AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Design and Production Engineering

Study of Parameters Affecting the Skinning Process of Palm Midribs

A Thesis submitted in partial fulfillment of the requirements of the degree of

Master of Science in Mechanical Engineering

(Design and Production Engineering)

by

Mohamed Wagih Naim Mohamed

Bachelor of Science in Mechanical Engineering
(Design and Production Engineering)
Faculty of Engineering, Ain Shams University, 2012

Supervised By

Prof. Hamed Ibrahim El-Mously

Prof. Assoc. Mostafa Rostom

Prof. Assoc. Ola Abdelbar

Cairo - (2018)

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Design and Production Engineering

Study of Parameters Affecting the Skinning Process of Palm Midribs

A Thesis submitted in partial fulfillment of the requirements of the degree of Master of Science in Mechanical Engineering

(Design and Production Engineering)

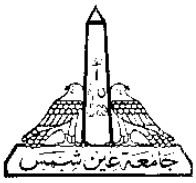
by

Mohamed Wagih Naim Mohamed

Examiners Committee

Name and Affiliation	Signature
Prof. Alaa Soliman El-Hakim **Design and Production Engineering dept., Cairo University**	.....
Prof. Sherif Bahi Mosharaf **Design and Production Engineering dept., Al-Azhar University**	.....
Prof. Hamed Ibrahim El-Mously **Design and Production Engineering dept., Ain Shams University**	.....

Date: 4 / 1 / 2018



AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Design and Production Engineering

Study of Parameters Affecting the Skinning Process of Palm Midribs

A Thesis submitted in partial fulfillment of the requirements of the degree of Master of Science in Mechanical Engineering

(Design and Production Engineering)

by

Mohamed Wagih Naim Mohamed

Supervision Committee

Name and Affiliation	Signature
Prof. Hamed Ibrahim El-Mously **Design and Production Engineering dept., Faculty of Engineering, Ain Shams University**	.....
Prof. Assoc. Mostafa Rostom **Mechanical Engineering dept., Arab academy for science and technology and maritime transport**	.....
Prof. Assoc. Ola Abdelbar **Agriculture Botany dept., Faculty of Agriculture, Ain Shams University**	.....

Date: 4/ 1 / 2018

Statement

This thesis is submitted as a partial fulfillment of Master of Science in Mechanical Engineering, Faculty of Engineering, Ain Shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

Signature

……...…….

Mohamed Wagih Naim Mohamed

Date: 1/2018

Researcher Data

Name	**:** Mohamed Wagih Naim Mohamed
Date of birth	**:** 21/11/1989
Place of birth	**:** Cairo, Egypt
Last academic degree	**:** Bachelor Degree
Field of specialization	**:** Mechanical Engineering
University issued the degree	**:** Ain Shams University
Date of issued degree	**:** July, 2012
Current job	**:** Teaching Assistant, Design and Production Engineering Department, Faculty of Engineering, Ain Shams University, Cairo, Egypt.

Summary

The efficient use of residues of the date palms, especially the midribs as local alternative resources for wood, will have a great impact on the economy of Egypt. The skinning of date palm leaves' midribs has been proved to be an appropriate technology for their processing for Egypt economically and socially. The skinning process is defined as the removal of the outer layers of the midrib, using several cutting tools or multi-edge cutting tool with pre-determined conditions for tool, workpiece, and process.

A test rig machine has been designed and executed to investigate the skinning mechanism, the effects of the clearance angle, tool angle, inclination angle, the skinning speed, and the layer thickness, on the specific skinning force (skinning force per unit width) and the surface roughness. Preliminary experiments have been carried out to eliminate the unsuitable values of tool material and specimen orientation.

The experiments have been planned to be carried out on levels, First, the skinning speed and the layer thickness have been studied together using the minimum wedge angle and large clearance angle, and 0° inclination angle conditions, to investigate the skinning mechanism changes and effect of these factors on the specific skinning force. Thereafter, effect of the clearance angle has been introduced in study of these two variables. Appropriate value of the clearance angle, layer thickness, and skinning speed have been selected to study effect of the tool angle on the specific skinning force. At the end, effect of the inclination angle has been investigated with selected values of layer thickness, skinning speed, clearance angle, and tool angle. Three repetitions of the same condition have been carried out, in which the same condition has been performed for different specimens (the same condition has been repeated three times for the same specimen for the preliminary experiments) to consider the variations between the specimens to represent the skinning correctly.

The skinning is the process of the removal of a continuous rigid layer by splitting from the specimen. The skinning mechanism, split-type layer formation, is similar to that of wood cutting. Skinning starts with the formation of initial crack by the skinning tool. The crack propagates as the tool moves to accomplish skinning of the whole specimen. The crack length varies within the specimen, indicating the variation of the material strength within the specimen. The crack length increases by the increasing the layer thickness. The crack length during the skinning of palm midribs is longer than that during the skinning of wood due to

the rigidity of the produced continuous layer. Defects present in the specimen decrease the quality of the produced surface or cause local failure of the skin. Failure of the skinning occurs due to bending of the skinned fiber bundles. The produced surface, is damaged, and layer thickness is increased. Failure occurs at large layer thickness, i.e. more than 2 mm, and large inclination angle, i.e. more than 20°, hence these conditions are not suitable for skinning without adding a pressure roller.

Due to the low toughness of the non-treated medium carbon steel tool, it is not suitable for skinning due to the presence of an impact at the start of the process and the presence of hard contaminations in the specimen. ` steel tool is suitable for skinning. The orientation of the specimen in which the smaller cross section is at the start of the skinning, is more suitable than the other orientation. The skinning force is affected by the different skinning conditions, in addition to the width of cut. The increase of the layer thickness from 0.5 mm to 2 mm, increases the specific skinning force by a ratio, which depends on the skinning speed. The specific skinning force decreases by increasing the layer thickness from 1 mm to 2mm for the speeds 14.6 m/min and 15.6 m/min. The minimum suitable clearance angle for the tool in skinning, is 6°. The skinning speed has low effect on the specific skinning force. The tool angle 30° is the optimum tool angle which produced a satisfactory skinned surface. The inclination angle decreases the specific skinning force. The surface roughness depends on the specimen material more than any other factor. The failure type of the high carbon tool, during the skinning process, is the microfracture of the tool edge.

Table of Contents

List of Figures