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Development and Performance Study of an Atomized Kerosene Oven for domestic use in Nigeria

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Abstract

This study was conducted to design, develop, and evaluate the performance of an atomized kerosene oven. The oven was developed to address the high operating costs, low thermal efficiency, and incomplete combustion associated with conventional kerosene ovens. It premixes atomized kerosene with steam in a 1:3 ratio to enhance atomization and improve air-fuel mixing, thereby promoting more complete combustion. Experimental evaluation methods for atomized kerosene stoves focus on determining their thermal efficiency, emission characteristics, and combustion quality, often comparing them with traditional wick stoves. The method includes the water boiling test (WBT), emission monitoring using flue gas analyzers, and pressure-controlled combustion testing. The oven comprises four main components: the oven chamber, kerosene tank, pressurized tank, and burner, with volumes of 338611 cm³, 59582 cm³, 884122 cm³, and 2061 cm³, respectively. The oven is medium-sized and intended for domestic use. The oven can bake 30 loaves of bread, each with an area of 120 cm², within 35 minutes. The production cost was N117,441.00 (approximately \$87.316). The operating temperature ranges from 180°C to 322°C. Based on the general energy equation, the oven generated 875.237 kJ of energy comparing it with traditional oven which has 675kJ of energy and the operating temperature ranges from 150 °C to 250 °C respectively. Performance testing confirmed that the oven functions efficiently. It produces a stable blue flame with minimal soot, reduces fuel consumption, enhances heat transfer, and offers a cost-effective and cleaner baking solution, particularly in low-resource settings.

Keywords: Atomized kerosene oven, combustion efficiency, thermal performance, domestic baking technology, energy-efficient cooking systems

Introduction

Food has a close relation to people's daily life, with significant health implications and as such food processing is a key point in the food industry. Baking is a major food processing method that has been practiced for ages and continues to be relevant (Gujba et al., 2015). Baking is an energy consuming process of cooking using dry heat to prepare food from raw staple agricultural products. In the baking process in the oven, the raw food is converted into edible food and concurrently, microorganisms that cause food spoilage are destroyed preserving it for a long time (Layeni, 2016; Lefebvre, 1980) Normally, baking is carried out in an oven or by using of a stove, but it could also be done in hot ashes or on hot stones. An oven is an enclosed thermally insulated space or cavity used for baking, drying or heating food (Lefebvre, 1980; Manhiça et al., 2012). Fellows (Muneer & Mohamed, 2003) indicated that the heat energy transfer across an enclosed oven is defined by a coefficient dependent on the changes in temperature of surfaces. The moisture present in the food substance instantaneously diffuses near the surfaces where it is transferred by means of convection. Moisture content is removed from food material via continual motion of the oven ambient air (Onakoya et al., 2023). Therefore, this study on baking ovens is vital in developing an efficient baking process leading to an improved quality of the product with good energy efficiency.

Over the years, it has been observed that food stuff gets wasted because of lack of good storage facilities or a device that can preserve it for a long period of time. The locally made oven was implemented to solve this problem, but was not good enough. The local oven, which uses wood as a source of fuel, has led to ecological problem such as deforestation, environmental problem such as air pollution, ecosystem disruption and negative impact on climate change (Romieu et al., 2019 & Sambo, 2019) over dependence on wood fuel as a domestic energy supply source has worsened the deforestation rate, leading to desert encroachment, leaching of soil as a result of wind and water erosion, reduction in the mineral contents of the soil and also led to the absence of wind breakers in some parts of Nigeria (Zhang & Datta, 2006). According to the International Energy Agency (Makonese et al., 2012), the household (domestic) cooking sector is a major user of energy in Nigeria, with about 80% of its population relying on fuel wood and charcoal for domestic cooking and other household energy use. As reported by the Food and Agriculture Organisation (Ogundahunsi et al., 2024), the yearly deforestation rate is projected at around 3% yearly, equal to the depletion of 410,000 hectares of wooded land per annum. Also, a gas oven was produced with the aim of solving this

problem but its disadvantages include causing devastating fire outbreaks resulting from gas leakages and being too expensive to maintain in both rural and urban communities. The electric oven was made and imported but the interruption of power supply in the middle of operations makes its usage ineffective. This affects the quality of the baked or heated product and also, an electric oven consumes more energy (Ibrahim et al., 2024), described that 26% of the Nigerian populace use kerosene as cooking fuel comprising 48% urban and 9% rural owing to its accessibility and safety. An atomized kerosene oven can be more effective, with a good percent of energy used for heating the food. Atomization can be defined as a process where a volume of liquid is transformed into a multiplicity of small drops (Garipov et al., 2025), the kerosene is naturally burned as a suspension of droplets produced by the atomization process. In this process, the surface area of the liquid is increased via vaporization making it have a bigger affinity with atmospheric oxygen for suitable and efficient combustion. The overall kerosene stove thermal efficiency is generally cited between 20 – 40% for wick kerosene oven but with this oven it has well maintained pressurized stove achieving over 50%. It has flame quality (combustion quality and emission) which produces a blue flame indicating near-complete combustion. The pressurized stove indicates high CO₂ emissions (e.g. 2739PPm) and low carbon monoxide CO (e.g. 73PPm) under optimal high pressure, blue flame conditions. The serpentine burner design and the use of heat radiation shields significantly increased the efficiency by reducing thermal losses. The kerosene stove remains popular for its economical, portability and high performance in both urban and rural areas in Nigeria. The performance factors, increasing cylinder pressure in pressurized stove (up to 2 bar) significantly improves thermal efficiency and combustion quality. The limitations of the wick stove in the market has the safety hazards of explosion from the pressure build-up, maintenance nozzle can become clogged by carbon build-up (soot) if the fuel is impure or the combustion is not optimized. Thus, this work is aimed at designing and constructing a medium but efficient atomized kerosene oven that has higher thermal efficiency with optimal performance around 2 bar (max), leading to increase flame temperature and reduced fuel consumption. The fuel temperature at the nozzle is critical for proper vaporization such as high efficiency and heat, less pollution and affordability has made this oven very important over the existing oven that has about 1 bar with lower pressures (0.2 – 0.4 bar) leading to reduced flame temperature and increased fuel consumption. This kerosene burner has great advantages over the existing oven in the market which could be used for domestic purposes.

Materials and Methods

The selection of materials that best suit the work was duly considered considering the desired engineering properties of the materials and their impact on the environment and the human health. The atomized kerosene oven is capable of converting the chemical energy of the volatile substance (kerosene) into heating energy for baking foodstuffs such as bread and cake. Various design factors were considered, including the area of the kerosene oven (3136 cm²), the volume of the kerosene tank (59582 cm³) and the pressurized water tank (88412 cm³).

Design Considerations

The Design of Kerosene Tank

Kerosene tank is designed using equation (Gujba et al., 2015).

$$V=LBW =59582 \text{ [cm]}^3 \text{ (Gujba et al., 2015).}$$

Where L, B, and W are the length (62 cm), breadth (31 cm), and height (31 cm) of the tank, respectively.

The Heat Supply for Combustion of Kerosene

Heat interaction occurs across the oven via a heat source, prompting the temperature of the food to rise. It is assumed that the heat given is uniform. The quantity of heat supply is given by equation (Layeni, 2016).

$$Q=MC\theta =1.8432 \text{ kJ (Layeni, 2016).}$$

where M,C,and θ are the quantity of heat supply by kerosene,(KJ) while the mass of Kerosene (kg), heat capacity of the kerosene (KJ/KgK), and temperature difference between the final and initial temperature ($T_1 - T_2$) (K).

$$\text{Hence; } Q = 0.1152 \times 0.5(355-323); Q = 1.8432 \text{ KJ}$$

Temperature of The Oven

The temperature within the oven will vary greatly depending on the amount of heat supplied from the source. The temperature of the oven is high enough to ensure that less time is needed to bake the food. The oven temperature can be obtained in equation (Lefebvre, 1980).

$$T=T_{\infty}+(T_0-T_{\infty})e^{-at} \text{ (Lefebvre, 1980).}$$

where T is the temperature of the oven; T_0 is the temperature of the oven; T_∞ is the ambient temperature; ℓ is the index of the atmospheric temperature; $-$ at is the exothermic reaction; T is the baking temperature. Hence; $T = 50 + (82 - 50) \ell 0.1296 \times 30$; $T = 355K$

Design of The Oven

In the design analysis of the oven, it will be noted that the oven is rectangular in shape. Thus, the volume of the oven is given by equation (Manhiça et al., 2012).

$V = l \times b \times w$ (Manhiça et al., 2012).

Where: $l = 91$ cm is the length of the oven; $w = 61$ cm is the breadth of the oven, and $w = 61$ cm is the height of the oven.

Hence, $V = 91 \times 61 \times 61 = 338611$ cm³

The area of the oven is large enough to ensure that about 30 loaves of bread, each with an area of 120 cm², can be baked. The volume of the oven chamber is 338611 cm³, which is the same as the volume of the oven. The area of the oven is calculated in the analysis using equation (Muneer & Mohamed, 2003).

$A = L \times B$ (Muneer & Mohamed, 2003).

$A = 60 \times 60 = 3600$ cm²

Heat of Combustion from the Burner to the Oven

The heat transfer by convection from the design analysis is given in equation (Onakoya et al., 2023).

$\partial/\partial x (K (\partial T) / \partial x) + \partial/(\partial y) (K (\partial T) / \partial y) + \partial/(\partial z) (K (\partial T) / \partial z) + q_v = \rho_{cp} \partial T / \partial x$ (Onakoya et al., 2023).

Where K = material conductivity (Wm⁻¹K⁻¹); q_v = the rate of energy generation per unit volume of the medium (W.m⁻³); ρ_{cp} = the density (kgm³); c_p = the specific heat capacity (Jkg⁻¹).

$Q = hA(T_s - T_w)$ (Romieu et al., 2019).

Where h is the thermal conductivity of the material (W/moK); A is the area of the section through which heat flows by conduction (m²); T_s is the initial temperature of the oven (K); T_w is the final temperature of the oven during baking (K).

Therefore, $Q = 47.57$ W x 0.1296 m² x 32 k/m²K = 197.28

Heat of Radiation from the Oven Wall to the Foodstuff

From the design analysis the heat transfer through radiation is given in equation (Sambo, 2019).

$$E_b = \sigma AT^4 \text{ (Sambo, 2019).}$$

Where: E_b is the radiant energy for heat transmission (KJ/hr); σ is the dimensional constant (Stefan-Boltzmann constant) (KJ/hr.m²T⁴); A is the area of the oven exposed to radiant energy (m²); T is the temperature of the body (K).

$$\text{Hence; } E_b = 5.67 \times 10^{-4} \times 0.1296 (3554 - 3234) = 36.72 \text{ W.}$$

The Heat Content of Combustion Products

The heat content of the combustion products was determined using equation (Zhang & Datta, 2006).

$$H_p = C_n/V \text{ (Zhang \& Datta, 2006).}$$

Where H_p is the quantity of heat supplied with respect to the mass volume of the kerosene (KJ/Kgm³); C_n is the calorific value of the kerosene (KJ/Kg); V is the volume of the kerosene (m³)

$$\text{Therefore, } H_p = 42250 \text{ KJ/Kg} / 5.9582\text{m}^3 = 7091.067\text{KJ/kgm}^3$$

Unsteady Conduction of Heat from the Heating Chamber of Mild Steel of the Oven

The unsteady conduction into the oven through the mild steel is given in equation (Makonese et al., 2012).

$$Q = \frac{-KA (T - T_s)}{dt} \text{ (Makonese et al., 2012).}$$

Where K is thermal conductivity in W/mK; A is the area of the section through which heat flow by conduction (m²); T is the inner temperature of the oven (K); T_s is the atmospheric temperature of the oven (K).

$$\text{Hence, } Q = -88 \text{ W} \times 0.1296 \text{ m}^2 \times 32 \text{ k/mK} \times 0.0015 \text{ m}^2 = -243.30 \text{ KJ}$$

The Heat of Conduction from Mild Steel Sheet to the Oven

The heat of conduction from mild steel sheet is given in equation (Ogundahunsi et al., 2024).

$$q = k(t_1 - t_2)/x \text{ (Ogundahunsi et al., 2024).}$$

Where K = the thermal conductivity of mild steel (W/mok); t_1 = the final temperature of mild steel (K); t_2 = the initial temperature of mild steel (K); x = the thickness of the mild steel (m).

Therefore, $q = 88 \text{ W/mk} \times 0.1296 \text{ m}^2 \times 32 \text{ K} / 0.0015\text{m} = 243.30 \text{ KJ}$.

The Design of the Burner

The design of the burner is given in equation (Ibrahim et al., 2024). where the volume of the burner is:

$$V = \pi r^2 h \quad (\text{Ibrahim et al., 2024}).$$

Where V = the volume of the burner (cm³); r = the radius of the burner (cm); and h = the vertical height of the burner (cm)

$$\text{Therefore; } V = 3.142 \times 42 \times 41 = 2061 \text{ cm}^3$$

Additionally, the surface area from the analysis is given in equation (Garipov et al., 2025).

$$S = 2 \pi r (h + r) \quad (\text{Garipov et al., 2025}).$$

$$S = 2 \times 3.142 \times 4 (41 + 4) = 1131.12 \text{ cm}^2.$$

Design of Pressurized Water Tank

The design of the pressurized water tank is described by equation (Ogundahunsi et al., 2024). The volume is calculated as follows:

$$V = H \times B \times W \quad (\text{Ogundahunsi et al., 2024}).$$

Where H = 92 cm (length of the pressurized water tank)

B = 31 cm (breadth of the pressurized water tank)

W = 31 cm (width of the pressurized water tank)

$$\text{Therefore, } V = 92 \times 31 \times 31 = 88412 \text{ cm}^3$$

The volume of the pressurized water tank is sufficient to prevent the need for frequent refilling during the baking process.

Design of Pressurized Water Tank

From the design analysis, the area of the glass fibre selected is given in equation (Moh, 2010).

Area = $L \times B$ (Moh, 2010).

Where: A is the area of the glass fibre (cm²); L is the length of the glass fibre (cm); and B is the breadth of the glass fibre (cm).

Therefore, $A = 91 \times 61 = 5551 \text{ cm}^2$

Also, the volume of the glass fibre selected is given in equation (Pande et al., 2024).

$V = L \times W \times B$ (Pande et al., 2024).

Where W is the width of the glass fibre (cm), and $B = 0.5 \text{ cm}$. Hence; $V = 2775.5 \text{ cm}^3$

Material Selection for Insulation (Plywood)

The area of the plywood selected is calculated using equation (Smith et al., 2023).

$A = L \times W$ (17)

$A = L \times W$ (Smith et al., 2023).

Where L is the length of the plywood (cm); and W is the width of the plywood (cm)

Hence, $A = 91 \times 61 = 5551 \text{ cm}^2$

Also, the volume of the plywood selected is calculated using equation (Johnson et al., 2021).

$V = L \times W \times B$ (Johnson et al., 2021).

Where W is width of the plywood (cm); B is the breadth (cm); and L is the length (cm)

Hence, $V = 91 \times 61 \times 1 = 5551 \text{ cm}^3$

Galvanized Pipe Connecting Kerosene Tank to Burner

The volume of the galvanized pipe linking the kerosene tank to the burner is given in equation (Gyan et al., 2025).

$V = \pi d^2 L / 4$ (Gyan et al., 2025).

Where d is the diameter of the galvanized pipe (cm); L is the length of the galvanized pipe (cm). Therefore; $V = 3.142 \times 22 \times 117 / 4 = 367.614 \text{ cm}^3$

The Selection of Pneumatic Pump

The pneumatic pump selected is the wheel barrow-sized pump with a capacity is 30 kgf/cm^2 .

The Selection of Pneumatic Pump

The energy balance equation is given in equation (Sharma et al., 2025)

$$Q = K_m A_m + hA (T_s - T_w) + K_{a_1} A_{a_1} + K_f A_f + \sigma AT^4 \text{ (Sharma et al., 2025)}$$

$$Q = 631670 + 197.28 + 243300 + 36.72 + 33.28 = 875.237 \text{ KJ}$$

Materials Selected for Construction of Atomized Kerosene Oven

The design and construction of the atomized kerosene oven consist of three main parts: (a) the chamber (b) the insulator, and (c) the casing. Key design factors were considered in the selection of materials for these three main parts to enhance the oven's effectiveness, reliability, stability, workability, and sustainability. Some other components that are the atomized kerosene oven are standard parts readily available in the market. It was realized that buying them is cheaper than producing them in-house. These components include; valve, pipes, pneumatic pump, oven lock, hinge, galvanized steel pipe, hoist, nipple, and door handle. Table 1 presents a summary of the materials selected for the construction of the three main sections of the atomized kerosene oven.

Table 1

Materials selection for atomized kerosene oven components

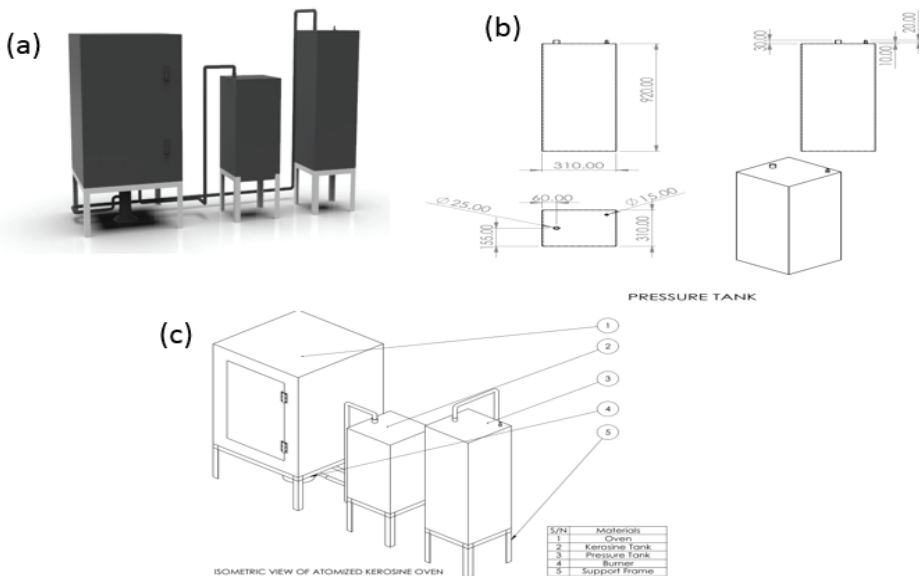
S/N	Components	Materials selected	Reason
1	The chamber	Mild Steel	High thermal conductivity, Minimum heat loss, toughness, low cost, availability
2	Insulators	Asbestos	Low thermal conductivity, low cost, suitability
		Polystyrene	Low thermal conductivity, low cost, suitability
		Glass fibre	Low thermal conductivity, low cost, suitability
3	Casing	Mild Steel	High Toughness, low cost, good tensile strength.

Construction Process

Fabrication of the automated kerosene oven was done at the Engineering Workshop of the Faculty of Engineering, Federal University of Technology, Yola, Nigeria. The processes involved in the manufacture of the components include marking out, cutting, shearing, bending, drilling, welding, and grinding. Some of the tools and equipment used include; welding machine, try square, hammer, center punch, anvil, vice, drilling machine, mallet, shearing machine, steel rule, and hack saw. The exploded view of the atomized oven is shown in Figure 1a, the top view of the designed atomized oven is shown in Figure 1b, and the isometric view of the atomized oven is shown in Figure 1c. Based on the design specifications, pressurized water tank stand, oven stand, and kerosene tank stand were fabricated using an angle iron device that was cut into suitable sizes and joined together by welding serve as support for pressurized water tank, oven, and kerosene tank.

Figure 1

Exploded view of the atomized oven (AV): (a) Top view of the AV, (b). Isometric view of the AT, and (c) Side view of the AT



Construction Process

In the design of the atomized kerosene oven, three forms of cost were involved, namely; material/components cost, direct labour cost, and overhead cost. The cost of material purchased for the fabrication of the atomized kerosene oven including bought – out component is shown in Table 2. It gives the outline of all the cost expended during the design and construction of the atomized kerosene oven. Overview of all the actual cost in producing the machine.

Table 2

Cost analysis of materials and bought – out component of the atomized kerosene oven.

S/N	Materials	Specifications	Qty.	Unit cost (₦)	Total cost (₦)
1	Mild steel sheet		3	5000	15000
2	Burner		1	5000	5000
3	Asbestos		4	1500	6000
4	Plywood		1	3000	3000
5	Angle bar		1	2500	2500
6	Square pipe		1	3000	3000
7	Packet of electrode	0.5 mm	1	4000	4000
8	Elbow union connection		2	1000	2000
9	Hinges		2	600	1200
10	Oven door lock		1	500	500
11	Valve		3	1200	3600
12	Pneumatic pump	Medium size (30 kgf/cm ²)	1	1800	1800
13	Paint (Ash)	Dulux	1 Liter	5000	5000
14	Round pipe (galvanize)		2	1000	2000
15	Nipple		3	1500	4500
	Total				59100
16	Direct Labour cost				20700
17	Overhead cost				10200
18	Transportation				12000
19	Miscellaneous				15000
	Total				#117,000.00

Results

Performance Tests

After the design and construction of the atomized kerosene oven, performance evaluation was carried out to determine its functionality, as shown in Table 3. The kerosene burner underneath the oven was wheeled out so that its burner could be seen from the top. The stove was then lit up and positioned at the center of the burner. As the wicks began to burn, a bluish color was noticed, signifying complete combustion. The water in the burner changed to steam, allowing the flow of kerosene through the pipe for atomization, resulting in a brighter burning flame in the oven. The oven door was opened, and the first test was ready to be conducted. The first test involved the atomized kerosene oven with cake flour of weights: 36.05 g, 32.13 g, and 30.82 g. The weights were determined using a manual weighing scale. The cake flour was loaded into the oven chamber, and after some time with initial and final temperatures recorded, a baked cake was obtained. For the second test, groundnuts of weights: 30.12 g and 32.16 g were determined using a manual weighing scale. The groundnuts were loaded into the oven chamber, the burner was lit up, and after some time with initial and final temperatures recorded, fried groundnuts were obtained. Lastly, a bread measuring 120 cm² in a mold was loaded into the oven chamber, the burner was lit up, and after some time with initial and final temperatures recorded, a baked bread was obtained.

Table 3

Results obtained in the performance test.

Test	Food Stuff Baked	Weight (g)	Time (Mins)	Initial Temp. °C	Final Temp. °C	Result
1	Cake	36.05	35	180	322	Baked cake was obtained
		32.13	30	180	322	
		30.82	28	180	322	
2	Groundnut	30.24	11	180	227	Fried groundnut was obtained
		32.11	13	180	227	
3	Bread	36.05	35	180	322	Baked bread was obtained
		34.15	33	180	322	
		32.45	30	180	322	

Conclusion

The constructed atomized kerosene oven represents a serious effort to satisfy the need for an inexpensive oven in rural areas where electricity is limited. The parts were carefully designed to achieve the objective of an atomized kerosene oven as stated in the introduction. In the end, it was possible to relate an efficient and operating atomized oven. Considering the high cost of purchasing of kerosene, atomized kerosene is very economical because one liter of kerosene will be atomized with about three liters of steam for fast and smokeless fuel combustion. Finally, with the use of smokeless fuel, it saves time and energy, making it more hygienic to bake food commodities using atomized kerosene oven.

References

- Garipov, M. D., Zinnatullin, R. F., Melkov, A. A., Khalilov, E. M., Shayakhmetov, V. A., & Gobyzov, O. A. (2025). Experimental study of aviation kerosene atomization by means of the compressed-air injection system with high pressure. *Thermophysics and Aeromechanics*, 31(5), 967–982. <https://doi.org/10.1134/S086986432405007X>
- Gujba, H., Mulugetta, Y., & Azapagic, A. (2015). The household cooking sector in Nigeria: Environmental and economic sustainability assessment. *Resources*, 4(2), 412–433. <https://doi.org/10.3390/resources4020412>
- Gyan, S. S., Niraj, K. M., Muthukumar, P., & Monikankana, S. (2025). Thermal performance and emission analysis of self-aspirated kerosene pressure stove with porous radiant burner using nanofuels. *International Journal of Environmental Science and Technology*, 20.
- Ibrahim, L. A., Elzallat, A. M., Elsakka, M. M., Farag, T. M., & Gad, H. M. (2024). Effect of atomizing gas type on kerosene spray combustion using gas-blast atomizer: A comparative numerical study. *Applied Thermal Engineering*, 239, Article 121996. <https://doi.org/10.1016/j.applthermaleng.2023.121996>
- Johnson, A. O., Oluwakemi, A., & Ojo, A. O. (2021). Households' energy choice pattern for cooking in Ado Ekiti South West Nigeria. *Green Reports*, 2(4), 41–49. <https://doi.org/10.36686/Ariviyal.GR.2021.02.04.016>
- Layeni, A. T., Nwaokocha, C. N., Adebayo, K., Ochibe, E., & Yusuf, R. (2016). Design and fabrication of a palm oil pressure stove. *International Journal of Energy, Environment & Economics*, 24(1), 131–146.
- Lefebvre, A. H. (1980). Air blast atomization. *Progress in Energy and Combustion Science*, 3(4), 233–261. [https://doi.org/10.1016/0360-1285\(80\)90017-9](https://doi.org/10.1016/0360-1285(80)90017-9)
- Manhiça, F. A., Lucas, C., & Richards, T. (2012). Wood consumption and analysis of the bread baking process in wood-fired bakery ovens. *Applied Thermal Engineering*, 47, 63–72. <https://doi.org/10.1016/j.applthermaleng.2012.03.007>
- Moh, K. D. (2010). The design and construction of a portable kerosene pressure-cooker. *African Research Review*, 4(2), 15–29. <https://doi.org/10.4314/afrrrev.v4i2.58285>

- Muneer, S. E. T., & Mohamed, E. W. M. (2003). Adoption of biomass improved cookstoves in a patriarchal society: An example from Sudan. *Science of the Total Environment*, 307(1-3), 259-266. [https://doi.org/10.1016/S0048-9697\(02\)00541-7](https://doi.org/10.1016/S0048-9697(02)00541-7)
- Ogundahunsi, O. E., Olaoye, I. O., & Fabunmi, P. A. (2024). Determination of thermal efficiency and fuel consumption rate of a pressure cooker fueled with blends of waste vegetable oil and kerosene. *Turkish Journal of Agriculture - Food Science and Technology*, 12(6), 1033-1038. <https://doi.org/10.24925/turjaf.v12i6.1033-1038.6319>
- Onakoya, A. B., Onakoya, A. O., Jimi-Salami, O. A., & Odedairo, B. O. B. O. (2023). Energy consumption and Nigerian economic growth: An empirical analysis. *European Scientific Journal*, 9(4), 25-40.
- Pande, M. Y., Patil, S., Desale, K., Rajput, G., Warke, K., & Patil, A. (2017). Experimental investigation on pressure stove with different blends of fuel. *IOSR Journal of Mechanical and Civil Engineering*, 14(4), 61-68. <https://doi.org/10.9790/1684-1404016168>
- Romieu, I., Riojas-Rodríguez, H., Marrón-Mares, A. T., Schilman, A., Pérez-Padilla, R., & Maser, O. (2009). Improved biomass stove intervention in rural Mexico: impact on the respiratory health of women. *American Journal of Respiratory and Critical Care Medicine*, 180(7), 649-656. <https://doi.org/10.1164/rccm.200810-1556OC>
- Sambo, A. S. (2009). Strategic developments in renewable energy in Nigeria. *International Association for Energy Economics Newsletter*, 3rd Quarter, 15-19.
- Sharma, M., Mahanta, P., & Mishra, S. C. (2011). An experimental investigation on efficiency improvement of a conventional kerosene pressure stove. *International Journal on Energy for Clean Environment*, 12(1), 79-93.
- Smith, K. R., Uma, R., Kishore, V. V. N., Zhang, J., Joshi, V., & Khalil, M. A. K. (2000). Greenhouse implications of household stoves: An analysis for India. *Annual Review of Energy and the Environment*, 25, 741-763. <https://doi.org/10.1146/annurev.energy.25.1.741>
- Makonese, T., Pemberton-Pigott, C., Robinson, J., Kimemia, D., & Annegarn, H. (2012). Performance evaluation and emission characterisation of three kerosene stoves using a heterogeneous stove testing protocol (HTP). *Energy for Sustainable Development*, 16(3), 344-351. <https://doi.org/10.1016/j.esd.2012.06.002>
- Zhang, J., & Datta, A. K. (2006). Mathematical modeling of bread baking process. *Journal of Food Engineering*, 75(1), 78-89. <https://doi.org/10.1016/j.jfoodeng.2005.03.058>