The effect of coconut fiber towards impact characteristics

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ABSTRACT – The aim of this study is to analyze the effect of the coconut fibre composition upon the energy and resilience characteristic. A series of four samples with composition of 15, 30, 45 and 60 vol.% of coconut fiber was prepared by mixing together with polyester resin and were tested using pendulum impact test machine. The energy and resilience were measured according to ASTM D-6110. The sample with 60 vol.% coconut fibre displayed the highest value of energy and resilience. This is due to the proper strength distribution by the fibre matrix. On top of that the coconut fibre itself behaved as a significant adhesion between the matrix and composite. As a conclusion, the higher composition of coconut fibre added to the composite resulted in better impact characteristic.

1. INTRODUCTION

Fibre is one of the elements that been used as reinforcement material to produce composites. This fibre usually present in the filament phase which having an extraordinary mechanical features in term of strength and stiffness properties [1]. A verity type of fibre currently been introduce in developing new composite material such as metallic, aramid, glass, carbon, alumina and ect but yet still limitation awareness on the enviremetal friendly aspect [2]. As countermeasure natural fibre tend to be acknowladge nowadays. The natural fibre can be obtained by extraction of plant or animals which can be revolve to filament phase.

Coconut fibre can be classify as one of the natural fibre which is a part of seed fibers. The life spand of the coconut fibre is longer compared to other natural fibre due to high amount of lignin beside the coconut fibre is more cost effective and also biogradable [3].

Currently, the potential of coconut fibre as a reiforcement material to produce new composite material still in slow development stage. A lot of uncertainties raised in term of the peformance of the coconut fibre as reinforcement material especially toward the impact characteristic which is still not yet extensively been study.

The objective of this study is to analyze the effect of the coconut fibre composition on the energy and resilience characteristic toward the impact test.

2. METHODOLOGY

A series of four samples with composition of 15, 30, 45 and 60 vol.% of coconut fibre was prepared according to the Table 1. Each sample was test by using Pendulum Impact Test Machine with 150º angle of hammer, and the impact result was recorded from the machine. The result was verify according to the ASTM D6110- Determining the Charpy Impact Resistance of Notched. Figure 1 illustrate the impact test for each sample.

Table 1 Composition of the sample.

Sample	Composition, Vol.%	
	Coconut fibre	Polyester Resin
1	15	85
2	30	70
3	45	55
4	60	40

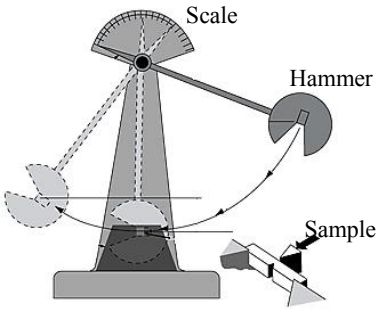


Figure 1 Impact test for each sample [4].

3. RESULTS AND DISCUSSION

Table 2 shows the impact result for overall samples. The fibre compositions of sample 1 which contain of 15 vol.% coconut fibre gave the lowest value of energy and resilience, which are 0.828 J and 5.21 KJ/m², following by another sample that gave an increasing trend. Sample 4 gave the highest value of energy and resilience which are 1.044 J and 6.57 KJ/m. The details comparison for each sample are given by Figure 2.

Table 2 Data obtained from the impact test.

Sample	Coconut fibre, Vol.%	Energy (Joule)	Resilience (KJ/m²)
1	15%	0.828	5.21
2	30%	0.899	5.39
3	45%	0.907	5.71
4	60%	1.044	6.57

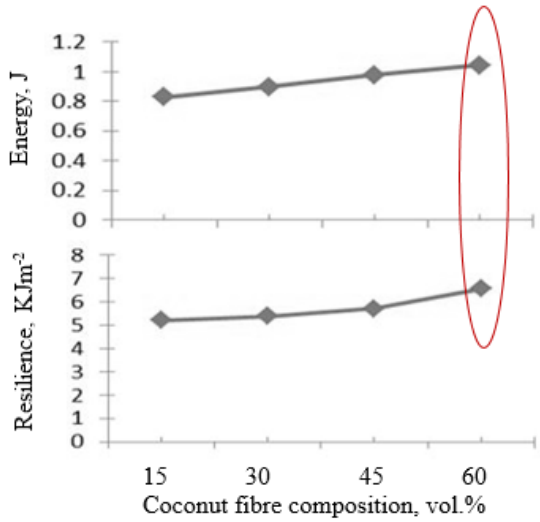
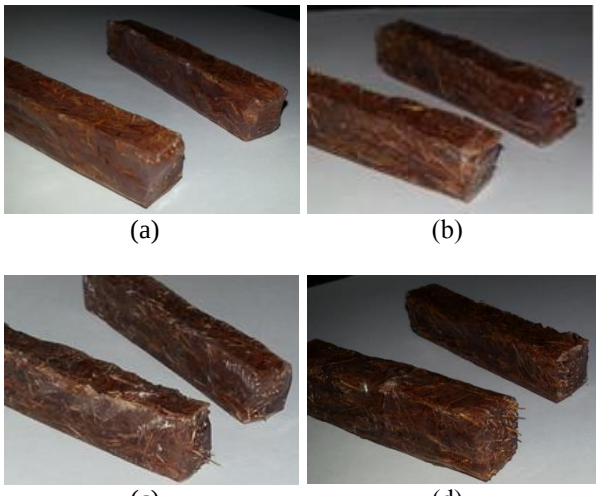


Figure 2 Graph energy and resilience versus coconut fibre composition.

According to some researcher, by adding some of coconut fibre content in sampling, the value of energy and resilience should be increase [5]. The scientific explaination to the increment of the energy and resilience was due to the properties of the coconut fibre where it able to allocate more toughness properties as it dispersed phase in the composites.

Coconut fibre also provided a good and proper adhesion between matrix within the composites. This method is able to stablize the strength distributions and absorption which proportionaly increased the impact energy [6].

Figure 3 shows the image for each sample in term of their cross-sectional area after the impact test was conducted. Refer to the image the more coconut fiber composition the darker the sample which reflected to the color or the coconut fiber itself. The higher content of the coconut fiber able to give better bonding property between resin and the fiber in term of the fiber adhesive support which illustrated by Figure 4.



(a) (b)

(c) (d)

Figure 3 Cross sectional area of each sample with coconut fiber (a) 15 vol.%, (b) 30 vol.%, (c) 45 vol.% and (d) 60 vol.%.

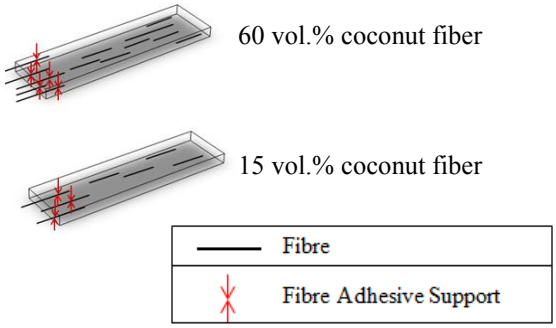


Figure 4 Fiber orientation and fibre adhesive support for sample with 15 and 60 vol.%.

4. CONCLUSION

As conclusion, the higher coconut fiber content the higher result obtained for the resilience and energy absorb which believed due to the physical properties of the coconut fiber itself. Coconut fiber able to provided good adhesion and bonding between the coconut fiber and polyester resin which lead to good strength distributions with balanced absorption of energy.

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