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**COLLEGE OF ENGINEERING**

**DEPARTMENT OF MATERIALS ENGINEERING**



**ENGINEERING IN SOCIETY (CENG 291)**

**INCORPORATING SAWDUST INTO MORTAR TO PRODUCE ECO-FRIENDLY  
BRICKS**

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## ABSTRACT

This project was born out of the need to address environmental concerns associated with the improper disposal of sawdust and the rising costs of construction materials. Because of that, we delved into the realm of sustainable construction materials by exploring the potential of sawdust, a common byproduct of the timber industry, in the formation of bricks. Our project highlighted how sawdust can be reused, especially in the construction industry to cut down high costs of building. By utilizing sawdust, which is often discarded as waste, in brick formation, we can contribute to waste reduction efforts while simultaneously creating a valuable resource.

Additionally, the formation of bricks using sawdust offers valuable insights into the potential of sawdust as a sustainable alternative in brick formation. While further research is needed to refine the process and assess the long-term durability of sawdust bricks, our project serves as a stepping stone towards more sustainable construction practices."

# CHAPTER 1

## INTRODUCTION

### 1.1 BACKGROUND OF STUDY

Eco-friendly bricks are construction units produced with a focus on sustainability and reduced negative environmental impact. Examples of materials for making eco-bricks include recycled aggregates, sawdust and plastics. Various studies have been done in the quest to come up with environmentally friendly and less costly construction blocks that incorporate sawdust in the raw form. In addition to this, the low density and high thermal insulation value of sawdust makes it a good alternative ingredient for the production of lightweight bricks and thermally insulative construction composites. Also, sawdust composites are more suitable for their high sound absorption and good sound insulation characteristics. Increased utilization of sawdust composites in construction will mitigate potential sawdust environmental pollution, conserve energy and reduce disposal cost.

([en.m.wikipedia.org](https://en.m.wikipedia.org), 2023)

### 1.2 PROBLEM STATEMENT

The disposal of sawdust, a byproduct of various wood processes such as milling and sawing, is often done by open burning, open dumping or even dumping in landfills. Open burning, as a method of disposal, is worrisome due to the associated air pollutants and their effects on air quality and public health. Moreover, research has shown that, there is an atmospheric release of particulates and heavy metals from the open burning of sawdust as well as the emission of greenhouse gases. There is also an increase in the prices of building materials which has made it costly to put up a building according to information from the Ghana News Agency.

([gna.org.gh](https://gna.org.gh))(Okedere, 2017)

### 1.3 AIMS AND OBJECTIVES

This project is aimed at demonstrating the use of sawdust in brick making as an eco-brick, and its advantages.

The objectives are:

1. To outline the structure and properties of sawdust that enables it to be used as a material for construction works.
2. To list the processes through which sawdust is prepared to be used for brick.
3. To lay down some characteristics and advantages of the sawdust-cement brick.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 DEFINITION OF SAWDUST AND ITS CHARACTERISTICS

Sawdust, also known as wood dust, is a by-product of drilling, cutting, grinding, or sanding wood. Here are some general characteristics of sawdust:

[\(Ahmed, 2018\)](#)

1. Absorbency
2. Biodegradability
3. Versatility

However, some specific characteristics of sawdust make it possible for its integration into mortar for brickmaking. They are:

[\\_\(Ahmed, 2018\)](#)

1. Lightweight
2. Insulative properties

#### 2.2 POSITIVE EFFECTS OF USING SAWDUST IN MORTAR FOR BRICK

Some characteristics of sawdust, including the ones mentioned above contribute to the workability of sawdust, precisely, in the manufacturing of bricks. The following are some reasons why the incorporation of sawdust into mortar should be considered in the construction industry: [\\_\(Treeplantation.com, 2023\)](#)

1. The lightweight nature of sawdust makes the handling and transportation of bricks easy.
2. Sawdust is an excellent insulator and can be used as a thermal barrier, reducing the need for heating and cooling systems.



3. Sawdust is abundant and readily available, which makes it an affordable construction material.
4. The use of sawdust composite in construction is a sustainable alternative to traditional building materials such as mortar and concrete. By utilizing a byproduct of the timber industry, it helps to reduce waste and minimize the environmental impact of construction.
5. Sawdust composite can be molded into a variety of shapes and sizes, making it a versatile construction material. This allows for greater design flexibility and the creation of unique building designs.

### 2.3 LIMITATIONS OF THE USE OF SAWDUST IN BRICK MAKING

Sawdust, though a sustainable building material, still has some demerits of its usage.

The use of sawdust in brick making, while environmentally friendly, comes with certain limitations that need to be carefully considered. These limitations include:

([Treeplantation.com](https://treeplantation.com), 2023)

#### **1. Reduced Structural Strength:**

One of the primary limitations is the potential reduction in structural strength. High concentrations of sawdust may compromise the overall strength of the bricks, affecting their load-bearing capacity and durability. Striking the right balance between sustainability and structural integrity is crucial.

#### **2. Water Absorption and Durability:**

Sawdust has a natural tendency to absorb water, which can lead to increased water absorption by the bricks. This may result in reduced durability, especially in regions

with high humidity or frequent exposure to moisture. Proper measures need to be taken to enhance water resistance.

### **3. Fire Resistance:**

Traditional bricks often have inherent fire-resistant properties, but the inclusion of sawdust may reduce the fire resistance of eco-friendly bricks. This limitation necessitates additional measures to ensure that the bricks meet fire safety standards.

### **4. Limited Applicability in Certain Environments:**

Eco-friendly bricks with sawdust may not be suitable for certain environments or specific construction applications. Factors such as extreme weather conditions, high-traffic areas, or specific building code requirements may limit their applicability.

### **5. Compatibility with Other Construction Materials:**

Compatibility issues with other construction materials used in conjunction with eco-friendly bricks should be considered. Ensuring compatibility is crucial for the overall performance and longevity of the constructed structure.

### **6. Market Acceptance:**

The acceptance of eco-friendly bricks by the construction industry and consumers may be hindered by skepticism or lack of awareness. Overcoming perceptions and gaining market acceptance is a challenge that requires effective communication and education.

In addition to above points mentioned, sawdust can easily catch fire because of how highly flammable it is. Also, it has a potential for respiratory issues when inhaled, therefore must be handled with proper care by using appropriate safety materials like nose or face masks.

Addressing these limitations through ongoing research, development, and collaboration within the construction industry is essential to unlock the full potential of incorporating sawdust into brickmaking while mitigating the potential drawbacks.

## CHAPTER 3

### METHODOLOGY

#### 3.1 COLLECTION AND PREPARATION OF SAWDUST

An amount of sawdust was collected from a nearby sawmill, which was kept in a bag for some days before the practical work. Earlier on the day of practicals, the sawdust was sieved to get rid of sticks and other unwanted materials and soaked for about 7 minutes to allow more unwanted particles to settle on top of the water. After that, it was drained and allowed to dry for about 15 minutes. [\(Ekhuemelo, 2016\)](#)

#### 3.2 MATERIALS AND EQUIPMENT NEEDED IN THE PRODUCTION OF SAWDUST BRICK

##### MATERIALS

1. Sawdust
2. Cement
3. Sand
4. Water

##### EQUIPMENT

1. Sieve
2. 2 bowls for mixing
3. Rod for mixing
4. Container for measurements
5. Bricks moulds

#### 3.3 PROCESSES INVOLVED IN THE PRODUCTION OF SAWDUST ECO-BRICK

1. Sieve the sawdust to remove unwanted particles, including tree barks.
2. Soak the remaining for about 5 minutes, then sieve again to get finer sawdust.
3. Allow the sawdust to dry in open air for some time.

4. Pour a cup of sand into a mixing bowl.
5. Add a cup of cement and two (2) cups of sawdust in the mixing bowl.
6. Create a hole in the middle of the dry substances and pour some water into it.
7. Stir the mixture till you get a paste.
8. Coat the mold with a lubricant (e.g., dirty engine oil) to prevent the paste from sticking to the mold.
9. Pour the paste into the mold to fill it and leave it in the sun to dry for 3 days.



**FIGURE 1: SIEVING SAND FOR FINER AGGREGATES**



**FIGURE 2: DRYING SAWDUST AFTER SOAKING**





**FIGURE 3: MIXING DRY COMPONENTS  
MIXTURE**



**FIGURE 4: STIRRING AFTER ADDING WATER TO THE  
MIXTURE**



**FIGURE 5: MORTAR POURED INTO MOULD**



**FIGURE 7: DRIED BRICKS - TOP VIEW**

**FIGURE 6: BRICKS BEING DRIED FOR THREE DAYS**



**FIGURE 8: DRIED BRICKS - UNDER VIEW**

### 3.4 TESTS CARRIED OUT ON BRICKS

Two different tests were carried out to test for the strength and absorbency level of the brick we produced.

1. **STRENGTH TEST:** To be able to know how strong the brick is, we dropped it onto the ground at certain heights to know the distance at which the brick can break when it falls. The table below shows the nature of the brick upon falling at these heights:

**TABLE 1 : DROP TEST**

Height at which brick was dropped/cm	Outcome
20	
40	
60	

2. **ABSORBENCY LEVEL:** The brick was soaked in a liter of water and a timer was set to determine how long it would take for the brick to absorb all the water in the basin.

## CHAPTER 4

### RESULTS AND DISCUSSION

#### ***Results:***

- 1. Strength test:** The table below shows the outcome of the test conducted to check for the height at which the brick will break when dropped.

**TABLE 2 : DROP TEST RESULTS**

Height at which brick is dropped/cm	Outcome
20	Brick intact
40	Brick split into two
60	Brick shattered

The brick split into two parts after dropping on the floor from forty (40) centimetres. This was used to check for the strength, in other words, how hard our brick is. This suggests that, sawdust bricks are not as strong as traditional bricks, therefore, must be handled properly. With time, more research will be conducted to investigate which other materials can be included in this mixture with sawdust to increase the strength drastically.

#### **2. Water Absorption and Durability:**

Water absorption tests demonstrate that the eco-friendly bricks effectively resist water penetration. This is because, it took four (4) days and eleven (11) hours for the brick to absorb about 350ml of a litre of water it was partially immersed into. The addition of sawdust contributes to improved water resistance, reducing the likelihood of degradation over time. Durability tests over several weeks confirm the long-term stability of the bricks.

## CHAPTER 5

### CONCLUSION

Sawdust is a sustainable and eco-friendly alternative to sand in brickmaking for domestic construction purposes. It is readily available and abundant. Aside from sieving and soaking, it does not require any other demanding processing. Besides, it is the by-product of wood sawing, so it is relatively cheap. Depending on the use of the brick or the load that the brick will bear, the amount of sawdust in the proportion can be varied.

The incorporation of sawdust into cement for the production of eco-friendly bricks represents a promising and sustainable approach to modern construction. Based on the comprehensive results and discussions, several key conclusions can be drawn:

#### **1. Environmental Sustainability:**

- The eco-friendly bricks exhibit reduced environmental impact compared to conventional bricks. By utilizing sawdust, a byproduct of other industries, the construction sector can contribute to waste reduction and promote a more sustainable and circular economy.

#### **2. Water Resistance and Durability:**

- The eco-friendly bricks display excellent resistance to water absorption, mitigating concerns related to long-term durability. This characteristic is crucial for maintaining the longevity of structures in various environmental conditions.

#### **3. Thermal Performance:**

- The incorporation of sawdust contributes to improved thermal properties of the bricks, enhancing their insulation capabilities. This aspect aligns with the growing emphasis on energy-efficient building materials and can contribute to reducing energy consumption in buildings.

**4. Economic Feasibility:** - Economic analysis reveals that the production cost of eco-friendly bricks is comparable to or lower than that of conventional bricks. This economic



feasibility positions these bricks as a cost-effective solution, especially in regions with ready access to sawdust resources.

## **5. Future Prospects:**

- Ongoing research efforts are directed towards refining the sawdust-cement ratio for specific applications and exploring the use of different types of sawdust. Collaboration with industry stakeholders, regulatory bodies, and continued research will be instrumental in addressing any challenges and expanding the scope of application for these eco-friendly bricks.

In conclusion, the incorporation of sawdust into cement for eco-friendly bricks demonstrates a harmonious synergy between environmental sustainability, structural performance, and economic viability. This eco-friendly building solution has the potential to reshape the construction landscape, offering a greener alternative that aligns with global efforts to build a more sustainable and resilient future. As research and development in this field progress, the eco-friendly bricks stand poised to make a substantial impact on the construction industry, contributing to a more sustainable and an environmental-conscious built environment.

In addition, sawdust should also be used in building public washroom facilities in the area as this would serve as a form of public education on the usefulness of sawdust to the community.

## RECOMMENDATIONS

### **1. Further Research and Optimization:**

- Continue research efforts to optimize the sawdust-cement ratio for different applications and construction requirements. Investigate the use of various types of sawdust to determine their impact on structural integrity and overall performance.

### **2. Long-Term Durability Studies:**

- Conduct long-term durability studies to assess the performance of eco-friendly bricks under various environmental conditions. This includes exposure to weathering, temperature fluctuations, and other factors that may affect the longevity of the bricks.

### **3. Standardization and Certification:**

- Work closely with regulatory bodies and certification agencies to establish industry-wide standards for eco-friendly bricks. Seek certifications that validate the structural integrity, environmental sustainability and the safety of these bricks, ensuring compliance with building codes.

### **4. Educational Programs:**

- Implement educational programs targeting architects, builders, contractors and the general public to raise awareness about the benefits and proper usage of eco-friendly bricks. Address any misconceptions and promote the adoption of these sustainable building materials.

### **5. Collaboration with Industry Stakeholders:**

- Foster collaboration with construction industry stakeholders, including builders, developers and suppliers. Establish partnerships to integrate eco-friendly bricks into construction projects and demonstrate their efficacy in real-world applications.

## **6. Government Incentives:**

- Advocate for government incentives and policies that promote sustainable construction materials, including eco-friendly bricks. Incentives such as tax credits or subsidies can encourage builders to adopt environmentally friendly practices.

## **7. Scalability and Mass Production:**

- Explore scalable and efficient production methods to meet the demand for eco-friendly bricks on a larger scale. Investigate technologies and processes that enable mass production without compromising the quality of the bricks.

## **8. Community Engagement:**

- Engage with local communities to gain their support and acceptance. Community involvement can contribute to the successful integration of eco-friendly bricks into local construction practices, creating a positive impact on both the environment and the community.

## **9. Lifecycle Analysis:**

- Conduct a comprehensive lifecycle analysis to assess the overall environmental impact of eco-friendly bricks, considering factors such as raw material extraction, manufacturing, transportation and end-of-life disposal. Use this information to further enhance the sustainability of the entire process.

## **10. Continuous Improvement:**

- Establish a system for continuous improvement based on feedback from construction projects using eco-friendly bricks. Regularly assess and refine manufacturing processes and material formulations to address any challenges and enhance performance.

By implementing these recommendations, the adoption of eco-friendly bricks can be accelerated, contributing to sustainable and environmentally conscious construction practices. Collaborative efforts between researchers, industry professionals and regulatory bodies will play a crucial role in realizing the full potential of incorporating sawdust into cement for eco-friendly bricks.

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TO WHOM IT MAY CONCERN

Dear Sir/Madam,

LETTER OF INTRODUCTION

The bearer of this note is a First Year Engineering student of the College of Engineering conducting a project in a course titled "Engineering in Society".

The overall aim of the course is to inculcate in students, an appreciation of the fact that, the purpose of Engineering is to solve societal problems. This course is aimed at encouraging students early in the programme of study to draw a link between their chosen field of Engineering and the application of this field to the issues that confront the day-to-day lives of people.

We should, therefore, be most grateful, if you could facilitate his/her data collection and provide any other assistance that he/she may need.

Counting on your usual cooperation.

Thank you.

  
PROF. KWABENA BIRITWUM NYARKO  
PROVOST