BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF TEXTILE AND GINNING ENGINEERING

DEVELOPMENT OF CORN-BASED BIOMASS COMPOSITE BOARD

BY

JINGO WILLINGTON

REG NO: BU/UG/2010/120

PHONE NO: O787692446

SUPERVISORS:

1. **MR. RWAWIIRE SAMSON**
2. **MR,SSEMBATYA MARTIN**

FOURTH YEAR PROJECT REPORT SUBMITTED IN PARTIAL FULFILMENT FOR THE AWARD OF A BACHELOR OF SCIENCE DEGREE IN TEXTILE ENGINEER

DEDICATION

This piece of work is dedicated to all those who have supported me on my journey to complete this level of my education especially my parents who have worked sacrificially and tireless to ensure that I attain education.

ACKNOWLEDGEMENT

First and foremost, I would like to extend my sincere gratitude to the Almighty God for His unlimited grace and love bestowed upon my life.

In a special way, I would like also to thank my supervisors for the advice, guidance and encouragement offered throughout the study I know have been a disappointment to you in some cases but thank you so much for not giving up on me.

Special thanks go to Eng. Morris of Henkel Company for his assistance and continued guidance to ensure that this exercise is successful.

Last but undoubtedly not least, I would also like to express my appreciation to my friends and colleagues for the moral and physical support given to me in my endeavors to complete this piece of work.

The Almighty God bless you abundantly

DECLARATION

Except where otherwise stated, I hereby declare that this piece of work is my own original work and has never been submitted wholly or partially to any University or institution of higher learning for any award whatsoever.

Signature: ----------

JINGO WILLINGTON

DATE: 23rd/07/2014

APPROVAL

This piece of work has been endorsed by:-

Signature: ----------

MR. RWAWIRE SAMSON

Main supervisor

Date: ----------

Signature: ----------

MR. SSEMBATYA MARTIN

Co-supervisor

Date: ----------

ABSTRACT

As the result of greater environmental awareness, the demand for environmentally friendly materials is significantly raised. Therefore, the interest in composites based on renewable resources has grown (Mohanty et al, 2000 and Toriz et al, 2003)

Because petrochemical-based plastic material persists beyond its functional life, a waste disposal problem is facing modern society. Research to alleviate pollution and litter problems includes efforts to develop plastics that degrade more rapidly in the environment.

Corn Board is green technology because it traps CO2. Typically, when biomass is left to decompose in the field, the CO2 previously captured and consumed by the growing plant is released back into the atmosphere. Conversely, when the corn stover is made into Corn Board, the CO2 is "trapped" in the material. Sequestering CO2 in Corn board alleviates the contribution of the decomposing biomass towards an increase of CO2 in the atmosphere.

In this research project, I developed a composite board to be used in civil applications; low stressed mechanical and recreational work in manufacture of skateboards.

A hand laying process was used simply because it is cheap, clean and flexible and requires little expertise.

Composite boards were tested for the mechanical properties, flexural and tensile.

The material exhibited low tensile strength at low material density but as the density was increased from 0.7 to 0.8 the tensile strength increased and almost tripled from 0.706MPa to 2.286MPa

The material also had a flexural strength of 8.805N and 12.479N with densities of 0.7 and 0.8 respectively

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CHAPTER ONE

1.0 INTRODUCTION

This chapter briefly gives the general information relevant to the research whilst clearly showing the problem of interest for the intended research. It as well shows how this study will help reduce the problem through the fulfilment of a number of objectives listed therein.

1.1 Background

Maize was introduced in Uganda in 1861 and has since become a major part of the farming system, ranking third in importance among the main cereal crops grown in the country (USAID, 2010). Most of the production of maize is aimed at supplying export market in the region, mostly Kenya, and recently southern Sudan. Uganda's small scale farmers have traditionally cultivated maize for food and for income generation. It forms an important part of the farming system, particularly in Eastern Uganda.

Rainfall: Like other countries at the equator, Uganda has two distinct wet and dry periods each year, the 'first rains in March-May and the 'Second rains' in September November although northern Uganda has one long rainy season typical of Savannah climate regions.

The bimodal rainfall distribution in most parts of the country permits at least two harvests of a crop a year. Only about half of the area of high rainfall is under crops.

The main production agro-ecological zones are in the west, east, north and southern Uganda(NRI/IITA, 2002) with the eastern region accounting for over 50 per cent of annual production (USAID, The bimodal rainfall distribution in most parts of the country permits at least two harvests of a crop a year. Only about half of the area of high rainfall is under crops.

The country has the potential of producing up to 7.5 million metric tons. However this is never achieved due to various production constraints including low soil fertility, lack of improved maize varieties, erratic rain fall patterns and drought stress during some seasons. Maize production is generally characterised by low yields, which result in high unit costs and thus low returns. Regardless of the farm size, Uganda's maize yield levels are low and are generally between 1.0 and 1.8 metric tons/hectare

References

1. Byerlee, D., with P. Anandajayasekeram, A. Diallo, Bantanyu Gelaw, P. W. Heisey, M. López-Pieira, W. Mwangi, M. Msale, R.Tripp, and S. Waddington. (1994). Maize research in Sub-Saharan Africa: An Overview of Past Impacts and Future Prospects. CIMMYT Economic Working Paper 94-03. Mexico, D.F.:CIMMYT

2. Muyinza, H., (1998). Evaluation of Maize Varieties, for Resistance to Weevil Sitophilus Zeaamais Motsch (Coleoptera:Curculionidae). Zoology Department, Makerere University Kampala

3. Borsdorf, R. (1999). Technical assistance report. Economic impact of postharvest technologies adopted in Uganda under the Postharvest Handling and Storage project.

4. Akgül M, _en S, Güler C (2005). Utilization Of Biomass As An Energy Source In Turkey, 14th European Biomass Conference and Exhibition Biomass for Energy, Industry and Climate Protection, 17-21 October, Palais des Congrès, Paris, France. pp. 345-348.

5. Konukçu M (2001). Forests and Turkish Forestry Benefits Statistical Facts and Forestry in The Constituon, Development Plans Goverment Programs and Annual Plans ISBN 975-19-2875-3, T.R. Prime Ministry, State Planning Organization, DPT Publication, p.2630, 258.

6. Kozlowski R, Piotrowski R (1987). Produkcja Plyt Pazdziezowo-Trocinowych (Flax Shives Saw Dust Production) Prace Instytutu Krajowych Wlokien Naturalnych (Works of the Institute of Natural Fibers). 31: 132-142.

7. Kozlowski R, Helwig M (1998). Lignocellulosic Polymer Composites in Science and Technology of Polymers and Advanced Materials Edited by Prasad PN Mark JE, Kandil SH, Kafafi ZH Plenum Press, New York.

8. Nemli G, Kırcı H, Serdar B, Ay N (2003). Suitability of kiwi (Actinidia siensis Planch) prunings for particleboard production. Holz als Rohund Werkstoff. p. 59, 411.

9. TS 642-ISO 554 (1997). Conditioning and/or standard atmospheres for trial and Standard reference atmosphere, Ankara.

10. TS-EN 310 (1999). Wood based panels, determination of modulus of elasticity in bending and bending strength. European Standardization Committee, Brussell.

11. TS-EN 319 (1999). Particleboards and fiberboards, determination of tensile strength perpendicular to plane of the board. European Standardization Committee, Brussell

12. TS EN 326-1 (1999). Wood- Based panels- Sampling, cutting and inspection- Part 1: Sampling test pieces and expression of test results, TSE, Ankara.

13. TS-EN 317 (1999). Particleboards and fiberboards, determination of swelling in thickness after immersion. European Standardization Committee, Brussell.

14. M.Ashok Kumar, G. Ramachandra Reddy, K. Hemachandra Reddy, G. Harinatha Reddy, N. Subbarami Reddy, Fabrication and performance of natural fibers: sansevieria cylindrica, waste silk, jute and drumstick vegetable fibres (*moringa oleifera*) reinforced with rubber/polyester composites, Ind.J. Mater. Sci. (in press).

15. K.V.P.Chakradhar, K.V.Subba Reddy, M.Ashok Kumar, N.Subbarami Reddy, ThermalAnalysis of epoxy/polyester blended clay filled nanocomposites, Int. J. Engg. Res. Ind.l Appl. (in press

16. S.Mohanty, S.K.Nayak, 2006. Mechanical and rheological characterization of treated jute-HD composites with a different morphology, J. Rein. Plas. Comp. 2(2006)1419-1439.

17. V.Naga Prasad Naidu, G.Ramachandra Reddy, M. Ashok Kumar, G. Harinatha Reddy, Heat capacity of sisal / glass fibre reinforced hybrid composites,Ind. J. Mater. Sci. (in press).

18. V.Naga Prasad Naidu, G.Ramachandra Reddy, M. Ashok Kumar, G. Harinatha Reddy, Compressive & impact properties o sisal / glass fibre reinforced hybrid composites, Ind. J. Mater. Sci. (in press).

19. V.S.Sreenivasan, S. Somasundaram, D. Ravindran, V.Manikandan, R.Narayanasamy, Microstructural physico-chemical and mechanical characterization of *sansevieria cylindrica* fibres: an exploratory investigatio, Mater.Des. 32(2011)453-461

20. V.S.Sreenivasan, D. Ravindran, V. Manikandan, R.Narayanasamy, Mechanical properties of randomly oriented short *sansevieria cylindrica* fibre/polyester composites, *Materials and Design* (in press) doi: 10.1016/j. matdes.2010.11.042.

21. P.Threepopnatkul, N.Kaerkitcha, N.Athipongarporn, Effect of surface treatment on performance of pineapple leaf fiber-polycarbonate composites, *Composites Part B* doi:10.1016/j.compositesb. 2009.04.008, 2009.

22. C.Uma Maheswari, K.Obi Reddy, A.Varda Rajulu, B.R.Guduri, Tensile Properties and Thermal Degradation Parameters of Tamarind Fruit Fibers, J. Rein. Plas. Comp. 27(2008) 1827-1832.

23. G.Venkata Reddy, S.Venkata Naidu, T.Shobha Rani, Impact properties of kapok based unsaturated polyester hybrid composites. J. Rein. Plas. Comp.26 (2008) 1789-1804.

24. A.Varada Rajulu, Y.Z.Meng, S.H.Li, G.Babu Rao, L.Ganga Devi, K.Mohana Raju, R.Ramakrishna Reddy, Effect of alkali treatment on properties of the lignocellulose fabric Hildegardia, J. Appl. Polym. Sci. 90(2003)1604-1608.

25. J.Jayaramudu, K.Obi Reddy C. Uma Maheswari D. Jeevan Prasad Reddy, A. Varda Rajulu, Tensile properties and thermal degradation parameters of Polyalthia cerasoides natural fabric reinforcement. Journal of Reinforced Plastics and Composites. 28(18)(2009)2177-2181.

26. M.A.Khan, M.M.Hassan, Effect of □-aminopropyl trimethoxy silane on the performance of jute-polycarbonate composites, J. Appl. Polym. Sci. 100(2006) 4142-4154.

27. M.A.Khan, F.Mina, L.T.Drzal, Influence of silane coupling agents of different functionalities on the performance of jute-polycarbonate composite. Proc 3rd Int Wood and Natural Fibre Compos Symp, September 19-20, Kassel, Germany, 2000, 5-1- 5- 8.

28. L.Y. Mwaikambo, M.P.Ansell, Chemical modification of hemp, sisal, jute and kapok fibres by alkalization, J. Appl. Polym.Sci. 89(2002)2222-2234

29. Ticolau, A., Aravinthan, T, Cardona, F.: A review of current development in natural fiber composites for structural and infrastructure applications. Toowoomba: University of Southern Queensland, 2010. 5 p. SREC2010-F1-5.

30. Taj, S., Munawar, M.A., Khan, S. Natural Fiber- Reinforced Polymer Composites. Applied Chemistry Research Centre. University of the Punjab, Pakistan. Vol.44, 2007, Number 2, p. 129-144.

31. Bledzki , A. K., Gassan, J.: Composites reinforced with cellulose based fibers. Progress in Polymer Science, Vol.24, 1999, Number 2, pp. 221-274(54).

32. Oksma, K., Nillson, P. Thermoplastic Composites Based on Natural Fibers. Proceeding of European Conference on Composite Materials Science. Technology and Application ECCM-8. Vol. 2, 1998, p. 133-140.