iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** VIII **Month of publication:** August 2017

DOI: http://doi.org/10.22214/ijraset.2017.8065

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue VIII, August 2017- Available at www.ijraset.com

Effect of Coir Ash on Corn Silk (Style) Fiber Reinforced Polyester Composites

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Abstract: ***Fiber-reinforced polymer composites played a significant role from early period of human civilization with wide range of applications for their high specific strength and specific modulus. The synthetic fibers such as glass, carbon, etc., have been used as fiber-reinforces plastics and possess high specific strength and specific modulus, their fields of application are very limited because of their inherent higher cost of production. In this connection, an investigation has been carried out to make use of corn style(silk), a natural fiber abundantly available in India. Apart from economic considerations of natural fibers, the useful properties of natural fibers are length, strength, elasticity, absorbency, abrasion resistance and various surface properties. The present work describes the development and characterization of a new set of natural fiber based polymer composites consisting of corn style(silk) fiber as reinforcement, polyester resin, some additional materials like coir ash. Experiments are carried out to study the effect of different fiber composition such as corn style(silk), coir ash and polyester composites. In the present work, polyester and coir ash gives better tensile strength and impact strength. These results indicate that corn silk(style) fiber can be used as a potential reinforcing material for many structural and non-structural applications. This work can be further extended to study other aspects of such composites like effect of fiber content, fiber orientation, loading pattern, fiber treatment on mechanical behavior of corn silk(style) fiber, coir ash and polyester composites.***
Keywords**: *Coir Ash, Corn Silk(Style) Fiber.***

I. INTRODUCTION

The bio fibers are cellulose in nature and are included of lignin, cellulose, hemicelluloses, pectin and wax. Therefore, all natural fibers are hydrophilic in nature. Normally, the bio fibers are found better the synthetic fibers (i.e. glass and carbon fiber) with the properties such as low density, bio- degradable non-abrasive, eco-friendly, low cost, high toughness and so on . However, it has some of the disadvantages as a quality variation, more moisture absorption, poor surface characteristic, etc.

Now, newer the various synthetic fibers like glass, nylon, rayon, acrylic, carbon etc. are used as reinforcement in a polymer matrix which are getting a mechanical properties. However, they are entirely high price materials. For this, bio fibers are corn, coconut, hemp, flux, sisal, jute, kenaf, coir, banana, etc. It can be alternatively used to reduce the cost of the composite materials. Various mechanical properties of natural composites such as tensile strength flexural modulus, impact strength and Young's modulus can be improved by treating it by Sodium Hydroxide (NaOH).

The surface treated bio fibers showed better efficiency than the untreated. Alkaline treatment (mercerization process) is illustrious. Chemical treatment of surface modification of natural fibers reinforced composites. This alkaline treatment removes wax, hemicelluloses and lignin hiding the surface of the fiber. It is accepted that the alkaline treatment result from increases surface roughness which create better mechanical interlocking between hydrophilic fibers and hydrophobic matrices.

Among the bio fibers, corn silk(style) fiber is nowadays widely used in many industrial applications such as paper industry, medicine, etc., . Corn silk(style) fiber provides a better contact between the fiber and matrix in reinforced composites. The high lignin content in corn silk(style) fiber is responsible for beneficial properties such as weather resistance.

Bio fibers are used in different forms as reinforcement in composite materials, such as random, continuous unidirectional and weaving patterns. In weaving patterns are found to be more excellent adhesion reinforcement as they can be applied in the development of the structure of the material. Thus, weaving bio fiber in different forms is significant in defining their final properties. Weaving patterns such as knitting are used for various bio fibers using fabric technologies to make bio fiber reinforced composites with better mechanical properties.

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II. MATERIALS AND METHOD

The purpose of this research is to represent the essential information on the main mechanical properties such as tensile strength and impact strength .this part experimental work a fiber- reinforced composite material prepared from raw corn silk(style).

A. Raw Material

In this present work, coir ash on corn silk(style) fiber and polyester resin are used as natural fiber and matrix, respectively. The corn silk(style) fibers were collected from corn waste. Corn silk(style) can be extracted from the husk of corn using the process of cutting off/pulling out and it used to rang in diameter between 150-200µm is shown Fig.1.

Fig.1:Raw Material

B. Surface Treatment Of Corn Silk(Style) Fiber

Corn silk(style) fiber through surface treatment with NaOH solution for 60 minutes at room temperature. Then after, fibers were washed with water or hydrogen peroxide then heated at 80 degree centigrade for 30 minutes to remove moisture.

C. Preparation Of Composite And Test Specimen

The fiber sample and polyester were weighed using the electronic balance. The fiber was mixed with the polyester at room temperature and stirred continuously for 3 minutes until a homogenous mixture was observed. 1% (by weight of polyester) of the accelerator; cobalt was added and stirred for another 3 minutes. Finally, 2% (by weight of polyester) of the catalyst, methyl ethyl ketone peroxide (MEKP) was added using the syringe and stirred continuously for another 3 minutes The reaction temperature was taken and the different composite was cast in the moulds and allowed to cure for one hour.

The cmposites prepared by a hand layup process with different composite specimen, as shown in Fig.2 & Fig.3.

Number of samples composition

1) Work piece S1= 95% Polyester, 5% Coir Ash
2) Work piece S2= 90% Polyester, 10% Coir As
3) Work piece S3= 85% Polyester, 15% Coir Ash
4) Work piece S4= 94.5% polyester, 5% Coir Ash, 0.5% Corn Silk(style) Fiber
5) Work piece S5= 89.5% polyester, 10% Coir Ash, 0.5% Corn Silk(style) Fiber
6) Work piece S6= 84.5% polyester, 15% Coir Ash, 0.5% Corn Silk(style) Fiber
7) Work piece S7= 94% polyester, 5% Coir Ash, 1% Corn Silk(style) Fiber
8) Work piece S8= 89% polyester, 10% Coir Ash, 1% Corn Silk(style) Fiber
9) Work piece S9=84% polyester, 15% Coir Ash, 1% Corn Silk(style) Fiber

Fig.2:Tensile Test Composite Specimens

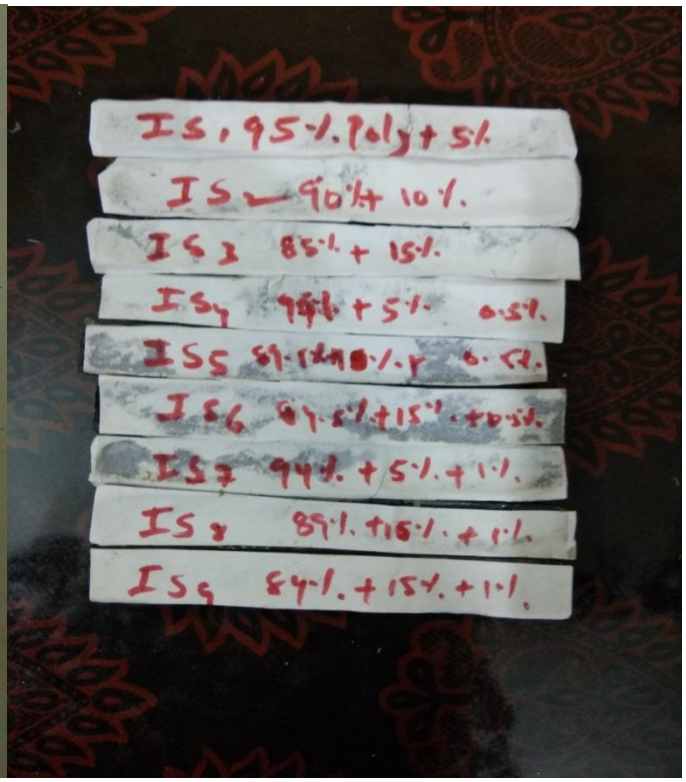


Fig.3:Impact Test Composite Specimens

The mixture was poured slowly into the zinc sheet mould. It was executed according to the ASTM test (ASTM D 638 type 1 for tensile test and ASTM D 256 for impact test). Sample production to obtain a smooth surface can by using a sheet of Mylar on the upper and the lower part of the sample. Then, leaving some composite for curing at room temperature for 2 days and then removed from the mould. Finally, take a sample to test the mechanical properties survey.

III. RESULTS

All the type composites prepared in this work are presented in the mechanical properties values of composites reinforced with corn silk(style) fiber at different oriented forms are tabulated in table 1.

Type of Composites	Brake Load(N)	Tensile Strength(MPa)	Impact Strength(KJ/Sq.m)
Work piece S1= 95% Polyester, 5% Coir Ash	1559.31	32.8	30.513
Work piece S2= 90% Polyester, 10% Coir Ash	1206.3	25.2	27.781
Work piece S3= 85% Polyester, 15% Coir Ash	745.3	15.6	14.530
Work piece S4= 94.5% polyester, 5% Coir Ash, 0.5% Corn Silk(style) Fiber	1461.2	30.9	28.492
Work piece S5= 89.5% polyester, 10% Coir Ash, 0.5% Corn Silk(style) Fiber	1353.4	28.4	25.813

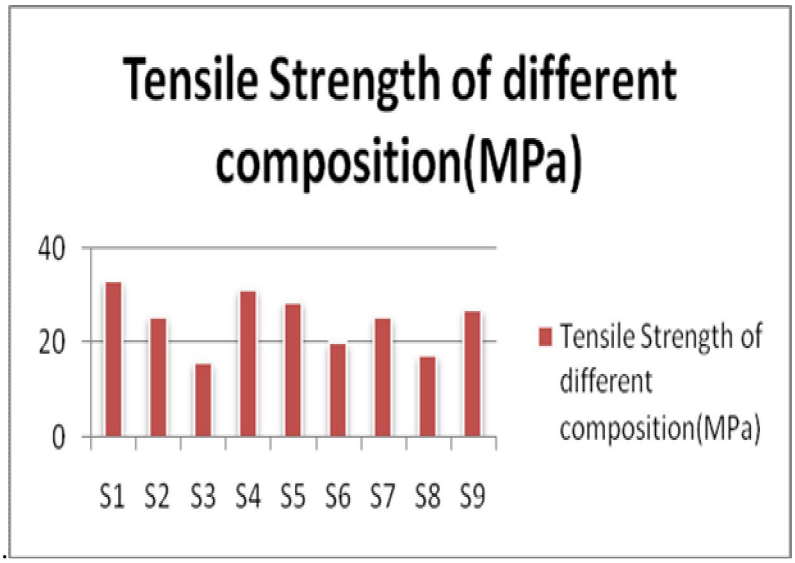
Work piece S6= 84.5% polyester, 15% Coir Ash, 0.5% Corn Silk(style) Fiber	961.1	19.9	15.786
Work piece S7= 94% polyester, 5% Coir Ash, 1% Corn Silk(style) Fiber	1186.6	25.0	21.365
Work piece S8= 89% polyester, 10% Coir Ash, 1% Corn Silk(style) Fiber	794.4	17.1	15.179
Work piece S9=84% polyester, 15% Coir Ash, 1% Corn Silk(style) Fiber	1245.5	26.6	24.236

Table 1: Result of Composites Tested the Mechanical Properties

A. Tensile Test Result

The strength of the coir ash on corn silk(style) fiber reinforced with polyester composite depends on the orientation of fibers and the interfacial adhesion between the fiber and the matrix. Fig.1 illustrates the tensile strength and elasticity of modulus of composites for different fiber orientation.

The effect of different fiber orientation on the tensile strength of corn silk(style) fiber reinforced polyester composites is shown in Graph.1



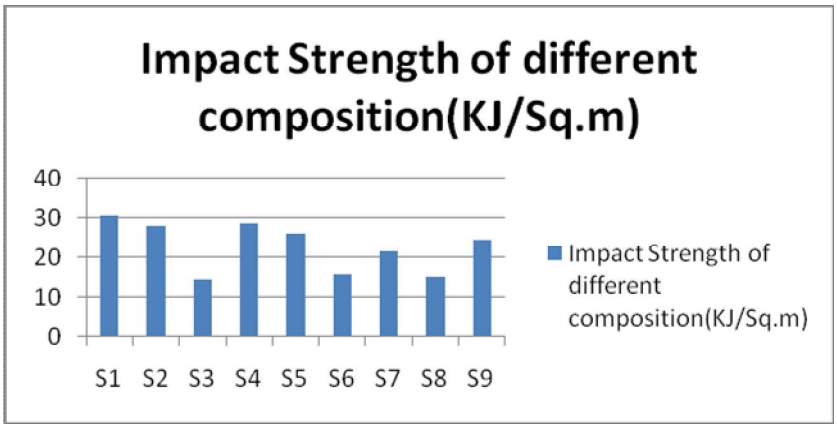
Graph.1: Tensile Test Result

From the Graph.1, the tensile strength for the composition of 95% Polyester and 5% Coir Ash gives the better result i.e. Break load=1559.31N and Ultimate tensile strength =32.8Mpa. The tensile strength for the composition of 84% Polyester, 15% Coir Ash, 1% Corn Silk(Style) Fiber gives the better result i.e. Break load=1245.45N and Ultimate tensile strength =26.6Mpa compared to 84.5% Polyester, 15% Coir Ash, 0.5% Corn Silk(Style) Fiber i.e. Break load=961.1N and Ultimate tensile strength =19.9Mpa.

B. Impact Test Result

The strength of the coir ash on corn silk(style) fiber reinforced with polyester composite depends on the orientation of fibers and the interfacial adhesion between the fiber and the matrix. Fig.1 illustrates the impact strength and elasticity of modulus of composites for different fiber orientation.

The effect of different fiber orientation on the impact strength of corn silk(style) fiber reinforced polyester composites is shown in Graph.2.



Graph.2: Impact Test Result

From the Graph.2, we observed that the impact strength for the specimen which has the composition of 95%Polyester,5% Coir Ash gives the better result as 30.513KJ/sq.m. The impact strength for the composition of 84% Polyester, 15% Coir Ash, 1% Corn Silk(Style) Fiber gives the better result i.e. Impact Strength=24.236KJ/Sq.m compared to 84.5% Polyester, 15% Coir Ash, 0.5% Corn Silk(Style) Fiber i.e. Impact Strength=15.786KJ/Sq.m.

IV. CONCLUSIONS

This paper the fabrication of natural composite using difference oriented coir ash on corn silk(style) fiber reinforced polyester composites by hand layup technique. In this study the mechanical properties (tensile strength and impact strength). Based on the test results, the following conclusion are observed. At 95% polyester,5% coir ash composition have high tensile strength and impact strength. As the fiber present increases the tensile strength increases, impact strength of composite is increased with increment of corn silk(style) fiber at 15% coir ash composition. , it is free from acidic and basic reaction occur in nature.

V. ACKNOWLEDGEMENT

It give me immense pleasure to take this opportunity to express my sincere and heartfelt to thanks to Dr. M. Gopi Krishna Ph.D , Assistant Professor, Department of Mechanical Engineering, Acharya Nagarjuna University College of Engineering & Technology, Guntur, Andhra Pradesh, India for his able and continual guidance help throughout the entire period of investigation.

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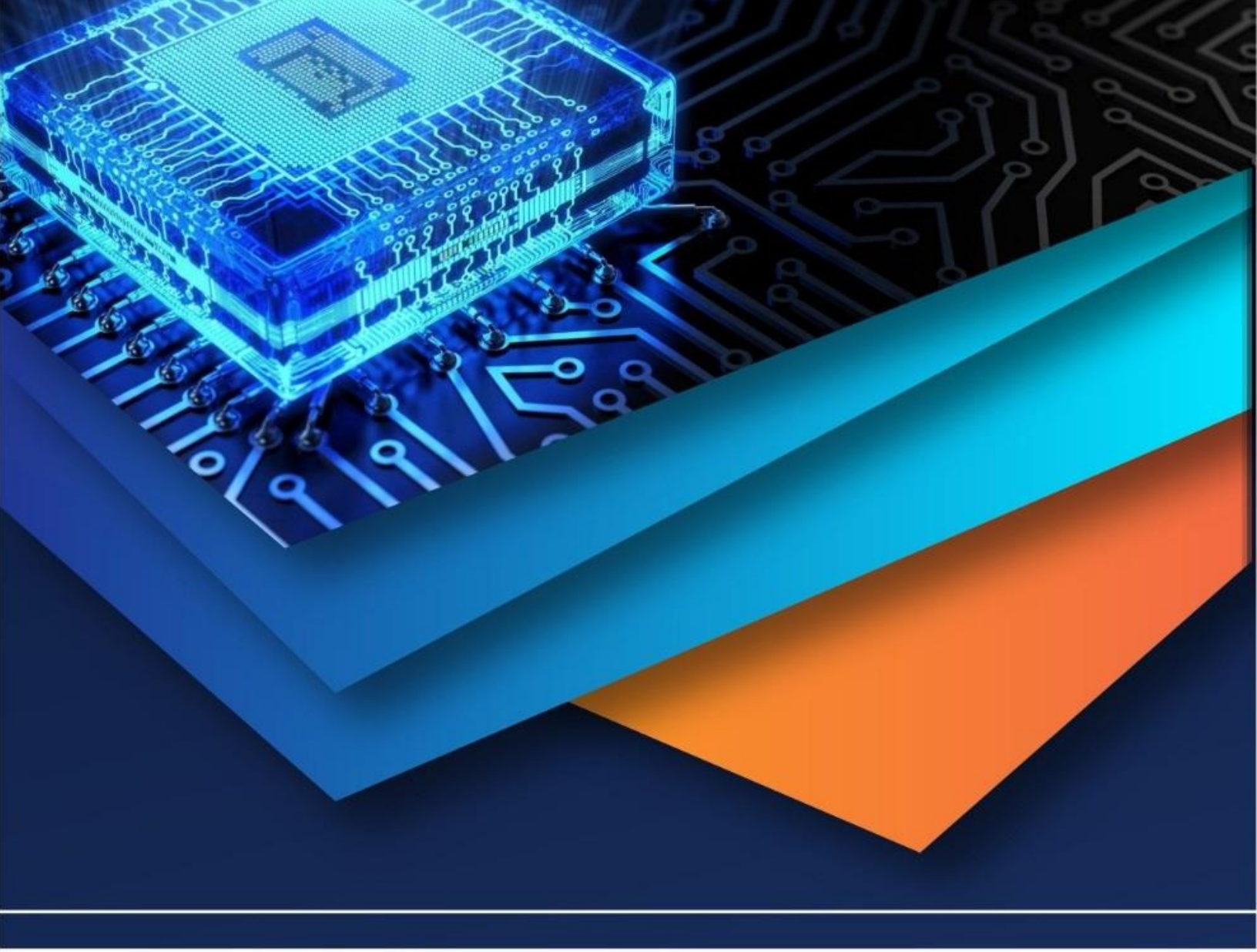

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