Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 07, July-2023

Optimization of a locally Fabricated Palm Fruit Digester using Response Surface Method (RSM)

[1]G. O. Erhimona, [2]I. U. Onyenanu (PhD), [3]Ochuko Utu

[1]Department of Welding Engineering & Offshore Technology, Petroleum Training Institute, Warri – Nigeria
[2]Department of Mechanical Engineering, Chukwuemeka Odumegwu Ojukwu University, Uli - Nigeria
[3]Department of Welding & Fabrication Technology, Delta State Polytechnic Ogwashi-Uku – Nigeria

***Abstract* – Palm oil production plays a crucial role in Nigeria's agricultural sector and economy. With favorable environmental conditions and fertile land, Nigeria has emerged as a leading palm oil producer in Africa. Derived from the oil palm fruit, palm oil is a versatile commodity widely utilized in various industries, including food, cosmetics, and biofuels. However, the expansion of the palm oil industry in Nigeria has brought forth a range of challenges. The primary concern associated with palm oil production lies in the extraction process. Despite the increasing demand for palm oil, a significant portion of Nigeria's population still relies on traditional or semi-mechanized methods for processing palm fruit, which is labour-unfavourable tensive and less efficient. To meet the escalating demand for palm oil, it becomes imperative for developing nations like Nigeria to embrace enhanced processing technologies. This study focuses on optimizing a locally manufactured palm fruit digester using Response Surface Methodology (RSM). The study employed a 4-factor, 3-level experimental design to investigate variables such as motor speed, number of blades, the weight of cooked palm fruit, and digestion time, aiming to determine the optimal values for two key responses: capacity throughput and machine efficiency. The coefficient of regression (R^2) values demonstrated a meaningful agreement between the experimental and predicted response values. The optimized performance values obtained were a capacity throughput of 0.133 kg/min and an efficiency of 81%.**

***K*eywords — Palm fruit, Palm oil, Digester, Response Surface Method (RSM), Optimization.**

I. INTRODUCTION

The demand for palm oil for domestic and industrial purposes has been consistently rising. It was estimated that in the year 2022 alone, palm oil production in Nigeria achieved a volume of 1.4 million metric tons. Over the period from 2009 to 2022, the production quantity generally exhibited an upward trajectory, with the most substantial growth observed in 2010, with an increase of approximately 14 per cent (Sasu, 2022). According to Sasu (2022), Nigeria was projected to consume approximately 1.8 million metric tons of palm oil during the 2021/2022 crop year. This consumption level marked a peak compared to the preceding decade, underscoring the significant role of palm oil as one of the country's major crops with rising domestic demand. Most palm oil is used for industrial purposes, while a smaller proportion is consumed by households (Sasu, 2022).

Nonetheless, palm oil, obtained from palm fruit, plays a critical and versatile role as a raw material in various industries, spanning both the food and non-food sectors. Palm oil is utilized in the manufacturing of a wide range of products, including margarine, soap, candles, bases for lipstick, condensed waxes and polishes, confectionery items, pharmaceuticals, tin plating, lubricants, biodiesel, fat spreads, ice cream, coffee whiteners, whipping creams, the formulation of fatty acids, palm-based cheese, micro-encapsulated products, filled milk, mayonnaise, salad dressings, and red oil/olefin.

Additionally, as Nigeria's population continues to grow, accompanied by an increased number of households and communities, there will be a greater need and consumption of oil palm products, especially red oil for daily cooking and consumption. Therefore, there is an urgent requirement for local technology that can effectively handle palm fruit processing. The implementation of such technology would not only alleviate the labor-intensive process of palm oil production for both local and industrial users but also boost productivity by substantially reducing the time and energy expended in processing, as highlighted in the study by Oghenevwaire, (2019).

According to Poku, (2002), the processing of fresh palm bunches (FFPB) for edible oil has been a longstanding tradition in Africa, spanning thousands of years. The resulting oil, known for its vibrant colour and rich flavour, holds a crucial position as a fundamental element in the traditional cuisine of West Africa. The key process in the production of palm oil is known as palm fruit digestion, which involves the release of the oil from the fruit through the rupture or breakdown of the oil-bearing cells, as mentioned by Aideloje et al. (2018). Digestion and oil extraction are considered vital and labor-intensive operations in traditional palm fruit processing. The traditional method of processing palm fruit oil is widely practiced among the population in Nigeria, with a focus on the pounding (digestion) and extraction stages, as highlighted by Kwaski (2002). These tasks have been the primary area of early efforts in the field. Within the realm of small-scale producers, traditional or semi-mechanized methods are predominantly employed for palm oil processing (Omereji, 2005).

The commonly utilized digester machine comprises a cylindrical vessel equipped with a central rotating shaft that carries multiple stirring arms, known as beaters. The fruit is pounded through the motion of these rotating beater arms, driven by a prime mover such as a fuel-powered diesel engine or an electric motor. Digester machines are available in two types: vertical and horizontal digesters.

The optimization process will play a critical role in to improving the performance of palm fruit digesters by identifying the key factors that influence their efficiency and determining the optimal conditions for maximum oil extraction. Response Surface Methodology (RSM), a statistical technique, offers a systematic approach to optimize complex systems with multiple variables and their interactions. By employing RSM, researchers can design experiments, collect data, and analyse the results to model and optimize the performance of palm fruit digesters in Nigeria. This research focuses on investigating the optimization of a locally made palm fruit digester using RSM. The study aims to identify the optimal combination of variables such as motor speed, digestion time, weight of the cooked palm fruit, and number of blades to maximize oil extraction efficiency and the capacity throughput. The findings of this research are expected to have significant implications for the Nigerian palm oil industry. By optimizing the palm fruit digestion process, the study aims to enhance oil extraction efficiency, reduce labour requirements, and promote sustainable practices within the sector. Improved palm oil extraction methods will not only contribute to increased productivity but also support the economic growth and development of rural communities dependent on palm oil production.

Furthermore, the results of this research can guide the design and operation of locally made palm fruit digesters, facilitating the adoption of efficient and cost-effective technologies in palm oil mills across Nigeria. Overall, this research holds great potential to contribute to the advancement of palm oil extraction methods in Nigeria. By optimizing locally made palm fruit digesters using the powerful tool of Response Surface Methodology (RSM), this study aims to address the challenges faced by the Nigerian palm oil industry, leading to increased efficiency, sustainability, and economic prosperity.

II. LITERATURE REVIEW

The demand for palm oil in Nigeria has significantly increased in recent years compared to the previous decade, as pointed out by Sasu (2022). Despite this growing demand, a considerable portion of the Nigerian population still relies on traditional or semi-mechanized methods for processing palm fruit. These methods have been proven to require a lot of labour and are less efficient. However, for developing countries like Nigeria to meet the high demand for palm oil, it is necessary to adopt improved processing technologies.

Several researchers have conducted studies in this area. Aideloje et al. (2018) developed a vertical palm fruit digester that demonstrated a capacity of 740 kg/h and an efficiency of 92.31% in performance tests. Asoiro & Udo (2013) explored the development of a motorized oil palm fruit rotary digester, which achieved a throughput capacity of 117.93 kg/hr and a performance efficiency of 64.88% at an optimal operating speed of 621.4 rpm. Durodola et al. (2017) conducted a study on the development and performance evaluation of an oil palm fruit digester. Additionally, Okafor (2015) worked on the development of a palm oil extraction system, specifically a vertical oil palm digester designed to feed the screw press through gravity. The performance test results indicated a 95.7% oil extraction efficiency for the screw press at an optimal temperature of 98°C.

Therefore, this study aims to optimize a locally made palm fruit digester using Response Surface Methodology (RSM).

III. MATERIALS AND METHODS

Material Specification:

From the design, the palm fruit digester is comprised of the following components; (1) The feeder (Inlet Channel), (2) Digester Drum, (3) Stirrer, (4) Frame, (5) Cover, (6) Outlet, (7) Prime mover (8) Sieve. The overall height of the palm fruit digester is 1250mm, width of 720mm and length of 450mm. The digester drum has a height 600 mm and diameter 450 mm. The feeder has a height of 190mm, width of 150mm and length of 150mm. the frame has a height of 908mm, width of 370mm and length of 370mm. the sieve has a diameter of 430mm. the stirrer has a height of 450mm, diameter of 30mm and a sweep clearance of 5mm. Fig. 1 shows the 3D CAD model done on SOLIDWORKS Software version 2021.

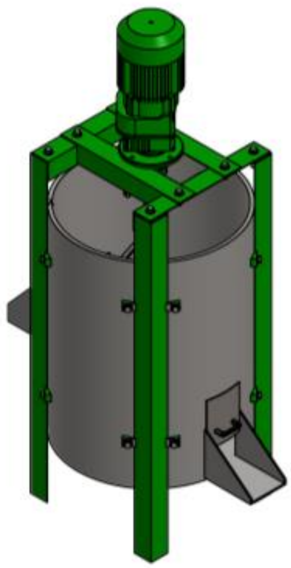

Fig. 1: 3D CAD Model of the Palm Fruit Digester

The material description of the machine is shown in Table 1 for each component part of the machine.

Table 1: Materials used for the palm fruit digester.

S/N	Parts	Material	Description
1	Drum	Stainless steel	2mm thickness
2	Feeder	Stainless steel	2mm thickness
3	Shaft	Stainless steel	Circular pipe (dia. 30mm)
4	Blades	Mild steel	Flat bar
5	Frame	Mild steel	45x45x5 angle iron
6	Sieve	Stainless steel	2mm thickness
7	Flange Bearing	Stainless steel	4 Hole Flange Bearing Unit 25mm ID
8	Gear motor	Cast Iron	YL7124
9	Bolts	Stainless steel	Hex Bolt, M10 x 35mm
10	Outlet Cover	Stainless steel	2mm thickness

Machine Fabrication

The palm fruit digester was fabricated locally at NUTABOLTS TECHNOLOGIES LTD workshop in Enugu State, Nigeria. Fig. 2 shows the pictorial view of the machine assembly while Fig. 3 shows the fully fabricated palm fruit digester. The technical specification of the locally manufactured palm fruit digester is show in Table 2.

Fig. 2: Assembling the component parts of the machine

Fig. 3: Locally fabricated Palm Fruit Digester

Table 2: Technical Specification the machine

S/N	Component Part	Unit	Value
1	Angular speed	Rad/sec	8.67
2	Machine power	hp	2
3	Mass of the shaft	Kg	3.167
4	Number of blades	-	8
5	Shaft diameter	mm	30
6	Shaft length	mm	570
7	Shaft speed	RPM	760
8	Tangential force acting on the blades	N	42.81
9	Torque	N-m	18.84
10	Volume	m^3	95.44
11	Weight of the blades	N	50

Machine Testing and Sample Testing Procedures:

Palm fruit bunches were purchased from New Market located in Enugu State, Nigeria. Manual threshing was employed to separate the palm fruits from their respective bunches. This involved using a machete to cut the fruit-laden spikelet from the bunch stem and manually separating the fruit from the spikelet. Subsequently, the palm fruits underwent a cooking process lasting approximately one hour. This cooking process aimed to weaken the pulp structure, resulting in its softening and facilitating the detachment of fibrous material and its contents during the digestion phase. The elevated temperature during cooking partially disrupted the oil-containing cells in the mesocarp, allowing for easier oil release. The cooked palm fruits were then weighed using a digital balance and loaded into the digester machine for oil extraction.

It may be noted that throughout the experiment, various process parameters such as the number of blades, motor speed, and digestion time were systematically adjusted based on predetermined measures outlined in the design table to attain optimal values for throughput and efficiency.

Experimental Design:

For the purpose of this study, an optimal design was achieved using I-optimal design, a specialized form of randomized design derived from the Response Surface Method (RSM). The primary objective of the study was to investigate the optimal performance of the digester machine. Four specific machine parameters that affects the general performance of the machine were considered, namely; the weight of the cooked palm fruit, number of blades, digesting time, and motor speed. The goal was to determine the optimal settings for these attributes to maximize the capacity throughput and machine efficiency. To this effect, an experimental design table consisting of 28 runs was developed using Design Expert version 13. This design table enabled a systematic exploration of the parameter space and facilitated the collection of data required for analysis and optimization purposes.

The design table was constituted through the four primary factors that affect the performance of the machine vary as shown during the mathematical formulation below:

$5 \leq$ A (Number of blades) ≤ 7 ….@ (3 levels)
500RPM $\leq$ B (Motor speed) ≤ 700 ….@ (3 levels)
8Kg $\leq$ C (Mass of boiled PF) $\leq$ 10Kg ….@ (3 levels)
2 mins $\leq$ D (Digestion time) $\leq$ 5 mins ….@ (3 levels)

While two (2) performance parameters were used as the Response in the Design of Experiment Table.

Response 1: Throughout (Kg/Sec.)
Response 2: Efficiency (%)

Table 3: Summary of the Design of Experiment table

	Factor 1	Factor 2	Factor 3	Factor 4	Response 1	Response 2
Run	A:Number of Blades	B:Motor Speed	C:Mass of Bolied Palm Fruit	D:Digestion Time	Throughput	Efficiency
		RPM	Kg	Minutes	Kg/Sec	%
1	6	600	9	5	0.114	76.5
2	7	500	10	5	0.145	86.7
3	5	600	10	2	0.111	74.3
4	6	700	9	2	0.112	72
5	6	600	9	5	0.14	84
6	5	500	9	5	0.113	78
7	7	500	9	3.5	0.125	83
8	6	500	10	3.5	0.115	86.5
9	5	700	8	5	0.114	76.5
10	7	500	9	5	0.135	90
11	5	700	9	3.5	0.113	78
12	5	600	8	2	0.1	72.1
13	7	700	9	5	0.13	84.2
14	7	600	9	2	0.118	88.5
15	6	600	9	2	0.112	73
16	7	700	10	3.5	0.127	85.2
17	5	700	10	5	0.117	70.2
18	5	500	8	5	0.112	71.05
19	7	700	8	3.5	0.123	82
20	6	500	9	2	0.139	83.4
21	6	700	8	2	0.111	71.5
22	6	500	9	2	0.139	83.4
23	7	500	8	5	0.113	85
24	6	500	8	3.5	0.125	83
25	5	700	9	3.5	0.13	78
26	5	500	8	3.5	0.111	74.3
27	6	600	9	5	0.14	84
28	7	600	9	2	0.118	88.5

IV. RESULTS

Predicted and Actual Results for the two (2) Responses:

Throughput;

Utilizing the design expert software, optimization was conducted on experimental design table. The coded equations were generated on each case and utilized to calculate the predicted values of the experiment. Fig. 4 shows the graphical representation of the predicted and actual values of the experiment for throughput. The graph confirms a high similarity for the predicted and actual values for the throughput investigation.

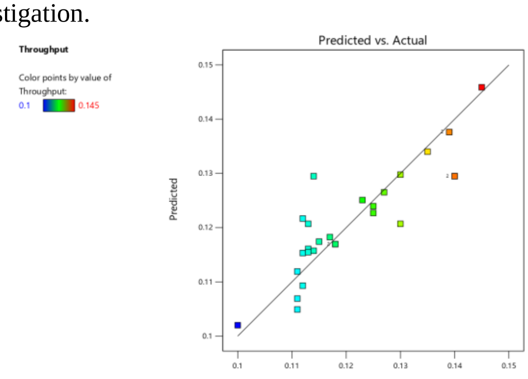

Fig. 4: Graph showing the predicted and actual values for the machine throughput

While the actual and predicted data sets of the physical tests for Palm Fruit Digester throughput were tabulated in Table 4. See below;

Table 4: Actual and predicted data sets of the physical tests for Palm Fruit Digester Throughput

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 07, July-2023

Run Order	Actual Value	Predicted Value	Residual	Leverage	Internally Studentized Residuals	Externally Studentized Residuals	Cook's Distance	Influence on Fitted Value DFFITS	Standard Order
1	0.1140	0.1295	-0.0155	0.297	-2.038	-2.529	0.098	-1.645	25
2	0.1450	0.1459	-0.0009	0.887	-0.288	-0.275	0.036	-0.769	27
3	0.1110	0.1069	0.0041	0.909	1.494	1.608	1.242[1]	5.090[1]	9
4	0.1120	0.1153	-0.0033	0.689	-0.657	-0.637	0.053	-0.949	8
5	0.1400	0.1295	0.0105	0.297	1.383	1.459	0.045	0.949	23
6	0.1130	0.1155	-0.0025	0.703	-0.501	-0.482	0.033	-0.741	21
7	0.1250	0.1227	0.0023	0.842	0.636	0.616	0.119	1.420	13
8	0.1150	0.1174	-0.0024	0.894	-0.823	-0.809	0.318	-2.350	16
9	0.1140	0.1157	-0.0017	0.916	-0.661	-0.641	0.266	-2.122	20
10	0.1350	0.1340	0.0010	0.357	0.136	0.129	0.001	0.096	22
11	0.1130	0.1207	-0.0077	0.478	-1.175	-1.201	0.070	-1.149	15
12	0.1000	0.1020	-0.0020	0.875	-0.626	-0.606	0.153	-1.605	1
13	0.1300	0.1298	0.0002	0.878	0.070	0.066	0.002	0.179	26
14	0.1180	0.1170	0.0010	0.478	0.158	0.150	0.001	0.144	7
15	0.1120	0.1217	-0.0097	0.205	-1.197	-1.227	0.021	-0.623	5
16	0.1270	0.1265	0.0005	0.902	0.169	0.160	0.015	0.486	17
17	0.1170	0.1183	-0.0013	0.954	-0.646	-0.626	0.482	-2.855[1]	28
18	0.1120	0.1093	0.0027	0.570	0.454	0.435	0.015	0.500	18
19	0.1230	0.1251	-0.0021	0.917	-0.796	-0.780	0.387	-2.586[1]	12
20	0.1390	0.1376	0.0014	0.480	0.211	0.201	0.002	0.193	3
21	0.1110	0.1049	0.0061	0.659	1.149	1.169	0.141	1.624	2
22	0.1390	0.1376	0.0014	0.480	0.211	0.201	0.002	0.193	4
23	0.1130	0.1161	-0.0031	0.826	-0.818	-0.803	0.176	-1.746	19
24	0.1250	0.1240	0.0010	0.557	0.174	0.165	0.002	0.185	11
25	0.1300	0.1207	0.0093	0.478	1.420	1.508	0.103	1.443	14
26	0.1110	0.1119	-0.0009	0.698	-0.183	-0.174	0.004	-0.265	10
27	0.1400	0.1295	0.0105	0.297	1.383	1.459	0.045	0.949	24
28	0.1180	0.1170	0.0010	0.478	0.158	0.150	0.001	0.144	6

Efficiency;

Fig. 5 shows the graphical representation of the predicted and actual values of the machine efficiency during experiment. Again, the graph confirms a high similarity for the predicted and actual values for the machine efficiency during the experiment. The actual and predicted data sets of the physical tests for machine efficiency were tabulated in Table 5.

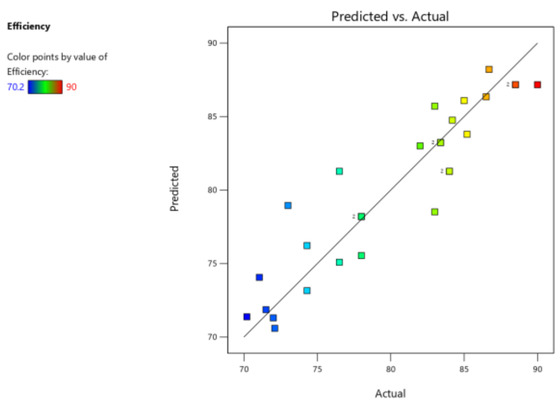

Fig. 5: Graph showing the predicted and actual values for the machine efficiency

Table 5: Actual and predicted data sets of the physical tests for Palm Fruit Digester Efficiency

Run Order	Actual Value	Predicted Value	Residual	Leverage	Internally Studentized Residuals	Externally Studentized Residuals	Cook's Distance	Influence on Fitted Value DFFITS	Standard Order
1	76.50	81.28	-4.78	0.297	-1.496	-1.611	0.053	-1.048	25
2	86.70	88.21	-1.51	0.887	-1.180	-1.207	0.608	-3.382[1]	27
3	74.30	73.16	1.14	0.909	0.994	0.993	0.550	3.144[1]	9
4	72.00	71.31	0.6938	0.689	0.327	0.311	0.013	0.464	8
5	84.00	81.28	2.72	0.297	0.851	0.838	0.017	0.545	23
6	78.00	75.55	2.45	0.703	1.182	1.209	0.184	1.859	21
7	83.00	85.71	-2.71	0.842	-1.787	-2.055	0.943	-4.738[1]	13
8	86.50	86.35	0.1518	0.894	0.122	0.116	0.007	0.338	16
9	76.50	75.09	1.41	0.916	1.278	1.325	0.994	4.387[1]	20
10	90.00	87.17	2.83	0.357	0.925	0.918	0.026	0.683	22
11	78.00	78.20	-0.1964	0.478	-0.071	-0.068	0.000	-0.065	15
12	72.10	70.59	1.51	0.875	1.118	1.134	0.487	3.004[1]	1
13	84.20	84.76	-0.5576	0.878	-0.420	-0.402	0.071	-1.080	26
14	88.50	87.18	1.32	0.478	0.480	0.461	0.012	0.441	7
15	73.00	78.95	-5.95	0.205	-1.751	-1.995	0.044	-1.013	5
16	85.20	83.80	1.40	0.902	1.172	1.197	0.701	3.630[1]	17
17	70.20	71.38	-1.18	0.954	-1.446	-1.543	2.420[1]	-7.041[1]	28
18	71.05	74.06	-3.01	0.570	-1.205	-1.236	0.107	-1.422	18
19	82.00	83.01	-1.01	0.917	-0.915	-0.907	0.511	-3.005[1]	12
20	83.40	83.24	0.1647	0.480	0.060	0.057	0.000	0.055	3
21	71.50	71.86	-0.3644	0.659	-0.164	-0.155	0.003	-0.216	2
22	83.40	83.24	0.1647	0.480	0.060	0.057	0.000	0.055	4
23	85.00	86.09	-1.09	0.826	-0.684	-0.665	0.123	-1.445	19
24	83.00	78.52	4.48	0.557	1.767	2.022	0.218	2.268	11
25	78.00	78.20	-0.1964	0.478	-0.071	-0.068	0.000	-0.065	14
26	74.30	76.22	-1.92	0.698	-0.918	-0.910	0.108	-1.383	10
27	84.00	81.28	2.72	0.297	0.851	0.838	0.017	0.545	24
28	88.50	87.18	1.32	0.478	0.480	0.461	0.012	0.441	6

Effect of the investigated Machine parameters on the Response:

Throughput;

From the result generated, Figure 6, showing the contour diagram of relationship between four (4) machine variables, i.e., number of blade (A), motor speed (B), mass of boiled palm fruit (C) and digestion time (D), and the palm fruit digester throughput. The result shows that number of blades (A) and mass of boiled palm fruit contribute more in terms of throughput for the machine developed. Figure 7 shows the 3D diagram of relationship between four (4) variables to the throughput of the Palm Fruit Digester

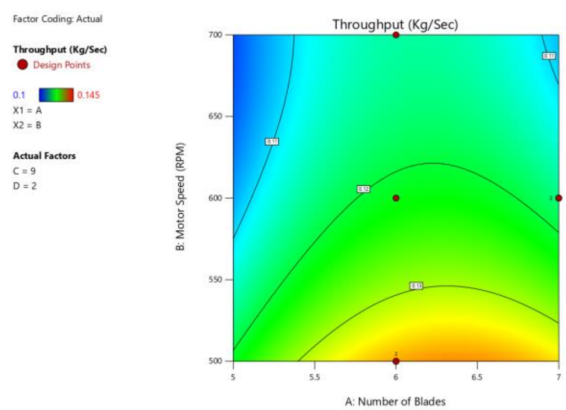

Fig. 6: Contour diagram showing the relationship between the variables and throughput

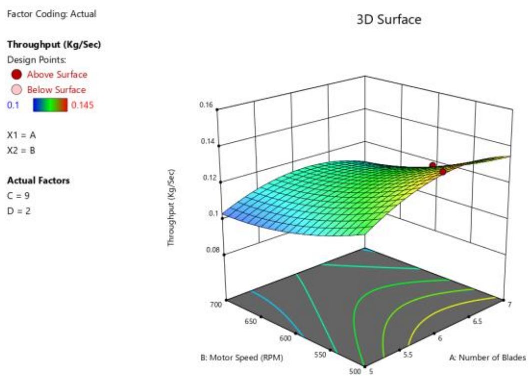

Fig. 7: 3D diagram of relationship between four (4) variables to the throughput of the Palm Fruit Digester

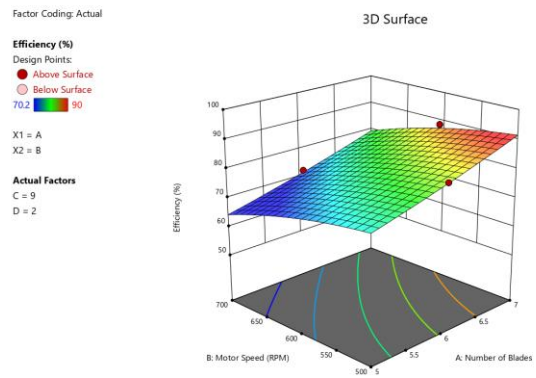

Fig. 9: 3D diagram of relationship between four (4) variables to the Efficiency of the Palm Fruit Digester

Efficiency;

Again, the result generated in figure 8 shows the contour diagram of relationship between four (4) machine variables, i.e., number of blade (A), motor speed (B), mass of boiled palm fruit (C) and digestion time (D), and the palm fruit digester efficiency. The result shows that motor speed contributes more to the machine efficiency while the number of blades shows less effect to the efficiency of the developed palm fruit digester. Figure 9 shows the 3D diagram of relationship between four (4) variables to the Efficiency of the Palm Fruit Digester

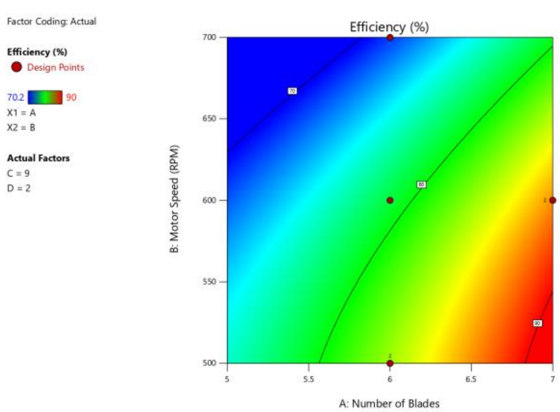

Fig. 6: Contour diagram showing the relationship between the variables and Efficiency of the machine.

Desirability Plot

From the solution of the combination of the 3 categoric factor levels, the selected or optimal values was found to be number of blades (5.885), Motor speed (560.570RPM), mass of the boiled palm fruit (9.745Kg) and digestion time (5minutes) will give a throughput of 0.133Kg/min and an Efficiency of 81%. Fig. 10 shows the desirability plot as generated from the software.

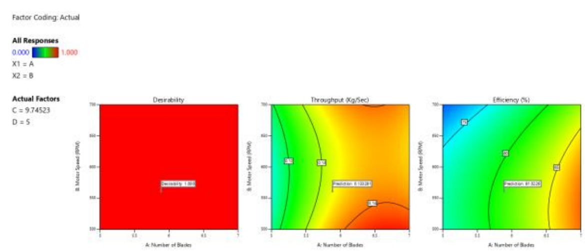

Fig 10: Optimal Desirability plot

V. CONCLUSION

This study focused on investigating the impact of various machine parameters (motor speed, boiled palm fruit, number of blades, and digestion time) on the throughput and efficiency of an improved palm fruit digestion machine. The I-optimal design (RSM) was used for the optimization process and the following conclusion is reached;

- The regression coefficient (R^2) values indicated a meaningful agreement between the experimental and predicted values for the optimization.
- The optimal performance values obtained were a capacity throughput of 0.133 kg/min and an efficiency of 81%.

VI. RECOMMENDATION

Further study should be done on blade angle to see if it can increase the performance of the machine.

VII. REFERENCES

[1] Aideloje, V. E., Okwudibe, H. A., Ososomi, S., & Ainakhuagbor, A. A. (2018). Design and Production of a Vertical Mobile Palm Fruit Digester. 5(1).

[2] Asoiro, F. U., & Udo, U. C. (2013). Development of motorized oil palm fruit rotary digester. Nigerian Journal of Technology, 32(3), 455–462.

[3] Durodola, O., Fashina, A., & Hammed, I. (2017). Development and Performance Evaluation of an Oil Palm Fruit Digester. Bioprocess Engineering, 1, 49–53. https://doi.org/10.11648/j.be.20170102. 13

[4] Ekine, D., & Onu, M. (2009). Economics Of Small-Scale Palm Oil Processing in Ikwerre and Etche Local Government Areas of Rivers State, Nigeria. Journal of Agriculture and Social Research (JASR), 8(2). https://doi.org/10.4314/ jasr. v8i2.43342

[5] Oghenevwaire, I. S. (2019). Design and Fabrication of a Motorized Oil Palm Fruit Rotary Digester Machine. American Journal of Engineering Research, 11.

[6] Okafor, B. (2015). Development of Palm Oil Extraction System.

[7] Poku, K. (2002). Small-scale palm oil processing in Africa. Food & Agriculture Org.

[8] Sasu, D. D. (2022). Nigeria: Production of palm oil 2009-2022. Statista. https://www.statista.com/ statistics/1134494/production-of-palm-oil-in nigeria/