

**FACULTY OF ENGINEERING**  
**DEPARTMENT OF POLYMER, TEXTILE, GINNING, AND INDUSTRIAL ENGINEERING**  
**FINAL YEAR PROJECT REPORT.**

**DEVELOPMENT OF SUSTAINABLE SMART FOOD PACKAGING FILMS BASED ON AN  
ANTHOCYANIN BLEND AND PALM KERNEL OIL.**

**By:**

**KAJUMBA ANNET**

**REGISTRATION NO: BU/UG/2017/21**

**Email: [annetkajumba2014@gmail.com](mailto:annetkajumba2014@gmail.com)**

**Tel: 0788885621/0702355828**

**MAIN SUPERVISOR: Associate Professor Samson Rwahwire**

**CO. SUPERVISOR: Mr. Vincent Muwulya**

A final year project report submitted as a partial fulfillment for the award of a bachelor of science in polymer, textile, and industrial engineering.

**February 2022**

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## ABSTRACT

There is an increasing demand for sustainable smart packaging technologies to reduce food poisoning and unnecessary food wastage, monitor the quality status of food, and enhance the shelf life of the food throughout its distribution. This study aimed to develop sustainable smart food packaging films based on polyvinyl alcohol (PVA), Chitosan (C), palm kernel oil, and anthocyanin blend extract by solvent casting technique. The structural, physical and functional properties of anthocyanin blend films were compared with those of single and mixed anthocyanin films. The results present in this study reveal that sustainable smart films based on natural extracts and biodegradable polymers were developed. The results also revealed that 7-100% PVA, 5-12% STTP, 5-20% Palm kernel oil, 5-15% glycerol, and 30-45% anthocyanin can be the best proportions to prepare better films. Anthocyanins from a blend gave obvious color changes and had increased color intensity. Furthermore, the smart films also had good response to pH variations due to pH changes thus can be used in monitoring and displaying information on the quality and freshness of food products like meat, fish, and milk. In addition, they can be used in maintaining the quality and freshness of meat products. The interaction between the anthocyanin blend extracts and biopolymers reduced the mechanical properties and thermal stability of the films and increased the color stability of the films. Future developments can be investigation of films' response in various temperatures as well as the study of the mechanical and thermal properties of the films. More research should be done on blending of different types of anthocyanin sources like flowers (butterfly peas, rose), fruits (mulberry, strawberry), leaves (red cabbage) and others to increase the color intensity in these films.

## **DECLARATION**

I **KAJUMBA ANNET** Reg. No. **BU/UG/2017/21** hereby declare that this project work is my original work and that the information contained in this project work 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:** .....

## **APPROVAL**

This project entitled “Development of sustainable smart food packaging films based on palm kernel oil, and an anthocyanin blend has been written under the supervision of;

### **Main supervisor**

Associate Professor Samson Rwahwire

Signature: .....

Date: .....

### **Co. Supervisor**

Mr. Vincent Muwulya

Signature: .....

Date: .....

## DEDICATION

I dedicate this report to my lecturers, friends and family.

## ACKNOWLEDGEMENT

I would love to extend my gratitude to a number of people whose efforts and financial support have managed me to progress and put a landmark in my education.

First and foremost, I would like to thank the Almighty God for giving me the strength to carry on with my final year project.

Sincere thanks go out to Busitema University, department of polymer, textile, ginning, and industrial engineering and most importantly my supervisors Dr. Samson Rwahwire and Mr. Vincent Muwulya for the great work done (guidance and consultations).

I also acknowledge the financial support of the Royal Academy of Engineering Grant through Uganda Institution of Professional Engineers and further grateful to my family, friends, and well-wishers for all the financial, moral, spiritual, and physical support.

Lastly, to all my course mates with whom I study with at Busitema University, thank you for the team cooperation.

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## LIST OF ABBREVIATIONS

UIPE	Uganda Institution of Professional Engineers
SDG	Sustainable Development Goal
NDP	National Development Plan
UIRI	Uganda Industrial Research Institute
UNEB	Uganda National Examination Board
HCl	Hydrochloric acid
NaOH	Sodium hydroxide
$C_3H_8O_3$	Glycerol
FTIR	Fourier Transform Infrared Spectrometry
SEM	Scanning Electron Microscopy
TGA	
ABE Extract	Red cabbage and eggplant Anthocyanin Blend
MSE	Mixed Single anthocyanin Extract
RCE	Red cabbage anthocyanin Extract
EPE	Eggplant anthocyanin Extract
PKO	Palm Kernel Oil