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A Review on the Enhancement of Mud Bricks Using Agricultural By-Products for Sustainable Construction

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Abstract:

Mud bricks are some of the most eco-friendly building materials; however, they are not widely used because they have weak strength, take in a lot of water, do not last long, and are easy to crack. In years, adding farming leftovers to mud bricks has become very popular as a way to make them better and also help reuse waste and build in a green way. This review looks at farming leftovers, like rice husk ash, wheat straw, rice straw, sugarcane bagasse ash, coconut fibres, sawdust and other materials from plants that are used as part of the mix or as support in making mud bricks. The review looks closely at how these materials affect the strength when pushed down, the strength when bent, the weight, how well they keep heat, how much water they take in, how much they shrink, how long they last and the environment overall. The results from the studies show that farming leftovers can make some parts of the mud bricks better if the type, size, amount and how they are handled are just right. But if too much is added, it can make the strength worse, the shape change and the ability to resist water get worse. The review also finds that there is not research on how long the bricks last, how to make the mix the same each time, how they work when made in big amounts and how they affect the environment all the way from start to finish. In the end, using farming leftovers in mud bricks is a way to turn waste from farming into useful building materials, cut down on using normal materials and help build in a low-carbon and recycling way.

Keywords: Mud Bricks; Agricultural By-Products; Sustainable Construction; Agricultural Waste; Earth-Based Construction; Compressive Strength; Durability; Eco-Friendly Building Materials; Circular Economy; Low-Carbon Construction.

1. INTRODUCTION

Agricultural Waste Stabilised Mud Bricks are a building material made by mixing earth with farm leftovers like rice husk ash, wheat straw, rice straw, sugarcane bagasse ash and sawdust. The construction industry uses a lot of resources and energy. This causes pollution, releases greenhouse gases and creates a lot of waste. As more people move to cities and the population grows, there is a need for building materials that are affordable and good for the environment. In this situation mud bricks made with agricultural waste are an alternative to regular building materials. These

Bricks are made by mixing soil with waste from farming. Things like rice husk ash, wheat straw, rice straw, sugarcane bagasse ash and sawdust are used. Adding these materials can make some qualities of the mud bricks better when used in the amounts. Depending on the type and amount of agriculture waste, things like heat insulation and resistance to cracks can improve. If too much waste is used, the bricks may not hold up as well or may absorb too much water. Choosing the mix is very important. Using waste from farms as bricks is also a way to deal with the waste and stop it from harming the environment. This method can help create building materials that are cheap, use less energy and are better for the planet. These materials are especially useful for building homes in areas and for small construction

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projects. The main goal of this project is to look at how agricultural waste affects the mechanical qualities of mud bricks. It also wants to see how well these bricks can be used in building that's good for the environment. [16]



2. IMPORTANCE

Agriculture-waste-stabilised mud bricks are important for promoting eco-friendly construction. These bricks use agricultural waste materials like rice husk ash, wheat straw, rice straw and sugarcane bagasse ash. Using these materials helps reduce waste disposal and environmental pollution. These bricks can help save resources and cut down on using regular fired bricks. The use of agricultural waste can make mud bricks better at keeping heat in and improve some of their physical characteristics. This can also lower energy use and building costs depending on the materials and how they are made. Also, this method of recycling waste helps rural areas grow and creates chances to make building materials for green construction.*[18]*

3. MATERIALS USED

1. Soil

Soil is the ingredient used to make mud bricks. It forms the base. Holds everything together. The best soil has a mix of sand, silt and clay.

2. Cement

Cement is used as a stabilising agent in mud bricks to help soil particles stick together better. It makes the bricks stronger when pressed down. It also helps reduce how water the bricks absorb, which makes them last longer.

3. Rice Husk Ash (RHA)

Rice husk ash comes from burning rice husks in a controlled way. It has silica in it, and how much silica depends on how it’s burnt.

4. Wheat Straw

Wheat straw is what's left after wheat is harvested. It has fibres that can be mixed into mud bricks.

5. Rice Straw

Rice straw is the plant material left after rice is harvested. It can be mixed into soil to add fibres.

6. Sugarcane Bagasse Ash

This ash comes from burning sugarcane bagasse, which is the fibrous part left after juice is squeezed out of sugarcane.

7. Sawdust

Sawdust is made of wood pieces from cutting and working with timber. Adding it to mud bricks can make them lighter and better at keeping heat.

8. Water

Water is needed to mix the soil and other materials into a dough. It helps spread everything and gives the mixture the right moisture for shaping and pressing. *[22]*

S.no	Materials	Proportion	Quantity for 1 kg Dry Soil
1.	Soil	Base Materials	1000 g
2.	Cement	Based on Mix Design	As per selected percentage
3.	Rice Husk Ash	5%	50 g
4.	Wheat Straw	0.5%	5 g
5.	Rice Straw	0.5%	5 g
6.	Sugarcane Bagasse Ash	5%	50 g
7.	Sawdust	1%	10 g
8.	Water	As per required	Determine by Test
9.	Rice Husk	1%	10 g
10.	Lime	Based on Mix	As per Selected percentage

Table 1: Proposed mix proportions for agricultural-waste stabilised mud bricks

4. ENVIRONMENTAL BENEFITS

"The utilisation of agricultural by-products in earth-based construction offers multi-dimensional ecological advantages. Specifically, these stabilised units aid in resource conservation, lower the embedded energy metrics of construction, and minimise carbon emissions by providing an eco-friendly alternative to conventional kiln-fired clay bricks" [18].

5. CRITERIA FOR PAPER SELECTION & REVIEW METHODOLOGY

The approach used in this review paper is to search for articles carefully. The search was done on science websites like Scopus, ScienceDirect and Google Scholar. The words used to find articles were 'Mud Bricks', 'Agricultural Waste Stabilisation' and 'Sustainable Building Materials. From all the articles found the focus was on studies. These studies were published between 2020 and 2025. They looked at how strong and how long-lasting the stabilised structural materials are. *[16]*

6. FUTURE PROSPECT

1. High compressive strength

It is the ability of the brick to carry load without break. The right amount of right agricultural wastes (e.g., rice husk ash, sugarcane bagasse ash, etc.) can be added and the strength of the mud brick can be increased.

2. High durability

The durability is the capacity of the brick to perform for long time. The properly prepared agriculture wastes' stabilized mud brick can be more resistant to crack and decay (depend on waste material use and mix proportion).

3. Efficient use of waste

It is the recycling of agricultural wastes (e.g., rice husk ash, wheat straw, rice straw, sugarcane bagasse ash, etc.) by using in bricks instead of wastes disposal and burning. Waste reduction and recycling.

4. For the development of eco-construction materials

Agriculture waste stabilized mud bricks can be one of the environment friendly construction materials. It can help to reduce the reliance on conventional construction material (if proper method is used to produce them). Less environmental impact.

5. Less cost construction

Lower cost of raw material and transport can be achieved (if local soil and agricultural wastes are used). But the real cost depends on waste process, method of preparation, labour, availability.

6. Resource Conservation

When we use agricultural waste in mud bricks, we can make use of the existing waste material and it can help reduce the need for some natural resources. This will help us to make efficient use of the resources in the construction industry.

7. Reduced Energy Consumption

Fired bricks need high temperature to manufacture which consumes a lot of energy. For mud bricks, if we do air drying (no kiln firing) it could need less energy for manufacturing depending on the process of making the mud bricks.

8. Better Thermal Insulation

Thermal Insulation is the ability of a material to reduce the transfer of heat. The right design of mud bricks can help in keeping comfortable temperature indoors by reducing heat transfer from the outside environment to the inside of the building.

7. CONCLUSION

Agriculture-waste-stabilised mud bricks show promise as a way to build sustainably and kindly toward the earth. Using agricultural waste materials like rice husk ash, wheat straw, rice straw and sugarcane bagasse ash can cut down on farm waste. Clean the air and water. Adding an amount of cement can make agriculture waste stabilised mud bricks stronger, longer lasting and better at keeping water out. Agriculture-waste-stabilised mud bricks also lower the need for fired bricks and save natural resources. Still, choosing the materials, mixing them in the right amounts and testing them in a lab are needed to make sure agriculture-waste stabilised mud bricks work well. More study can prove that agriculture-waste stabilised mud bricks are good for homes and other green building projects. *[22]*

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