UNIVERSITI TEKNOLOGI MARA

THE INFLUENCE OF HYDROTHERMAL AND THERMOCHEMICAL TREATMENT ON PROPERTIES OF HIGH DENSITY KENAF (*Hibiscus cannabinus*) FIBREBOARD

MOHAMAD NURUL AZMAN MOHAMMAD TAIB

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AUTHOR'S DECLARATION

I declare that work in this thesis was carried out accordance with the regulations of Universiti Teknologi MARA. It is original and is the result 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.

I hereby, acknowledge that I have been supplied with the Academic Rules and regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Mohamad Nurul Azman Mohammad Taib
Student I.D. No.	:	2010266446
Programme	:	Master of Science
Faculty	:	Faculty of Applied Sciences
Thesis Title	:	The Influence of Hydrothermal and Thermochemical Treatment on Properties of High Density Kenaf (*Hibiscus cannabinus*) Fibreboard
Signature of Student	:	
Date	:	November 2014

ABSTRACT

This study focused on influence of hydrothermal and thermochemical treatment at elevated temperature on physical, mechanical, chemical characteristics and fibre surfaces properties of high density kenaf fibreboard (HDKF). In this study, water has been used as a medium to transfer heat for hydrothermal treatment and sodium hydroxide (NaOH) solution with 3% concentration as a medium for thermochemical treatment. Three different temperature of 100ºC, 130ºC and 150ºC were used for both hydrothermal and thermochemical treatments. Sample made from untreated fibre (control sample) were compared with samples made from hydrothermally treated and thermochemically treated kenaf fibres. The influence of these different treatments on physical properties that were thickness swelling and water absorption were determined and compared. The samples were also tested for mechanical properties tests that were flexural and internal bonding tests. Furthermore, the characterization of kenaf chemical composition and observation on kenaf fibres surfaces were carried out. In general, the thickness swelling showed some improvement when the fibres were treated with hydrothermal and thermochemical treatments. Results on water absorption for hydrothermal samples showed no improvement because most of the water just filled up spaces and voids in the fibres and did not swell the fibres significantly. Results for mechanical properties showed reduction for MOR after hydrothermal and thermochemical treatment. However it does not significantly affect the service strength of the boards. Results for MOE and IB had improvement after treated with different treatments. In general, HDKF made from both hydrothermal and thermochemical treated kenaf fibres at high temperature appeared to be the practical choice for applications due to low thickness swelling.

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CHAPTER ONE
INTRODUCTION

1.1 GENERAL BACKGROUND

In recent years, wood material for use by wood based industry has become scarce and expensive. A need to look for alternative natural materials and at the same time help conserve the remaining forest has led to a serious consideration in the utilization of plantation-based fibres such as kenaf , coconut coir and oil palm fibres (Suffian, 2007; Guntekin *et al.*, 2008; Rahim, 2009). Kenaf is cultivated for its fibre in India, Bangladesh, United States of America, Indonesia, Malaysia, South Africa, Vietnam, Thailand and to a small extent in southeast Europe (Paridah *et al.,* 2011). Two types of fibres can be extracted from this plant: bast fibre, which is the outer layer and core fibre, which is the inner layer (Aisyah *et al.*, 2012). Historically, kenaf has been used as a cordage crop to produce twine, rope and sackcloth. Nowadays, there are various new applications for kenaf in production of pulp and paper, building materials, absorbents and animal feeds (Paridah *et al.,* 2011; Dempsey *et al.*, 1975).

Bio-composite is a product made from natural sources such as wood, cotton and agriculture waste and mixed with human made resources such as polypropylene, polyethylene and also cement. Many bio-composite products are available in the market nowadays such as polymer composites, fibreboard, particleboard and cement board. Fibreboard one of bio-composite product has gained popularity in Malaysia due to reduction of solid wood supply.

Modification of lignocellulosic materials or natural fibres has been done by researchers to enhance the properties of the material in terms of physical and mechanical properties. Many studies have been conducted by researchers to treat the natural fibres using alkalization, acetylation and silane treatments (Adhlan *et al.,* 2011; Edeerozey *et al.,* 2007; Gassan and Bledzki, 1999). Alkalization treatment by NaOH is the most common chemical treatment to enhance the natural fibres properties. Disadvantages of chemical treatment are increase cost of production and hazardous to environmental. This treatment also can be a carcinogen agent to human. Hydrothermal treatment which is more environmental friendly only uses water and heat as a medium. It will be the preferred treatment in industry.