

# **Turning Waste to Wealth: Recycling of Sawdust into Briquette fuel to Enhance Health and Economic Status of Low Income Earners in Ilorin, Nigeria.**

**BY**

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## **Abstract**

*Energy is a major factor that determines the socio-economic development of a nation. But notwithstanding, the utilization of energy must not be at the expense of the environment and the future. To reduce high dependence on biomass as a source of energy is to promote the use of briquettes at homes and by the industries. This research work examined the recycling of Sawdust briquette fuel as a way of reducing environmental pollution and degradation through deforestation, resulting from burning of firewood and cutting of trees. The research work was conducted using Sawdust obtained from a sawmill. Paper mash gotten from used, discarded papers was used as binder for the sawdust. The two were compressed mechanically and dried naturally. The briquette produced from these materials was compared with firewood on the two samples. Flame and water boiling tests were carried out on the two samples.*

*Results obtained showed that equal weight of Sawdust briquette fuel and firewood boiled 2litres of water in 13minutes and 18 minutes respectively showing that the former is a more efficient fuel than the latter. It was also observed that the sawdust briquette fuel burned completely to ashes with a bright blue flame, but the firewood burned with a yellow flame leaving behind thick black soot.*

*It was concluded that the briquette fuel as source of heat made from Sawdust have the following advantages over firewood; very easy to produce and cheap, healthy for use, prevent or reduces deforestation and can serve as source of income, if produced for commercial purposes. It is therefore recommended that effort should be made to promote the use of sawdust briquette as source of fuel over firewood.*

## **Keywords**

Energy, Sawdust, Briquette, Environment, Biomass, Recycling.

## **Introduction**

In recent years, briquette power technology has attracted the attention of researchers and innovators in the developing countries, coming at a time when global energy costs tend to be rising beyond affordability limits for homes and industrial uses. Briquetting is a technology which uses either a dry or a wet process to compress solid waste (sawdust) into different sizes and shapes. The invaluable benefit of this technology is that, apart from solving environmental pollution, it can lead to the production of low cost, locally made solid fuel for cooking or heating purposes as well as serving an alternative to firewood or charcoal, and even coal and cooking gas. Briquette fuels are fuels made from compacted organic matter or biomass. Briquette was introduced and its use as domestic fuel is gradually taking over the conventional use of firewood and charcoal as it is more economical, made from waste products of processed biomaterials and it is environmentally friendly as most briquettes produced emits less poisonous gasses like carbon(II)oxide, CO compared to firewood, (Erikson and Prior, 2015).

Raw materials for making fuel briquette include agricultural and commercial residues such as rice husks, sawdust, scrap papers, weeds and leaves. In this research work, sawdust is most considered because of a very big Sawmill located almost into the premises of the College of Education, Ilorin as it affects other locations in the country. This has led to environmental problems such as pollution, resulting into heaps on our streets, drainage system and water ways, resulting into flooding due to the blockage of the waterways. If these agricultural waste products, especially sawdust, can be properly recycled, into useful products, more goods will be made available to our society, environmental pollution and other diseases attack would be greatly reduced. Eneh (2011), asserted that Pollutants from agricultural wastes in developing countries including Nigeria substantially constitute avoidable source of air pollution as well as widespread hazards of fire. Agricultural air pollution in Nigeria could come from contemporary practices, which include clearing, felling and burning of natural vegetation (Francis and Peter, 2002)

The main reason prompting research into alternative energy source is that fire wood has been reducing alarmingly in most forests. While briquette which is smokeless and provide higher temperature more quickly than coal and wood has been gaining more interest. The households who could not avail the gas or grid connection could use briquette made from sawdust, as an alternative fuel source. Briquetting of biomass can be considered for its economic, reliability and ease of operation. Hence briquetting of sawdust for solid fuel is used for heating in cooking

stoves, fire place and furnace. According to Yahaya and Ibrahim (2012), solid fuel briquettes also have the advantage of cleanliness, ease of handling, produce a small volume of smoke and its ash content is rich in potash and phosphate. This ash can be used as fertilizer on an unfertile soil.

With briquetting of sawdust, a new fuel source is found which will help in reducing wild dumping of sawdust in sawmill areas. This will drastically reduce the cutting of trees for fuel which will result in desertification in future.

Sawdust is a byproduct of wood with a typical dry or membranous outer covering of wood. However, wood is an exceptional biomass, it has good flow ability, normally available with 10-12% moisture and the ash contain fewer alkaline materials. Presently, solid fuel briquette technology has not gained any appreciable popularity and use in Nigeria notwithstanding the abundance of raw materials for its production from sawmills all over. From North to South, East to West, sawdust can be found littering sawmills in Nigeria with its pyramids scattered all over. These wastes could be turned into wealth by utilizing the sawdust to produce solid fuel briquette.

## **Materials and Methods**

**Raw materials:** Sawdust was collected from the sawmill located nearest to the research centre, specifically, sawmill garage, Ilorin, with variable moisture content depending on the length of seasoning. The sample taken was dried ensuring about 10% moisture content and old papers were collected, shredded/ grinded into near powder state and soaked in water to form paper mash.

**Equipment used:** weighing balance, stopwatch, thermometer, locally fabricated pressing stick and briquette stove.

## **Experimental Procedure**

The sawdust solid fuel briquette production process was carried out by mixing binder paper mash and sawdust together. The use of a binder allows lower pressure to be used. The binder used in the cause of this research project was paper mash. The reasons are because it is readily available, cheap and have higher binding effect with less smoke. The binder and water were mixed with the sawdust to form a paste, which was put into a cylindrical mould using

mechanical compression. The briquettes were produced and dried directly in the sun. The skills needed to operate the equipment are basic and easy to learn. Briquettes were produced at the ratio 2:1 (saw dust / paper mash respectively). These mixtures were loaded into a fabricated mould and compressed by weight to the mould for 30 minutes and sun-dried. The drying process was continued for proper drying to be achieved prior to the flame and boiling water tests using the fabricated briquette stove by the researchers.

### **Nature and appearance of the briquette**

The briquettes obtained from the mould after drying were clean, strong and well formed. There was noticeable hair like small cracks on the sawdust / paper mash briquette. This may be due to low compressive force applied. It could also be due to unequal distribution of pressures which was restricted at the top of the mould. This error can be remedied by the use of a compaction machine or higher pressure jack. The compressive strength is a criterion of briquette durability, Emerhi (2011).

### **Flame Test for Briquette**

The nature of the colour of the flame for a burning fuel gives an indication of the quality of heat and the cleanliness of the flame. For example, a blue flame indicates a clean and high quality heat. On the other hand, yellow flame indicates a low quality heat with soot deposits. During the water boiling test the colour of the flame for the sawdust/paper mash was blue with no smoke when stabilized which signifies complete combustion and high heating efficiency while for firewood, the colour of the flame was pale yellow throughout with high smoke content.

### **Water Boiling Test**

The water boiling test is a well-known test which has been used previously by researchers. It measures the time taken for a given quantity of fuel to heat and boil a given quantity of water. In this case, a known quantity each of both briquette and firewood were measured and used to boil equal amounts of water using aluminum pots.

### **Experimental Test**

Equal weight of sawdust / paper mash briquettes and firewood were stacked into two different fabricated stoves. Two aluminum pots containing two liters of water each were seated/mounted on the stoves. The stoves were ignited and as soon as the flames were stabilized for 2-5 minutes, a stop watch was activated. The initial temperatures of the water were taken using digital thermometer and thereafter readings were recorded at 2minutes interval. The readings were stopped after recording boiling points for the two samples.

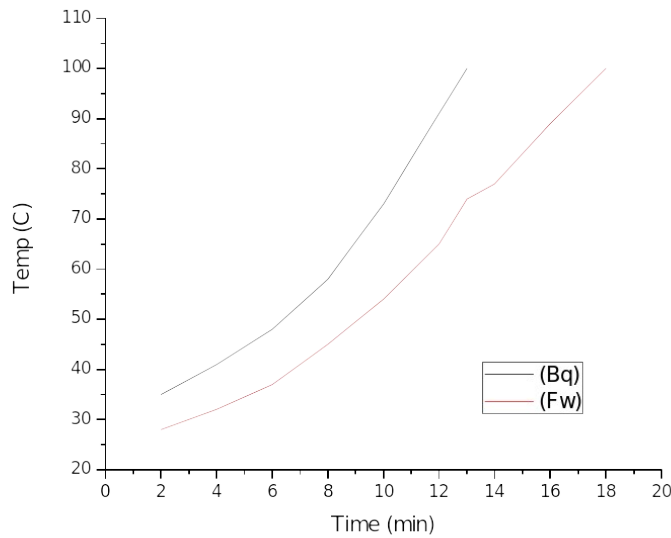
### Results and Discussion

**Table 1: Data showing the temperature values for the rate of boiling of water using Sawdust briquette fuel (Bq) and firewood (Fw)**

Time (min)	Temp.( °C) for Sawdust briquette (Bq)	Temp.(°C) for Firewood (Fw)
2	35	28
4	41	32
6	48	37
8	58	45
10	73	54
12	91	65
13	100	74
14	-	77
16	-	89
18	-	100

- Ambient Temperature ( Room temperature) 25°C

From table 1, it can be seen that at an interval of 2 minutes, the temperature taken for boiling of water for the briquette and firewood was different (e.g., at time 2minutes, the temperature for the two samples were 35°C and 28 °C respectively). Water boiled at 100 °C at 13 minutes and 18 minutes respectively for the briquette and firewood. Table 1 therefore shows that the briquette is more efficient in generating heat than firewood. A graphical interpretation of results obtained from table 1 is as shown in figure 1



**Figure 1: Graph showing comparison of rate of boiling of water for Sawdust briquette (Bq) fuel and firewood ( Fw)**

From the tests analysis, on the flame test, the briquette fuel gave a blue flame which indicated high temperature with heating efficiency. While the flame from firewood was pale yellow resulted in both lower temperature and heating efficiency accordingly.

From the results of boiling of water test analysis, it was found that briquette fuel from Sawdust boils water faster than firewood due to the fact that the water boils in 13minutes with briquette fuel as against firewood that boils in 18minutes.

**Conclusion**

The briquette fuel as source of heat made from Sawdust have the following advantages over firewood

1. very easy to produce and cheap
2. Healthy for use
3. Prevent or reduces deforestation and;
4. Can serve as source of income, if produced for commercial purposes.

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