A PROJECT REPORT

ON

"STUDY OF WATER ABSORPTION BEHAVIOUR OF NATURAL FIBRE REINFORCED POLYMER COMPOSITES UNDER VARIOUS PRETREATMENT CONDITIONS OF NATURAL FIBRE "

Submitted to

UNIVERSITY OF MUMBAI

In Partial Fulfilment of the Requirement for the Award of

BACHELOR'S DEGREE IN
MECHANICAL ENGINEERING

BY

SHAIKH MD AMMAR 16DME173
MUBIN ANSARI 16DME127
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UNDER THE GUIDANCE OF
PROF. ZAKIR ANSARI

DEPARTMENT OF MECHANICAL ENGINEERING
Anjuman-I-Islam's Kalsekar Technical Campus
SCHOOL OF ENGINEERING & TECHNOLOGY
Plot No. 2 3, Sector - 16, Near Thana Naka,
Khandagaon, New Panvel - 410206

2018-2019

A PROJECT II REPORT

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CERTIFICATE

This is certify that the project entitled

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submitted by

SHAIKH MD AMMAR	**16DME173**
MUBIN ANSARI	**16DME127**
KHAN ZAID SHER	**16DME156**

is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering (MECHANICAL Engineering) at ***Anjuman-I-Islam's Kalsekar Technical Campus, Navi Mumbai*** under the University of MUMBAI. This work is done during year 2018-2019, under our guidance.

Date: 30 /04 /2019

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Project I Approval for Bachelor of Engineering

This project entitled ***S̈TUDY OF WATER ABSORPTION BEHAVIOUR OF NATURAL FIBRE REINFORCED POLYMER COMPOSITES UNDER VARIOUS PRETREATMENT CONDITIONS OF NATURAL FIBRE*** ¨ by ***SHAIKH MOHAMMED AMMAR, MUBIN ANSARI AND KHAN ZAID*** is approved for the degree of ***Bachelor of Engineering in Department of Mechanical Engineering*.**

Examiners

1. ....
2. ....

Supervisors

1. ....
2. ....

Chairman

....

Declaration

We declare that this written submission represents my ideas in my own words and where others ideas or words have been included, We have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ABSTRACT

It is observed through research that Natural Fibre Reinforced Polymer Composite have high water absorption capacity. In order to make the commercial use of natural fibres, which are abundantly available at a very less cost, their water absorption is to be reduced. It was found that the chemical and physical treatment of natural fibre improves their water absorption ability. The current paper explores the different methods and treatments of natural fibre from the perspective of improving its water absorption properties.

Keeping this in view the present work has been under taken to develop a polymer matrix composite (epoxy resin) using Coir fibre and to study its moisture absorption behavior. The composite are prepared with different volume of Coir fibre.

This work aims to prepare and test samples for their water absorption capability. Four different samples are required to be prepared in the ratio of 30:70 for fibres to matrix respectively. The samples have the natural fibres treated under different situations such as untreated, chicken fat under cold treatment,chicken fat under hot condition and NaOH treated. The experiment are to be conducted as per ASTM D570-98. The prepared samples are to be kept in the water and are to be taken out after an interval of 12 hours to check the water absorbed. This has to be continued till the saturation level. It has to be estimated if the samples follow Fick's law.

Keywords: Eco-Sustainability[ES], Epoxy Resin[ER], Chicken Fat[CF], Fick's Law[FL].

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Chapter 1

Introduction

Natural fibers are not new to the world. They gained popularity because of renewable, environmental friendly, low cost, lightweight and high specific mechanical performances are the advantages of these plant fibres over the glass fibre or carbon fibre. Composites are exciting materials which are finding increasing application in transportation, aerospace, defence, communication, sporting, electronics and number of other commercial and consumer products. Composite materials have become one of the fastest growing research and development areas of Material Science because of their high potential. In current years there is swift growth in the arena of fibers, matrix, materials, processing, boundary structure, bonding and their characteristics on the final properties of composites. The technological developments in composite materials help in meeting the global industrial demand for materials with improved performance capabilities. them being light weight , readily available , abundant in quantity, nonabrasive, combustible, nontoxic, low cost and biodegradable properties.But because of their lower strength and mechanical properties and also being moisture absorbent in nature, they could not stand a chance against glass fibers which possess high strength and mechanical properties and also being moisture resistant in nature.But at the end of the day, glass fiber being a plastic origin is not environment friendly and after witnessing the exploitation of plastic and its adverse effect on the environment, it is something of serious concern and cannot be neglected.but the use of glass fibres cannot be completely eradicated because of it positive properties and also complete use of only natural fibers cannot be implemented because of its drawbacks..Therefore hybridization seems the only possible way.Even if replacing a small percentage of glass fibers with natural fibers in a material production on large scale can cause tremendous positive effect on the environment and also contribute to higher eco-sustainability. The use of gelatin as a binder for natural fibres in polymer matrix has been tried with in a few works.

In this work, coir being used as the natural fiber, because it is easily available in the local areas and one of the most widely used in natural fibre reinforced polymer composite industry. The glass fiber of 35 gm is to be used. According to the plan of experiments, 12 samples are to be produced using hand-layup process. In every case the natural fibres are untreated, treated with chicken fat under hot treatment, treated with chicken fat under cold condition and treated with NaOH. Three samples under each case are prepared to avoid errors. The fibre to matrix ratio would be 30:70 respectively.

1.1 COMPOSITES

1.1.1 Why a composite?

Over the last three decades years composite materials, plastics and ceramics have been the ascendant developing materials. Numerous uses of composite materials have grown evenly, pervasive and dominant new markets interminably.

As stated by Jartiz, [1] Composites are such a universal material which can provide such properties that are not possible to obtain from any distinct material. Composites possess cohesive structures brought up by physically amalgamating two or more suited materials, but different in composition and characteristics and occasionally in configuration.

IKelly [2] evidently emphasises that the composites should not be considered as just combination of two different materials. In wider sense; the amalgamation has its particular characteristic properties. In relations of strength, heat resistant or specific other advisable quality, it is far better than the components taken individually or fundamentally different from both of them.

Berghezan [3] defines as “The composites are amalgamated materials which differ from alloys by the fact that the individual components in composites preserve their characteristics but are combined in such a way so as to take advantage of their features only and not of their limitations”, in order to obtain a much better material.

Van Suchetclan [4] describes composite materials as diverse materials which consist of two or more solid states that are in constricted interaction with each other. He also stated that composites can be also contemplated as homogeneous material on a microscopic level in a way that whichever part of it is separated will have the physical property same as the composite.

1.1.2 The two broad classes of composites are:

(i) Fibrous composites
(ii) Particulate composites

Table-1.1 Classification of composite

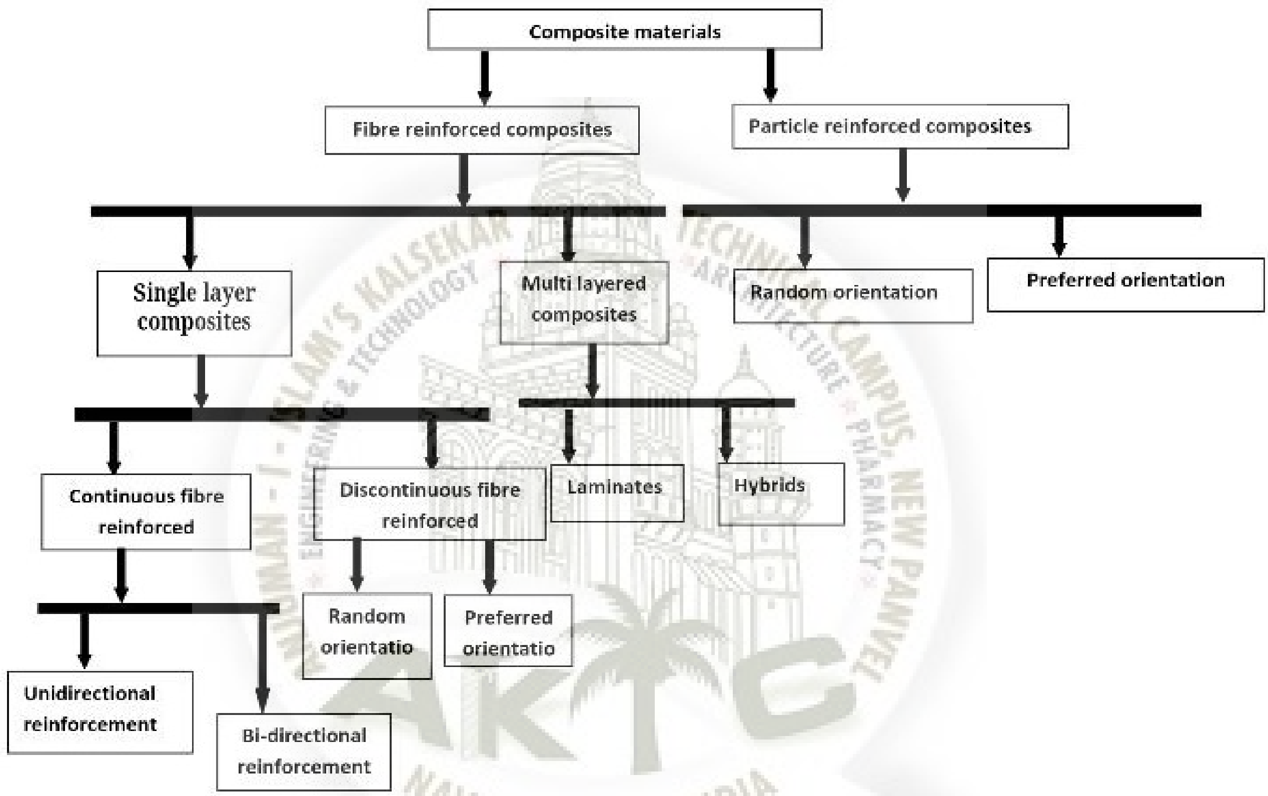


Figure 1.1: CLASSIFICATION OF COMPOSITE

1.2 APPLICATION

1.2.1 Automobile industry:

For inner and outer parts fibre reinforced plastics are used. These are used in industries because of their advantages over the glass fibre reinforced composites such as cheaper, environment friendly, etc. By these fibers cars according to End-of-Life directive can be developed as the resulting products from these composites can be re-used and do not have to be land filled unlike glass fibre. Because of their softness and non-harsh behaviour unlike glass fibers they are used in interior automotive uses and are having advantages of not injuring the passengers.

1.2.2 Packaging industry:

In these industries these are used for light weight pallets. Weight reduction is the chief reason for using composite material in place of wood, which saves fuel during transportation.

1.2.3 Consumer products:

Natural fibre can be used for any injection moulded product. Reduction of plastic use, flame retardancy and re-use. Examples are household appliances like cell phones, refrigerators and computers. They are less vulnerable to fire due to the fibre structure of composite. Also the high fibre loads results in major material cost reduction.

1.2.4 Building and construction industry:

In these they are used for roofings and instance profiles. Cost reduction, re-use and flame retardancy are the advantages.

1.3 Coir as a natural fiber

Figure 1.2: COIR FIBER

1.4 Glass as a artificial fiber

Figure 1.3: GLASS FIBER

1.5 Purpose

In view of the sustainable development, there has been a shift in the paradigm from artificial materials to natural alternative sources of materials. The use of natural fibre reinforced polymer composite in a country like India not only proves to be an alternative to the artifical materials on account of ease of availability but also it proves to be a low cost option due to abundant availability. It was found that by treatment of agro fibres with some chemicals minimises the water absorption rate such fibres when used as a reinforcement in NFRPC it proves to be an improved performance. It was also found that NaOH gives the best chemical treatment for coconut fibre with 29.96 percent cellulose, 11.58 percent lignin and 23.09 percent hemi-cellulose.

1.6 OBJECTIVE

The main objective of this project is to prepare a PMC using coir fiber as reinforcement and epoxy as matrix material and to study its moisture absorption characteristics under different environmental conditions. Out of the available manufacturing techniques, we have chosen hand-lay-up method to construct the composite. Then the composites were manufactured by varying the no. of layers of fibre.

Chapter 2

Literature Survey

2.1 NATURAL FIBERS:

Natural fibers have become suitable options to traditional synthetic or manmade fibers and have the prospective to be used in cheaper, more sustainable and more environment friendly composite materials. Natural organic fibers can be obtained from either animal or plant sources. Most of the useful natural textile fibers are obtained from plant, with the anomaly of wool and silk. All plant fibers comprises of cellulose, whereas protein act as a chief content of fibers of animal origin. Hence, the natural fibers are categorized on the basis of their origin, whereas the plant fibers can be further classified on the basis of plant parts from which the parts are originated.

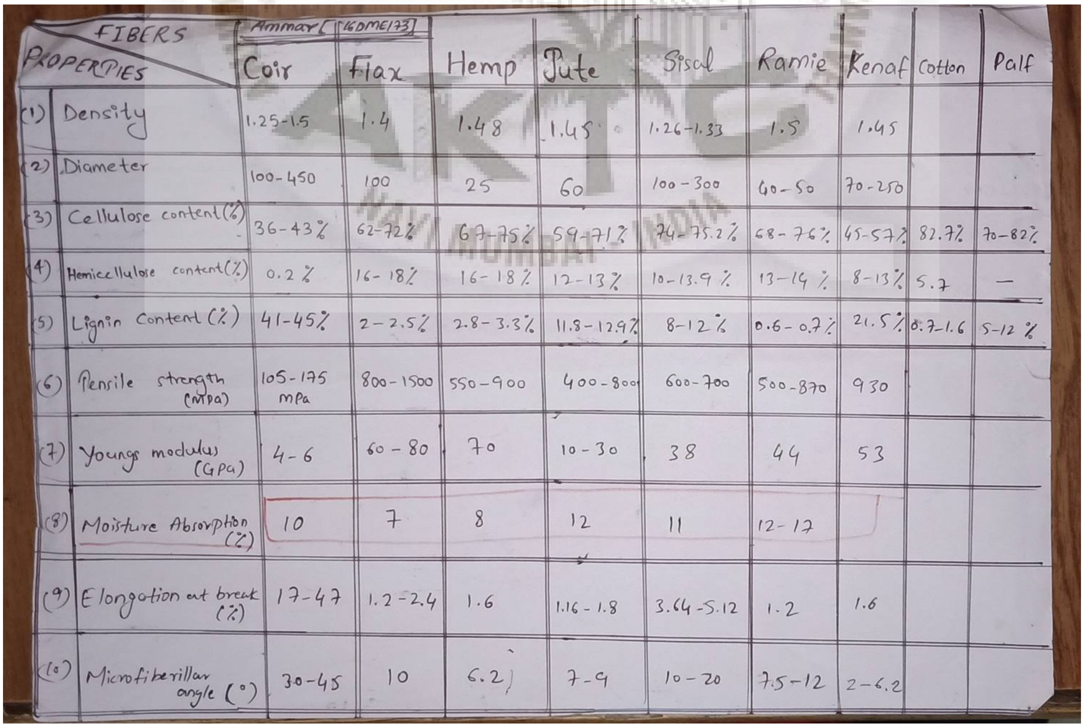
Normally, plant or vegetable fibers are cast to reinforce polymer matrices. Plant fibers are a renewable resource and have the capability to be recycled. The plant fibers leave slight residue if they are burned for disposal, returning less carbon dioxide (CO2) to the atmosphere than is separated during the plant's growth.

The chief driver for switching natural fibers for glass is that they can be grown with lesser cost than glass. The price of glass fiber is around Rs. 300.0/- per kg and has a density of 2.5 gm/cc. On the other hand, natural fiber costs Rs. 15.0/- to 25.0/- per kg and has a density of 1.2-1.5 gm/cc. As can be seen from Table-2.1,The tensile strength of natural fibre is considerably lower than the glass fibers. On the other hand, when the specific modulus of natural fibers is measured, the natural fibers show values that are similar to or even better than glass fibers. Material cost savings, suitable to the use of natural fibers and high fiber filling levels, coupled with the benefit of being non-abrasive to the mixing and moulding tools make natural fibers a thrilling outlook. These reimbursement mean natural fibers could be used in many applications, including building, automotive, household appliances, and several other applications.

2.1.1 PROPERTIES OF NATURAL FIBERS

Table-2.1 Properties of glass and natural fibers

Mechanical Properties	Fibers						
	E-glass	Hemp	Flax	Jute	Sisal	Coir	Ramie
Density (gm/cc)	2.25	1.48	1.4	1.46	1.33	1.25	1.5
Tensile Strength (MPa)	2400	550-900	800-1500	400-800	600-700	220	500
Young's Modulus (MPa)	73	70	60-80	10-30	38	6	44
Specific Modulus (MPa)	29	-	26-46	7-21	29	5	2
Failure Strain (%)	3	1.6	1.2-1.6	1.8	2-3	15-25	2
Moisture Absorption (%)	-	8	7	12	11	10	12-17



FIBERS / PROPERTIES (Ammar [16DME173])	Coir	Flax	Hemp	Jute	Sisal	Ramie	Kenaf	Cotton	Palf
(1) Density	1.25-1.5	1.4	1.48	1.45	1.26-1.33	1.5	1.45		
(2) Diameter	100-450	100	25	60	100-300	40-50	70-250		
(3) Cellulose content(%)	36-43%	62-72%	67-75%	59-71%	74-75.2%	68-76%	45-57%	82.7%	70-82%
(4) Hemicellulose content(%)	0.2%	16-18%	16-18%	12-13%	10-13.9%	13-14%	8-13%	5.7	—
(5) Lignin Content (%)	41-45%	2-2.5%	2.8-3.3%	11.8-12.9%	8-12%	0.6-0.7%	21.5%	0.7-1.6	5-12%
(6) Tensile strength (MPa)	105-175 MPa	800-1500	550-900	400-800	600-700	500-870	930		
(7) Youngs modulus (GPa)	4-6	60-80	70	10-30	38	44	53		
(8) Moisture Absorption (%)	10	7	8	12	11	12-17			
(9) Elongation at break (%)	17-47	1.2-2.4	1.6	1.16-1.8	3.64-5.12	1.2	1.6		
(10) Microfiberillar angle (°)	30-45	10	6.2	7-9	10-20	7.5-12	2-6.2		

Figure 2.1: NATURAL FIBERS PROPERTIES

2.2 Paper Title: Effect of alakali treatment of coir fiber reinforced poly biodegradable composites

The poly(butylene succinate) biodegradable composites reinforced with coir fibers were developed.The effect of alkali treatment on the surface morpholgy and mechanical properties of coir fibers was studied.Mechanical properties of coir fiber composites was studied. The fiber surface morphologies and fractured surface of the composites exhibited an improvement of interfacial fiber matrix adhesion in the composites reinforced with alkali treated coir fibers.

Keywords: Polymer Matrix Composites(PMCs), Mechanical Properties(MP), Surface Treatment(ST).

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2.2.1 Advantages of Paper

a. Effect of alakali treatment on mechanical properties of coir fiber has been studied.

b. Properties of fiber and glass have been developed.

c. Coir fiber biodegradable composites with different fiber content have been developed.

d. Alkali treatment of coir fiber increased the interfacial bonding strength and wettability of the fibers.

2.3 Paper Title :Evaluation of hybrid short coir fibre reinforced composites

A full factorial design (2231) has been used to investigate the eect of the use of sodium hydroxide fibre treatment, physical and mechanical properties of hybrid short coir fibre reinforced composites (HSCoirFRCs). The response variables considered in this work were the apparent density, porosity, tensile and exural strength, the modulus of elasticity and the Charpy impact resistance. The alkali treatment contributed not only to reduce the apparent porosity, but also to increase the mechanical properties of the HSCoirFRCs. A reduction of the impact resistance and an increase of the apparent density was also identied after treatment. Cold pressing signicantly aected the physical and mechanical properties of the HSCoirFRCs. Higher pressure levels enhanced the wettability of the bres and, consequently, the mechanical performance of the composites. The incorporation of cement microparticles as a second reinforcementphase was however not eective, leading to decreased strength and an increased apparent density of the materials.

Keywords: Coir bre, Hybrid composite, Alkaline treatment.

2.3.1 Advantages of Paper

a. According to Defoirdt et al. [43], as the coir fibre is a natural product, its properties depend not only on the plant species, but also on the climate and terrain where it has grown, harvest period, extraction method, the date of harvesting and the maturity at harvesting.

b. According to Defoirdt et al. [43], as the coir fibre is a natural product, its properties depend not only on the plant species, but also on the climate and terrain where it has grown, harvest period, extraction method, the date of harvesting and the maturity at harvesting.

c. The alkali treatment-reduced the aparent porosity and signicantly improved the tensile and exural properties of the HSCoirFRCs because of the improved fibre/-matrix bonding. However, this strong interface fibre failure.

2.4 Paper Title:CHEMICAL COMPOSITION OF NATURAL FIBRES

The component of any natural fiber differs with variety, area of production and origin, maturation of plant. The major component of a fully developed natural fiber cell walls are cellulose, hemicellulose, lignin and pectin. These –OH including polymers are distributed all the way through the fibre wall.

2.4.1 Cellulose

The long thin crystalline micro-fibrils in the secondary cell wall are prepared of cellulose. It is the reinforcing material and is in charge for better mechanical strength of fibers. Chemically, cellulose is explained as a highly crystalline section alternating with regions of non-crystalline or amorphous cellulose [16, 17].

2.4.2 Hemicelluloses

Hemicelluloses vary from cellulose in three dissimilar ways.
1. In contrast with cellulose (including 1,4--D-glucopyranose units only) they have some assorted sugar units.
2. They reveal a considerable degree of chain branching, while cellulose is a linear polymer.
3. The standard of polymerization of local cellulose is ten to hundred times greater than the hemicelluloses.

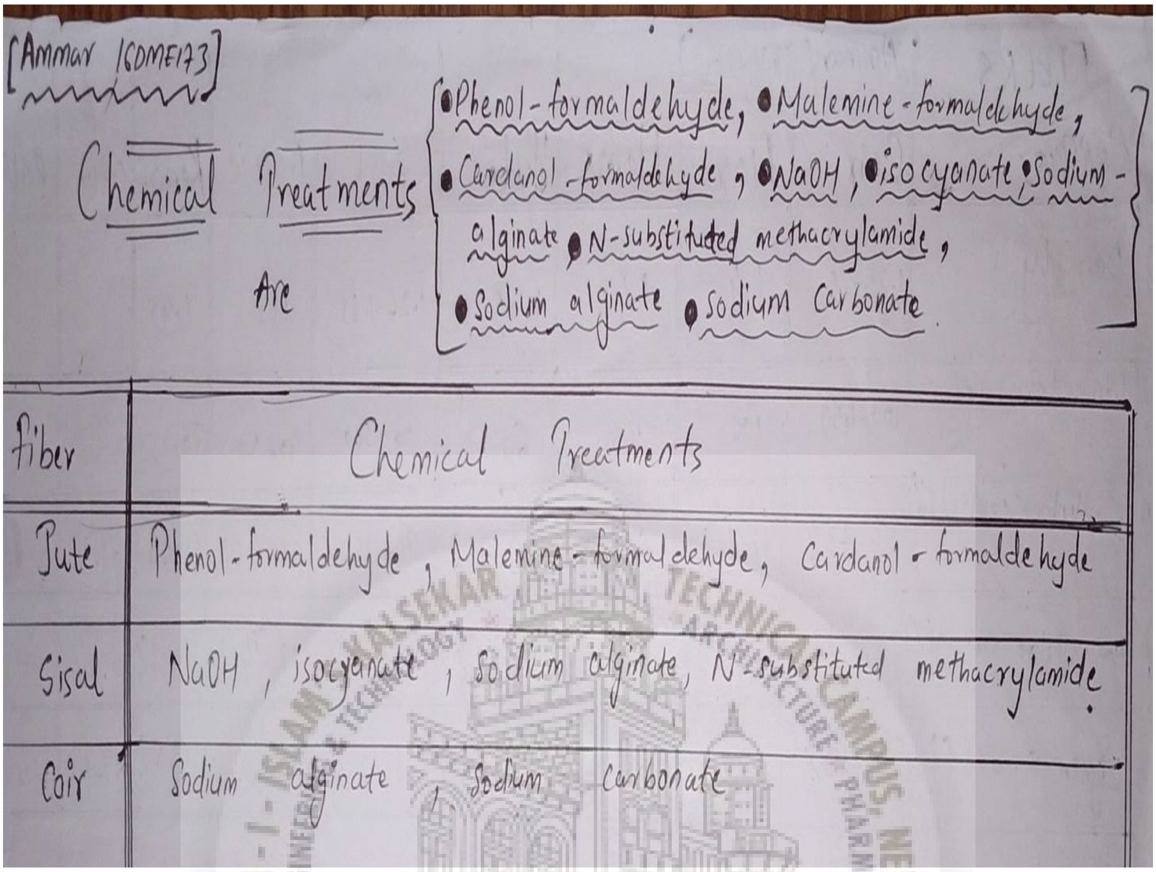
2.4.3 Lignin

Collectively with cellulose, it is the superabundant and significant polymeric organic substance in the world of plant. For trees of 100 meters height to stay upright lignin plays a major role as it multiplies the compression strength of plant fibers by sticking the fibers collectively to form a stiff structure.

2.4.4 Pectin

Pectin, otherwise called pectic polysaccharides, is rich in galacturonic acid. A few different polysaccharides have been distinguished and described inside the pectic gathering.

2.4.5 CHEMICAL TREATMENTS



[Ammar 16DME173]

Chemical Treatments Are {
• Phenol-formaldehyde, • Malemine-formaldehyde,
• Cardanol-formaldehyde, • NaOH, • isocyanate, • Sodium-alginate • N-substituted methacrylamide,
• Sodium alginate • sodium Carbonate }

Fiber	Chemical Treatments
Jute	Phenol-formaldehyde, Malemine-formaldehyde, Cardanol-formaldehyde
Sisal	NaOH, isocyanate, sodium alginate, N-substituted methacrylamide.
Coir	Sodium alginate, sodium carbonate

2.5 Comparison

	Natural Fibre	Glass Fibre
Density	Low	Twice that of Natural fibre
Cost	Low	Low, but higher than Natural fibre
Renewability	Yes	No
Recyclability	Yes	No
Energy Consumption	Low	High
Distribution	Wide	Wide
CO_2 neutral	Yes	No
Abrasion to Machining	No	Yes
Health risk when inhaled	No	Yes
Disposal	Biodegradable	Not Biodegradable

Chapter 3

Project Planning

3.1 Members and Capabilities

Table 3.1: Table of Capabilities

SR. No	Name of Member	Capabilities
1	AMMAR	Research, Design, overall
2	MUBIN	Research, marketing, maprations
3	ZAID	Research, maprations

3.2 Roles and Responsibilities

Table 3.2: Table of Responsibilities

SR. No	Name of Member	Role	Responsibilities
1	AMMAR	Team Leader	Overall Project
2	MUBIN	Member	Marketing and helper
3	ZAID	Member	Helper

Chapter 4

METHODOLOGY

4.1 Sample prepration

Prepare samples of coir untreated, treated, chicken fat (hot and cold) and Conduct water immersion test at room temperature in tap water. The samples have to be taken out and weighed at the end of 12, 24, 36, 48 and up to 72 h. Note down the water absorbed by every sample at the end of the test. Find out what was the pattern of water absorption Observe the fractograph of the tensile test specimen

4.1.1 Procedure for treating with fat:

Take a known amount of fat (in terms of weight percentage of composite) heat it to a known temperature keep the fibres in it for a known time and mix it manually. Sample preparation guidelines: (Treated samples) The proportion of matrix to fibre would be 70:30 by weight. The size of the sample would be 120x100x3. The dog bone shaped specimen would be prepared from the plate.

4.1.2 Key paper:

Effects of water absorption on glass fibre composites M. Haameem J.A. a, M.S. Abdul Majid a,, M. Afendi a, H.F.A. Marzuki b, E. Ahmad Hilmi b, I. Fahmi a, A.G. Gibson c

4.2 Method of Chemical Modification

4.2.1 Alkaline Treatment:

When it comes to reinforce thermoplastics and thermosets, alkaline treatment is one of the mostly used treatments. In the modification done by the alkaline treatment the disruption of hydrogen bonding in the network structure takes place resulting in increased surface roughness. By using this treatment, certain amount of lignin, wax and oils covering the outer surface wall of the fibre was removed, depolymerizes cellulose and depicts the short length crystallites. Addition of aqueous sodium hydroxide (NaOH) to natural fibre stimulates the ionization of the -OH group to the alkoxide.
Fiber –OH + NaOH Fiber – O – Na +H2O
Alkaline treatment has two effects on the fibre:
1) It increases surface roughness by the disruption of hydrogen bonding resulting in better mechanical linking.
2) It increases the number of possible reactions sites by increasing the amount of cellulose exposed on the fibre surface.

4.3 COMPOSITE FABRICATION

For preparation of composite the following materials have been used;
1. Coir fiber
2. Epoxy
3. Hardener

4.3.1 Epoxy Resin :

The epoxy resin used in this examination is Araldite LY-556 which chemically belongs to epoxide family. Its common name is Bisphinol-A-Diglycidyl-Ether. The hardener with IUPAC name NNO-bis (2aminoethylethane-1,2diamin) has been used with the epoxy designated as HY 951.

4.3.2 Composite preparation :

Initially, wooden moulds with dimensions of 120 x 100 10 mm3 were prepared for the fabrication. For different number a layer of fibre, epoxy resin and hardener (ratio of 10:1 by weight) with a calculated amount was mixed thoroughly in a glass jar.Illustrates the mould used to construct the composite.

4.3.3 FIRST HAND LAY UP SETUP

Hand lay up process is used in order to create the samples.It is made up of wood but not sucessfull in working because of epoxy and hardner, so we can't use it as shown below in figure 4.1

Figure 4.1: HAND LAY UP

4.3.4 SECOND SETUP

Hand lay up process is used in order to create the samples.This the mould which is best to made sample instead of previous hand lay up which was made by wooden. The mould of 120mmx120mm was used for preparing three samples of 76.2x25.4x3.2mm as shown below in figure 4.2

Figure 4.2: MOULD

4.4 Moisture absorption test

Moisture absorption was conducted in accordance with ASTM D570-98. Four specimens were cut with dimensions of 120 x 100mm (length x width) and the experiment was performed using test samples. The specimens prior to testing were dried in an oven at 800 C and then were allowed to cool to room temperature and kept in a desiccator. The weight of the samples were taken before subjected to steam, saline water and distil water environments. After expose for 12 hr, the specimens were taken out from the moist environment and all surface moisture was removed with a clean dry cloth or tissue paper. The specimens were reweighed to the nearest 0.001 mg within 1 min. of removing them from the environment chamber. The specimens were weighed regularly from 12-72 hrs with a gap of 12hrs of exposure. The moisture absorption was calculated by the weight difference. The percentage weight gain of the samples was measured at different time intervals by using the following equation:

$$\%M_t = \frac{(W_t - W_0) \times 100}{W_0}$$

Where ‘W0’ and ‘Wt’ denote the oven-dry weight and weight after time ‘t’, respectively. Equilibrium Moisture Content (EMC) of the sample is the moisture content when the periodic weight change of the sample was less than 0.1 percentage and thus the equilibrium state was assumed to be reached.

4.5 CALCULATIONS

The coir obtained from market is to be segregated so as to remove the unwanted powder from it. The coir fibres are then to be dried under sun for 24hours. The exact mas of coir fibre, natural fibre and matrix is to be calculated from its density as follows

Density of epoxy (LY556)=1.15 to1.2 gm/cm3
Density of hardner (HY 951) = 0.97 to 0.99 gm/cm3
Volume of mould is 100x120x3
Denisty of glass = 2.5 kg/cm3
Density of coir = 1.5 kg/cm3
Weight ratio of epoxy:hardner was 10:1
Volume of composite = 36cm3
Mass of glass fibre = 2.5*36 = 90gm
Glass fibre is 15 percent of total volume so mass = 13.5gm
Mass of coir fibre = 1.15*36=41.4gm
Coir is 15 percent of total volume of composite so mass = 6.21gm
Mass of epoxy = 1.15*36 = 41.4 gm
70 percent of it is = 0.7*41.4= 28.98gm
Mass of hardner =0.99*36 = 35.64gm
01 percent of it is 0.1*270 = 3.564gm
Total mass of epoxy and hardner is 33gm
So ratio of epoxy to hardner of 10:1 would yield 36gm epoxy and 3.6 gm hardner
Suggested modifications chopped fibre instead of random long fibre To be done in the form of mat, instead of joining together

4.6 SAMPLES

Number of Samples

Table 4.1: Table of Samples

SR. No	Treatment of Natural Fiber	No of Samples
1	Untreated	03
2	Treated with NaOH	03
3	Hot Treated with Chicken Fat	03
4	Cold Treated with Chicken Fat	03

The prepared specimen are then to be conditioned in an oven at 1100c for one hour. Similar procedure is used for preparing the samples of natural fibres treated under different conditions as mentioned below.

4.6.1 Untreated

Figure 4.3: UNTREATED

The natural fibre that is coir remain untreated and the composite is prepared with keeping 30 percent fibres to 70 Percent matrix. Three such samples are prepared to be tested for water absorption test.

4.6.2 Chemically treated with NaOH

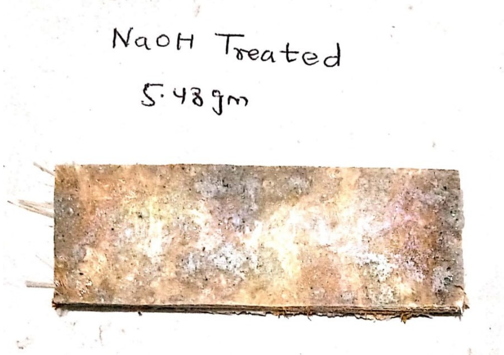


Figure 4.4: NaOH TREATED

For this the coir fiber sheets are now immersed in 10 percent NaOH solution for 1 hour. The natural fibre thus treated with NaOH is washed with water and dried.

4.6.3 Hot Treatment with Chicken Fat

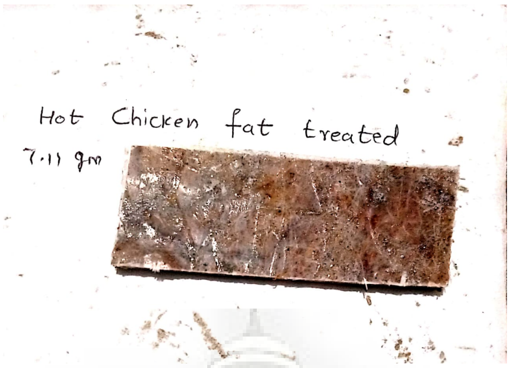


Figure 4.5: HOT C.F TREATED

Chicken fat bought from local butcher shop, is cleaned and poured in a utensil and heated, once the fat becomes liquid the coir fibre is inserted in the utensil so that the fat gets soaked in the natural fibre. The fibres are kept in this position for an hour so that soaking becomes uniform.

4.6.4 Cold treatment with Chicken fat

Figure 4.6: COLD C.F TREATED

In this, the coir is treated with fat but without heating it. The fibres are rubed by hand against the fat manually and thus making a layer of chicken fat on the surface of the fibre.

Chapter 5

TESTS

Moisture absorption test in accordance with ASTM D 570 [5] is to be conducted.The percentage of moisture absorbed is calculated as per the following equation

WEIGHT PERCENTAGE = WET WEIGHT - CONDITIONED WEIGHT/CONDITIONED WEIGHT x100

The specimen as per the category mentioned are to be immersed in distill water solution and are to be weighed after an interval of 12 hours. The weight of the specimen after conditioning is also required to be measured through an electronic weight balance. A graph of Increase in weight Vs square root of time is to be prepared based on which it can be found if the behavior of water absorption follows Ficker's rule or not.

Chapter 6

Sample Testing

6.1 WEIGHT OF THE SAMPLE:

6.1.1 Sample Results from 0 to 12 hours

SAMPLE NO	SAMPLE TYPE	DATE	SAMP WEIGHT AT 0 Hrs (gm)	SAMP WEIGHT AT 12 Hrs (gm)
S01	Untreated	25/4/19	10.754	11.314
S02	NaOH Treated	25/4/19	6.061	6.351
S03	Hot chicken Treat	25/4/19	8.192	8.623
S04	Cold chicken Treat	25/4/19	10.121	10.562

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6.1.2 Sample Results from 12 to 24 hours

SAMPLE NO	SAMPLE TYPE	DATE	SAMP WEIGHT AT 12 Hrs (gm)	SAMP WEIGHT AT 24 Hrs (gm)
S01	Untreated	25/4/19	11.314	11.980
S02	NaOH Treated	25/4/19	6.315	6.791
S03	Hot chicken Treat	25/4/19	8.623	9.132
S04	Cold chicken Treat	25/4/19	10.562	10.980

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6.1.3 Sample Results from 24 to 36 hours

SAMPLE NO	SAMPLE TYPE	DATE	SAMP WEIGHT AT 24 Hrs (gm)	SAMP WEIGHT AT 36 Hrs (gm
S01	Untreated	26/4/19	11.980	12.420
S02	NaOH Treated	26/4/19	6.791	7.121
S03	Hot chicken Treat	26/ 4/19	9.132	9.648
S04	Cold chicken Treat	26/4/19	10.980	11.120

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6.1.4 Sample Results from 36 to 48 hours

SAMPLE NO	SAMPLE TYPE	DATE	SAMP WEIGHT AT 36 Hrs	SAMP WEIGHT AT 48 Hrs
S01	Untreated	26/4/19	12.420	12.619
S02	NaOH Treated	26/4/19	7.121	7.532
S03	Hot chicken Treat	26/4/19	9.648	9.891
S04	Cold chicken Treat	26/4/19	11.120	11.520

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6.1.5 Sample Results from 48 to 60 hours

SAMPLE NO	SAMPLE TYPE	DATE	SAMP WEIGHT AT 48 Hrs (gm)	SAMP WEIGHT AT 60 Hrs (gm)
S01	Untreated	27/4/19	12.619	12.813
S02	NaOH Treated	27/4/19	7.532	7.920
S03	Hot chicken Treat	27/4/19	9.891	10.104
S04	Cold chicken Treat	27/4/19	11.520	11.898

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6.1.6 Sample Results from 60 to 72 hours

SAMPLE NO	SAMPLE TYPE	DATE	SAMP WEIGHT AT 60 Hrs (gm)	SAMP WEIGHT AT 72 Hrs (gm)
S01	Untreated	27/4/19	12.813	13.001
S02	NaOH Treated	27/4/19	7.920	8.290
S03	Hot chicken Treat	27/4/19	10.104	10.412
S04	Cold chicken Treat	27/4/19	11.898	12.041

Chapter 7

Result of Moisture Absorption

$$\%M_t = \frac{(W_t - W_0)\times 100}{W_0}$$

7.1 Percentage of weight gain (M)

TIME IN Hrs	Untreated	NaOH	HOT CHICKEN TREATED	COLD CHICKEN TREATED
00	0.0000	0.0000	0.0000	0.0000
12	5.2073	4.7841	5.2612	4.3572
24	5.8865	6.9280	5.9028	3.9575
36	3.6727	4.8593	5.6590	1.2750
48	1.6022	5.7716	2.5186	3.5971
60	1.5376	5.1513	2.1534	3.2812
72	1.4672	4.6172	3.0482	1.2018

7.2 Graph

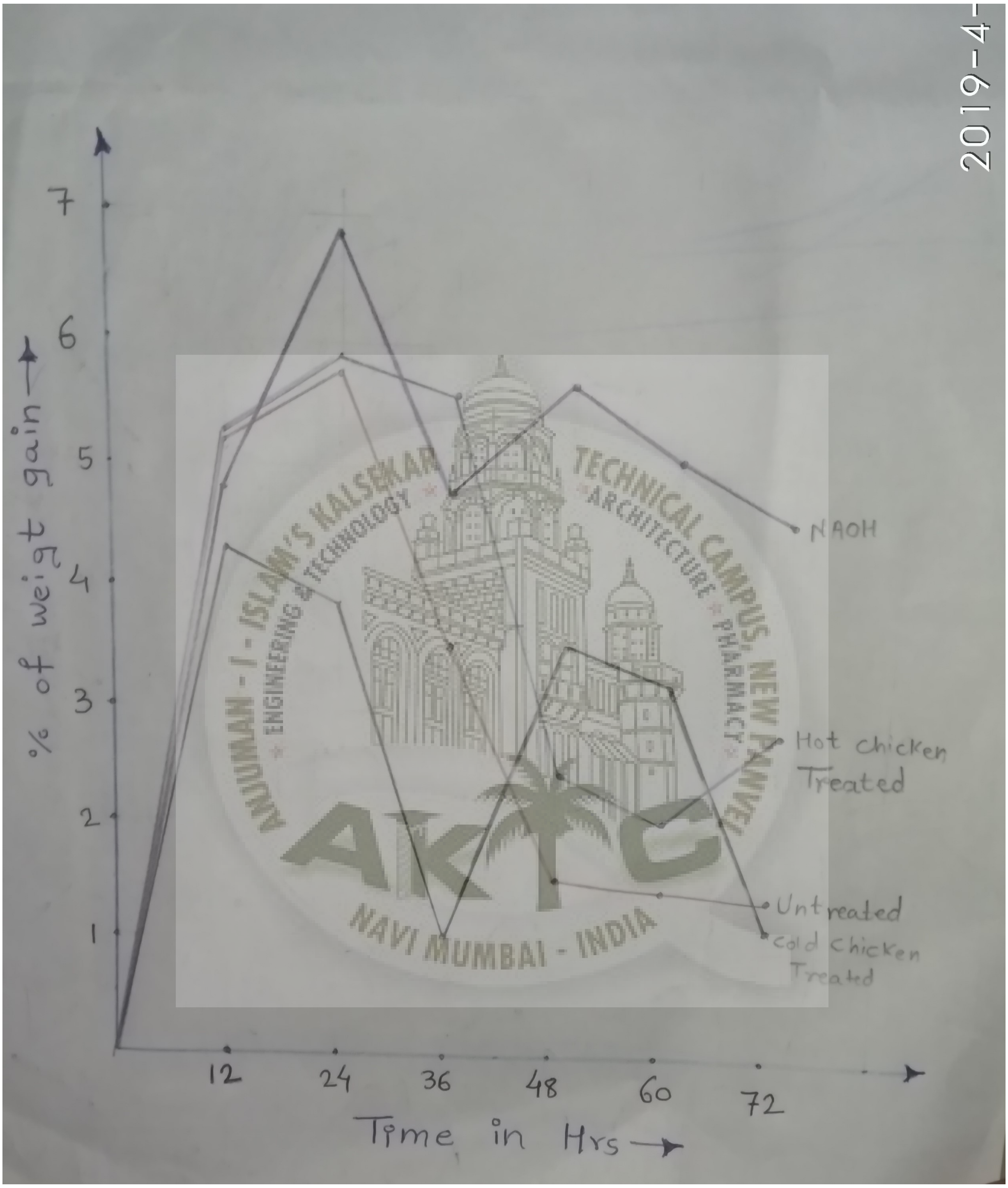

Figure 7.1: Percentage of Weight gain(M) Vs Time(hrs)

Chapter 8

Screenshots of Project

8.1 SAMPLES

Figure 8.1: 4 SAMPLES

8.2 WORKING

Figure 8.2: SAMPLE PREPRATION

Figure 8.3: SAMPLE CHICKEN FAT

FAT.jpeg

Figure 8.4: SAMPLE EPOXY

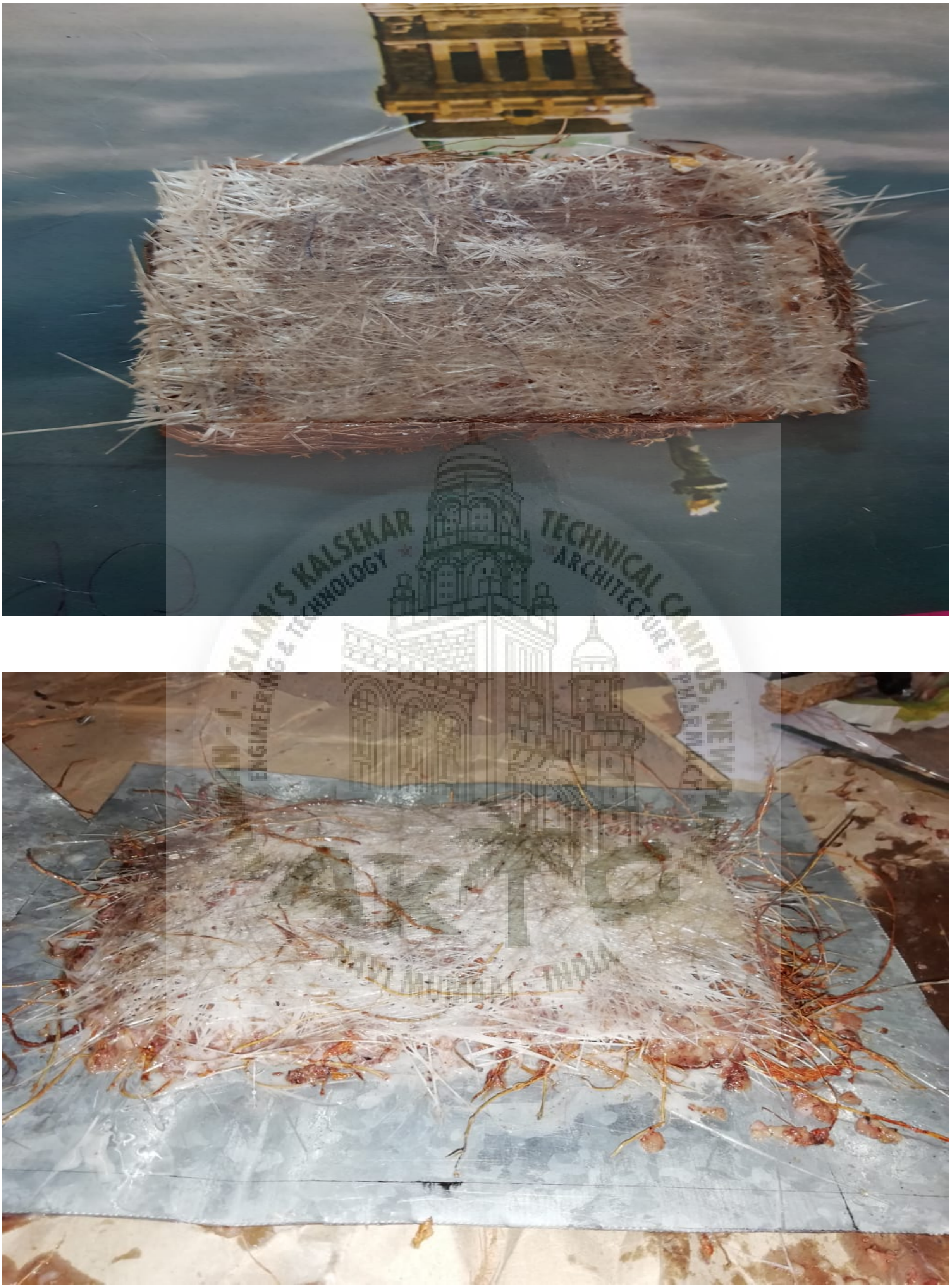

Figure 8.5: SAMPLE COLD CHICKEN

8.3 SAMPLE PREPRATIONS

Figure 8.6: CHICKEN FAT

Figure 8.7: UNTREATED

Figure 8.8: NaOH TREATED

Figure 8.9: HOT CHICKEN TREATED

Figure 8.10: COLD CHICKEN TREATED

Chapter 9

CONCLUSION

The Coir fibre can successfully be used as reinforcing agent to fabricate composite by suitably bonding with epoxy resin.The fibre surface modification by chemical treatments significantly improves the fibre matrix adhesion, which in turn improves the mechanical properties of composite.The moisture uptake values increases with increase in fiber loading.Under all environment conditions, the moisture diffusion process of both treated and untreated Coir fibre composites are found to follow the Fick's law.

Chapter 10

FUTURE SCOPE

The samples such prepared should be subjected to testing for mechanical properties such as tensile strength, Flexural strength, elongation, and impact strength. Also the fractured surface can be tested for analysing the defects between fibre and matrix.The surface of fracture and worn out samples can be study by using Scanning Electron Microscope (SEM) to have an idea about the fracture behaviour of the composite.

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