

A Study on Mechanical Properties of Sisal Fibre Reinforced Epoxy Based Biocomposite Material with Potato Starch as Filler Material

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Abstract - This study investigates into the mechanical properties of a novel biocomposite material formed by reinforcing epoxy with sisal fibers and incorporating potato starch as a filler. The increasing demand for sustainable and eco-friendly materials has spurred the exploration of natural fibers and bio-fillers in composite manufacturing. In this research, the focus lies on sisal fibers known for their exceptional strength and potato starch, recognized for its biodegradability and widespread availability.

Key Words: sisal fiber, epoxy, biocomposite, mechanical properties, potato starch.

Table -1: Constituents and their concentration in the prepared Biocomposites.

SAMPLES	EPOXY RESIN %	SISAL FIBERS %	POTATO STARCH FILLER %
A	90	10	0
B	80	10	10
C	70	10	20
D	60	10	30

1.INTRODUCTION

A composite is considered to be a multiphase material. It exhibits a significant proportion of the properties of both constituent phases such that a better combination of properties is released. This principle is termed as the principle of combined action. According to this principle, better combination of two or more distinct material is possible.

Basically a composite material is made up of reinforcement material and matrix material. Reinforcement material is stronger and stiffer than the matrix material. Matrix material is used to bind the reinforcement material and hence it is also known as binder.

A Biomaterial is any material, natural or manmade, that comprises whole or part of a living structure or biomedical device which performs, augments, or replaces a natural function. The intention of using biomaterials is to improve the quality of life of human beings by restoring the function of natural living tissues and organs in the body that has been underperforming, diseased or damaged, it is essential to understand relationships among the properties, functions, and structures of biological materials.

A variety of devices and materials are used in the treatment of disease or injury. Common examples include sutures, tooth fillings, needles, catheters, bone plates, etc.

2. RESULTS AND DISCUSSION:

In this chapter the results obtained from tension, Flexural and Hardness tests are tabulated and represented graphically to analyze the behavior of Biocomposites.

Table -2: Peak load and Tensile strength of various prepared Biocomposites.

Composition	Trials	Peak Load (N)	Tensile Strength (N/Mm ²)
A	Trial 1	452	25.11
	Trial 2	694	38.55
B	Trial 1	889	49.39
	Trial 2	467	25.95
C	Trial 1	619	34.40
	Trial 2	426	23.64
D	Trial 1	209	11.62
	Trial 2	441	24.51

The graph of stress vs strain for tensile test conducted on the prepared specimens is as follows:

Filler Concentration - 0%

(A) Trial 1

Test Name : TENSILE TEST Test Type : Normal
Test Mode : Tensile Elongation Device : CrossHead
Test Parameter : Peak Load Test Speed [mm/min]: 3.00

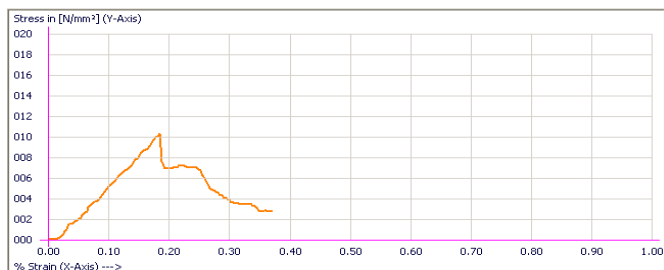


Fig -1: Stress vs Strain of tensile test for 0% filler Biocomposites.

(B) Trial 2

Test Name : TENSILE TEST Test Type : Normal
Test Mode : Tensile Elongation Device : CrossHead
Test Parameter : Peak Load Test Speed [mm/min]: 3.00

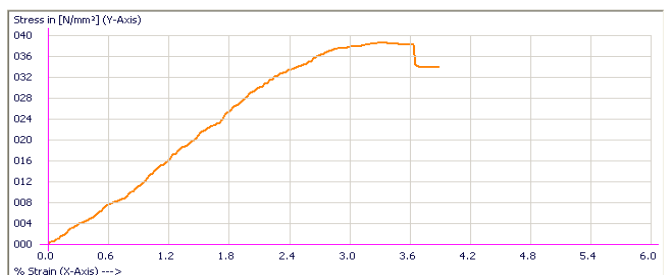


Fig -2: Stress vs Strain of tensile test for 0% filler Biocomposites

Filler Concentration - 10%

(A) Trial 1

Test Name : TENSILE TEST Test Type : Normal
Test Mode : Tensile Elongation Device : CrossHead
Test Parameter : Peak Load Test Speed [mm/min]: 3.00

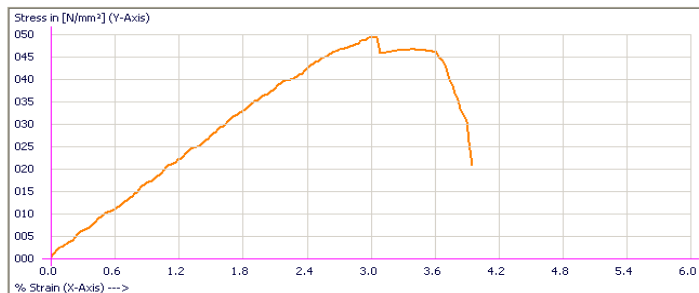


Fig -3: Stress vs Strain of tensile test for 10% filler Biocomposites

(B) Trial 2

Test Name : TENSILE TEST Test Type : Normal
Test Mode : Tensile Elongation Device : CrossHead
Test Parameter : Peak Load Test Speed [mm/min]: 3.00

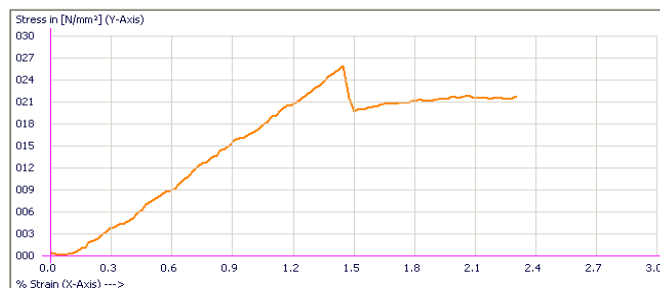


Fig -4: Stress vs Strain of tensile test for 10% filler Biocomposites

Filler Concentration - 20%

(A) Trial 1

Test Name : TENSILE TEST Test Type : Normal
Test Mode : Tensile Elongation Device : CrossHead
Test Parameter : Peak Load Test Speed [mm/min]: 3.00

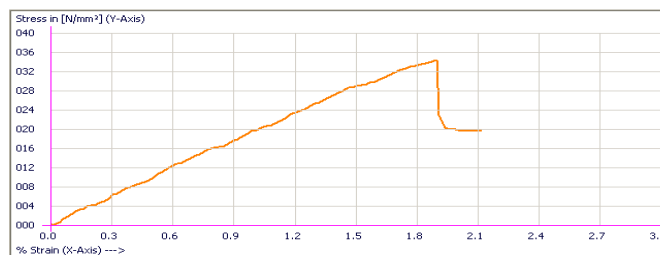


Fig -5: Stress vs Strain of tensile test for 20% filler Biocomposites

(B) Trial 2

Test Name : TENSILE TEST Test Type : Normal
Test Mode : Tensile Elongation Device : CrossHead
Test Parameter : Peak Load Test Speed [mm/min]: 3.00

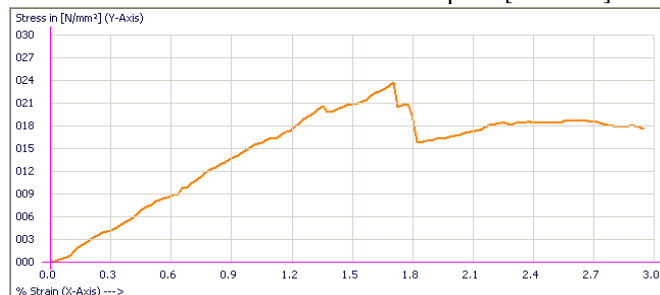


Fig -6: Stress vs Strain of tensile test for 30% filler Biocomposites

Filler Concentration - 30%

(A) Trial 1

Test Name : TENSILE TEST Test Type : Normal

Test Mode : Tensile Elongation Device : CrossHead

Test Parameter : Peak Load Test Speed [mm/min]: 3.00



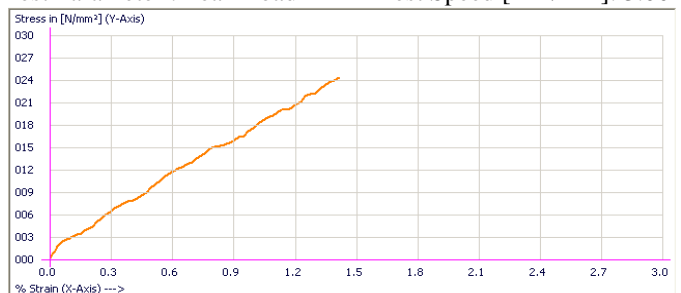
Fig -7: Stress vs Strain of tensile test for 30% filler Biocomposites

(B) Trial 2

Test Name : TENSILE TEST Test Type : Normal

Test Mode : Tensile Elongation Device : CrossHead

Test Parameter : Peak Load Test Speed [mm/min]: 3.00



3. CONCLUSIONS

The present work has been undertaken, with an objective to explore the potential of the Sisal fiber reinforced epoxy polymer Bio-composites and to study the mechanical properties of the bio-composites.

Bio-composites can supplement and eventually replace petroleum based composite materials in several applications thus offering new agricultural, environmental, manufacturing and consumer benefits.

Tensile test For all the Bio-composites tested, it is observed that the Peak Load and tensile strength increases up to 10% filler content then it starts to reduce from that point for higher filler percentage. Hence 10% filler content has better tensile properties compared to the 0%, 20%, 30% filler content.

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