Evaluation of Mechanical Properties of Coconut Shell Powder and PVC Resin Powder

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ABSTRACT

In this paper mechanical behaviour of shell powder is reinforced to poly vinyl chloride with respective percentage of epoxy composite. Coconut shell process laminates and poly vinyl chloride powder laminates are excellent materials to reinforce with epoxy to sustain advanced structural applications due to their high specific mechanical properties. The most important factors in manufacturing of the laminates is the adhesive bonding between coconut shell powder and synthetic polymer(poly vinyl chloride powder).
The various combinations were formed like
1. Coconut shell powder laminate+ Epoxy resin
2. Poly vinyl chloride powder laminate+ Epoxy Resin
3. Coconut shell powder (50%)+ poly vinyl chloride (50%)+ Epoxy resin.
4. Coconut shell powder(25%)+ poly vinyl chloride (75%)+ Epoxy resin.
Four different samples are fabricated with the ratio of PLIOGRIP EPOXY RESIN 178c of 400grams by different concentrations of coconut shell powder laminate, polyvinyl chloride powder laminate, combination of coconut powder and polyvinyl chloride laminate of two sample with different ratios, after the laminates are thoroughly dried for eight days and cut through water jet machining according to the dimensions for tensile and flexural tests. The tensile and flexural specimens are then subjected to mechanical tests

Keyword : - *excellent material to reinforce* , *adhesive bonding between coconut shell powder and synthetic polymer*

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1. MECHANICAL TESTING

1.1 Testing Methods

New testing methods are required to evaluate the chemical, physical and mechanical properties of engineered structural composites since their properties are anisotropic. So also, different standard specimen shapes are required t evaluatethe properties of reinforcement, matrix material, lamina and laminates. Here water jet machining is used for cutting the laminate without any shear or deformation. Laminates are then cut according to their desired dimensions for testing in water jet machining. Around 12 samples are cut depending upon their orientations for 4 laminates. 0o, 45o and 90o orientations are taken from the laminate for cutting in which the mixture is evenly distributed.

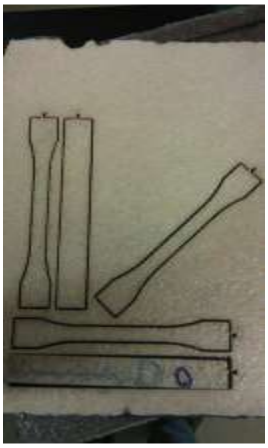


Fig-1: Laminates after cutting operation

Fig-2. Tensile specimens

2. STANDARD TEST METHODS FOR TENSILE PROPERTIES POLYMER MATRIX COMPOSITE MATERIALS (ASTM D3039):

ASTM D3039 tensile testing is used to measure the force required to break a polymer matrix composite specimen. Specimens are placed in the grips of a Universal Test Machine at a specified grip separation and pulled until failure. For ASTM D3039 the test speed can be determined by the material specification or time to failure (1 to 10 minutes).

2.1 Specimen Size

The most common specimen for ASTM D3039 is constant dog-bone shaped specimen, 150 mm in length and 3.2 mm thickness. Optional tabs can be bonded to the ends of the specimen to prevent gripping damage.

Fig -3: Instron Tensile Testing Machine.

2.2. Standard Test Methods for Flexural Properties Of Polymer Matrix Composite Materials (ASTM D7264):

ASTM D7264 outlines testing of flexural properties of polymer matrix composites using a bar of rectangular cross section supported on a beam and deflected at a constant rate. The test method summarizes two procedures. Procedure A outlines a three point loading system for center loading. Procedure B outlines a four point loading system for two equal loading points. This test method is designed for polymer matrix composites and uses a standard 32:1 span-to-thickness ratio in comparison to other methods such as ASTM D790, a three-point flexure for plastics, which uses a standard 16:1 span-to-thickness ratio or ASTM D6272 which is a four point flexure.

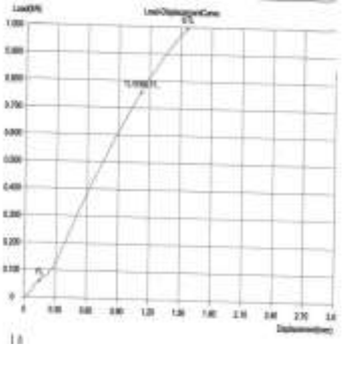
Fig -4 Flexural specimens.

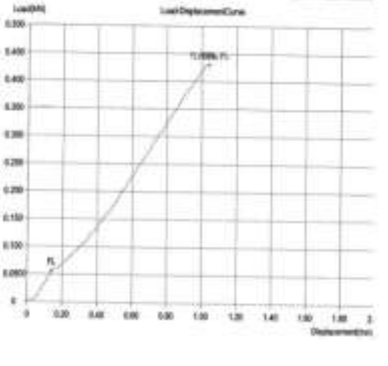
Fig -5 Flexural Testing Machine.

3.COCONUT AND POLYVINYL CHLORIDE POWDER LAMINATE (50%PVC – 50%COCONUT SHELL POWDER):

Test parameters	**Sample 0_o orientation**	**Sample 45_o orientation**	**Sample 90_o orientation**
Gage Thickness(mm)	8.63	7.93	8.15
Gage Width(mm)	10.00	10.05	10.23
Original Cross Sectional Area(mm_2)	86.30	79.70	83.37
Ultimate Tensile Load(KN)	0.99	0.84	0.66
Ultimate Tensile Strength(N/mm_2)	12	11	8

TABLE 1: RESULTS OF TENSILE TEST OF LAMINATE 1





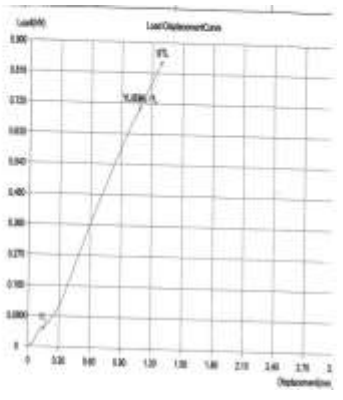


Fig -6: Graph showing coconut chloride powder laminate orientations
a) 0o b) 45o and c) 90o.

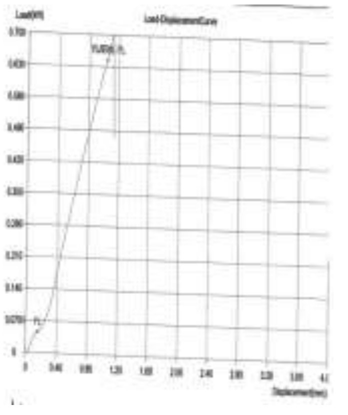


Fig-7: Graph showing coconut powder(powder & polyvinyl (25%)& polyvinyl chloride powder (75%) according to their Laminate according to their orientations
a)0o b) 45o and c) 90o.

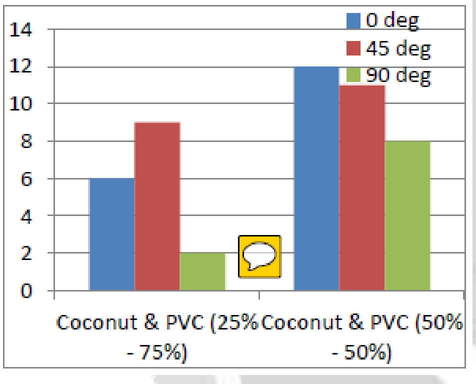


Fig-8: bar graph showing the ultimate tensile strength of the laminate at different orientations

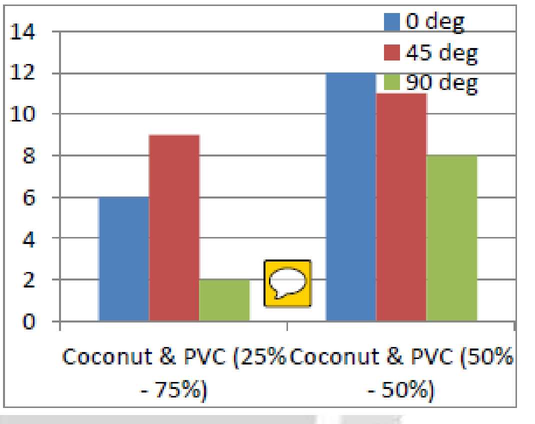


fig-9 bar graph showing the flexural strength of each laminate at different orientations

4. CONCLUSIONS

Finally, the study between the coconut & polyvinyl chloride leads to success in the mixing ratio of 50% of the coconut and 50% of the polyvinyl chloride in both the test like tensile strength and flexuralstrength.

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