DEVELOPMENT OF A PLANTAIN DOUGH MACHINE FOR THE PREPARATION OF FRESH PLANTAIN PULPS

By

AKINOLA AKINYEMI ADEDEJI

(MATRIC NUMBER: 18PCM01997)

MAY, 2021.

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES OF COVENANT UNIVERSITY, OTA, OGUN STATE, NIGERIA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER IN ENGINEERING (M. Eng) DEGREE IN MECHANICAL ENGINEERING, IN THE DEPARTMENT OF MECHANICAL ENGINEERING, COLLEGE OF ENGINEERING, COVENANT UNIVERSITY, OTA.

MAY, 2021

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfillment of the requirements for the award of Masters in Engineering in the Department of Mechanical Engineering, College of Engineering, Covenant University, Ota.

Mr. John A. Phillip …….

(Secretary, School of Postgraduate Studies) Signature and Date

Professor Akan B. Williams …….

Dean, School of Postgraduate Studies Signature and Date

DECLARATION

I, **AKINOLA, AKINYEMI ADEDEJI (18PCM01997)** declare that this research was carried out by me under the supervision of Prof. Joshua O. Okeniyi of the Department of Mechanical Engineering, University, Ota. I attest that the dissertation has not been presented either wholly or partly for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

AKINOLA AKINYEMI ADEDEJI **……..**

Signature and Date

CERTIFICATION

We certify that the dissertation titled **"Development of a Plantain Dough Machine for the Preparation of Fresh Plantain Pulps"** is an original work carried out by **AKINOLA, AKINYEMI ADEDEJI (18PCM01997)** in the Department of Mechanical Engineering, College of Engineering, Covenant University, Ota, Ogun State, Nigeria, under the supervision of **Prof. Joshua O. Okeniyi**. We have examined and found the work acceptable for the award of a Masters in Engineering in Mechanical Engineering.

Prof. Joshua O. Okeniyi **……..…….**
Supervisor Signature & Date

Prof. Joshua O. Okeniyi **…….**
Head of Department Signature & Date

Prof. Bukola O. Bolaji **……..…….**
External Examiner Signature & Date

Prof. Akan B. Williams **…….**
Dean, School of Postgraduate Studies Signature & Date

DEDICATION

This project is dedicated to the supreme God, a giver of knowledge and understanding. I thank HIM for HIS divine protection over my life and for HIS leading and guidance for the successful completion of the Master's program in Mechanical Engineering, and also to my lovely parents, family, and colleagues for their unflinching support.

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ABSTRACT

Plantain (*Musa Paradisiaca)* is one of the major staples which is largely cultivated and consumed in tropics and subtropics with Nigeria as one of the major producers in the world. Plantain dough is a meal common in the southern part of Nigeria with known pharmacological benefits which serve as antihypertensive, hypoglycaemic, anti-cholesterol, antioxidant, anti-allergic, and lots more as a result of its nutrients. Annual production of plantain suffers a great loss of over 50% to post-harvest resulting from the inefficient storage facility, lack of proper handling methods and materials, and also inadequate preparation machine. A plantain dough machine was designed and fabricated using locally sourced materials in other to facilitate the preparation of fresh plantain pulps. The machine consists of; Shaft, pulleys, an auger, an electric motor, and a framework to support it. The fabrication was successful using the GTAW welding process. The performance evaluation of the developed machine was carried out, three (3) trials of each processed number of plantain fingers were experimented to investigate variation in processing time. Results obtained were analyzed to determine the mean processing time and the standard error, the coefficient of determination, R^2, obtained is 0.999 to indicate a good fit of the quadratic trend line and the standard error for each of the experimental treatments did not exceed 9.5, which is indicative of a natural variation occurrence during experimentation. The processing time for ten plantain pulps was less than twenty minutes indicative of a very adaptable time for the preparation of a dough meal. Mass production of the plantain dough machine will facilitate the preparation and also enhance the consumption of plantain dough which has more health benefits and hence reducing the annual loss of plantain. The plantain dough machine will help the fast food and eateries as production time is minimal.

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NOMENCLATURES

a	Acceleration (m/s^2)
ω	Angular speed (rad/sec)
A	Area (m^2)
ASS	Austenitic Stainless Steel
Δθ	Change in temperature (℃)
CRES	Corrosion resistance steel
D	Diameter (mm)
D_2	Diameter of Driven (mm)
D_1	Diameter of Driver (mm)
DSS	Duplex Stainless Steel
FSS	Ferritic Stainless Steel
F	Force (newton)
f	Frequency (Hz)
GTAW	Gas Tungsten Arc Welding
GDP	Gross Domestic Product
L	Length (m)
MSS	Martensitic Stainless Steel
m	Mass (kilogram)
$\bar{x}$	Mean
Mt.	Metric tonnes
M	Moment (Nm)
AA	Musa Acuminata colla
BB	Musa Balbisiana colla
M. Paradisiaca	Musa paradisiaca
M. Sapientum	Musa sapientum
n	Number of sample(s)
%	Percentage
RDAs	Percentage dietary allowances
P	Power (Watts)

H	Quantity of heat (J)
r	Radius (millimeter)
R_B	Reaction at "B" (kN)
rpm	Revolutions per minute
N	Shaft speed (rpm)
τ	Shear force (N/m^2)
SMAW	Shield Metal Arc Welding
C_p	Specific heat capacity (kJ/KgK)
SS	Stainless Steel
σ	Stress (Nmm^2)
Σ	Summation
T	Temperature (°C)
k	Thermal conductivity (w/m°C)
t	Time (s)
TIG	Tungsten Inert Gas Welding
v	Velocity (m/s)
V	Voltage (volts)