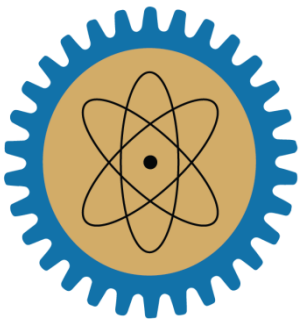


BUSITEMA UNIVERSITY

Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF POLYMER TEXTILE AND INDUSTRIAL ENGINEERING

FINAL YEAR PROJECT REPORT

DEVELOPMENT OF A LUFFA FIBER/ PLA BIO COMPOSITE MATERIAL FOR INDOOR WALL PARTITIONING APPLICATIONS

BY

OCHAR JAMES

BU/UP/2019/1800

Email 1: ocharjames13@gmail.com

AND

NAMBOZO SARAH GIFT

BU/UP/2019/1787

Email 2: nambozosarah680@gmail.com

A final year project report submitted to the department of polymer textile and industrial engineering at Busitema University in partial fulfillment of the requirement for the award of a bachelor's degree in polymer textile and industrial engineering

SEPTEMBER 2023

ABSTRACT

This is an outline for a project proposal report that was done at Busitema University between June 2023 and August 2023 for the second semester of the fourth year. The study reveals the potential of luffa fiber as a workable reinforcement for PLA matrix, providing a promising avenue for the creation of ecologically friendly and sustainable bio composites with enhanced performance properties. Utilizing the compression molding technique, luffa fiber was chemically treated and combined with PLA to create samples of Bio composite materials. The physical properties such as water absorption, moisture content and mechanical properties such as tensile strength, flexural strength a generated Bio composites are anticipated to be assessed. The research project intends to give engineering students the fundamental abilities needed to become competent as well as a fascinating look into engineering activities.

ACKNOWLEDGEMENT

We greatly thank the almighty God who enabled us to implement this project as well as the gift of life and strength that enabled us fully participate in the final year project. Special thanks goes to our lecturers (Mr Tigalana Dan, Dr Kamalha Edwin and Dr Nibikora Ildephonse) who dedicated their time to impart different research ideas and guide us until the day of presentation. Also special thanks to Head of department, Polymer textile and Industrial Engineering Dr Kamalha Edwin (PhD), Busitema University for organizing and overseeing to ensure that project research was conducted well.

LIST OF ACRONYMS

1.	N_aOH	Sodium hydroxide
2.	PLA	Poly lactic acid
3.	ULT	Un treated luffa fiber
4.	TLT	Treated luffa fiber
5.	FTIR	Fourier-Transform Infrared Spectroscopy
6.	PP	Polypropylene
7.	PVC	Polyvinyl Chloride
8.	ASTM	American Society for Testing and Materials
9.	ISO	International Organization For standards
10.	PET	Polyethylene Terephthalate
11.	UV	Ultraviolet

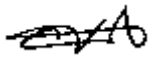
LIST OF TABLES

LIST OF FIGURES

DECLARATION

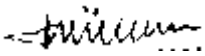
We hereby affirm that this final year project report is, to the best of our knowledge, the result of our research and work, and that it has never been offered or submitted to any organization or university for an academic award.

OCHAR JAMES

Signature……  ……..…….

Date……11/09/2023 ……...……

NAMBOZO SARAH GIFT

Signature……  …….……...

Date……11/09/2023 ……

DEDICATION

I Ochar James dedicate this report to My beloved parents, Uncle and other relative who have worked tirelessly to support me in my academic journey .

I Nambozo Gift Sarah dedicate this report to My beloved parents relatives and friends who endlessly supported and motivated me towards my goal and throughout the project proposal. We also thank my dear friends, course mates for their cooperation and lastly our supervisors who patiently and wisely handled us throughout the research project.

APPROVAL

This report has been submitted to the department of Polymer Textile and Industrial Engineering with the approval of the following supervisors.

Name..... Dr. NIBIKORA I.....

Signature.....

Date..... 11/9/2023.....

Name..... Dr. EDWIN KAMALHA.....

Signature.....

Date..... 11/09/2023.....

Name..... DAN TIGALANA.....

Signature.....

Date..... 11/09/2023.....

TABLE OF CONTENT

1 CHAPTER ONE:

1.1 INTRODUCTION

In the pursuit of sustainable and eco-friendly construction materials, there has been a growing interest in the development of innovative solutions that address both environmental concerns and functional requirements. One such avenue of exploration is the creation of bio-composite materials, which combine natural fibers with biodegradable polymers to yield versatile, eco-conscious alternatives for traditional construction components(Bosák & Palko, 2019). This study explores the fascinating field of developing a bio-composite material for use in partition walls using luffa fiber and polylactic acid (PLA), exhibiting the potential to transform interior architecture with a focus on sustainability. Luffa fiber, sourced from the matured inner fibrous structure of the luffa gourd, offers an intriguing opportunity as a natural reinforcement in composite materials(Alhijazi et al., 2020). It boasts several attributes that make it a viable candidate for construction applications, including its lightweight nature, inherent strength, and renewability. On the other hand, polylactic acid (PLA), derived from renewable resources such as corn starch or sugarcane, presents an environmentally conscious choice as a biodegradable and compostable polymer(Kamran et al., 2022). Partition walls, being integral components of interior spaces, play a pivotal role in providing privacy, spatial organization, and noise separation. However, the conventional materials used for partition walls, such as gypsum board or concrete, often come with environmental drawbacks and limited design flexibility(Maneschi & Melhado, 2010). The interaction between luffa fiber and PLA holds the promise of overcoming these limitations by offering a sustainable solution that combines the advantages of both materials. Conclusion: By combining the durability of natural fibers with the environmentally friendly properties of biodegradable polymers, this research aims to contribute to the ongoing transformation of the construction industry into a greener, more responsible sector. The development of a luffa fiber/PLA bio-composite material for partition wall applications represents a significant step towards sustainable construction practices.

5.4 REFERENCES:

Adeyanju, C. A., Ogunniyi, S., Ighalo, J. O., Adeniyi, A. G., & Abdulkareem, S. A. (2021). A review on Luffa fibres and their polymer composites. *Journal of Materials Science*, *56*(4), 2797–2813. https://doi.org/10.1007/s10853-020-05432-6

Alhijazi, M., Safaei, B., Zeeshan, Q., Asmael, M., Eyvazian, A., & Qin, Z. (2020). Recent developments in Luffa natural fiber composites: Review. *Sustainability (Switzerland)*, *12*(18), 1–25. https://doi.org/10.3390/su12187683

Alsuwait, R. B., Souiyah, M., Momohjimoh, I., Ganiyu, S. A., & Bakare, A. O. (2023). Recent Development in the Processing, Properties, and Applications of Epoxy-Based Natural Fiber Polymer Biocomposites. *Polymers*, *15*(1). https://doi.org/10.3390/polym15010145

Bosák, L., & Palko, M. (2019). Wall Panel Made of Bio-composites. *MATEC Web of Conferences*, *279*, 02010. https://doi.org/10.1051/matecconf/201927902010

Chandra BhaskarBhaskar Chandra KandpalBhaskar Chandra KandpalRakesh ChaurasiaVishal Khurana. (2015). (7) (PDF) Recent Advances in Green Composites – A Review. *International Journal For Technological Research In Engineering (IJTRE)*, *2*(April), 1–7.

Chen, Y., Su, N., Zhang, K., Zhu, S., Zhu, Z., Qin, W., Yang, Y., Shi, Y., Fan, S., Wang, Z., & Guo, Y. (2018). Effect of fiber surface treatment on structure, moisture absorption and mechanical properties of luffa sponge fiber bundles. *Industrial Crops and Products*, *123*(June), 341–352. https://doi.org/10.1016/j.indcrop.2018.06.079

Daniel-Mkpume, C. C., Ugochukwu, C., Okonkwo, E. G., Fayomi, O. S. I., & Obiorah, S. M. (2019). Effect of Luffa cylindrica fiber and particulate on the mechanical properties of epoxy. *International Journal of Advanced Manufacturing Technology*, *102*(9–12), 3439–3444. https://doi.org/10.1007/s00170-019-03422-w

Drumright, R. E., Gruber, P. R., & Henton, D. E. (2000). Polylactic acid technology. In *Advanced Materials* (Vol. 12, Issue 23). https://doi.org/10.1002/1521-4095(200012)12:23<1841::AID-ADMA1841>3.0.CO;2-E

et al., 2005 Mohanty. (2016). 事業所における定期健康診断受診者の 健康習慣実行度とストレス反応の因子構造－健康習慣指数と職業性ストレス反応の主成分分析を試みて－ 田甫久美子View metadata, citation and similar papers at core.ac.uk. *PENGARUH PENGGUNAAN PASTA LABU KUNING (Cucurbita Moschata) UNTUK*

SUBSTITUSI TEPUNG TERIGU DENGAN PENAMBAHAN TEPUNG ANGKAK DALAM PEMBUATAN MIE KERING, *15*(1), 165–175.

Garlotta, D. (2001). A literature review of poly(lactic acid). *Journal of Polymers and the Environment*, *9*(2), 63–84.

Gottfridsson, M., & Zhang, Y. (2015). *Environmental impacts of shoe consumption*. 96.

Jawaid, M., & Composites, F. (2019). *Acoustic and mechanical properties of luffa fiber-reinforced biocomposites This is a post-refereeing final draft . When citing , please refer to the published version : mechanical properties of luffa fiber-reinforced Mohamed Thariq , Naheed Saba , In Wood*. 325–341.

Kamran, M. J., Jayamani, E., Heng, S. K., Wong, Y. C., Rahman, M. R., Al-Bogami, A. S., Huda, D., Bakri, M. K. Bin, & Rahman, M. M. (2022). Characterization and Comparative Study on Chemically Treated Luffa Fiber as Reinforcement for Polylactic Acid Bio-composites. In *BioResources* (Vol. 17, Issue 2, pp. 2576–2597). https://doi.org/10.15376/biores.17.2.2576-2597

Li G., Zhao, M., Xu F., Yang B., Li X., Meng X., & Teng L. (2020). Synthesis and Biological Application of. *Molecules*, *25*(5023), 1–18.

Lopes, M. S., Jardini, A. L., & Filho, R. M. (2014). Synthesis and characterizations of poly (lactic acid) by ring-opening polymerization for biomedical applications. *Chemical Engineering Transactions*, *38*, 331–336. https://doi.org/10.3303/CET1438056

Maneschi, K., & Melhado, S. (2010). Scope of design for production of partition walls and facade coverings. *Architectural Engineering and Design Management*, *6*(1), 3–17. https://doi.org/10.3763/aedm.2009.0098

Mateus, R., Neiva, S., Bragança, L., Mendonça, P., & Macieira, M. (2013). Sustainability assessment of an innovative lightweight building technology for partition walls - Comparison with conventional technologies. *Building and Environment*, *67*, 147–159. https://doi.org/10.1016/j.buildenv.2013.05.012

Mowafi, S., Taleb, M. A., & Industries, T. (2018). *Utilization of Proteinic Biopolymers: Current Status and Future Prospects*. *15*. https://doi.org/10.21608/JTCPS.2018.5007.1002

Pang, X., Zhuang, X., Tang, Z., & Chen, X. (2010). Polylactic acid (PLA): Research, development and industrialization. *Biotechnology Journal*, *5*(11), 1125–1136. https://doi.org/10.1002/biot.201000135

Partap, S., Kumar, A., Sharma, K., & Jha, K. K. (2012). Luffa Cylindrica : An important medicinal plant. *J. Nat. Prod. Plant Resour*, *2012*(1), 127–134.

Puri, V., Chakrabortty, P., Anand, S., & Majumdar, S. (2017). Bamboo reinforced prefabricated wall panels for low cost housing. *Journal of Building Engineering*, *9*, 52–59. https://doi.org/10.1016/j.jobe.2016.11.010

Ranakoti, L., Gangil, B., Misha, S. K., Singh, T., Sharma, S., A., I. R., & El-khatib, S. (2022). Critical Review on Polylactic Acid : Properties , Structure ,. *Materials*, *15*(4312), 1–29.

Randall, J. (2022). *Polylactic Acid Technology* (Issue April 2005). https://doi.org/10.1201/9780203508206.ch16

Robert, B., & Brown, E. B. (2004). *No 主観的健康感を中心とした在宅高齢者における健康関連指標に関する共分散構造分析Title*. *1*, 1–14.

Sengupta, A., Pattnaik, S., & Sutar, M. K. (2017). *Biocomposites : An Overview*. *4*(8), 648–653.

Shukla, P. (2022). *Biocomposites : Fabrication , Properties , and Applications – A Review , Biocomposites : Fabrication , Properties , and Applications – A Review ,. October 2014*.

Vasconcelos, G., Lourenço, P. B., Mendonça, P., Camões, A., Mateus, R., Bragança, L., Brito, A. G., & Poletti, E. (2013). Proposal of an innovative solution for partition walls: Mechanical, thermal and acoustic validation. *Construction and Building Materials*, *48*, 961–979. https://doi.org/10.1016/j.conbuildmat.2013.07.079

Wei, L., & McDonald, A. G. (2016). A review on grafting of biofibers for biocomposites. *Materials*, *9*(4). https://doi.org/10.3390/ma9040303

Zahid Rayaz Khan, M., & Srivastava, S. K. (2018). Development, Characterization and Application Potential of Bio-composites: A Review. *IOP Conference Series: Materials Science and Engineering*, *404*(1). https://doi.org/10.1088/1757-899X/404/1/012028

Zaman, H. U., Song, J. C., Park, L., Kang, I., Park, S., Kwak, G., Park, B., & Yoon, K. (2011). *Poly (lactic acid) blends with desired end-use properties by addition of thermoplastic polyester elastomer*. 187–198. https://doi.org/10.1007/s00289-011-0448-5