



# Study and compare the mechanical properties of bio fiber reinforced composites

G. Sathish Kumar, R. Sridhar  , T. Gokul, R. Pugazhenth

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## Abstract

This study aims to evaluate the result of experimental investigation carried out on mechanical properties and dynamic mechanical analysis over a range of temperature and five different frequencies of short banana fiber polyester composite. The effect of temperature on the storage modulus ( $E'$ ), loss modulus ( $E''$ ), and loss factor or damping efficiency ( $\tan \delta$ ) is determined. Composites specimen is fabricated in random fiber orientation using to hand lay-up method by Influence of fiber length (10mm) and weight percentage (5, 10, 15, 20wt%). Studies revealed that increase in the fiber content will increase the Mechanical property and storage modulus ( $E'$ ) and the maximum is given by the composites having a fiber loading of 20wt% at all temperature ranges. The peak height of loss modulus ( $E''$ ) and damping curves ( $\tan \delta$ ) were lowered with respect to the fiber content. The properties were compared with neat polyester. In this work increasing fiber content increases the Mechanical property and storage modulus ( $E'$ ) of the composite.

## Introduction

In several applications, the natural fiber composite is truthful alternative to the synthetic fiber composite, meanwhile the fiber hold various comparatively credits, like less density, more specific strength, less cost and renewability. The furthest generally used plant fiber is polymer reinforcement are banana, sisal, flax, jut, hemp, ramie etc., which are previously contributed to different fields. The recitals of combined resources are generally based on automatic distinctiveness, like tensile, compression, impact properties and flexural etc. Though the natural fiber reinforced composite is fully not studied to the structural engineering particularly in dynamic load situations. Damping is one of the important role allied with the vibrant conduct of the material due to its effect on systems feat, like reliability and safety [1].

The vibrations elevate more-noise level, broken of stresses exhaustion, premature wear and dangerous working circumstances. The structures can knowledge too greatly of pulsation when the forceful loading creates vibration at normal incidence of the material. Hence, consideration of the entire Mechanical Property of the material is very significant for the effectual design and use of this composite [2]. The Dynamic mechanical analysis (DMA) and Mechanical Properties are important technique to examine the mechanical behavior of the polymer composites resource. Predominant revisions are made on the vibration method damping in the polymers. However, damping mechanisms in the FRP material differ from the conventional polymer [3], [4] (Table 1).

In the composite material, the incidence of filler or strengthening medium express multi part interior structure in the material in which the damping performances trust not only on property of separate materials but on various other features like volume fraction, quality of the interface, plasticization of polymer and load direction[5], [6]. There are different energy tolerance mechanisms in the fiber-reinforced composite like visco-elastic nature of matrix, fiber materials, friction produced by the slip in the matrix, energy tolerance at clefts and delaminating caused at dented spots, visco-plastic and the thermo elastic damping [7] (Table 2).

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## Section snippets

### Tensile test

Tensile test is the basic materials science TGST in which the specimen is subjected to a load tension until certain limit [8]. The test result is basically used to choose a material for particular application, quality control, and to analyze how the material will behave under various forces. Properties that are directly measured by the help tensile test are ultimate tensile strength, maximum elongation and area reduction (Fig. 1)...

### Rockwell hardness test

Hardness is a typical fundamental physical property of any...

### Tensile strength

Table 3 and Fig. 4.

Above Fig. 4 shows that the tensile tests of 5%, 10%, 15% and 20% of banana fibre we can test in three samples value are ultimate load 3500N, breaking load1264N, ultimate stress 20.68N/mm<sup>2</sup> breaking stress 8.826N/mm<sup>2</sup> respectively. When compared to the above Fig. 4 it is absorbed that 20% ratio of banana fibre has more ultimate strength....

### Rockwell hardness testing

Table 4.

Fig. 5 shows the hardness test values of 5%, 10%, 15% and 20% of banana and 95%, 90%, 85% and 80% of resin we can test in three...

## Conclusions

In this study, the mechanical property and damping characteristics of the short banana fiber reinforced polyester composite is tested by the free tensile testing, dynamic mechanical study and hardness testing. It is decided that the adding of banana fiber raises the mechanical characteristics. It is noted that the highest value of storage modulus of 7.7 GPa and low modulus value of 3.5E+07Pa are attained with the adding of 20wt% banana fiber to the composite material. It is noted that the...

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper....

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...Modernization and construction on a larger scale require the exploration of physical characteristics in order to standardize them and ensure their controlled and mastered use. This is not new, as it is now encouraged [1–3]. It should also be noted that in Central Africa, we are still behind in taking into account the environmental and energy impact in the construction policy...

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