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

By

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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.

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

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Chairman: Associate Professor Mohamad Zaki Ab. Rahman, Ph.D.

Faculty: Science

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.

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

PENYEDIAAN DAN PENCIRIAN FILEM-BIODEGRADASI BAGI CAMPURAN KANJI SAGO DAN KITOSAN

Oleh

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Pengerusi: **Profesor Madya Mohamad Zaki Ab. Rahman, Ph.D.**

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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.

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I certify that an Examination Committee met on 15th 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 followers:

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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:

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