

CHAPTER 7

Semantan Bamboo - Virgin Pulp Source for Recycled Paper Enhancement

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Abstract

Corrugated paper is currently being produced from recycled paper as the main raw material but recycled paper has some limitation, one of them is it only can be recycled five to seven times, before the fiber become stiff. Therefore, the additional of imported softwood pulps was needed as their source of virgin pulps, to maintain the paper strength. Local bamboo has been identified as potential source of readily available raw material for such purpose. The pulping of *Semantan* bamboo revealed that pulping condition with 15% alkali charge and 150°C cooking temperature with 8000 beating revolutions leads to good paper properties. The paper tensile index was 87.71 Nm/g, bursting index was 6.94 kPa.m²/g, tearing index was 12.72 mN.m²/g and folding endurance was 613 double folds. After that, the bamboo pulp was mixed with recycled paper pulp and made into 120 g/m² paper for corrugated paper manufacturing. The results

revealed improved values with increasing bamboo percentage added to the recycled paper. Zero-span index and flat crush test for 2.5%, 5%, 7.5% and 10% bamboo added with recycle paper properties were 90.06, 91.38, 95.23 and 96.90 Nm/g and 1.49, 1.49, 1.53 and 1.61 Nm/g respectively. In conclusion, Malaysian bamboo possesses great potential in enhancing the recycled paper properties, therefore bamboo serves as a good substitute for the current imported virgin softwood pulps.

Introduction

Pulp and paper is one of the most important industries in the world. The consumer for pulp and paper products involved all stage of society. Historically the first paper was made from non-wood material by Tsai Lun in China. In 20th century, wood has been dominant to be the main source for pulp and paper material, due to its availability, low cost and good paper properties.

Recently, due to the shortage of wood supplies and the environmental concern related to deforestation, alternative raw material is needed to supplement or replace wood source to maintain the pulp and paper production. Many research and development have been done towards this issue. Most of the countries still depend on the imported raw material for their pulp and paper production, including Malaysia.

90 to 95% of corrugated paper raw material used recycled paper from various sources such as old corrugated cardboard, writing paper, old news paper and etc. The recycled fiber will be stiff due to lack of fiber flexibility after went through the paper making process especially the drying and calendaring processes. After being recycled more than five times, the fiber will be weaker and virgin pulp need to be added to maintain or improve the fiber strength (Rushdan, 2003). Nowadays, most of the virgin pulp is made from imported softwood fiber and it cost about USD500 to 900 per metric tonne (Brian McClay, 2016).

Methodology

The best bamboo paper (Nurul Husna *et al.*, 2013) was produced from *Semantan* bamboo (15% Alkali, 150°C and 8000 beating revolution), was blended with commercial recycled paper collected from Pascorp Paper Sdn Bhd, Bentong, Pahang. 120 g/m² paper was produced and it zero-span index was tested. After that, it was turned into corrugated form and tested for the flat crush testing endurance.

Result and Discussion

Table 1 shows the treatment conditions for *Semantan* bamboo and recycled paper blending, and the results for zero-span index and flat crush test index. The treatment involved the different percentage of *Semantan* bamboo from 2.5 up to 10% added to the recycled paper material.

Table 1
Treatment Condition for Semantan Bamboo and Recycled Paper Blending

Treatment	Semantan Bamboo (%)	Recycled paper (%)	Zero-span Index (Nm/g)	Flat Crush Test Index (Nm/g)
A	0	100	78.83	1.49
B	2.5	97.5	90.06	1.49
C	5	95	91.38	1.49
D	7.5	92.5	95.23	1.53
E	10	90	96.90	1.61

Fig. 1 shows the zero-span index for different percentage of Semantan bamboo and recycled paper blending. The lowest zero-span index (78.83 Nm/g) was found in the first treatment (A) which consists of 100% recycled paper pulp. Then the zero-span index slightly increased with the increasing of the additional of *Semantan* bamboo pulp from 2.5, 5, 7.5 and 10%. It finally increased up to 96.90 Nm/g when 10% of *Semantan* bamboo was added to the recycled paper pulp.

Fig. 2 shows the flat crush test index for different treatment of Semantan bamboo and recycled paper blending. The flat crush test index increased slightly with the increasing of the *Semantan* bamboo percentage added in the bamboo-recycled paper blending, as the highest flat crush test index found in treatment E, which consists of 10% *Semantan* bamboo and 90% of recycled paper.

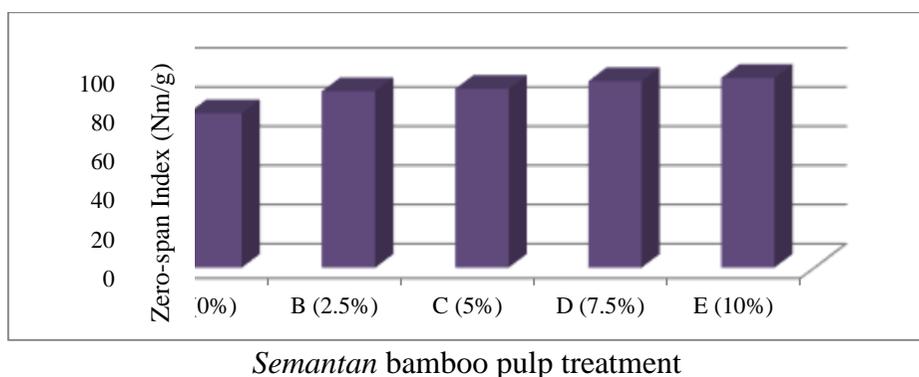


Fig. 1: Zero-span index for different percentage of Semantan bamboo and recycled paper blending

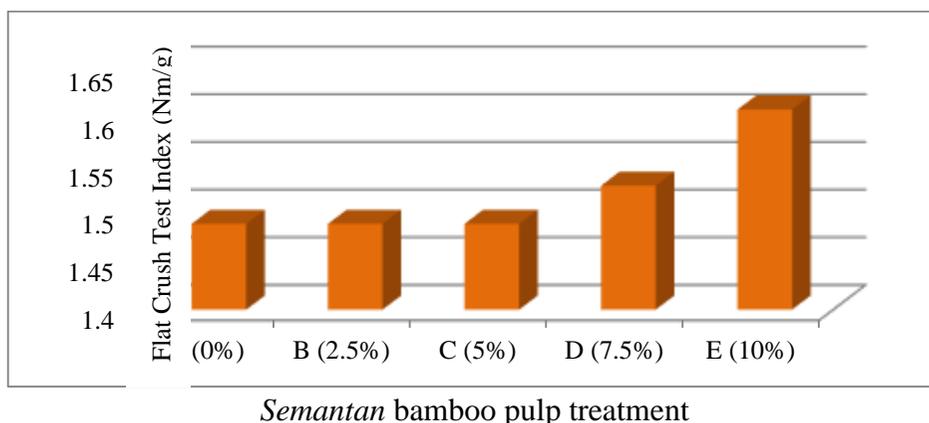


Fig. 2 Flat crush test index for different treatment of *Semantan* bamboo and recycled paper blending

Conclusion

Semantan bamboo has high potential to be used as virgin pulp in substituting the imported virgin pulp, because bamboo pulp is locally available and plantation bamboo can be harvested within 1 to 3 years compared to wood source material. Results show that bamboo pulp improved the recycled paper strength, with additional of 2.5 to 10% of bamboo fiber.

References

- Brian McClay (2016). Brian McClay & Associés Inc. is a pulp and related end-uses Market Intelligence Consultancy established in 1997 to assist subscribers and clients around the world to improve their understanding of current and future market conditions and emerging marketplace trends. Retrieved from <http://www.nrcan.gc.ca/forests/industry/current-prices/13309>
- Rushdan, I. (2003). Structural, mechanical and optical properties of recycled paper blended with oil palm empty fruit bunch pulp. *Journal of Oil Palm Research*, Vol. 15, No. 2, December 2003, pp. 28-34
- Nurul Husna, M.H., Suhaimi, M. and Rushdan, I. (2013). Effect of Soda-Anthraquinone Pulping Conditions and Beating Revolution on the Mechanical Properties of Paper Made from *Gigantochloa scortechinii* (*Semantan* Bamboo), *The Malaysian Journal of Analytical Sciences*, 17(1): 75-84.