Investigation of Asian Palmyra Palm Leaf Mid Rib & Asian Palmyra Palm Fruit Husk Polymer Composite

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Abstract- *In the gift state of affairs world is facing a heavy drawback of the compound wastes owing to its non-biodegradable nature. Production of the fiber composite is one amongst the noble approaches to reduce this drawback and modify the compound based mostly materials as part perishable. In last twenty years several researchers are investigation and exploring new natural fibers and their composites with polymers as matrix material. owing to varied blessings and eco-friendly nature, fiber composites area unit commutation typical materials and glass fibers in moderate strength applications. Strength of natural fiber/polymer composites extremely rely on entomb facial strength between deliquescent fiber and hydrophobic polymers. During this paper potential of a brand new fiber as mid-vein of Asian Palmyra Palm & Asian Palmyra Palm Fruit Husk is investigated for the aim of synthesis of a brand new fiber composite. Tensile properties of mid-veins and entomb facial strength between midrib and polyester rosin and demanding embedded length area unit determined by tensile take a look at and fiber pull-out take a look at. Results show that mid-vein of Asian Palmyra Palm & Asian Palmyra Palm Fruit Husk have potential for development of fiber composite.*

Keywords- Polymer matrix composites, Natural fibers, midrib of coconut palm leaf, Interfacial strength, etc.

I. INTRODUCTION

Plastics or polymers area unit substitution standard materials like wood, metal, glass and ceramics and its application will be complete in several aspects of our lives. the benefits of plastics over standard materials area unit easy formability, Low process temperature, terribly density compared with metals, wonderful surface end and lack of corrosion. Due to advances in technology and growing world population production of plastics within the sort of totally different product also are growing day by day. Worldwide production of plastic is approximately one hundred forty million tons once a year. To extend the strength and performance of plastics, fibers area unit bolstered in it. Synthetic fibers like Carbon, Glass, Kevlar etc. area unit the foremost popular and industrial fibers used for reinforcement of plastics. Since most of the plastics (Polyethylene, polypropylene, vinyl resin etc.) and artificial fibers area unit non-biodegradable and build up within the encompassing at a rate of 25 tons per annum that is proving to be a significant ecological and environmental drawback.

Also, artificial fibers need production of fiber itself and are dangerous to atmosphere and health. With the rise of worldwide crisis, ecological and environmental risk plant primarily based natural fiber bolstered plastics have attracted abundant interest thanks to their potential of serving as alternative reinforcement to the artificial fibers. Natural fibers like jute, flax, hemp, fiber and sisal have gained an advertisement value for the assembly of natural fiber bolstered plastics and also have established as a greener substitute to fiber with excellent structural strength against moderate loading conditions.

Mechanical properties of a natural fiber composite chiefly depend upon fiber matrix interface and potency of stress transfer from matrix to fibers as reported by several researchers. Stress transfer ability from matrix to fiber depends upon interfacial adhesion between the fiber and also the compound matrix. Experimental analysis of surface strength between fiber and matrix material in a very natural fiber bolstered composite, single fiber pull-out take a look at is recommended by several researchers.

Midrib of Asian Palmyra Palm leaf is that the giant, centre, main vein that helps to carry the leaf, facing the sun. it's unremarkably used for creating brooms and caps.

Figure1: Midribs of Asian Palmyra Palm leaves

Vein of palm leaf content half-hour polysaccharide and Sixteen Personality Factor Questionnaire polymer and its properties is found considerable for the aim of reinforcement of plastics which might be used for various structural elements wherever moderate strength is needed like door panels, roof sheets, packaging etc.

II. MATERIAL AND METHOD

The major Natural fibers that required for making this polymer are,

- **Asian Palmyra Palm Leaf Mid Rib**
- **Asian Palmyra Palm Fruit Husk**

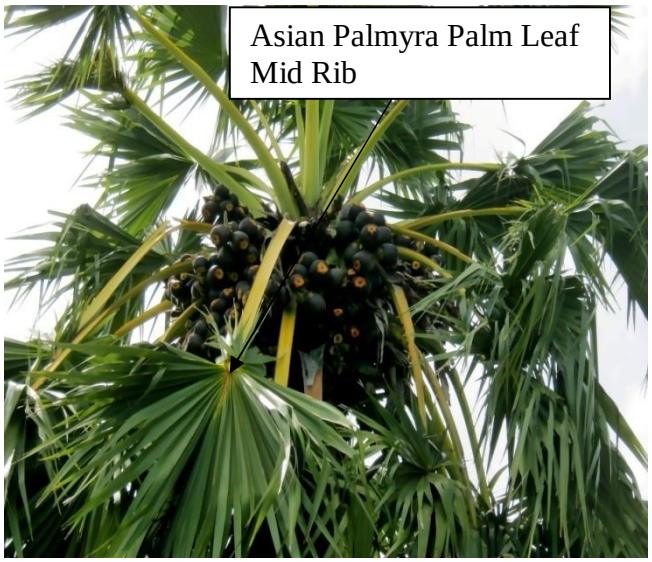

Figure 2: Asian Palmyra Palm Leaf

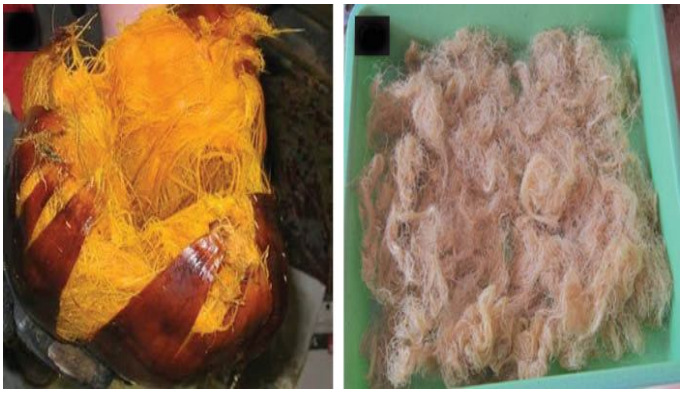

Figure 3: Asian Palmyra Palm Fruit Husk

I. Material

Midrib of Asian Palmyra Palm Leaf Mid Rib and Husk of Asian Palmyra Palm is obtained from the Asian Palmyra Palm tree Polyester resin (Grade: VBR 4513) with Cobalt naphthanate as accelerator and methyl ethyle ketone peroxide (MEKP) as hardener. The resin has 500-600 cps viscosity, 15-25 min. gel time at 25°C and 38-40% volatile content. Healthy Midribs were designated from stock and cut uniformly. designated a part of midribs were finished with the assistance of a knife then washed completely in running water for clearing their surface from leaf residuals and alternative impurities. Midribs square measure allowed to dry 1st in sun lightweight and than in hot air kitchen appliance at 60° for eight hrs.

II. specimens

Specimens for tensile testing were ready by cutting hand-picked (middle part) length from finished stock. Diameter of sticks was measured by a vernier. Gauge length of one hundred fifty metric linear unit was unbroken between griping ends, ready by glass fiber strengthened sheets Fig. 4 shows mould for casting of single fiber pull-out take a look at specimens , that was developed on a surface plate by connexion loose items of the tiles. A through hole is generated within the walls of the mould to support and facilitate extended length of the fiber embedded within the organic compound. Fig.5 shows specimens for single fiber pull-out take a look at, 5 specimens for single fiber pull out take a look at were ready with cross-sectional 20x20 metric linear unit and gauge length will move an appropriate length in line with pull out strength.

Figure 4: Mould for casting of single fiber

Figure 5: Specimens for single fiber pull-out

III. Mechanical testing

To determine strength of MCL fiber tensile check were conducted on a minimum of 5 specimens of Midribs on Instron 3382 UTM at cross head speed of five mm/min. so as to spot surface shear strength and stress transfer capability of matrix to fiber single fiber pull out check were conducted at cross head speed of 2mm/min on a similar UTM, on a minimum of 5 specimens. All check were conducted at 230C temperature and fifty fifth wetness.

Figure 6: UTM

III. RESULTS AND DISCUSSION

I. Tensile strength

Table I shows Mechanical properties of vein as natural fiber. Higher strength of fiber than matrix material ensures the chance for improvement within the strength of plastic material.

Table I: Properties of fiber

Density (in gm/cm3)	Tensile strength (in MPa)	Tensile modulus (in GPa)	Specific Tensile strength	Specific Tensile modulus	Elongation at failure (in %)
1.6	179.4	16.23	138.6	11.6	1.7

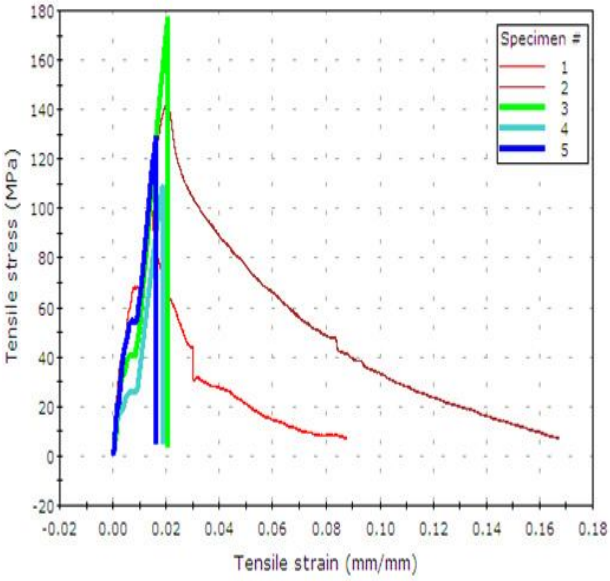

Figure 7: Stress-strain curves

Specific properties calculated per unit density of fiber during which specific modulus of mid-vein is found quite fiber and cotton fiber and within the vary of jute fiber. Mechanical properties of mid-vein extremely rely upon nature. Even midribs totally different of various leaves might have different properties. Tensile check results shows most durability of 179.4 MPa that is within the vary of fiber strength, and tensile modulus of 16.23 measure that is quite that for fiber, cotton and sisal fibers however but flax, hemp, ramie, jute and artificial fibers as compared with rumored journal knowledge. mid-vein fiber is thought of as bundle of micro fibrils having lesser binding strength between them and will increase likelihood of inner cells failure thanks to this reason, mid-vein

fiber with larger diameter would expected to own lesser strength however midribs area unit found robust enough for the moderate strength functions.

II. Single fiber pull-out strength

Mechanical properties of fiber bolstered chemical compound composite powerfully rely on surface bonding as a result of natural fibers are wealthy in hydroxyl radical teams like celluloses, hemicelluloses, cellulose and polymer that causes robust polar and deliquescent nature whereas polymers are vital hydrophobic in nature. several researchers have studied surface characteristics of fiber composite by single fiber pull-out. within the gift study single fiber pull- take a look at is meted out for determination of surface bonding strength between MCL fiber and polyester rosin as matrix material. Fig. eight shows machine generated load- deflection curve for various specimens underneath single fiber pull-out take a look at, most load (Fmax.) at that fiber debonding starts is determined as 210 N. surface shear strength (τc) between matrix and fiber is calculated from equation (1).

$$\tau c = \frac{Fmax.}{\pi dl} \qquad (1)$$

Where *d* and *l* are the diameter and embedded length of the MCL. Results for fiber pull out test are shown in Table 2. Critical length (*Lc*) can be calculated by Equation (2)

$$Lc = \frac{\sigma d}{2\tau c} \qquad (2)$$

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Where, σ is that the strength of the fiber, d is that the diameter of fiber; τc is that the surface shear strength. Single fiber retreat strength in terms of surface shear strength τc and demanding embedded length Lc is decided as a pair of .23MPa and five .9 cm severally with polyester rosin as matrix material. Table II shows results of single fiber pull-out. The important length, Lc, is that the minimum length that the fibers should need to strengthen a cloth to their most load. In single-fiber retreat take a look at, the retreat stress will increase linearly with the fiber length embedded within the matrix. The fiber fails once the retreat stress reaches the fiber failure stress and also the minimum embedded length at that the fiber fails is termed because the important fiber length. Higher the fiber–matrix adhesion, lower the worth of Lc.

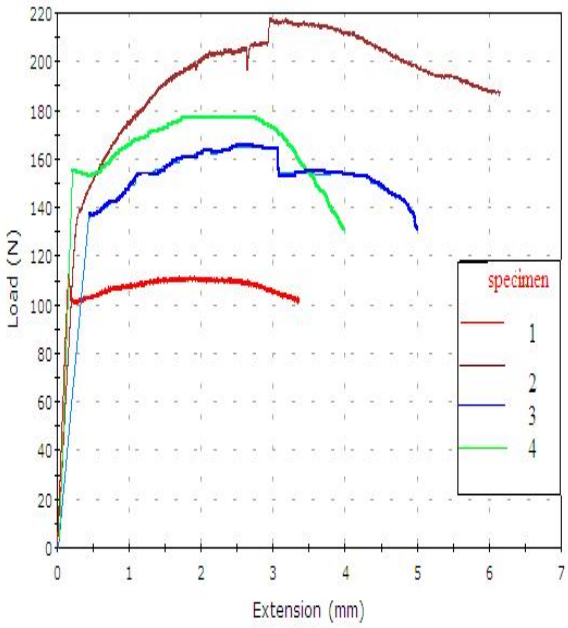

Figure 8: Machine generated Load-deflection curve for single fiber pull-out test

Table II: Single fiber pull-out test result

Diameter of fiber	Embedded length	Maximum pull-out load	Interfacial shear strength (τc)	Critical length (Lc)
1.5 mm	20 mm	210 N	2.23 MPa	5.9 cm

IV. CONCLUSION

Present study shows potential of the midribs of Asian Palmyra Palm leaves as associate alternate fiber for reinforcement of plastics and proposes development of a brand new fiber composite. MCL fiber is found lighter than the numerous business fibers and have potential to develop a lighter composite for moderate strength functions like piece of furniture, packaging, boards, sheets etc. lastingness of the MCL is found competitive with the opposite natural fibers. Single fiber pull out strength and therefore the vital length powerfully suggest for appropriate surface treatment of the fiber to boost the surface bonding with hydrophobic polymers.

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