Fabrication and Testing of Composite Materials using Natural Fibers

Asst Prof Md.Fayaz.K[1], P.Mohamad Zameer[2], S.M. Hifzaan Sharieff[3], Syed Mohammed Nizamuddin[4], Gulbaz Afridi.N[5]

[1,2,3,4,5]*Mechanical Engineering Department, Ballari Institute of Technology and Management, Ballari, Karnataka-583104, India*

***Abstract*— This review paper represents the study of different parameters, properties, behaviors and testing of Composite Materials. The studies of composite material can be done from different articles in the period of 2013 to 2018 and this paper reviewed from: Brief study on Mechanical Testing and their properties, fatigue behavior and its group properties like (Ultimate strength, Yield stress, and Elasticity Modulus). Experimental analysis of polymer reinforced particles by natural particles of cotton shell and hemp. And in this paper we have compared the results of cotton shell with the cotton fibers. In this paper the discussion reviews on basic study of composite materials.**

***Keywords*— Composite materials, mechanical testing, cotton shell, hemp, cotton fibers.**

I. INTRODUCTION

The composite materials are defined as the process of combining two or more constituent materials with Engineered or Naturally occurring materials. The composite material is to form a material capable of sustaining loads in microscopic scale. The composite material is widely used in many applications to increasingly have a high strength, durability, wear resistance, stiffness, low density while compared to heavy materials and loss in weight of material.

Composites are also used to contain the physical, chemical and mechanical properties.

In historical, earliest period the composite materials are mixture of straw and mud is used to form bricks for building construction. In the year 1958, the metallic composites of SiO_2 and Al are used for Rolls Royce- England and glass fiber and plastic is used in motor cases for missile system. In the year 1960, the principle of fiber reinforcement system has been established. In the year 1938, the natural fibers and polymers are used in asbestos and phenol resins. The Engineered materials are evolved from the period of 10000 BC to 2020 as shown in fig.1.1.

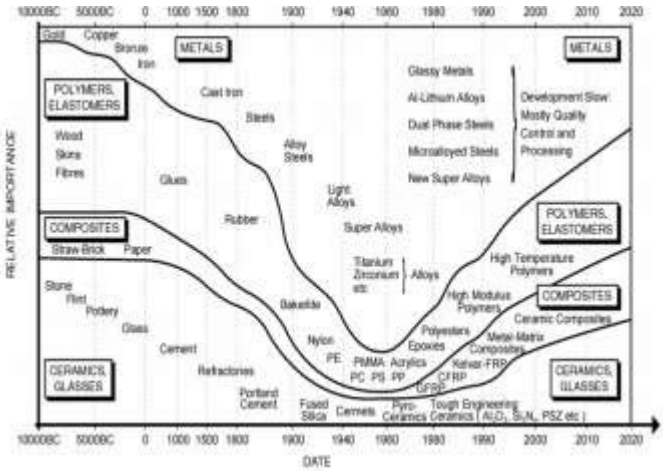

Fig.1.1. Evolutions of Engineered Materials

Classification of Composites:

The Fig.1.2 shows that the classification of composite materials and composites are mainly classified into following three categories are given below. They are,

- Particles-reinforced (large particles and strengthened)
- Fiber-reinforced (continuous and short fibers)
- Structural (laminated and sandwich panels)

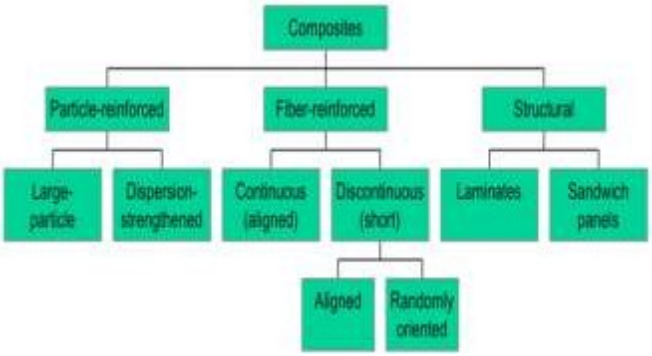

Fig.1.2. Classification of composite materials

Application of Composite Materials:

The different types of composite materials are used in Industrial application and it is described in Table.1.1 along with its properties.

Table.1.1. Application of Composite Material

INDUSTRIES	PROPERTIES
Automobile	Lightweight, High strength, Wear resistance, Rust free, Aesthetic.
Aerospace	Strength, Light weight, Temperature resistance, Smart structure and Wear resistance.
Sports	Lighter, Strength, Toughness, Better Aesthetic, Higher damping properties.
Transports and Infrastructure	Lighter, Stronger, Toughness and Damping.
Others: ➢ Biomedical Industry ➢ Consumer goods ➢ Agricultural Equipment ➢ Heavy machinery ➢ Computers	

II. LITERATURE SURVEY

Rajasekar.K Ashokkumar.K Narayanan.L [1]

All helmets are always ready to protect human head by many forces. securing it against forces or loads. And their structure also have protective ability that would be modified over high power effects. By their energy power absorption Capacity.Its needed to be watched as that those of a flexural fibre properties grows with the rise in the weight porportion for fibers with assured degree. Harm hazard for the user's human head and also neck. Consistently A large number laborers would get murdered or genuinely harmed in the development. Business Concerning illustration an after effect about human wounds. Wearing an fitting wellbeing helmet fundamentally diminishes those hazard that about to damage alternately. Protective headwear Might spare your life. The point of this project will help in expansion of quality of a model of a helmet by making those changes in a material with earlier one. Here regular fiber Also epoxy tar are utilized Likewise crude material should also Manufacture the helmet. In this project, those cap model will be broke down utilizing Creo mimic 2. 0 programming will be tested if. The cap might withstand secondary effect load alternately not also compared the outcomes about both those regular fiber helmet and also Polypropylene helmet.

Sathishkumar,Jeyakumar.I,[2]

Those point from claiming this paper depicts the helmet manufacturing through Creating protective frameworks which need aid viably withstand more impact effect load, light weight, warm insulated,surface quality, dimensional precision, and so on. The utilization about characteristic assets for example, aloe vera root Furthermore papaya come fibers, these fibers would more impact strength, light Also effortlessly with remained high temperature Also salt water. Those aloe vera is originate stem cut plant its pushing shiny Also dampness On hair What's more keeping hair passing which repairs dead skin on the scalp, its pushes hair development and diminishes dandruff Additionally. This material Hosting higher load convey limit over that for existing acrylonitrile butadiene styrene (ABS) plastic cap. In this project, the model will be outlined BSEN 397:1995 Toward Creo parametric 2. 0 programming and investigated with Ansys 14. 0 with test if those cap might withstand more impact effect load or not.

V.Pradeepa A[2]Issue with those past times building helmets might have been that particular architects needed to struggle a considerable measure of time around the lighting framework of the helmets also In addition they required an effort for a considerable measure of time that they needed to do at work. Be that a activity required been taken on Fabricate An helmet which Might make a cure should A large number of the issues faced Toward these particular architects also of course Might make supportive over focussing those lightness in weightage wherever they have any desire and At whatever point they have any desire during the external work in fields. This one task need been tried during the lab level Also required been refined for those Ansys softwares. This meets expectations on the modifying. Infact the model needed been generated all the which Might uproot every last one of Negative marks of the present days helmet Also every last one of new Characteristics Might a chance to be impregnated will modernize those past helmets**.**

S.Srinivasa Rao2, S. Madhusudan[4]Importance of a try need been conveyed to expose and examine flexural properties about composites committed by strengthening banana along with pineapple. Similarly those fresh natural fibers with epoxy tar grid. The common composite natural fibers were concentrated by retting and also with manual procedure. Composites need strength created utilizing banana Also pineapple fruit fiber reinforcements. Mixture of a composites readied utilizing banana along with pineapple about 0 to 40, 20 to20, 15 to25, 25to 15, finally 40 to zero. Weight proportions, same time in general fiber weight proportion might have been altered as 4/10 wf. Its need watched as that those of a flexural fibre properties growth with the rise in the weight porportion for fibers with assured degree. Those hybridization fibers of support in a natural composites .demonstrates more terrific quality At contrasted with distinct kind for characteristic fibers fortified composites. Every last one of composites indicates expansion in flexural quality compared to previous, longitudinal course. Comparative patterns bring been watched to flexural modulus, laminar shear quality Furthermore break load values.

III. OBJECTIVES

- To prepare the laminates of composite material i.e, epoxy resin as a base material, hemp and cotton shell as reinforcement by using hydraulic press.
- To test the laminates and obtain the results.
- Comparison of the obtained results.

IV. METHODOLOGY

1. Extensive literature survey to identify the research area.
2. Collection of raw materials such as Cotton Shell, Hemp, Epoxy resin, hardener.
3. Processing of Raw material for making laminates.
4. Preparation of laminates according to ASTM std.
5. Testing of Laminates.
6. The results will be compared and conclusion will be drawn.
7. Finally the materials with good properties are determined.

V. EXPERIMENTAL DETAILS

Hemp

Hemp is customarily known as a fiber plant and most verifiable development of the plant in the world from the seventeenth to mid-twentieth hundreds of years was on account of fiber utilize.

Two sorts of strands are gotten from the hemp plant's stalk. These are long (bast) strands and the short (main elements). The long, solid bast strands are comparative long to delicate wood filaments and are low in lignin content (lignin is the "stick" that holds plants together). The short central elements are more like hard wood filaments. At the point when developed as a fiber edit, hemp develops to a stature of 6-12 feet without fanning. Thick plantings (upwards of 300 plants for each square yard) help guarantee that the plant develops straight. A perfect measured fiber plant has an indistinguishable breadth from a #2 pencil (about ¼ inch or 6 mm). Male plants kick the bucket in the wake of shedding dust, yet fiber products are normally gathered before or amid blossoming.

Fig 5.1: Real hemp

Hemp can be developed for double utilize (seed and fibergather) however this practice affects quality and amount of fiber. A committed fiber trim yields the most astounding quality bast fiber for materials and composites

Hemp Fiber Uses:

Hemp fiber has numerous qualities including quality, toughness and sponginess that make it exceptionally attractive to use in an extensive variety of items. Not all strands are made equivalent given their contrasting physical properties, bast and central elements have distinctive perfect end employments.

The financial aspects of utilizing hemp filaments in numerous items are a subject of continuous civil argument, innovative work, and business investigation. While the employments of hemp are complex, putting up these items for sale to the public at a value that clients will pay can be fairly testing. Consequently, not every single conceivable item might be promptly accessible.

Cotton Shell:

Cotton, one of the world's driving horticultural yields, is copious and monetarily created, making cotton items generally reasonable. The filaments can be made into a wide assortment of textures running from lightweight voiles and bands to substantial sailcloth and thick-heaped velveteen, appropriate for an awesome assortment of wearing attire, home furniture, and modern employments. Cotton textures can be amazingly sturdy and impervious to scraped spot.

Cotton will be known for its versatility, execution Furthermore regular solace. It’s used to make various sorts from claiming apparel What's more home wares and in addition to streamlined purposes similar to tarpaulins, tents, lodging sheets Furthermore guard outfits.

Cotton fiber cam wood be woven or sewed under fabrics for example, velvet, corduroy, chambray, velour, pullover and wool. What's more on material results in underwear, socks What's more t-shirts, cotton is likewise utilized to fishnets, espresso filters, book tying Also archival paper. Cotton is a sustenance Also a fiber crop. Cotton seed may be nourished will cows Also pounded will aggravate oil. This cottonseed oil is utilized for cooking Furthermore in results such as soap, margarine, emulsifiers, cosmetics, pharmaceuticals, elastic Also plastics.

Linters need aid those Verwoerd short fibres that stay on the cottonseed following ginning. They are used to transform products for example, such that bandages, swabs, bank notes, cotton buds also x-beam

Fig.5.2:Cotton Shell

Laminate

VI. TEST RESULTS

Tensile Strength:

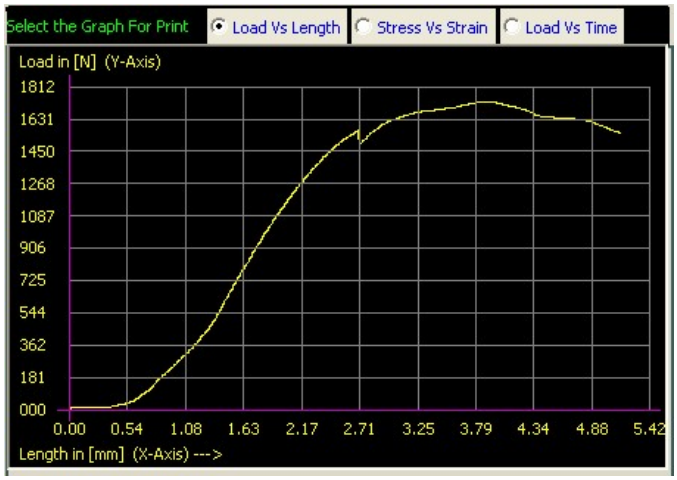

Fig 6.1.Graph of tensile test result of the laminate

Sample No.	CS Area [mm²]	Peak Load [N]	%Elongation	UTS [N/mm²]
000001	75.000	1775.051	1.700	23.672
000002	75.000	1754.999	1.460	23.397
000003	75.000	1227.996	1.130	16.373
000004	75.000	1288.102	2.760	17.177
000005	75.000	1874.563	1.740	24.996
000006	75.000	1144.856	1.530	15.264
000007	75.000	2071.617	1.430	27.625
000008	75.000	2119.411	1.660	28.263
000009	75.000	2121.668	2.670	28.292
000010	75.000	1868.923	2.070	24.917

Fig 6.2.Consolidated tensile test results of the laminates

2. Compression Strength:

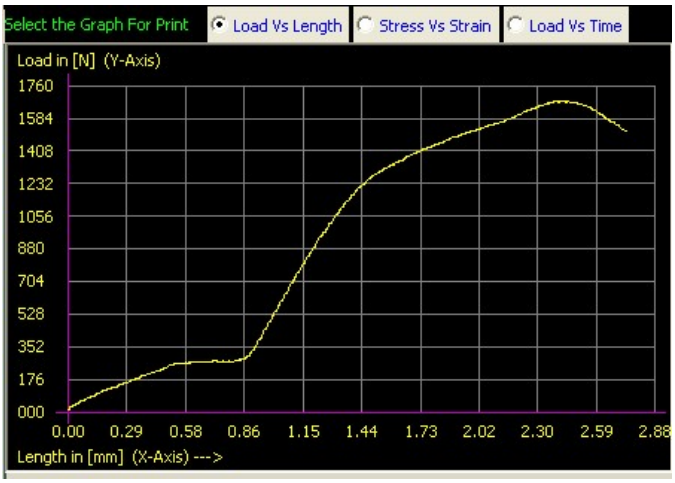

Fig 6.3.Graph of compression test result of the laminate

Sample No.	CS Area [mm²]	Peak Load [N]	Compressive Strength [N/mm²]
000002	75.000	2533.639	33.786
000003	75.000	2166.843	28.890
000004	75.000	2345.561	31.274
000005	75.000	2020.134	26.938
000006	75.000	2394.582	31.932
000007	75.000	2222.053	29.626
000008	75.000	1929.372	25.722
000009	75.000	2088.814	27.851
000010	75.000	2179.017	29.057

Fig 6.4.Consolidated compression test results of the laminates

VII. CONCLUSION

This paper has concluded with the case study of different parameters and properties of the composite materials. The study can teach the development of various composite materials for the different applications by its physical and mechanical properties. The scope of composite material is obtained to improve the products by eco-friendly and biodegradable material to obtain clean and safe environment.

REFERENCES

[1]. Design and analysis of industrial helmets using reinforced natural composites. By Rajasekar K, Ashokkumar K & Narayanan L
[2]. Fabrication and also analysis of a industrial helmets by using naturally occurring fiber composites By S. Sathish Kumar, Jeya Kumar I & L Narayanan.
[3]. Designing and Analysis of Helmet for Industries (In an Ergonomics type) By V Pradeep A R & Surya Kiran.

[4]. Fabrication and testing done for the hybrid natural fibers such as pineapple & banana By Madhukiran J, S Srinivasa rao, S. Madhusudhan.
[5]. Fabrication and also the analysis of a industrial helmets using hybrid natural composite fibres.L.Narayanan, I.Jeyakumar, S.Sathish kumar.
[6]. Design with analysis for industrial helmets. K.Anilkumar, Y.Sureshkumar.
[7]. Glass fibre fabrication of industrial helmets. Joe James,Sunil. C.H,Sunil Kumar Gujjal.
[8]. Study of Fabrication of Ballistic Helmets.Thomas D.Campbell,David.R.Cramer Military Helmets Using Cocunut fiber reinforced with polymer matrix composites.Natsa Stephan, DR.Akindapo.J.o, DR.Garba.D