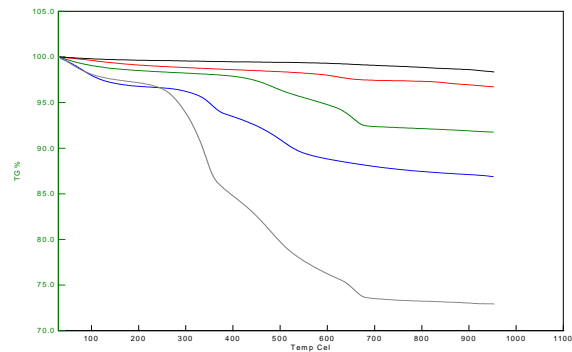


Figure 7: TGA image of bagasse and palm fruit fiber composite cement bricks

7. COMPRESSION TEST ON BRICKS



Figure 8: compression testing procedure

Bri	Composition	Load	Breaki
1	20gms of bagasse &	6.93	1363
2	30gms of bagasse & paper residue	4.96	1073
3	20gms of palm fiber & paper residue	3.9	860
4	30gms of palm fiber	3.53	706
5	10gms of bagasse & 10gms of palm fiber	6.08	1216
6	15gms of bagasse & 15gms of palm fiber	4.61	922

Table.1. Breaking stresses on different composites

8. RESULTS AND DISCUSSIONS

In this paper an investigation on thermal resistance of a lightweight construction material containing sugar mill waste particles was presented. Results were examined according to combination-specialty properties, and specialties of paper residue bricks at various weights were determined in experiments. Unit weight of paper residue brick was calculated less than standard brick that has unit weight of 1740 kg/m^3 . Unit weight of a lightweight material must be lower than 1000 kg/m^3 . As the replacement ratio of paper residue increases, unit weight of brick decreases owing to lower unit weight of pressed clay. Unit weight of pressed paper residue and clay were calculated as 121.6 and 1349 kg/m^3 , respectively. Shrinkages of standard brick and paper residue brick with the replacement ratio of 50% are 7.95% and 11.5%, respectively.

Measurements were carried out in a dry state using a transient plane source technique. To determine the effect of the sugar mill waste (Bagasse) particles ratio on the thermal behavior of a cement composite, 10%, 20%, 30%, 40% and 50% sugar mill waste (Bagasse) particle ratios by volume as replacement to cement, were used. The experimental investigation revealed

that the addition of sugar mill waste particles reduces the material unit weight; furthermore, thermal conductivity of the composite has been improved. The thermal insulating effect of sugar mill (Bagasse) waste particles is most attractive and indicates a high and promising potential for development.

9. CONCLUSION

Effective recognition of sugar industrial Bagasse, paper residues and Palm fruit fibers were useful for an admixture with brick products. In this composite bricks Identified that little shrinkage (1.5-2.5%) occurred in the clay brick and also in the cement brick (1.75-2.80%), that contained Bagasse, paper residue and palm fruit fiber while the brick without admixture shrunk by about 4%. Their fired densities varied between 1.88 and 1.28 g/cm^3 , which correspond to a decrease of 29%, when compared to the density of the brick without admixture. Apparent water absorption values were increased with increase in bagasse, paper residue and palm fruit fiber addition. Pressing direction of the bricks and shape of the pores in samples has a considerable effect on mechanical strength. Due to increase the content of bagasse, paper residue and palm fruit fiber addition, then compressive strength of the samples decreased but compressive strength of the samples was still higher than the standard strength values. Their thermal conductivity values decreased by up to 45% while required mechanical strength could be maintained. Results indicated that the bagasse, paper residue and palm fruit fiber could be easily utilized as pore-forming additives into brick bodies to facilitate production of thermal insulated bricks. These an industrial waste i.e. bagasse, paper residue and palm fruit fibers were better thermal insulation properties, so these materials were preferred for admixture with construction materials, to reduce thermal conductivity.

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