BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF TEXTILE AND GINNING ENGINEERING

FINAL YEAR PROJECT REPORT.

IMPROVING ELECTRICITY FROM SILK COCOONS THROUGH FEEDING SILKWORMS WITH SILVER NANOPARTICLES.

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A final year project report submitted in the partial fulfillment the requirements for the award of the BSc. In Textile engineering of Busitema University.

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DECLARATION

I NAMBAJJWE CHRISTINE Reg no BU/UG/2015/82 hereby declare that this project research is my original work and that the information contained in this project is out of my hard work and research, except where explicit citation has been made and it has not been presented to any institution of higher learning for any academic award.

Signature .....

Date 06:06:2019.....

APPROVAL

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

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DEDICATION

I would like to dedicate this report to my beloved family especially my mum and dad, Mr. and Mrs. Kiwanuka and my friends for their support in my journey to success. After all, we have dreams, but in order to make dreams into reality, it takes an awful lot of determination, dedication, self-discipline and effort.

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ABSTRACT

Silk Cocoon Membrane (SCM), a complex natural protein fibrous membrane is gaining significant attention in the textile industry, biomedical industry and the research society due its outstanding properties and ecological friendliness. The possibility of obtaining electricity from the SCM attracts particular interest. Silver nanoparticles are widely used for antimicrobial and electrical applications due to their improved antimicrobial activity and good electrical conductivity. Nevertheless, several toxological studies have indicated that they are potentially hazardous to human health and the environment as well, therefore, the need to use them with great attention. In this work, we report improved electrical properties of SCM through in vivo addition of silver nanoparticles to the silkworm. After feeding silkworm larvae with different concentrations of nanoparticles, we evaluated the changes in survival rates, performance of the larva and cocoon weights and we found that AgNP's though increase cocoon weights, have some lethal effects on silk worms as well as affecting normal body performance of the silk worm larva. An analysis of the thermal electric properties of the SCM fed on AgNP's under different conditions of temperature and humidity revealed that addition of silver nanoparticles to silkworm larvae through traditional functionalization approach can result into increase in electricity obtained from the SCM. Therefore, the successful generation of silver nanoparticle cocoons by in vivo feeding is expected to open up possibilities for the large-scale production of electricity from the silk cocoon membrane.

Keywords: Silk Cocoon Membrane (SCM), Silver nanoparticles (AgNP's), Electricity.

LIST OF ACRONYMS

SCM – Silk Cocoon membrane(s).

AgNP's – Silver nanoparticles

TiO_2 NP's – Titanium dioxide nanoparticles.

NMR- Nuclear Magnetic Resonance.

FTIR- Fourier Transform InfraRed Spectroscopy

EDX- Energy Dispersive X-ray Spectroscopy

B. mori- Bombyx mori

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CHAPTER ONE.

This chapter outlines the relevant information about the project, problem statement, justification, objectives of the study, significance and scope of the study.

1.1 BACKGROUND.

Natural biomaterials have received extensive research interests owing to their superior properties and ecological friendliness. In particular, silk cocoon membrane, a natural protein biological material has gained significant attention from the textile industry(Pan et al. 2012), biomedical industry(Scheibel et al. 2010), basis for research in future material design(Tansil et al. 2011) and other aspects of technology due to its good properties.(Morse et al. 2013).

Silk cocoon membrane (SCM), a fibrous protein membranous shell, acts as a protective enclosure ensuring effective metamorphosis of the silkworm pupae to silk moth and it offers protection for the dormant pupae against predators, offers photo protection(Kaur et al. 2013), and carbon dioxide gating(Roy et al. 2012), which are necessary for the growth, and survival of the developing pupae. Further, the nervous organization of the dormant pupae is governed by environmental influences and senses environmental changes by capturing the incident light as well as translating the variation in temperature and humidity and converting it into electrical signals(Tulachan et al. 2016). In particular, B. mori is the most commercially domestic exploited species due to cannibalistic natural instincts of other species especially spiders(Wang et al. 2016).

To enhance silk performance, various approaches have been undertaken intending to improve silk properties and extend its functionalities for various applications. These approaches include post functionalization processes and traditional functionalization method. Post functionalization methods include regenerating of silk fibroin through wet or dry spinning methods which are costly and employ toxic chemicals and multi complex procedures(Liu et al. 2015). Traditional functionalization approach entails direct feeding of silkworms with mulberry leaves accompanied with various supplements. It is an easy and green method which has been adopted to produce modified silks and in particular inorganic nanoparticles have been added to mulberry leaves to produce silk with special features for example, TiO_2 NP's for UV resistant silks(Cai et

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