FABRICATION AND CHARACTERIZATION OF RAW AND DEWAXED COIR FIBER REINFORCED POLYMER COMPOSITES

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CERTIFICATE

This is to certify that the thesis entitled "***FABRICATION AND CHARACTERIZATION OF RAW AND DEWAXED COIR FIBER REINFORCED POLYMER COMPOSITES"*** submitted by Miss. RINKI CHOUDHURY, Roll No. 410PH2122 in partial fulfillment of the requirements for the award of Master's degree in Physics at the National Institute of Technology, Rourkela (Deemed University) is an authentic work carried out by her under my supervision and guidance. To the best of my knowledge and believe, the matter embodied in the present thesis has not been submitted to any other University/ Institute for the award of any Degree or Diploma.

Date: Prof. D.K. Bisoyi

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ABSTRACT

Coir fiber was selected for this study as it is non-toxic, low cost, high lignin content, low density, low tensile strength, low tensile modulus and high range of elongation compared to other fibers. Composites were prepared using Coir fiber in the rough (raw) stage, after washing with tap water, and also subjected to various other treatments. After which their mechanical, chemical composition, morphological properties were determined in the laboratory and the results are discussed. There was a good improvement in their properties due to chemical composition modification and surface modification (fiber / matrix adhesion). Characterization study was done by XRD, SEM, INSTRON and FTIR facility.

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CHAPTER-1

INTRODUCTION

1.1 INTRODUCTION:

Composites are usually man-made. Composite material is a 3D combination of atleast two chemically distinct materials, with a interface separating the components, created to obtain properties that can't be achieved by any of the components acting alone.

On the other hand a composite material is defined as a structural material that consists of two or more combined constituents those are combined at a microscopically level and not soluble in each other. One is called the reinforcing phase, is in the form of sheets, fiber or particle and another one in which it is embedded is called matrix phase. The matrix phase materials are generally continuous; they may be metal, ceramic or polymer. The strong fiber surrounded by a weaker matrix material. The example of composites systems include concert reinforced with steel n epoxy reinforced with graphite fibers. [1]

- Wood, straw, mud are everyday composites.
- Composites have been used to optimize the performance of some conventional weapons.
- Composites are very anisotropic and heterogeneous.

The reinforcing materials are generally fibers. The bonding between fibers and the matrix is created during the manufacturing phase of the composites material. The fibers may be natural and man-made.

1.2 ADVANTAGES AND DISADVANTAGES OF COMPOSITES

1.2.1 ADVANTAGES:

- High resistance to corrosion and fatigue degradation.
- High "strength to weight" ratio.
- Due to greater reliability, there are fewer inspection and structural repairs.
- High resistance to impact damage
- Good heat sink properties of composites, especially carbon-carbon, combined with their light weight have extended their use for aircraft brakes.
- Improved friction and wear properties.

1.2.2 DISADVANTAGES:

- High cost of raw materials.
- Matrix is weak, so low toughness.
- Transverse properties may be weak.
- Difficult to attach.
- Analysis is difficult.
- Matrix is subject to degradation of environment**.**

The fibers may be natural and man made

1.3 FIBER:

Fiber consist of thousands of filaments having a diameter of between 5-15 micrometer.

1.3.1 NATURAL FIBER:

Natural fiber used as a alternate for glass, motivated by potential advantages of lower raw material price, weight saving and thermal recycling or the ecological advantages of using resources which are renewable. Natural fiber have lower-durability and lower strength than glass fiber.

Cellulose is a natural polymer with high strength and stiffness per weight, and it is a building material of long fiber cells. [2]

1.3.2 DIFFERENT TYPES OF NATURAL FIBER:

Bast fiber: in general bast consists of a wood core surrounded by a stem. Within the stem there are no. of fibers bundles, each containing individual fiber cells. The filaments are made up of cellulose and hemicelluloses, bonded together by lignin and pectin.

Ex: flax, hemp, jute, kenaf, ramie

Leaf fiber (the fiber extracted from leaf): Ex: sisal, abaca, palm.

Seed fiber: Ex: cotton, coir, kapok.

1.4 ADVANTAGES AND DISADVANTAGES OF NATURAL FIBER:

1.4.1ADVANTAGES:

- Low specific weight which results higher specific strength and stiffness than glass.
- It is a renewable resource, the manufacture requires a little energy, CO2 is used while oxygen is given back to the environment.
- Producible with low investment, which makes the material an interesting product for low-wage countries.
- Friendly processing, no wear of tooling, no skin irritation.
- Thermal recycling is possible.

1.4.2 DISADVANTAGES:

- Low Strength properties, particularly its impact strength.
- Variable quantity depending on unpredictable influences such as weather.
- Swelling of the fibers accures due to moisture absorption Moisture absorption.
- Dispensation temperature is restricted.
- Lower durability.
- Poor fiber resistance.

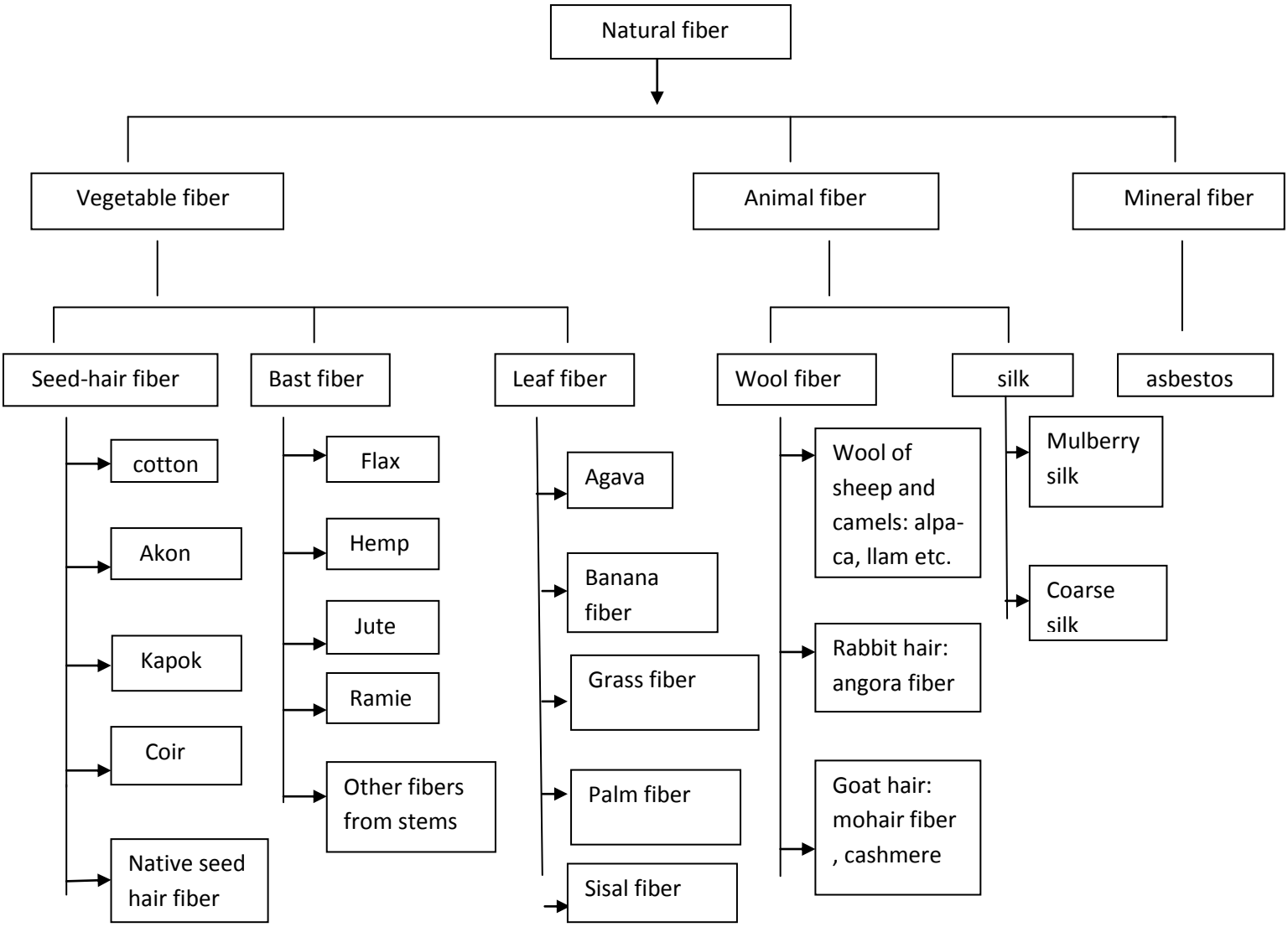


Table 1.1 different types of fibers

1.5 CHEMICAL COMPOSITION OF NATURAL FIBER:

- The chemical composition of natural fibers depends upon the type of fibers.
- The fibers are basically a rigid, cellulose, crystalline micro fibril-reinforced amorphous lignin and with hemi cellulosic matrix.
- Most plant fibers are consisting of cellulose, lignin, waxes, hemicelluloses and some water soluble components except cotton.
- Hemi cellulose is responsible for the biodegradation, micro absorption and thermal degradation of the fiber as its shows least resistance.
- Lignin is thermally stable and prone to UV degradation.
- The cell wall contain 60-80% cellulose, 5-20% lignin and upto 20% moisture.
- The cell wall of the fibers undergoes pyrolysis with increasing processing temperature and contributes to char formation.

1.6 MECHANICAL PROPERTIES:

The mechanical properties and physical properties of natural fibers vary considerably depending on the chemical and structural composition, fiber type and growth condition. [3]

Table 1.2 compositions of different natural fiber

fiber	Cellulose (wt%)	Hemi-Cellulose (wt%)	Lignin (wt%)	Pectin (wt%)	Moisture Content (wt%)	waxes	Micro-fibrillar angle
flax	71	18.6- 20.6	2.2	2.3	8-12	1.7	5-10
hemp	70-74	17.9-22.4	3.7-5.7	0.9	6.2-12	0.8	2.6-2
jute	61-71.5	13.6-20.4	12-13	0.2	12.5-13.7	0.5	8
kenaf	45-57	21.5	8-13	3.5	-	-	-
ramie	68.6-76.2	13.1-16.7	0.6-0.7	1.9	7.5-17	0.3	7.5
nettle	86	-	-	-	11-17	-	-
sisal	66-78	10-14	10-14	10	10-22	2	10-22
Hene-queen	77.6	4-8	13.1	-	-	-	-
palf	70-82	-	5-12.7	-	11.8	-	14
banana	63-64	10	5	-	10-12	-	-
abaca	56-63	-	12-13	1	5-10	-	-
Oil palm FEB	65	-	19	-	-	-	42
Oil palm mesoscars	60	-	11	-	-	-	46
cotton	85-90	5.7	4	0-1	7.85-8.5	0.6	-
coir	32-43	0.15-0.25	40-45	3-4	8		30-49
Cereal strow	38	15-31	12-20	8	-	-	-

1.7 COIR FIBER:

Coir is a natural fiber extracted from the kusk of coconut and used in product such as floor mats, doormats, brush, mattresses etc. We prefer coir fiber because it is easily available, low cost (chip), low moisture content etc.[4]

1.7.1 COMPOSITION OF COIR FIBER

Chemical and physical property:

- ✓ Coir is a lignocellulosic material.
- ✓ It is bio-degradable
- ✓ Length in cm. - 0.6 mm
- ✓ Diameter /width in micron- 16

Single fibers:

- ✓ Length in inches- 6-8
- ✓ Density(g/u)- 1.40
- ✓ Tenacity(g/ten)- 10.0
- ✓ Breaking elongation(%)- 30
- ✓ Moisture regain at 65% RM(%)- 10.5
- ✓ Swelling in water(diameter)- 5%

Chemical composition:

- ✓ Water soluble- 5.25%
- ✓ Pectin and related compound- 3.00%
- ✓ Hemicelluloses- 0.25%
- ✓ Lignin- 45.84%
- ✓ Cellulose- 43.44%
- ✓ Ash- 2.22%

100.00%

Because of high lignin content coir is more durable.

CHAPTER-2

LITERATURE SURVEY

This chapter outlines some of the fresh reports published in literature of natural fiber-reinforced composites with special importance on coir fiber reinforced polymer composites.

2.1 ON NATURAL FIBER

The mechanical property of a natural fiber-reinforced composite depends on many parameters like fiber strength, fiber length and orientation, modulus, and fiber-matrix interfacial bond strength.

A strong fiber-matrix interface bond is critical for high mechanical property of composites. A good interfacial bond is needed for effective stress transfer for effective stress transfer from the matrix to the fiber whereby maximum utilization of the fiber strength in the composites is achieved. Modification to the fiber also improves resistance to moisture induced degradation of the interface and the composites properties. In addition, factors like processing techniques/conditions have significant influence on the mechanical properties of fiber reinforced composites. Mechanical properties of natural fibers such as flax, hemp, jute and sisal, are very good and may replace the glass fiber in case of specific strength and modulus. A number of investigations have been conducted on several natural fibers.

To study the effect of fibers such as kenaf, hemo, flax, bamboo, and jute on the mechanical properties of composites of composites materials. Mansur and Aziz studied bamboo-mesh reinforced cement composites, and found that this material reinforcing material could enhance the ductility and toughness of the cement matrix, and significantly increase its tensile, flexural, and impact strength. On the other case, jute fabric-reinforced polyester composites were tested for the evaluation of mechanical properties and compared with wood composites, and it was found that the jute fiber composite has better strengths than wood composites.

A pulp fiber reinforced thermoplastic composite was investigated and found to have a combination of stiffness increased by factor of 5.2 and strength increased by a factor of 2.3 relative to the virgin polymer. Information on the usage of banana fibers in reinforcing polymers

is limited in the literature. In dynamic mechanical analysis, Laiy et al. have investigated banana fiber reinforced polyester composites and found that the optimum content of banana fiber is 40%.mechanical properties of banana-fiber-cement composites were investigated physically and mechanically by Corbiere-Nicollier et al. It was reported that Kraft pulped banana fiber composite has better flexural strength. In addition, short banana fiber reinforced polyester composite was studied by Pothan et al.; the study concentrated on the the effect of fiber content and fiber length. The maximum tensile strength was observed at 30 mm fiber length while maximum impact strength observed at 40 mm fiber length. Incorpotion of 40% untreated fibers provides a 20% increase in the tensile strength and a 34% increase in impact strength .Joseph et al. tested banana fiber and glass fiber with varying fiber length and fiber content as well. Luo and Netravali studied the tensile and flexural properties of the green composites with different pineapple fiber content, compared with the virgin resin. Sisal fiber is moderately common and inflexible .It has durability, good strength, ability to stretch, affinity for certain for dyestuffs and resistance to deterioration in ocean water. Sisal ropes and twines are extensively used for agricultural marine, shipping, and general industrial use. Belmeres et al. found sisal, henquen, and palm fiber have very similar physical, chemical, and mechanical properties. Cazaurang et al. carried out a systematic study on the properties of henequen fiber and pointed out that these fibers have fibers have mechanical properties suitable for reinforcing thermoplastic resins. Ahmed et al. carried out research work on filament wound cotton fiber reinforced for reinforcing high-density polyethylene (HDPE) resin. Khalid et al. Also studied the use of cotton fiber reinforced epoxy composites along with glass with glass fiber reinforced polymers. Fuad et al. investigated the new type wood based filler derived from oil palm wood flour (OPWF) for bio-based thermoplastics composites by thermo gravimetric analysis and the results are very promising .Schneider and Karmaker developed composites using jute and kenaf fiber and polypropylene resins and they reported that jute fiber provided better mechanical properties than kenaf fiber. Sreekala et al. performed one of the pioneering studied on the mechanical performance of treated oil palm fiber –reinforced composites. They studied the tensile stress stain behavior of composites having 40% by weight fiber loading. Acrylated, Isocyanate, silane, latex coated and peroxide-treated composite withstand tensile stress to higher strain level. Isocyanate treated, silane treated, acrylated, and latex coated composites showed yielding and high extensibility. Tensile modulus of the composites of the composites at 2% elongation of the

showed slight enhancement upon mercerization and permanganate treatment .the elongation at break of the composites with chemically modified fiber was attributed to the changes in the chemical structure and bond ability of the fiber. Alkali treated (5%) sisal polyester bio composite showed about 22% increase in tensile strength. Joseph and Thomas studied effect of chemical treatment on the tensile and dynamic mechanical properties of short sisal fiber reinforced low density polyethylene composites. Mohanty et al. studied the influence of different surface modifications of jute on the performance of the bio composites. Jute fiber content also affected the bio composite performance and about 30% by weight of jute showed optimum properties of the bio composites.

2.2 <u>ON COIR FIBER REINFORCED COMPOSITES</u>*:*

Many aspects of the use fibers as reinforcement in polymer-matrix composites are described in the literature. Coir is an abundant, renewable, cheap and biodegradable lignocelluloses fiber used for making a wide variety of products. Coir has been also been tested as filler or reinforced in different composite materials. Furthermore, it represents an additional agro-industrial non-food feedstock (agro industrial and food industry waste) that should be considered as feedstock for the formulation of ecocompatible composite materials. Coconut coir is the most interesting products as it has the lowest thermal conductivity and bulk density .the addition of coconut coir reduced the thermal conductivity of the composite specimens and yielded a lightweight product. Development of composites materials for buildings using natural fiber as coconut coir with low thermal conductivity is an interesting alternative which would solve environment and energy concern. Geethamma et al. have studied the dynamic mechanical behavior of natural rubber and its composites reinforced with short coir fibers. Coir fiber-polyester composites were tested, as roofing and as helmets.

Coir–polyester composites with untreated and treated coir fibers, and with fiber loading of 17 wt%, were tested in tension, flexure and notched Izod impact. The results obtained with the untreated fibers show clear signs of the presence of a weak interface long pulled-out fibers without any resin adhered to the fibers and low mechanical properties were obtained. Even though showing better mechanical performance, the composites with treated fiber present, however only moderation the values of the mechanical property analyzed. Alkali treatment is

also reported for coir fibers fiber–polyester composites, with volume fraction ranging from 10% to 30%, show better properties than composites with untreated fibers, but the flexural strength of these composites was consistently lower than that of the bare matrix. A maximum value of 42.3 MPa is reported next to a value of 48.5 MPa for the neat polyester. Acetylating of coir fibers increases the hydrophobic nature, increases the resistance to fungi attack and also increases the tensile strength of coir fiber composites .However, the fiber loading has to be fairly high, 45 wt% or even higher, to achieved a significant reinforcing effect when the composite is tested in tension. Moreover, even with high coir fiber loading fractions, there is no development in the flexural strength. From these results, it is clear that the usual fiber treatments reported so far did not significantly change the mechanical performance of coir–polyester composites. Even though there are several reports in the literature which discuss the mechanical property of natural fiber reinforced polymer composite. However very limited work has been done on role of fiber length on mechanical behavior of coir fiber reinforced epoxy composite. Against this the present research work has been undertaken, with an objective to discover the potential of coir fiber as a reinforcing material in polymer composites and to investigate its effect on the mechanical behavior of the resulting composites. The present work aims to develop this new class of natural fiber based polymer composites with different fiber lengths and to analyze their mechanical property by experimentation.

CHAPTER-3

MATERIALS AND METHODS

This chapter describes the details of processing of the composites and the experimental procedures followed for their mechanical characterization. The raw materials used in this work are

1. Coconut fiber
2. Epoxy resin
3. Hardener

3.1 SPECIMEN PREPARATION

The fabrication of the various composite materials is carried out through the hand lay-up technique. short coconut coir fibers(fig.3.1)are reinforced with epoxy LY 556 resin, chemically belonging to the "epoxide" family is used as the matrix material, whose common name is Bisphenol A Diglycidyl Ether. The low temp curing epoxy resin (Araldite LY 556) and corresponding hardener (HY951) are mixed in a ratio of 10:1 by weight. The epoxy resin and the hardener are supplied by Ciba Geigy India Ltd. The coir fiber is collected from rural areas of orissa, India.

Figure 3.1 Coconut coir fiber

3.2. TREATMENT OF FIBER

Fibers as received are washed with distilled water to remove the surface dirt present in the fibers and then the fibers are dried in air circulating oven at a temp of 100^0c until it gains a constant weight .Then the fibers are designated as washed fibers. For de-waxing the coir fibers are cooked in a mixture of ethanol and benzene in a ratio 1:2 by Roy[5] . We took 300ml ethanol and 600ml benzene for this process. The fibers are cooked with these chemicals for 12hrs so that to attain hohlraum character which means the substances lying in layers with free spaces in between [6]

During this process the fibers are cooked in this solution under gradual increase and decrease of temperature of the bath from 30-55.5c.this process of heating and cooling was done per every 2 hrs for a period 12 hrs. Finally the fiber bundles are removed from the mixture at 30c and washed with distilled water. Then the fibers are again dried in a oven at a temperature of 100c until it gets constant weight. Then the fiber is called as de-waxed coir fiber.

3.3 FABRICATION OF COMPOSITE PLATE:

A handmade wooden mold is designed for the fabrication of the randomly oriented raw coir fiber-reinforced epoxy composite (RCFREC) and de-waxed fiber-reinforced epoxy composite (DCFREC). First, a releasing plastic is spread over the bottom of the wooden mold. Heavy duty silicon spray is applied to the plastic sheet for easy removal of the composite plate. The fibers are cut into 20 mm length and distributed uniformly at the bottom of the mold which is prepared before. Fifteen volume percentage of the fiber is used for the fabrication of the composite. Initially, epoxy and hardener are mixed together on a weight percentage of 10:1 to form a matrix. The matrix is poured over the fibers evenly then pressed and pushed down with the iron roller to avoid and eliminate the air bubbles. Finally, load is given to it to remove excess matrix and left for curing at room temperature for 24 h.

CHAPTER-4

EXPERIMENTAL TECHNIQUES

4.1 X-RAY DIFFRACTION:

X-Ray crystallography is a method of determining the arrangement of atoms with in a crystal in which a beam of X-rays strikes a crystal and diffracts into many precise directions. From the angles and intensities of the diffracted beam, the 3-D picture of the density of electrons within the crystal can be studied. X-ray diffraction is a versatile, non-destructive technique that reveals detailed information about crystallographic structure of the material.

4.1.1 PRINCIPLE OF XRD:

Braggs law: when a beam of parallel X-rays penetrating a stack of planes of spacing d_{hkl} (as shown in fig) at an angle of incidence θ each plane will reflecting a portion of the incident beam. The reflected rays are combined to form a diffracted beam if they differ in phase by a whole number of wavelength i.e if the path difference AB-AD= nλ where n is an integer.

AB= d/Sinθ

AD=AB Cosθ= (d/Sinθ)(Cos2θ)

nλ= AB-AD=2dSinθ

nλ= 2d Sinθ …(1)

Eqn. 1 is the Bragg condition for diffraction [7]

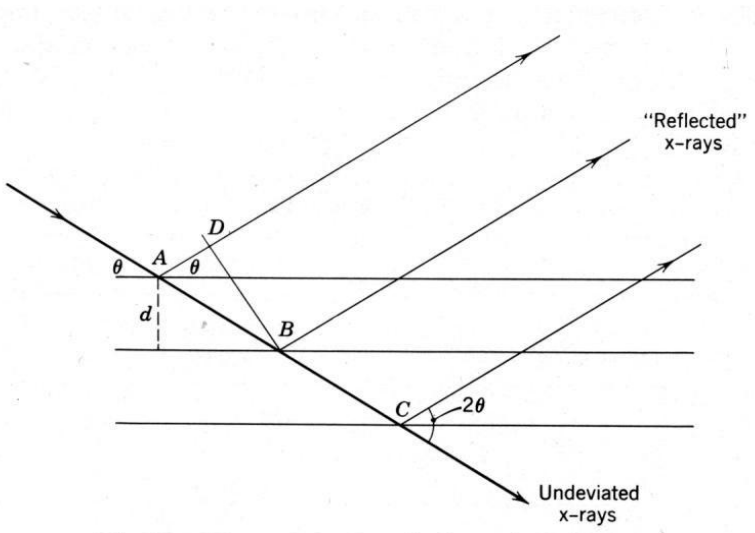


Fig 4.1 Bragg's diffraction

Two geometrical facts :

(1) The incident beam, the diffracted beam and the normal to the reflecting plane are always coplanar.

(2) The angle between the transmitted beam and diffracted beam is 2θ, which is known as diffraction angle, and it is this angle, rather than θ, which is usually measured experimentally**.**

4.1.2 APPLICATIONS:

1) From the Bragg's law, relationship between d-value and the the lattice constants can be obtained.

 The wavelength is known.

  θ is the half value of the peak position (in the x-axis, 2θ, corresponds to the detector that rotates around the sample giving the peak position).

  Thus d value is calculated.

2) Phase identification: By comparing the experimental data with known standards in the JCPDS file, which are for random orientation of a single crystal or grain can be determined.

3) The crystal structure of an unknown material can be determined.

4) Crystallite smaller than 120nm create broadening of diffraction peaks. This peak broadening can be use to enumerate the average crystallite size of nano-particles using the Scherre equation:

$$D = \frac{0.94\lambda}{\beta cos\theta}$$

Where, λ is the wavelength of the X-ray and β is the full width at half maximum.

Fig 4.2 XRD machine

4.2 INSTRON:

Instron is a producer of test equipment designed to evaluate the mechanical properties of materials and components.

Hindman and George Burr in 1946, worked togetherly, to determine the properties of new materials. Togetherly, they designed a material testing machine based on strain gauge load cells and servo-control systems. This lead to the formation of instron engineering corporation.[8]

4.2.1 APPLICATION:

- tensile strength testing
- compressive strength
- fatigue testing
- flexural strength testing

Fig 4.3 Instron

4.3 FTIR: (Fourier Transform Infra-Red)

FT-IR stands for Fourier Transform Infra-Red. This is the favored method of infrared spectroscopy in which IR radiation is passed through sample. Some of the infrared radiations are absorbed by the sample and some of them passed through (transmitted). The resulting IR spectrum represents the molecular transmission and absorption creating a molecular finger print of the working material. [9]

- It can identify unknown materials.
- It can determine the quality or steadiness of a sample.
- It can determine the quantity of components in a mixture.

4.4 SEM: (scanning electron microscope)

Using Scanning electron microscope microstructure features were studied. A scanning electron microscope is a type of electron microscope that images a sample by scanning it with a beam of electrons in a raster scanning pattern. The electrons interact with the atoms that makeup the sample producing signals that contain information about the sample's surface morphology, composition, and electrical conductivity. The 1st SEM image (silicon steel) was obtained by Max knoll in 1935[10]

Fig 4.4 SEM machine

CHAPTER-5

RESULT AND DISCUSION:

5.1 RESULTS OF FTIR:

From fig (5.1) peak 3422-3398 (O-H stretch) The O-H group increases in case of de-waxed coir fiber in comparison to raw coir fiber. Peak 2928-2924 (Alkyl C-H) The C-H group also increases in de-waxed coir fiber . In case of de-waxed fiber peak position 1674 (Aromatic C=C bending), for raw fiber peak position 1730 (Aldehyde C=O stretch) . Here shifting of bonds accure. Peak 1052-1020 (C-O A strong absorption). 528-668 here also sift of peak accure.

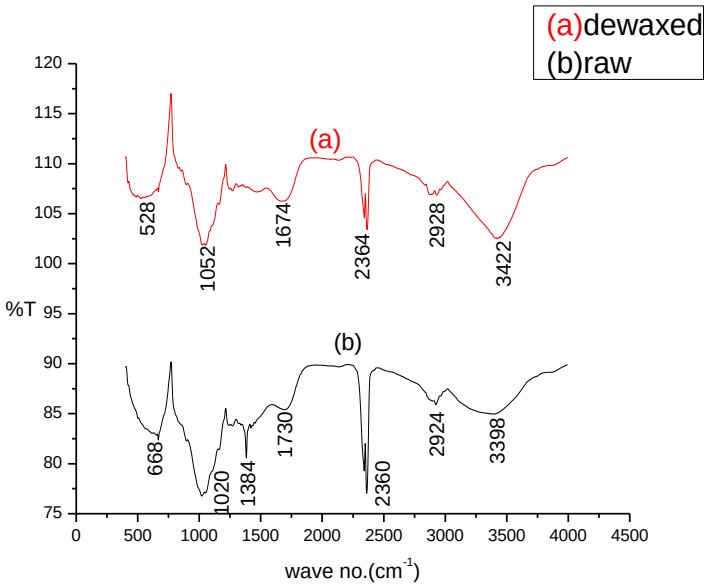


fig 5.1.IR spectra of raw and de-waxed coir fiber

5.2 RESULTS OF XRD:

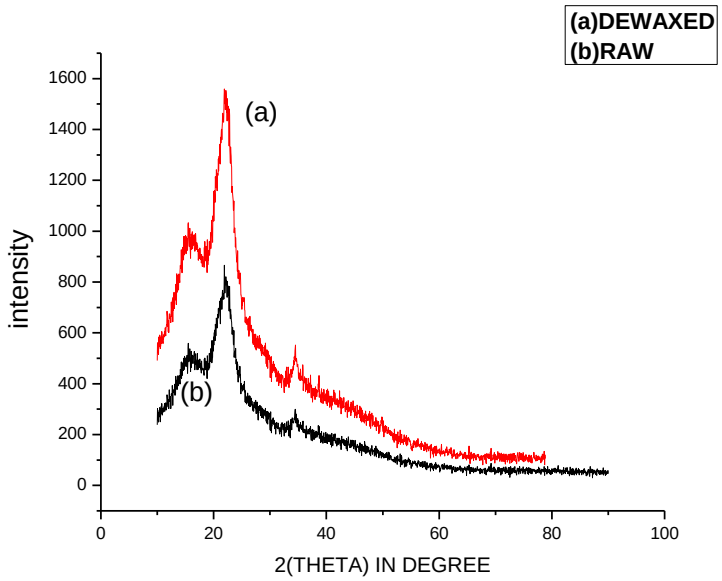
The XRD patterns of both de-waxed and raw coir fibers are shown in fig (5.2). The FWHM (full width at half maxima) of the diffraction peak of both de-waxed n raw coir fibers are analyzed. The diffractograms of both de-waxed and raw coir fiber a well defined max peak 2θ=22 and 2θ=21.9 in degree. Which is the characteristic of cellulose [11]

Table (5.1) shows degree of crystallinity of de-waxed and raw coir fiber. It can be seen after de-waxing the degree of crystallinity of fiber increased, which is due to reduction of lignin content of the coir fiber and the rearrangement of cellulose chain. The change in crystalline peaks in fig (5.2) denote the change in the crystalline region.

Table (5.1) The degree of crystallinity of raw and de-waxed coir fibers

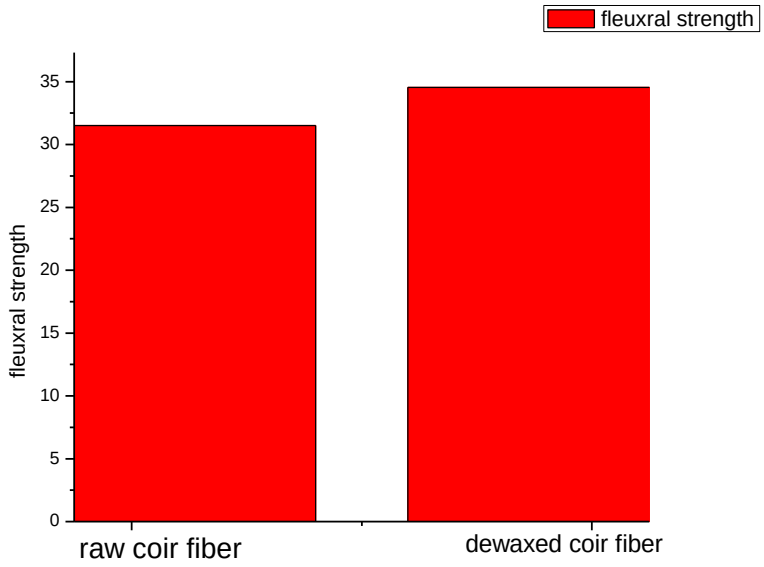
Coir fiber	Highest peak position 2θ(in degree)		Degree of crystallinity (%)
raw	21.9		66.78
De-waxed	22		67.96

Percent of crystalline peak area relative to the whole diffraction area suggests an improvement in the degree of crystallinity of de-waxed fiber. Both the fibers are amorphous in nature having one cellulose peak. The increase in the size of the crystallites is due to the decrease in crystal distortion.[12]



Fig(5.2) XRD pattern of de-waxed n raw coir fiber

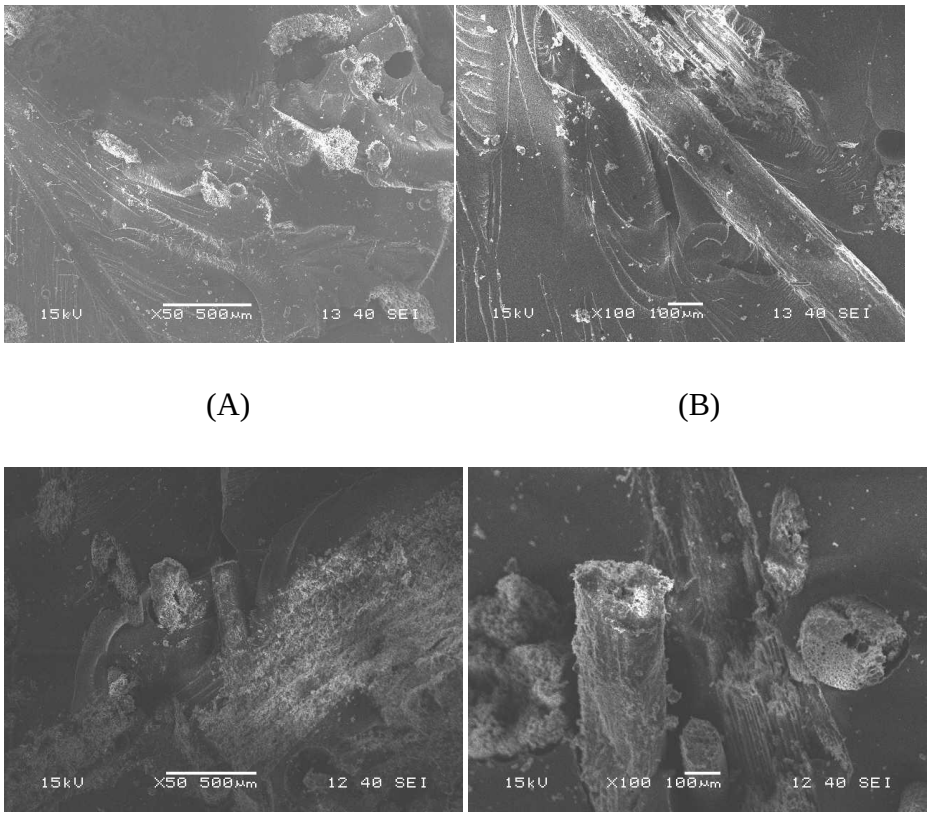
5.3 **RESULTS OF INSTRON**:



Fig(5.3)The flexural strength of raw and de-waxed coir fiber

The figure shows the flexural strength of both raw fiber and de-waxed fiber. From the 3 point bend test it is found that the strength of de-waxed fiber is higher than raw coir fiber. For the fiber–reinforced composites the interfacial zone plays a leading role in transferring the load between fiber and matrix which affects the mechanical properties such as strength. This finding demonstrates that flexural failure depends mainly on the fiber /matrix adhesion. The increased value of flexural strength in case of de-waxed may be increase in effective surface area available for contact with the matrix [13]

5.4 <u>RESULTS OF SEM</u>:



(A) (B)

(C) (D)

Fig 5.4 SEM images

From the above SEM image the (B), (D) images are longitudinal section of the de-waxed and raw coir fiber respectively. (A), (C) is the surface of de-waxed and raw coir fiber respectively .

It is observed that the treatment has improved the surface roughness of the fiber as compared to the untreated or raw fibre. From fig (C) it is confirmed that the adhesion between the fiber and matrix is poor and bubbles are there as there are gap around the fiber at the interface whereas in the treated composite the fiber matrix adhesion is shown by fiber breakage rather than fiber pullout.

5.5 CONCLUSION:

In this study, we synthesized starch based bio-composite materials and studied the structural parameter of fiber with the correlation to morphological and thermal properties of the composites by varying matrix concentration with fixed fiber concentration. Bio-composites were prepared with the help of coir fiber and epoxy and hardener using handmade mould. From XRD patterns of the fibers crystallite size and degree of crystallinity has been found to more in de-waxed coir fiber in comparison to raw coir fiber. SEM microstructure for composite shows good adhesion of fiber with the matrix. From the 3 point bend test it is found that the strength of de-waxed fiber is higher than raw coir fiber. From FTIR graph the chemical composition of both the fibers are determined. From all above characterization it is concluded that after de-waxing the coir fiber becomes more efficient for binding with matrix for making composites.

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