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Technical Report

Static bending and impact behaviour of areca fibers composites

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A B S T R A C T

Natural fibers are considered to have potential use as reinforcing agents in polymer composite materials because of their principle benefits: good strength and stiffness, low cost, and be an environmental friendly, degradable, and renewable material. A study has been carried out to evaluate physical, flexural and impact properties of composite made by areca fibers with randomly distributed fibers. The extracted areca fibers from the areca husk were alkali treated with potassium hydroxide to get better interfacial bonding between fiber and matrix. Then composite laminates were fabricated by using urea formaldehyde, melamine urea formaldehyde and epoxy resins by means of compression molding technique with varying process parameters, such as fiber condition (untreated and alkali treated), and fiber loading percentages (50% and 60% by weight). The developed areca fiber-reinforced composites were then characterized by physical, bending and impact test. The results show that flexural and impact strength increases with increase in the fiber loading percentage. Compared to untreated fiber, significant change in flexural and impact strength has been observed for treated areca fiber reinforcement.

1. Introduction

Environmental awareness, new rules and legislations are forcing industries to seek new materials which are more environmental friendly. Over the past two decades, plant fibers have been receiving considerable attention as substitutes for synthetic fiber reinforcements for applications like interior door panel of an automobile, packaging, low-cost housing, and other structures [1–3]. Unlike the traditional synthetic fibers like glass and carbon these lignocellulosic fibers are able to impart certain benefits to the composites such as low density, low cost, renewability, biodegradability and high degree of flexibility during processing [4]. Nowadays natural fibers like, cotton, coir, sisal jute and other natural fibers have attracted the attention of scientists and technologists. It has been found that the natural fiber composites possess required mechanical strength and other properties with better electrical resistance, good thermal and acoustic insulating properties.

In recent years, extensive studies which have been done on lignocellulosic fibers such as sisal [5,6], jute [7,8], pineapple [9–12], banana [13–15], and oil palm empty fruit bunch fibers [16,17] have shown that lignocellulosic fibers have the potential to be used as an effective reinforcement in thermoplastics and thermosetting materials. According to Bledzki et al. [18] and Wambua et al. [19], lignocellulose fibers exhibit several advantages over their synthetic fiber counterparts. Lignocellulose fibers have drawn attention due to their abundant availability, low cost and renewable nature. Owing to their low specific gravity, which is about 1.25–1.50 g/cm^3 compared to synthetic fibers, in particular glass fiber which is about 2.6 g/cm^3, lignocellulose fibers are able to provide a high strength to weight ratio in plastic materials. The usage of lignocellulose fibers also provides a healthier working condition than the synthetic fibers. This is due to the fact that, the glass fiber dust from the trimming and mounting of glass fiber components causes skin irritation and respiratory diseases among workers [20,21]. Besides that, the less abrasive nature of the lignocellulose fibers exhibits a friendlier processing environment as the wear of tools could be reduced. Furthermore, lignocellulose fibers exhibit good thermal and insulating properties, easily recyclable and are biodegradable especially when used as reinforcement in biopolymer matrix.

Although there have been numerous studies on mechanical behaviour of natural fiber-reinforced composites, only a few references are available on areca fiber-reinforced composites. Among all the natural fiber reinforcing materials, areca appears to be a promising material because it is inexpensive, abundantly available, and a very high potential perennial crop. It belongs to the species *Areca catechu* L., under the family Palmecea and originated in the Malaya Peninsular, East India [22]. In India, areca cultivation is coming up in a large scale basis with a view to attaining self sufficiency in medicine, paint, chocolate, chewable gutka, etc. The husk of the areca constitutes about 60–80% of the total weight and volume of the fresh fruit. The average filament length (4 cm) of the areca

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