International Journal of Technology (2012) 1: 16-23
ISSN 2086-9614

MECHANICAL PROPERTIES AND MICROSTRUCTURE OF METROXYLON SAGO FIBER TREATED BY SODIUM HYDROXIDE

Hairul Abral[1*], Eko Kasmianto[1], Mastariyanto Perdana[1]

[1]*Department of Mechanical Engineering, Universitas Andalas, 25163 Padang, Sumatera Barat, Indonesia*

(Received: May 2011 / Revised: October 2011 / Accepted: December 2011)

ABSTRACT
In the present study, natural fibers located in thick outer woody rinds of the metroxylon sago (MS) tree were investigated. The investigation focused on measuring the mechanical properties and observing the microstructures of MS fibers before and after treatment with 5% sodium hydroxide. A scanning electron microscope was used to observe the microstructure of MS fiber, and the results showed that there was a decrease in fiber diameter after mercerization. A porous structure in the cross-section area of untreated fibers was clearly seen, and it was highly compressed after mercerization. The strength of MS fiber increased significantly after it was treated by 5% NaOH solution for two hours. The average ultimate strength of untreated MS fiber was recorded as 46 MPa; treatment with sodium hydroxide resulted in a significant increase in average ultimate strength to 163 MPa. Additionally, the elastic modulus of treated fiber was greater than that of untreated fiber.

Keywords: Mechanical properties; Microstructure; Natural fibers

1. INTRODUCTION
Many metroxylon sago plants grow well in tropical countries such as Indonesia. As reported by Singhal et al. (2008), wild sago palms grow in Indonesia in an area roughly estimated as more than 7 million ha in Sumatera, Papua, and Kalimantan. Sago palm is a species of the genus metroxylon belonging to the Palmae family; it reaches a maximum height of 25 m and a diameter of 40 cm. The most useful section of the sago palm tree is the trunk, where starch can accumulate until the flowering stage. Sago starch is an ingredient in various food products such as sago meal, noodles, biscuits, and desserts (Singhal et al., 2008). Additionally, sago starch can be used to produce adhesive material for paper, textiles, and plywood. Starch in the sago trunk is generally obtained from extraction of the pith, which is enclosed by an outer woody rind that is approximately 50 mm thick and light lengthways so that the soft pith can be separated using a sharpened knife.

The woody rind usually becomes waste, but an abundance of fibers is typically embedded in such waste bark. Therefore, we were interested in researching the sago palm fiber that lies in the woody rind as potentially useful material for the reinforcement of a natural fiber composite. Many investigations of the sago palm have been conducted; the majority focuses on sago starch (Karim et al., 2008; Nawang et al., 2001; Sopade & Kiaka, 2001). Karim et al. (2008) reported the effects of alkali on the pasting properties of sago starch, as well as modifications in gel properties on cooling and storage.

[*] Corresponding author's email: abral@ft.unand.ac.id, Tel. +628126720355, Fax. +6275171301