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Full Length Article

Analysis on Coconut Fibre Reinforced Polymer Composite with Polyurethane Coating

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ABSTRACT: Recently, bio composite materials are synthesized using natural cellulose fibers as reinforcements together with matrix, which have attracted the attention of researchers due to their low density with high specific mechanical strengths, availability, renewability, degradable and being environmental-friendly. The present work attempts to make an improvement in the current manufacturing methodology and materials used to have better mechanical properties as well as to enhance the compatibility between fibers and the matrix. The bio- composite are prepared with the unsaturated polyester matrix and fibers such coconut fiber by using hand lay-up method with appropriate proportions to result in shell structure. Composites fabricated are planned to evaluate its mechanical properties such as tensile strength, impact strength and compression strength.

Keywords: Bio composite materials, Environmental-friendly, Manufacturing methodology, Polyester matrix, Mechanical properties.

1. Introduction

Presently there are many different remedies are identified to replace the heavy materials even though they can't able replace the composite materials. Composite material plays a major role in our day to day part of life.

Recently researches are mainly concentrating in producing the bio-composites in the sense where they are easily available source (availability) and to make highly effective by reducing harmfulness because of the presence of natural ingredients.

Composites are a method of producing new kind of materials by different compositions by different matrixes and majorly there are three various forms of composites are available, they are metal matrix, ceramic matrix and fiber matrix.

They are fabricated by the different methods likely open mold and closed molded.

2. Objectives

1. To make highly thermal resistive composite material.
2.To produce super-hydrophobic material economically.
3.The Study of the performance of a short fibre-reinforced polymer composite .
4.The fibre aspect ratio, fibre orientation and existence of a strong interface between fibre and polymer
5.The main objective of the present study w as the utilization of coir fibre as reinforcement for natural polymer composites with highly thermal resistance.

3. Fabricating Process

Step 1: Choice of matrix material

Polyester belonging to the ester own family became taken because the matrix. HY 951 turned into used as the hardener.

Step 2: Selection of reinforcement and natural fibers

Herbal fiber like Coconut coir is taken to fill as reinforcements inside the Polymer composite.

Step 3: Extraction of fibers

It changed into extracted from the husk shell of coconut from the coconut palm (Cocos nuciferal.). The extraction method changed into a basically manual method. The extracted fibres had been soaked in warm distilled water at 70°C for two h, after which smoothly washed with alcohol to eliminate greases which may additionally attach on the fibre surface all through the fibre extraction system, rinsed with deionised water and dried beneath vacuum at ninety °C. The as a result cleaned fibres are taken into consideration as untreated fibres. In order to prevent the effect of a hard fibre floor because of erratically distributed organic material , coir with a smooth floor become selected.

Step 4: Surface remedy of fiber

Freshly drawn fiber generally consists of plenty of impurities that may adversely affect the fiber matrix bonding. Therefore the composite material crafted from fiber might not possess high-quality mechanical properties. Consequently it's far suited to eliminate the impurity content of the fiber and perhaps decorate the floor topography of the fiber to attain a stronger fiber-matrix bonding. The fiber changed into left to treat with 5% NaOH for three-four hrs. Later they have been drawn and dried under sunlight for 1-2 hours.

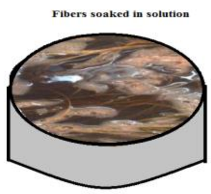

Fig 3.1 (Fibers Soaked in Solution)

Step 5: Moist Hand lay-up method

Hand lay-up technique is the simplest approach of composite processing. The infrastructural requirement for this method is also minimal. The processing steps are pretty simple. To start with, a release gel is sprayed on the mold floor to avoid the sticking of polymer to the surface. Skinny plastic sheets are used at the top and bottom of the mildew plate to get right surface end of the product. Reinforcement inside the shape of woven mats or chopped strand mats are reduce as consistent with the mildew size and positioned on the surface of mould after 245erspex sheet. Then thermosetting polymer in liquid shape is mixed very well in appropriate share with a prescribed hardner (curing agent) and poured onto the surface of mat already placed in the mould The polymer is uniformly spread with the assist of brush. The polymer floor and a curler is moved with a moderate pressure at the polymer layer to remove any air trapped in addition to the excess polymer present. The system is repeated for every layer of polymer and mat, till the required layers are stacked.

Step 6: Preparing the specimen for testing

Cutting the specimen needed size for the testing as the ASTM standard. Cutted specimen are shown blow.

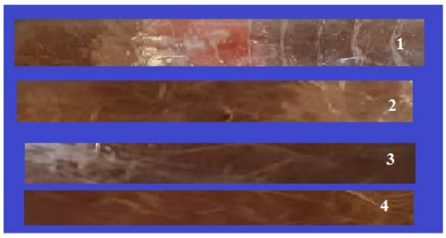

Fig3.2 (Coated specimen for tensile strength and compressive strength.)

Fig3.3 (Un-coated specimen for tensile strength and compressive strength.)

Fig3.4 (Coated specimen for bending strength.)

Fig3.5 (Un-Coated specimen for bending strength.)

Fig 3.6 (Coated specimen for hardness test)

Fig 3.7 (Un- Coated specimen for hardness test)

4. TESTING AND RESULTS

4.1 Effect of PUE Coating On Hardness

The measured hardness values can be seen that the hardness is decreasing with the increase in PUE coating. However further increase in PUE coating increases the hardness value.

Fig 4.1(Side View Of Rock Well Cum Brinell Hardness Tester)

Fig 4.2(Front View Of Rock Well Cum Brinell Hardness Tester)

Hardness	
Type	Value
Coated	13.2
Un-Coated	13.12

Table4.1 (Tested Value Of Hardness Strength On Coated And Uncoated Specimen)

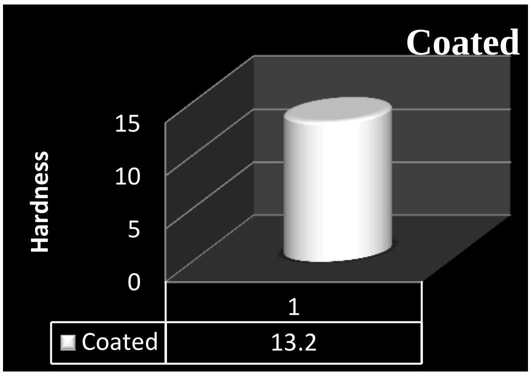

Chart4.1 (Chart shows the Hardness strength of coated specimen)

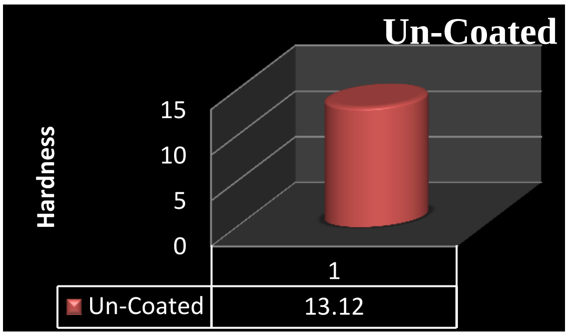

Chart 4.2 (Chart shows the Hardness strength of Uncoated specimen)

4.2 Effect of PUE Coating On Tensile Properties

The check consequences for tensile strengths and moduli are shown in Table 4.2of coated and uncoated piece, respectively. it is visible that the tensile energy of the composite will increase with increase in PUE coating. There can be two motives for this increase in the electricity residences of those composites as compared. One possibility is that the chemical response at the interface between the filler particles and the matrix may be too robust to transfer the tensile. From Chart 4.3 it's miles clean that with the boom in PUE coating the tensile moduli of the coir fiber reinforced polyester composites increases steadily.

Un-coated Specimen Tensile Strength KN	Coated Specimen Tensile Strength KN
19.5	20
21.5	21
22	21
22	21.5

Table 4.2(Tested Value of Tensile Strength on Coated And Uncoated Specimen)

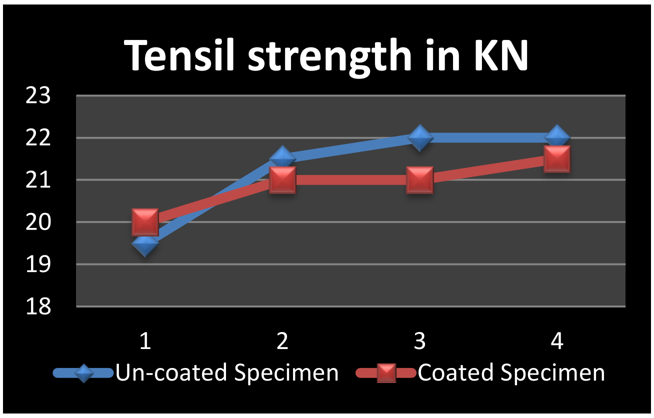

Chart 4.3 (Chart shows the Tensile strength of coated and Uncoated specimen)

4.3 Effect of PUE Coating on Compressive Properties

The take a look at outcomes for compressive strengths and moduli are proven in Table 4.3 of coated and uncoated piece, respectively. it is visible that the compressive power of the composite will growth with increase in PUE coating. There may be reasons for this increase inside the energy residences of those composites compared. One opportunity is that the chemical response at the interface between the filler particles and the matrix can be too sturdy to transfer the compression. From Chart 4.4 it's far easy that with the growth in PUE coating the compressive moduli of the coir fiber bolstered polyester composites increases progressively.

Fig 4.5(Compressive Test on Universal Testing Machine)

Un-coated Specimen Compressive Strength KN	Coated Specimen Compressive Strength KN
18.5	19
19.6	19
20.6	20.3
21.2	23

Table 4.3 (Tested Value of Compressive Strength On Coated And Uncoated Specimen)

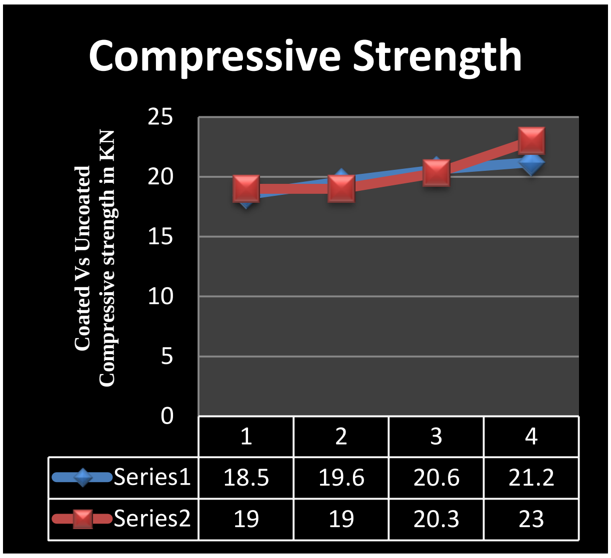

Chart 4.4 (Chart shows the Compressive strength of coated and Uncoated specimen)

4.4 Effect of PUE Coating on Flexural Strength

Table 4.4 & 4.5 shows the contrast of flexural strengths of the composites received experimentally from the bend assessments. it is interesting to note that flexural power increases with growth in PUE coating.

Un-coated Specimen	
Load kN	Deflection (mm)
0.2	0.3
0.4	0.6
0.6	0.9
0.8	1.4

1	2.5
1.2	2.9
1.4	3.6
1.6	4.1
1.8	4.8
2	5.4
2.2	6
2.4	7.1

Table 4.4(Tested Value Of Flexural Strength On Uncoated Specimen)

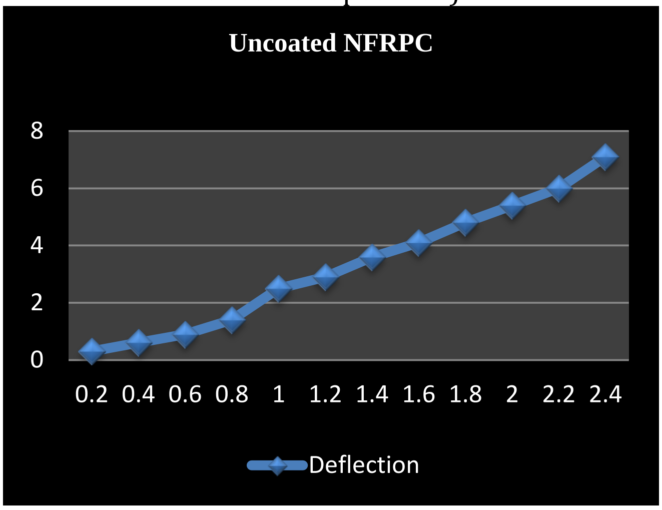

Chart 4.5 (Chart shows the Flexural strength of Uncoated specimen)

COATED SPECIMEN	
Load kN	Deflection (mm)
0.2	0.3
0.4	0.6
0.6	0.8
0.8	1.1
1	2.4
1.2	2.8
1.4	3.4
1.6	3.9
1.8	4.3
2	5
2.2	5.8
2.4	6.3
2.6	7.1

Table 4.5(Tested Value Of Flexural Strength On Coated Specimen)

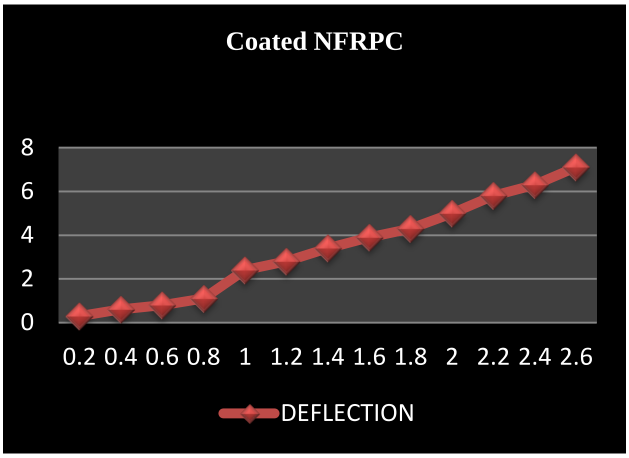

Chart 4.6 (Chart shows the Flexural strength of coated specimen)

4.5 Comparison of PUE Coated Un-Coated Material Flexural Strength

Load kN	Deflection (mm)	
	coated Specimen	Un-coated Specimen
0.2	0.3	0.3
0.4	0.6	0.6
0.6	0.8	0.9
0.8	1.1	1.4
1	2.4	2.5
1.2	2.8	2.9
1.4	3.4	3.6
1.6	3.9	4.1
1.8	4.3	4.8
2	5	5.4
2.2	5.8	6
2.4	6.3	7.1
2.6	7.1	

Table 4.6(Tested Value Of Flexural Strength On Coated And Uncoated Specimen)

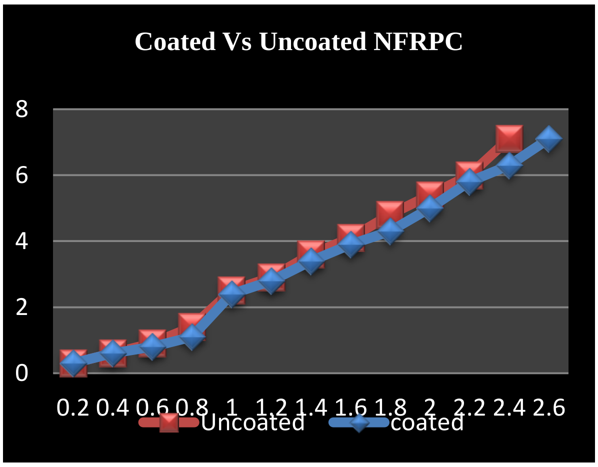

Chart 4.7 (Chart shows the Flexural strength of coated and Uncoated specimen)

4.6 Effect of PUE Coating on Impact Strength

The impact strength values of various composites recorded throughout the effect assessments are given in table 4.7. It shows that the resistance to effect loading of coconut coir fiber reinforced polyester composites does not improves with

growth in PUE coating as shown in Chart 4.8 . high stress fees or effect hundreds can be predicted in lots of engineering applications of composite substances. The suitability of a composite for such programs ought to consequently be decided now not most effective via usual design parameters, however by way of its effect or strength absorbing properties.

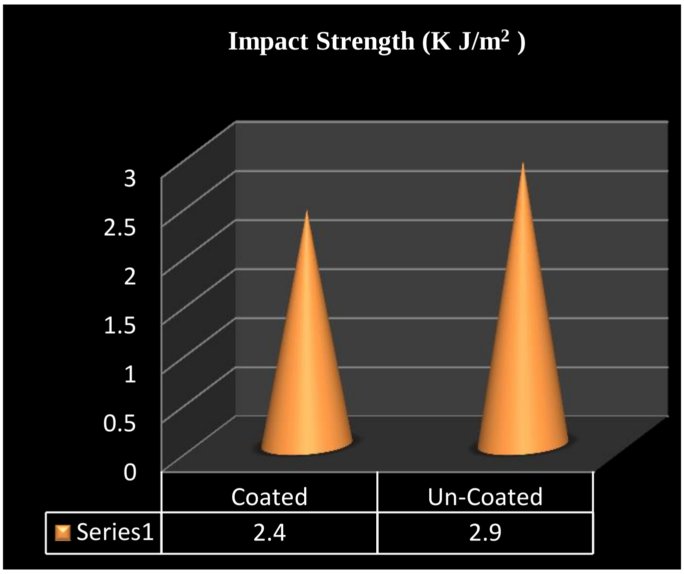

Chart4.8 (Chart shows the Impact strength of coated and Uncoated specimen)

Fig 4.7(Impact Testing Machine)

5. ADVANTAGES & DISADVANTAGES

5.1 Advantages

They may be eco-friendly, biodegradable, to be had in massive quantities, renewable, reasonably-priced and feature low density in comparison to synthetic fibres together with glass, aramid, carbon and steel fibres,

- Low cost and high overall performance of NFRPCs contented the financial component of the industry.
- The disposal of NFRPCs is straightforward in comparison to SFRPCs.
- The abrasive nature of fibre is a whole lot lower which leads to benefits in regard to technical process and recycling system of the composite substances.

Impact Strength (K J/m²)	
Type	Value
Coated	2.4
Un-Coated	2.9

Table 4.7(Tested Value Of Impact Strength On Coated And Uncoated Specimen)

Herbal fibre composites are used in location of glass more often than not in non- structural programs. Automotive additives including doorways, bonnets and many others. Crafted from Glass fibre bolstered composites are now being replaced with the aid of NFRPCs.

5.2 Disadvantages

- High moisture absorbing property is the fundamental downside of the natural fibres. This phenomenon reduces the interfacial bonding between the polymer matrix and fibre and causes destructive effects on the mechanical homes.
- These have: bad wettability, incompatibility with some polymeric matrices.

Plant fibres cannot be used at once in its herbal shape. It requires chemical modification to take away the waxy layer to enhance the interfacial adhesion between fibres and polymer matrix.

6. Result and Discussions

- Nowadays a lot of attention is paid to environmentally-friendly substances. This led to developing interest in natural lignocellulosic substances and composites primarily based on them.
- Lignocellulosic Composites are a whole lot extra safety all through hearth than man-made polymers because of loss of dangerous melting and less poisonous gases and smoke manufacturing.
- Exciting consequences have been obtained even as studying natural PE, PUE and that with an admixture of coir. warmness launch price HRR and mass loss charge MLR (Multiple linear regression) curves show that thermal decomposition and combustion of the referred to samples arise in a distinctive way. The addition of fibres with PUE coating resulted in an boom in flame retardancy of composite in comparison to PUE, PE alone.
- It has been observed that the mechanical residences of the composites together with hardness, tensile electricity, flexural power, impact strength, and so on, of the composites also are significantly motivated with the aid of the PUE coatings.

7. Conclustion

The mechanical residences of polyester composites reinforced with coir fiber had been studied and mentioned here. The following conclusions may be drawn from the prevailing take a look at. here, we've used randomly discontinuous fiber format inside the composite, so that the ratio of fibers within the composite is excessive.

- This investigation shows that growth in PUF coating will increase the tensile electricity.
- The NaOH remedy on coir fiber would take away the impurity and rougher fiber floor may result after treatment. this will boom the adhesive ability of the coir fiber with the matrix inside the fabricated composite resulting in true tensile strength.
- The coated fiber have better reinforcing property than un-covered fiber.
- It's far determined that the tensile strain at spoil for un-lined fibers is greater than covered fibers, which suggests deflection of un-coated fibers is extra than coated fibers, which finish that by means of treating the fibers with PUE growth the property of ductility.
- Its miles found that coated and un-lined specimen mechanical property of the composite modifications boom in PUE coating boom the mechanical belongings.
- The burden at damage decreases with growth in PUE coating.

By the experimental traits it was clearly located/concluded that the natural coconut coir fiber matrix cloth is nice appropriate for structural and non structural applications.

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