MECHANICAL & THERMAL PROPERTIES OF HYBRID REINFORCEMENT POLYMER COMPOSITE

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ABSTRACT

Evolving of the polymer composites with natural fibres as a sustainable surrogate material for some engineering applications, distinctly in aerospace applications and automobile application are being probed. Natural fibre composite such as sisal, betelnut polymer composite appear more attractive due to their higher specific strength ,lightweight and low cost. In this study, sisal and betel nut fibre reinforced polymer composite are prepared and their mechanical properties such as tensile strength ,compressive strength are evaluated . This composite is prepared by using compression moulding method with 10,15 wt % of sisal and betelnut fibre in to polymer matrix. Morphological analysis was carried out in tensile and compressive sample composite using SEM to analyse the fracture mechanism.

Keywords: *sisal, betel nut fibre, polyester, mechanical properties, SEM*

1. INTRODUCTION

Betel nut is the confection of Areca palm tree (Areca catechu), a species of palm, which is native of Malaysia and widely grows across Asia, Taiwan, and India. This research aims to study the physical and morphological properties of betel nut husk agro-decay to determine the suitability of betel nut husk fibre as reinforcement in polymer composites [1]. In this study, we have developed novel composite material using betel nut fibre reinforced with unsaturated polyester. The effect of chemical treatment onto betel nut fibres on mechanical, sound absorption and thermal properties of composites has been examined. The reinforcing property of the alkali treated fibre was also compared with that untreated fibre[2]. Epoxy resin in its restore state has many desirable properties such as high stiffness and strength, excellent chemical and solid resistance. However, its main drawback is brittleness. One of the most successful methods of improving epoxy toughness is combined with reactive liquid elastomers, e.g. amine-terminated butadiene a crylonitrile (ATBN). In this work, sisal fibre, a renewable natural fibre with a high specific strength and biodegradable properties, was selected. Normally, when the hydrophilic fibre is employed in the hydrophobic polymer, various fibre surface treatment have been done for improving interfacial adhesion and mechanical properties. Therefore, the authors studied the effects of alkalized and silanized woven sisal fibre on the mechanical properties of GDNR/epoxy resin blend[3,2]. Composite materials are known to have high specific modulus ,high specific strength, high resistance to corrosion, low weight and can be tailored to meet specific purpose, which give them

advantage over universal materials such as metals and ceramics reported that matrix modification led to better mechanical performance than fibre modification in flax fibre/polypropylene composites. Specifically, the modification of unsaturated polyester resin has been reported to raise the impact property [4].

Nomenclature

S10	10 Wt% Sisal Fibre Reinforced Polymer Composite
S15	15Wt% Sisal Fibre Reinforced Polymer Composite
B10	10 Wt% Betelnut Fibre Reinforced Polymer Composite
B15	15 Wt% Betelnut Fibre Reinforced Polymer Composite
SB10	10 Wt% Sisal AndBetelnut Fibre Reinforced Polymer Composite
SB15	15 Wt% Sisal AndBetelnut Fibre Reinforced Polymer Composite

2. MATERIAL PREPARATION

2.1.MATERIAL

The sisal were used as reinforcement and matrix respectively. The sisal fibre are collected in the form of residues from tuticorin district,tamil nadu,india.The betel nut fibre were used as reinforcement and matrix respectively. The sisal fibre are collected in the form of residues from tirunelveli district,tamil nadu,india.The cashew nut ash(particle) collected from rajkumar impex tuticorin district,tamilnadu,india.

Fig.1.Material Preparation For Sisal And Betelnut Fibre

2.2. PREPARATION OF COMPOSITE

The material used for the experiment is prepared by compression moulding. The sisal and betel nut fibres of 300×125×3 mm are used specimen preparation. The fibre weight percentage of sisal and betel nut fibres each 100grams. The polymer resin and hardner were mixed in the ratio 10:1 arts and it was stirred with simple mechanical stirring. The moulds were cleaned and dried before applying polymer resin. The fibre were laid uniformly over the mould before applying releasing agent. The fibres were than uniformly compressed for few minutes to remove fibre after 1hrs . Then fibre were removed from mould. The releasing agent was applied over mould.

Fig.2. Preparation of composite

2.3. MECHANICAL TESTING

Tensile test and compressive test of the specimen were carried out. For each test and composite six specimens were tested value is calculated. The tensile and compressive test carried out universal testing machine as per ASTM D638,ASTM D 695 .

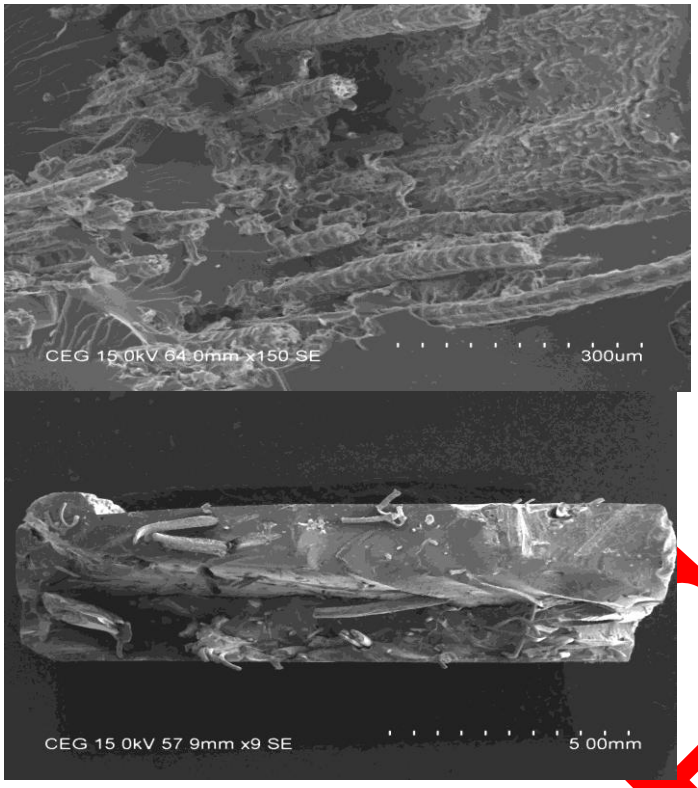
(a) **(b)**

Fig.3. Specimen preparation for tensile and compressive test

3.RESULTS AND DISCUSSION

3.1.Scanning Electron Microscope(SEM)

The micrograph of fractured specimen of tensile and compressive test of sisal and betelnut fibre reinforced polymer composite. The SEM images show that there was large breakage of fibres and few voids presents due to pull our test. This indicates the interaction between the sisal and betelnut fibre as a reinforced and polymer as a matrix.

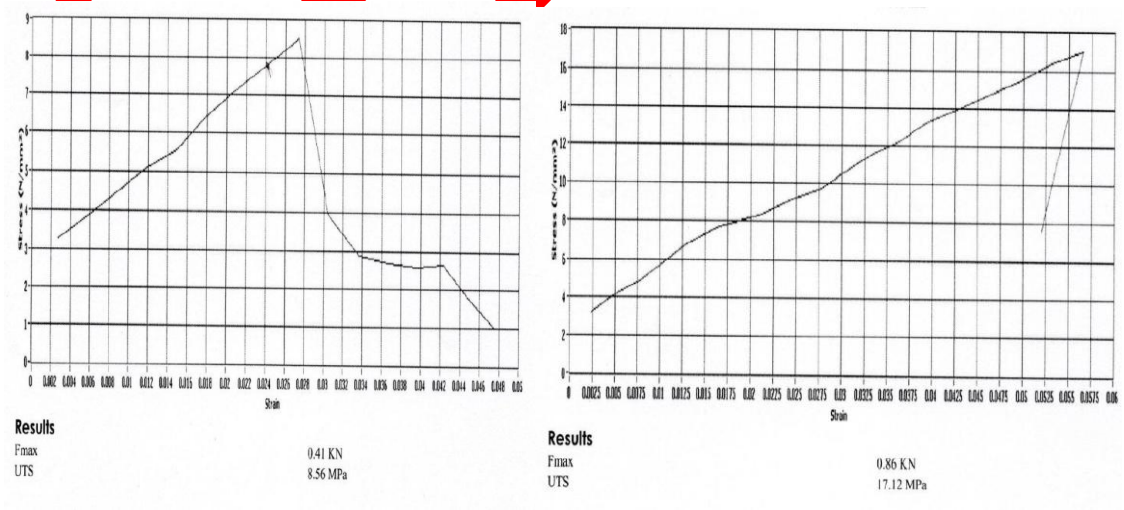


(a) **(b)**

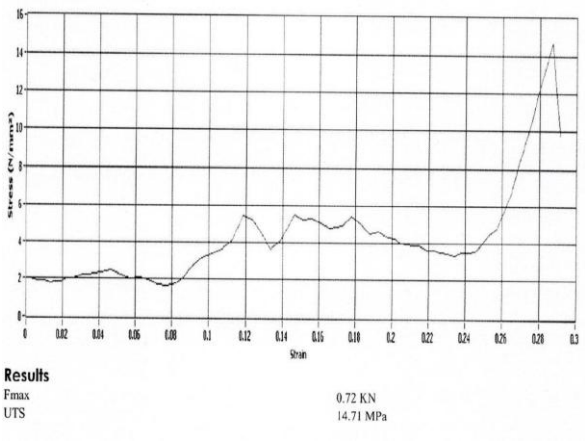
Fig .4.SEM images of fractured specimen a) Tensile b) Compressive

3.2.Tensile Test

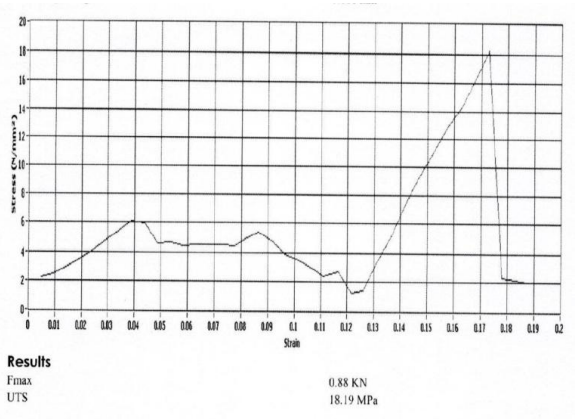
A stress strain graph for S10,S15,B10,B15,SB10,SB15 are show in fig.5. The tensile modulus is obtained by taking the corresponding value of stress and strain from the linear portion of graph.It may be noted that increasing the sisal and betelnut fibre content in composite resulted in increase in ultimate tensile strength. The ultimate tensile strength of SB10 was found 16.29Mpa.



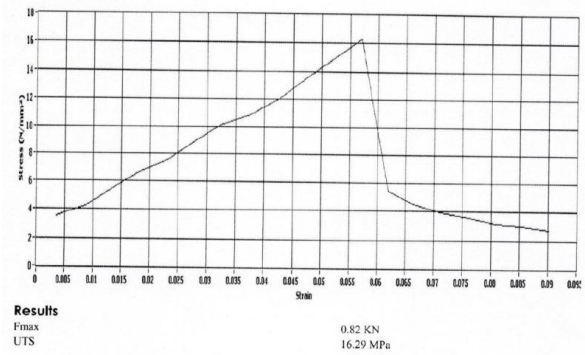
(A) (B)



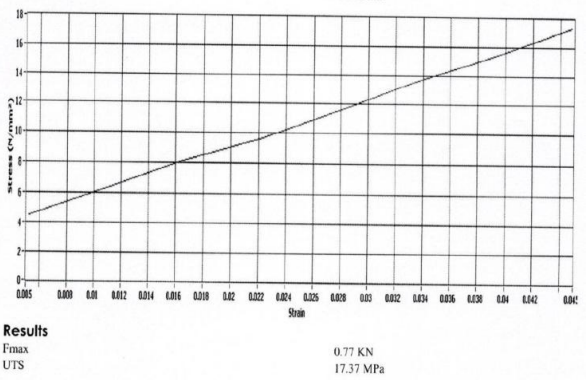
(C)



(D)



(E)

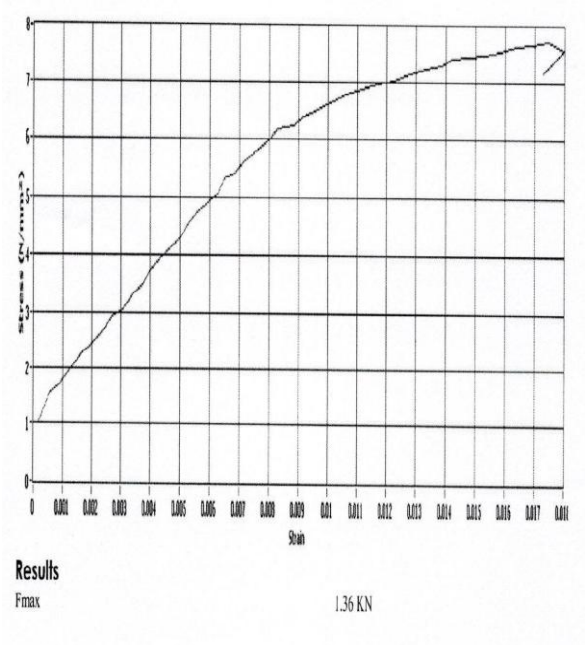


(F)

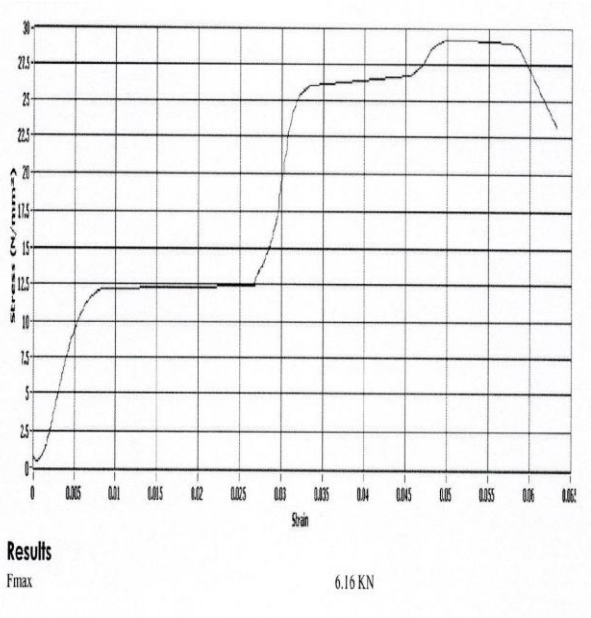
Fig.5. A Stress Strain Graph For Tensile(a) S10,(b)S15,(c)B10,(d)B15,(e)SB10,(f)SB15

3.3.Compressive Test

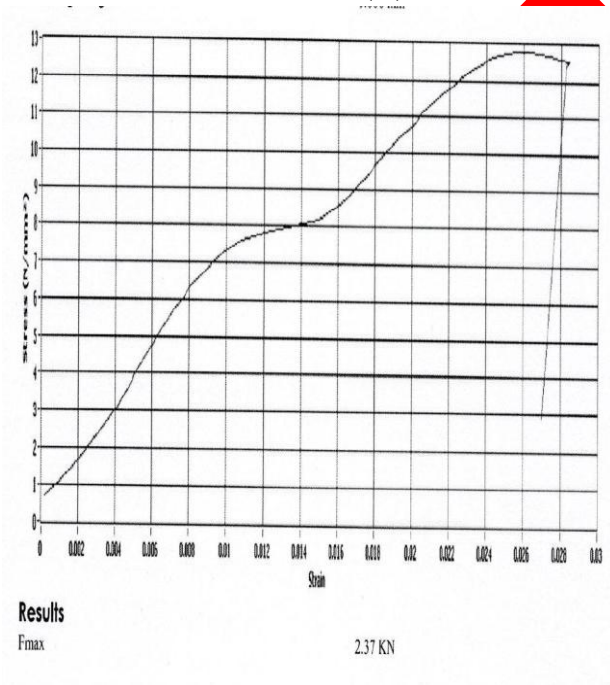
A stress strain graph for S10,S15,B10,B15,SB10,SB15 are show in fig.6. The corresponding value of stress and strain from the linear portion of graph.It may be noted that increasing the sisal and betelnut fibre content in composite resulted in increase in ultimate yield strength . The ultimate yield strength of SB10 was found 23Mpa.


Strain
Results
Fmax
1.36 KN

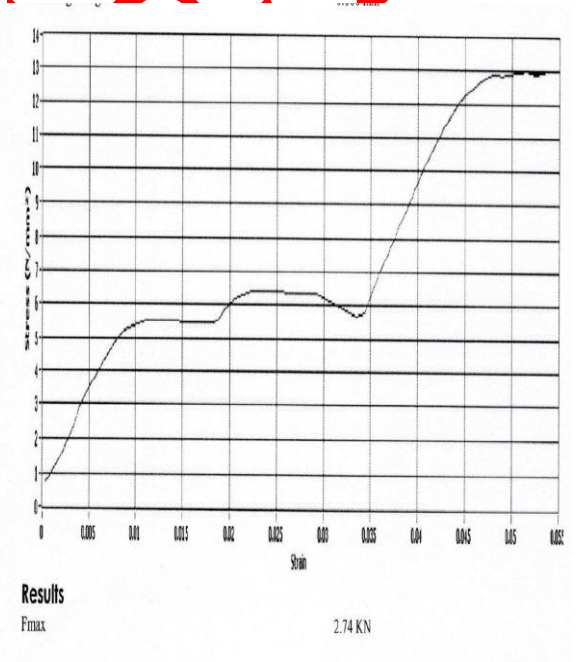
(A)


Strain
Results
Fmax
6.16 KN

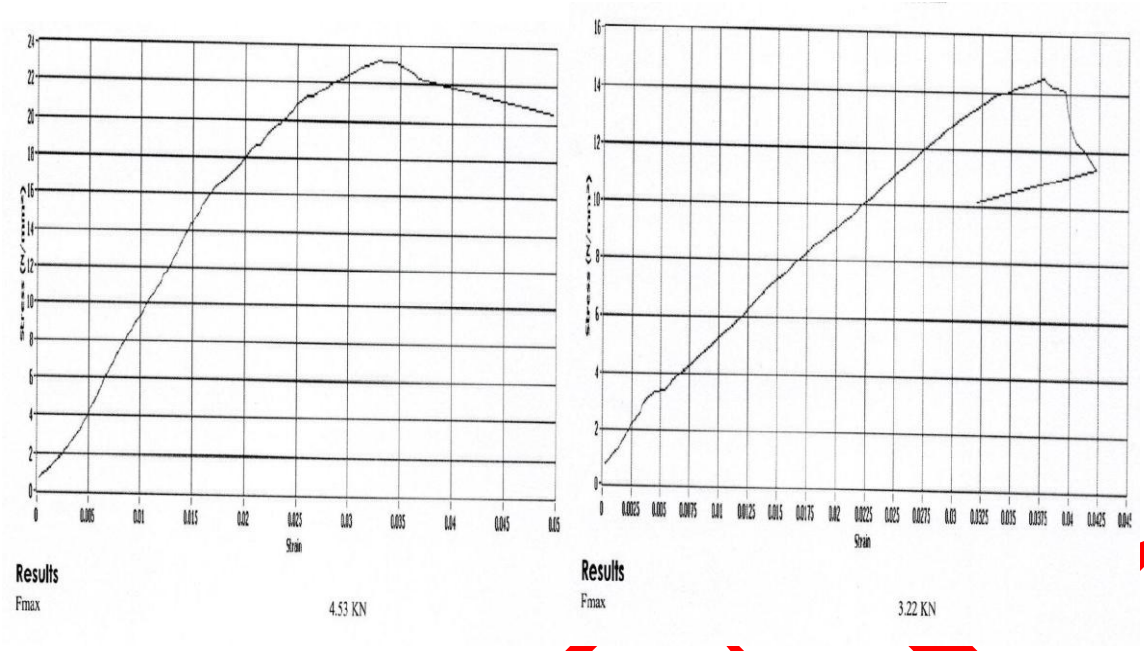
(B)


Strain
Results
Fmax
2.37 KN

(C)


Strain
Results
Fmax
2.74 KN

(D)



(E) **(F)**

Fig.6. A Stress Strain Graph For Compressive(a) S10,(b)S15,(c)B10,(d)B15,(e)SB10,(f)SB15

4. CONCLUSION

It is seen that by using sb 10 wt% of sisal and betelnut fibre reinforced polymer composite the tensile and compressive properties are found to be maximum. The ultimate tensile strength and ultimate yield strength are found to be 16.29 Mpa and 23 Mpa respectively. The failure morphology of tested samples is examined by scanning electron microscope.

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