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ISO 9001:2000 No Sijil :0500132

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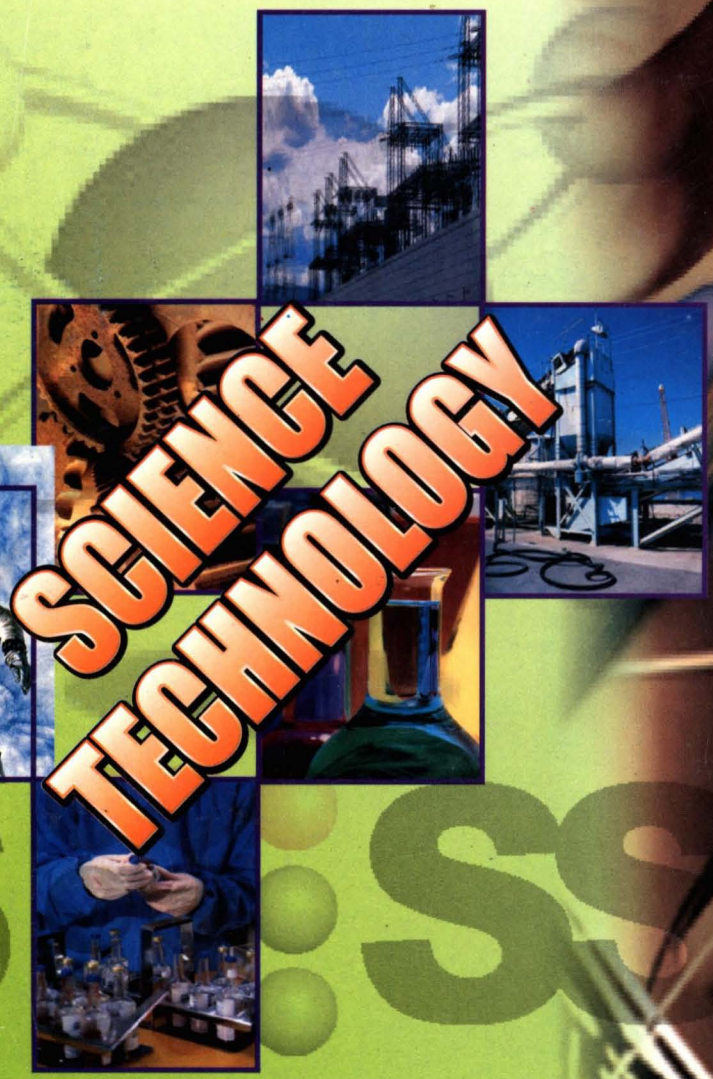

NATIONAL SEMINAR ON SCIENCE TECHNOLOGY & SOCIAL SCIENCES 2006

30-31 May 2006

Swiss Garden Resort & Spa

Kuantan, Pahang

Kenaf Based Cement Bonded Particleboard: A Preliminary Study on Mechanical and Physical Properties

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ABSTRACT

The construction of cement board that using kenafs' fibres as the main filler in the cement boards has been developed and their performances in terms of mechanical and physical properttes are evaluated. Kenaf based cement bonded particleboard (CBP) at four (4) different of kenaf cement ration which are starting from 1:2.5, 1:5, 1:2.75 and 1:3 have been produced and their mechanical and physical properties were evaluated and the Malaysian Standard is used as standard requirement. Two types of kenaf parts which are bast and core fibers are used with fiber size fixed at 2 mm during board making in purposes to study the performance of board based on different fiber types. The treatment on the fiber during mixing with cement also undergoes which using ammonium sulphate and aluminum sulphate. From the earlier results it shows an indicator that bast long fiber contributed better result of mechanical testing than core short fiber of cement board, but both of them produced nearly same figures of thickness swelling test results and they pass the minimum number of standard requirement for thickness swelling. Meanwhile, fiber that contained of aluminum sulphate show the promising yield than the ammonium sulphates' samples in terms of mechanical and physical tests results and exceeded the minimum standard level.

Keywords: *Cement bonded particleboard, kenaf, bast, core*

Introduction

A cement bonded particleboard (CBP) is a product produced by mixturing of wood particles and cement as an inorganic binder. To manufacture this board, we need to mixtures between wood particles with presence of water, chemical additives (as an accelerator) and of course cement which act as a binder. Such blended material was forming on the steel plate prior to press under certain pressure and kept it in the hardening chamber before exposed to the room temperature for a month.

The good characteristics produced from this product including its durability against termites, fungus, fire resistance and low sound transmission (Dinwoodie 1983 and Anonymous 1987). In this study, kenaf fibers were used to be a wood aggregates. Kenaf (*Hibiscus cannabinus L., Malvaceae*) is a new plant and has been introduced since 1999 in Malaysia. This plant is a light wood species and can be cultivated within 4-5 months after planted. It's has two types of fiber comprising of inner fiber which is called core and outer fiber called bast. A bast fiber has a long fiber length than core but it is only 30% of the whole plant weight and the rest belongs to core fibers.

The aims in this study are concentrating on the effect of different type of kenaf fibers and the optimum of wood/ cement ratio usage that revealed to the good of mechanical and physical properties of CBP.

Raw Material and Laboratory Story

Kenaf's fiber has been used. The plant was cultivated from FRIM's plot station in Bidor Perak. Both of outer kenaf layer called bast and the inner kenaf's fiber called core were used in the cement bonded particleboard. There are several process on the kenaf plant before it become a fiber, the kenaf's stem at the height of 5 metres were chipped through a chipper machine then sieved to isolate the outer and inner kenaf's fiber in the vibrater screening before using knife ring flaker in order to obtain a small core fiber and cutter machine to reduce the length of bast fiber. They all are screened to get the fiber sizes at 2 mm.

Kenaf based cement bonded particleboard has successfully made through the mechanical processes. A ration of kenaf's fiber, cement, water and accelerator (aluminum sulphate) was determined and their mixturing activity has been done in the cement blender machine. A mold with size of 45 by 45 by 10 mm was used in order the cement board at density of 1300 kg/m3 is produced. The multi layers of mold on multi layer of plate were clamped under pressure of 20 kg/cm2 for an overnight in the hardening chamber with temperature controlled at 65C. A group of multi layer pre-hardening board was declamped and such boards were expose to the ambient temperature for 21 days. The Malaysian Standard Specification for Wood Cement Board, MS 934: 1986 (Anonymous 1986) has been referred

in order the testing of mechanical (bending and internal bond tests) and physical (thickness swelling and water absorption) were tested.

Results and Discussion

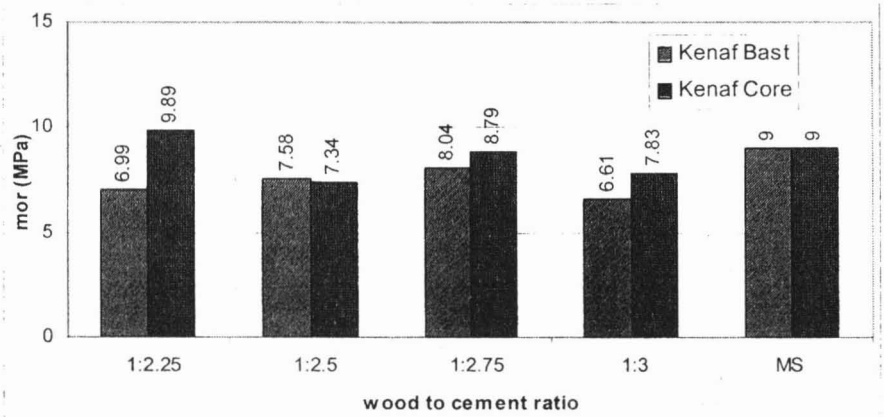

Figure 1: mor values of kenaf based cement bonded particleboard

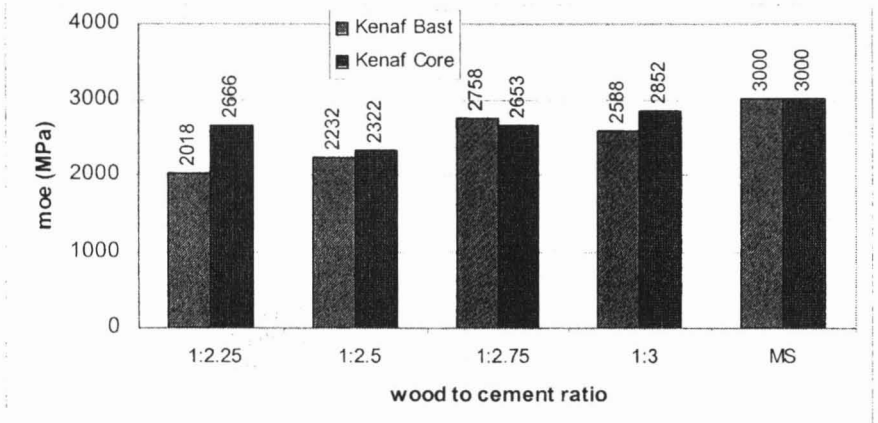

Figure 2: moe value of kenaf based cement bonded particleboard

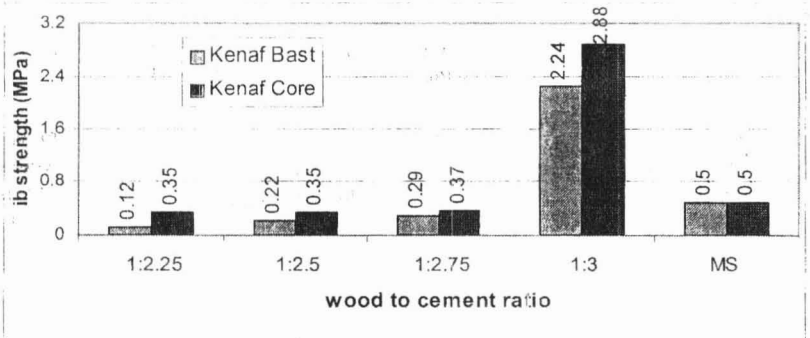

Figure 3: ib values of kenaf based cement bonded particleboard

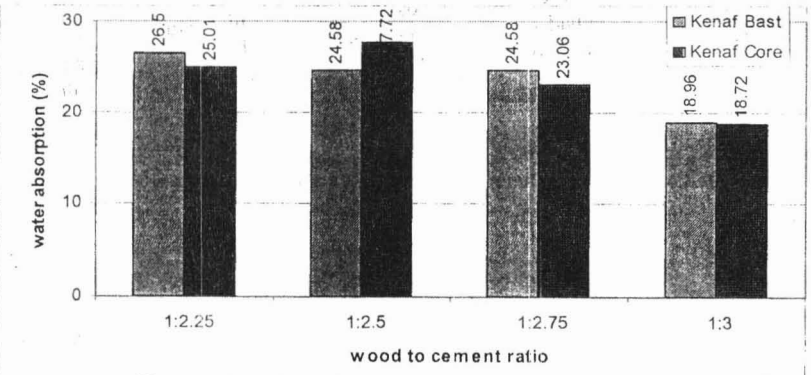

Figure 4: water absorption percentage of kenaf based cement bonded particleboard

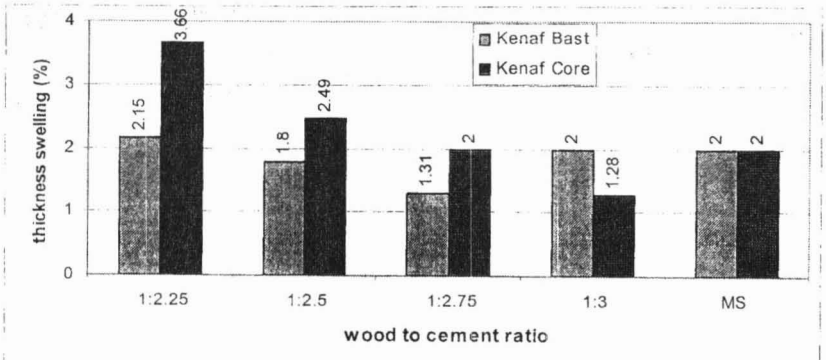

Figure 5: thickness swelling percentage of kenaf based cement bonded particleboard

In general, the MOR values (Figure 1) of two's kenaf fiber used in the cement board demonstrated the figures that slightly the same. All of them did not commit or surpassed the minimum Malaysian Standard requirements. CBP at cement content of 2.75 was generally display a highest of MOR for both of kenaf's fiber type of CBP, however the MOR values decreased as wood:cement ratios in CBP increased to 1:3. The kenaf's core CBP has shown a higher MOR than kenaf's bast CBP for almost all of wood to cement ratios.

It is determined that the best of MOE (figure 2) yield of CBP at both of kenaf's fiber was the wood to cement ratio of 1:2.75 and 1:3. The results of CBP at cement content at 2.75 and 3.0 are better than the other CBPs even though they not met the minimum standard requirement.

From the graph of Figure 3, it is clearly show that the internal bond test of CBP is strongly exhibited by the board at 1:3 of wood to cement ratio. Other CBPs display a weak of internal bond test and not fulfill the minimum standard requirement which is at 0.5MPa.

The results of water absorption and thickness swelling are demonstrated above in Figure 3 and 4 respectively. Both of them show the trend of decreasing of water interaction to the CBP as cement contents are increasing. The lowest percentage of water absorption and thickness swelling results are belongs to the CBP at wood to cement ratio at 1 3. The CBP of cement contents at 2.75 and 3.0 display the number where meeting the minimum standard requirements.

Conclusion

As a conclusion, the best of wood to cement ratio of kenaf's CBP is 2.75 to 3.0 for a good results of mechanical and physical properties. It is same track with the commercial usage of cement between 2.75 to 3.0.

Acknowledgements

The author would like to appreciate the twos' industrial training students from Shah Alam Polytechnic namely Shahril Idzwan and Muhammad Fazimie of their good job while conducting this study. Mr. Jalali Hj. Salleh who is Senior Research Assistant at Wood Composites Unit also appreciated on his invaluable knowledge input during this study.

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