MECHANICAL, MORPHOLOGICAL, THERMAL, AND DURABILITY PROPERTIES OF RESIN TRANSFER MOULDED KENAF FIBRE REINFORCED UNSATURATED POLYESTER COMPOSITES

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2016

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by

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Thesis submitted in fulfillment of the requirements

for the degree of

Doctoral of Philosophy

June 2016

ACKNOWLEDGMENT

Bismillaahirrahmaanirrahiim,

First and foremost, I would like to express my special gratitude to my supervisor Prof. Dr. Zainal Arifin Mohd Ishak for his valuable advice, encouragement, and constant dedication during my period of study. A sincere thanks is accorded to my co-supervisor Prof. Madya Dr. Razaina Mat Taib for helpful discussions and insightful suggestions.

I would like to thank Dean Prof. Dr. Zuhailawati Bt. Hussain, all lecturers, and administrative staffs for their kind cooperation and assistance. Thanks are also extended to technical staffs for their invaluable assistance and technical support.

My sincere thanks are also extended to my friends of Indonesian students, namely Teguh Darsono, Muhammad Faishal, Muhammad Syukron, Indra Surya and Sudibyo for their supports and friendship. Last but not least, I would like to convey my special thanks my parents, my lovely family, my loving wife Atik Susanti and my daughters Larasati Fadhilah Adani and Isyana Faisha Adani who constantly supported and encouraged me.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AKUPC	Alkali Treated Kenaf Fibre Unsaturated Polyester Composite
AFM	Atomic Force Microscope
ASTM	American Society of Testing Material
DMA	Dynamic Mechanical Analysis
DTG	Differential Thermogravimetric Analysis
FT-IR	Fourier Transform Infra-Red
HKUPC	Heat Treated Kenaf Fibre Unsaturated Polyester Composite
IFSS	Interfacial Shear Strength
ILSS	Inter Laminar Shear Strength
KF	Kenaf Fibre
OWRK	Owens–Wendt–Rabel– Kaelble
SEM	Scanning Electron Microscope
SEN-B	Single End Notched - Bending
RMS	Root Mean Square
ROM	Rule Of Mixture
RTM	Resin Transfer Moulding
T_g	Glass Transition Temperature
TGA	Thermogravimetric Analysis
UKUPC	Untreated Kenaf Fibre Unsaturated Polyester Composite
UPR	Unsaturated Polyester
UV	Ultra Violet

XPS	X-Ray Photoelectron Spectroscopy
XRD	X-Ray Diffraction

LIST OF SYMBOLS

θ	Diffraction angle
d	Diameter of fibre
s	Fibre aspect ratio
E_{f1}	Elasticity Modulus offibre in 1st direction
σ_{c1}	Tensile strength of composite in 1st direction (*unidirectional*)
σ_{c2}	Tensile strength of composite in 2st direction (*unidirectional*)
τ_y	interfacial strength between fibre and matrix
E_c	Elasticity Modulus of composite in random fibre distribution
$E_{1/}\, E_{11}$	Elasticity Modulus of composite in 1st direction (Longitudinal)
E_{22}	Elasticity Modulus of composite in 2st direction (Transverse)
E_f	Modulus of the fibre and matrix.
E_m	Modulus of the matrix
V_f	Volume fraction of fibre
υ_m	Poisson's ratio of the matrix
P_f	Fibre packing factor
S_c	Critical aspect ratio for the composite
τ_{iu}	Interfacial shear strength
σ_{fu}	Fibre ultimate strength
σ^*_f	Tensile stress in the fibre at matrix failure strain
σ_{mu}	Matrix ultimate strength
ξ	Parameter of particular elastic property
σ^1_m	Tensile stress in the matrix at fibre failure strain
σ^*_m	Tensile stress in the matrix at composites failure strain

W_f	Weight of fibre
W_m	Weight of matrix
δ_f	Density of fibre
δ_m	Density of matrix
t	Time
η	Viscosity
r	Radius of the capillary
θ	Contact angle
$\tilde{r}$	Packed fibre in a tube
τ	Tortuosity of the capillaries.
m	Mass of the adsorbed liquid
ρ	Density of the liquid
n	Number of capillaries
c	Empirical constant of the porosity and tortuosity of the capillaries
γ_L	Surface tension of liquid,
γ_S	Surface energy of solid
γ_s^p	Polar energy for solid,
γ_L^p	Polar energy for liquid
γ_s^d	Dispersion energy for solid
γ_L^d	Dispersion energy for liquid
Y	Shape factor of fracture toughness sample
P	Maximum load,
S	Length of the span
B	Thickness of fracture toughness sample
W	Width of fracture toughness sample

a	Total notch length of fracture toughness sample
L	Lightness
a	Chromacity coordinates of red-green direction
b	Chromacity coordinates of yellow-blue direction
ΔE_{ab}	The total change in colour
M_t	Water content (percent weight) at times t
M_1	Weight of the wet sample at a t_1
M_2	Weight of the wet sample at times and t2
M_0	Initial weight of the sample
M_m	Maximum weight gain
h	Thickness of samples
D	Diffusion coefficient
S_c	Sorption coefficient
P_c	Permeability coefficient
E’	Storage modulus
$tan\ \delta$	Tangent delta

SIFAT-SIFAT MEKANIKAL, MORFOLOGI, TERMA DAN KETAHANAN KOMPOSIT POLIESTER TAK TEPU DIPERKUAT GENTIAN KENAF YANG DIHASILKAN MELALUI KAEDAH PENGACUAN PEMINDAHAN DAMAR

ABSTRAK

Dalam kajian ini, sifat-sifat komposit polyester tak tepu diperkuat dengan lembaran gentian kenaf (KF) tak teranyam yang dihasilkan dengan cara pengacuan pemindahan damar (RTM) telah dikaji. Lembaran gentian kenaf tak teranyam telah dirawat dengan alkali dan haba untuk jangkamasa yang berbeza sebelum proses pengacuan. Rawatan alkali telah menyebabkan penyingkiran sebahagian kandungan hemi-selulosa dan lignin dan telah dibuktikan melalui ujian spektroskopi infra-merah jelmaan Fourier (FTIR), analisis pembelauan sinar-X (XRD), mikroskop elektron imbasan (SEM) dan spektroskopi fotoelektron sinar-X (XPS). Sementara itu, rawatan haba hanya menyingkirkan bendasing dan kandungan sari. Penyingkiran bahan-bahan ini secara langsung meningkatkan sifat pelekatan dan kekuatan gentian seterusnya menambah baik kekuatan ricih antara laminar (ILSS), tegangan dan kekuatan lenturan komposit. Namun begitu rawatan alkali menghasilkan komposit yang mempunyai sifat-sifat mekanikal yang lebih baik daripada rawatan haba. Gentian kenaf yang paling optimum untuk rawatan alkali adalah yang direndam dalam larutan 6% NaOH selama 3 jam, manakala untuk rawatan haba pula adalah gentian kenaf yang dirawat pada suhu 140 ^{o}C selama 10 jam. Hasil ujian eksperimen ke atas komposit diperkuat gentian kenaf tak terawat dan terawat didapati selari dengan hasil ujian pemodelan mikro-mekanik. Hasil ujian DMA menunjukkan