INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN MULTIDISCIPLINARY EDUCATION

ISSN (print): 2833-4515, ISSN (online): 2833-4531

Volume 04 Issue 11 November 2025

DOI: 10.58806/ijirme.2025.v4i11n11 Impact factor- 6.748

Page No. 1199-1207

Cardava Banana Peel Charcoal Briquettes

Lace A. Delos Santos

Isabela State University Ilagan Campus, Master of Arts in Industrial Education

ABSTRACT: This study explores the use of Cardava banana (*Musa acuminata* × *balbisiana*) peels as a main ingredient in making charcoal briquettes. The research was conducted to find out if banana peels can be a good substitute for wood charcoal and if they are acceptable and marketable to consumers. Three treatments were made: 100% banana peel, 50% banana peel mixed with sawdust, and 50% banana peel mixed with corncob. The briquettes were tested based on their heat, smoke, cooking time, and aroma. Results showed that the mixtures with sawdust and corncob produced stronger heat and burned longer compared to pure banana peel briquettes. They also emitted less smoke and gave off a mild, pleasant smell. Overall, the study found that banana peel briquettes are eco-friendly, affordable, and a good alternative fuel source that can help reduce waste while providing livelihood opportunities.

KEYWORDS: Cardava banana peel, charcoal briquettes, sustainability, eco-friendly fuel, waste utilization

I. INTRODUCTION

Cooking-type bananas such as the cultivar Cardava (a member of the ABB Group of the genus Musa) are widely grown in the Philippines and form a key component of the local food economy and food-processing systems. For example, the closely related "Saba" banana (Musa acuminata × balbisiana Colla (ABB Group) 'Saba') has been identified as a viable staple in food-security strategies in the Philippines. Pabuayon, Pantoja, Manila, & Santos (2021) reported that Saba banana and other root-crops are being considered as alternatives to rice in Quezon Province to enhance resilience in local food systems. In the local context, the Cardava cultivar is widely used for fresh consumption and processed foods such as banana chips, contributing significantly to the agribusiness chain. Calica & Lingbawan (2019) examined the value chain of Cardava banana chips in Luzon and found that the processing and marketing of this cultivar generate important livelihood opportunities.

Despite its significance, banana production inevitably generates substantial amounts of waste—particularly peels—that are often discarded. Conversion of these banana wastes into value-added products presents an opportunity to enhance circularity in agricultural systems, reduce waste management burdens, and contribute to sustainable energy solutions. Briquetting of biomass residues is a promising approach in this context. For example, Wilaipon, Trirattansirichai, & Tangchaichit (2014) demonstrated that banana-peel briquettes produced under moderate die pressure had a heating value of ~18.9 MJ/kg and could serve as a bio-fuel substitute. In another study, Mibulo, Nsubuga, Kabenge & Wydra (2023) showed that banana peel briquettes achieved calorific values up to ~22.77 MJ/kg when blended with other waste materials under Ugandan conditions.

Against this backdrop, this study proposes to explore the feasibility of producing briquettes from Cardava banana peels and assesses their acceptability and marketability as an alternative to conventional charcoal fuel in the Philippines. The study is underpinned by the hypothesis that there is no difference in the level of acceptability among briquettes produced via three different treatments (null hypothesis). The specific aims are: (1) to identify and implement the processes required for preparing banana-peel briquettes using the three treatments; (2) to assess their acceptability in terms of flame/temperature, cooking time, smoke, and aroma as evaluated by barbeque and *tupig* vendors; (3) to determine their marketability in terms of consumer demand, material availability, and production cost; and (4) to test whether there are significant differences in acceptability among the three treatments.

By focusing on Cardava banana wastes—a major agricultural by-product in the Philippines—and linking them with renewable energy innovations, the study contributes to the dual goals of waste valorisation and sustainable fuel alternatives. Moreover, it aligns with broader national and global objectives of promoting circular economy practices and reducing reliance on traditional charcoal fuel, which is often associated with deforestation and higher greenhouse gas emissions (Bot et al., 2022).

This study was conducted to determine the level of acceptability of Cardava (Musa acuminata x Balbisiana) banana peel charcoal with different treatments. Specifically, this study aims to answer the following questions:

1. What are the processes that need to be followed in making cardava banana peel charcoal?
2. What is the level of acceptability of the developed banana peel briquettes as evaluated by the barbecue and tupig vendors in terms of:

    a. temperature or flame;

b. cooking time,
c. smoke; and
d. aroma;

3. What is the level of marketability of the banana peel briquettes along the three treatments?
4. Is there a significant difference in the level of acceptability of the banana peel briquettes using the three treatments as evaluated by the barbeque and tupig vendor-respondents?

This study is governed by the null hypothesis, which states that: "There is no difference in the level of acceptability of the banana peel briquettes using the three treatments as evaluated by the barbeque and tupig vendor-respondents". Generally, this study aimed to find out the level of feasibility of Cardava (Musa acuminata x Balbisiana) banana peel briquettes. Specifically, it aimed:

1. To perform the processes involved in the preparation of banana peel briquettes along the three treatments as an alternative to charcoal.
2. To find out the level of acceptability of the developed banana peel briquettes as evaluated by respondents in terms of *temperature* or *flame*, *cooking time*, *smoke*, and *aroma*.
3. To determine the level of marketability of banana peel charcoal along the three treatments in terms of *consumer demand*, *availability of materials*, and *production cost*.
4. To determine the significant difference in the level of acceptability of banana peel briquettes along the three treatments in terms of temperature or flame cooking time, smoke, and aroma as perceived by the barbeque and tupig vendors.

II. METHODOLOGY

This chapter represents the research design, data gathering instrument, material, development procedure, experiment test evaluation, and statistical tools in the study.

Research Design

In this study, Experimental Observation Design was used. Three (3) samples were used with the following ingredients: 100% banana peel; 50% banana peel and 50% sawdust; and 50% banana peel and 50% corncob. Corn starch and water were combined or mixed following the right proportion as a binder for the briquette.

Preparation of Cardava Peel Powder

Step 1: Spread out the collected banana peels in the sun.
Step 2: Place the banana peels inside the big-sized metal can
Step 3: Burn for at least 1-2 hrs depends on the number of peels
Step 4: Let the can completely cool down
Step 5: Collect the black carbonized banana peels
Step 6: Grind the banana peels until they become powder
Step 7: Store the powdered banana peels in an airtight container.

Preparation of Starch and Water Mixture Binder

Step 1: Measure 4 tbsp of starch and 8 cups of water.
Step 2: Combine the starch and water in a casserole.
Step 3: Boil for up to 5-6 minutes.
Step 4: Turn off the stove and let it cool down.

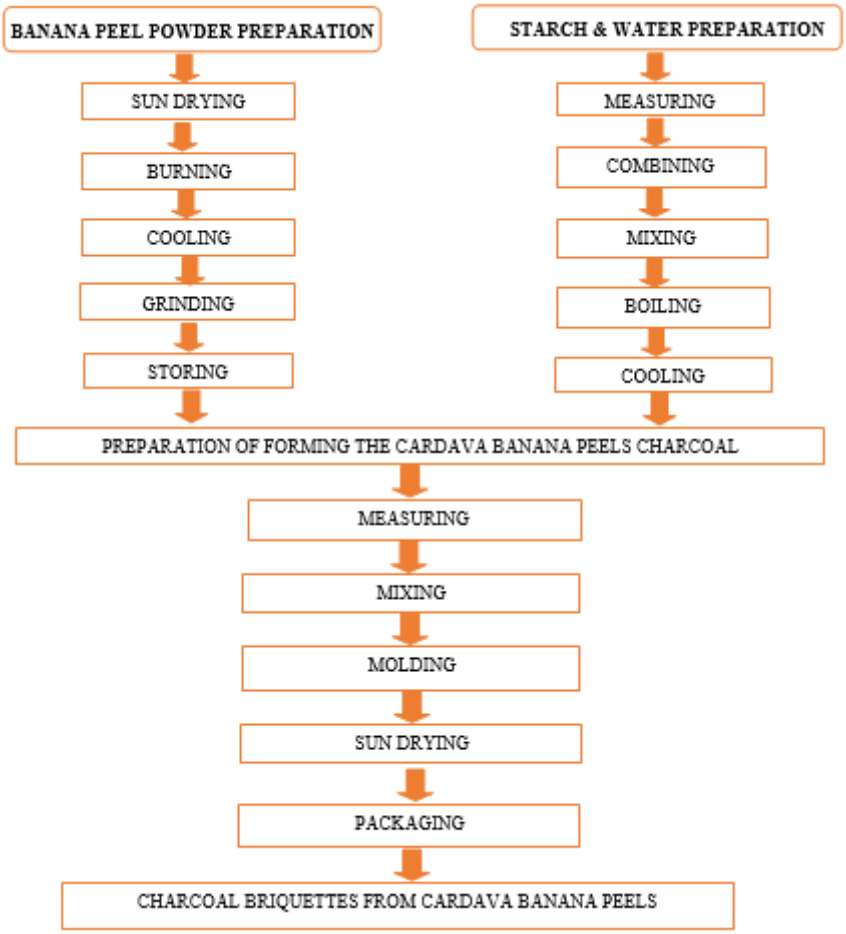
Preparation of Briquettes out of Banana Peel Powder and Starch and Water Mixture

Step 1: Measure the amount of banana peel powder and the binder.
Step 2:
Step 3: Burn at least 1-2 hrs depends on the number of peels
Step 4: Let the can completely cool down
Step 5: Collect the black carbonized banana peels
Step 6: Grind the banana peels until it become powder
Step 7: Store the powdered banana peels in an airtight container.

Tools and materials used in the Utilization of cardava peel charcoal briquettes.

1. Tong
2. Huge Can
3. Measuring cup
4. Mini blender
5. Casserole
6. Improvise moulder
7. Plastic Basin

Cardava Banana Peel Charcoal Briquettes



Data Gathering Procedure

Permission to conduct the study was requested from the respondents. After permission was approved, administration of the questionnaires followed. Directions in relation to the accomplishment of the questionnaires were discussed by the researchers to the evaluators personally. After the administration of the data gathering instrument were retrieved from the respondents. The observation evaluation through a questionnaire checklist was used to gather the information in relation to the Cardava Peel Charcoal Briquettes. Likewise, the observation method was applied to determine changes in the developed charcoal in terms of temperature or flame, cooking time, smoke, and aroma.

Observation Evaluation

The finished products were subjected to an observation score sheet. thirty varied groups of evaluators were selected and properly oriented on how to evaluate the products using a score card with the sample code. The evaluators were asked to use the sample charcoal. Data on the temperature or flame, cooking time, smoke, aroma, and acceptability of each briquette were collected and decoded subject to statistical analysis.

Data Gathering Instruments Used

The instrument for data gathering used includes a score sheet using a qualitative analysis method that determines the acceptability of the charcoal product in terms of the temperature or flame, cooking time, smoke, and aroma using the five-point Likert's scale and given weight. Furthermore, the level of hotness of the developed banana peels briquettes along the treatments used in terms of temperature the 5- point Likert's Scale below was applied:

Scale	Mean Rating	Description
5	4.50 - 5.00	Very Hot (VH)
4	3.50 – 4.49	Hot (H)
3	2.50 – 3.49	Moderately (MH)
2	1.50 – 2.49	Somewhat (SH)
1	1.00 – 1.49	Not Hot (NH)

On the other hand, the level of quickness of the developed banana peel briquettes along the treatments used in terms of cooking time, the 5- point Likert's Scale below was applied:

Scale	Mean Rating	Description
5	4.50 - 5.00	Very Quick (VQ)

4	3.50 – 4.49	Quick (Q)
3	2.50 – 3.49	Moderately Quick (MQ)
2	1.50 – 2.49	Somewhat Quick (SQ)
1	1.00 – 1.49	Not Quick (NQ)

For the level of thickness of the developed banana peel briquettes along the treatments used in terms of smoke, the 5- point Likert's Scale below was applied:

Scale	Mean Rating	Description
5	4.50 - 5.00	Very Thick (VT)
4	3.50 – 4.49	Thick (T)
3	2.50 – 3.49	Moderately Thick (MT)
2	1.50 – 2.49	Somewhat (SH)
1	1.00 – 1.49	Not thick (NH)

For the level of fragrance of the developed banana peels briquettes along the treatments used in terms of aroma, the 5- point Likert's Scale below was applied:

Scale	Mean Rating	Description
5	4.50 - 5.00	Very Fragrant (VF)
4	3.50 – 4.49	Fragrant (F)
3	2.50 – 3.49	Moderately Fragrant (MF)
2	1.50 – 2.49	Somewhat Fragrant (SF)
1	1.00 – 1.49	Not Fragrant (NF)

For the level of marketability of banana briquettes using the treatments in terms of consumer demand, the 5- point Likert's Scale below was applied:

Scale	Mean Rating	Description
5	4.50 - 5.00	Highly Marketable
4	3.50 – 4.49	Marketable
3	2.50 – 3.49	Moderately Marketable
2	1.50 – 2.49	Somewhat Marketable
1	1.00 – 1.49	Never Marketable

Statistical Tools Used

All data were gathered and interpreted using the following tools:

1. **Likert's Scale.** This was used to determine the descriptive meaning of the indicators of the variables used.

2. Mean (M). This was utilized to determine the level of acceptability of the charcoal from cardava peel.

3. One-Way Analysis of Variance. This was utilized to determine the differences in the level of acceptability of the cardava peel charcoal among the group of respondents.

III. RESULTS AND DISCUSSION

This chapter presents the findings, analysis and interpretation of the data gathered to determine the level of acceptability and level of marketability of banana peel briquettes along the three treatments for making the conclusions and recommendations.

Level of Acceptability of the Banana Peel Briquettes the Along Three Treatments as Evaluated by the Respondents in Terms of Temperature, Flame, Cooking Time, Smoke and Aroma

b.1. Level of Acceptability of the Developed Banana Peel Briquettes Using Treatment 1

Furthermore, Table 1 presents the level of acceptability of the banana peel briquettes along Treatment 1.

Table 1. Level of Hotness of the Developed Banana Peels Briquettes Along Treatment 1 in terms of Temperature

100 % Banana Peel Briquette	Overall Weighted Mean	Qualitative Description
Barbeque Vendor	4.0	Moderately Hot
Tupig Vendor	3.49	Moderately Hot

As to the level of hotness of the briquettes in terms of its temperature with the 100% banana peel briquettes mixture, the barbeque and tupig vendors rated it 4.0 and 3.49 which is "*moderately hot"*. This goes to show that the two groups of evaluators gave the same qualitative description. The temperature or flame of the briquettes is constant, of producing an evident the banana peel briquettes showed that the materials could produce high temperature to cook food. In support to the findings, Grover, (1996) said that banana peel briquettes produce high temperature to cook food.

Cardava Banana Peel Charcoal Briquettes

Table 2. Level of Quickness of the Developed Banana Peels Briquettes Along Treatment 1 in terms of Cooking Time

100% Banana Peel Briquette	Overall Weighted Mean	Qualitative Description
Barbeque Vendor	3.6	Quick
Tupig Vendor	3.5	Quick

As to the level of quickness of the 100% banana peel briquettes in terms of cooking time consumed, both groups of respondents rated the cooking time "*moderately quick*", 3.4, and 3.5, respectively. This means that the cooking time of briquettes is slightly faster than compared to wood charcoals. This is maybe due to the quality of dryness and compactness of the banana briquettes. Likewise, it can be considered the volume of the material to be roasted. Ukpaka et al.,2019 confirm the findings of the researcher that in most cases, the cooking time of rice using banana briquettes is not as fast as compared to charcoals.

Table 3. Level of Thickness of the Developed Banana Peels Briquettes Along Treatment 1 in terms of Smoke

100% Banana Peel Briquette	Overall Weighted Mean	Qualitative Description
Barbeque Vendor	1.49	Not Thick
Tupig Vendor	1.48	Not Thick

As to the level of thickness of the 100% banana peel briquettes in terms of the visibility of smoke during burning, once again both the barbeque and tupig vendors agreed that the banana briquettes produced "*not thick*" smoke while burning. This goes to show that the banana briquettes are eco-friendly as it passed the quality of emission needed in burning a fuel. Again, it could be implied that the production thick smoke in burning charcoal is the quality of dryness and compactness applied. Likewise, Ukpaka et al.,2019 found out that low flame produced thick smoke. However, high flame produced less and thin smoke.

Table 4. Level of Fragrance of the Developed Banana Peels Briquettes Along Treatment 1 in terms of Aroma

100 % Banana Peel Briquette	Overall Weighted Mean	Qualitative Description
Barbeque Vendor	3.6	Fragrant
Tupig Vendor	3.5	Fragrant

As to the aroma of the burning 100% banana peel briquettes, once more, both the barbeque and tupig vendors agreed that the smoke of burned banana briquettes is "*fragrant*" 3.6 and 3.5, respectively. This means that the pure banana briquettes produce good smell when it is burned. This goes to show that banana briquettes are eco-friendly for bringing a good smell when burning. N. Dahmen, (2009) confirms the findings of the present researchers that banana peel briquettes are eco-friendly by producing a pleasant smell when burned.

b. 2. Level of Acceptability of the Developed Banana Peel Briquettes Using Treatment 2

Table 5. Level of Hotness of the Developed Banana Peels Briquettes Along Treatment 2 in terms of Temperature

50% Banana Peel Briquette and 50% Sawdust	Overall Weighted Mean	Qualitative Description
Barbeque Vendor	4.75	Very Hot
Tupig Vendor	3.28	Moderately Hot

As to the level of hotness in terms of temperature of the 50% banana peel briquettes and 50% sawdust, the evaluation of the barbeque vendors rated it 4.75 which is "*very hot",* while, 3.28 "*moderately hot*" for the tupig vendors. This goes to show that the combination of banana peel materials and sawdust can likewise produce warm temperature needed to roast barbeque and tupig. Though the barbeque and tupig vendors gave different ratings, still, the findings revealed that the briquettes produced the necessary temperature to cook food. A. Hosseini, (2014) admitted that banana peel briquettes mixed with sawdust can produced high temperature flame when burned.

Table 6. Level of Quickness of the Developed Banana Peels Briquettes Along Treatment 2 in terms of Cooking Time

50% Banana Peel Briquette and 50% Sawdust	WAM	Qualitative Description
Barbeque Vendor	4.25	Quick
Tupig Vendor	3.71	Quick

As to the level of quickness of the 50% banana peel briquettes and 50% sawdust in terms of cooking time consumed. It can be seen that both the two groups of respondents rated the cooking time "*quick*", 4.25, and 3.71 respectively. This means that the cooking time of briquettes of 50-50 ratio is fast as rated by the barbeque tupig vendors. It can be implied that the volume of the material to be roasted is a factor of length of time. Furthermore, this is maybe due to combination process and the quality of dryness and

compactness of the briquettes. Ukpaka et al.,2019 confirm the findings of the researcher that in most cases the cooking time of rice using banana briquettes alone is not fast unless mixed with other materials.

Table 7. Level of Thickness of the Developed Banana Peels Briquettes Along Treatment 2 in terms of Smoke

50% Banana Peel Briquette and 50% Sawdust	WAM	Qualitative Description
Barbeque Vendor	1.50	Somewhat Thick
Tupig Vendor	2.49	Somewhat Thick

As to the level of thickness of the 50% banana peel briquettes and 50% sawdust in terms of smoke during burning, the barbeque and tupig vendors gave the same rating of "*somewhat thick*" smoke (1.50) and (2.49). This goes to show that the banana peel and sawdust briquettes are environmentally friendly for producing thin smoke. This shows that it passed the quality of emission needed in burning a fuel. Again, it could be implied that the production thick smoke in burning charcoal is due to the quality of dryness and compactness applied. M. Abdollahi, A. Hosseini, (2014) supported the findings of the present researchers that production thick smoke in burning charcoal is the due to quality of dryness and compactness applied.

Table 8. Level of Fragrant of the Developed Banana Peels Briquettes Along Treatment 2 in terms of Aroma

50% Banana Peel Briquette and 50% Sawdust	WAM	Qualitative Description
Barbeque Vendor	3.38	Moderately Fragrant
Tupig Vendor	3.86	Fragrant

As to the aroma of the burning 50% banana peel briquettes and 50% sawdust. The tupig vendors have agreed that the scent of the briquettes while burning is "*fragrant*" (3.86). While, the barbeque vendors smelled the briquettes "*moderately fragrant*" (3.38). This means that the combination of pure banana briquettes and sawdust produced good smell when it is burned. This goes to show that banana briquettes and sawdust are environmental healthy for bringing good smell when burning. N. Dahmen, (2009) confirm the findings of the present researchers that banana peel briquettes are eco-friendly by producing pleasant smell when burned.

b. 3. Level of Acceptability of the Developed Banana Peel Briquettes Using Treatment 3

Table 9. Level of Hotness of the Developed Banana Peels Briquettes Along Treatment 3 in terms of Temperature

50 % Banana Peel Briquette and 50% Corncob	Overall Weighted Mean	Qualitative Description
Barbeque Vendor	4.88	Very Hot
Tupig Vendor	3.57	Hot

As to the level of hotness in terms of temperature of the 50% banana peel briquettes and 50% corncob, the evaluation of the barbeque vendors rated it 4.88 which is "*very hot",* while, 3.57 "*hot*" for the tupig vendors. This goes to show that the combination of banana peel materials and corncob can likewise produce warm temperature needed to roast barbeque and tupig. Though the barbeque and tupig vendors gave different ratings, still, the findings revealed that the briquettes produced the necessary temperature to roast barbeque and tupig. A. Hosseini, (2014) admitted that banana peel briquettes mixed with another material can produced high temperature flame when burned.

Table 10. Level of Quickness of the Developed Banana Peels Briquettes Along Treatment 3 in terms of Cooking Time

50 % Banana Peel Briquette and 50% Corncob	WAM	Qualitative Description
Barbeque Vendor	4.25	Very Quick
Tupig Vendor	3.71	Quick

As to the level of quickness of the 50% banana peel briquettes and 50% corncob in terms of cooking time consumed. It can be seen that the barbeque vendors rated the cooking time "*very quick*", (4.25). While, the tupig vendors rated the cooking time "*quick*" (3.71) only. This means that the cooking time of briquettes of 50-50 ratio of banana peel briquettes and corncob is rapidly done. On the other hand, the tupig vendors rated it lower. It can be implied that the volume of the material to be roasted is a factor of length of time of roasting. Furthermore, this is maybe due to combination process and the quality of dryness and compactness of the briquettes. Ukpaka et al.,2019 confirm the findings of the researcher that in most cases the cooking time of rice using banana briquettes alone is not fast unless mixed with other materials.

Table 11. Level of Thickness of the Developed Banana Peels Briquettes Along Treatment 3 in terms of Smoke

50 % Banana Peel Briquette and 50% Corncob	WAM	Qualitative Description
Barbeque Vendor	3.33	Moderately Thick
Tupig Vendor	3.38	Moderately Thick

Cardava Banana Peel Charcoal Briquettes

As to the level of thickness of the 50% banana peel briquettes and 50% corncob in terms of smoke during burning, the barbeque vendors discovered "*moderately thick*" (3.33) smoke. While, the tupig vendor agreed that the banana briquettes produced "*moderately thick*" (3.38) smoke while burning. This goes to show that the banana peel and corncob briquettes produced small amount of smoke. So, the banana peel briquettes mixed with corncobs are environmentally healthy as it passed the quality of emission needed in burning a fuel. Again, it could be implied that the production thick smoke in burning charcoal is the quality of dryness and compactness applied.

Table 12. Level of Fragrant of the Developed Banana Peels Briquettes Along Treatment 3 in terms of Aroma

50% Banana Peel Briquette and 50% Corncob	WAM	Qualitative Description
Barbeque Vendor	4.0	Fragrant
Tupig Vendor	4.75	Very Fragrant

As to the aroma of the burning 50% banana peel briquettes and 50% corncob. The tupig vendors have agreed that the scent of the briquettes while burning is "*fragrant*" (4.0). While, the barbeque vendors smelled the briquettes "*very fragrant*" (4.75). This means that the combination of pure banana briquettes and corncob produced good smell when it is burned. This goes to show that banana briquettes and corncob are environmental healthy for bringing good smell when burning. N. Dahmen, (2009) confirm the findings of the present researchers that banana peel briquettes are eco-friendly by producing pleasant smell when burned.

B. Level of Marketability of the Banana Peel Briquettes the Along Three Treatments as Evaluated by the Respondents in Consumer Demand, Availability of Materials and Production Cost

Table 13. Level of Marketability of Banana Briquettes Using the Three Treatments along Consumer Demand

Consumer Demand Indicators	Weighted Mean	Qualitative Description
1. The consumers liked to buy banana peel briquettes due to its environmental value.	4.41	Marketable
2. The consumers are attracted to buy the banana peel briquettes due to its compactness and hardness.	4.38	Marketable
3. The consumers are encouraged to buy banana peel briquettes due to its fine and fragrant smoke while burning.	4.27	Marketable
4. The consumers are attracted to buy banana briquettes due to temperature quality.	4.19	Marketable
Total	**4.31**	**Marketable**

As to the level of marketability of banana peel briquettes using the three treatments along consumer demand, it has been found out that the banana peel briquettes are "*marketable*" (4.41) due to its environmental value. Furthermore, the banana peel briquettes are "*marketable*" (4.38) due to its compactness and hardness. Likewise, the banana peel briquettes are "*marketable*" (4.27) due to its fine and fragrant smoke while burning. Equally, the banana peel briquettes are "*marketable*" (3.66) due to its hot temperature while burning. As a whole, the computed overall mean is 4.31 falls under the qualitative description of "*marketable*". This shows that the banana peel briquettes are saleable anytime due to its hardness and heat quality, healthy and economical features.

Table 14. Level of Marketability of Banana Peel Briquettes Using the Three Treatments along Availability of Materials

Availability of Materials Indicators	Weighted Mean	Qualitative Description
1. The materials of banana peel briquettes are always available the whole year-round.	4.51	Highly Marketable
2. The materials of banana peel briquettes can be found anywhere.	4.43	Marketable
3. The materials of banana peel briquettes are always manageable anytime.	4.49	Marketable
4. The materials of banana peel briquettes are always accessible anywhere.	4.41	Marketable
Total	**4.46**	**Marketable**

As to the level of marketability of banana peel briquettes using the three treatments along availability of materials Table 14 presents the data of interest. As seen in the Table, the banana peel briquettes are "*highly marketable*" (4.51) for always available the whole year-round. Likewise, the banana peel briquettes are "*marketable*" (4.43) for the materials can be found anywhere. Moreover, the banana peel briquettes are "*marketable*" (4.49) for the materials are always manageable anytime. Furthermore, the banana peel briquettes are "*marketable*" (4.41) for the materials are always nearby anytime. The computed overall weighted mean of 4.46 falls under the qualitative rating of "*marketable*". This shows that the materials in making banana peel briquettes using the three treatments are always obtainable anytime and anywhere.

Cardava Banana Peel Charcoal Briquettes

Table 15. Level of Marketability of Banana Peel Briquettes Using the Three Treatments along Production Cost

Production Cost Indicators	Weighted Mean	Qualitative Description
1. The materials of banana peel briquettes are cheap and available.	4.22	Marketable
2. The banana peel briquettes are easy to buy for it is affordable.	4.32	Marketable
3. The packaging of the banana peel briquettes are simple and cheap.	4.32	Marketable
4. The banana peel briquettes are promising livelihood for a meager capital.	4.32	Marketable
Total	**4.29**	**Marketable**

As to the level of marketability of banana peel briquettes using the three treatments along production cost, it has been found out that the banana peel briquettes are "*marketable*" (4.22) for the materials are costless and available. Meanwhile, the banana peel briquettes are "*marketable*" (4.32) due to its easy to acquire and affordable. On the other hand, the banana peel briquettes are "*marketable*" (4.32) due to the packaging is simple and cheap. Likewise, the banana peel briquettes are "*marketable*" (3.79) due to a promising livelihood for a meagre capital. As a whole, the computed overall mean is 4.16 which is equivalent to "*marketable*". This shows that the production cost of the banana peel briquettes is attractive due to its costless materials and ingredients.

C. Test of Difference in the Level of Feasibility of the Banana Peel Briquettes using the Three Treatments as Evaluated by the Barbeque and Tupig Vendor-Respondents

Table 16. Significant Difference in the Level of Feasibility of Banana Peel Briquettes using the Three Treatments as Evaluated by the Barbeque Vendors

Source of Variation	Sum of Squares (SS)	Degre of Freedom (df)	Mean Square (MS)	F-value	Table Value	Decision
Between Groups	619.029	2	309.5145			
Within Groups	615.5568	9	68.3952			Significant
Total	**3.4722**	**11**		4.5254	4.26	

For barbeque vendors, the computed F-value is 4.5254, while the Table value is 4.26 found to be lesser than F-value computed. At 11 degrees of freedom, the F-test showed a "*significant*" result. This goes to show that there is a significant difference in the evaluation of the barbecue and tupig vendors. Meaning, they have the same perceptions as to the three treatments along temperature, cooking time, smoke, and aroma. In this case, "*reject*" the null hypothesis.

Table 17. Significant Difference in the Level of Feasibility of Banana Peel Briquettes using the Three Treatments as Evaluated by the Tupig Vendors

Source of Variation	Sum of Squares (SS)	Degre of Freedom (df)	Mean Square (MS)	F-value	Table Value	Decision
Between Groups	.329225	2	.1646			
Within Groups	1.161975	9	.12911			Significant
Total	**1.4912**	**11**		1.27	4.26	

For tupig vendors, the computed F-value is1.27, while the Table value is 4.26 found to be greater than F-value computed. At 11 degrees of freedom, the F-test showed a "*significant*" result. This goes to show that there is a significant difference in the evaluation of the barbecue and tupig vendors. Meaning, they have the different perceptions as to the three treatments along temperature, cooking time, smoke, and aroma. In this case, "*reject*" the null hypothesis.

IV. CONCLUSION

Based on the given findings, the study concludes that the banana peel briquettes from the three treatments and proportions is highly feasible for roasting and cooking. The temperature is sustainable. The cooking time is normal. Furthermore, the banana peel briquette is eco-friendly for producing thin smoke and good smell when burning. The three treatments were proven saleable along consumer demand, availability of materials and production cost. Hence, the responses of the respondents were proven the same in economic aspects. But not the same in terms of banana peel briquettes structures such as compactness and flammability.

REFERENCES

1) Abdollahi, M., & Hosseini, A. (2014). In *Encyclopedia of Toxicology* (3rd ed.).
2) Bot, B. V., Axaopoulos, P. J., Sosso, O. T., Sakellariou, E. I., & Tamba, J. G. (2022). Economic analysis of biomass briquettes made from coconut shells, rattan waste, banana peels and sugarcane bagasse in household cooking. *International Journal of Energy and Environmental Engineering*, *14*(2). https://doi.org/10.1007/s40095-022-00508-2

3) Calica, G. B., & Lingbawan, K. R. (2019). Value chain analysis on processing Cardava banana chips in the Philippines: Luzon case. *International Journal of Scientific Research and Management (IJSRM)*, *7*(1). https://doi.org/10.18535/ijsrm/v7i1.em01
4) Calica, G. B., Lingbawan, K. R., & Cruz, R. S. D. (2018). Assessment of the postharvest handling systems and losses of cardava banana in the Philippines. *Asian Journal of Postharvest and Mechanization*, *1*(1), 67.
5) Hoornweg, D., & Bhada-Tata, P. (2012). *What a waste: A global review of solid waste management.* World Bank.
6) *Journal of Food Science and Technology.* (2014, December). *51*(12), 3527–3545. https://doi.org/10.1007/s13197-012-0861-2
7) Lenntech. (n.d.). *Fossil fuels and the greenhouse effect.* Retrieved November 8, 2025, from https://www.lenntech.com/greenhouse-effect/fossil-fuels.htm
8) Mallimbo. (2009, May 18). *Banana peels: An alternative way of making charcoal.* WordPress. https://mallimbo.wordpress.com/2009/05/18/banana-peels-an-alternative-way-of-making-charcoal/
9) Mibulo, T., Nsubuga, D., Kabenge, I., & Wydra, K. D. (2023). Characterization of briquettes developed from banana peels, pineapple peels and water hyacinth. *Energy, Sustainability and Society*, *13*, 36. https://doi.org/10.1186/s13705-023-00414-3
10) Mindanao Development Authority. (n.d.). *Charcoal briquetting.* Retrieved November 8, 2025, from https://now.minda.gov.ph/charcoal-briquetting/
11) Pabuayon, I., Pantoja, B., Manila, A., & Santos, M. L. (2021). Addressing food security: Saba banana and root-crops as alternative food staples to rice in Quezon Province, Philippines. *Journal of Public Affairs and Development.*
12) ResearchGate. (2021). *Nipah Musa acuminata balbisiana banana peel as a lignocellulosic precursor for activated carbon characterization study after carbonization process with phosphoric acid impregnated activated carbon.* https://www.researchgate.net/publication/354823017_Nipah_Musa_Acuminata_Balbisiana_banana_peel_as_a_lignocellulosic_precursor_for_activated_carbon_characterization_study_after_carbonization_process_with_phosphoric_acid_impregnated_activated_carbon
13) Royce Food Corporation. (n.d.). *What on earth are coconut charcoal briquettes?* Retrieved November 8, 2025, from https://www.roycefood.com/blog/what-on-earth-are-coconut-charcoal-briquettes/
14) ScienceDirect. (n.d.). *Charcoal.* Retrieved November 8, 2025, from https://www.sciencedirect.com/topics/chemical-engineering/charcoal
15) Specialty Produce. (n.d.). *Cardaba bananas.* Retrieved November 8, 2025, from https://specialtyproduce.com/produce/Cardaba_Bananas_13244.php
16) Wilaipon, P., Trirattansirichai, K., & Tangchaichit, K. (2014). Moderate die-pressure banana-peel briquettes. *Journal of Renewable Energy and Smart Grid Technology*, *2*(1), 50–55.
17) Yuliah, Y., Kartawidjaja, M., Suryaningsih, S., & Ulfi, K. (2017, May). Fabrication and characterization of rice husk and coconut shell charcoal-based bio-briquettes as alternative energy source. *IOP Conference Series: Earth and Environmental Science*, *65*(1), 012021. IOP Publishing. https://doi.org/10.1088/1755-1315/65/1/012021