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DESIGN CONSTRUCTION AND TESTING OF A COMPACT MACHINE FOR SHELLING *EGUSI* MELON SEEDS

ABSTRACT
Melon shelling has been and still remains a serious problem to the farmers in Nigeria. The techniques for shelling melon are still traditional based on the use of hands, sack and stick. this method of melon shelling is laborious, time wasting, uneconomical and shell melon with low efficiency.

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Introduction

Melon (Citrulluslanatus or *Egusi*) is a widely cultivated staple plant in different nations of the West Africa. The crop comprises of a white edible seed coated with a light weight brownish shell. The white part is of much nutritional value majorly used for consumption, whereas the shell has been reportedly used for several purposes such as a metallic alloy to pant, livestock feed, and crude oil remediation (Larry *et. al.*,2021).

Melon seed is a good source of amino acids such as arginine, vitamins B1, Vitamin B2, Niacin,

Combining basic engineering design considerations with other requirements, a compact melon shelling machine was designed, constructed and tested from locally available materials. The machine consists mainly of shelling unit (shelling drum and concave), hopper, prime mover engine and the frame and the separating/cleaning champers which include the screen, shaker and blower. The developed machine was powered using an air-cooled gasoline engine of 7.5 hp at a 2400rpm. Aa *egusi* melon seeds at 12% moisture content were used to test the machine. Results indicated the mean shelling efficiency of 43.92 % and cleaning efficiency 32.70%. The percentage of the unshelled melon is 16.67%. The average percentage shelled but damage/broken is 6.54%, while the percentage weight loss is 9.50%. The mean percentage of chaff removed by the fabricated machine is 10.9% against targeted 33.3% of the hand shelling.

Keywords: egusi-melon, efficiency, gasoline-engine, moisture, shelling.

Tryptophan and methionine and minerals such as Zinc, Iron, Potassium, Phosphorus, Sulphur, magnesium (Onyeike and Acheru 2002). Melon seeds are major soup ingredient and a common component of daily meals. Coarsely ground up, they thickens stews and contribute to widely enjoyed steam dumplings. It is also a good herbal cure for cancer and is best for curing breast cancer (Grossman, 2007).

Nigeria is the leading *egusi* melon producer in Africa with production amounting to 370,000 ton which represents 64.24 % of total production of the continent (Ebukiba *et al*., 2022). There is also a prospect for use of the melon seed in the improvement of infant nutrition in view of its high protein and fat content (Van der vossen et al. 2004). Almost all the big markets in Nigeria, Benin, Cameroon, Ghana, Togo, and other nearby nations sell the seed. Melon is in high demand in tropical markets, especially in the peri-urban and urban markets. It is also exported to Ethiopia and Sudan where the consumption is high and the extracted yellow oil is in high demand. Egusi is one of the agricultural products that can boost the Gross Domestic Product (GDP) of Nigerian if it is mass produced by mechanizing all stages of its production (Omale *et al*., 2023).

Despite several attempts by researchers to develop shelling machines to boost the country's production of egusi, over 95% of the egusi seeds available in Nigerian markets are processed using local/traditional methods, this in turn has direct effect on the quantity and price of the egusi seeds in the market at any point in time (Omale et al., 2023). Best quality egusi melon kernels in the market today are the hand shelled and has an attractive price to the farmers, but in short supply due to vigorous nature of traditional process of hand shelling.

Therefore, to ensure availability of clean egusi seeds in sufficient quantities in Nigeria and World markets at all times, there is need to develop a more efficient, affordable and portable egusi melon shelling machine that will also include cleaning unit using indigenous technology and available materials. This research is aimed at developing and testing a compact machine for shelling egusi melon seeds for small scale farmers and melon processors.

MATERIALS AND METHOD

Conceptual Features

The basic features of the shelling machine include:

i. The frame
ii. The hopper

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iii. The shelling drum
iv. The concave
v. The shaft

Frame

This is the foundation to which all other components are attached directly or indirectly. It is made of mild steel and it is so chosen because of its property to resist external applied without breaking (strength) and resistance to deformation under stress (or stiffness). The frame (ac-channel or U-channel) is three inches in thickness. And stands at a height of 135cm and a horizontal base of 80cm.

Hopper: This is the upper most layer of a shelling machine which is use to collect grains for proper shelling and it is constructed with mild steel which has 2mm thickness and it ability to form into shape, cheap and available.

The Shelling Drum: This is the most functioning part of a shelling machine which consist the shelling bars which rotate anti-clockwise to aid proper shelling. It is made of 2mm mild steel which has the ability to resist comprehensive stress, and weakness.

Concave: The concave is made up of mild steel 2mm thickness. The mild steel is cheap, available and resist wear and corrosion.

Shaft: It carries the shelling drum, which perform the shelling of melon in the machine. The shaft material consideration includes, strength, high were resistance properties, low notch sensitivity factor very good machinability and good heat treatment properties. Since the shaft used is a transmission shaft because it transmits power from the electric to the machine and as such carry load (as in shelling drum). therefore, stress in the shaft is calculated for which includes:

Shear stress due to transmission of torque (due to tensional load). Bending stress and stress due to combined tensional and bending stress.

Belt drive: This is the machine part that transmits torque from one shaft to the other by means belt attached to it (pulley). because of the nearness of one pulley to the other, a V-belt is used to transfer motion from the engine pulley to other shaft carrying pulleys.

Material consideration for pulley selection includes friction resistance, durability and good wear characteristics. The diameter and size of the pulley were determined based on the need and function it will perform.

Bearing: This machine element gives the rotating shaft, it aligns the rotating shaft properly and prevent it from wobbling operation.

Design Consideration

The following factors were considered in the design and construction of the melon shelling machine.

i. The shape and size of melon
ii. The cost and availability of materials to be used for the machine construction.
iii. Ease of operation and reliability of the machine based on the strength rigidity and durability of the machine.

Design Calculations

In order to achieved an efficient shelling operation of the machine. The following design calculation were made.

Design of Hopper

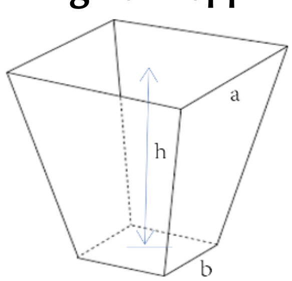

Figure 1: Hopper

The shape chosen for hopper is that of a truncated square base pyramid for simplicity, and it design includes determination of appropriate dimensions that will ensure minimal number of refills thereby reducing labor on the operator. Figure 1 shows the selected shape of the hopper

Determination of Volume of the Hopper (V_h)

To calculate for the volume of the hopper, we assumed mass of melon per batch and using the relationship:

$$V_h = \frac{m_m}{\rho_{bm}} \qquad (1)$$

Where ρ_{bm} is the bulk density of melon = 456.339kg/m^3 (Bande *et al*, 2002),

m_m is the mass of melon per batch = 12kg (assumed)

$$V_h = \frac{12}{456.339} = 2.63 \times 10^{-2} m^3$$

Determining the Height of the Hopper

Determining height h, of the hopper we assumed the lengths of sides of the two faces and using the relationship in Mayanja *et al*., (2018)

$$from\ V = {}^{1}/_{3}\, h\,(a^2 + b^2 + ab) \qquad (2)$$

Where: V is the volume of truncated pyramid, a is the length of the sides of the larger face = 0.36m (assumed), b is the length of the smaller face = 0.12m (assumed), h is the height of the hopper.

$$\therefore h = {}^{3V}/_{(a^2 + b^2 + ab)} \qquad (3)$$

$$\therefore h = {}^{(3 \times 2.63 \times 10^{-2})}/_{(0.36^2 + 0.12^2 + 0.36 \times 0.12)}$$

$$= 0.42m$$

To allow for free board, we use the height of 0.45m for the hopper.

Determination Of the Angle of Repose of the Hopper.

The angle of repose was calculated using the formulae of

$$\tan\theta = \mu \qquad (4)$$

Where

The θ is the angle of repose and μ is the coefficient of friction. The coefficient of friction (μ) of melon on mild steel is given as 0.923 (Asiodu, 1989)

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Hence,
$\theta = \tan^{-1} 0.923 = 42.7^{o}$

Design of Shelling Drum

Determination of Number of Shelling Bar, n

Number of shelling bars was obtained from the relationship

$$n = \frac{2\pi r}{x} \quad (5)$$

Where: r is the radius of the beater and
x is the distance between shelling bars

substituting D = 0.26m, therefore, r = 0.13, x = 0.03m

$$n = \frac{2 \times 3.146 \times 0.08}{0.3} = 16.778 = 16\ shelling\ bars$$

Determination of weight of shelling bars (W_b)

Volume of a shelling bar (V_b)

$$V_b = L\ x\ b\ x\ t \quad (6)$$

L, b, and t are the length, breadth and thickness of shelling bar respectively.

L = 0.28m, b = 0.02m, t = 0.005m

V_b = 0.28 x 0.02 x 0.005
= 2.8 x 10^{-5} m^3

Mass of shelling bars, m_b

From $m_b = \rho_s V_b$ (7)

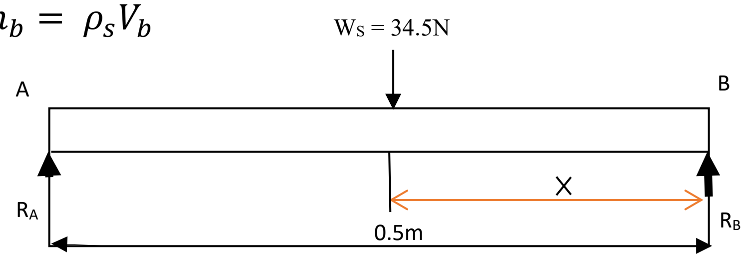

Figure 2: Free Body Diagram of the Loaded Central Shaft

Where ρ_s = is density of mild steel ($7850 kg/m^3$), V_b = volume

$m_b = 2.8 \times 10^{-5} \times 7850$

m_b = 0.22kg

total mass = 0.22 x 16 = 3.52 kg

$weight, w_b = 0.22 \times 9.81 = 2.16N$

Total weight of shelling bar (T_{wb})

$T_{wb} = W_b \, x \, n$ (8)

$= 2.16 \times 16$

$= 34.5N$

Determination of Power Requirement for Shelling

The total power required was calculated using this equation.

$P_T = P_{Inner\ drum} + P_{Shaft} + P_{shelling}$ (9)

$P_{shelling}$ is negligible since seeds are not resident in shelling but flow through in pieces.

Therefore, $P_T = P_{Inner\ drum} + P_{Shaft}$

But the shaft and Inner drum are welded together, so

$P_T = P_{Inner\ drum\ with\ shaft}$

$P_T = \frac{2\pi N T_T}{60}$ (10)

Where T_T = total torque developed by inner drum with shaft Nm

N = is the number of revolutions per minute of the inner bar with shaft = 400rpm

Determination of Torque Developed by Inner Drum

from $T = F_c r$ (11)

where F_c is the centrifugal force of the rotating drum and r is the radius of the drum

$F_c = m_b \omega^2 r$ (12)

Where m_b is the total mass of the rotating drum =3.52 kg, ω is the angular velocity of the drum in radians/sec

But $\omega = \frac{2\pi N}{60}$ (13)

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$$\omega = \frac{2\times3.142\times400}{60} = 41.89 radians/sec$$

$$F_c = 3.52 \times 41.89^2 \times 0.13 = 802.98N$$

$$T = 802.98 \times 0.13 = 104.39Nm$$

$$P_T = \frac{2 \times 3.142 \times 400 \times 104.39}{60 \times 1000} = 4.37kW$$

Design of Central shaft

The load on the shaft was mainly from the total weight of the shelling drum assembly T_{wb}.

$R_A + R_B = W_s$ (14)

$R_A = R_B$

$R_A = W_s/2 = 17.3N$

Taking moment about the center, M_B

M_B - = 0 clockwise moment

$$M_B = R_A \times \left(\frac{X}{2}\right) = 17.3 \times 0.25 = 4.3\text{Nm}$$

Determining the Diameter of the Central Shaft

$$d_s^3 = \frac{16}{\pi\tau_a}\sqrt{(k_m M_B)^2 + (k_t M_T)^2} \quad (15)$$

Where: d_s = shaft diameter, (m); τ_a = allowable shear stress for mild steel = 40×10^6 N/m²; M_B = bending moment = 4.3Nm; M_T = torsional moment or torque = 104.39Nm, K_m = combine shock and fatigue factor applied to bending moment = 1.5 to 2.0 for load suddenly applied with minor shock; K_t = combined shock and fatigue factor applied to torsion moment =1.0 to 1.5 for load suddenly applied with minor shock.

$$d_s^3 = \frac{16}{3.142 \times 120.38 \times 10^6}\sqrt{(1.5 \times 4.3)^2 + (1 \times 104.39)^2}$$

$$= 1.33 \times 10^{-5}$$

$$d = \sqrt[3]{1.33 \times 10^{-5}} = 2.37 \times 10^{-2}m = 23.7mm$$

Therefore, a commercial shaft of 24mm diameter was chosen.

Design of Screen Shaker Mechanism

The sieves/screen was fixed inside the sieve assembly which is suspended by hangers. The screens with the help of eccentric drive experience horizontal oscillation and small vertical motion. The combined motion ensures that the shelled seeds move or slide down from the screen. Screen and hanger angle are provided to ensure efficient separation. The connecting rod L, imparts velocities in X and Y directions on the sieve assembly as shown by Okunola *et. al.* (2018) in Figure 3.

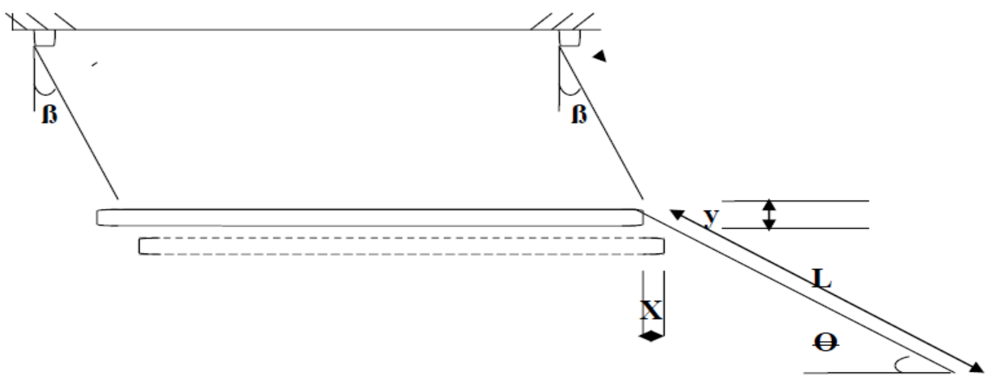


Figure 3: Sieve Mechanism

Determination of Power Requirement of Shaker, P_s

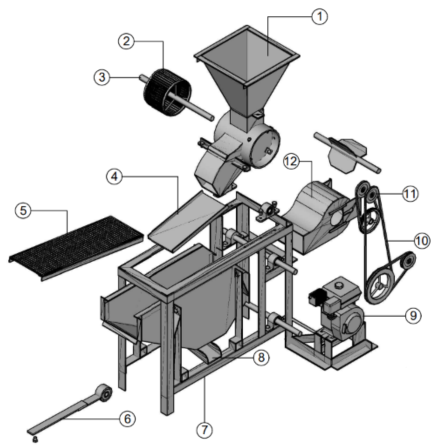
Theoretical power requirement for oscillation can be approximated by summation of power required for the movement in the vertical and horizontal directions.

For the vertical side; According to (Okunola *et al.*, 2018)

$$HP_1 = \left[\frac{W_S \times N \times 2 \times Y}{4{,}500}\right] \quad (16)$$

For the horizontal side

$$HP_2 = \left[\frac{W_S \times N \times 2 \times X \times \mu}{4{,}500}\right] \quad (17)$$



PART LIST	
1	HOPPER
2	SHELLING DRUM
3	SHAFT
4	COLLECTOR
5	SCREEN
6	VIBRATOR
7	FRAME
8	OUTLET
9	ENGINE
10	BELT
11	PULLEY
12	BLOWER

Figure 4: Exploded View of the Designed Melon Shelling Machine

Ws - Weight of sieve assembly and test materials on it (65N)
N - Speed in revolutions per minute, (240 rpm).
Y- Vertical displacement of the reciprocating assembly in meter per stroke, X tan 15^{o}
X - Horizontal displacement of reciprocating assembly in meter per stroke, 5.0×10^{-2} m
µ - Co-efficient of friction between hinge points (0.4).

$$P_s = H_{p1} + H_{p2} \qquad (18)$$

Determination of Shaker Shaft Diameter

The shaker shaft diameter was determined using the expression below: According to (Adedeji *et al.*, 2021)

$$d^3 = \frac{16T}{\pi\tau} \qquad (19)$$

Where = the diameter of the blower shaft
T = the torsional moment (Nm)
τ = the maximum allowable shear stress = $40 \times 10^6 N/m^2$

Selection of the Prime Mover

Design analysis indicated that power required for shelling is 6.04hp and the power required for screen shaker is 0.44hp. Total power require to operate the machine is 6.48hp, which is equivalent to 4.83kW.

Using a power factor of 1.15, power required is 7.45hp; therefore, an air-cooled gasoline engine of 7.5hp with 2400rpm rating is selected to power the machine.

Analysis of Belt Drive on the Thresher

A belt is a loop of flexible material used to link two or more rotating shafts mechanically, most often parallel. It is used as a source of motion to transmit power efficiently or to track relative movement.

Determination of Pulley Diameter

A pulley is a wheel that carries a flexible rope, cord, cable, chain or belt on its rim to transmit energy and motions. The diameter of the driven (machine) pulley was calculated from the following expressions, according to Khurmi and Gupta (2004)

$$N_1 D_1 = N_2 D_2 \qquad (20)$$

Where N_1 = the driving pulley speed = 2400rpm

N_2= the driven pulley speed = 400rpm

D_1 = the diameter of diving (motor) pulley = 0.044m

D_2 = the diameter of driven (machine) pulley (m)

$$D_2 = \frac{N_1 D_1}{N_2} \qquad (21)$$

Determination of belt length

Required length of the belt was determined using the relationship:

$$L = \frac{\pi(d_2+d_1)}{2} + 2c + \frac{\pi(d_2+d_1)^2}{4c} \quad (22)$$

Where

L = Length of belt

d_2 = diameter of the shaft pulley (264mm)

d_1 = diameter of the motor pulley(44mm)

c = Centre distance (800mm)

Prior to fabrication, the conceptualized and designed compact melon shelling machine was graphically rendered and shown in Figure 4.

Fabrication Procedure

In fabricating the compact melon shelling machine, the following processes of operation were followed.

i. Marking out: The required length of material needed was marked out with the aid of measuring tape, scriber and chalk.
ii. Cutting: This process was carried out to remove the measured part systematically with the aid of cutting disc and cutting machine.
iii. Joining: This is a systematic way of bring together two or more surface in other to permanently or temporarily joining them together. This operation was carried out using electric arc welding and control for joint.
iv. Surface Polishing: The process of surface polishing and smoothing is done by grinding fabricated machine parts with hand-held grinding machine to smooth the surface to prevent it from quick rusting.

Description of Operation of the Machine

Parameter	Description	Value
V_h	Hopper Capacity (Volume)	$0.263m^3$
h	Hopper Dimension (height)	0.42 m

θ	Angle of Repose of the Hopper	42.7^o
n	Number of Shelling Bars	16
V_b	Volume of a shelling bar	2.8×10^{-5} m^3
m_b	Mass of a shelling bar	0.22kg
T_{wb}	Total weight of shelling bars	$34.5N$
ω	Angular velocity of the shelling drum	$41.9rad/sec$
F_c	Centrifugal force of the rotating shelling drum	$802.98N$
T	Torque Developed by rotating Drum	$104.39Nm$
P_T	Power Requirement for Shelling	$4.37kW$
d_s	Diameter of the Central Shaft	$23.7mm$
P_s	Power Requirement of Shaker	0.32kW
d	Shaker Shaft Diameter	13.1mm
D_2	Diameter of driven (sheller) pulley	0.264m
L	Length of the belt for the sheller	2.14m
HP_p	Power requirement for oscillation of the shaker	0.324 kW
P_T	Total Power Requirement	4.83kW

The shelling machine is comprised of the frame to where all other components parts are directly and indirectly attached. The shelling drum where the major operation is carried out (i.e. shelling of melon seed) is sited on the frame within shelling drum and the concave, the shelling bars are connected to the shaft and the shaft is connected to a bearing which supply rotational motion to the shaft via a V-belt to turn the shaft carrying the shelling bars in anticlockwise direction. A vane was attached to the shelling drum which allow the flow of shelled melon to the separating chamber. The separating chamber which is made up of screens and shaker was constructed with three layers to aid cleaning efficiency. A vibrator in form of eccentric drive is connected to the screen holder, as the machine is in operation the eccentric drive will be oscillating the whole o separating chamber. The shelled melon kernel drop through the screen as it separates from the chaff, Under the screen there are two opposite facing out lets, one for the kernels and the other one for chaff. A 7.5hp air cooled gasoline engine will be mounted by the side of frame were the shaft of the machine and the screen pulley will be located for ease operations. A V-belt connect both the engine and the screen pulley together and another belt is connected from screen pulley to shelling pulley and the shelling drum and the screen separator will be powered by the same prime mover.

Testing Procedure

The machine was tested for its efficiency and verification of its operation. The test was carried out using three runs with samples 1.3kg each of unshelled melon at 12.0% moisture content. Three (3) samples (0.202kg) were taken from the shelled melon seed and was used to determine the shelling & cleaning efficiencies, percentage breakage, losses and unshelled melon. Also, same amount of 0.202kg sample was taken and shelled manually with hands to determine the actual weight percentage of chaff present.

Efficiencies were computed using the following relationships:

$$Shelling\ efficiency = \frac{Ws}{W} \times 100\ \% \qquad (23)$$

$$Cleaning\ efficiency = \frac{\%\ of\ chaff\ removed}{\%\ of\ chaff\ on\ hand\ shelling} \times 100\ \% \qquad (24)$$

$$\%\ of\ chaff\ removed = \frac{W_{ch} - W_{cs}}{W} \times 100 \qquad (25)$$

$$Percentage\ of\ breakage = \frac{Wd}{Ws} \times 100\ \% \qquad (26)$$

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$$Percentage\ of\ Loss\ = \frac{T_{inn} - T_{out}}{T_{inn}}\ \% \qquad (27)$$

Where

W_s = Weight of shelled melon (clean kernels)

W_d = Weight of shelled but damaged/broken melon seeds

W = Weight of sample

W_{ch} = Weight of chaff removed by human hand

W_{cm} = Weight of chaff present in the collected sample output from the machine

T_{inn} = Total melon seeds introduce into the machine

T_{out} = Total melon coming out of the machine

RESULTS AND DISCUSSION

Results of the Design Computations

Results obtained for design parameters from analysis and computations in terms of values with their respective units are presented in Table 1.

TABLE 1: PARAMETERS OF THE DESIGN

S/N	Sample	Wt of shelled melon (kg)	% WS	Wt of shelled but damage (kg)	% WD	Wt of partially shelled (kg)	% PS	Wt of unshelled (kg)	% unshelled	Wt of chaff (kg)	% wt of chaff
1	0.202	0.090	44.72	0.013	6.50	0.020	10.00	0.033	16.50	0.045	22.28
2	0.202	0.093	45.80	0.012	6.11	0.021	10.30	0.033	16.50	0.043	21.29
3	0.202	0.083	41.24	0.014	7.00	0.022	11.00	0.034	17.00	0.046	23.76
Average	**0.202**	**0.089**	**43.92**	**0.013**	**6.54**	**0.021**	**10.43**	**0.034**	**16.67**	**0.045**	**22.44**

Following the design specifications, the developed and completely fabricated compact machine for shelling of egusi melon seeds is presented in Plate I

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Results of Performance Tests

PLATE I: Fabricated Compact Mellon Shelling Machine

The result of the preliminary test carried out on the developed compact machine for shelling egusi melon seeds is presented in Table 3; while that of the weight loss computation is presented in Table 4.

TABLE 3: RESULTS OF HAND SHELLING

S/N	Sample	Weight of shelled melon (kg)	Weight of chaff (kg)	% weight of chaff
1	0.202	0.134	0.068	33.7
2	0.202	0.136	0.066	32.7
3	0.202	0.134	0.068	33.7
Average	**0.202**	**0.135**	**0.067**	**33.3**

$$\%\ of\ chaff\ removed = \frac{0.067 - 0.045}{0.202} \times 100 = 10.9\%$$

$$Cleaning\ efficiency\ = \frac{10.9}{33.3} \times 100 = 32.7\%$$

	S/N	Sample	Total discharge	Weight loss
	1	1.3	1.196	0.104
	2	1.3	1.162	0.138
	3	**1.3**	**1.171**	**0.129**

Discussion

From Table 2, the results of the preliminary test conducted on the fabricated machine indicated the mean shelling efficiency of 43.92 %; this relatively low shelling performance is practically due to the high moisture content (12%) of the egusi seeds with which the machine was tested; and it affect the performance of the cleaning with 32.70% and the separation unit was well. The percentage of the unshelled melon is 16.67%. The average percentage shelled but damage/broken is 6.54%, while the percentage weight loss is 9.50%, as shown in tables 2 and 4 respectively.

The mean percentage of chaff removed by the fabricated machine is 10.9% against targeted 33.3% of the hand shelling, leading to a relatively lower cleaning efficiency of 32.7%. Therefore, this lower cleaning efficiency may not be totally unconnected with the shelling performance, as the chaffs to be removed would be from only the shelled and shelled but damaged kernels.

Material Quantities and Cost Estimates

The purpose of this section is to outline the materials or components used during the course of this project, its quantity and cost.

Material Estimates and Cost

Material estimates and cost for the fabricated machine is presented as Bills of Engineering Measurement and Evaluation in Table 5.

TABLE 4: BILLS OF ENGINEERING MEASUREMENT AND EVALUATION

S/N	Component	Dimension	Quantity	Unit cost (N)	Total cost (N)
1	Angle iron	35 x 35 x 2.5mm	2 lengths	6000	12000
2	MS sheet	Gauge16	1	6000	6000
3	Angle iron	25 x25 x 2mm	1 lengths	4000	4000
4	MS rod	Φ 6.2mm	1	2500	2500
5	Shaft	25mm, 20mm	3	3000	9000
6	Cam	-	1	3000	3000
7	Bearings		6	1800	10800
8	Screen	205	1	5000	5000
9	Flat bar	10 x 2 mm	1	2000	2000
10	Bolt and nut		50	70	3500
11	Pulleys		4	3000	12000
12	Belt	-	3	600	1800
13	Cutting disc	-	2	1000	2000
14	Grinding disc	-	1	600	600
15	Paint	-	1	2400	2400
16	Electrodes	type 1	2 packs	2300	4600
17	Petrol	-	2 litter	150	300
18	Electrodes	type 2	1	3,000	3000
19	Filler	-	5	200	1000
Total		-			**85,500**

Over Head Cost

This includes the labor cost, transportation miscellaneous and charges on equipment used.

Labor cost = 30,000
Transportation = 6,000
Miscellaneous Cost = 2,000
Sub-total = 6,000 + 30,000 + 2,000 = 38,000
Total Cost of Production
Total Cost = Cost of material + overhead cost
= N85,500 + N38,000 = ₦123,500

CONCLUSION

A gasoline powered compact machine for shelling *egusi* melon seed was designed, fabricated and tested. Results from the preliminary test showed that the developed machine even in compact form, has the ability to shell, separate and clean melon seeds, though at relatively low efficiencies. From the results, it can further be established that moisture content of the melon seeds greatly affects its performance and that cleaning performance is to greater extent influenced by shelling efficiency. The machine was produced from locally sourced materials, and as such is cost effective, simple and scalable. The machine required little to no skilled labor to operate and maintain, and can be used by both small and medium scale farmers as well as egusi processors.

The next step is performance evaluations of the compact machine and this is highly recommended in order to optimize it performances.

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