



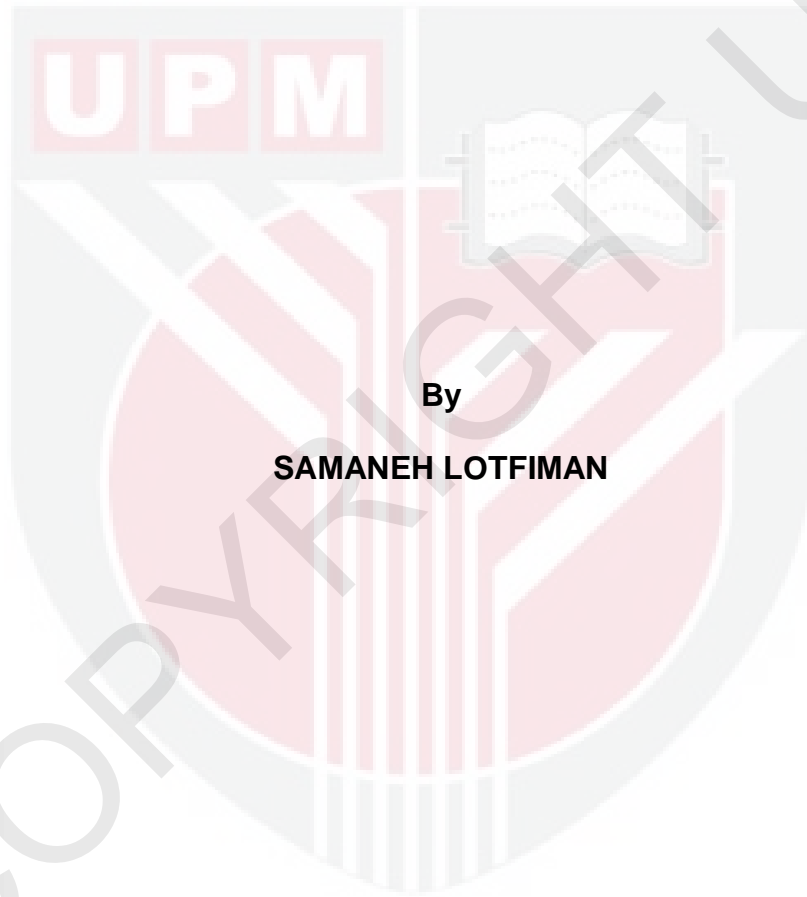
UNIVERSITI PUTRA MALAYSIA

***BACTERIAL CELLULOSE PRODUCTION FROM EXTRACTED
DATE SYRUP***

SAMANEH LOTFIMAN

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**BACTERIAL CELLULOSE PRODUCTION FROM EXTRACTED DATE
SYRUP**

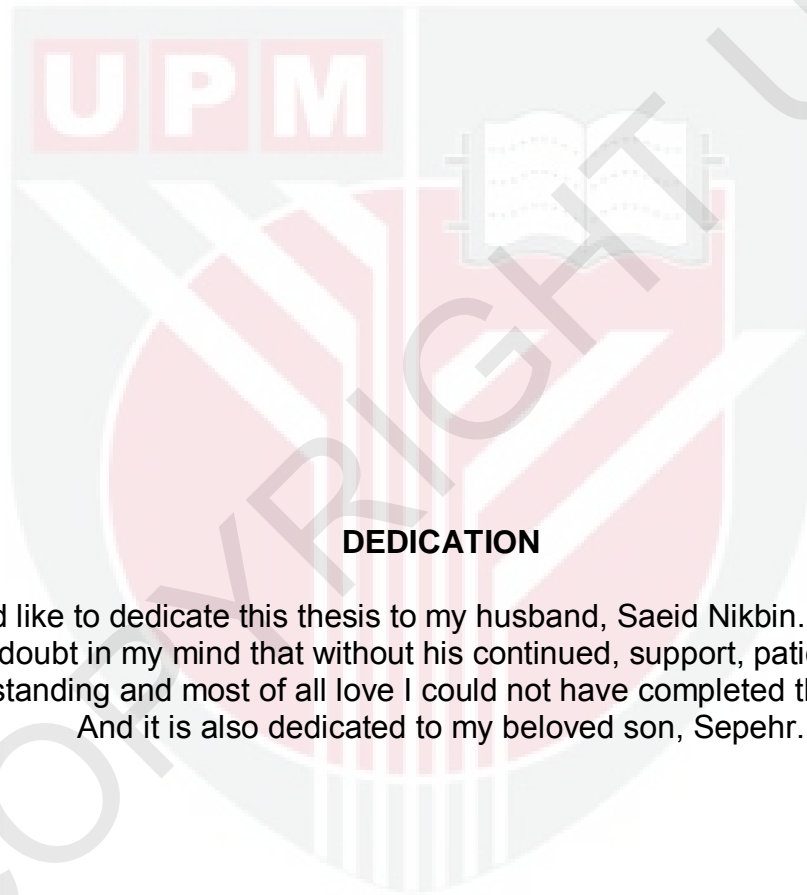


By

SAMANEH LOTFIMAN

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfilment of the Requirements for the Degree of Master of Science
November 2010**

“There does not exist a category of science to which one can give the name applied science. There are science and the applications of science, bound together as the fruit of the tree which bears it”



DEDICATION

I would like to dedicate this thesis to my husband, Saeid Nikbin. There is no doubt in my mind that without his continued, support, patience, understanding and most of all love I could not have completed this process. And it is also dedicated to my beloved son, Sepehr.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

BACTERIAL CELLULOSE PRODUCTION FROM EXTRACTED DATE SYRUP

By

SAMANEH LOTFIMAN

November 2010

Chairman: Dayang Radiah Awang Biak, PhD

Faculty : Engineering

Bacterial cellulose (BC) is used in various industries such as food, paper, electronic and biomedical. However, the current productivity is still very low. Therefore, it is imperative to seek for BC production by utilizing other sources.

Therefore, the main objectives of this work were (i) to quantify and characterized sugars from date using various extraction methods, (ii) to optimize bacterial cellulose production using the extracted sugars as substrate, (iii) to characterize and quantify bacterial cellulose production from the various extraction methods used.

It is predicted that replacing glucose in Hestrin and Schramm medium with extracted date syrup will alter the specific properties of the BC produced. To achieve these objectives, different sugar extraction methods were compared, namely stirred and ultrasonic-assisted water extraction, and solvent extraction using 50% ethanol and 80% methanol as solvents.

The results of the work showed that sugar extraction from date by water with ultrasonic assisted, extracted the highest amount of total sugar (79%). The amount of extracted total sugar via water (stirring), ethanol and methanol were 71%, 67% and 57% respectively. Furthermore, the results revealed that BC was formed in the medium where date syrup was used as a carbon source.

The enriched medium utilizing extracted syrup produced from 30 g dry date/l via ultrasonic assisted water extraction method was able to produce 186% BC more than that produced in Hestrin and Schramm medium. SEM analysis of the BCs showed fine nanofibers (60-90 nm) and smooth surface. The presence of C=O amid bond and one of collagen features, in the BC exhibited by FTIR demonstrated that the BC produced in the enriched medium has the potential to be used in medical application, *i.e.* wound dressing. The BC mechanical tests results revealed considerable improvement in the Young Modulus, tensile stress and elongation at break

values over the BC formed in the Hestrin and Schramm medium, namely; 29-80%, 50-140% and 33-119% respectively.

To conclude, this work has successfully achieved the outlined objectives. The properties of the BC characterized illustrated that BC can be re-engineered by using date fruit as a carbon source; this has created a more promising future for BC especially in medical applications.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

**PENGHASILAN SELULOSA BAKTERIA DARIPADA EKSTRAK PATI
KURMA**

Oleh

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Selulosa bakteria (SB) digunakan dalam pelbagai industri seperti makanan, kertas, elektronik dan bioperubatan. Namun, produktiviti pada masa kini masih sangat rendah. Oleh kerana itu, adalah sangat penting untuk mencari pengeluaran SB dengan memanfaatkan sumber karbon lain.

Oleh kerana itu, tujuan utama kajian ini adalah (i) untuk mengukur dan mencirikan jenis gula dan kurma dengan menggunakan pelbagai kaedah ekstrak, (ii) untuk mengoptimumkan pengeluaran selulosa bakteria menggunakan gula yang diekstrak sebagai substrat dan, (iii) mencirikan dan mengukur pengeluaran selulosa bakteria daripada pelbagai kaedah ekstrak yang digunakan.

Adalah dijangka, dengan menggantikan glukosa dalam media Hestrin dan Schramm dengan sirap kurma akan mengubah sifat khusus SB yang dihasilkan. Untuk mencapai tujuan tersebut, kaedah ekstrak gula yang berbeza dibandingkan, iaitu ekstrak air menggunakan pengaduk daw berbantu ultrasonik dan ekstrak pelarut dengan menggunakan 50% pelarut etanol dan 80% pelarut metanol.

Hasil kerja menunjukkan bahawa ekstrak gula dari kurma menggunakan air berbantu ultrasonik dapat mengekstrak jumlah gula tertinggi (79%). Jumlah gula keseluruhan dihasilkan melalui air (secaro aduk), etanol dan metanol adalah masing-masing 71%, 67% dan 57%. Selanjutnya, hasil menunjukkan bahawa SB dapat dihasilkan di dalam media yang mengandungi sirap kurma sebagai sumber karbon.

Media yang diperkaya menggunakan pati ekstrak yang dihasilkan daripada 30 g kurma kering / l melalui kaedah ekstrak air berbantu ultrasonik mampu menghasilkan 186% SB lebih daripada yang dihasilkan oleh media Hestrin dan Schramm. Analisis SEM menunjukkan SB mempunyai gentian nano halus (60-90 nm) permukaan licin. Kehadiran ikatan C=O amid, salah satu sifat kolagen, dalam SB yang ditunjukkan oleh FTIR menunjukkan bahawa SB yang dihasilkan dalam media yang diperkaya mempunyai potensi untuk digunakan dalam aplikasi perubatan, iaitu pembalut luka. Ujian mekanikal SB menunjukkan peningkatan yang cukup besar untuk nilai Modulus

Young, tegasan tegangan dan nilai putus pemanjangan untuk SB yang dihasilkan dalam kajian ini berbanding SB yang dihasilkan dalam media Hestrin dan Schramm, iaitu; 29-80%; 50-140% dan 33-119% masing-masing.

Kesimpulannya, hasil kerja ini telah berjaya mencapai tujuan yang digariskan. Sifat-sifat SB yang dicirikan mengilustrasikan bahawa SB boleh direkhasil lagi dengan menggunakan buah kurma sebagai sumber karbon, ini lebih menjanjikan masa depan yang lebih baik untuk SB terutama dalam aplikasi perubatan.

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I'll always cherish the friendship and help of my close friend; Eng. Ms, Shohre Kianfar.

I would also like to thank my beloved husband for providing so many opportunities for me. He has strengthened me during the times when I thought I could go no further. Without him, none of this would have been possible. I also very thank my Heavenly Father and Mother who taught me that even the largest task can be accomplished if it is done one step at a time.



I certify that an Examination Committee met on 30th November 2010 to conduct the final examination of Samaneh Lotfiman on her Master of Science thesis entitled “Production of Bacterial Cellulose by Acetobacter Xylinum using Date Syrup Extract Enriched Medium” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the Master of Science degree. Member of the Examination Committee are as follows:

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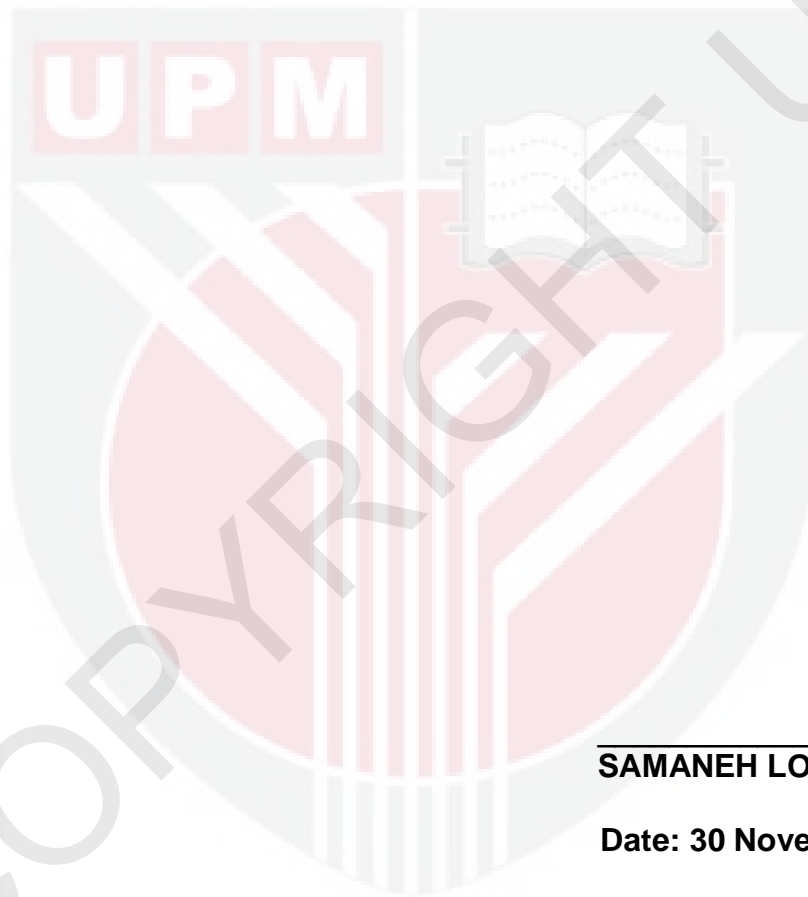
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DECLARATION

I declare that the thesis is my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously, and is not currently, submitted for any other degree at Universiti Putra Malaysia or other institutions.



SAMANEH LOTFIMAN

Date: 30 November 2010

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