Improvement of Mechanical Properties of Rattan Fiber–reinforced/Carbon Nanotube/Epoxy Resin Composites by Alkaline Treatment Method

P. Pattanakitkaset[1], W. Thamjaree[2] and W. Nhuapeng[3]

[1,2,3]*Department of Physics and Materials Science, Faculty of Science, Chiang Mai University, Suthep Road, Chiang Mai, 50200,Thailand*

**Corresponding author. E-mail: commandoboom8@gmail.com*

Abstract

In this research, mechanical properties of short rattan fiber (Calamus sp.7 of in San Pa Koi, Chiang Mai) approximately length 1.0 cm – nanoparticles carbon nanotube (CNTs), which was prepared via chemical vapor deposition (CVD) technique, reinforced epoxy resin composites were investigated. Rattan fibers were treated in Sodium Hydroxide in different soaking time. To improve the ability of adhesion compare with non-soaked rattan fibers since alkaline destroy external surface, which coated with waxy substances. The samples were fabricated in different types with different ratio (5%, 10% and 15% by volume) of soaked and non-soaked fiber for reinforced suitable. Moreover mix different ratio of the fibers and CNTs nanoparticles and epoxy resin composites for testing mechanical properties. From the results, the impact resistance is the most effective to improve reinforcement. It could be found that the suitable ratio the fibers mix with epoxy resin is 15% by volume and 1.0 hour soaked. In addition adding the CNTs nanoparticles into epoxy resin can promote the mechanical properties of composites samples which exhibited the higher value of 17.3% of impact resistance when compared with that the fibers and epoxy resin composites.

Objective

Improving the mechanical properties of rattan fiber reinforced carbon nanotube and epoxy resin composites by an alkaline treatment method.

Materials and Methods

Unprepared Rattan Fiber

Prepared Rattan Fiber

Soaked Rattan Fiber
Different Time

Dried in air 24 hours
and Prepared Samples

Impact Testing Machine

Property Measurement of the Nanocomposites

The absorbed energy is calculated using the following equation:

$$AE\left(\text{Absorbed Energy}\right) = E_p - E_p^*$$

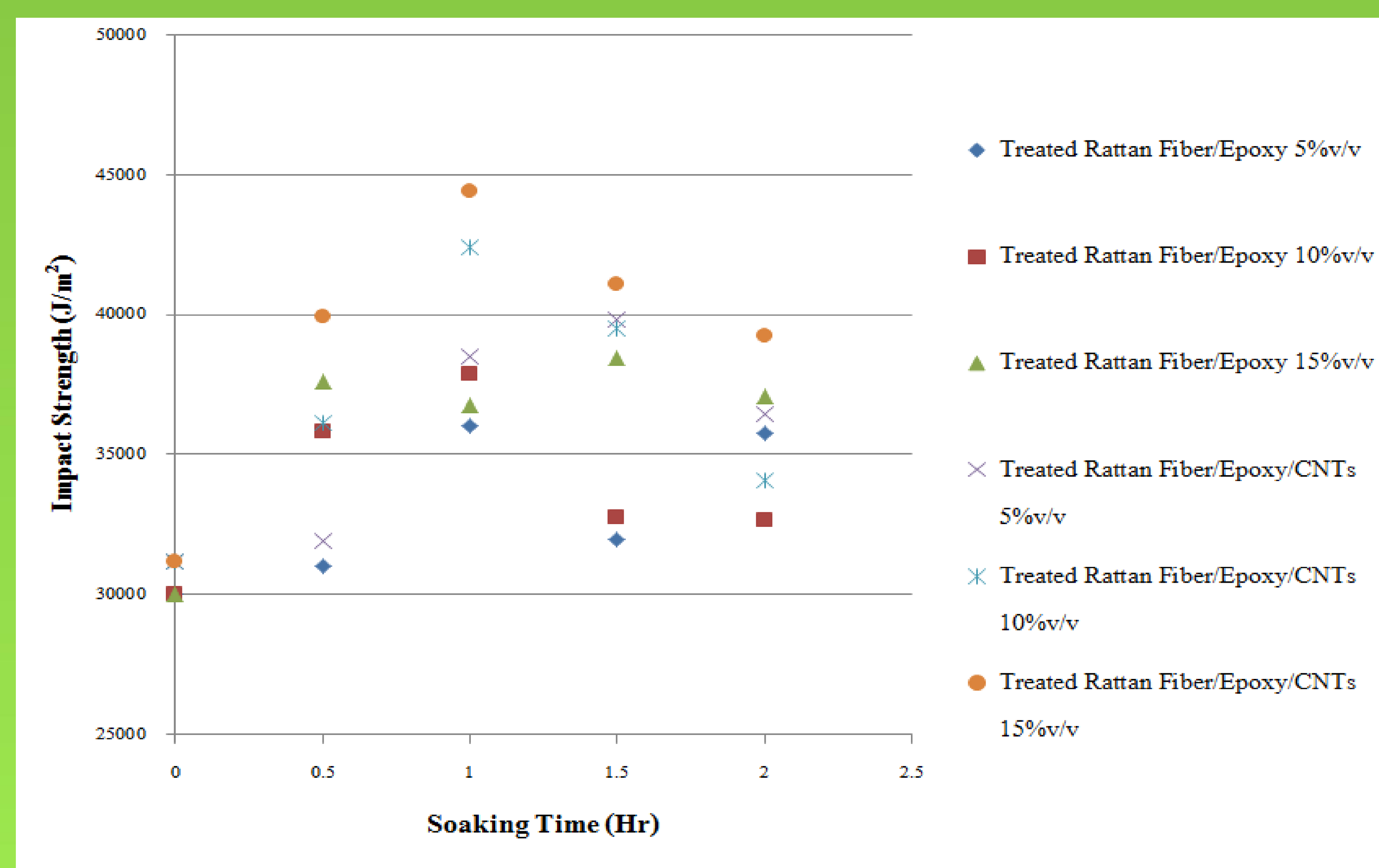
$$E_p^* = \omega r\left(\cos\beta - \cos\alpha\right) = mgr\left(\cos\beta - \cos\alpha\right)$$

Where $E_p = 27.88\ J$; α is the angle of pendulum before impact; β is the angle of pendulum after impact.

Result and Discussion

The maximum reduction in impact strength was 26.1 % and 42.4 % for rattan fiber/epoxy resin and rattan fiber/CNTs epoxy composites, respectively. It is to known that the interfacial adhesion strength between matrix, CNTs and rattan fiber affected the impact property of composites.

The good interfacial adhesion between reinforcement treated rattan fiber and CNTs epoxy was the important factors for the effectiveness of impact strength improving.



Conclusions

In this study, impact strength has tend the increased of rattan fiber content as same as rattan fiber reinforced CNTs epoxy resin composites. The fiber proved to be effective reinforcement for the impact strength improving. But soaked the fiber more than 1.0 hour the impact strength will ineffective because alkaline destroy hemicellulose more than limited, also poor interfacial bonding resulted poor energy between rattan fiber and epoxy matrix.

Acknowledgments

The author would like to thank Composites and Reinforcement nanocomposites Research Laboratory, department of Physics and Material at Chiang Mai University for support to this project.

References

1. I. Van de Weyenberg, T. Chi Truong, B. Vangrimde, I. Verpoest; Composites: Part A 37 (2005) 1368.
2. P. Kongkaew, W. Nhuapeng, W. Thamjaree; Physics and Material, Chiang Mai University (2006) 264.
3. J. Gassan, A.K. Bledzki; Composites Science and Technology 59 (1999) 1303.