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Research Article

Study on Mechanical Properties of Epoxy Composite with Natural Reinforcement - Coir Fiber and Dates

S Anbusezhian[1], Milun Tom Miji[2], Vishnu Vijayan MC[3]

[1]Assistant Professor, Department of Mechanical Engineering, Achariya College of Engineering and Technology, Pondicherry, India.
[2,3]Student, Department of Mechanical Engineering, Achariya College of Engineering and Technology, Pondicherry, India.
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I N F O

Corresponding Author:
S Anbusezhian, Department of Mechanical Engineering, Achariya College of Engineering and Technology, Pondicherry, India.
E-mail Id:
anbutamil123@gmail.com
Orcid Id:
https://orcid.org/0009-0005-3796-828X
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A B S T R A C T

The mechanical way of behaving of coir-built up Epoxy Sap Composite is to be explored. Normally happening coir fiber are utilized as support while thermosetting polymer pitch epoxy is utilized as network material. The normal fiber enjoys an upper hand over inexhaustible assets and has high promoting claim. To diminish the dampness ingestion conduct of coir fiber, it is synthetically treated with 5% Sodium Hydroxide (NaOH). This substance treatment diminishes the liking of fiber towards material and increments surface harshness subsequently bringing about better framework support interface holding. Both crude and treated coir tests were used for the creation. Coir fiber built up Epoxy tar bio composite were fabricated utilizing pressure shaping. Regular fiber supported polymer composite act as a significant choice to man-made fiber built up polymer composite since they are richly accessible, practical, recyclable and biodegradable having a high mechanical strength and are rapidly jumping up concerning research and modern applications. The fundamental goal is to evaluate the mechanical properties of coir fiber with epoxy polymer along with date seed powder utilized as filler material. The example was manufactured with coir at different elements of coir like distance across, length and content along with date seed powder. Pliable, flexural and influence were led in the pre-arranged composite materials according to the method of ASTM standard. From the outcome we observed that the effect strength is more when dates seed powder is utilized as filler material with coir fiber and epoxy sap

Keywords: ASTM, Epoxy Resin, Coir Fiber, Sodium Hydroxide, Date Seed Powder

Introduction

A composite is mix of two materials in which one of the materials, called the building up stage, is as strands, sheets, or particles, is implanted in different materials called the grid stage. The supporting material and the network material can be metal, clay, or polymer. Composites commonly have a fiber or molecule stage that is stiffer and more grounded than the nonstop grid stage and act as the chief burden

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conveying individuals. The framework goes about as a heap move medium among strands, in not so great situations where the heaps are complicated, the network might try and need to bear loads cross over to the fiber pivot. The network is more flexible than the filaments and in this way goes about as a wellspring of composite sturdiness. The framework additionally safeguards the strands from ecological harm previously, during and after composite handling. When planned appropriately, the new joined material displays preferable strength over would every individual material. They can be likewise thought to be as homogeneous materials for a minuscule scope as in any piece of it will have a similar actual property.

Literature Review

[1]There has been a developing interest in using normal filaments as support in polymer composite for making minimal expense development materials lately. Normal 19 filaments are imminent supporting materials and their utilization up to this point has been more conventional than specialized. Among this paper concern Assessment of mechanical properties like elasticity, flexural strength and effect strength for various fiber length and fiber volume portion Specimen1 [3mm] Sisal (25%) - coir (15%), Example 2 [3mm] Sisal (20%) - coir (20%), Example 3[5mm] Sisal (20%) - coir (20%). Sisal and coir strands utilized as support materials with grid of Epoxy gum to assembling of composite plate by hand rest up interaction and cut into that according to ASTM for testing the materials. ASTM guidelines are D 638, D 256,D 790. By G.Velmurugan 1, SP Venkatesan PV Prakash, N Sathishkumar N Vijaya kumar.[1]

[2]Coir fiber is treated with antacid to improve the fiber properties. To quantify every one of the consequences for the coir fiber composite because of the soluble base treatment different portraying devices, for example, SEM, and flexural tests are done. Because of the treatment the enhancement for the outer layer of the fiber is seen because of the decrease of the contaminations, lignin content and so on which is affirmed by SEM examination an expansion in fibre strength is additionally gotten which might be because of better fiber-grid attachment. A lessening in level of crystallinity is seen during XRD examination. Anyway an expanded physical and mechanical properties is seen because of the salt treatment on the coir fiberBy Sushree, Sangita, Mullick.

[2]Coir fiber-supported polypropylene-based unidirectional composites were ready by pressure forming. Mechanical properties like elasticity, pliable modulus and effect strength of the subsequent composites were viewed as expanding with expansion in the stacking of coir strands, arrived at an ideal and from there on diminished with additional expansion in fiber stacking. In light of fiber stacking, 30 weight% fiber-supported composites had the ideal arrangement of mechanical properties. After soluble base treatment of coir fiber, tetramethoxy orthosilicate treatment was directed to advance bond between coir fiber and polypropylene lattice. Treatment of the coir fiber with tetramethoxy orthosilicate after the salt pre-treatment upgraded the mechanical properties and water desorption of the resultant composites, coming about because of the superior attachment between the coir fiber and polypropylene framework. These outcomes were likewise affirmed by the examining electron magnifying lens perceptions of tractable crack surfaces of coir fiber/polypropylene composites. The interfacial shear strength of the composites was likewise estimated utilizing a solitary fiber discontinuity test and a miniature bond test.By Haydar U Zaman and MDH Ask.

Material and Method

Coir

Coir is a dialect cellulosic fiber, which are removed from the external husk of coconut. Coir has low elasticity and youthful's modulus as a result of its low cellulose and high lignin contents. Morphological specialists completed by the analysts on coir filaments uncovers that the outside sheath of lignin discourages the cellulose to make interfacial bond with the polymers. The expulsion of this fringe layer of lignin by and large achieves a predominant and more steady interfacial bond. To achieve this there are a few medicines those are broadly settled like soluble base treatment, fading and so on. Such adapted coir is then isolated in light of various distances across, for example, 0.5, 0.7 and 0.9 in mm utilizing profile projector. Then this isolated coir is partitioned into four unique lengths for example 10, 20 and 30 in mm.

Table 1.Composition of Coir Fibre

Items	Percentage
Water soluble	5.25%
Pectin and related compound	3.00%
Hemi-cellulose	0.25%
Lignin	45.84%
Cellulose	43.44%
Ash	2.2%

Compositio of Coir Fiber

Epoxy LY-556

An adaptable generally thermosetting gum made by copolymerization of an epoxide with another compound having two hydroxyl gatherings and utilized primarily in

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coatings and cements called likewise epoxy. Epoxies are polyether developed from monomers in which the ether bunch appears as a three membered ring known as the epoxide ring. while numerous varieties exist, the most widely recognized epoxy tar is shaped from Epichlorohydrin and bisphenol A. These two monomers first structure an epoxy pre polymer that holds two terminal epoxide rings.

In the above structure, n fluctuates from around 2 to 25 rehashing units. Such low-atomic weight pre-polymers as these are called oligomers. Contingent upon their typical chain length, the pre-polymers shift from thick fluids to solids. In a normal epoxy response, the pre-polymers are additionally polymerized through the launch of the terminal epoxide rings by amines on anhydrides. This cycle, called restoring ,yields mind boggling, thermosetting organization polymers in which the rehashing units are connected by straight ether gatherings.

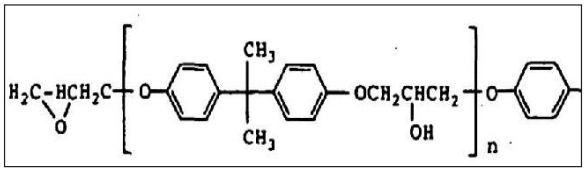

Figure 1.Chemical properties of Epoxy

Chemical Properties of Epoxy

Synthetic Name: BISPHENOL A DIGLYCIDYL ETHER Pitch (BADGE)Molecular Equation C21H24O4Formula Weight : 340.41286Density:1.17 g/cm3Boiling Point: 210o/1mmHg

Hardener

Araldite HY-951 is an unfilled epoxy projecting gum framework that is prestigious for its magnificent electrical properties and the chance of a higher filler expansion. Araldite HY-951 low consistency, aliphatic amine hardener for epoxies that offers inconceivable mechanical strength fixes at room temperature. Araldite HY-951 is likewise notable for its fantastic protection from compound and environmental debasement. Araldite HY-951 is valuable for epitomizing or preparing of low voltage electric parts utilizing the vacuum projecting technique.

Powdered Dates Seed (Filler Material)

The date seeds were isolated from their natural products physically or precisely, there after washed and cleaned to eliminate pollutants and they were dried and crushed with hammer plant to acquire filler powder. The filler powder were made to go through wire network screen to get a fine molecule size, from that point broiler dried at temperature of around 60^{o}C before the utilization to lessen the dampness content. Tests were from that point put away in desiccators

Compression Molding

Compression molding is a notable method to foster assortment of composite items. It is a shut trim interaction with high strain application. In this strategy, two matched metal molds are utilized to manufacture composite item. In compression molder, base plate is fixed while upper plate is versatile. Support and network are set in the metallic shape and the entire get together is in the middle of between the pressure disintegrate. Intensity and tension is applied according to the necessity of composite for a distinct timeframe. The material in the middle of between the trim plates streams because of utilization of strain and intensity and obtains the state of the shape pit with high layered exactness which relies on form plan.

Fabrication of Coir Rein forced Composite

Themixtureismadeby mixingAraldite LY-556andHY-951 hardener. The epoxy to hardener proportion is 10:1; to this combination 15% of powdered dates seed (filler material) is added. The filler Wt. % is fixed at 15% since best outcomes were gotten at this extent, after the testing directed for the five distinct extents for example 5%, 10%, 15%, 20% and 25% by Wt. To this combination coir is included understanding with the Taguchi's symmetrical cluster.

Curing

Curing basically alludes to the course of hardening of polymer framework materials. Ceramic grid are just warmed a cooled around the filaments to set or in the event of carbon, exposed to rehashed fluid penetration followed via carbonization.For the thermoset-lattice materials, heat is typically added as an impetus to speed the normal compound response of polymerization. Two-section epoxies, comprises of a piece of epoxy and a compound hardener that respond when blended. Heat isn't added to a two-section epoxy, yet is emitted as a result of the response. Unpredictable gases are emitted during relieving. Those unpredictable gases come from the warming solvents used to hold the epoxy back from restoring preceding the gathering time. Overall higher the temperature during the restoring, the more limited the fix time.

Result

Tensile Test

Table 2.Table for Tensile Strength

Tested Parameters	Observed Values				
	Filler Material				
Tensile Strength (MPa)	5%	10%	15%	20%	25%
	5.7	9	26.1	24.9	19.7

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Graph for Tensile Test

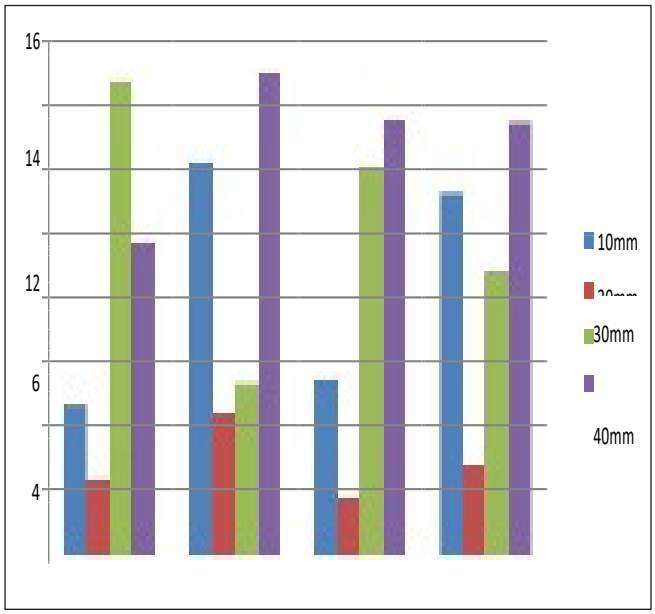

Figure 2.Graph for Tensile Test

Flexural Test

Table 3.Tabulation for Impact Test

Tested Parameters	Observed Values				
	Filler material				
Flexural Strength (MPa)	5%	10%	15%	20%	25%
	27.2	41.6	55.2	53.4	55.5

Graph for Flexural Test

Impact Test

Graph for Impact Test

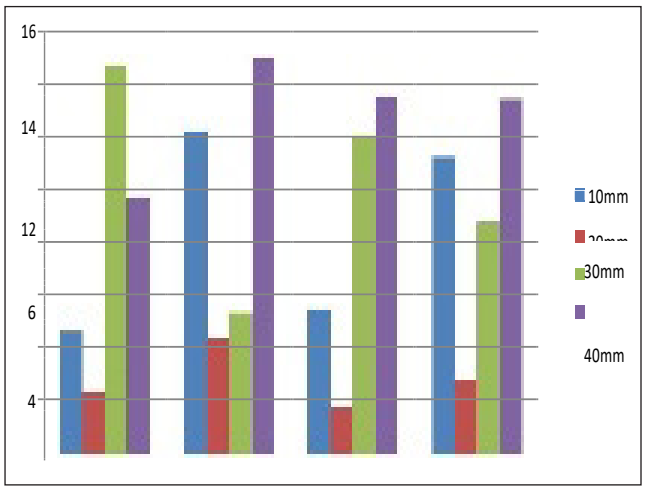

Figure 3.Graph for Impact Test

For Flexural Test

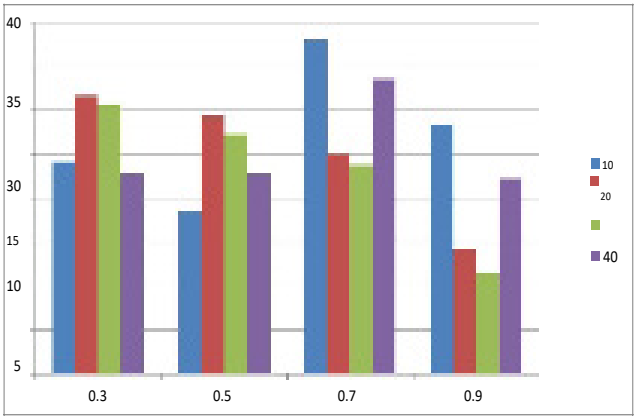

Figure 4.Graph for Flexural Test

Impact Test

Table 4.Tabulation for Flexural Test

Tested Parameters	Observed Values				
	Filler material				
Flexural Strength (MPa)	5%	10%	15%	20%	25%
	0.84	0.84	0.84	0.84	0.63

Conclusion

The accompanying ends are gotten from the tests directed for the examples arranged. The powder content were made at 5%, 10%, 15%, 20% and 25% by Wt. Tests were directed for pliable, flexural and influence strength. Elasticity is most extreme at 15%, flexural strength is greatest at 25%, in the interim by utilizing just filler the effect strength continued as before for up to 20% and a significant reduction is found for 25% of filler. From those results the most extreme strength of Epoxy-Filler viewed as at 15% by Wt.

Fiber width was chosen at0.3, 0.5, 0.7 and 0.9 with a Fiber length of 10mm, 20mm, 30mm and 40mm separately for every breadth. Elastic, flexural and Effect strength were directed for the examples referenced above which counts up to a sum of 16 examples. From those tests for the supported examples with the filler material Effect strength has expanded contrasted with the epoxy-filler composite. Though the tractable and flexural strength has been diminished. The effect strength was most extreme for the example made from fiber breadth 0.9 with a fiber length of 30mm. Ductile is greatest at fiber distance across of 0.9 with fiber length 20mm and flexural is most extreme for the fiber measurement of 0.9 with fiber length of 30mm.

From the above results acquired we infer that when powdered dates seed is utilized with coir as support the Effect strength has been expanded while tractable and

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flexural properties has been diminished. So this built up material can be utilized for assembling of materials where influence strength is viewed as more. For assembling of materials with a most extreme 26MPa and 55MPa for ductile and flexural strength individually just filler-epoxy composite can be utilized, while for assembling of materials considering their effect strength coir supported filler composite can be utilized since they have a greatest effect strength of 4.5MPa for fiber measurement 0.9 and fiber length of 30mm

Examination of tests referenced above was directed with coir support since it was finished up from the diaries that coir when added to filler like coconut shell has expanded the properties of the materials. So it is reasoned that dates seed when involved with coir fiber is certainly not a decent blend for upgrading the mechanical properties other than influence. It very well may be utilized financially past due were influence strength is viewed as something else for instance the assembling of vehicle dashboard, where influence strength is more considered at is how much energy retained during influence and how much the material can endure the effect

References

1. Processing and properties of Natural Fiber reinforced Polymer composite. Jyoti Prakash Dhal1 and S. C. Mishra
2. Preparation and Characterization of The Carbon Fiber Reinforced Epoxy Resin Composites. Prashanth Bhanakar, HK Shivananda
3. Review on natural fiber reinforcement polymer composites. U.S.Bongarde and V.D.Shinde
4. Study on Mechanical Behavior of Bio-Fiber Reinforced Polymer Matrix Composite VN Loganathan, M.Palanisamy, K.Sathish Kumar Influence of filler material on glass fiber/epoxy composite laminates during drilling. MC Murugesh KC Sadashivapp
5. Effect of Hemalite Filler Matreial on Mechanival Properties of Glass/Epoxy Composites. MN Channapa goudra, Ajith G Joshi, Sunil THned, Mahantesh Patil
6. Study on Mechanical Behavior of Bio-Fiber Reinforced Polymer Matrix Composite .Nikhil B Anigol, Prof. Anil S Paul
7. Epoxy Resin Composite Based on Functional Hybrid Fillers. Mariusz Oleksy, Karolina Szwarc-Rzepka, Maciej Heneczkowski, Rafał Oliwa and Teofil JesionowskiBiofiber-Reinforced Polypropylene
8. Composites. Rajeev Karnani, Mohan Krishnan, Ramani Narayan
9. Preparation, Structure, Properties Of The Coir Fiber/ Polypropylene Composites. Haydar U Zaman and MDH Beg

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