

# Chapter 5

## Estimation of Mechanical and Tribological Properties of Epoxy-Based Green Composites

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### ABSTRACT

*Composites based on natural fibre reinforcement have generated wide research and engineering interest in the last few decades due to their small density, high specific strength, low cost, light weight, recyclability and biodegradability and has earned a special category of 'green composite'. Here, in our proposed research, wood dust reinforced epoxy composite was processed with different % filler weight primarily. For this, natural filler based epoxy composite from wood dust is developed and its mechanical behaviour, including Tensile, Flexural, Density etc., under various testing conditions and % of filler weight were studied. These samples were simultaneously tested for abrasive wear and friction coefficient measurement. Microstructure of the composites was studied to analyze the distribution of the filler in the epoxy matrix change using scanning electron microscopy.*

DOI: 10.4018/978-1-5225-0424-5.ch005

## **INTRODUCTION**

Composites constitute of two main constituent materials: matrix and reinforcement. The matrix material surrounds and supports the reinforcement materials by maintaining their relative positions. The reinforcements impart their special mechanical and physical properties to enhance the matrix properties. A synergism produces material properties unavailable from the individual constituent materials, while the wide variety of matrix and strengthening materials allows the designer of the product or structure to choose an optimum combination. The reinforcing material can be of the form of particle (usually called filler) or fibre. In a particle reinforced composites, the reinforcement can be with large particle or small particle. It is not strictly the physical dimensions of the particles by which the materials are classified; rather it is the mechanism of reinforcement. In a small particle reinforced material the mechanism is on a molecular level whereas in case of large particle it is at macro level. The particles may be dispersed into or precipitated from the matrix; hence the properties can be varied with the amount and type of dispersion.

In the recent years, rising concern towards environmental problem and the need for more multifarious polymer-based materials has led to increasing interest about polymer composites reinforced with Green reinforcement, i.e., materials derived from natural resources like trees etc. The natural composites, or green composites, have shown a growth of interest because of their recyclability, biodegradability and abundant availability (Thakur et al., 2012).

Specific properties of natural composite such as light weight, low cost, renewable in nature, high specific strength and modulus have extended their usage and allow a considerable reduction in the use of non-biodegradable polymers and non-renewable resources (Bhowmick et al., 2012). Also in automobile industry the use of wood based natural composites enhance the mechanical strength and acoustic performance, reduce material weight and fuel consumption, improve biodegradability and production cost for the auto interior parts (Herrera-Franco and Valadez-González, 2004). They are also much less abrasive than inorganic-mineral counterparts to process machinery, less dangerous for the production employees in case of inhalation, easy to be scorched, and leads to final composites with lower specific weight (in comparison to mineral-filled counterparts) and allows obtaining interesting properties in terms of thermal and acoustic insulation. Also natural composite can be easily disposed at the end of their life cycle by compositing or by recovery of their calorific value in a furnace which is not possible in synthetic composite with reinforcement such as glass.

The woven banana fibre reinforced epoxy composites showed a very stable mechanical behaviour under different loading and speed condition (Sapuan et al., 2006). The epoxy based pissava fibres composite has rich silicon content on the surface

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