



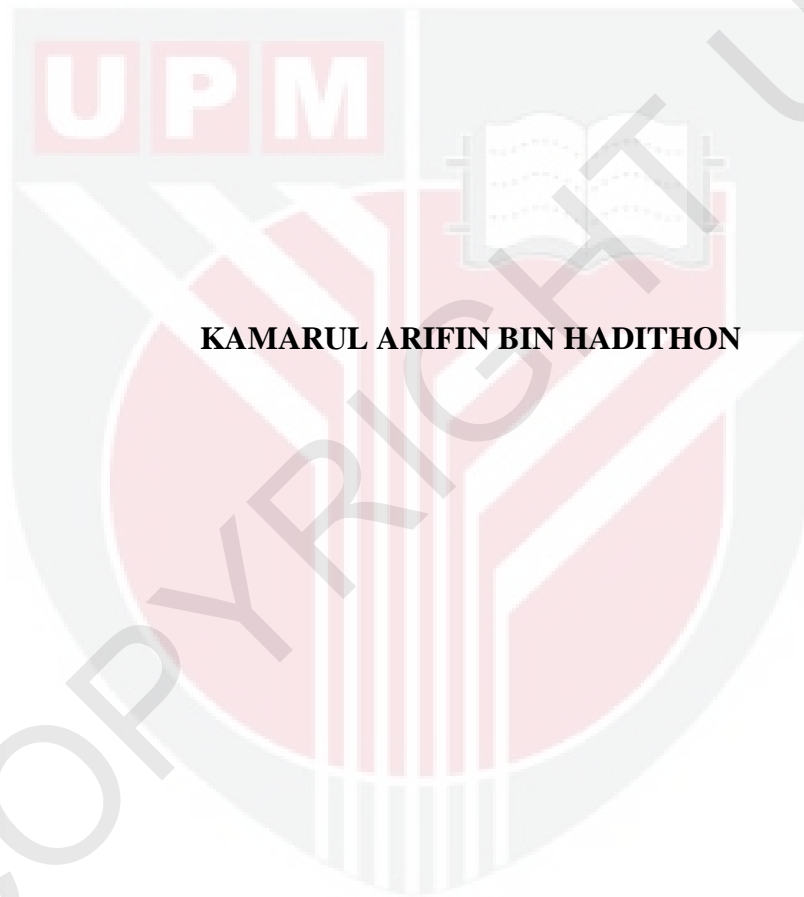
UNIVERSITI PUTRA MALAYSIA

**PREPARATION AND CHARACTERIZATION OF WHOLE STEM
KENAF FIBRE- POLY(BUTYLENE ADIPATE CO-TEREPHTHALATE)
COMPOSITES**

KAMARUL ARIFIN BIN HADITHON

IPTPH 2011 4

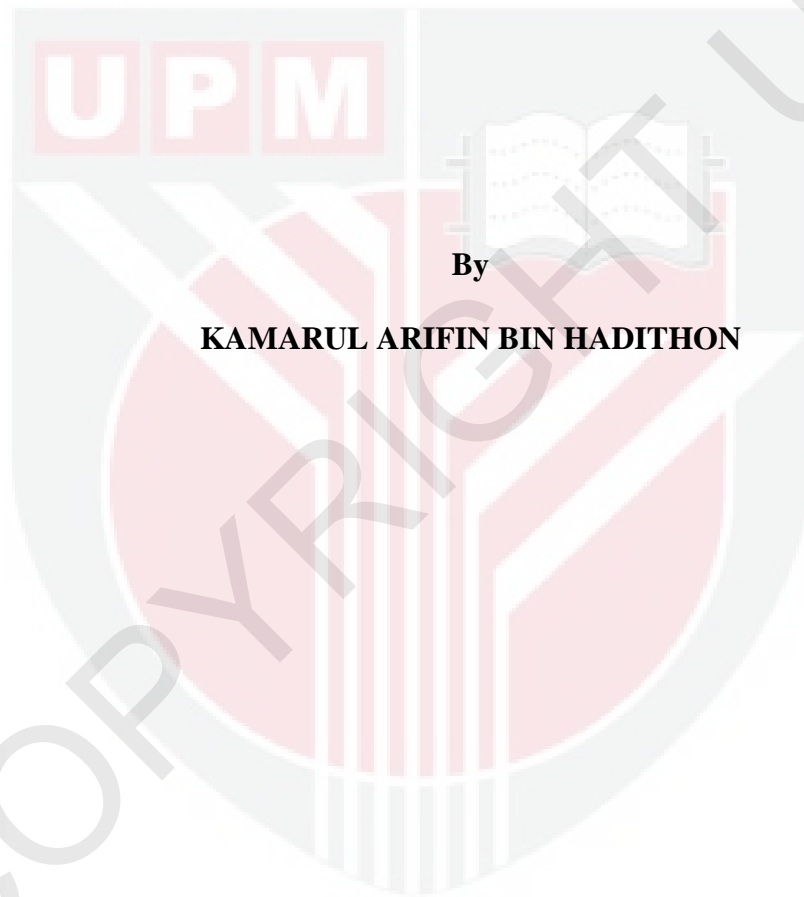
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KAMARUL ARIFIN BIN HADITHON

**MASTER OF SCIENCE
UNIVERSITI PUTRA MALAYSIA
2010**

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FIBRE- POLY(BUTYLENE ADIPATE CO-TEREPHTHALATE) COMPOSITES**



By

KAMARUL ARIFIN BIN HADITHON

**Thesis Submitted to the School of Graduates Studies Universiti Putra Malaysia, in
Fulfillment of the Requirements for the Degree of Master of Science**

2010

Dedications

Special dedications belong to my beloved family;

My Parent

Hadithon Bin Hj Sidek and Habsah Binti Taib

My beloved brothers and sister

Hairunizam Hadithon, Firdaus Hadithon, Muhammad Farhad Hadithon,
Rahayu Hadithon

My Brother and Sisters-in law

Husin Abdul Aziz, Azkiah Hj Umar, and Sulastri Subandi

My lovely nephew and neice

Mohd. Khairul Wafiq, Mohd Hafizul Hakim, Muhammad Aiman, Muhammad Afif
Iman, Mohd. Khairul Wafri, Nurul Nuha, Wardina Faqihah, Sofea Humairah



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

PREPARATION AND CHARACTERIZATION OF WHOLE STEM KENAF FIBRE- POLY(BUTYLENE ADIPATE CO-TEREPHTHALATE) COMPOSITES

By

KAMARUL ARIFIN BIN HADITHON

2010

Chairman: Nor Azowa Ibrahim, PhD

Institute : Tropical Forestry and Forest Products (INTROP)

This study focused on the preparation and characterization of whole stem kenaf (WSK) fibre with poly(butylene adipate co-terephthalate) (PBAT) by melt blending technique. The biodegradable composite were prepared at 10, 20, 30, 40 and 50% weight of fibre loading using internal mixer. The blending process was carried out for 10 minutes at 130°C with rotor speed 30 rpm.

The effects of fibre loading and NaOH fibre chemical treatment on physical and thermal properties were investigated by using FT-IR, DMA, TGA, and SEM. Mechanical testing on tensile, flexural and impact were also performed. Water absorption and biodegradation tests were also studied to study the effect of fibre loading and fibre chemical treatment on biodegradability of WSK/PBAT composites.

For the untreated fibre, the results show that tensile strength remained constant as filler loading from 10% to 30%, but increased at 40%. The properties of composites on flexural and impact strength were decreased with the increasing of the fibre loading. Meanwhile, the increases of tensile and flexural modulus on the composite were observed.

The used of NaOH chemical treatment fibre as filler improved the mechanical properties of the composite. The NaOH treatment at 4% concentration gave the best improvement on the mechanical properties of the composite.

The FT-IR spectrum of the treated fibre showed that alkaline treatment removes hemicelluloses and lignin from WSK kenaf fibre surface. The FT-IR spectrum of the blends indicated that no chemical interaction between component of the composite. Thermogravimetric analysis (TGA) confirmed the removal of hemicelluloses and lignin from WSK fibre after treatment.

The DMA indicates that the storage modulus of the composites increase with the increased of the fibre loading but decreased after 40% fibre loading. The WSK fibre treatment improves the stiffness of the composite with the increase of storage modulus compared with untreated fibre composites which resulting the better interaction of fibre with matrix.

The water absorption of the composite increased with the increasing of fibre loading while the NaOH treatment fibre absorb less water compared with untreated fibre composite. The weight loss on biodegradation test increased with the increasing of the fibre loading and the treated composite degrades slower than untreated composite. Scanning Electron Microscopy (SEM) indicates the clean fibre surface on treated fibre compared with untreated fibre. SEM analysis also gave the clear indication on the reduction of holes and good fibre bonding with PBAT on the NaOH fibre treatment composite.

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

**PENYEDIAAN DAN PENCIRIAN KOMPOSIT GENTIAN BATANG KENAF -
POLY(BUTELENA ADIPAT CO-TEREFTALAT)**

Oleh

KAMARUL ARIFIN BIN HADITHON

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Kajian ini tertumpu kepada penyediaan dan pencirian adunan gentian batang kenaf dengan poli(butelena adipat ko-tereftalat) (PBAT) menggunakan teknik pengadunan leburan. Komposit boleh urai disediakan berdasarkan peratus komposisi gentian kenaf bermula daripada 10, 20, 30, 40, dan 50% menggunakan teknik pengadunan dalaman. Komposit boleh urai ini telah disediakan pada suhu pemprosesan pada 130°C, kelajuan putaran pada 30 rpm, dan masa pemprosesan selama 10 minit telah dilakukan.

Kesan terhadap penambahan komposisi gentian dan rawatan NaOH keatas gentian terhadap sifat mekanikal, fizikal, dan termal telah dikaji menggunakan pelbagai teknik seperti FT-IR, DMA, TGA, dan SEM. Ujian mekanikal seperti regangan, kelenturan, dan kekuatan impak juga dijalankan ke atas sampel komposit tersebut. Ujian serapan air dan ujian penguraian sampel juga dijalankan bagi mengkaji kesan terhadap penambahan peratusan gentian dan rawatan NaOH keatas gentian batang kenaf.

Bagi gentian tanpa rawatan NaOH, keputusan menunjukkan bahawa kekuatan regangan mengalami perubahan sedikit dengan kenaikan komposisi gentian dari 10% hingga 30% tetapi meningkat pada 40% kandungan gentian. Ujian kelenturan dan impak kepada komposit menunjukkan bahawa kekuatan komposit semakin berkurang dengan peningkatan peratusan kandungan gentian. Walaubagaimanapun, modulus bagi ujian regangan dan kelenturan didapati meningkat.

Rawatan NaOH telah menunjukkan peningkatan ke atas sifat mekanikal komposit. Rawatan NaOH pada 4% kepekatan telah memberikan peningkatan terbaik terhadap sifat mekanikal komposit.

Ujian FT-IR terhadap gentian terawat mendapati tiada tindak balas kimia antara komponen komposit. Keputusan ujian FT-IR pada gentian terawat mendapati bahawa rawatan alkali membuang hemiselulosa dan lignin daripada permukaan gentian batang kenaf. Analisis TGA juga mengesahkan penyingkiran hemiselulosa daripada gentian batang kenaf selepas rawatan.

Analisis DMA menunjukkan bahawa modulus simpanan komposit meningkat dengan pertambahan kandungan gentian tetapi menurun selepas 40% kandungan gentian. Gentian batang kenaf terawat memperbaiki kekerasan komposit dengan peningkatan modulus simpanan berbanding komposit tanpa rawatan.

Ujian serapan air ke atas komposit meningkat dengan peningkatan kandungan peratusan gentian manakala rawatan NaOH menunjukkan kadar penyerapan air berkurangan berbanding dengan komposit tanpa rawatan gentian. Dalam ujian biodegradasi, pengurangan berat meningkat dengan peningkatan kandungan gentian manakala komposit dengan rawatan gentian biodegradasi lebih perlahan berbanding komposit tanpa rawatan gentian. Ujian mikrograf SEM mendapati permukaan gentian yang bersih pada gentian yang dirawat berbanding gentian tanpa rawatan. Analisis SEM juga memberi gambaran jelas terhadap pengurangan rongga dan ikatan yang kuat antara gentian dengan PBAT pada komposit dengan rawatan gentian.

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In the name of Allah

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I want to dedicate my sincere and gratitude to all my colleagues in biocomposite laboratory group, for their encouragement and helpful during this project.

Last but not least, I would like to express my deepest gratitude to my beloved family and friends who have always encouraged, understanding and support me to finish this project.

I certify that an Examination Committee has met on to conduct the final examination of Kamarul Arifin Bin Hadithon on his Master of Science thesis entitled “**Preparation and Characterization of Whole Stem Kenaf Fibre-Poly(butylene adipate co-terephthalate) Composites**” 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 are as follows:

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of Supervisory Committee are as follows:

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Date:

DECLARATION

I hereby declare that the thesis is based on my original work except for 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 any other institutions.

KAMARUL ARIFIN BIN HADITHON

Date:



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