DEVELOPING WOUND DRESSING FROM BACTERIAL CELLULOSE

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Degree Master of Science

Department of Chemical and Process Engineering

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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 (NH₄)₂H₂PO₄ at an initial pH 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 re-absorbing 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
Acknowledgement

I am very much grateful to Dr. Marliya Ismail, Senior Lecturer, Department of Chemical and Process Engineering, University of Moratuwa for being the main supervisor of this research project.

I am also grateful to Dr Terrence Rohan Chinniah, Senior Lecturer, Department of Microbiology, Faculty of Medicine, University of Colombo, Prof. Mandika Wijeyerathne, Professor, Department of Surgery, Faculty of Medicine, University of Colombo and Prof. Ajith de Alwis, Professor, Department of Chemical and Process Engineering, University of Moratuwa for being co supervisors of this project.

I am thankful to Dr. Marliya Ismail for giving me the moral support and guidance throughout this research work and Dr Terrence Rohan Chinniah for his invaluable advice and training in the microbiological aspects of this project. I am also grateful to Prof. Mandika Wijeyeratne for giving me the opportunity to get clinical exposure without any hesitation while Prof. Ajith de Alwis for giving me words of encouragement along the way.

I owe a word of thanks to Staff Technical Officers, Mrs. Jayanthi Maskorala, Mrs. Renuka Jayalatherachchi and Technical Officers, Mrs. D.L.C. Priyantha Seneviratne and all the staff members of the Microbiology Lab of Medical Faculty of Colombo University for their fullest support in conducting microbial isolation part of the project.

I wish to express my gratitude to Technical Officer, Mrs. I.K Athukorala and Senior Staff Technical Officer Ms. A.S Wahalathanthri and all the other Technical officers and lab assistants of Department of Chemical and Process Engineering, University of Moratuwa for their assistance in carrying out experiments for developing the wound dressing.

I wish to thank to Mr. Bandusena Samarasekera, Senior Lecturer, Department of Material Science and Engineering, University of Moratuwa for facilitating me in obtaining FTIR spectroscopy measurements.
My heartiest thanks will also go to my parents, husband, siblings, all my family members and friends who always gave courage and made persistent confidence in me throughout the completion of this project.

This M.Sc. thesis was supported by University of Moratuwa Senate Research Grant Number SRC/LT/2009/38.

Finally, I would appreciate everybody, who helped me in numerous ways in different stages of the project, which was of utmost importance in bringing out this effort a success.
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<tr>
<td>BC</td>
<td>Bacterial cellulose</td>
</tr>
<tr>
<td>BHI</td>
<td>Brain Heart Infusion</td>
</tr>
<tr>
<td>CS</td>
<td>citrate synthase</td>
</tr>
<tr>
<td>FTIR</td>
<td>Fourier Transform Infrared Spectroscopy</td>
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<tr>
<td>GK</td>
<td>Glucokinase</td>
</tr>
<tr>
<td>G Pa</td>
<td>Giga Pascal</td>
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<tr>
<td>IR</td>
<td>infrared</td>
</tr>
<tr>
<td>M Pa</td>
<td>Mega Pascal</td>
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<td>PGA</td>
<td>phosphoglycerate</td>
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<td>PGM</td>
<td>phosphoglucomutase</td>
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<tr>
<td>RBC</td>
<td>Rotating Biological Contactor</td>
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<tr>
<td>SEM</td>
<td>Scanning Electron microscopy</td>
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<tr>
<td>UDPGlc</td>
<td>uridine diphosphoglucose</td>
</tr>
<tr>
<td>WVTR</td>
<td>Water Vapor Transmission Rate</td>
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