MANUFACTURING OF BRICK USING BIO-MATERIAL FROM AGRICULTURE WASTE (WHEAT STEMS)

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Abstract- Waste management is becoming a major issue for communities worldwide. Burning agricultural waste is one of the major causes of pollution in India. Burning agricultural waste is one of the major causes of pollution in India. Thus, to meet the ever-increasing demand of building materials, new sustainable materials are needed. The potential application of agro-waste', like wheat stems, wheat steam, as the ingredient for alternative sustainable construction materials in the form of bricks. In this paper study of compressive strength and crushing strength weight of bricks is done by adding rice stems into the bricks of size 230mm*110mm*70mm* were manufactured .The bricks samples were tested at 7 , 14 and21 days. This demonstrates that bricks containing rice stem to exhibits compressive strength 54% of regular fly ash bricks, Weight of bio bricks is lesser than fly ash bricks,water absorption is also more than fly ash bricks.

Keywords- fly ash, wheat stem, Bio bricks, Compressive strength.

1.INTRODUCTION

The construction industry has developed rapidly, and this has led to great demand for building materials, including bricks. Conventionally, across the world, bricks are made from several materials, including clay. However, the manufacture of bricks poses serious environmental problems. For example, the process of extraction of clay involves damaging the topsoil, leading to land degradation.

Eco-friendly bricks made using agricultural waste, such as paddy stubble,wheat stem offer a sustainable alternative to traditional bricks. By incorporating agricultural waste into the brick-making process, these bricks help reduce environmental impact by diverting agricultural residues from open burning, which is a major source of air pollution and greenhouse gas emissions.

Additionally, these bricks often require less energy to produce compared to traditional bricks, further lowering their carbon footprint. They also provide a potential solution to the problem of agricultural waste management, offering farmers an alternative to burning stubble and improving soil health through the incorporation of organic matter. Overall, eco-friendly bricks made from agricultural waste are a promising innovation that combines sustainability with practicality.

The topsoil supports plant growth and thus acts as a home for animals and living beings. This makes it a more pressing environmental issue. On the other hand, firing of bricks in kilns after moulding the brick consumes a large amount of energy and releases a large quantity of greenhouse gases. In fact, brick making industries are among the most-significant emitters of carbon gases, as almost 20% of carbon -emitting global gases are due to brick-making industries. This degrades the air quality and may lead to respiratory health issues in human beings. Furthermore, some kilns operate under very high temperatures, and this results in the emission of dangerous fumes that contain certain metals, becoming a hazard to human beings. These fumes also contribute to air pollution.Therefore, the concern of all stakeholders in the construction industry, and particularly environmentalists, is to search for more sustainable, environmentally friendly bricks. One needs to develop a comprehensive understanding of the type of pollution in question, the possible sources, and how to regulate the same.It is also necessary to develop a critical understanding of the available alternative measures to address the environmental pollution associated with the process of brick production.Therefore we are using wheat stem as binding material into the bricks.

2.LITERATURE REVIEW

Study of Alaa.A.Shakir, Sivakumar Naganathan, Kamal Nasharuddin Bin Mustapha,(2013) states that the increase in the popularity of using environmental friendly, low cost and lightweight construction materials in building industry has brought about the need to investigate how this can be achieved by benefiting the environment as well as maintaining the material requirements affirmed in the standard. Recycling of waste generated from industrial and agricultural activities as building materials appears to be viable solution not only to such pollution problem but also to the problem of economic design of buildings (Perez JA et al, 1996). Brick belongs to the wide family of construction materials since it is mainly used for the construction of outer and inner walls in buildings. The brick industry is the most indicated technological activity sector to absorb solid waste due to the large quantity of raw material used by the sector as well as by the large volume of final products in construction similarly by Stefania Luizzi, Sara Sananrica, Pietro Stefanizzi (2017) The present work reports an up to date review of some building insulation products made with vegetable fibers derived also from agro-waste in the Mediterranean area. Recycling of such wastes into sustainable, energy efficient construction materials is a suitable solution for the problem of pollution and natural resource conservation for future generations. Main hygrothermal properties of the fiber-based building materials have been reviewed according to recent literature. Hemp, straw and olive waste products have shown the potential to develop energy efficient and cost effective sustainable construction materials along with enhanced hygrothermal behaviour. Several researchers determined the hygrothermal properties of bio-based insulation materials demonstrating the dependence to the fiber contents. The environmental conditions have also a great importance in this field. For this reason some studies underlined that it is fundamental to simulate the overall hygrothermal behaviour of the buildings. From the various literatures it is noted that products/composites produced from various agro-waste materials, have low thermal conductivity and high hygric performances. The principal problem of these materials is their durability. Further researches have to be done in order to prevent mold growth and make their use more suitable. The generated small database about hygrothermal performances will eventually be beneficial to the manufacturers or researchers to develop innovative construction materials. Roshan Paliwal , Yogesh Shivarkar ,Arun Pund , Prakash Jha , Prathamesh Bhavsar (2018)In this study, it 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.

3. Materials and methods

A. MATERIALS

1. Fly Ash: Fly ash is a by product of coal combustion and is used as a partial replacement for Portland cement to reduce the energy required for cement production. This leads to fewer carbon emissions and less use of natural resources. Additionally, using fly ash in cement can improve the strength and durability of the final product, reducing the need for maintenance and repair. Thus, using fly ash in cement is a sustainable and environmentally friendly option.

Fig 1. Fly Ash

Two classes of fly ash are defined in ASTM C618: 1) Class F fly ash, and 2) Class C fly ash. Class C are often high-calcium fly ashes with carbon content less than 2%; whereas, Class F are generally low-calcium fly ashes with carbon contents less than 5% but sometimes as high as 10%. In general, Class C ashes are produced from burning sub-bituminous or lignite coals and Class F ashes bitu minous or anthracite coals.

2. Cement

All the specification and quality standards given below are as per IS Code 12894 : 2002 and IS Code 16720 : 2018. Ordinary Portland cement, conforming to IS 269. Ordinary Portland Cement (OPC) grade 43/53 has been found to be the most suitable cement 53 grade cement is a type of cement preferred for its high compressive strength. The term “53 Grade” signifies that the cement attains a minimum compressive strength of 53 mega pascals (MPa)

mix	Fly ash (%)	Stone dust (%)	Wheat stems (%)	Cement (%)
A	53	12	6	12

after 28 days of curing period. The OPC 53 grade cement has reduced permeability corroborates with minimising the

moisture content, chemical and pollutants, resulting in the long-term integrity of structures.

Fig 2. Ordinary Port Land cement

3. Wheat Stem

Fig 3. Wheat stems

B.Method (Mix Design)

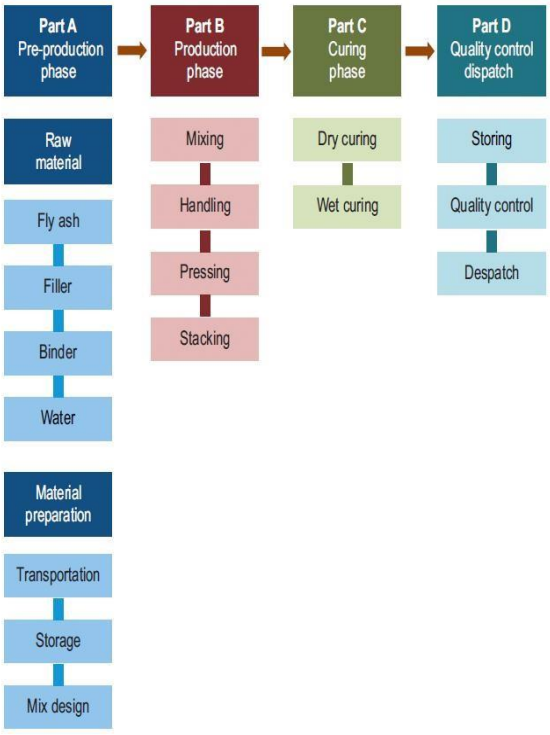
The raw materials are mixed in the mechanized pan mixer. One inclined belt is fitted in between pan mixer and pressing machine to convey the mixture of raw materials to the pressing machine. The pressing machine has eight set of brick mould. One set of mould receive the mixture, then it is compressed and finally eight bricks are made in one revolution of this machine. The unit is producing 130 bricks per batching mixture. After compression of the bricks , these are caried out through the trolly and stacked carefully for drying and curing . Water is given after 7 days of manufacturing twice in two weeks.

Table No 1: Percentage Composition of Ingriedients

Mix	Sample	Dimension of Bricks L×B×D(mm)	Surface Area L×B (mm2)	Total Load (KN)	Compressive Strength N/mm2	Average compressive Strength Mpa
A	1	230×110×70	25300	108.6	4.10	4.32 Mpa
	2	230×110×70	25300	110.8	4.38	
	3	230×110×70	25300	112.3	4.50	

4. EXPERIMENTAL PROCEDURE

A. BRICKS MANUFACTURING



B. TEST PERFORMED

1)Water Absorption Test

The bricks, when tested in accordance with the procedure laid down in IS 3495 (Part 2), after immersion in cold water for 24 hours, shall have average water absorption not more than 20 percent by mass up to class 12.5 and 15 percent by mass for higher classes.

Fly ash bricks generally have lower water absorption than red clay bricks. Fly ash bricks have a water absorption of 6–12%, while red clay bricks have a water absorption of 20– 25%. The acceptable water absorption for bricks in construction is between 12% and 20%.

2) Hardness Test on brick

This test is done to know the hardness of bricks. In this test, scratches are made on the surface of the brick by a

hard thing. If it does not leave any impression on the brick surface then it will be considered as good quality bricks . When an incision is made on the surface of the brick; any impression on the nail shouldn't be produced. This is basically to test the hardness of the bricks. No record (impressions) indicates good quality.

3) Compressive Strength Test

Compressive strength test on bricks are carried out to determine the load carrying capacity of bricks under compression with the help of compression testing machine .

5. RESULT & DISCUSSION

5.1 Compressive strength test on bricks

They are carried out to determine the load carrying capacity of bricks under compression with the help of compression testing machine.

Table No 2 : Compressive strength of Eco-friendly Bricks of 7 days curing.

Mix	Sample	Dimension of Bricks L×B×D(mm)	Surface Area L×B (mm2)	Total Load (KN)	Compressive Strength N/mm2	Average compressive strength Mpa
A	1	230×110×70	25300	78.5	3.16	3.64 Mpa
	2	230×110×70	25300	90.7	3.70	
	3	230×110×70	25300	100.9	4.06	

Table No 3 : Compressive strength of Eco-friendly Bricks of 14 days curing

Mix	Sample	Dimension of Bricks L×B×D(mm)	Surface Area L×B (mm2)	Total Load (KN)	Compressive Strength N/mm2	Average Compressive Strength Mpa
A	1	230×110×70	25300	170.8	6.25	6.43 Mpa
	2	230×110×70	25300	128.1	5.09	
	3	230×110×70	25300	199.2	7.96	

Table No 4: Compressive strength of Eco-friendly Bricks of 21days curing

5.2Water absorption test:

The percentage of water absoption of Eco- friendly bricks are 13.80 and 17.09 which are greater than fly ash bricks having percentage water absorption is 12.78%.

Table No 5: Water Absorption Test

Observation					
Sr. No.	Sample	Dry Weight in Kg (W1)	Weight of specimen After immersion in water in Kg (W2)	% of water absorption	Mean Value in %
Sample 1 (7 days)	1.1	3.195	3.632	13.80	13.88
	1.2	3.175	3.620	13.90	
	1.3	3.134	3.564	13.94	
Sample 2 (14 days)	2.1	3.056	3.592	17.96	17.24
	2.2	3.044	3.549	16.84	
	2.3	3.022	3.536	16.93	
Sample 3 (21 days)	3.1	3.456	3.913	13.52	13.06
	3.2	3.426	3.902	13.82	
	3.3	3.414	3.796	11.85	

5.3 Hardness Test on brick :

This test is done to know the hardness of bricks. In this test, scratches are made on the surface of the brick by a hard thing. If it does not leave any impression on the brick surface then it will be considered as good quality bricks .

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6. CONCLUSION

- The process of manufacturing these bricks should be carefully optimized to ensure that the final product meets the required standards for strength, durability, and thermal insulation. Proper quality control measures should be in place to ensure that the bricks are of high quality and suitable for construction purposes.
- Using these materials in brick manufacturing can reduce the consumption of natural resources like clay and sand.
- Bricks made from agricultural waste may have lower strength compared to traditional bricks. The strength can vary depending on the specific materials used and the manufacturing process.
- The strength of fly ash brick manufactured with the above compositions is ranges between
- 6. Mpa and 8 MPa. Bio brick are lighter and stronger than flyash bricks.

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