DEVELOPING WOUND DRESSING FROM BACTERIAL CELLULOSE

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Degree Master of Science

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Abstract

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Cellulose produced by bacterium *Acetobacter xylinum* has unique properties including high mechanical strength, high water absorption capacity and highly pure fiber network structure. These properties have enabled bacterial cellulose to be used in applications such as Nata de Coco, enzyme immobilization, artificial skin and wound dressings.

The objective of this project was to investigate the production and properties of bacterial cellulose as appropriate for wound dressings using coconut water as the main substrate medium. Preliminary focus of the research was to identify and isolate *Acetobactor xylinium* from a kombucha mixed culture. Bacterial cellulose pellicles were prepared by static fermentation of *Acetobacter xylinum* containing culture in coconut water while supplementing with glucose and $(NH_4)_2H_2PO_4$ at an initial pH of of 4.3.

Properties of resulting bacterial cellulose pellicles were investigated for its strength, structure and permeability characteristics. The average thickness of each pellicle was 3 mm in wet form and 0.25 mm after oven drying. Young's modulus was in the range of 1 - 3 G Pa up to 15% moisture content. Fourier Transform \infrared spectroscopy (FTIR) on oven dried bacterial cellulose were very much similar to commercial products of bacterial cellulose wound dressings. Water vapor transmission rate (WVTR) through the dressing was in the range of 5-15 (g/hr^{-1} m^{-2}) while increasing the moisture content decreased the WVTR. These investigations proved that there is an optimum moisture content of 15% that gives the most appropriate properties for a wound dressing.

Further the wound dressings that were prepared and packed in sterile conditions were applied on selected patients. The results showed that dry dressings were more appropriate than wet dressings. However, dry dressings lose their strength when reabsorbing moisture.

In conclusion, it could be said preliminary research showed coconut water can be used in preparation of bacterial cellulose as wound dressing since it has suitable characteristics. However, further research is required to find the variation of properties with moisture content and re-absorption characteristics of bacterial cellulose.

Key words: bacterial cellulose, *Acetobacter xylinum*, coconut water, wound dressing

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LIST OF ABBREVIATIONS

Abbreviation	Description
BC	Bacterial cellulose
BHI	Brain Heart Infusion
CS	citrate synthase
FTIR	Fourier Transform Infrared Spectroscopy
GK	Glucokinase
G Pa	Giga Pascal
IR	infrared
M Pa	Mega Pascal
PGA	phosphoglycerate
PGM	phosphoglucomutase
RBC	Rotating Biological Contactor
SEM	Scanning Electron microscopy
UDPGlc	uridine diphosphoglucose
WVTR	Water Vapor Transmission Rate