FORMATIONTION OF INSULATING BRICKS FROM AGRICULATURAL WASTE & DETERMINATION OF THERMAL PROPERTIES BY COMPARING WITH PRESENT BRICKS

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Abstract: Today world is facing challenge of energy crisis. There are many ways of heat energy wastage in the form of heat in heat transfer applications. It is require recovering these waste heats by some means. The present study includes experimental investigation for heat transfer in fire bricks & saving heat energy & increase efficiency of furnace. From experimental data, analysis and comparison of result with industrial fire bricks has done. Experimental result of heat transfer rate from fire bricks is compared to thermal analysis. Overall this investigation discusses to saving the heat transfer rate by using agricultural waste.

Index Terms: Energy, Heat, Bricks, Agriculture

I. INTRODUCTION

Energy is essential for the economic growth and social development of any country. The quality of life is closely related to energy consumption, which has continuously increased over the last few decades in developing countries. For increasing the energy saving it is very essential to increasing the efficiency from heat energy. The energy output of any furnace system using agricultural waste bricks can be used for heat energy. Increasing the utilization amount of heat energy received by the furnace improves heating .In the recent year different ways are adopted for improving the power output. The power outputs of furnace depend upon the proper utilization & removing heat loss from furnace bricks i.e. available energy. In this study to bricks from agricultural waste is taken under study. The heat transfer analysis of bricks less with different waste is decide to carried out experimentally and experimental results is compared with thermal analysis for further analysis. In addition to the energy cost saving on heating, there are several other benefits derived from using the heat energy.

India is one of the agricultural country which produce large amount of by product from agriculture but its fact that large amount of agricultural waste is still not use in proper way. In this project mainly focus on by product of rice husk (RH), pigeon pea (PP), wood and sugarcane bagasse, coconut fiber . Project mainly accommodate the formation of insulating bricks using agricultural by product .In this chaptered are briefly introduced about status of rice husk, pigeon pea , coconut fiber ,wood and sugarcane bagasse in India . Sugarcane bagasse (SB) is residue product in large quantity by sugar industries. In general, one tone of sugarcane generates 280 kg of bagasse, the fibrous by product remaining after extracted from sugarcane. About 54 million dry tones of bags are produce annually through the world .Sugarcane bagasse has a strong potential in a in displacing fossil fuels and can be extensively used in boilers ,turbines and furnaces for power generation Other applications of sugarcane bagasse are as sources of animal feet energy, pulp, paper and board . The amount of organic waste obtain from the agriculture industry is abundant in India but the utilization is still limited. Large amount of untreated waste from agriculture and industrial sector contaminate land, water and air by means of leaching, dusting and volatilization. According to improper treatment of sugarcane bagasse also causes similar problems.

II. LITERATURE REVIEW

This section provides an overview of previous student that have been conducted by conducted by researchers in the field of making insulating brick. Different sources reviewed in understand the technique and studies that have been conducted.

GEORGE W. CHURCH [1]. has been studied on the confined soil bricks, A confined soil brick including a preformed container of desired configuration with a compacted soil filler therein; a water repellant coating or sheet material may be applied to at least one side of said container. The present invention relates to confined soil bricks and more particularly to such confined soil bricks which utilize the soil available at the building site. The present invention relates to confined soil bricks wherein the soil in the locality is utilized; such soil is placed in a preformed container and compacted there in An object of the present invention is the provision of a low cost building material which may be manufactured at the construction site. Another object is to provide such a building material utilizing readily available materials which often are unused and must be transported away from the construction site.

SIVAKUMAR NAGANATHAN [2]. has been studied on the Bricks From Waste Material . Recycling of such waste as raw

material alternatives may contribute in the exhaustion of the natural resources; the conservation of not renewable resources; improvement of the population health and security preoccupation with environmental matters and reduction in waste disposal costs. In the review of utilization of those waste, this paper reviewed recycling various waste material in bricks production.
The effects of those wastes on the bricks properties as physical, mechanical properties will be reviewed and recommendations for future research as out comings of this review will be given. This reviewed approach on bricks making from waste is useful to provide
potential and sustainable solution.

VIKTOR BANHIDI [3] has been studied on agricultural waste which is providing insulating property. The use of agricultural wastes (byproducts) in various segments of brick and tile industry is increasing continuously. These additives, which are previously mixed into the raw or compound clay, start to ignite during the firing process, providing extra thermal energy inside the product and decreasing the required external energy need. Besides this effect, the combustion of additives increases the porosity of the final product resulting in enhanced thermal insulation properties. In this paper the effect of some common agricultural wastes (sawdust, rice-peel and seed-shell) on the thermal properties of brick clay products was investigated.

DAVID EHIGIE ESEZOBOR [4] has been worked on coconut shell. The use of coconut shell particulates to enhance the insulating refractory properties of Ukpor, Osiele and Kankara fireclays in Nigeria was studied in this paper. The chemical analysis of the raw materials was conducted using Atomic Absorption spectrometer. The samples used for different tests were prepared by mixing the clay, bentonite and coconut shell,

IRENA MARKOVSKA [5] has been worked on agricultural waste which is light in weight & studied on properties of material. Lightweight ceramic materials in the form of bricks and blocks are widely used in modern construction. They may be obtained by adding of rice husk, rye straw, etc., as porous forming materials. Rice husk is a major by-product of the rice milling industry. Its utilization as a valuable product has always been a problem. Various technologies for utilization of rice husk through biological and thermochemical conversion are being developed. The purpose of this work is to develop light weight ceramic materials with clay matrix and filler of rice husk and examine their main physic mechanical properties. The results obtained allow to suppose that the materials synthesized on the basis of waste materials can be used as lightweight materials for construction purpose.

LASZLO A. GOMZE[6] has been worked on the properties of insulation of bricks. The use of technologically by product agricultural wastes in various segments of the brick and tile industry is increasing continuously. The additives, mixed into the raw clay ignite during the firing process, adding extra thermal energy from inside the mixture decreasing the energy requirements of the manufacturing process. Added to this, through the combustion of the bio-wastes the porosity increases enhancing the thermal insulation properties of the final product. We have investigated some common, agricultural wastes to determine their effect on the thermal properties of bricks. In our experiments industry relevant amounts of additives (sawdust, rice-peel, seed-shell) were added to the basic clay composition.

GERHARD BAYER [7] has been worked on method of production of bricks from red mud. A method for producing bricks from red mud, including mixing filter-wet red mud with a water-fixing substance, then mixing the mixture of red mud and water-fixing substance with clay to provide a resulting mixture containing 50 to 92 weight percent red mud based on the dry weight of red mud plus clay, and water-fixing substance, forming the resulting mixture into raw bricks, drying the raw bricks with heated gases at a temperature below 70 DEG C, and firing the dried raw bricks at a temperature between 900 DEG -1,100 DEG C.

CHAOUKI SADIK [8] has been study on the Production of porous firebrick from mixtures of clay and recycled refractory Waste.Production of porous and lightweight bricks with acceptable flexural strength is accomplished. Expanded perlite
was used as an additive to an earthenware brick to produce the pores. SEM-EDX, XRD and XRF analysis of the raw materials and the elaborated refractory were performed. Mixtures containing perlite were prepared at different proportions (up to 30%Vol.%). Apparent porosity at 1600°C was investigated with the bulk density, water absorption, firing shrinkage and flexural strength. Microstructural investigation was carried out by both natural light microscopy and polarized light microscopy. The results obtained showed that the samples tested here maintained their shape without undergoing any deformation up to 1600°C. The use of expanded perlite decreased the fired density of the bricks down to 1.55g/cm.

AJAY KUMAR [9] has been study on the rice husk & its thermal properties**.**The technological trend towards waste utilization and cost reduction in industrial processing has attracted use of Rice Husk as a value added material. Both rice husk (RH) and Rice Husk Ash (RHA) has been found suitable for wide range of domestic as well as industrial Applications .Considering the importance and increasing demand of this material, a systematic study based on properties and industrial applications has been carried out and reviewed in this paper. Potential and suitability of RH for use in possible new areas in near future has also been highlighted. Though RHA finds largest and most commercially viable markets in cement, concrete and steel industries, constraints to the expansion of this market is due to the health issues associated with using crystalline ash and hence there is a great potential for use of amorphous RHA in these area.
Rice husk has been used directly or in the form of ash either as a value added material for manufacturing and synthesizing new materials or as

a low cost substitute material for modifying the properties of existing products. Presence of silica is an additional advantage in comparison to other byproduct materials which makes RH an important material for a wide range of manufacturing and application oriented processes. Easy availability and low price of rice husk in rice producing countries is an extra benefit towards the use of this material. Despite having high potential and suitability in so many well established uses, use of rice husk has been limited. In the competitive market, proper utilization of rice husk and its ash will benefit industrial sectors. The use of rice husk as fuel/electricity generation in efficient manner is likely to transform this agricultural waste material in to a valuable fuel for industrial sectors. A systematic approach to this material can give birth to a new Industrial sector of rice husk peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations.

Outcome of Literature Review

After the literature we have decide to work on agricultural waste as a insulator .We are inspire to work on agricultural waste properties analysis and experimental role in thermal insulation properties from agricultural waste.

Objective

- To compare the thermal analysis of experimental result with existed bricks data by analysis.
- To compare the outlet temperature, heat loss, etc.
- To study the agricultural waste properties & its proper utilization.

METHOD FOR FORMATION OF BRICK

The fundamentals of brick manufacturing have not changed over time. However, technological advancements have made contemporary brick plants substantially more efficient and have improved the overall quality of the products. A more complete knowledge of raw materials and their properties, better control of firing, improved kiln designs and more advanced mechanization have all contributed to advancing the brick industry. Clay is one of the most abundant natural mineral materials on earth. For brick manufacturing, clay must possess some specific properties and characteristics. Such clays must have plasticity, which permits them to be shaped or molded when mixed with water; they must have sufficient wet and air-dried strength to maintain their shape after forming. Also, when subjected to appropriate temperatures, the clay particles must fuse together Clays occur in three principal forms, all of which have similar chemical compositions but different physical characteristics. Surface Clays. Surface clays may be the up thrusts of older deposits or of more recent sedimentary formations. As the name implies, they are found near the surface of the earth. Shale are clays that have been subjected to high pressures until they have nearly hardened into slate. Fire Clays. Fire clays are usually mined at deeper levels than other clays and have refractory qualities. Surface and fire clays have a different physical structure from shale but are similar in chemical composition. All three types of clay are composed of silica and alumina with varying amounts of metallic oxides. Metallic oxides act as fluxes promoting fusion of the particles at lower temperatures. Metallic oxides (particularly those of iron, magnesium and calcium) influence the color of the fired brick.

The manufacturer minimizes variations in chemical composition and physical properties by mixing clays from different sources and different locations in the pit. Chemical composition varies within the pit, and the differences are compensated for by varying manufacturing processes. As a result, brick from the same manufacturer will have slightly different properties in subsequent production runs. Further, brick from different manufacturers that have the same appearance may differ in other properties. The manufacturing process has six general phases: 1) mining and storage of raw materials, 2) preparing raw materials, 3) forming the brick, 4) drying, 5) firing and cooling and 6) de-hacking and storing finished products.

The clay soil and water were mixed to produce the brick. The clay has been mixed using a mechanical mixer with agricultural waste material for 30 minutes. After clay was mixed together the clay was compacted into the mould. It consists of three layers with 100 times compaction for every layer. To ensure that the compaction rate is uniform the samples were compacted using hand operated soil compactor. Then, the compacted clay was removed from the mould by using the hand operated soil compactor. The sample was pressed into the mould according to the required sizes. Raw bricks produced were dried in the oven before the firing process. Thing stage is very important because if the brick is fired in wet condition, it will affect the perfection of the brick due to cracking, bending or splitting that will make it not suitable to be used for construction building. Therefore, the brick was dried in the oven with 105^0C for 24 hours. Then the bricks were fired in the furnace. The fired brick was tested for dry shrinkage, initial rate of absorption, thermal conductivity, and compressive strength.

III RESEARCH ISSUE IN INSULATING FIRE BRICKS FROM AGRICULTURAL

There are many research problems that must be solved to support the improvement properties of insulation of fire bricks. Solutions to these problems should be compromise by different issues discuss below:

Heat transfer rate

- A very common criticism is that heat energy production is more but the bricks relatively inefficient to save this heat.
- Currently, we observe in villages, the old houses wall made from soil & agricultural waste i.e. mixture of wheat straw, soil & cow dung. So that we need to check thermal properties of agricultural waste materials.

Improvement of insulating property

We required agricultural waste for the thermal testing & worked on this material & improve the insulating property

Production of fire bricks

- Production is important, because we required method of production of fire bricks.
- After the formation of bricks have not hard this is brittle. So this required to hardness so required heat treatment method for bricks.

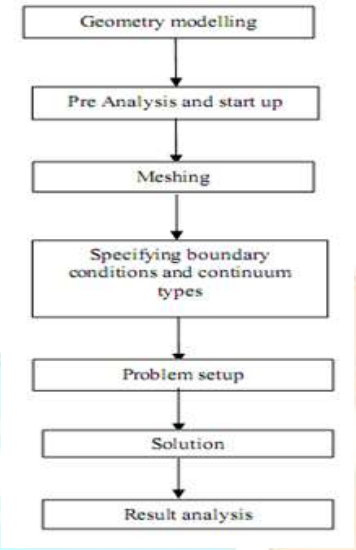
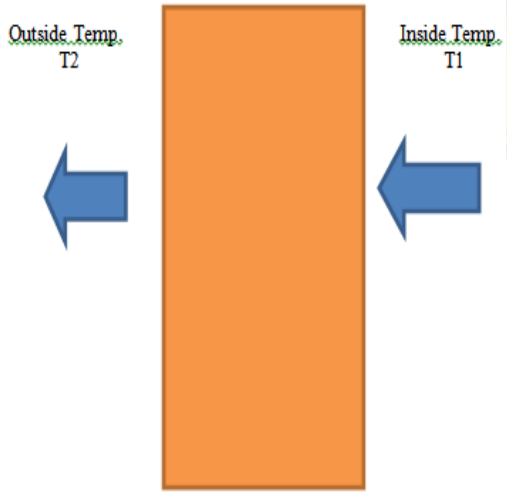


Fig..methodology flow chart.

Experimental Setup:-



K= THERMAL CONDUCTIVITY (W/M^0C)
T1= INSIDE TEMP.
T2= OUTSIDE TEMP.
Q= RATE OF HEAT LOSS PER UNIT AREA(W/M^2)
LA = LENGTH OF BRICKS
$Q = \Delta T / R$
WHERE R IS THE RESISTANCE = L / K

Facilities Required For Proposed Work

For the Experimental Investigation of insulated fire bricks following facilities will be required.

- Clay & Agricultural waste is the most important part for this project work.
- Agricultural waste consistsofwheat straw, rice husk,& waste from dry cotton plant, etc.
- Heating furnace of bricks.
- Thermal analysis system

COMPARATIVE ANALYSIS

A thermal insulator is a poor conductor of heat and has a low thermal conductivity. Insulation is used in furnace and in manufacturing processes to prevent heat loss or heat gain. Although its primary purpose is an economic one, it also provides more accurate control of process temperatures and protection of personnel. It prevents condensation on cold surfaces and the resulting corrosion. Such materials are porous, containing large number of dormant air cells.

Thermal insulation delivers the following benefits:

Reduces over-all energy consumption

• Offers better process control by maintaining process temperature.

• Prevents corrosion by keeping the exposed surface of a refrigerated system above dew point

• Provides fire protection to equipment

• Absorbs vibration

The thermal conductivityof a material is the heat loss per unit area per unit insulation thickness per unit temperature difference. The unit of measurement is $W\text{-}m^2/m°C$ or W-m/°C. The thermal conductivity of materials increases with temperature. So thermal conductivity is always specified at the mean temperature (mean of hot and cold face temperatures) of the insulation material.

The raw materials used in the experimentsweresubjected to different preliminary analysis steps in orderto determine to which extent those raw materialsaresuitable for the preparation of the fire clayrefractorybricks.

Insulating fire bricks

Insulating fire bricks are soft and light in weight. They can be easily cut by handheld hack saw or any other hand tool like chisel or even drill bit. Color of insulating bricks varies but usually they come in shades from light brown to white, see pictures. In refractory air is the best insulation and this is why insulating firebricks have excellent insulating properties. Their body is made of tiny air spaces similar to honeycomb effect.

How to use light weight fire bricks insulation

Use of light weight fire brick insulation is broad, mainly in industrial and hobby kilns heated up with either electric spiral elements or gas burners, furnaces, both for hot face lining or outer back-up heat insulation.Do not confuse lightweight insulating fire

bricks with heavy dense firebricks. Insulating bricks are refractory too and of course withstand very high temperatures range BUT for purpose they have very low thermal conductivity and don't absorb the heat well at all. Those are intentions for heat insulation. For instance if you used them for building of the hot face in a wood fired oven (for cooking) the oven wouldn't cook, because it wouldn't store and hold almost any heat. You can however use these insulating fire bricks on the outer side (of the heavy firebrick walls, vault or under the floor bricks and slab) to prevent the soaked in heat in the chamber's body mass from escaping and achieving superb results. Meaning well insulated oven which will hold the absorbed heat in its mass, where it should be to cook for long time.

Properties Of Existing Bricks

- Bulk Density : 604 Kg/m³
- Modulus of Rupture : 1.52MPa
- Permanent Linear Change on reheating 24hrs. @ 1280°C : 1.95%
- Cold Compressive Strength : 2.01 MPa
- Thermal Conductivity 300°C : 0.2 W/m.°K
- Thermal Conductivity 750°C : 0.28 W/m.°K
- Thermal Conductivity 1000°C : 0.32 W/m.°K

Chemical Composition of Fire Bricks

- Alumina : 37%
- Silica : 61%
- Ferric Oxide : 1.6%

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