



## Effect of fiber length on physical and mechanical properties of medium-density particleboard –A Review

Vinay Kumar\* Sanjay Tiwari\*\*

\*M.tech Scholar, Mechanical Engineering Department, BN College of Engineering & Technology Lucknow, Uttar Pradesh, India

\*\*Associate Professor, Mechanical Engineering Department, BN College of Engineering & Technology Lucknow, Uttar Pradesh, India

### ABSTRACT

Composite materials with natural fiber such as jute, bamboo, and coconut provide advantages of high stiffness and strength to weight ratio as compared to conventional construction materials, i.e. wood, concrete, and steel. Despite these advantages, the widespread use of synthetic fiber-reinforced polymer composite tends to decline because of their high-initial costs, their use in non-efficient structural forms, and most importantly their adverse environmental impact. Also, this review paper provides suitable fiber length as well as suitable fiber ratio or fiber volume fraction.

**Keywords:** - Fiber length, Fiber ratio, Mechanical properties

### INTRODUCTION

In recent years there is a vast growth in natural fiber-based polymer composites due to its various attractive features likes biodegradability, no abrasiveness, flexibility, availability, low cost, lightweight, etc. Different researchers have performed various experiments to enhance the mechanical properties of natural fiber-based

polymer composites.

### Definition of composite material

Composite mainly formed from two different materials one of which is in the particle or fiber is combined with other material known as a matrix. The fiber in the composites acts as a

assumption load-carrying member due to its peak strength modules while matrix in the composites performs as a load transfer medium between the fibers. Due to additional ductility of the composite material, it gives matrix maximum toughness.

### Classification of composite material

#### 1. Based on the matrix material

- a) Metal matrix composites
- b) Ceramic matrix composite
- c) Polymer matrix composite

#### 2. Based on reinforcement

- a) Particle reinforced composites
- b) Fiber-reinforced composite

### Merits of composite material

Some advantages of composite material over the conventional one are as follows:

- 1) Improved impact properties and torsional stiffness.
- 2) Low thermal conductivity.
- 3) Lightweight.
- 4) High strength to weight ratio.
- 5) Heat resistance.
- 6) High performance at Elevated Temperature.
- 7) High impact strength.
- 8) Creep resistance.
- 9) Molded-in inserts.
- 10) The ability of quench.

#### Application of composite material

- 1) In aircraft, it is used in the loading gear, spoiler, flap body, etc.
- 2) In automobiles, it is used to make leaf spring, exterior body, engine components, etc.
- 3) In electrical it is used to made computer housing, insulators, etc.
- 4) It is used to make a water tank and pipes.
- 5) It is also used for making furniture.
- 6) It is also used for making particleboard.

### LITERATURE REVIEW

This chapter outlines the recent work done in the field of mechanical properties of natural fiber composites

**J.A. Flores et al (1)** study about pressure impact on common reed fiberboard production using crusher blades. Urea-formaldehyde resin use as adhesive. The final result of this investigation is that when pressure varying  $3\text{N/mm}^2$  to  $25\text{N/mm}^2$ . The result allowed us to state that pressure and particle size play an important role for enhance the mechanical properties of the fiberboard.

**Himanshu Bisaria et al (2)** investigated the effect of length of the fiber on physical and mechanical properties of undirected oriented short jute fiber composite by taking 30% fiber ratio with various fiber lengths of 5, 10, 15 and 20mm into epoxy matrix. The interpretation of this research is at 15mm fiber length flexural and tensile properties were found maximum and impact properties were found maximum at 20mm fiber length with 30% wt fraction.

**Sunil Singh Rana et al (3)** examine the effect of difference on mechanical properties in the reinforced composite. The composite prepared by hand lay-up method by using the various fiber lengths (5, 10, 15, and 20mm) by fixed

fiber ratio that is 30wt%. The result determined in terms of storage modulus, loss modulus, and damping at different frequencies such as 1, 2, and 5 Hz.

**Wim Nhuapeng et al (4)** investigate the mechanical properties of Hybrid composite by taking various fiber volume fractions that are as follows 25wt%, 30wt%, 40wt%, and 50wt%. The conclusion of this study was the specimen of 30wt% and 25wt% indicate better mechanical properties whereas the 40wt% indicates outstanding sound properties.

**Tiesong Lin et al (5)** study the effect of length of fiber on fracture behavior and mechanical properties of geopolymer matrix composite material by taking dissimilar fiber length (2, 7, and 12mm). After a study by a three-point bending test, optical microscope and scanning electron microscopy the result indicate that 7mm fiber length show as maximum flexural toughness as well as the highest work of fracture.

**Ashish Kumre et al (6)** study about the difference in mechanical properties of sisal glass fiber reinforced composite by replacing artificial fiber to natural fiber by taking fiber at various lengths (5, 10, 15, and 20mm). The result was of this investigation, the tensile strength not increased but tensile modulus, impact properties were improved.

**F. Rezaei et al (7)** study the effect of fiber length on thermo-mechanical properties of carbon fiber composites by producing the specimen by hot pressing method. The outcome came out by executing thermal gravimetric examine and dynamic mechanical analysis and outcome show that when fiber length rise then thermal stability increased and damping properties improved.

**Shahana Parvin et al (8)** give a review of the mechanical properties of natural fiber composite. Natural fibers are very much agreed with the epoxy matrix. They have the potential to replace artificial fiber. Thus these composite can replace the most conventionally used material.

**S. Keck et al (9)** investigate rupture mechanical conditions of unidirectional lineup flax fiber-reinforced composites were presented. Compact tension samples were tested under stable loading conditions. Thereby, five different fiber directions referring to the initial crack in concurrence with five various fiber ratios were studied. It can be deduced, that the arrangement of the fiber concerning the position of the initial crack plane

affects the crack path evolution. Moreover, the number of a fiber expressed by the fiber volume fraction influences the crack path as well.

## REFERENCES

**Hari Om Maurya et al (10)** investigate the mechanical behavior of epoxy composite using short sisal fiber. In this study, composite were develop with various lengths of fires (5, 10, 15, and 20mm) with 30% fiber volume fraction. The outcome of this study was at 15mm fiber length flexural strength enhances 25% and at 20mm fiber length, impact properties improved.

## CONCLUSION

After the whole study, there are some conclusion came out that are as follows:

- 1) The tensile and elasticity depends on fiber ratio and fiber length
- 2) The physical properties are depending on fiber length and fiber ratio.
- 3) The mechanical and physical characteristics also depend on the method of producing the composite material.
- 4) Screw withdrawal strength of the particle board depends on the orientation and length of the fiber.
- 5) At 11.5 mm fiber length with a 36% fiber ratio the composite material shows the maximum mechanical and physical properties.

## FUTURE WORK

After study the conclusion of this research there is some future work came out which are as follow:

- 1) We can replace epoxy resin to phenol-formaldehyde resin as well as urea-formaldehyde resin.
- 2) We can fix the fiber length and varying the fiber volume fraction.
- 3) We can fix the fiber volume fraction and varying the fiber length.
- 4) We can change the alignment of the fiber.

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