CHARACTERIZATION AND COMPARISON OF TENSILE STRENGTH OF BIO DEGRADABLE COMPOSITE BY VARYING THE LENGTH OF ARECA FROND FIBRE REINFORCEMENT

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ABSTRACT:
This study is about comparing the strength by varying it's length and weight of areca frond fibre reinforcement and development of bio degradable composites which are uses in low strength applications analysis of results indicated that length of fibre has considerable effect on flexural strength of bio degradable composites.bio degradable resin matrix was prepared using corn starch water plasticizers and treated short and long fibres in random orientation.
The main aim of this paper is to extend a procedure for the extraction of areca fibres from areca leafs, treating those fibres with environment friendly treating media ,preparation of matrix material from bio degradable and renewable resources The composites are prepared by using hand layup technique and are characterized with respect to mechanical properties tensile strength, tensile modulus and comparison of tensile properties by varying it's length of fibres and of composite materials. The experimental results are validated by finite elemental methods.
Keywords: Characterization-areca fiber reinforcement-length -composite-tensile strength.

1.0 INTRODUCTION

Composites. Composites are novel engineering materials made from two or more constituent that remain part and separate on a macroscopic level while forming a single module. There are two category of element materials, matrix and reinforcement. At most one portion of each type is necessary. The matrix matter ambience and ropes the reinforcement by maintain their virtual position. The reinforcement impart unique physical (mechanical and electrical) property to improve the matrix properties A synergism produce material property occupied from naturally occurring materials. Composites endow with the designer, fabricator, equipment manufacturer, and consumer with enough flexibility to assemble the demands presented by unlike environments and special needs. Thus composites, due to their heterogeneous composition, provide unique flexibility in design along with other attributes like superior directional properties, high specific strength, and stiffness properties. Manufacturing of composites with composite shape specially moulding with polymer composites, reparability, corrosion resistance, durability, adaptability, and cost efficiency has concerned their use in several engineering and former application.

Biodegradable Composites. Environmental concern and stricter government regulations on recycling materials pressed scientists to build up new materials mainly from renewable resources. Using natural fibres in biodegradable matrices can give plentiful advantages with regard to fibres usually used in composites. The pretty features of these fibres are their abundant accessibility, low cost, light weight, and high specific modulus in compare to the synthetic fibres. Biodegradable composites are developed with a perception of sustainability.

Valadez Gonzalez treated the henequen fibers with a NaOH aqueous solution (2% w/v) for an hour at 25°C and treated fibers wash with distilled water until all the NaOH was eliminate.,then the fibers were dried to 60°C for 24h. The treatment of fibers improved the surface roughness that results in a better mechanical interlocking and increment the amount of cellulose exposed on the fiber surface. Morphological and silane chemical amendment of the fiber surface improved interfacial shear strength between fibers and thermoplastic matrix.

2.0: ARECAL LEAF FIBERS

Areca Catechu is a slender, single trunked palm that can grow to 20- 30 m. It is cultivated from East Africa and the Arabian Peninsula across tropical Asia and Indonesia to the central Pacific and belongs to Arecaceae (Palme) pa lm family. Plants leaves are still pinnately compound, and of 1-1.5m long, longest near middle of branch. The leaf of the Areca is a rigid fibrous section casing endosperm, mainly poised of hemicelluloses. Areca fibers hold 13 to 24% of lignin, 35 to 64.8% of hemicelluloses, 4.4% of ash content and left over 8 to 25% of water content.

3.0EXTRACTION OF ARECA FIBERS

Areca leafs collect from in and around parts of Manipal was use to learn the strength of fiber and to arrange the composites. Leafs were soaked in water for about 3 days. Soaking course loosen fibers and it can be extracted simply. The fibers are separated from the leaf by using metal wire brush and fibers are dried in room temperature. Extracted fibers known as untreated fibers. The figure 1shows soaked areca leafs and extracted areca fibers correspondingly. The length of leaf was separated into three parts; front, middle and bottom. The length of each partition was 50mm. 45 specimens were set and the average width of the fiber was 0.32252 mm and average thick nesses of fiber was 0.23472 mm and were chosen as the final dimensions of the fiber. Figure 2 shows the micro-photograph of fiber at 5X magnification.

Figure 1: soaked areca leafs and extracted areca fibers

Figure 2: The micro-photograph of fiber at 5X magnification

The most basic type of mechanical test that is commonly performed is tensile. It is simple and inexpensive. Deformation can be measured by stretching a material in opposite direction. A complete tensile profile is obtained as it is continued to stretch until it breaks.

4.0: Fiber treatment

The sample for the handling are set from the extracted fibers. For consistency the samples length was maintain as 250 mm and batch of 30 fibers treated at a time. Weights of sample are calculated by using Electronic Balance. Natural fibers contain around 10% of water content; to eliminate this moisture the samples are heated in oven at 80° C for 15 minutes. For treating purpose 1N of Sodium carbonate solution set.

According to US Federal Resource Conservation and Recovery Act (RCRA) regulations removal of Sodium carbonate is measured to be as non-hazardous waste and effect of this on aquatic and environment is very a smaller amount. The fibers are dished in treating media for 15 hours. To view pH changes during the treatment process pH of the treating media before and after the treatment measured by using digital pH meter. The solution reuse for conduct course till the solution become acidic. The weights of treated samples are deliberate and the samplesare dried in room temperature.

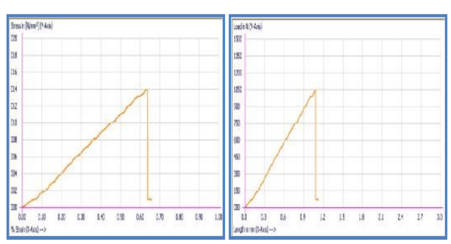
TABLE 1: PARAMETERS AND OBSERVATION

Parameters	Observation
Initial weight of untreated fibers	1.640 gram
Weight after heating at 80°C for 15 min 10.17	1.359 gram pH of 1N solution
Weight after 15 hours	3.72 gram
pH after 15 hours	10.40

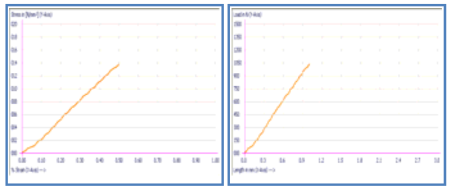
At the end of action it is practical that the chemical nature of the solution does not change radically hence it is concluded that the solution can be reused for treatment process till any major changes in the pH value of solution are experiential.

5.0: RESULTS AND DISCUSSION

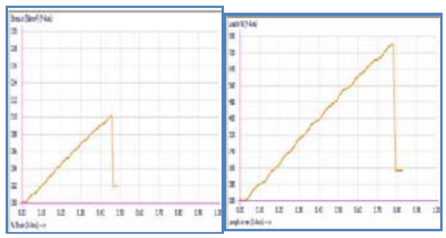
Tensile test is carried out for the specimens having ASTM D3039 Strength and modulus of fiber as well as bonding strength between fibers and matrix are the prime factors, which accounts for the tensile strength of composite materials. The ultimate point in the curve represents the complete fracture of the fiber. The values of UTS and Young's modulus for the composites are shown in graph 1



GRAPH 1:Tensile Stress / Strain and Load / Displacement10 mm Fiber Length for biodegradable composite



GRAPH 2: Tensile Stress / Strain and Load / Displacement10 mm Fiber Length for biodegradable composite



GRAPH 3: Tensile Stress / Strain and Load / Displacement10 mm Fiber Length

Table 2: Tensile Properties of 10mm Fiber Length

Specimen Number	Stress (N/m2)	Modulus of Elasticity (N/mm^2)
1	09.56	2055.52
2	10.04	21824.82
3	10.62	2179.64
4	09.24	2849.54
5	10.19	2312.07

Table 3 Tensile Properties of 20mm Fiber Length

Specimen Number	Stress (N/mm^2)	Modulus of Elasticity (N/mm^2)
1	12.08	1975.22
2	11.96	2071.87
3	13.18	2149.20
4	12.39	2109.43
5	12.07	1941.76

Table 4: Tensile Properties of 30mm Fiber Length

Specimen Number	Stress (N/mm^2)	Modulus of Elasticity (N/mm^2)
1	12.43	2199.96
2	12.25	2489.14
3	13.39	3047.73
4	13.48	3346.16
5	13.14	2765.99

This finite element analysis investigations on the fiber lengths reported in the present work give some insight into areca composite behavior. In the present analysis, the Von-Misses stresses and deformation of the areca composite at different length of fibers. Von-Mises Stress and Displacement Plot for bio degradable composite (10 mm Fiber Length)

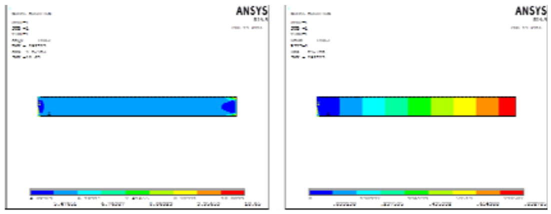


Fig.3 Von-Mises Stress and Displacement Plot for bio degradable composite (20 mm Fiber Length).

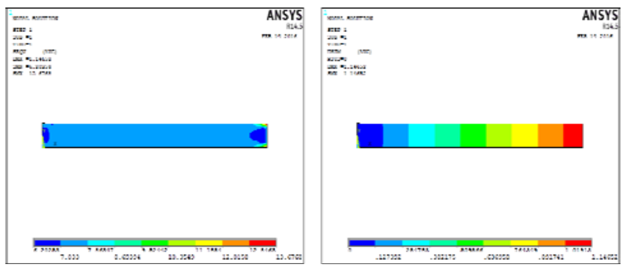


Fig. 4 Von-Mises Stress and Displacement Plot for biodegradable composite (30 mm Fiber Length)

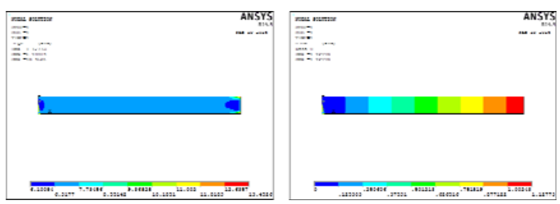


Table 5 Comparison of Tensile properties for Experimental and Ansys of biodegradable composite

Fiber Length (mm)	Experime ntal (N/mm^2)	FEA (MP a)	% of Error
10	10.60	10.76	1.50
20	13.17	13.45	2.08
30	13.46	13.67	1.53

The analysis is done for tensile specimen of same dimension used in experimental work. Considering this result, it is confirmed that experimental result is similar to the result FEA analysis. The errors may occur due to some possible measurement errors are done in experimental tests such as measurement, non-uniformity in the specimens properties (voids, variations in thickness, non-uniform surface finishing) and fiber misalignment and resin flow or bleed-out during curing that created slight differences in the modulus, density and thickness of the composite which affects the results.

6.0: CONCLUSIONS

The natural Areca frond has been found to be better reinforcing materials for primary and secondary structural materials. Tensile strength and modulus of 30mm fiber length areca sheath fiber reinforced polymer composite is found to be 13.67 N/mm^2 and 3345.16 N/mm^2 respectively, these values are more than 10mm & 20mm fiber length areca sheath fiber composites Longer the fiber length higher the strength is from the experimental and numerical simulation method.

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