ELEPHANT GRASS-GLASS FIBER HYBRID COMPOSITES

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Abstract- An attempt has been made in the present work to explore and the possible use of variety of cultivated/wild grown fiber in the development of elephant grass–glass fiber reinforced polyester hybrid composites. The fiber is extracted from retting and manual method, and the test specimens are prepared as per "ASTM"standards. Five different contents are incorporated in the specimen, with each fiber content five identical specimens are prepared. Elephant grass–glass fiber reinforced polyester hybrid composites, are prepared by incorporating up to (40/0%,30/10%,20/20%,10/30%,0/40%) by mass.. It is observed clearly (40/0%) only mass of fiber compare with (30/10%) of hybrid composites. There is tensile strength, tensile modulus, flexural strength, flexural modulus; impact strength is 65.415Mpa,68.635Mpa,123035Mpa,1536.3Mpa, 257.305j/m, 2282.85 j/m respectively. There is increases the percentage of natural fiber to the glass fiber content increase the tensile strength ,tensile modulus, flexural strength, flexural modulus, impact strength, respectively. The effect of NaOH treatment of the Elephant grass fibers on these properties was also studied. It was observed that hybrid composite increase with glass fiber content. These properties were found to be higher when NaOH Elephant grass fiber were used in the hybrid composites. The elimination of amorphous hemi-cellulose with NaOH leading to higher crystallinity of the Elephant grass fibers with NaOH treatment may be responsible for these observations.

I. INTRODUCTION

The word "composite" means two or more distinct parts physically bounded together". Thus, a material having two more distinct constituent materials or phases may be considered a composite material. Fiber-reinforced composite materials consist of fiber of high strength and modulus embedded in or bonded to a matrix with distinct interfaces (boundary) between them. In this form, both fiber and matrix retain their physical and chemical identities, yet they produce a combination of properties that cannot be achieved with either of the constituents acting alone. In general, fiber are the principal load-carrying members, while the surrounding matrix keeps them in the desired location and orientation, acts as a load transfer medium between them, and protects them from environmental damages due to elevated temperatures and humidity etc. The properties that can be improved by forming a composite material include strength, stiffness, corrosion resistance, wear resistance, attractiveness, weight, fatigue life, temperature-dependent behavior, thermal insulation, thermal conductivity, acoustical insulation and electrical insulation. Naturally, neither all of the properties are improved at the same time nor is there usually any requirement to do so. Composite materials have a long history of usage.

Their beginnings are unknown, but all recorded history contains references to some form of composite material. For example, straw was used by the Israelites to strengthen mud bricks. Plywood was used by the ancient Egyptians when they realized that wood could be rearranged to achieve superior strength and resistance to thermal expansion as well as to swelling owing to the presence of moisture..

More recently, fiber reinforced resin composites that have high strength-to-weight and stiffness-to- weight ratios have become important in weight-sensitive applications such as aircraft and space vehicles

II. CLASSIFICATION OF COMPOSITES

The commonly accepted classification of composites is:

1) fibrous composites,
2) laminated composites,
3) Particulate composites.

1) The fibrous composite:
The fibrous composites are formed by embedding and binding together of fibbers by a continuous matrix. According to the definition fibre is a material in an elongated form such that it has a minimum length to a maximum average transverse dimension of 10:1, a maximum cross-sectional area of 5.2×10^{-4} cm ^{2} and a maximum transverse dimension of 0.0254 cm. A fiber is inherently much stiffer and stronger than the same material in bulk form, because of its perfect structure. Commercially available fibres are of glass, boron, Kevlar and graphite. The matrix is meant for bonding the fibrous so that they act in concert. The purpose of the matrix is manifold, namely to support, to protect and to transfer stress among the fibers. The matrix is usually of much lower strength, stiffness and density and is tougher than the fibres. It would not withstand itself high stresses. Resins are widely used as matrix materials. The composite, resulting from the combination of fibers and matrix, possesses higher specific stiffness and specific strength, and is lighter than conventional engineering materials.

2) Laminated Composites:

Bonding layers of different materials or same materials makes laminated composites. In this class of composites, discontinuous matrix or mechanical fasteners are used at times to keep the layers together. Depending upon the ways of fabrication, behavior, or constituent materials of laminates, laminated composites are commonly called as bimetal, clad-metals, laminated or safety glass, plastic based laminates, laminated fibrous or hybrid composites and sandwiches.

3) Particulate composites:

Suspending particles of one or more materials in a matrix of another material produces particulate composites. The particles and matrix can be either metallic or non-metallic. The commonly used particulate composites are concrete, solid rocket propellants, carbides etc.

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III. RESEARCH NEEDS

Natural fibers have played a significant role in human civilization since prehistoric times, with humans having depended on them for garments and other simple domestic uses as well as complex uses such as land dwellings and reed-built sailing craft. Modern technological innovations producing synthetic fibers with a wide selection of desirable properties by manipulations of the condensation of short-or-long-chain polymers compete with and in some cases, surpass the production of vegetable fibers in many countries. In a tropical country like India, there are large varieties of regenerative plants and trees with fiber content. Some of them are cultivated over the generation and some are wild plants, trees, and creepers that grow in forests and woods. It is an established fact that any material in its fibrous form is stronger than in bulk form. Using the fact, these strong fibers are used to reinforce the weak materials. Bamboo, country Date, Jute, Sisal, Banana and Palms available freely in the countryside has been used in their crude form. Over the last four decades, composites of synthetic fibers have been developed adopting the knowledge of naturally available vegetative organs of bamboo, palm trees, sisal, etc. It is concerned with the reduction of weight of space vehicles and aircraft for optimum pay load. The constituents of these exotic composites are of high-cost: they are cost effective only in high-tech fields. They do not meet the needs of common person. The depleted natural resources of construction materials necessitate the research for cost-effective substitutes. There comes the knowledge of synthetic composites to develop new substitutes by proper conglomeration of cheap vegetative and waste materials.

For the past decades, very small contribution of research work was found towards the design and fabrication of composite materials using natural fibers. The proposed research work is intended to exploit the advantages of using natural fibers as reinforcement material in composites. Under the proposed research work, the following aspects of natural fibers and composites are studied.

i) Identification of natural fibers
ii) Identification of matrix material
iii) Extraction of various natural fibers
iv) Preparation of natural fiber reinforced plastic specimens for Bending test
v) Bending test of natural fiber composites

IV. ASPECTS OF THE PROPOSED RESEARCH WORK

The proposed research work is intended to exploit the advantages of using natural fibers as reinforcement material in composites. The work provides basic understanding of the behavior and response of new natural fibres and lightweight materials. Under the proposed research work the following aspects of natural fibres and composites have been studied.

1. Preparation of natural fiber -glass fiber reinforced hybrid composite specimens as per ASTM standards.
2. Tensile properties of natural fiber -glass fiber reinforced hybrid composite at various weight percentages.
3. Flexural properties of natural fiber -glass fiber reinforced hybrid composite at various weight percentages
4. Impact properties of natural fiber -glass fiber reinforced hybrid composite at various weight percentages

V. RESULTS

Specific weight: It is the ratio of weight (N) of the specimen to the volume (m^3) of the specimen.

Ultimate bending strength: It is the ratio of ultimate load at failure to the cross sectional area of the specimen.

Flexural modulus: It is the ratio, within the elastic limit of stress to corresponding strain.

Specific bending strength: It is the ratio of ultimate bending strength (N/m^2) to the specific weight (N/m^3) of the composite.

Specific flexural modulus: It is the ratio of flexural modulus (N/m^2) to specific weight (N/m^3) of the specimen.

VI. CONCLUSIONS

1. Being the density of untreated Elephant grass is less than (1.01)times compared to treated Elephant grass fibre.
2. In tensile testing of fiber composites, the tensile strength ,modulus and weight percentage calumns observed that there is increases the weight percentages of glass to the natural fiber percentage containt (30/10% to 10/30%)there is increases the tensile strength and modulus compare (10/30%)of EGRP hybrid composites only mass of glass fiber there is less strength and modulus (0/40%)at 1.50,1.22 times respectively. Is an untreated fiber composites.and treated there is 1.35,1.10 times respectively.
3. The curve drawn between load Vs deflections there is (40/0%) of EFRP is less strength at (1.02) times compared to the (30/10%) of EGRP. Is an untreated fiber composites.
4. The curve drawn between load Vs deflections there is (40/0%) of EFRP is less strength at (1.11) times compared to the (30/10%) of EGRP. Is an treated fiber composites.
5. The load deflection curves are shown in fig no 1. For only mass of fibre curve shows (40/0 %) .An increases the glass fiber content at(30/10 %)increasing the load defflections at 1.06 times respectively . Similarly with NaOH treatment of fibercomposites (40/0%), to the glass fiber hybrid composites(30/10 %) an 1.12 times increases as shown in (fig 2).
6. From (figure 3and 4). drawn between weight percentage on x-axis and flexural strength modulus, on y-axis, it is observed that flexural strength,modulus of (40/0%) of EFRP composites compare EGRP hybrid (30/10%) composites less than 1.056,1.04 times respectively, in without any treatment.

7. A graph is drawn by taking percentage of weight fraction on X-axis and Impact energy(J/m) is taken on Y-axis shown fig (9).it is observed that with out treatment of EFRP composites (40/0%) .compare with NaOH treatment of EGRP hybrid composites (40/0%) is less than 1.78 times respectively.An increases the weight percentages of glass fiber to the Elephant grass fiber increases the strength.

VII. SCOPE FOR FUTURE WORK

For the total understanding of the behavior of the Elephant grass –Glass fiber reinforced hybrid composites; further study in many aspect is needed. The present work can be extended in the following directions.

1. Other surface treatment for the fiber for better interface bonding.
2. The expected life of elephant grass- Glass fiber reinforced hybrid composites in view of biodegradability.
3. Effect of moisture and other environments on the biodegradability of the elephant grass- Glass fiber reinforced hybrid composites.
4. Easier and cheaper method of extraction and process of elephant grass fibers.
5. Fabrication techniques for mass production.
6. study of thermal and acoustic properties of elephant grass- Glass fiber reinforced hybrid composites.

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