TENSILE AND COMPRESSION TEST OF BAGASSE FIBER WITH EPOXY RESIN REINFORCED COMPOSITE MATERIAL

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by

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LUCKNOW

June, 2022

CERTIFICATE

It is certified that the work contained in this thesis entitled **"Tensile and compression test of bagasse fiber with epoxy resin reinforced composite materials",** by **Anurag Saroj** (Roll No1200456001), for the award of **Master of Technology** from Babu Banarasi Das University has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

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ABSTRACT

In this research, we are going to make a future material with the using of bagasse fiber and epoxy resin reinforced composite materials. It is using the waste of natural thing, which is not harmable to the nature and human being after it reformed in new materials. It can be recyclable easily. Today's everywhere use the light materials, and these composite materials give the light in weight materials with the high strength, and test perform on the workpiece for it measure strength is Flexural, tensile and compression strength.

The sugarcane bagasse fiber are highly generated in the agriculture area and it gone waste after take out the juice from sugarcane, so it has good mechanical property and it's also easy recyclable, and eco-friendly it is low cast, light in weight with good strength, Now a days use of agriculture crop is locate as substances improvement of fiber composite reinforcement and it is simple and secure recyclable product at the end of that provider and its maximum appropriate aspect to use of this agricultural crop like as: cotton, wheat, banana, bagasse, etc. it's far low price and mild in weight and its additionally have true properties. In these studies, look at approximately the mechanical conduct of bagasse fiber reinforced epoxy composite material, exceptional form of energy together with Flexural strength and tensile strength take a look at of that reinforced composite and it is Dry pulpy stalky substances that remains after crushing sugarcane to bring out their juice. It is used as biofuel for the manufacturing of heat, energy etc. And manufacture of building materials. Its residences consisting of Cellulose: 45-55%, Hemicellulose: 20-25%, Lignin: 18-24%, Ash: 1-4%.

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER – 1
INTRODUCTION

1.1 BACKGROUND

India presents with a plentiful availability of herbal fibre together with Jute, Coir, Sisal, Pineapple, Ramie, Bamboo, Banana etc. has cantered at the improvement of herbal fibre composites commonly to discover value-brought software approach. Such herbal fibre composites are properly appropriate as wooden substitutes withinside the housing and creation zone. The improvement of herbal fibre composites in India is primarily based totally on pronged method of stopping exhaustion of woodland assets in addition to making sure proper financial returns for the farming of herbal fibres.

The traits in composite fabric after assembly the demanding situations of aerospace zone have deluge down for serve to home and business applications. Composites, the surprise fabric with light-weight; excessive strength-to-weight ratio and stiffness homes have come a protracted manner in changing the traditional substances like metals, wooden etc. The fabric scientists everywhere in the global centered their interest on herbal composites bolstered with Jute, Sisal, Coir, Pineapple etc. mainly to put down the rate of raw materials.

1.2 WHY A COMPOSITE

Over the closing thirty years composite substances, ceramics and plastics were the be in control of rising substances. The capacity and quantity of programs of composite substances have fill out steadily, pervasive and vanquish new markets relentlessly.

Modern composite substances represent an enormous percentage of the engineered substances marketplace starting from ordinary merchandise to state-of-the-art area of interest programs.

While composites have already validated their really well worth as weight-saving materials, the contemporary project is to cause them to value effective. The efforts to provide economically appealing composite additives have led to numerous revolutionary production strategies presently getting used withinside the composites industry. It is obvious, mainly for composites, that the development in production era by myself isn't always sufficient to triumph over the value hurdle. It is crucial that there be an incorporated attempt in design, material, process, tooling, fine assurance, production, or even software control for composites to end up aggressive with metals.

The composites enterprise has begun to understand that the economic programs of composites promise to provide a lot large enterprise possibilities than the aerospace zone because of the sheer length of transportation enterprise. Thus, the shift of composite programs from plane to different business makes use of has turn out to be distinguished in current years.

Increasingly enabled with the aid of using the creation of more modern resin matrix substances and excessive overall performance reinforcement fibres of glass, carbon and aramid, the penetration of those superior substances has witnessed a constant enlargement in makes use of and extent. The elevated extent has ended in a predicted discount in costs. High overall performance FRP can now be determined in such numerous packages as composite designed to face up to explosion's impacts, gasoline cylinders for herbal fuel line vehicles, windmill blades, business power shafts, assist

beams of toll road bridges or even paper making rollers. For positive packages, using composites as opposed to metals has in truth ended in financial savings of each fee and weight.

The need of composite for lighter creation substances and extra seismic resistant systems has located excessive emphasis at the use of recent and superior substances that now no longer best decreases useless weight however additionally absorbs the shock & vibration thru tailor-made microstructures. Composites are actually substantially getting used for rehabilitation/ strengthening of pre-present systems that should be retrofitted to lead them to seismic resistant, or to restore harm because of seismic activity. Disparate traditional materials (steel), the belongings of the composite matter designed thinking about the structural aspects. The layout of a structural thing the use of composites entails each cloth and structural layout. Composite homes (stiffness, thermal growth etc.) may be numerous constantly over a huge variety of values beneath Neath the manipulate of the designer. Careful choice of reinforcement kind permits completed product traits to be tailor-made to nearly any precise engineering demand. Although using composites can be a clean preference in lots of case fabric choice in others will depend upon elements along with running lifetime requirements, wide variety of gadgets to be fabricate (run length), complication of product formation, feasible financial savings in fabrication rate and at the experience & abilities the fashion dressmaker in valuing the finest capacity of composites. In a few cases, satisfactory outcomes can be completed via using composites alongside conventional materials.

1.3 COMPOSITE

Here we know about composite it is nothing but the combination of two or more than two materials. This study going on the epoxy resin with bagasse fibre on the different ratio of each other. For test of strength of material to apply tensile and compressive load on that workpiece. Applications of composite materials like as: furniture, interior panels, wall lining, doors, toys, building and construction industry (panels, false ceilings, partition boards etc.) packaging, automobile and railway coach interiors and storage devices with the advantage of lower cost and good quality.

While using the composite materials because it is very light in weight and it have good strength with cheap in rate of comparison to other materials. It made by using two or more than two materials similar or dissimilar materials which have different properties, it has good adhesive properties which is good for bonding with each other.

Van Suchetclan, Explanation of composite substances as heterogeneous substances such as or greater stable phases, that are in intimate touch with every different on a microscopic scale. They may be additionally taken into consideration as homogeneous substances on a microscopic scale within side the feel that any part of it's going to have the identical bodily properties.

Kelly , surely say that the composites must now no longer be appeared easy as an aggregate of materials. In the wider significance; the aggregate has its very own oneof-a-kind properties. In phrases of electricity to resistance to warmth or a few different appropriate qualities, it's far higher than both of the additives by myself or considerably exceptional from both of them.

1.4 PROPERTIES OF COMPOSITES MATERIALS

Composites encompass one or greater on and off levels implant in a non-stop segment. The on and off segment is commonly tougher and more potent than the non-stop segment and is known as the ‘reinforcement material’, while the non-stop segment is called as the ‘matrix’.

Properties of composites are depending on the residences in their basic materials, their dispersal and the interplay amongst them. The composite residences can be the quantity selection sum of the residences of the components might also additionally engage in a conflict manner ensuing in advanced or higher residences. Apart from the character of the basic materials, the shape of the reinforcement and length dispersal affects the residences of the composite to a tremendous enduring. The awareness dispersal and intention of the reinforcement additionally have an effect on the residences.

The form of the on and off phase which may also with the aid of using cylindrical, spherical or square cross-sanctioned platelets, the scale and length dispersal which command the feel of the material and extent selection decide the unite area, which performs a crucial position in figuring out the quantity of the interplay among the reinforcement and the matrix.

1.5 CATEGORIZATION

On the base of geometric structure which is responsible of strength of the fabricated materials, broadly it has two types of categories:

(1) Particulate composite
(2) Fibrous composite

1.5.1 PARTICULATE COMPOSITE

Itself designate; the fabrication is of particle nature. It can be cubic, spherical, tetragonal, a platelet, or of different every day or abnormal shape, however it's miles about similar. In general, debris aren't very powerful in enhancing rapture refusal however they beautify the stiffness of the composite to a constrained extent. Particle fillers are extensively used to enhance the residences of matrix substances which includes to regulate the thermal and electric application, enhance overall performance at multiplied temperatures, lessen abrasion, boom put on and friction resistance, enhance ductility, boom floor hardness and decrease shrinkage.

Particles are used to growth to lower the ductility of the matrix. Particles also are need to lessen the fee of the composites. matrices and Reinforcements may be common, less expensive substances and are without problems processed. Most of the beneficial houses of ceramics and glasses encompass excessive low density, melting temperature, stiffness, excessive strength, put on and corrosion resistance. Many ceramics are correct electric and thermal insulators. Some ceramics have unique houses; a few are magnetic substances; a few are piezoelectric substances and some unique. However, ceramics have one principal drawback: they are brittle. An instance of particle–

bolstered composites is a vehicle tire, which has carbon black debris in a matrix of poly-isobutylene elastomeric polymer.

1.5.2 FIBROUS COMPOSITE

A fiber is characterized through its period being plenty more in comparison to its divisional aspect. The aspect of the fabrication decides its functionality of come up with its residences to the composite. Fibers are very powerful in enhancing the rapture resistance of the matrix considering a fabrication having an extended size cast down the boom of incipient cracks regular to the reinforcement that could different clever result in failure, mainly with brittle matrices.

Man-made fibers of non-polymeric substances show off plenty better power alongside their period on account that big flaws, which can be gift within side the bulk material, are minimized due to the small divisional aspect of the fiber. In the case of polymeric substances, of the molecular shape is liable for excessive power and stiffness.

Common fiber strengthened composites are collected of fibers and a matrix. Fibers are the reinforcement and the primary supply of power even as matrix adhesive all of the fibers collectively in form and convey stresses many of the fabricating fibers. The fibers bring the masses alongside their longitudinal directions. most of the time, filler is probably brought to easy the producing process, effect special homes to the composites or to lessen the goods rate. familiar fiber fortifies retailers consist of incombustible, beryllium, carbon/graphite fibers, carbide, beryllium, molybdenum, beryllium oxide, molybdenum, glass fibers, aluminium oxide, polyamide, natural-born fibers etc. Similarly, not unusual place matrix substances consist of epoxy, polyurethane, phenolic resin, vinyl ester, polyester etc. Among those resin substances,

polyester is maximum extensively used. Epoxy, which has better adhesion and much less shrinkage than polyesters, is available in 2d for its excessive cost.

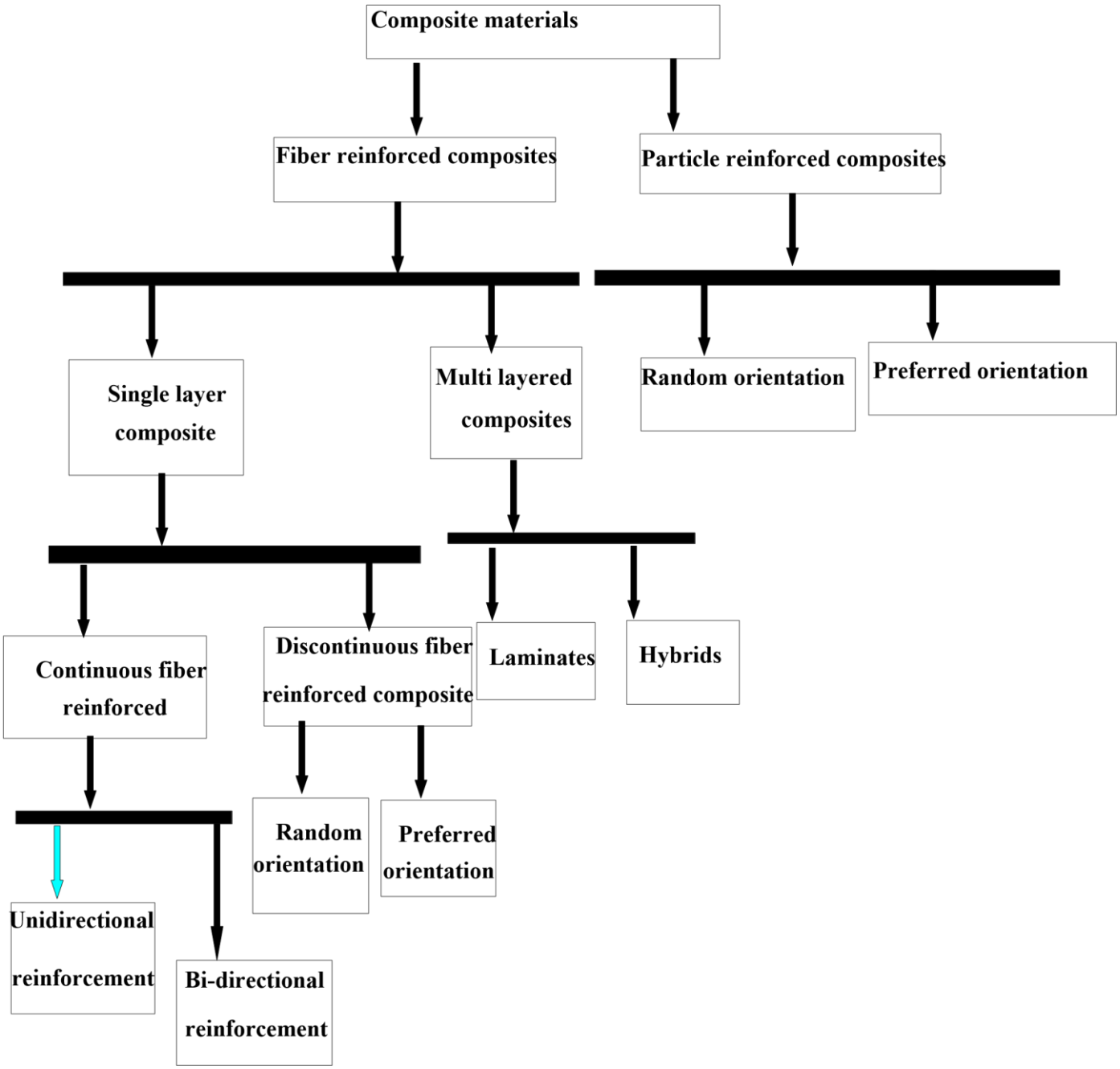


Figure no. :1.1 Classification of composite

1.6 COMPONENTS OF COMPOSITE MATERIALS

In its maximum fundamental form, a composite substance is one, which consists of as a minimum factor running collectively to supply substance residences which might be distinctive to the residences of these factors on their own. In practice, maximum composites encompass the ‘matrix’, and a reinforcement of a few types, brought frequently to growth the power and stiffness of the matrix.

In this study use of composite materials which use to make a new matrix material of very light in weight with good durability, it enhances the properties of the composite materials which use in this composite materials, three components are used to make composite materials which list below down;

(1) Bagasse Fibre

(2) Epoxy Resin

(3) Hardener

1.6.1 BAGASSE FIBER

It is dry mushy stalky substances that remains after crushing sugarcane to bring out their juice. It is used as clean-energy for the manufacturing of heat, energy etc. and manufacture of constructing materials. Its residences which include Cellulose: 4555%, Hemicellulose: 20- 25%, Lignin: 18-24%, Ash: 1-4%. It additionally satisfies the greening necessities with the aid of using being biodegradable, recyclable reusable and additionally eco-friendly.

Sugarcane bagasse is a spinoff from the take out of sugarcane, that is wealthy in carbohydrate polymers and lignin. Hemicellulose and cellulose are collected of

monomeric sugars, which can be transformed into fructose via way of means of enzymatic hydrolysis. Lignin, a complicated of three-dimensional polymer community design, near the cellulose and hemicellulose, stopping their humiliation at the same time has come up with to their mechanical strength.

Sugarcane is one of the maximum critical vegetation withinside the international and its miles cultivated in more than one hundred countries. Even aleven though the cane is discerning for the sugar produced, the modern-day cognizance on durable power and environmental execration need to lead the goods operate from the sugarcane to be the premise of Biorefinery with a huge variety of use.

Sugarcane mainly collection of sucrose, water, fibre, in the percentage of 12%, 70% and 15% respectively. Sugarcane very widely produced in world-wide, sultry and subsultry countries Latin America and Eastern Asia produce largest sugarcane as shown in figure;

Figure no. :1.2 This figure indicates the largest sugarcane produced country

The major countries which produced the sugarcane are these countries Brazil is the main manufacturer of sugar cane withinside the international and it ranks first with 48.28% of the arena production, India is the second one manufacturer with 21.45%, China with 8.06%, Thailand with 6.29%, Pakistan with 4.01%, Mexico with 3.85%, Colombia with 2.19%, Indonesia with 2.12% and the Philippines and the US with values decrease than 2%. This graph will show us that the producing sugarcane which countries most sugarcane till 2013.

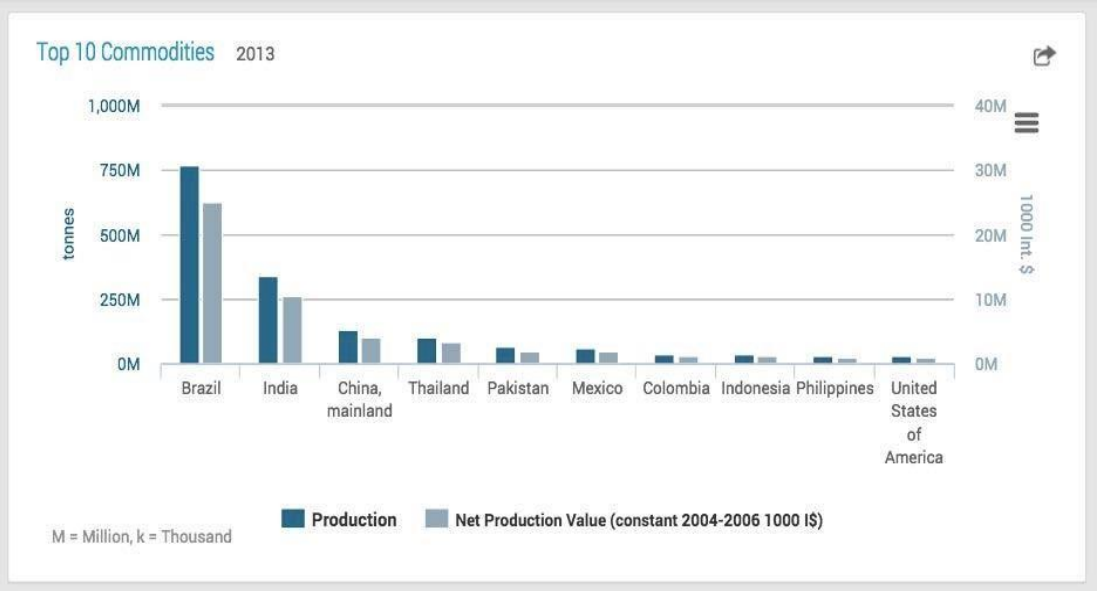


Figure no. :1.3 mainly sugarcane producing countries to 2013

This is the updated graph till 2020 which of the most produce countries of sugarcane as shown in this figure;

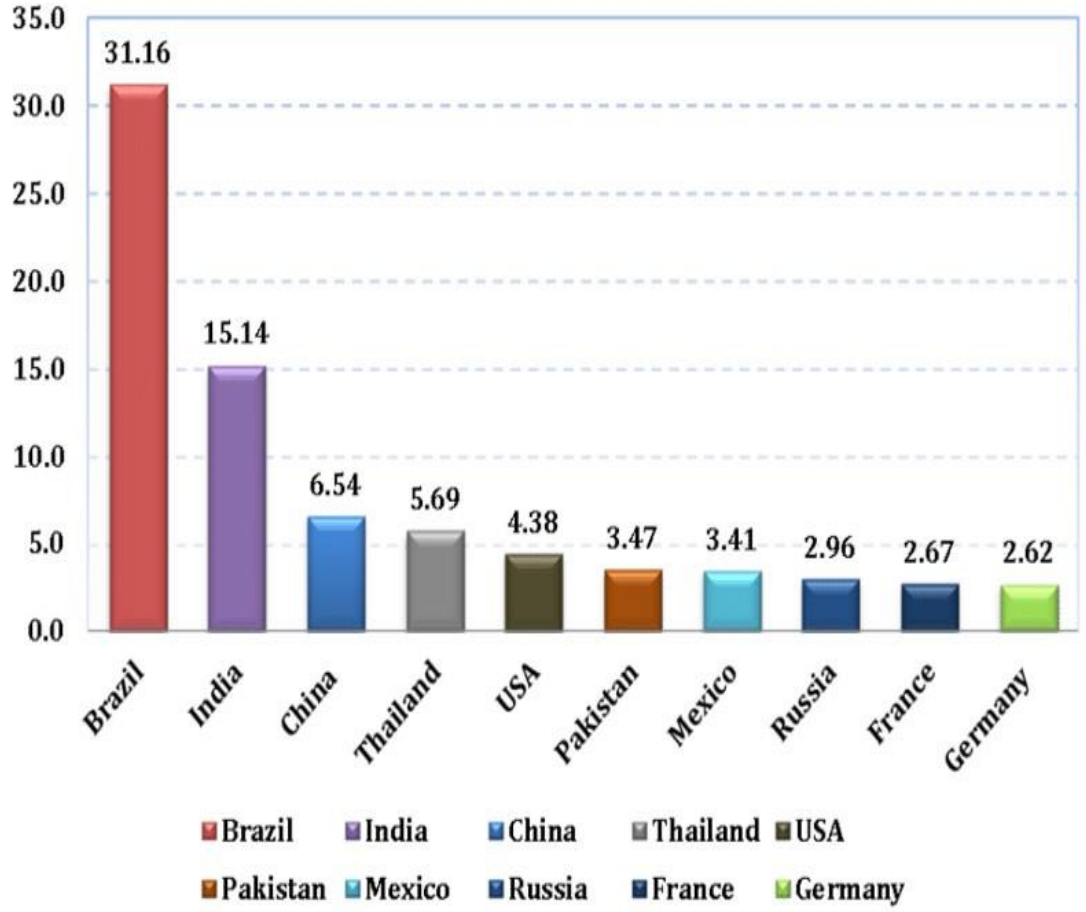


Figure no. :1.4 Major sugarcane produce countries till 2020 The data is in (Thousand Metric Tons)

Sugarcane generators are factories that technique sugarcane to gain uncooked or white sugar and molasses. Sugar factories are agro primarily based totally industries and bring bagasse in massive amount so as to be to be had in massive amount for paper production. Raw sugar generators are placed near sugarcane fields due to the fact sugarcane worsen inside 24 hours of harvesting. This figure shows down of the producing the sugar from mills;

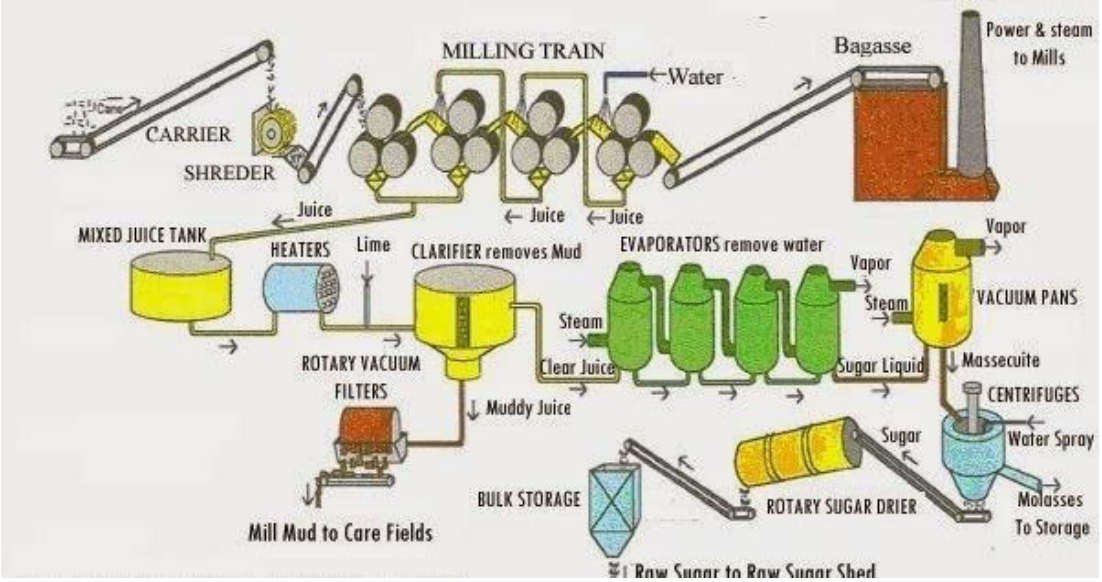


Figure no. :1.5 Sugarcane mill

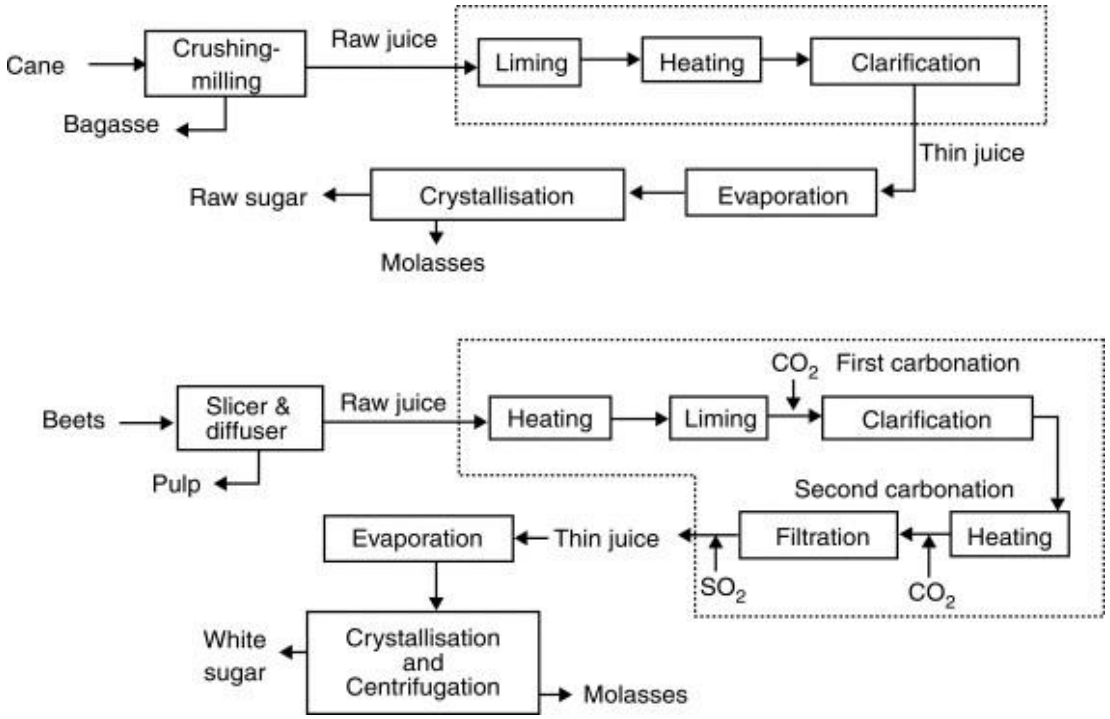


Figure no. :1.6 Block diagram of sugarcane mill

1.6.1.1 Crushing milling machine

Sugarcane put down into crushing milling machine after transportation of sugarcane. This machine makes fine part of sugarcane in this machine. This machine has very sharp blad for crushing of sugarcane which is fit into large hopper (for sugarcane cursing in large amount). After crushing of sugarcane and extract their juice that juice called raw juice.

1.6.1.2 Heating and clarification process

In this process, raw juice is very thin which come from extract process, to make that thick of raw juice then it is heated on very high temperature in vessel after that it goes through clarification process which clear the thin juice. And send it to make sugar.

1.6.1.3 Evaporation

In this process they evaporate of the juice which come from heating process, it makes the cold of juice to take it crystal shape. And it’s also can be made in the molasses form.

1.6.1.4 Raw sugarcane bagasse

This process come after extract their juice from sugarcane and it goes to make the generation for heat go in the vessel for fire and produce to make heat for the juice. it's far the maximum critical stable derivative from sugarcane, generated in the course of the sugarcane juice process. Typically, the humidity content material of bagasse is 40–50% and its predominant chemical additives are cellulose (30.0%), hemicelluloses (23%) and lignin (22%). It represents round 1/2 of the sugarcane count and is mainly intermeshed in lignocelluloses.

Sugarcane is a tropical perpetual grass, be the property of to the gender of Saccharum lactis. despite the fact that sugarcane prospers in moisture climates with a mean temperature among 21°C and 35°C, sugarcane may be grown in lots of regions of the southern United States, Colombia, Brazil, India, China and different countries.

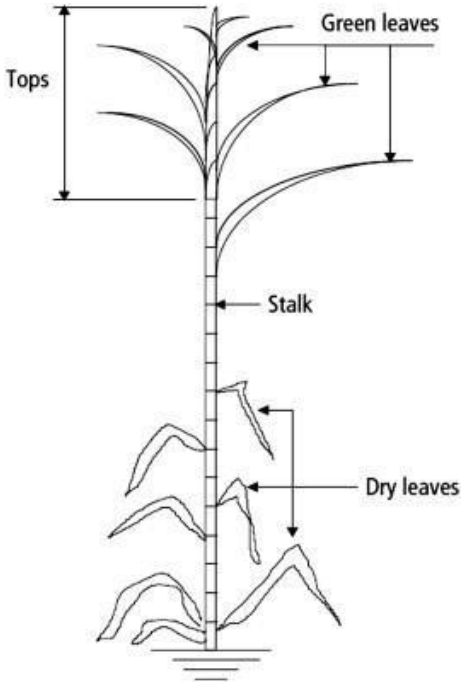


Figure no. :1.7 sugarcane plant parts

every ton of sugarcane storage carries approximately a hundred and fifty kg of dry sugars inclusive of sucrose and its far n for the manufacturing of sugar and ethanol, a hundred twenty-five kg of dry bagasse fiber is for use to produced warmness and energy for the producing of sugarcane.

Bagasse, that's a complicated material, is one of the foremost merchandises of the enterprise of sugarcane. It includes about 50% cellulose, 25% hemicellulose and 25% lignin. Due to its considerable availability, that could function a super microbial system for the manufacturing of value-brought merchandise substrate. In the fibrous

division, now no longer the whole lot is fit for use due to the fact there are different non-fibrous substances along with vascular vessels, parenchyma, tissue fibers, amongst others. The chemical evaluation of the fiber division and pith fraction is indexed in Table1.

Table no. :1.1 Chemical analysis of fiber and pith sugarcane

Analysis	**Integral Bagasse (%)**	**Fiber Fraction (%)**	**Pith Fraction (%)**
Cellulose	45.0	47.7	41.2
Pentosans	25.0	25.0	25.0
Klason Lignin	20.7	19.0	21.7
Ethanol-Benzene Extractives	2.7	2.4	29.0
Hot Water Extractives	4.1	3.4	4.3
Cold Water Extractives	2.2	2.2	3.0
NaOH (1%) Extractives	34.9	32.0	36.0
Ash	2.6	1.4	5.5

bagasse fractions

1.6.1.5 Application of bagasse fibre

Many studies and research show us to use of bagasse as for the production of bio-based materials renewable power generation source. In Table no 2

Table no:1.2 Applications of bagasse

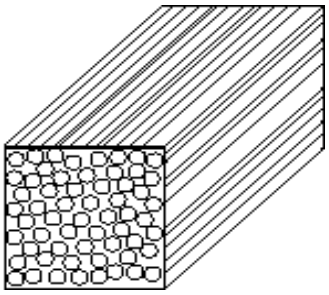
Field	Application	Authors
As a fuel	Electricity as energy coal Briquettes	(Akhtar et al., 2011; Alves et al., 2015; Santos, Ely, Szklo and Magrini, 2016)
	Bio-fuel	Teixeira, Pena and Miguel, 2010
	Ethanol	Hwu and Cai, 2010; Liu et al., 2015
		Capecchi et al., 2015; de Cassia et al., 2016; Mesa et al., 2016
Fibrous products	Unbleached pulps and Bleached	Andrade and Colodette, 2014; Hassan et al., 2015; Khristova et al., 2006; Nie et al., 2015
	Paper of Fiber Board	Doost-Hosseini, Taghiyari, and Elyasi, 2014
		Hassan et al., 2015
	Activated Carbon	(Gonçalves, Pereira, and Veit, 2016)
	Fertilizer	(Parthasarathy and Pradhan, 1982)
	Animal feed	(Abdel-Aziz et al., 2015)
	Concrete	(Bahurudeen et al., 2015; Rerkpiboon et al., 2015; Sua-iam and Makul, 2013)
	Soil amendment	(Meunchang et al., 2005; Mohee et al., 2015)

In the remaining years, the green usage of agro-business products, which includes sugarcane bagasse it has grown. more procedures and goods had been said the usage of bagasse as raw material, the maximum mainly, withinside the industry, is the

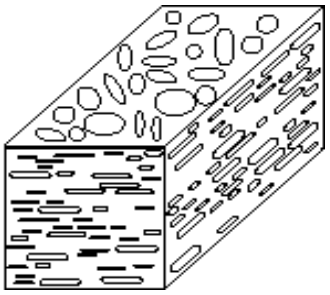
manufacturing of paper and pulp, and bioethanol; different programs are energy technology and fermentation goods.

Table no. :1.3 Chemical composition of selected common natural fibers

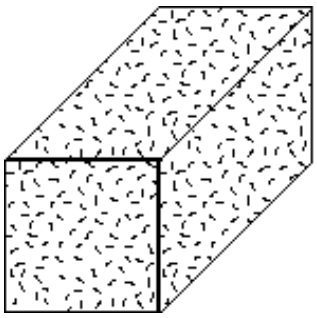
Types of fiber	Cellulose (%)	Lignin (%)	Hemicellulose (%)	Pectin (%)	Ash (%)
A. Bast fiber					
Fiber flax	71	22	18.6-20.6	2.3	-
Seed flax	43-47	21-23	24-26	-	5
Kenaf	31-57	15-19	21.5-23	-	2-5
Jute	45-71.5	12-26	13.6-21	0.2	0.5-2
Hemp	57-77	3.7-13	14-22.4	0.9	0.8
Remie	68.6-91	0.6-0.7	5-16.7	1.9	-
B. Core fiber					
Kenaf	37-49	15-21	18-24	-	2-4
Jute	41-48	21-24	18-22	-	0.8
C.Leaf fiber					
Abaca	56-63	7-9	15-17	-	3
Sisal	47-78	7-11	10-24	10	0.6-1
Henequen	77.6	13.1	4-8	-	-



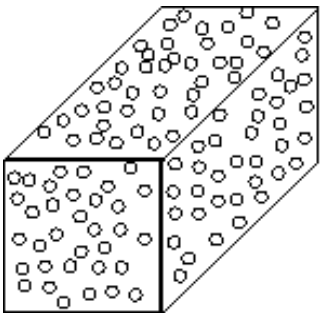
(a) Random fiber (short fiber) reinforced composites



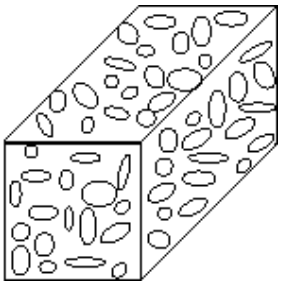
(b) Particles as the reinforcement



(c) Continuous fiber (long fiber) reinforced Composites



(d) Flat flakes as the reinforcement



(e) Fillers as the reinforcement (Filler composites)

Figure no. :1.8 Bagasse fibre

1.7 EPOXY RESIN

Epoxy resin is typically described as a viscous liquid with less molecular weight that includes linear molecules concerning a couple of epoxide group. Epoxy resins are typically produced with the aid of using the condensation response of epichlorohydrin. The epoxide group, additionally called the glycidyl unit, consists of an oxygen atom that shape three membered oxirane chain with the aid of using bonding to 2 contiguous carbon atoms. with bisphenol A as visible in Figure 3.

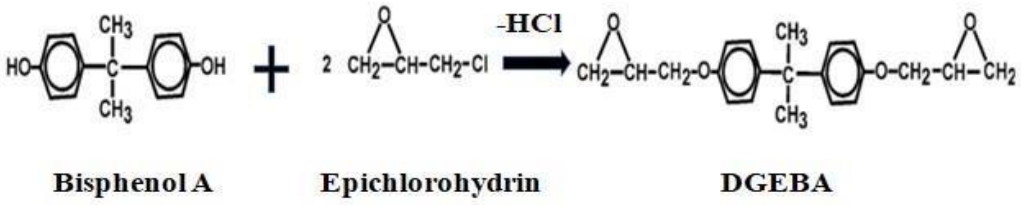


Figure no. :1.9 Formation reaction of di glycidyl ether bisphenol

Due to the truth one molecule of bisphenol A reaction with molecules of

epichlorohydrin consistent with stoichiometry, it is viable to differ the molecular mass of epoxy resin with the aid of using positioning the quantities of each component. Therefore, epoxy resins are typically described with suggest molecular mass.

As the suggest molecular mass of epoxy resin rise, its toxicity and reactivity decrease. Furthermore, low molecular epoxy resins such as short chains exist as fluid at room temperature, while excessive molecular ones are strong.

For this issue, less molecular epoxy resins may be dealt with effortlessly and applied for coatings or adhesives, casting at the same time as strong ones basically want to be mixed in natural solvents.

In the company of all epoxies, di glycidyl ether bisphenol A (DGEBA) is the some familiar utilize one because of its modest molecular weight and capacity to exist in diverse viscosities. In inclusion, DGEBA includes epoxide organizations that boom its reactivity and crosslinking density whilst its reaction with a hardener. Therefore, they have got higher glass conversion temperature via way of means of the distinctive feature of excessive crosslinking and higher adhering residences due to the presence of extra hydroxyl organizations after the response with a hardener.

To change of epoxy resins right into a crosslinked form, utility of warmth and heal agent is needed, which solidify the resin with the aid of using growing a 3-dimensional community with epoxy chains. heal agents which comprise acid anhydride, amine, imidazole, amide, phenol or mercaptan natural compounds are mainly applied to solidify epoxy resins. The shape of amine is intently related to ammonia (NH3), and primarily based totally on the wide variety of alkyl agencies

replacement in place of hydrogen atoms, primary (NH2-R), secondary (NH-R1) and tertiary (N-R2) amines are explained. On the alternative hand, the wide variety of amino agencies withinside the shape nominates the form of amine molecule, like diamine or polyamine, monoamine. Moreover, amines may be aliphatic which includes linear carbon chains, cycloaliphatic which incorporates carbon loop and lastly fragrant wherein a benzene ring is connected to the amino group.

The crosslinking response begins off evolved among hydrogen atom of the amine molecule and oxygen atom of the epoxide category. At the primary level, hydrogen atom connected to one of the amino category reactions with epoxide category oxygen atom, which motive the development of hydroxyl category and the number one amine to be decreased to a secondary amine. Then, the secondary amine reacts with any other epoxy group's oxygen atom and the response is completed.

In inclusion, the usage of amine crosslinked hardeners, which are produced through being partly reacted with an epoxy resin, may be very not un usual place owing to their better reactivity. Epoxy resins are the maximum malleable and flexible thermosetting polymers that have been extensively used as matrix fabric earlier programs along with sporting goods aerospace, 13 marine, automotive, electronic systems, construction, musical instruments, adhesives, coatings and paints. Due to their excessive overall performance and potential of being tailor-made consistent with the order to properties, epoxies are one of the main beneficial substances with inside the composite production. In epoxy-primarily based totally composites, epoxy matrix gives excessive dimensional balance due to low shrinkage in the course of curing, tremendous resistance to thermal care of, corrosion and

chemical compounds because of its infusible crosslinked modal, excessive power to weight ratio and superior adhesion things.

Figure no. :1.10 Epoxy Resin and Hardener

CHAPTER – 2
LITERATURE SURVEY

Suraj Kumar Mehar et al, in current years the herbal fiber composites have captivate tremendous significance as a capacity constructional fabric. The appealing functions of herbal fibers like banana, jute, coir, and sisal were their low fee, mild weights, excessive precise modulus, renewability and biodegradability. Natural fibers are lignocellulosic in nature. The particular composites are obtaining significance because of their non-carcinogenic and bio-degradable nature. The herbal fiber composites may be very fee powerful fabric specifically for constructing and production industry.

Although often extra from conventional plants consisting of rice shell or sugarcane bagasse or from the same old processing functions of wooden industries do now no longer meet the necessities of being lengthy fibers. Bagasse includes approximately 40% cellulose, 30% hemicellulose, and 15% lignin. there use of bagasse is especially as a gas with inside the sugarcane mill furnaces. It is felt that the cost of this agricultural extra may be improve with the aid of using connection with resin to supply composites appropriate for constructing materials.

The possession of this in view the prevailing paintings has been take up to increase an epoxy resin, (polymer matrix composite) the use of bagasse fiber as reinforcement and to examine its mechanical goods and environmental production. These composites have been organized with unique extent selection of bagasse fibers. The experiments had been carried out below laboratory situations to assess the impact of various surroundings inclusive of sub-zero, steam, saline water and herbal situations at the mechanical goods of the composites. Flexural strength of the composites became

assess with the aid of using 3 factors bend test as in keeping with ASTM D2344-84. The extent selection of composites having extra mechanical properties became taken for the second one section of experimentation.

The 2d segment of test includes remedy of bagasse fiber with acetone and alkali. To assess the alternate in mechanical properties because of the handled fiber the composite became once more subjected to unique surroundings inclusive of saline water, steam, sub-zero and herbal situations. Micro structural study has been additionally made to get a concept approximately the impact of handled and untreated fibers at the mechanical properties of the composites.

The sugarcane extra bagasse an agricultural fabric can efficaciously be applied to provide composite through certainly bonding with resin for cost brought product.

By evaluating the flexural strength of composite with various fiber use of, it changed into obtrusive that quality mechanical belongings consequences had been acquired with bagasse fiber that had been each washed and handled for each acetone and alkali handled fibers.

Water absorption capability of the fiber determined to be decreased whilst handled with alkali in assessment to acetone handled fibers. This can be because of the chemical response which reduces the hydroxyl organization with inside the cell wall of herbal fiber molecules, therefore lowering the water absorption capability of the composite.

In widespread fiber get out is the fundamental mode of failure for all herbal fiber composite. In our case from the morphology of the fractured surface (handled below exceptional environment) for the alkali dealt with fiber it changed into determined that

fiber breakage had been the fundamental mode of failure. It is likewise determined from washed and deal with samples that when treating the fiber with alkali the fiber–matrix bonding has advanced loads which ends up in better flexural strength.

Sandesh S Nayak et al. The present time composite substances represent a full-size percentage of the engineered substances market starting from regular merchandise to state-of-the-art merchandise and applications. Research goes directly to expand more recent herbal fibre-bolstered plastic composites on the way to update metal and plastic elements. Over the closing thirty years composite substances, plastics and ceramics were the presiding rising substances. While composites have already showed their really well worth as weight-saving substances, the modern challenge is to lead them to price powerful. The gift paintings have been undertaken to expand an epoxy resin (matrix composite) the use of bagasse fibre as reinforcement and to look at its mechanical homes and overall performance for automobile (structural) applications. The composites are organized with special extent fraction of bagasse fibre. Natural fibre-bolstered composites may be carried out withinside the plastics, vehicle and packaging industries at minimum fabric price. Environmental recognition nowadays motivates the researchers, international on the research of herbal fibre bolstered polymer composite and price powerful choice to artificial fibre bolstered composites based on inexperienced composite fabric. Thus, fabric scientists and engineers are usually striving to supply both improved conventional substances or absolutely new substances. This gift paintings have been below taken to expand a polymer matrix composite (epoxy resin) the use of sugarcane fibre and to look at its mechanical department.

The bagasse became successively handled with 14% Toulene answer after which later with 1M Citric acid and became sun-dried. Composites having special percent weight fraction of 0, 2.5, 5, 7.5 % of sugarcane bagasse fibre for special laminates have been made. The link behaviour of those composites became investigated by tensile check, flexural check, effect check and density check. The fabricated composite samples have been reduced in keeping with the ASTM requirements for special experiments and its mechanical homes like density, hardness, tensile energy and effect energy are performed. Investigated that makes use of bagasse fibre with polymer to make matrix composite (epoxy resin) and examine its mechanical residences and overall performance for vehicle (structural) utility. The fabricated composite pattern had been reduced in keeping with the ASTM requirements for special test like as: density, hardness, tensile electricity and effect electricity. The paintings are a success and the end result which received are appropriate and similar for the software of few vehicle sectors. It has proper bonding with epoxy resin. Maximum tensile electricity and flexural electricity found for the organized composite with the burden percent of the bagasse fibre being 3.75%.

Sebastin joyal J et al. In this study, paintings have been executed to research tensile, hardness and effect goods of composite of fabric constitutes sugarcane bagasse powder and epoxy resin. These composites are adhered the usage of epoxy resin HY951 resin and LY551 hardener certainly jumbled together suitable volume. Hybrid composites had been organized the usage of sugarcane bagasse powder; even as usual powder weight fraction become constant as 20gram. Here for making ready samples Hand layup approach is used, workpiece is organized. This represent have appropriate tensile & bending energy & their density. These composites may be utilized in numerous

functions due to its precise functions of waste utilization, surroundings friendly, biodegradability, appropriate energy and a terrific opportunity to plastics.

Studies at the evaluation of composite cloth the use of sugarcane bagasse with epoxy resin HY951 resin and LY551 hardener definitely jumbled in suitable volume. The end result observed from the sugarcane bagasse strengthened epoxy-primarily based totally hybrid composite is usefulness. These exams finished at the UTM machine. The composite ends up much less ductile as sugarcane content material is increased.
Further paintings executed at the fibre floor remedy and residue removal in recycled HDPE to enhance mechanical properties.

The material choice and houses of sugarcane bagasse bolstered epoxy primarily based totally hybrid composites has been acquired until now with the assist of numerous journals. Reinforcement making and experiments outcomes are yet to be acquired in future. The current effort confirmed the usefulness of sugarcane bagasse fiber as reinforcement to different herbal fiber fabric. The tensile hardness and compression assessments of sugarcane bagasse fiber can be carried out the use of UTM machine. The composites can also additionally emerge as much less ductile as sugarcane content material is increased. Further paintings need to be achieved associated with fiber floor remedy and residue removal in recycled HDPE to enhance mechanical properties.

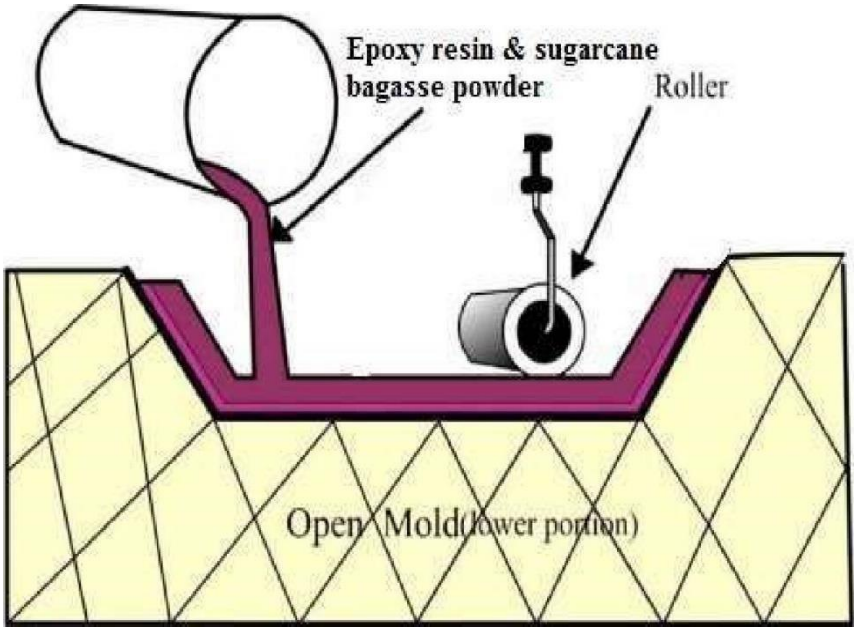


Figure no. :2.1 Hand layup process

Lalta Prasad et al, Physical and Mechanical Behaviour of Sugarcane Bagasse FibreReinforced Epoxy Bio-Composites, in this observe, experiments are executed to observe the physical and mechanical behaviour of chemically-dealt with sugarcane bagasse fibre-bolstered epoxy composite. The impact of alkali treatment, fibre varieties, and fibre duration on physical and mechanical goods of the composites is calculated. To observe the morphology of the raptured composites, scanning electron microscopy is executed over raptured composite surfaces.

The observe determined that the range and lengths of fibres notably have an effect on the physical and mechanical properties of the sugarcane bagasse-bolstered composites. From the wear and tear observe, its miles determined that the composite manufactured from minor fibre lengths display less wear. The chemically-handled bagasse-bolstered composites fabricated on this observe display

good physical and mechanical properties and are, therefore, advanced to be used in programs in area of traditional herbal fibres.

The minimal void rapture changed into acquired for composites bolstered with 5 mm period of all sorts of fibres due to the higher compress composite shaped with a little fibre period as compared to ten mm and 15 mm fibre period.

The most final tensile energy changed into acquired for the bagasse-bolstered herbal composite of range A and minimal tensile energy acquired for the C sort of bagasse-bolstered epoxy composite. Found at the tensile energy, the finest period of fibre changed into 10 mm.

The most extension changed into acquired withinside the D composite bolstered with fibres of 10 mm in period and minimal in A composite bolstered with fibres of five mm in period. This is because of the ductile nature of 10 mm fibres as compared to 5 mm, which confirmed a brittle nature.

The most hardness changed into recorded for composite fabric B bolstered with a fibre period 10 mm and minimal for composite D bolstered with a fibre period of five mm. This occurred due to the fact B composites have been product of the tough plant life of sugarcane and D from the tender plant of sugarcane.

The most put on changed into acquired for A composite bolstered with a 5 mm fibre period and minimal for C composite bolstered with a ten mm period. This is because of the decrease hardness of A composite bolstered with a five mm fibre period and better hardness of C composite bolstered with a ten mm period.

The most effect energy changed into located for the D composite bolstered with a fibre period of 15 mm due to the ductile nature of the fibre. Hence, it is able to take in extra energy earlier than fracture.

V. Vidyashri et al, Sugarcane bagasse fiber that's copiously to be had as waste after procedure of sugarcane is used as reinforced composites. The raw material fibers have been dealt with chemically to improve similarity and adhesion with the epoxy polymer. Untreated and treated fibers have been subjected to evaluation including SEM, XRD and Thermogravimetric Analysis (TGA) to recognize the structural modifications and to decide thermal firmness. The mechanical residences of fibers and the composites have been calculated through carrying out tensile tests. The effects reveal alkaline pretreated and KMnO4 dealt with fibers display progressed mechanical and thermal residences.

The material having two or greater awesome elements raw substances is taken into consideration as a composite material. Such substances encompass one or greater discontinuous segment that is implant in a non-stop segment. The desist segment is more difficult and more potent than the non-stop segment that is known as the reinforcement segment and the non-stop segment is known as matrix. This segment with inside the composite is the simple shape that offers power and tenacity, at the reinforcement used, composites are extensively termed as artificial fiber (Kevlar, carbon, glass, graphite, boron, etc.) and herbal fiber (flax, sisal, hemp, jute, bamboo, etc.) strengthened composites. The composites are labeled primarily based totally at the form and shape of the reinforcement into types namely, particle-strengthened and fibre-strengthened composites. Composites wherein reinforcement is of particle nature is referred to as particle-strengthened composites. Piece is non-fibrous and normally

has no lengthy dimension. Particles aren't very beneficial in enhancing the rapture resistance; however, they enhance the stiffness of the composite to a few extents.

The bagasse raw materials of fibers had been chemically dealt with sodium hydroxide, alkaline KMnO4, and phosphoric acid. These fibers had been subjected to floor evaluation the use of SEM which discovered the roughness of the surface improved. Further, alkaline KMnO4 and phosphoric acids had been powerful in enhancing the thermal traits of fibers and their fabricated composites with epoxy resin. The tensile residences confirmed development for the samples after KMnO4 remedy while in comparison with that of raw fiber bolstered composites and neat epoxy polymer. Therefore, optimization of processing situations the use of KMnO4 will be explored similarly to apprehend the alternate withinside the bonding traits with inside the fiber and it’s come up with in composite residences. Further, chemical adjustments that could arise want to be analysed with the aid of using FTIR approach and floor location with the aid of using BET measurement. Exploring some of these residences could be beneficial for optimizing composite residences and might be suggested with the aid of using us in our destiny publications. Such composites may discover software in low load-bearing packages in which biodegradability is one of the requirements.

CHAPTER – 3
MATERIALS AND METHOD USED FOR COMPOSITE

3. MATERIALS

3.1 Raw Materials

Raw materials used in this experiment is fallowing:

- Bagasse fibre
- Epoxy Resin
- Hardener

3.1.1 Bagasse Fibre

The sugarcane bagasse is a remnant extensively generated in excessive amount with inside the agroindustry. It is a fibrous residue of sugarcane stalks remains after the crushing and take out of juice from the sugarcane. Bagasse is typically Gray-yellow to light inexperienced in colour. It is cumbersome and pretty uneven in particle size. The sugarcane residue bagasse is a below used, renewable agricultural material that include distinct cell constituents. The first is a thick walled, highly long, fibrous fraction operate from the peel and fibrovascular bunch dispersed thru out the indoors of the stalk. The 2nd is a pith fraction operate from the skinny walled cells of the floor tissue.

It is dry mushy stalky substances that remains after crushing sugarcane to bring out their juice. It is used as clean-energy for the manufacturing of heat, energy etc. and manufacture of constructing materials. Its residences which include Cellulose: 45-55%, Hemicellulose: 20- 25%, Lignin: 18-24%, Ash: 1-4%. It

additionally satisfies the greening necessities with the aid of using being biodegradable, recyclable reusable and additionally eco-friendly.

Sugarcane bagasse is a spinoff from the take out of sugarcane, that is wealthy in carbohydrate polymers and lignin. Hemicellulose and cellulose are collected of monomeric sugars, which can be transformed into fructose via way of means of enzymatic hydrolysis. Lignin, a complicated of three-dimensional polymer community design, near the cellulose and hemicellulose, stopping their humiliation at the same time has come up with to their mechanical strength.

Sugarcane is one of the maximum critical vegetation withinside the international and its miles cultivated in more than one hundred countries. Even aleven though the cane is discerning for the sugar produced, the modern-day cognizance on durable power and environmental execration need to lead the goods operate from the sugarcane to be the premise of Biorefinery with a huge variety of use.

3.1.2 Epoxy resin

Epoxy resin is typically described as a viscous liquid with less molecular weight that includes linear molecules concerning a couple of epoxide group. Epoxy resins are typically produced with the aid of using the condensation response of epichlorohydrin. The epoxide group, additionally called the glycidyl unit, consists of an oxygen atom that shape three membered oxirane chain with the aid of using bonding to 2 contiguous carbon atoms. with bisphenol A as visible in Figure 3.

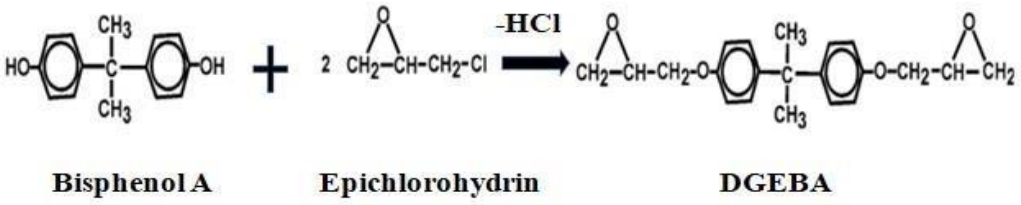


Figure no. :3.1 Di glycidyl ether bisphenol

These are the properties of the epoxy resin:

a. Excellent adhesion to different materials.
b. High resistance to chemical and atmospheric attack.
c. High dimensional stability.
d. Free from internal stresses.
e. Excellent mechanical and electrical properties.
f. Odourless, tasteless and completely nontoxic.
g. Negligible shrinkage

Due to the truth one molecule of bisphenol A reaction with molecules of epichlorohydrin consistent with stoichiometry, it is viable to differ the molecular mass of epoxy resin with the aid of using positioning the quantities of each component. Therefore, epoxy resins are typically described with suggest molecular mass.

As the suggest molecular mass of epoxy resin rise, its toxicity and reactivity decrease. Furthermore, low molecular epoxy resins such as short chains exist as fluid at room temperature, while excessive molecular ones are strong. For this issue, less molecular epoxy resins may be dealt with effortlessly and applied for coatings or adhesives, casting at the same time as strong ones basically want to be mixed in natural solvents.

3.1.3 Hardener

In this work hardener is used. This has a viscosity of 10-20 MPa at 25ºc. hardener mixed with epoxy and bagasse fibre for make of the workpiece.

3.2 PREPARATION OF COMPOSTE

These procedures are used to prepare for the composite materials;

3.2.1 Bagasse Fibre Preparation

Fresh bagasse fibers were collected from juice shop of sugarcane. That was wet bagasse fibre. It needs to be dry, then I put on the roof for dry of bagasse fibre in the sunlight for two to three weeks. When it will be properly dry then I make it in the powder form from use of my grinder.

Figure no. :3.2 less grinder bagasse

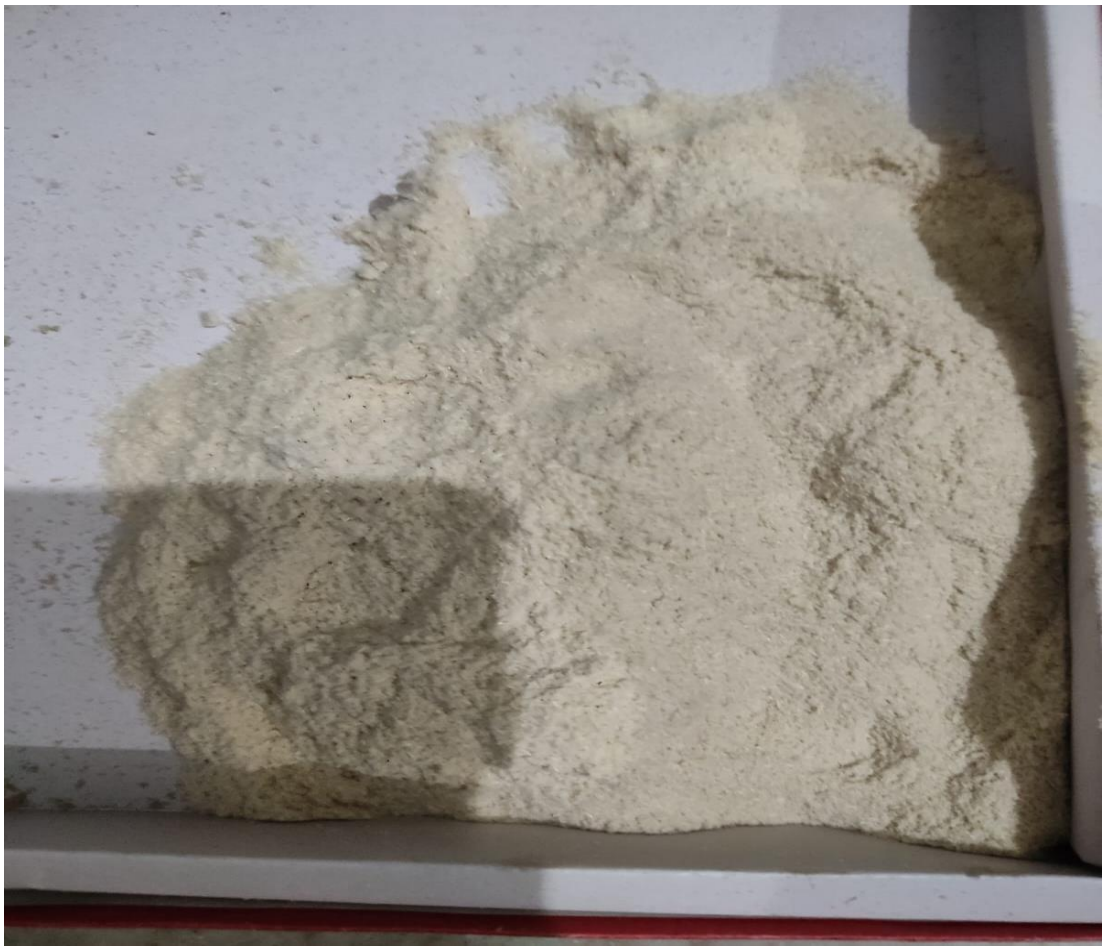


Figure no. :3.3 Powder of sugarcane bagasse fibre

It is dry mushy stalky substances that remains after crushing sugarcane to bring out their juice. It is used as clean-energy for the manufacturing of heat, energy etc. and manufacture of constructing materials. Its residences which include Cellulose: 4555%, Hemicellulose: 20- 25%, Lignin: 18-24%, Ash: 1-4%. It additionally satisfies the greening necessities with the aid of using being biodegradable, recyclable reusable and additionally eco-friendly.

3.2.2 Experimental Method

- Purchase the sugarcane bagasse and epoxy resin from the shop, as much as need.
- Let the sugarcane bagasse dry for two weeks in the sun light.
- Make powder of the sugarcane bagasse from using double mill flour machine/grinder.
- Mixing the epoxy resin and hardener for 15-20 min in the different ratio of epoxy resin and hardener.
- Stirred the sugarcane bagasse powder into the prepared epoxy resin and hardener mixture and pour the in to mould.
- The specimens are formed by using required dimension of moulds in a hand layup process.

3.2.3 Preparation of mould

There are two types of moulding for preparation of two type of composite materials for tow type of testing which will perform on those composite materials;

1. Tensile test
2. Flexural test

3.2.3.1 Tensile test mould

The dimension of tensile test is under 165mm*15mm*10mm, which is made by wooden mould for composite materials. It is prepared by hand lay-up method.

Figure no. :3.4 Prepared mould

There are three composite materials prepared for tensile test. Which have same dimension but different ratio.

Figure no. :3.5

Figure no. :3.6

Figure no:3.7

1. Fig no 18 has the ratio of bagasse fibre, epoxy resin and hardener
   3gm of bagasse fibre, 34gm of epoxy resin and 3gam of hardener

2. Fig no 19 has the ratio of bagasse fibre, epoxy resin and hardener
   5gm of bagasse fibre, 30gm of epoxy resin, and 5gm of hardener

3. Fig no 20 has the ratio of bagasse fibre, epoxy resin and hardener
   4gm of bagasse fibre, 32gm of epoxy resin, and 4gm of hardener

Table no. :3.1 Ratio of Raw materials for tensile strength

S N	Specimen Designation	Bagasse fibre (grams)	Epoxy Resin (grams)	Hardener (grams)
1	A	4	32	4
2	B	5	30	5
3	C	3	34	3

3.2.2.2 Flexural Test mould

The dimension for flexural testing is 100mm*30mm*10mm, which is made by wooden mould for composite materials. It is prepared by hand lay-up method. There are 6 workpiece of bagasse fibre composites materials;

Figure no. :3.8 Prepared mould for flexural testing

Figure no. :3.9 Prepared specimen for flexural testing

Table no. :3.2 Ratio of raw materials for flexural strength

S N	Specimen designation	Bagasse fibre (grams)	Epoxy resin (grams)	Hardener (grams)
1	0	1	18	10
2	1	2	19	10
3	2	3	20	10
4	3	3	21	10
5	4	4	22	10
6	5	5	23	10

3.3 COMPOSITE MATERIALS

Here we know about composite it is nothing but the combination of two or more than two materials. This study going on the epoxy resin with bagasse fibre on the different ratio of each other. For test of strength of material to apply tensile and compressive load on that workpiece. Applications of composite materials like as: furniture, interior panels, wall lining, doors, toys, building and construction industry (panels, false ceilings, partition boards etc.) packaging, automobile and railway coach interiors and storage devices with the advantage of lower cost and good quality**.**

CHAPTER – 4
RESULTS AND DISCUSSION

4. INTRODUCTION

It is come to an end from the preceding segment that the strength of the composites will increase with boom in fiber quantity fraction while subjected to exclusive environmental treatment. Since the cooperate bonding among the reinforcing fibers and the resin matrix is a crucial detail in knowing the mechanical goods, numerous authors have centered the research at the remedy of fibers to enhance the bonding with resin matrix. The mechanical goods of the composites are managed through the goods and portions of the factor substances and through the man or woman of the cooperate place among matrix and reinforcement. Lack of proper unite adhesion makes the usage of cell fiber composites much less adorable.

The low interfacial goods among the fiber and polymer matrix, due to hydrophilic nature of herbal fiber reduces the ability of getting used as reinforcing agents. Chemical adjustments are taken into consideration to optimize the interface of fibers. Chemicals might also additionally prompt hydroxyl companies or introduce new components which could successfully interlock with the matrix. There are diverse chemical treatments to be had for the fiber surface modification. Chemical treatment which includes isocynates, alkali, acetylation, silane, acrylation, benzoylation, maleated coupling agents, permanganate treatment is mentioned in information in.

4.1 EXPERIMENTS PROCEDURE

- Purchase the sugarcane bagasse and epoxy resin from the shop, as much as need.
- Let the sugarcane bagasse dry for two weeks in the sun light.
- Make powder of the sugarcane bagasse from using double mill flour machine/grinder.
- Mixing the epoxy resin and hardener for 15-20 min in the different ratio of epoxy resin and hardener.
- Stirred the sugarcane bagasse powder into the prepared epoxy resin and hardener mixture and pour the in to mold.
- The specimens are formed by using required dimension of molds in a hand layup process.
- For study the strength of the specimen's test on the UTM machine.
- Analyze the test of specimen and note down on conclusions.

4.2 RESULTS

There are two type of results which are present in this study as following;

4.2.1 Tensile Test

4.2.2 Flexural Test

4.2.3 Compression Test

4.2.1 Tensile Test

Tensile testing, additionally referred to as tension testing, is an essential substances technology and engineering take a look at wherein a pattern is subjected to a managed anxiety till failure. Properties which might be without delay measured through a tensile take a look at are breaking strength, ultimate tensile strength, most elongation and discount in area. From those measurements the subsequent homes also can be determined: Poisson's ratio, Young's modulus, strain-hardening and yield strength, traits.

Uniaxial tensile trying out is the maximum normally used for acquiring the mechanical traits of isotropic substances. Some substances use biaxial tensile trying out. The fundamental distinction among those trying out machines being how load is carried out at the substances. Tensile testing helps ensure that the required levels of strength and ductility.

It is the process of find out the basic mechanical properties such as tensile strength, young modulus and percentage strain. The test was conduct on the UTM (Universal Testing machine). The dimension of the workpiece is 165mm*15mm*10mm.

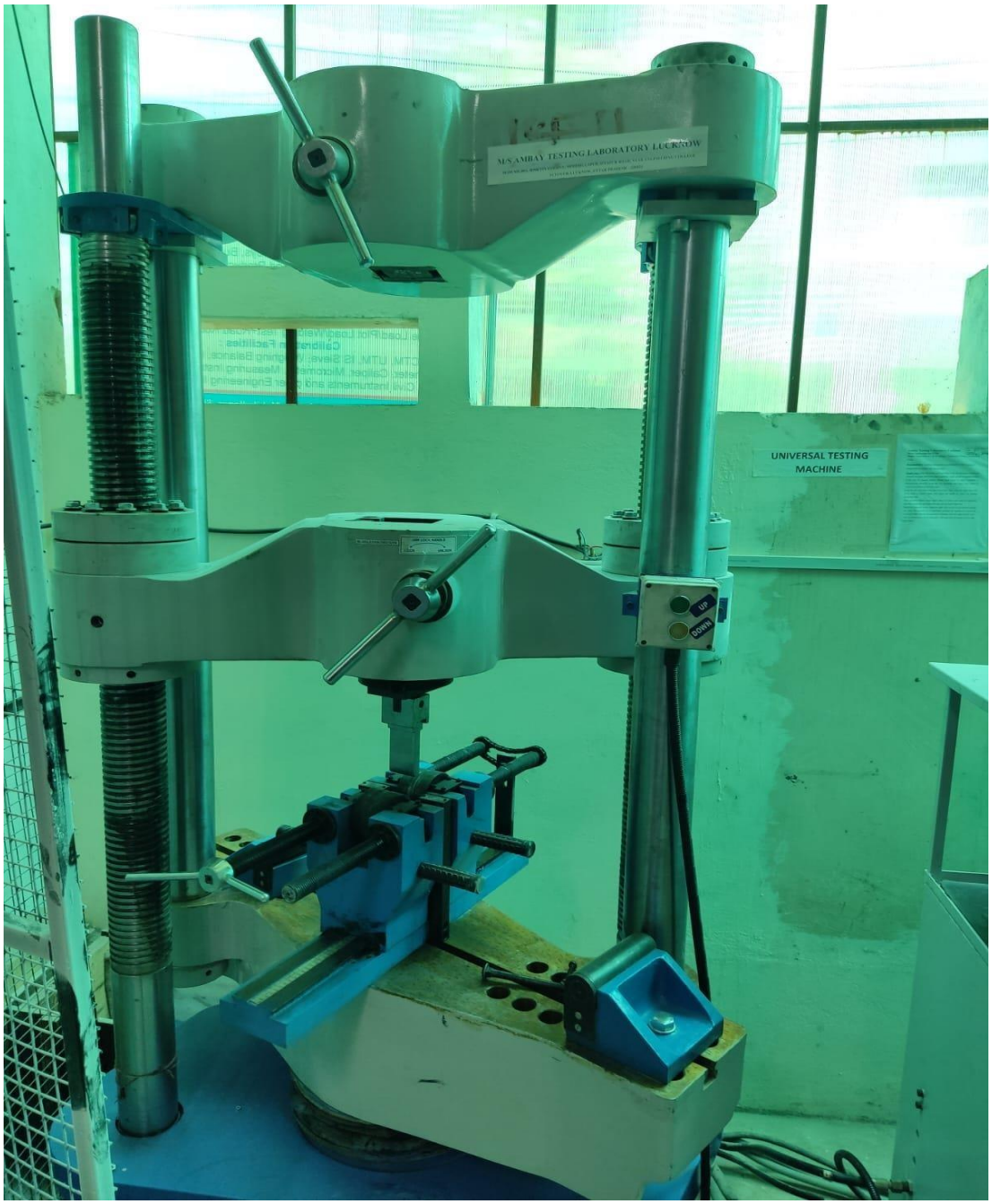


Figure no. :4.1 UTM (universal testing machine)

For A workpiece,

It has the ratio of bagasse fibre, epoxy resin and hardener are; 4gm of bagasse fibre, 32gm of epoxy resin, and 4gm of hardener.

Figure no. :4.2 Before test

Figure no. :4.3 After test

Result of A composite materials on which tensile test performed, the result of shown down;

Tensile strength = 11.155 N/mm^2

Yield stress = 7.416 N/mm^2

Load at peak = 1.790 kN

% elongation = 5%

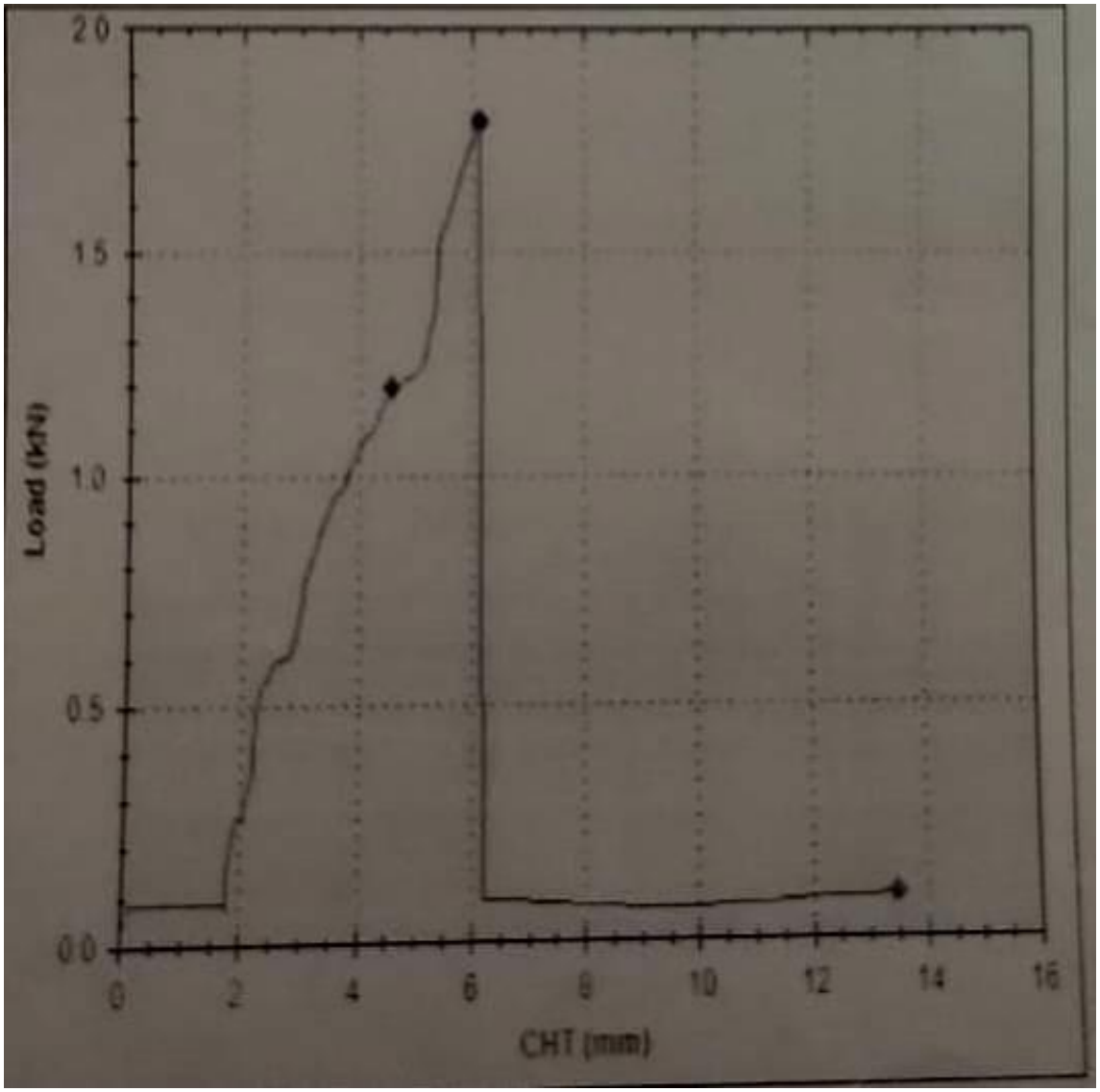


Figure no. :4.4 Graph of stress [load (KN)] vs strain [cross head travel (CHT)] in mm

For B, workpiece,

It has the ratio of bagasse fibre, epoxy resin and hardener are; 5gm of bagasse fibre, 30gm of epoxy resin, and 5gm of hardener.

Figure no. :4.5 Before Test

Figure no. :4.6 After Test

Result of B, composite materials,

Tensile strength = 19.435 N/mm^2

Yield stress = 18.291 N/mm^2

Load at peak = 2.930 kN

% elongation = 5%

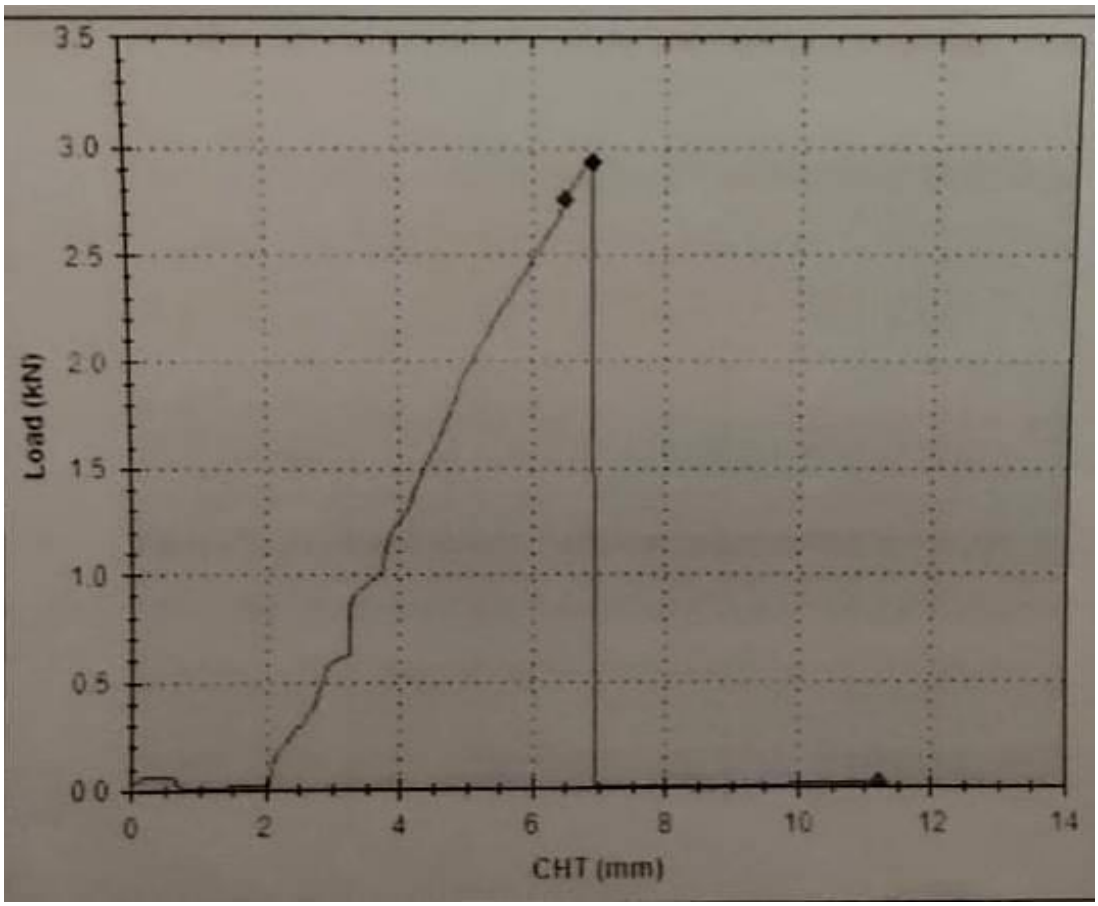


Figure no. :4.7 Graph of stress [load (KN)] vs strain [cross head travel (CHT)] in mm

For C, workpiece,

It has the ratio of bagasse fibre, epoxy resin and hardener are; 3gm of bagasse fibre, 34gm of epoxy resin, and 3gm of hardener.

Figure no. :4.8 Before Test

Figure no. :4.9 After Test

Result of C, composite materials,

Tensile strength = 8.314 N/mm^2

Yield stress = 6.523 N/mm^2

Load at peak = 1.3 kN

% elongation = 5%

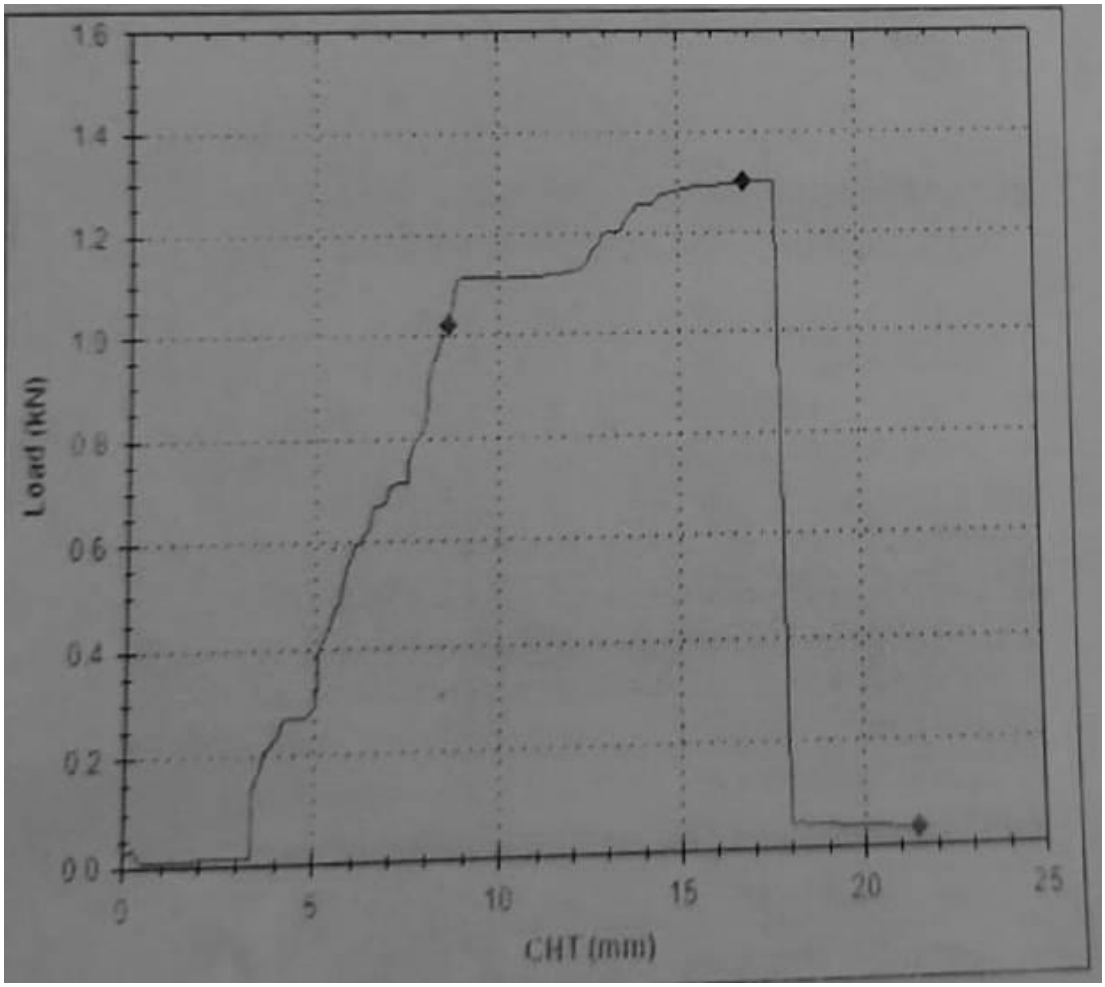


Figure no. :4.10 Graph of stress [load (KN)] vs strain [cross head travel (CHT)] in mm

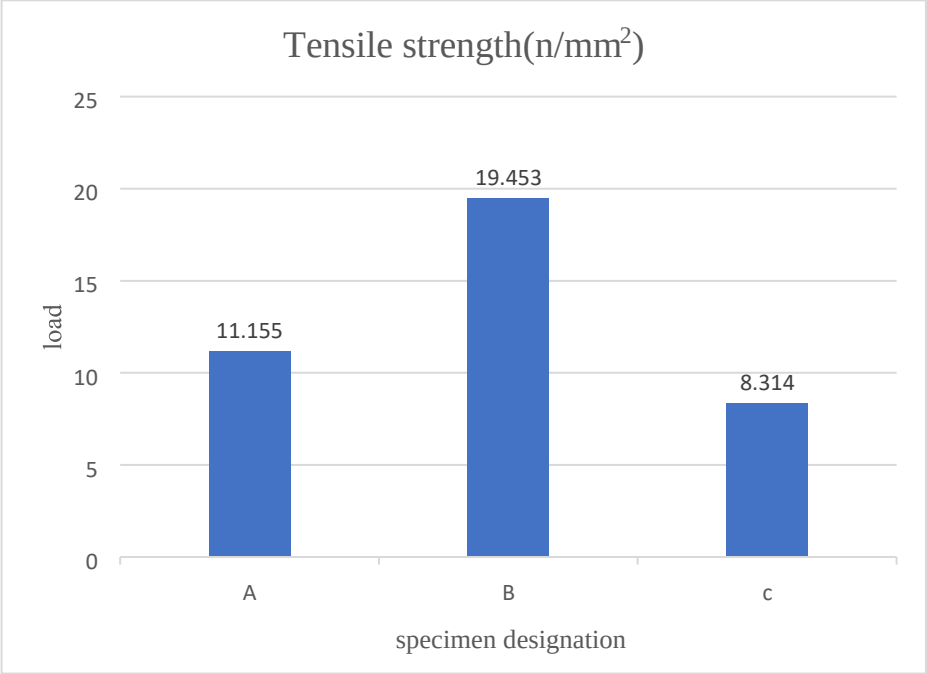


Figure no. :4.11 Chart for Tensile strength

4.2.2 Flexural Test

The three-point bending flexural take a look at offers values for the modulus of elasticity in bending Ef, flexural stress σf, flexural strain εf and the flexural strain–stress reaction of the material. This take a look at is accomplished on a general checking out system (tensile checking out system or tensile tester) with a three-point or four-point bend fixture. The most important gain of a three-factor flexural take a look at is the convenience of the specimen preparation and checking out.

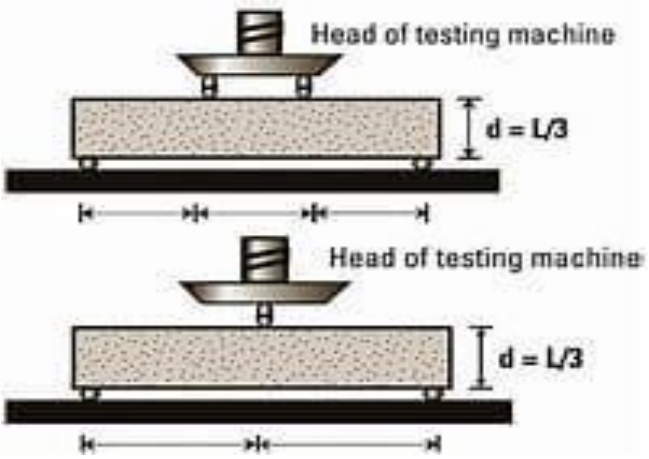


Figure no. :4.12 Flexural testing machine

There are 6 type of composite workpiece which have same dimension of 100mm*30mm*10mm, but they have not the same ratio of raw materials, I designated by the 0, 1, 2, 3, 4, 5, and 6. These are equal in diameter. This test performed on the UTM by using 3-point loading.

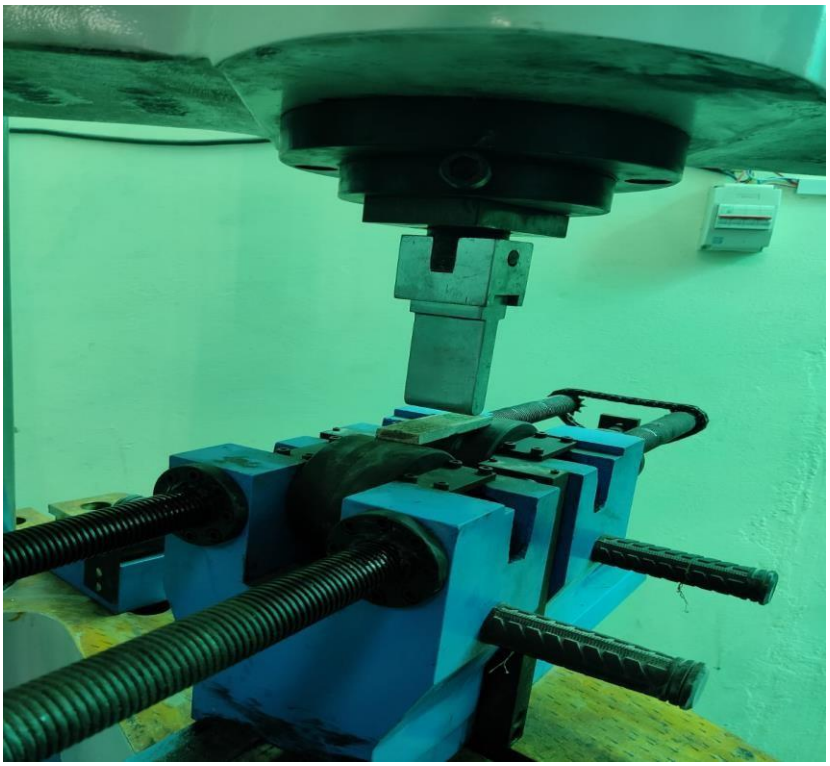


Figure no. :4.13 flexural testing performed on UTM

For 0, workpiece;

In this we use the ratio of bagasse fibre, epoxy resin and hardener are respectively;

1gm bagasse fibre, 18gm epoxy resin, 10gm hardener

Figure no. :4.14 flexural strength tested w/p number 1

Calculation flexural strength using this formula,

$$\text{Flexural stress} = 3Fl/2bd^2$$

For F = 0.285KN

$$\text{Flexural stress} = \frac{3\times285\times100}{2\times30\times10^2}$$

$$= 14.25 \text{ MPa}$$

For 1, workpiece;

In this we use the ratio of bagasse fibre, epoxy resin and hardener are respectively;

2gm bagasse fibre, 19gm epoxy resin, 10gm hardener

Figure no. :4.15 flexural strength tested w/p number 2

$$\text{Flexural stress} = 3Fl/2bd^2$$

For F = 0.425KN

$$\text{Flexural stress} = \frac{3\times425\times100}{2\times30\times10^2}$$

$$= 21.25 \text{ MPa}$$

For 2, workpiece;

In this we use the ratio of bagasse fibre, epoxy resin and hardener are respectively;

3gm bagasse fibre, 20gm epoxy resin, 10gm hardener

Figure no. :4.16 flexural strength tested w/p number 3

Flexural stress $= 3Fl/2bd^2$

For F = 0.328KN

$$\text{Flexural stress} = \frac{3\times328\times100}{2\times30\times10^2}$$

= 16.4 MPa

For 3, workpiece;

In this we use the ratio of bagasse fibre, epoxy resin and hardener are respectively;

3gm bagasse fibre, 21gm epoxy resin, 10gm hardener.

Figure no. :4.17 flexural strength tested w/p number 4

Flexural stress $= 3Fl/2bd^2$

For F = 0.320KN

$$\text{Flexural stress} = \frac{3\times320\times100}{2\times30\times10^2}$$

$$= 16\text{MPa}$$

For 4, workpiece;

In this we use the ratio of bagasse fibre, epoxy resin and hardener are respectively;

4gm bagasse fibre, 22gm epoxy resin, 10gm hardener.

Figure no. :4.18 flexural strength tested w/p number 5

Flexural stress $= 3Fl/2bd^2$

For F = 0.455KN

$$\text{Flexural stress} = \frac{3\times455\times100}{2\times30\times10^2}$$

$$= 22.75\text{MPa}$$

For 5, workpiece;

In this we use the ratio of bagasse fibre, epoxy resin and hardener are respectively;

5gm bagasse fibre, 23gm epoxy resin, 10gm hardener.

Figure no. :4.19 flexural strength tested w/p number 6

$$\text{Flexural stress} = 3Fl/2bd^2$$

For F = 0.565KN

$$\text{Flexural stress} = \frac{3\times455\times100}{2\times30\times10^2}$$

$$= 28.25\text{MPa}$$

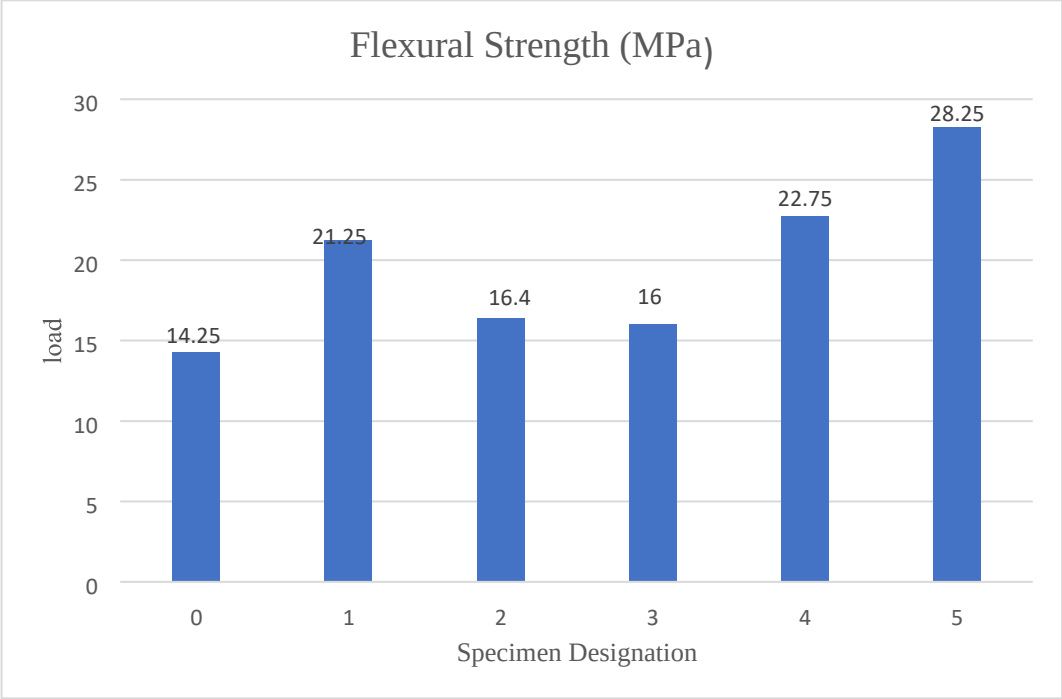


Figure no. :4.20 load chart of flexural strength

Table no. :4.1 Flexural strength of composite

S N	Specimen Designation	Flexural Strength (MPa)
1	0	14.25
2	1	21.25
3	2	16.4
4	3	16
5	4	22.75
6	5	28.25

Table no. :4.2 Tensile strength

SN	Specimen designation	Tensile strength (MPa)	Yield stress (MPa)	Load at peak (kN)	Elongation %
1	A	11.115	7.416	1.79	5
2	B	19.453	18.291	2.93	5
3	C	8.314	6.523	1.3	5

4.3 RESULTS AND DISCUSSION

4.3.1 Tensile Strength

In this study, observed the result of fibre reinforced composite materials.it is observed that the tensile strength varies from 8.314 MPa to 19.453 MPa.

The maximum value of tensile strength is gotten in (B) = 19.453MPa.

The minimum value of tensile strength is gotten in (C) = 8.314MPa.

The maximum value of yield stress is gotten in (B) = 18.291MPa

The minimum value of yield stress is gotten in (c) = 6.523MPa

Load at peak for the (A) =1.79 kN

Load at peak for the (B) =2.93kN

Load at peak for the (C) = 1.3kN

4.3.2 Flexural Strength

Hence, the value change with their variation in mixture of epoxy resin and bagasse fiber and result shown following:

The maximum value of flexural strength is 28.25 MPa

The minimum value of flexural strength is 14.25 MPa

The flexural strength of this reinforced composite materials is got by 3-point bend test using UTM machine. The flexural strength is varying with using the different type ratio of each other (epoxy resin, bagasse fiber) and hardener put same in each mixture. The flexural strength varies from 14.25 MPa to 28.25 MPa.

The investigation on flexural behaviour of bagasse fibre with epoxy resin reinforced composite materials with different ratio of each other. The conclusion drawn from this work are here.

The flexural strength of the composite varies from 14.25 MPa to 28.25 MPa. the maximum flexural strength is obtained for the composite with 5grams. This is the water resistance materials.

4.3.3 Compression Strength

In this study we observed the basic mechanical properties such as compression strength, when applied the load on the specimen of flat surface then it expends without break till 750kN. Its increase surface area and change its shape and size.

I found it good in this test.

CHAPTER – 5
CONCLUSION

5. CONCLUSION

The investigation on flexural, tensile and compression behaviour of bagasse fibre with epoxy resin reinforced composite materials with different ratio of each other.

The conclusion drawn from this work are here.

1. The sugarcane waste bagasse an underutilized renewable agricultural material can successfully be used to produce composite by suitably bonding with resin for value added product.
2. we found the high strength at the using 5gm bagasse fibre powder in both of Tensile and Flexural strength. Here for preparing specimen using Hand layup method. It can be use in more way because rare future of the environmentally friendly, waste utilization, good strength, bio-degradability and alternative for plastic.
3. It can be used in the place of plastic, wood. In the future, work to do some more research on it to make it fireproof. When it will be used in the place of wood, then deforesting would be reduced and use of the waste of bagasse fiber to make some wooden thing.
4. The bagasse fibre has good flexural strength as the maximum value find on the 5mg bagasse fibre with 28.25MPa flexural strength.
5. It has good tensile strength find on the also on 5gm bagasse fibre with 19.453MPa.
6. Its also has good adhesion with epoxy resin and bagasse fibre.
7. It is the water resistance composite materials.

CHAPTER – 6
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6. REFERENCES

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List Of Publications

My paper "**TENSILE STRENGTH OF EPOXY RESIN AND BAGASSE FIBRE REINFORCED COMPOSITE MATERIALS**" is Published under Dogo Rangsang Research Journal ISSN : 2347-7180 Vol-09 Issue-01 no. 01 : 2022 https://journaldogorangsang.in/no_1_online_22.html.

My paper "**TENSILE AND COMPRESSION TEST OF EPOXY RESIN AND BAGASSE FIBRE REINFORCED COMPOSITE MATERIALS**" is presented in the International Conference on Processing and Characterization of Materials (ICPCM-2022) organized by SSN College of Engineering.

My paper "**FLEXURAL STRENGTH OF EPOXY RESIN AND BAGASSE FIBRE REINFORCED COMPOSITE MATERIALS**" is accepted and presented in the "International Conference on Advances in Mechanical Engineering" (ICAME-2022) organized by the Department of Mechanical Engineering G H Raisoni College of Engineering, Nagpur, India and it is waiting for the publication.

3

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