



Rice husk briquette as a sustainable energy solution and climate change mitigation strategy in Nigeria: A Policy Brief

Suleiman Usman YUNUSA

suleimanyunusa001@gmail.com; suyunusa@abu.edu.ng; yunusa.s@edu.wascal.org

Highlights

- ❖ One of the human factors that induces climate change in Nigeria is deforestation for fuel/energy production.
- ❖ Rice husk can be transformed into fuel briquette with the potential to substitute/replace the use of charcoal and fuel wood and curtail deforestation.
- ❖ With an appropriate and affordable briquette production technology, the huge agricultural waste generated in Nigeria, especially rice husk would be effectively managed providing a viable solution for environmental protection.
- ❖ Converting rice husk to briquette has more environmental benefits than charcoal production. Doing this will reduce climate change by 33.3% and minimize land use by 99.6%.

1. Introduction

Nigeria, being the most populated country in Africa and one of the most populated globally is faced with several human-induced factors (anthropogenic) that increase carbon footprint and climate change. Due to the country's continuous population growth and inflation, many households (more than 70%) live in energy poverty as they cannot afford or access clean energy. On this note, several households have resorted to using solid fuels especially fuelwood and charcoal to meet their primary energy needs (Yunusa et al., 2024). This contributes greatly to the country's

deforestation rate which is currently among the top ten globally (FAO, 2016), and also exposes the country to increasing climate change impacts. More alarming is that Nigeria is the second global producer of charcoal, through which more than 36,000 trees are lost annually. This further increases the country's risk of climate change and land degradation. This has made attaining one of the most essential United Nations Sustainable Development Goals (SDG 7), which looks at ensuring access to clean and affordable energy challenging despite the huge human and material resources invested by the government and several donor agencies. On this note, this study is focused on contributing to two pivotal SDGs: SDG 7 and SDG 13 which look at climate action.

Nigeria is blessed with huge agricultural waste (biomass), as about 55.9 million tonnes of agricultural waste is generated per year in Nigeria (Iye & Bilsborrow, 2013). Rice husk is among the major agricultural wastes produced in Nigeria, with about 2.4 million tons generated annually (Yunusa et al., 2024). This is because Nigeria is the largest producer of rice in Africa, producing approximately 8.4 million tons per year (FAO, 2021). Because there are no waste management measures, the generated wastes are often landfilled, contributing to land wastage. While some are burned contributing to the emission of greenhouse gases.

Against this backdrop, rice husks can be converted to energy (fuel briquette) to augment the energy shortfall in the country, improve waste management, reduce deforestation, improve land use, and mitigate the impacts of climate change.

2. Approach

The approach followed in achieving the research objective is summarized in Figure 1. This ranges from the collection of rice husk and the binding feedstocks to the production of briquettes using three binders (Figure 2). Furthermore, a comparative environmental impact assessment with charcoal was carried out to determine the climate change, land use, and other environmental impacts of producing and using rice husk briquette against charcoal.

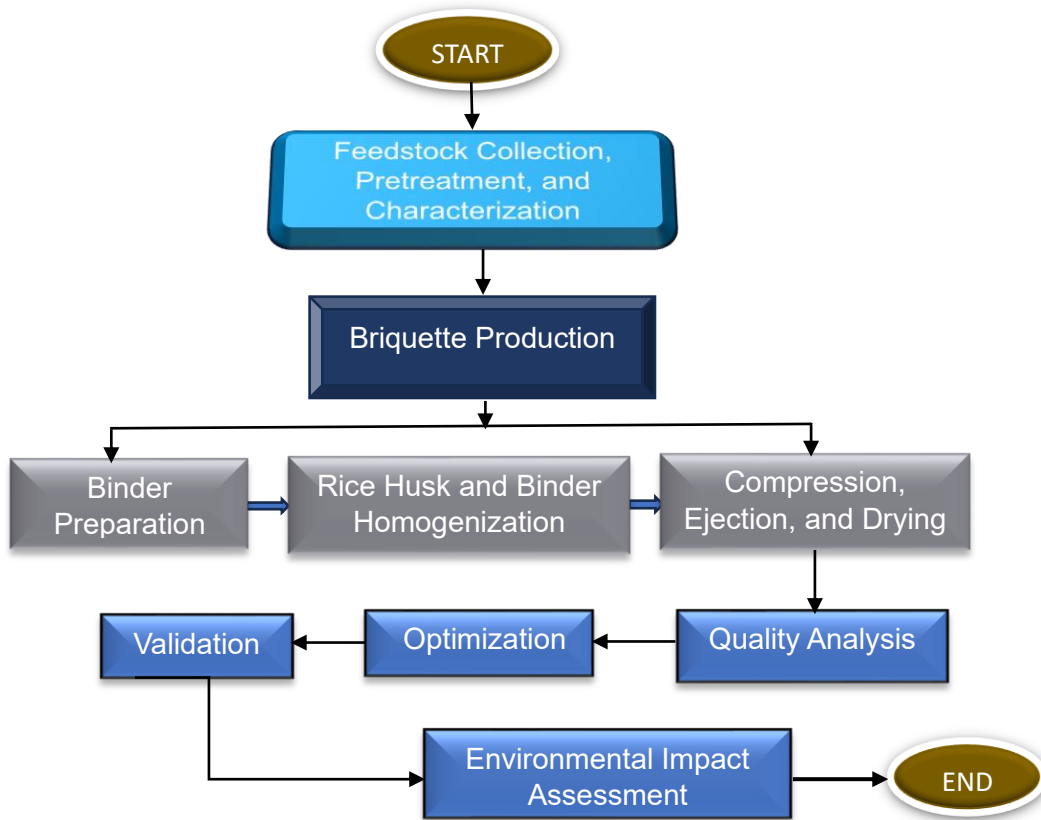


Figure 1. Study Flowchart (Yunusa et al., 2024)



Figure 2. Briquettes produced with rice husk and (a) Locust bean pulp (LBP) binder, (b) Sweet potato peel (PPL) binder, (c) Cassava starch (CSS) binder

3. Key Findings

The findings show that fuel briquettes with optimum quality for domestic use (Figure 2) can be produced under low pressure using the hydraulic piston press. Similarly, potato peel and African locust bean husk and pulp have shown good performance as binders in comparison to cassava starch. Hence, validating their use in fuel briquette production, especially when employing low-pressure machines. The briquettes developed have energy content between 13.54 to 18.74 MJ/kg (Figure 3), conforming with the European Norm (ENplus) limit of 16.56 MJ/kg and the ISO 17225-7 (2021) limit of 14.5 MJ/kg. The findings further prove that the briquettes have adequate energy densities and can be considered a cooking energy source (Muazu & Stegemann, 2017).

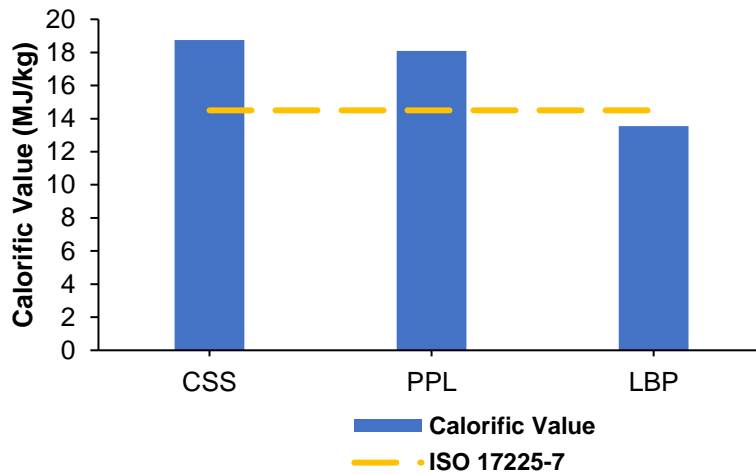


Figure 2. Energy content in the briquette

Figure 3 shows the result of the environmental impact assessment. From the findings, producing and using rice husk briquette has more environmental benefits than charcoal. This implies a climate change mitigation potential of 33.3% and a land use impact reduction of 99.6% for briquette produced and used in place of charcoal. For example, 50% of the rice husk generated in Nigeria (i.e., around 1.2 million tonnes) can yield about 1.6 million tonnes of fuel briquettes. This quantity of briquette can sustainably serve a many households relying on charcoal and fuelwood in the country and can mitigate climate change by 261 million kg CO₂ eq per year. The findings therefore prove that fuel briquette has the potential to mitigate climate change.

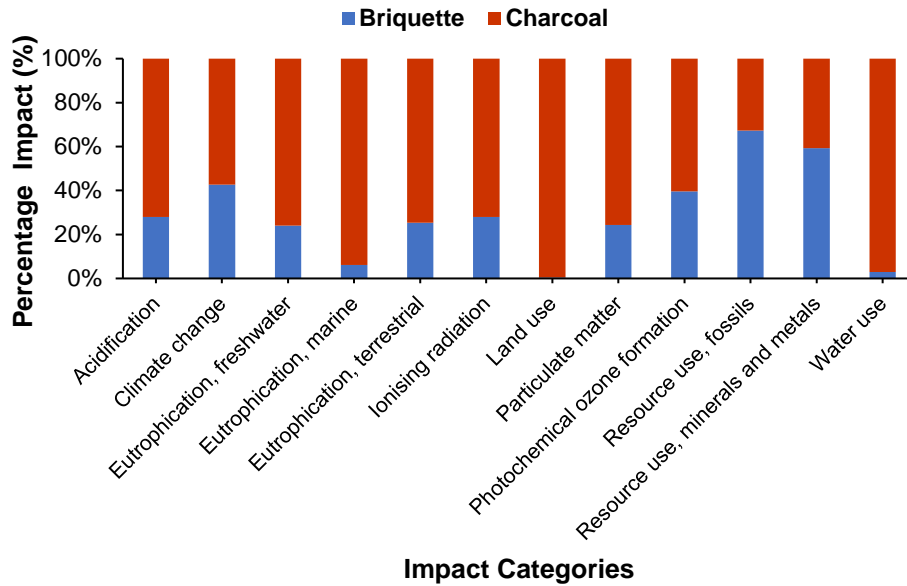


Figure 3. Relative impacts of briquette and charcoal production

4. Conclusion, Policy Recommendation, and Implication

The rate of deforestation and climate change in Nigeria is partly induced by energy sourcing, poor waste management, and a lack of actionable policies. To minimize this problem, there is a need for policymakers to act actively and urgently on policies relating to energy sufficiency, climate change, and deforestation control. This policy brief has summarized an approach through which alternative energy can be developed from waste biomass with the potential to minimize deforestation and mitigate climate change. Through which the following policy recommendations were made for consideration:

- i. A waste management unit should be set up across major agricultural production states and local government areas (LGAs) to reduce landfilling and burning of agricultural wastes
- ii. An appropriate and affordable technology for briquette production should be set up close to the waste management units (in section i) for large-scale production
- iii. A market for fuel-briquette should be set up locally to ensure availability and accessibility
- iv. A national scale database for environmental impact assessment such as LCA should be developed to ensure the accurate estimation of potential impacts of processes and products

- v. A service delivery protocol should be developed and implemented for waste-to-energy conversion as a measure of forest conservation and climate change mitigation. This will aid the sustainable use of agricultural waste for energy.

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