UNIVERSITI PUTRA MALAYSIA

PROPERTIES OF KENAF (*HIBISCUS CANNABINUS* L.) FIBERS AND HANDSHEETS FOR LINERBOARD PRODUCTION

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PROPERTIES OF KENAF (*HIBISCUS CANNABINUS* L.) FIBERS AND HANDSHEETS FOR LINERBOARD PRODUCTION

By

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DEDICATION

Dedicated to:

Mohammad Bahman Beigi (1921-2010)

Pioneer nomadic education in Iranian communities
In Malaysia, almost 50% of the total paper consumption comes from packaging paper such as kraft liner and medium corrugated. However, there is no local production of kraft pulp in Malaysia and this poses the highest potential for imports. On the other hand, the government of Malaysia has actively encouraged the paper and paperboard industry to enhance self-sufficiency. The insufficiency in the supply of fiber for papermaking has necessitated the paper industry to search for alternative fiber. Kenaf has been identified as one of the potential sources for pulp fibers and some research have been carried out on locally available kenaf in the production of pulp and paper. The study was done in four steps to evaluate the suitability of Malaysian cultivated kenaf for linerboard production. First, the chemical and morphological properties of kenaf fractions were characterized. The chemical and morphological analysis indicated that bast and core fibers were significantly different. The core fraction with short and wide fibers had
higher lignin, hemicelluloses and lower cellulose compared to the long and slender fiber in the bast fractions. In the second step, the pulping properties of different fractions of kenaf (core, bast, and whole stem) were studied. The pulping result showed that kenaf fractions gave high pulp yield (54.2-58.4%) with environment friendly soda-AQ pulping process at mild cooking condition. In comparison to core fibers, bast fibers were relatively easy to delignify and produced paper at higher freeness, lower drainage time and lower strength properties except for tear index. Moreover, due to higher freeness and lower drainage time, bast fibers had the potential to develop strength. Core pulp due to very low freeness and high drainage time was used as unbeaten pulp. Whole stem kenaf showed intermediate properties between core and bast. In the third step, pulp fractionation and sequence selective process was carried out as a new approach to use kenaf whole stem for paper and paperboard production. The result showed that fractionation and sequence selective process made a good opportunity to better beating and fibrillation long fiber at higher level of PFI revolution and remixing with unbeaten short fiber and produced paper with significantly higher strength and better drainability than unfractionated beaten whole stem. In the final part of this study, kenaf whole stem pulps were used to improve old corrugated containers board (OCC). The blending experiments led to the conclusion that fractionated pulp had better effect in the improvement of OCC than unfractionated pulp. In this part, kenaf whole stem pulps were compared to unbleached softwood kraft pulp and mechanical treatment (beating) to improve OCC. The result showed that addition 5-10% fractionated whole stem or unbleached softwood kraft pulp improved OCC properties same as when it was beaten with 2000 PFI revolution. Nonetheless, with better tear index and drainability. The overall conclusion is that, using whole stem, rather than separating the kenaf into bast and core fractions may reduce fiber supply costs for kenaf significantly which would represent a problem for the
commercialization of the raw material. The extra processing steps involved in separation and pulping keeps kenaf from competing effectively with wood. The results discussed above demonstrate that most respects (strength properties and drainability) the whole stems are good for linerboard production or OCC improvement when fractionation and sequence selective process is used to improve strength properties.
SIFAT-SIFAT GENTIAN DAN KERTAS DARIPADA KENAF (HIBISCUS CANNABINUS L.) UNTUK PENGENLARAN BODLINER

Oleh

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Disember 2010

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kebolehan aliran yang lebih baik. Kesimpulannya, dengan menggunakan keseluruhan stem, daripada memisahkan kenaf kepada pecahan kulit dan stem boleh mengurangkan kos bekalan gentian kenaf secara signifikan yang mana merupakan masalah pengkomersilan bahan mentah ini. Langkah-langkah pemprosesan tambahan, dan kos tambahan dua pemulpaan meletakkan kenaf berupaya bersaing dengan pemprosesan menggunakan sumber kayu. Sebagaimana data yang telah dibincangkan di atas menunjukkan bahawa dalam kebanyakan segi (sifat-sifat kekuatan dan kebolehan aliran) keseluruhan stem adalah lebih baik untuk pengeluaran bodliner atau pemulihan OCC apabila pemisahan dan proses pemilihan turutan digunakan untuk membaiki sifat-sifat kekuatan.

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I certify that a Thesis Examination Committee has met on 22nd December 2010 to conduct the final examination of Ahmad Azizi Mossello on his thesis entitled “Properties of Linerboard from Kenaf (Hibiscus cannabinus) Fibers” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the University [P.U.(A) 106] 15 March 1998. The Committee recommends that that the student is awarded the Doctor of Philosophy.

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also, declare that is it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.
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