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Review on Bio- Bricks

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Abstract: *This paper reviews the utilization of Agricultural waste for making Bio Bricks and other construction materials to reduce burning and disposal problems of Agricultural waste due to increasing Air Pollution and make economic and environment efficient construction material. Agricultural waste burning is a significant source of pollution in India, especially after the harvesting season. Bio-bricks was developed as an alternative and sustainable building material that is made up of agricultural waste. And at the same time will also lead to the reduction of air pollution and create new jobs at the grassroots level. The use of Agricultural waste in construction materials is one of new way to deal with disposal and burning of Agricultural waste. India is home to some of the most polluted cities of the world in terms of its air quality. Data shows that around 20 out of the 30 most polluted cities of the world are in India. So the study provides green building material through Agricultural waste for sustainable development of Bio Bricks. Some additional work in this project can be done which will help environment with decreasing Air pollution by reducing of Agricultural waste. Bio-bricks can be developed as a carbon- negative, sustainable and economically viable material for construction. With the right kind of product development and incentives, it can diversify into numerous products satisfying the needs of an ecologically sensitive future.*

Keywords: sustainable development, lime binder, gypsum, bio brick, agricultural waste, burning of agricultural waste.

I. INTRODUCTION

Today's facts about many environmental problems like global warming, Ozone layer problems, and waste accumulation. All of these problems lead to increased developments in the Phenomenon of climate change, natural disasters, and the emergence of epidemics. With the continuous increase in the world's population, the problems related to using raw materials increased, leading to an environmental imbalance.

Construction has become entirely dependent on concrete structures and fired clay bricks, whose manufacture leads to the emission of a massive amount of greenhouse gases. Moreover, despite their high compressive properties, their thermal properties are poor, leading to an increase in the micro-climate problem. The results of the growing construction industry will be like a bell of danger as conventional materials are responsible for producing a massive amount of greenhouse gas emissions and environmental pollution (clay, sand, cement, bricks, etc.)

Changing conventional materials and reusing agricultural waste is essential to enhance air quality and reduce air pollution.

Agricultural waste burning is a significant source of pollution in India, especially after the harvesting season. Bio-bricks was developed as an alternative and sustainable building material that is made up of agricultural waste. And at the same time will also lead to the reduction of air pollution and create new jobs at the grassroots level.

What is bio brick

Sustainable building material from agricultural waste, lime binder and water as an al- ternate to burnt clay bricks.

Brick making industry in India

Following China, India is the second largest manufacturer of bricks across the globe. No wonder, this very building material holds so much of importance in the Indian architecture. India alone produces over 10 percent of the bricks which are globally produced and has about 1,40,000 brick-making enterprises, who account for 250 billion brick

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masonry units (Source). This industry also employs around 15 million workers and consumes annually over 35 million tons of coal. Today there are many other options available to choose from when it comes to building materials, but bricks have always been one obvious choice. This is industry is surely growing as the demand for Bricks never declines due to the fast-economic growth, urbanization, and prosperity. This blog aims to explain how this legendary building material – Bricks, are made. Yes, let's simplify it for you – The Brick Making Process In India.

Brick Demand

Following China, India is the second largest manufacturer of bricks across the globe. No wonder, this very building material holds so much of importance in the Indian architecture. India alone produces over 10 percent of the bricks which are globally produced and has about 1,40,000 brick-making enterprises, who account for 250 billion brick masonry units (Source). This industry also employs around 15 million workers and consumes annually over 35 million tons of coal. Today there are many other options available to choose from when it comes to building materials, but bricks have always been one obvious choice. This is industry is surely growing as the demand for Bricks never declines due to the fast-economic growth, urbanization, and prosperity. This blog aims to explain how this legendary building material – Bricks, are made. Yes, let's simplify it for you – The Brick Making Process In India.

Challenges Faced By The Brick Making Industry In India

Despite the high demand for bricks in India, there are some challenges that the industry is facing. One of the main challenges is the availability of raw materials. While clay is abundant in many parts of India, the quality of the clay varies from region to region. This has led to a shortage of high-quality clay in some areas, which has affected the production of bricks.

Another challenge facing the brick industry in India is the use of traditional brick kilns, which are known to be highly polluting. These kilns emit large amounts of particulate matter, carbon monoxide, and other pollutants, which have a negative impact on air quality and the health of those living in the surrounding areas. To address this issue, the government has been promoting the use of cleaner brick kiln technologies, such as the Vertical Shaft Brick Kiln (VSBK), which is more efficient and produces fewer emissions.

The high demand for bricks in India has also led to a rise in the price of bricks in recent years. According to a report by the Brick Industry Association, the price of bricks in India increased by around 30% between 2016 and 2020. This increase in price has been attributed to several factors, including the rising cost of raw materials, increasing labor costs, and the use of more sustainable and Eco-friendly brick-making techniques.

Despite these challenges, the demand for bricks in India is expected to continue to grow in the coming years. The government's focus on infrastructure development and sustainable building practices, as well as the growth of the construction and manufacturing sectors, are all expected to contribute to this growth.

Pollution cause due to burnt clay brick

Were found that most of the people around the bricks kiln was more concern about the soil and air pollution. People are suffering or facing breath problem, nasal problem, eye burning and other diseases. Brick kilns production of different toxic pollutant components for air pollution and human hazards. People are suffering with diseases like respiratory, nasal cognition, burning of eyes and loss of visibility, which accelerated many accidents on that particular area due to brick kilns. Some of the ash is carried by flue gases. It is possible to mix a part of the fuel in the powdered form with the clay during clay preparation. This fuel is referred as internal fuel as it is present inside the brick. As the brick is heated in the kiln, combustion of internal fuel takes place. However, in this case as the fuel particles are entrapped in the brick, the ash associated with them remains inside the brick and does not come out. This helps in reducing the pollution. Use of good quality agriculture soil in large quantities for brick making is also a grave area of concern. In geographical regions having thin topsoil, this result in reduction in the productivity of land and in extreme cases the land does not remain fit for agriculture use. To reduce this wastage some steps can be taken. At present only top surface (3 to 10 ft) is utilized for brick making, resulting in large surface area being affected due to digging of soil for brick making. So deep mining of clay can reduce the area affected due to dig of soil for brick making. All this mentioned measures would require mechanization of some of the processes in brick making. Development of suitable low cost

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machinery for making perforated/hollow products as well as support for popularizing these products on large scale are essential for reducing wastage of agriculture soil in brick making. The degradation of environment by bricks making process is very serious matter because Global health is most important for everyone. That there are bad effects of these bricks making process on soil, water, air, vegetation and human health.

Agricultural waste in India

After China, India is the second biggest maker of agricultural waste. It creates in excess of 130 million-tons of Paddy straw out of which just half is utilized as feed and the other half goes to squander, either in landfills or is basically unloaded some where. It likewise delivers in excess of 50 million-tons of stick bagasse.. As should be visible, India has different rural practices, which delivers in excess of 500 million-tons of horticultural waste consistently. The excess waste (84 – 141 million-tons) is typically singed by the ranchers which brings about enormous air contamination causing significant wellbeing perils. A review in light of Punjab alone showed that stubble delivered per section of land of paddy and wheat is around 23 and 19 quintals individually. Around 85% of the paddy stubble is scorched in the open fields. On account of wheat stubble around 11% was singed. Considering how much stubble being created, in any event, consuming a more modest level of it can make significant harm the climate around it.

Burning of agricultural waste

However, current management strategies for crop residue, the major by-product of the agricultural sector, are deemed unsustainable and incompatible with this intensive production rate. Crop residue burning , is the most common way to manage the crop by-product, and it is the fourth largest contributor to biomass burning emissions globally (Andreae and Merlet, 2001; Sahu et al., 2021). In India, around 87.0 Mt of crop residue is burned annually, which is much larger than the entire agricultural waste production in other Asian countries like Bangladesh (72.0 Mt), Indonesia (55.0 Mt), and Myanmar (19.0 Mt) (Bhuvaneshwari et al., 2019; Datta et al., 2020; NPMCR, 2014; TERI, 2021). India is the world's second-largest contributor to carbonaceous aerosols, emitting 84.0 Tg.yr−1 (Grover and Chaudhry, 2019). CRB activities are the primary source of particulate matter (PM), sulfur dioxide (SO2), Nitrogen oxide (NOX), carbon monoxide (CO), black carbon (BC), and volatile organic compounds (VOCs) during the pre- and post-monsoon crop harvest (Grover and Chaudhry, 2019; Liu et al., 2022; Zhang et al., 2019). These emissions increase the risk of acute respiratory infection and other correlated diseases and deteriorate the living standards of agrarian states and their surrounding regions (Bikkina et al., 2019; Chakrabarti et al., 2019; Jethva et al., 2019; Ravindra et al., 2019). Recently, Crop residue burning was found to exacerbate negative health impacts associated with the COVID-19 pandemic (Chauhan et al., 2023).

Need of sustainable development of bricks

All this mentioned measures would require mechanization of some of the processes in brick making. Development of suitable low cost machinery for making perforated/hollow products as well as support for popularizing these products on large scale are essential for reducing wastage of agriculture soil in brick making. The degradation of environment by bricks making process is very serious matter because Global health is most important for everyone. That there are bad effects of these bricks making process on soil, water, air, vegetation and human health. The environment is degraded by the bricks making process and the result of this degradation is to be studies in various angles so that some remedial planning can be suggested. The bricks making process affects not only environment but also human health.

The main adverse effects of crop residue burning include the emission of greenhouse gases (GHGs) that contributes to the global warming, increased levels of particulate matter (PM) and smog that cause health hazards, loss of biodiversity of agricultural lands, and the deterioration of soil fertility

So sustainable development of bio bricks reduce the air pollution and give alternative source to clay bricks.

II. LITERATURE REVIEW

Rautray priyabrata (15 July 2016) have research from IIT, Hyderabad and KIIT, Bhubaneswar in collaboration with Swinburne University of technology, Australia, have first developed bio-brick. A sustainable building material from agriculture waste as an alternate to brunt clay. The process of making bio brick starts with careful selection of dry agro-

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waste such as paddy straw, wheat straw, and sugarcane bag case and cotton plant. The agro-waste is 1st chopped to desire size admixed with lime based slurry and water with the help of hand or mixer. The mixture is poured into moulds and thoroughly compacted with wooden dowel to make compact bricks. The molds are than left for 24 hours before the sides for the molds were opened and left to dry for 15 to 20 days. Chopped straw (size <15mm) + lime powder + water = bio brick Chopped husk and lime slurry mixed in 1:3 ratio by weight. (1)

Rania Emad Abd El-Hady (2017) have developed agro concrete block by using local risk husk as a vegetable aggregate and a lime binder. In comparison with common approach of rice husk recycling, they try valorise this residue in its natural state. They highlight that the formulated composite material could benefit from their low thermal conductivity for the purpose of using as insulating filling material in a wall timber frame or as non-fired brick wall building. Rice husk concrete blocks have been fabricated in laboratory with the remaining dry density about 880 kg/m3. 15 wt% of rice husk and N/V-0.7 are appropriate for the formulation stage with mechanical tamping method. In term of mechanical resistance, both compressive and tensile strength of the concrete specimens they studied. Relevant results suggest that producing concrete block should be used for non-load bearing elements especially in building envelopes. As the carbonation process plays a key role in solidification/ stabilization contaminant, we also could reuse rice husk of wastewater treatment in such agro-concrete product to get over the current environmental impact. (2)

Siddharthsingh (2022) In this paper the properties of agro waste based gypsum samples with various straw sizes, temperature and agro-waste content variation of 0 to 25 wt% were investigated. The present study has shown the potential utilization of agro-waste (rice straw) in gypsum hollow-core blocks for partition walls. Various composition of agro-waste-based gypsum samples have been tested and studied for mechanical, thermal, sound absorption, sound transmission loss, fire retardant, nail retention, thermal admittance studies by Indian, ASTM and British standards. The performance evaluation of the prototype wall has been Done under adverse environments of high humidity variations, rainfall, and sunlight exposure. The agro-waste based gypsum blocks may be used a promising material for drywall partitions owing to their thermal insulation, moderate density, good acoustic and fire-resistant properties. The of crop residue burning is causing serious health issues which is very detrimental in COVID-19 pandemic situation. Clean and eco friendly agricultural practices and awareness among farmers about ill effects of crop residue burning and implementation of government policies are required to mitigate the effects of crop residue burning for a clean and sustainable future. (3)

Rautray priyabrata (July 2023) This research paper explores the practical application of Bio-Bricks in building construction. Bio-Bricks are sustainable bricks made upcycling agro-waste generated after each harvest. The report draws from the experience and learnings from previous research papers (Rautray et al., 2019, 2021). It tries to understand the making of Bio-Bricks samples and the economic benefits that can be gained from the material. The process of making the Bio-Bricks material, designing the building, constructing the molds, in-situ casting process, making the roof with Bio-Bricks material, and ICED23 607 finishing the structure. The documentation of the research project was done through photography and videography, followed by daily observations and reflections. After completion of the construction, the building was observed for two years for any defects or weathering effects. During construction, due care must be taken to protect the structure from heavy rain. Their inherent properties make Bio-Bricks conducive to cement mortar, lime mortar or clay plastering. Based on the availability and cost, either of the processes can be applied. Even after two years of construction, the Bio-Bricks-based guard room has hardly shown any crack, deterioration or damage due to the vagaries of weather. (4)

III. CONCLUSION

Based on study it can be conclude that manufacturing of Bio Bricks by Agricultural waste is best way to burning and compost Agricultural waste and it causes less Air pollution and more beneficial to environment as well as economy when compared to current methods of waste disposal of burning method into open Area. so as per study Bricks Lightweight, easy to assemble, and affordable. Bio Bricks are very resistant to bad weather and climatic variations. They are easy to install and can be more affordable. They have thermal insulation and fire retardant. By using Agricultural waste in Bio Bricks reduce the burning and also decreases Air Pollution.

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