Characterization of sodium hydroxide-treated kenaf fibres for biodegradable composite application

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Abstract
Natural fibres have shown immense potential as reinforcement for composites in the place of conventional fibres. Natural fibres are lightweight, cheap and environmentally friendly. However, it is already established that natural fibres have poor interaction with polymers due to its hydrophilic nature, resulting in poor interfacial adhesion, which is detrimental to the properties of the composite. Chemical surface treatment has been done to improve the interfacial adhesion. Various concentrations of sodium hydroxide (NaOH) and soaking times were employed, and the treated fibres were then characterized using thermogravimetric analyser, X-ray powder diffraction and Fourier transform infrared (FTIR) spectrometer. Single-fibre tensile tests were done on selected samples. The surface of the fibre was analysed with field-emission scanning electron microscope to study the surface morphology of the treated and untreated fibres. Generally, the treated fibres have higher thermal stability compared to untreated fibres. However, no significant trend was observed as a result of varying NaOH concentration and soak time. It was also observed that kenaf fibres treated with 4% (w/v) NaOH for 5 h exhibited the highest tensile modulus and tensile strength compared to other treated fibres. Impact properties of composites prepared from untreated and NaOH-treated kenaf were tested to confirm the finding, and it was determined that the treated kenaf composites have superior impact properties to its untreated counterpart.

Keywords
Natural fibres, interfacial adhesion, fibre surface treatment, fibre characterization

Introduction
Interest in eco-friendly materials have been renewed due to environmental concerns. Issues such as biodegradability, recyclability and environmental safety have become increasingly important during material selection.¹ Traditionally, structural polymer composites have utilized man-made fibres such as glass and carbon fibres as reinforcements. However, researchers have studied extensively on natural fibres obtained from plants as a substitute. Plant fibres such as hemp, sisal and kenaf show great potential as a substitute for glass fibres. The natural fibres are cheaper, renewable, environmentally friendly and have lower density.² Despite the interest, the application of natural fibre-reinforced composites has been limited. To date, it has been established only in the automotive industry (interior parts) and to an extent penetrated the construction and consumer goods markets.³ Several major technical considerations must be addressed before natural fibre composites will be widely accepted. It is generally accepted that natural fibres have poor interaction with some polymeric matrices and high moisture absorption.²,⁴ Poor interaction between the fibre and the matrix leads to poor wettability and subpar

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