MECHANICAL PROPERTIES AND DIELECTRIC CONSTANT OF COCONUT COIR-FILLED PROPYLENE

By

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

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Chairman: **Associate Professor Mansor Ahmad, Ph.D.**

Institute: **Advanced Technology**

Natural fiber filler (coconut coir) has an outstanding potential as reinforcement in thermoplastics. The objective of this study is to evaluate the optimum parameters of producing fiber filler composites using coconut coir filler. Experiments were carried out to investigate the effects of three independent variables, namely fiber content, fiber size and different chemical treatment on the mechanical and physical properties of the fiber plastic composites fabricated from coconut coir fiber filler. This study deals with the preparation of coconut coir composites using compression technique in which good interfacial adhesion is generated through blendings of fibers filler modification and matrix.

The laboratory experiments were carried out using factorial design comprised $2 \times 4 \times 5$ levels of treatments with a total of 40 treatment combinations. The variables were (1) two types of fiber filler size, (2) five levels of fiber filler content (5%, 10%, 15%, 20% and 25%) and (3) four levels of different chemical treatments. The factorial design was adopted for this work because it provides the best statistical analysis on the effect of the

variables on the properties studied. Initially the coconut fibers filler were treated in order to improve resin fiber filler interfacial bonding. The treatment agents used included alkali, stearic acid, acetone and potassium permanganate. The various reactions between the modified fiber filler and propylene chains are expected to improve the interfacial adhesion between the fiber filler and polymer. The method of fiber treatment was by using different chemicals. Generally, composites with treated fiber filler have higher tensile modulus and flexural modulus greater than composites with untreated fiber filler. The poor properties of composites with untreated fiber filler may be due to the untreated fiber filler that do not adhere well to the resins. Typical mechanical tests on the strength, flexural, hardness and dielectric were performed and the results are reported.

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

SIFAT MEKANIKAL DAN PEMALAR DIELEKTRIK DIISI SERABUT KELAPA -PROPILENA

Oleh

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Julai 2004

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Pengisi gentian semulajadi (serabut kelapa) mempunyai potensi yang baik sebagai penguat dalam termoplastik. Tujuan kajian ini adalah untuk menilai parameter yang optimum bagi menghasilkan gentian komposit dengan menggunakan serabut kelapa. Eksperimen dijalankan dengan mengkaji tiga jenis pembolehubah, iaitu kandungan gentian, saiz gentian dan rawatan kimia yang berlainan terhadap sifat mekanik dan fizik untuk gentian plastik komposit yang terdiri daripada pengisi gentian serabut kelapa. Kajian ini ditumpukan kepada kaedah penyediaan serabut kelapa komposit dengan menggunakan teknik mampatan di mana ikatan terjana melalui pengadunan gentian yang diubahsuai dengan matrik.

Kerja amali dijalankan dengan rekabentuk faktorial $2 \times 4 \times 5$ rawatan dengan jumlah 40 jenis kombinasi. Pembolehubah itu ialah (1) dua jenis saiz pengisi gentian, (2) lima jenis kandungan yang berlainan (5%, 10%, 15%, 20% dan 25%) dan (3) empat jenis rawatan kimia yang berlainan terhadap pengisi gentian. Permilihan rekabentuk faktorial untuk kerja penyelidikan ini adalah kerana ia memberi analisis statistik yang baik terhadap

kesan pembolehubah ke atas ciri yang dikaji. Pada permulaan, pengisi gentian kelapa dirawat untuk meningkatkan pengikatan antara pengisi gentian dengan resin. Bahan kimia yang digunakan termasuk alkali, asid stearik, aseton dan kalium permangganat. Pelbagai tindak balas yang berlaku di antara gentian yang dirawat dan rantai propilena dijangka akan memperkuatkan ikatan antara pengisi gentian dan polimer. Kaedah rawatan gentian yang dijalankan adalah dengan mengguna bahan kimia yang berlainan. Secara am, komposit yang mengandungi gentian pengisi yang dirawat mempunyai modulus tensil dan modulus lenturan yang lebih tinggi berbanding komposit yang mempunyai gentian pengisi tanpa dirawat. Kelemahan komposit yang mempunyai gentian pengisi tanpa dirawat mungkin disebabkan serabut gentian tidak berpaut baik dengan resin. Ujian kekuatan tegangan, lenturan, kekerasan dan sifat dielektrik telah dilakukan dan keputusan dilaporkan di sini.

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I certify that an Examination Committee met on July 22, 2004, to conduct the final examination of Lai Chin Yung on his Master of Science thesis entitled "Mechanical Properties and Dielectric Constant of Coconut Coir-Filled Propylene" in accordance with Universiti Putra Malaysia (Higher Degree) Act 1980 and Universiti Putra Malaysia (Higher Degree) Regulations 1981, and 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 expect for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other at UPM or other institutions.

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LAI CHIN YUNG

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