Mechanical Biodegradable and Water Absorption Study of Banana and Jute Plain Woven Fabrics Reinforced with Polyvinyl Alcohol Biodegradable Composites

A. Tharun Prakash[1] Ashwath.G. V[2] Chandan Gowda.N. V[3] Hemanth Kumar R[4] Amaresh Gunge[5]
[1,2,3,4,5]Nagarjuna College Of Engineering And Technology, Bangalore

Abstract— Composite materials emerged in the middle of the twentieth century as a promising class of engineering materials providing new prospects for modern technology. In this first chapter, a basic overview of structural materials is given before moving on to an overview of composite materials. Generally speaking, any material consisting of two or more components with different properties and distinct boundaries between the components can be referred to as a composite material. Moreover, the idea of combining several components to produce a material with properties that are not attainable with the individual components has been used by humans for thousands of years. Correspondingly, the majority of natural materials that have emerged as a result of a prolonged evolution process can be treated as composite materials.

Keywords: Tesseract, OCR, optical character recognition, character Recognition, document

I. INTRODUCTION

Materials are the basic elements of all natural and man-made structures. Figuratively speaking, these materialize the structural conception. Technological progress is associated with continuous improvement of existing material properties as well as with the expansion of structural material classes and types. Usually, new materials emerge due to the necessity to improve structural efficiency and performance. In addition, new materials themselves as a rule, in turn provide new opportunities to develop updated structures and technology, while the latter challenges materials science with new problems and tasks. One of the best manifestations of this interrelated process in the development of materials, structures, and technology is associated with composite materials and structural elements to which this book is devoted Composite materials emerged in the middle of the 20th century as a promising class of engineering materials providing new prospects for modern technology.

Fig. 1: Jute plain woven fabrics

Generally speaking, any material consisting of two or more components with different properties and distinct boundaries between the components can be referred to as a composite material. Moreover, the idea of combining several components to produce a material with properties that are not attainable with the individual components has been used by man for thousands of years. Correspondingly the majority of natural materials that have emerged as a result of a prolonged evolution process can be treated as composite materials.

II. LITERATURE SURVEY

Rajuand Kumar: studied the effect of variation of thickness on bending/flexural behavior of glass Fibre reinforced in epoxy based laminated composite material. The laminate composite samples fabricated by using vacuum baggage technique. The fabricated specimen was subjected to static three-point bending and followed as per ASTM D90 standards. The flexural strength and stiffness of the composites were estimated to evaluate the flexural property of laminated composites.

Rout and Sahoo: researched on erosion wear in non-linear problem due to its operating variables. The wear method depends on numerous parameters like as impact velocity, impingement angle, material, erodent size, etc. To obtain minimum erosion rate and the experiments to conducted the material with combination of these considerations. The waste granite powder was used as filler in the jute Fiber reinforced epoxy composite. It was detected that granite filled samples contain better erosion resistance in comparison of unfilled ones.

Brien, chin, long, and Wetzel: worked with development of Composites having polymer– matrix reinforced by polymer ribbon monofilaments. This material is mechanically robust and transparent composite materials. The outcome represents that these polymer–polymer composites offer good transparency with wide temperature range, and superior ballistic dispersion resistance compared with monolithic transparent polymers.

Wu, Chi, Wu, and Lee: work focused on basalt Fibre (BF) reinforced with high density polyethylene (HDPE). The mechanical, thermal, and morphological studied. The micro- mechanical modelling of tensile properties for the BF/HDPE composites exhibits good selected models for the experimental study. The organic coating of BFs Fibre was examined and confirmed using FTIR spectrum with the amount was approximate 0.15 wt.% detected from TGA study. The surfactant coating assisted the BF dispersion in the HDPE matrix.

Karaduman, sayeed, onal, and rawal: studied of the viscoelastic properties of jute/polypropylene nonwoven reinforced composites by dynamic mechanical analysis. The chemical treatment of Fibre completed by alkali solution to obtain better adhesion property of the Fibre-matrix interface. The degrees of highest storage modulus and loss modulus of nonwoven composites enhanced with increase in the jute Fibre content.

Kumar, sahoo and bhowmik: worked on fabrication and experimentation of sundi wood dust particle reinforced composite materials. In this work, sundi wood dust particle reinforced epoxy composite processed at seven different % of filler wt. The tensile and flexural tests were executed at three different speeds to investigate the mechanical behavior of composites.

Rathankar and shivanand: worked on effect of Fibre orientation of epoxy laminated composite. Three-point static bending test/Flexural test conducted according to ASTM standards. Hand lay-up method is adopted for fabrication of samples. In composite fabrication Fibre orientation on 00, 450, 900 and laminated composite plate thickness 2mm and 4mm. Graphite Fibre laminate 450 exhibit higher flexural strength than glass Fibre laminate with same orientation.

III. Objectives of the Research Work

(1) To study the effect of stacking sequence on the strength and level of bonding.
(2) Number of banana/jute plain woven fabrics used for preparing hybrid composite specimens.
(3) To prepare the natural fiber hybrid composite specimens by using hand lay up method as per ASTM standards
(4) Hybrid composite laminates tested for mechanical behavior (tensile, flexural and impact)
(5) Weight loss of hybrid composite specimens can be studied by using biodegradability test with 30 days.
(6) Weight gain of hybrid composite specimens can be studied by using distilled water test with 30 days.

IV. Materials and Methodology

A. *Materials used*


(a)


(b)


(c)


(d)


(e)

Fig. 2: (a) Banana fabric (b) Jute fabric (c) Mold (d) PVA (e) Weighing machine

- Plain Woven banana and Jute Fabrics Fig 2(a)-Banana fiber
- Polyvinyl Alcohol(PVA) Fig 2(b)-Jute fiber
- Weighing Machine Fig 2(c)-Mold component
- Mold component Fig 2(d)-Polyvinyl alcohol

B. *Methodology Followed*

- Selection of the materials and process.
- Identifying the stacking sequence.
- Preparation of the natural fibre hybrid composite laminates.
- Testing of mechanical characteristic (tensile, flexural and impact)
- Biodegradability analysis with natural soil at 60 days
- Water absorption analysis with distilled water for 60 days

V. Results and Discussions

A. *Tensile Properties*

Sample numbers	Peak load (Kg)
Sample 1	122.892
Sample 2	165.23
Sample 3	155.265

Table. 1: Tensile Properties

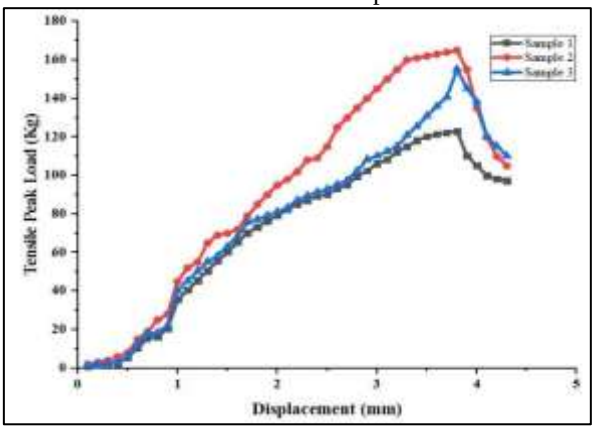

Fig. 3: Tensile load Vs Displacement

B. *Flexural test results*

Sample numbers	Peak load (Kg)
Sample 1	6.35
Sample 2	8.985
Sample 3	7.25

Table. 2: Flexural Test results

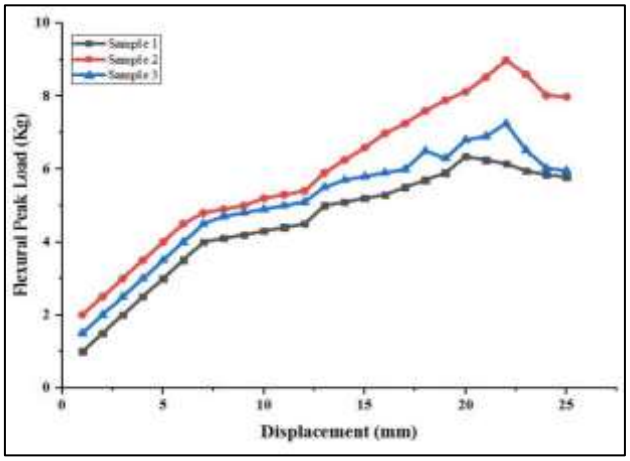

Fig. 4: Flexural Strength Vs. Displacement

C. Impact Test results

Sample number	Trail-1	Trail-2	Avg. Impact load
Sample 1	2.35	2.45	2.4
Sample 2	4.56	4.75	4.655
Sample 3	3.85	3.78	3.185

Table. 3: Impact Testing

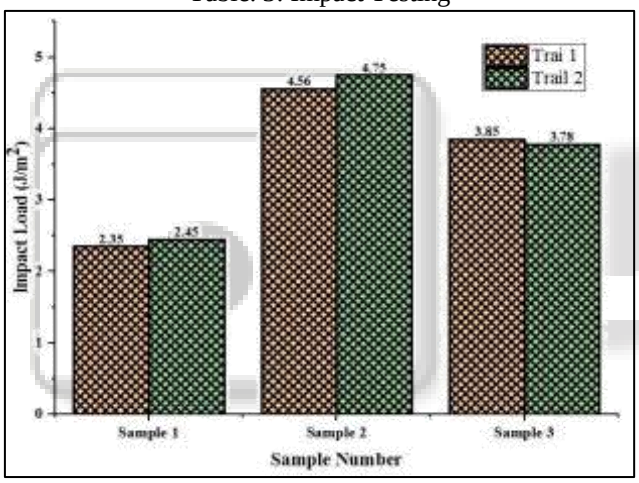

Fig. 5: Impact Load Vs. Trailing

D. Water absorption test results

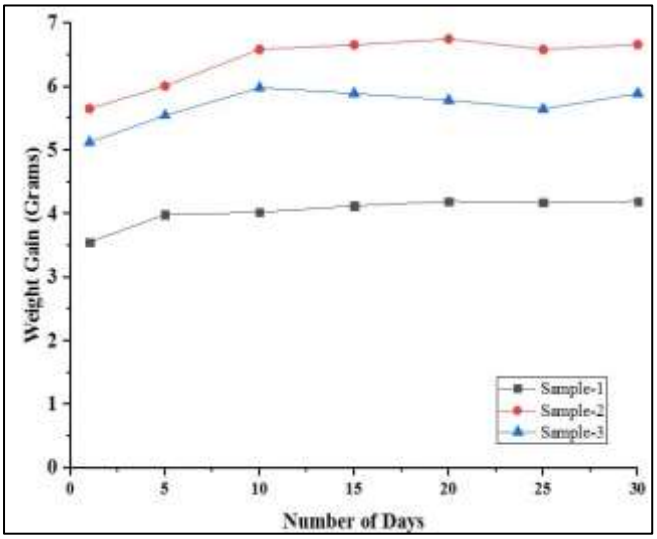

Fig. 6: Water Absorption in samples Vs. days

No of Days	Weight Gain (Grams)		
	Sample-1	Sample-2	Sample-3
1	3.556	5.655	5.125
5	3.985	6.012	5.548
10	4.025	6.589	5.985
15	4.125	6.659	5.895
20	4.198	6.751	5.789
25	4.178	6.589	5.652
30	4.198	6.665	5.895

Table. 4: Water Absorption in samples

VI. CONCLUSION

- The effect of layering sequence and hybridization of jute fabrics with banana fabric on the mechanical and water absorption properties was studied.
- It is observed that the layering pattern has significant effect on the tensile, flexural and impact properties of the composite.
- Even though woven jute fibers were hybridized with woven banana fiber, the effect of hybridization is lesser when compared with the effect of layering sequence.
- Further, it is observed that composite of Banana/ Jute/ Banana is suitable for applications encountering tensile and bending loads.
- For application encounters impact loading, composite of Jute/Banana/Jute tri layer is suitable.

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