

**INVESTIGATION OF SUITABLE METHODS TO  
EXTRACT THE FIBRES AND OPTIMIZATION OF  
TREATMENT METHODS FOR SRI LANKAN BANANA  
CULTIVARS FOR TEXTILE MATERIAL**

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Degree of Master of Philosophy

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Sri Lanka

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Thesis/Dissertation submitted in partial fulfilment of the requirements for  
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University of Moratuwa  
Sri Lanka

March 2021

## DECLARATION

I declare that Master of Philosophy thesis entitled “Investigation of suitable methods to extract the fibres and optimization of treatment methods for Sri lankan banana cultivars for textile material” is my original work and contains no material that has been previously submitted, in whole or in part, for the award of any other academic Degree or Diploma in any other University or institute of higher learning except where the acknowledgement is made in the text.

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Date: .....

The above candidate has carried out research for the MPhil Dissertation under my supervision.

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Date: .....

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Prof. U.G.S. Wijayapala

Date: .....

## ABSTRACT

The banana pseudostem is an ideal source of natural cellulose substitute fibre. This thesis investigates the effects of banana fibre extraction and treatment parameters on fibre fineness, and establishes suitable methods to reduce the fineness that enable the usage of banana fibres as textile materials. Ten popular Sri Lankan varieties of banana pseudostem were selected for this study. Among the fibre fineness of the mechanically extracted banana fibre of the ten varieties, Ambun (genome AAA) middle layers of the pseudostem was selected for further analysis since it gives the lowest fineness. Enzyme and chemical treatments were ministered to the mechanically extracted fibre of the middle layers of the pseudostem. The diameter of the scanning electron microscope and fibre linear density were used to observe and determine the fineness of the biologically and chemically extracted fibres and enzymes from the chemically treated banana fibres. This demonstrated that fibres treated with a combination of enzymes and chemicals to be the finest. Furthermore, it was discovered that due to this combined treatment of enzymes and chemicals (5% Enzyme and 6% H<sub>2</sub>O<sub>2</sub>, 2% Na<sub>2</sub>SiO<sub>3</sub>, 3% NaOH) treated banana fibres achieved fibre linear density of 4 tex. The diameter of the fibre was reduced from 168.4µm to 48.8µm, which is a 71% reduction compared to the diameter of the mechanically extracted fibre. All the experiments conducted on the reflectance curves of dyed banana fibres found that the dye absorption tendency of pre-treated banana fibres and its dyeing behaviours to be similar to that of cotton. This leads the current study to posit that the process of dyeing cotton can be used to dye banana fibres as well. The outcome of this research is to help those working in the apparel industry to select Sri Lankan banana fibres based on strength and fineness suitable for their textile products.

**Keywords:** *Pseudostem, Natural fibre, Banana fibre, Mechanical extraction, Biological and Chemical treatments, and dyeing*

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## **LIST OF ABBREVIATIONS**

AATCC	- American Association of Textile Chemists and Colourists
ASTM	- American Society for Testing and Materials
CIE	- International Commission on Illumination
DCS	- Department of Census and Statistics
GDP	- Gross Domestic Product
FTIR	- Fourier-transform infrared spectroscopy
IBPGR	- International Board for Plant Genetic Resources
ISO	- International Organization for Standardization
SEM	- Scanning electron microscope
JIS	- Japan Industrial Standards