UNIVERSITI TEKNOLOGI MARA

ENSILE PROPERTIES OF KENAF/GLASS HYBRID COMPOSITE LAMINATES REINFORCED WITH NANOSILICA

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Thesis submitted in fulfillment
of the requirements for the degree of
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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 18th December 2015 to conduct the final examination of Norhashidah binti Manap on her Master of Science thesis entitled "Tensile properties of kenaf/glass hybrid composite laminates reinforced with nanosilica" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The Panel of Examiners was as follows:

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

Natural fibres have emerged as potential reinforcement materials for composite structure and have gained interests by many researchers due to their lightweight and low cost when compared to synthetics fibres. Substitution materials from synthetic fibre to natural fibre have become a trend in recent years. Kenaf fibres have become one of the best candidates to be used as reinforcing materials in polymer composite. However, the adhesion between natural fibre and polymer is weak due to different polarity of natural fibre and hydrophobic polymer. This causes low mechanical properties of the composite. Therefore, in this research the fibre is treated with sodium hydroxide (NaOH) in order to improve the fibre-matrix adhesion. On top of that, nanosilica particles and glass fibre were also added into the kenaf composite in order to further improve its mechanical properties. This study focuses on the effect of fibre treatment, addition of nanosilica and glass fibre hybridization on tensile properties of kenaf composites. Morphological examination and physical characterization on kenaf and its composites were also conducted. Three different concentrations of sodium hydroxide which are 3, 5 and 7 wt. % were used to soak the natural fibre in order to determine the suitable concentration of sodium hydroxide. The longitudinal and transverse tensile properties of 3, 5 and 7 wt. % NaOH treated kenaf composites were compared. The results showed that the 7 wt. % NaOH treated kenaf fibre composite has the highest longitudinal and transverse tensile strength. Therefore, 7 wt. % NaOH treated kenaf composites was selected to be impregnated with 3 different percentages of nanosilica (5, 13, 25 wt. %). Longitudinal and transverse tensile tests were conducted on the nanosilica filled kenaf composite. In addition, in order to improve the properties of kenaf composite, it was hybridized with glass fibre. The results showed that the additional of 5 wt. % of nanosilica in kenaf composite improved 29.73% of the longitudinal tensile modulus when compared to the pure system. However, a slight decreased in longitudinal tensile strength was recorded. The addition of 13 and 25 wt. % of nanosilica in kenaf composite showed an adverse effect of longitudinal tensile modulus. This may be due to a weak fibre-matrix interfacial adhesion because of the presence of nanosilica particles hindered the wetting process of the natural fibre in the matrix. The SEM micrographs showed the evidence of weak interfacial adhesion where fibre pull out and matrix cracking were observed on the fractured specimens. This research contributes to a new knowledge on the effects of fibre treatment, nanosilica inclusion and glass hybridization on tensile properties, morphological and physical properties of kenaf composites.

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