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Ain Shams University
Faculty of Engineering
Design and Production engineering Department

AN INVESTIGATION INTO THE MACHINABILITY OF SEVERAL LOCAL WOOD SPECIES AND DATE PALM LEAVES' MIDRIBS

A Thesis Submitted in partial fulfillment of the requirements of the degree of M. Sc. In Mechanical Engineering.

BY

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1996

Statement

This dissertation is submitted in partial fulfillment for the degree of Master Science in Mechanical Engineering, to Ain Shams University.

The work included in this thesis was carried out by the author at the laboratories of the department of Mechanical Engineering, Ain Shams University.

No part of this thesis has been submitted for a degree or qualification at any other University.

Signature:

Mostafa Rostom Ahmed

Examiners Committee

The undersigned certify that they have read and recommend to the Faculty of Engineering, Ain Shams University for acceptance a thesis entitled " An investigation into the machinability of several local wood species and date palm", submitted by Mostafa Rostom Ahmed, in partial fulfillment of the requirements for the degree of Master of Science in Mechanical Engineering.

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ACKNOWLEDGMENTS

I would like to express my sincere appreciation to Prof. Dr. H. I. EL- Mously, Dr. M. Abd EL-Salam for their guidance, assistance, encouragement and patience at every stage of this research.

The support of the technicians of the Center for Development of Small- Scale Industries and Local Technologies, Faculty of Engineering, Ain Shams University, is appreciated.

AN INVESTIGATION INTO THE MACHINABILITY OF SEVERAL LOCAL WOOD SPECIES AND DATE PALM LEAVES' MIDRIBS.

By

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Abstract

Machinability tests were conducted on some local wood species (Eucalyptus, and Casuarina), as well as date palm leaves' midribs as one of the non-timber locally available resources. For comparison, the widely known Beech wood was included in the research. Turning was carried out in both longitudinal and cross feed directions using high speed steel tool.

The relationships between the machinability criteria (cutting forces, cutting temperature, tool life) and the machining variables (cutting speed, feed, depth of cut) were obtained.

The results indicate that from the viewpoint of the cutting force and consumed power, Eucalyptus, Casuarina, and DPLM can be machined easily using conventional wood working machine tools, designed for wide known commercial woods (e.g., Beech). From the tool life viewpoint Eucalyptus and Casuarina have a reasonable tool life using HSS, compared with Beech. But, in case of DPLM the tool life is too small, so that, it is better to replace HSS tools by harder tool materials as cemented carbides in cutting of DPLM.

Key words : Wood working, Machinability.

Summary

Egypt relies on importation for the satisfaction of its needs in wood. With the increase of prices of wood this will represent a burden on Egypt's balance of payments. Thus, research should be directed to the use of local substitutes, i.e., local wood species or non-timber resources, such as date palm leaves' midribs (DPLM).

The use of local woods or non-timber resources is hindered by the lack of information about their properties. Machinability is one of the important wood properties, which has to be known to enable the suitable choice of wood working machine tools and machining variables, as well as the proper cutting tool materials.

Machinability criteria were investigated for many widely known wood species. Researchers concentrated on the effect of machining variables on machinability criteria.

The objective of the present work is to determine the machinability criteria and machinability data for some local wood species (Eucalyptus, and Casuarina), as well as date palm leaves' midribs as one of the non-timber locally available resources. For comparison, the wide-known Beech wood was included in research. Machinability criteria were determined in turning on a conventional center lathe in longitudinal and cross feed cutting directions. The cutting tool material was chosen to be high speed steel.

The test rig used consists of a three component tool force dynamometer, thermocouples embedded in cutting tools for cutting temperature measurement, four channels bridge amplifier, and computer, equipped with analog to digital converter. The dynamometer and the amplifier were designed and implemented specially for this study. The whole system was

calibrated. Tool wear as a tool life measure was measured using a tool room microscope.

The relationships between the machinability criteria (cutting force components, cutting temperature and tool life) and the machining variables (cutting speed, feed and depth of cut) were obtained as well as the machinability data.

The results of research show that each machinability criterion is affected in different way by each of the machining variables. The cutting force for Eucalyptus, Casuarina, and DPLM is smaller or almost the same as compared with Beech, But, the cutting temperature is higher than that for the Beech. The tool life in case of Eucalyptus, Casuarina, and Beech is very long, since no appreciable wear was recorded after 2 hours of cutting, whereas it was comparably short for DPLM.

Concerning the cutting force the results indicate that, Eucalyptus, Casuarina, and DPLM can be machined easily using conventional wood working machine tools, designed for widely known commercial woods (e.g., Beech). From tool life viewpoint Eucalyptus and Casuarina have a reasonable tool life, compared with Beech when machined with HSS, while DPLM has a considerably shorter tool life. So that, it is better to use harder tool materials such as cemented carbides.