PREPARATION AND CHARACTERIZATION OF BIODEGRADABLE FILMS FROM SAGO STARCH AND CHITOSAN BLENDS

By

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

2004
DEDICATION

To my beloved parents (Father and Mother) whose patience, support and companionship have facilitated my study, and made my life enjoyable.

To my grateful brother (Mazin) for his love, and encouragement.

To my patient and bleeding country (Iraq), May Allah grants you peace.
Several blends were prepared based on sago starch, chitosan in the presence of glycerol as a plasticizer using a solvent casting technique. The blends and their performance films were characterised by Fourier transform infrared analysis (FTIR), differential scanning calorimetry (DSC), scanning electron microscopy (SEM), and oxygen permeability test.

The blended films were flexible and homogeneous on microscopic scale. The FTIR spectra showed that the interaction of the blend component was only a physical interaction and there was no new bond formed in the blends. DSC was used to study the glass transition temperatures of sago starch and chitosan blend films. DSC experiment provides further evidence of physical interaction.

Biodegradability study of the films was carried out using “soil burial” method. The biodegradation rate of starch-based films was found to be dependent mainly on the amount of starch incorporated in the film, while increasing chitosan composition increased its anti microbial property.
Higher starch concentration and higher plasticization degree increased the permanence of starch phase significantly and enhance the rate of weight loss. Holes were detected on the surface of the films as a consequence of starch consumption by microorganisms.

The oxygen gas permeability of sago starch, chitosan, and their blend films was examined using the permeability console and permeability cell apparatus. The results indicated that both sago starch and chitosan films have low oxygen permeability. However, it was found that the oxygen gas permeability coefficient values were increased at higher temperature. Film of chitosan showed highest permeability than the other films in blending. It was observed that oxygen gas permeability coefficient values of the film blends increased with increasing glycerol content.
Beberapa adunan berasaskan kanji daripada sagu, kitosan dengan kehadiran gliserol sebagai pemplastik disediakan dengan menggunakan kaedah pengadunan larutan. Pencirian adunan dan prestasi filemnya diuji dengan menggunakan analisis infra merah Fourier (FTIR), kalorimetri imbasan pembezaan (DSC), mikroskop pengimbasan elektron (SEM) dan pengujian kebolehtelapan oksigen.

Filem adunan adalah boleh lentur dan homogen pada skala mikroskopik. Spektra FTIR menunjukkan interaksi bagi komponen adunan adalah secara fizikal dan tiada sebarang ikatan baru terbentuk di dalam adunan. DSC digunakan bagi mengkaji suhu peralihan kaca bagi filem adunan kanji sagu dan kitosan. DSC menunjukkan hanya ada interaksi fizikal.

Kajian biodegradasi bagi filem dijalankan dengan menggunakan kaedah timbus tanah. Kadar biodegradasi bagi filem berasaskan kanji bergantung kepada amaun kanji di dalam filem. Kandungan kanji yang tinggi dan darjah pemplastikan yang
tinggi telah meningkatkan pengekalan bagi fasa kanji, meningkatkan kadar kehilangan berat. Kawah biodegradesi telah dikesan pada permukaan filem disebabkan oleh penggunaan kanji oleh mikroorganisma.

Kajian ketelusan gas oksigen bagi filem-filem kanji sagu, kitosan dan adunan daripada kedua-duanya dilaksanakan dengan menggunakan peralatan panel penelusan dan sel penelusan. Filem bagi kanji dan kitosan mempunyai penelusan oksigen yang rendah, dan pekali penelusan oksigen meningkat apabila suhu ditingkatkan. Filem kitosan menunjukkan penelusan yang tertinggi berbanding lain-lain filem adunan. Filem adunan kanji dan kitosan menunjukkan peningkatan nilai pekali penelusan gas dengan meningkatnya kandungan gliserol.
ACKNOWLEDGEMENTS

Alhamdulillah, under the graceful blessing of the Loving God, the unending love of my parents, my brother, lecturers and friends, this thesis has been successfully completed. I would like to take this opportunity to thank a group of people who have given me the greatest support during my master’s study at the University Putra Malaysia. I extend my sincere gratitude with most grateful and appreciation to the chairman of my supervisory committee, Assoc. Prof. Dr. Mohamad Zaki Ab. Rahman for giving me an opportunity to pursue a master’s degree. Many times, his patience and constant encouragement has steered me to the right direction with much advice throughout my study.

I am also pleased to thank to my co-supervisor Assoc. Prof. Dr. Mansor Ahmad, and Assoc. Prof. Dr. Abdul Amir H. Kadhum for their invaluable guidance, comments and careful review throughout my research work. Also I wish to take this opportunity to express my heartfelt appreciation to my co-supervisor Prof. Dr. Wan Md. Zin Wan Yunus who has taken time to look at the various stage of my study in spite of his very busy schedule as a Dean of Faculty.

I am very much appreciative of the assistance given to me by the all staff member of Chemistry Department especially Mr. Nordin Ismail, Mrs. Rusnani Aminuddin, Mr. Mat Kamal Margona, Mr. Zulhisham Razali, Mr. Abas, and Mr. Nazri.
I would also like to acknowledge all graduate students in the Polymer Group, Chemistry Department (UPM), especially to Dedy Suhendra, H.N.M. Ekramul Mahmud, Faraj Abu Ilaiwi, Muhammad Khawaldeh, Sonny Widiarto, Yehya Muneeb, Lim Chee Siong, Mrs. Nor Azowa Ibrahim, and Muhammad Aidil Adha for their friendly co-operation.

I am very much appreciative of the assistance given to me by the all staff members, and graduate students, Department of Chemical Engineering and Process, Faculty of Engineering, in University Kebangsaan Malaysia (UKM), especially, Mr. Hayder AL-Mahdee, Azlan, and Mrs Aina for their help in one way or another.

At last and most importantly, I would like to express my most sincere and warmest gratitude to, my father, my mother and my brother for their prayers, loving, generous, endless support and moral inputs during my study. They are always close to my heart.
I certify that an Examination Committee met on 15\textsuperscript{th} September 2004 to conduct the final examination of Ali Mohamad Ali Abdul Amir on his Master of Science thesis entitled “Preparation and Characterization of Biodegradable films from Sago Starch and Chitosan Blends” 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 relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for the quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

______________________________

ALI MOHAMAD ALI ABDUL AMIR

Date:
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEDICATION</td>
<td>ii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>vii</td>
</tr>
<tr>
<td>APPROVAL</td>
<td>ix</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>xi</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>xii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xiv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xvi</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>xviii</td>
</tr>
</tbody>
</table>

## CHAPTER

I  **INTRODUCTION**  
- Polysaccharides  
- Starch and sago starch  
- Chitin and chitosan  
- Polymer blends  
- The Objectives of the Study  

II **LITERATURE REVIEW**  
- Natural polymers and starches  
- Chitin and chitosan manufacturing and their producing  
- Polymer degradation  
- Microorganisms and soil burial test  
- Aerobic and anaerobic process in degradation  
- Significant of permeability studies onto membranes  
- Thermal analysis into starch and chitosan films  
- Polymeric materials for packaging and biomedical purposes  
- Significant studies of starch film blends and their applications  
- Significant studies of chitosan film blends and their applications  

III **METHODOLOGY**  
- Materials  
- Preparation of films  
  - Preparation of sago starch films  
  - Preparation of chitosan films  
- Blending process  
- Characterization of the films  
  - Fourier Transform Infrared Analysis (FTIR)  
  - Differential Scanning Calorimetry (DSC)  
  - Scanning Electron Microscopy (SEM)  
  - Gas Permeation Test  
    - Measurement of Gas Permeability Coefficient  
    - Measurements of permeability  
  - Biodegradable Testing
**IV RESULTS AND DISCUSSIONS**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Physical Characteristics of the Films</td>
<td>48</td>
</tr>
<tr>
<td>The physical characteristics of the sago starch film</td>
<td>48</td>
</tr>
<tr>
<td>FT-IR spectra of sago starch film</td>
<td>50</td>
</tr>
<tr>
<td>DSC analysis of sago starch film</td>
<td>51</td>
</tr>
<tr>
<td>The Physical Characteristics of Chitosan Film</td>
<td>53</td>
</tr>
<tr>
<td>FT-IR spectra of chitosan film</td>
<td>54</td>
</tr>
<tr>
<td>DSC analysis of chitosan film</td>
<td>55</td>
</tr>
<tr>
<td>The Physical Characteristics of Sago Starch - Chitosan Film Blends</td>
<td>56</td>
</tr>
<tr>
<td>FT-IR spectra of sago starch – chitosan blend film</td>
<td>57</td>
</tr>
<tr>
<td>DSC analysis of sago starch – chitosan blend film</td>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodegradable Studies of Blend Films</td>
<td>62</td>
</tr>
<tr>
<td>Films Morphology Analysis</td>
<td>66</td>
</tr>
<tr>
<td>Oxygen Gas Permeability Analysis</td>
<td>74</td>
</tr>
</tbody>
</table>

**V CONCLUSION**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIBLIOGRAPHY</td>
<td>80</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>90</td>
</tr>
<tr>
<td>BIODATA OF THE AUTHOR</td>
<td>109</td>
</tr>
</tbody>
</table>