FACULTY OF ENGINEERING

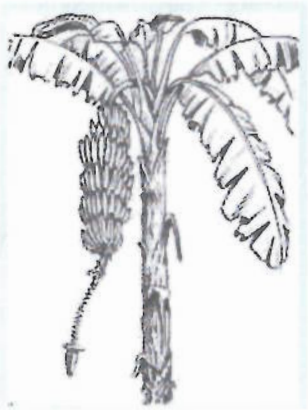
DEPARTMENT OF TEXTILE AND GINNING ENGINEERING

FINAL YEAR PROJECT REPORT

ON

DESIGN AND CONSTRUCTION OF BANANA FIBER PSEUDOSTEM EXTRACTOR MACHINE

BY



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A fourth year project report submitted to the department of Textile and Ginning leading to the award of Bachelors in Textile Engineering.

MAY 2014

APPROVAL

This project report has been submitted for examination with approval from the following supervisors:

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DEDICATION

I dedicate this final year project to my mother, Hope, sisters Elon, Daphine, and brothers Evans and Owen. For all the support they gave me during my carrier of Education.

To God be the glory

ACKNOWLEDGEMENT

I would like in special way to thank the Almighty God for looking me through my entire life up to-date. May His Name be praised.

I would also like to send my special gratitude to the following persons:

My supervisors Mr. Ssembatya Martin and Mr. Rwahwire Samson for their parental advice, encouragement and guidance which made this project a success. May God reward you abundantly.

Special thanks to Mr. Malinga, Mr. Olietho Geofrey and all technicians of Busitema University Workshop for advice and well work done during fabrication of the machine.

The management and Department of Textile and Ginning Engineering Busitema University for the financial support and technical guidance given to me during development of this machine.

Lastly to my fellow students, Ochan Remmy, Ronald, John, Richard, Sharon and Godias for the contribution towards my work

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ABSTRACT

Banana fiber is a natural fiber textile which is popular used produced by farmers using manual scraping leading to a slow process and failure to meet a demand requirement. This study emphasizes on banana fiber extraction. The comparison of extraction fiber machine of rasp bar and saw-tooth bar was studied. This basic information was used for mechanical design, construction and testing the performance of the extraction fiber machine in a farmer scale. The testing factors of this study were clearances of 0.75, 1.00 and 1.5 mm, extraction drum speeds of 645, 775, and 905 rpm (6.8, 8.1 and 9.5 m/s, respectively) and feeding positions of 45 and 90 degree. For the banana leaf sheath prepared from the second to the sixth layer at the length of 0.8 m, it found that the width, thickness and weight of banana stems were not significantly different. When compared the extraction fiber unit, the rasp bar type could separate a good texture of banana leaf sheath, while the saw-tooth bar type made a damage texture until the machine could not work. The results of factors affecting machine operation found that the extraction drum speed and clearance had no significant effect on percent of fiber extraction and force, while, the feed position had a significant difference on percent of fiber extraction and force. The clearance of 1.5 mm, drum speed of 645 rpm and feed position of 90 degree were suitable condition for extraction which provided a good quality of fiber by visual observations which gave the least residual amount of tissue and a small damage fiber. Moreover, the extraction capacity was 231 of prepared sheath/h that was higher than using the existing machine and manual scrapping approximately 1.5-2 and 20-34 times, respectively

CHAPTER ONE INTRODUCTION

1.1.Background

Banana is one of the important fruit crops grown almost in every state of the world. Apart from fruit, it generates huge quantity of biomass as waste in the form of pseudostem, leaves and suckers. Of these, on an average about 60 to 80 t/ha is pseudostem alone (*Johnston, 2003*).. Presently, the banana pseudostem is absolute waste in most parts of the world.

The baseline survey conducted by the researcher in Uganda covering 53 banana growers during 2012 revealed that 40 per cent are either composting the pseudostem or chopping and incorporating it into soil while rest of the farmers are disposing it either on field bunds. Among the farmers interviewed, no one knew about preparing any value added from the pseudostem. Further, at national level work related to developing value added products from banana pseudostem is mostly restricted to manual fiber extraction and products like handicrafts, hand woven fabrics, are prepared on a small scale. With the sizable area under banana, it was thought to develop a machine for extracting banana fiber with high output.

After harvesting of fruits and leaves, pseudostem is cut near to the ground level. Presently, fiber extraction from pseudostem is being done mostly by hand extraction in villages. The major drawback of this method is extremely poor fiber output (0.5 kg/day/man). In order to mechanize the fiber extraction from pseudostem, research has been carried out

Starting from the manual procedures to extract banana fibers, a range of ideas have been developed to design a prototype to produce banana fibers. Different stages have been followed, with several tests and redesign phases, in order to achieve the actual prototype, named the Multi-Phase Decorticating Machine (MPDM). The first prototype MPDM has already been tested, and is now undergoing modifications; preliminary tests showed that some modifications were needed in order to improve the amount of fiber extracted (and thus, the efficiency of the extraction process), and also the quality of fiber produced.

Banana fiber, a ligno-cellulosic fiber, obtained from the pseudo-stem of banana plant (Musa sepientum), is a bast fiber with relatively good mechanical properties. Plant fibers are schlerenchymatous cells with heavily lignified cell walls having a narrow lumen in cross section.

REFERENCES

- KS Das, D Nag, S Debnath and LK Nayak. (2010). Machinery for extraction and traditional spinning of plant fiber. Indian Journal of Traditional Knowledge. Vol. 9 (2), April 2010, pp. 386-393
- Jacob N. and Prema P. Novel process for the simultaneous extraction and degumming of banana Fiber under solid-state cultivation. Journal of Microbiology. 2008 39: 115-121.
- Khurmi, R.J and Gupta, J.K.,(2005). A textbook of machine design, New Dehli-110055, Eurasia publishing house.
- Shigley`s Mechanical engineering Design, Eighth Edition, Buydnas –Nisbett.
- Maleque M. A. and F. Y. Belal. (2007). Mechanical properties study of Pseudo-stem Banana Fiber Reinforced Epoxy Composite, Arabian J Sci Engg. 32(2B): 359-364.
- Ray D.P., Bhaduri S.K., Nayak L.K., Ammayappan, L., Manna, K.and Das K. (2012) Utilization and value addition of banana fiber-A Review, Agricultural Review 33(1): 46-53
- Mahapatra D. et al. (2010..)Banana and its By product Utilization: An Overview, J Sci. Ind. Res., 69: 323-329
- Matthiesen, M.L; Boteon, M.2003. Analysis and principles of Banana production in Brazil.
- Uraiwan Pitimaneeyakul; Banana fiber: Environmental Friendly fabric, King Mongkut`s Institute of Technology Ladkrabang, Thailand.
- Journal of Agricultural Engineering and Technology (JAET). Volume 13, 2005
- Design Data compiled by the Faculty of Mechanical Engineering P.S.G College of Technology, Coimbatore 641004 India (1982)