

UNIVERSITI TEKNOLOGI MARA

**PHYSICAL AND MECHANICAL
PROPERTIES OF
HYBRID BAMOO - WOOD VENEER
(HBWV) PANEL FOR FURNITURE
COMPONENTS**

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ABSTRACT

Increasing demand for wood and dwindling wood resources has led to the use of alternative material in the production of furniture. Hybrid Bamboo-Wood Veneer (HBWV) panel is one of the alternative material that has potential to be commercialized and used as furniture components. HBWV panel is a product from laminates bamboo and wood veneers. In this study betong bamboo, (*Dendrocalamus asper*) veneers were laminated with sesenduk (*Endospermum malaccense*) veneers to form HBWV panel using urea formaldehyde (UF) with glue spread of 75 gm^{-2} . Two types of board with lamination arrangement called Hybrid 1 and Hybrid 2. Each hybrid was then pressed at two different pressure 70 kgcm^{-2} and 130 kgcm^{-2} respectively. The main objective of this study was to evaluate the physical and mechanical properties including moisture content (%), density (kgm^{-3}), delamination (%), water absorption (%), thickness swelling (%), bending MOR and MOE (MPa), tesion-shear (MPa) and screw withdrawal (N), which were tested in accordance to British Standard (BS:EN) 1993. The results show that, difference in pressure does not affect all properties except the screw withdrawal at face direction, density and moisture content. Mean value of screw withdrawal at face direction is 1192.19 N and 1069.69 N for 130 kgcm^{-2} and 70 kgcm^{-2} respectively. The mean value of density is 0.59 kgm^{-3} and 0.56 kgm^{-3} for 130 kgcm^{-2} and 70 kgcm^{-2} respectively. The mean value for moisture content is 13.3 % and 12.9 % for 70 kgcm^{-2} and 130 kgcm^{-2} respectively. Lamination has significant properties except for delamination, water absorption and tension-shear in dry condition. Lamination Hybrid 2 showed a higher mechanical properties as compared to lamination Hybrid 1. Mean bending (MOR) is 58 MPa and 36 MPa for Hybrid 1 and Hybrid 2 respectively. Mean bending (MOE) is 13528 MPa and 5827 MPa for Hybrid 2 and Hybrid 1 respectively. Mean tension-shear of wet condition is 2.06 MPa and 1.85 MPa for Hybrid 1 and Hybrid 2 respectively. Mean value for screw withdrawal face direction is 1397 N and 865 N for Hybrid 2 and type respectively. While for the edges direction, the mean value is 1240 N and 753 N for Hybrid 2 and Hybrid 1 respectively. The physical properties mean value for moisture content is 13.6 % and 12.6 % for Hybrid 2 and Hybrid 1 respectively. Mean value for density is 0.60 kgm^{-3} and 0.54 kgm^{-3} for Hybrid 1 and Hybrid 2 respectively. It is shown that lamination Hybrid 2 with high pressure gives the best physical and mechanical properties compare to lamination Hybrid 1.

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CHAPTER ONE

INTRODUCTION

1.1 Background of The Study

The Malaysian furniture industry has developed from a cottage-based industry in the early 1980s. It supply mainly the domestic market and grown to become a full-fledged export industry today. Export of furniture increase from 31% in 2011 to 34.3% in 2017 (Amarthalingam, 2017). In furniture industries today, there are several type of materials used that ranging from solid wood, non-wood forest biomass, plastic, metal or combinations to manufacture a product with highest quality (Anokye, *et al.* 2016).

Bamboo is a non-wood plant that abundantly grows in many of the tropical countries (Ming *et al.*, 2017). Recently bamboo has received much attention as potential raw material for wood-based industry in Malaysia due to its properties and capability. Bamboo is one of the oldest plants and provides thousand of uses. Bamboo was used as building and construction material such as village house, bridges; and has been widely used for household utilities such as handicrafts, chopstick, fishing poles, woven mats, cricket boxes, containers. Bamboo also can be used as furniture components, household utensils and many other applications (Chang *et al.*, 2018).

Currently, bamboo has been explored and expanded for high value-added products. Work toward bamboo has been carried out in the past number of years to enhance the utilization and range of product that can be made from bamboo (Ashaori *et al.*, 2010). With abundant sources of bamboo that are currently being underutilized, the production of reconstituted products such as particleboard, fibreboard, plywood, bamboo mat-board and other wood-based composite offer tremendous potential and opportunities toward its fullest utilization (Yu *et al.*, 2017).

With suitable treatment, bamboo can become a very promising material for furniture components, bamboo mat-board and plywood. Laminated veneer board has been commercialized in China this kind of product has been commercialized. Laminated veneer board from bamboo was also discovered as one of the potential product due to its good durability, uniformity and strength.