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Organic Plastic Production from the Banana fiber and the E-Glass fiber

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Abstract: *Natural fibers are getting attention from researchers and academicians to utilize in polymer composites due to their eco-friendly nature and sustainability. In this study, a new combination of natural fiber composite was fabricated by mixing glass fiber and banana fiber. Later, the ability of the natural composite material over plastic material was tested. The natural fiber composite resulted in high strength and the strength factor of plastic fiber and new composite material was analyzed by Ansys Structural Solver.*

1. INTRODUCTION

Due to the cost, ease of use, easy replacement and customized design, the demand for plastic products is increasing drastically. Plastic synthetic materials are made from a variety of organic polymer such as PVC, Nylon and Polyethylene. The word plastic is derived from Greek word 'plastikos' (capable of being mold). It exhibits an adaptability to change according to the environment. The benefits of plastic was outlined by Yarsley and Couzents in 1940s .Their of benefits is in the beginning of the "Plastic age "[7]. The polymers are compared that can be processed by flow. Mostly plastics are made from the petro chemicals .The world's first plastic was *Bakelite.* It is the chain of carbon atom with addition of O_2, N_2 and sulphur. Over few decades the production of plastic has reached enormous level. It has a dangerous effect on the humans and the environment. As an alternative, researchers are carrying out studies to replace the polymer compound by natural compounds. These natural composites are biodegradable and sustainable.

2. MATERIALS USED

2.1 Natural fiber:

The natural fiber used in this study was extracted from banana stem. Banana fiber is generally extracted by the metal scraper with the flat and blunt blade. The sheath of the pseudo stem was scraped and the fiber was separated and dried. The banana fiber was selected because its strength, light weight, low elasticity and eco-friendly.

2.2 Glass fiber:

The glass fiber is selected as an additive to natural fiber because it increases the strength of the product. Out of various kinds of glass fibers, E-glass fiber was used because of its cost and considerable strength than the other fibers.

2.3 Resin:

There are many types of resin such as Epoxy Resin, GP Resin, Isotactic Resin. In this method epoxy is used because it is high grade resin. It has good binding properties. But it takes 24hrs for complete curing.

3. METHODLOGY

The natural banana fiber and the e-glass fiber were combined to form a composite material. The various methods for making composite material are:

- Hand lay-up method
- Pultrusion
- Machine layup method

In this study the hand layup method was adopted to fabricate composites. Fabrication of the natural composite was done by mixing the banana fiber and the e-glass fiber with the help of a resin in a stainless steel frame.

- The size of the frame was first decided and the required size of the frame was made in stainless steel.
- Then the PVA (Poly vinyl alcohol) was applied to the surface of frame. PVA was used to restrict the flow of resin.
- Then *Gel coat* is added to get the smoother surface.
- For one kg of gel-coat 20ml of accelerator was used and 20ml of catalyst was added to the gel coat.
- The amount of accelerator used was based on the weather conditions. If it is summer less amount of accelerator is used and vice versa. (For 1kg of resin 100ml of hardener is used. mix them, because the hardener should be completely dissolved in the resin)

Fig 1 Resin

Fig 2 Resin with Hardener

Fig. 3 Glass fiber

Fig. 4 Natural fiber

3.1 Fabrication procedure:

I. Then the resin was poured in to the frame.
II. The glass fiber was cut into the required size according to the frame.
III. The glass fiber was placed in the frame.
IV. After placing the glass fiber, the natural fiber (banana fiber) was placed in horizontal and vertical manner. This helps in reduction of void formation that affects the strength of the composite material.
V. Then the excess resin is exerted out.
VI. Each layer of the material should be allowed for 24 hours for curing.
VII. The number of layers depends upon the thickness of the material.
VIII. Thus after a period of time the composite material is ready.

Fig.5 Natural fiber with resin

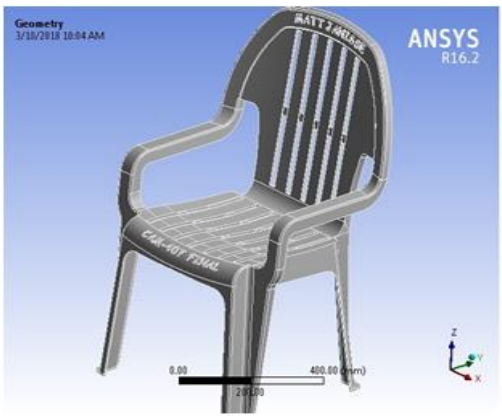
Fig.6 Layers of fibers

4. RESULT AND DISCUSSION

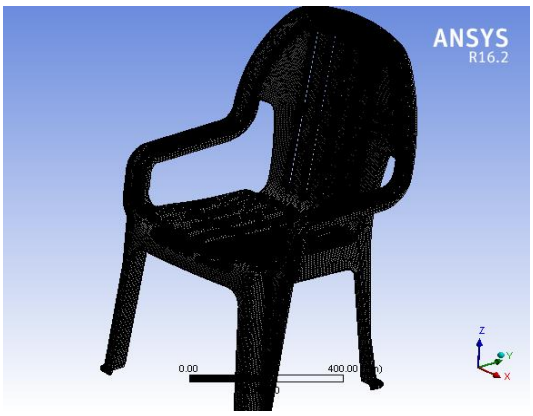
The testing was performed by conducting Finite Element Analysis (FEM). FEM is defined as the subdividing of the elements into the finer parts and analyzing the characteristics. The Fem result shows that the plastic chair has less strength comparing to the natural fiber composite material. The newly fabricated material was found to be easily degradable when treated with strong alkali (NaOH).

In the first step the solution is obtained by setting the integral to zero. The second step deals with the division of the domain of the elements. In the third step, for the interpolation functions is chosen as the primary variable the unknown values of the primary variable at pre-selected points of the element, called as the nodes. In the fourth step, the primary variable is substituted into the integral form. *The Ansys* software is also used for the numerical testing. Any irregular domain can be analyzed.

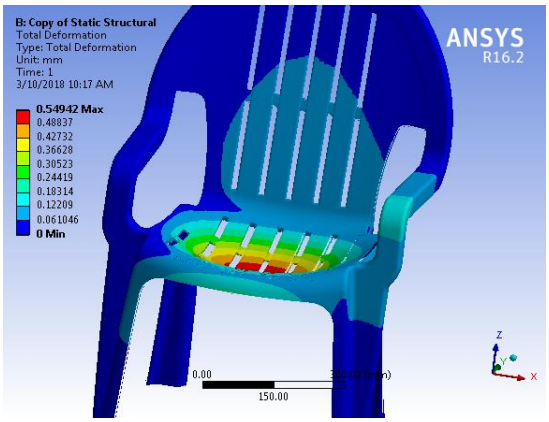
Geometry importing:



Meshing



5. Result composite material:



6. CONCLUSION

In this study, replacement of plastic material by naturally synthesized composite material was studied. Based on the results obtained the natural composite has high tensile strength, less weight factor and are easily biodegradable. Hence this natural composite fiber can serve as an alternative for polymer compounds.

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