Characteriaztion and Its Chemical Pretreatment Effects of Natural Lignocellulosic Fiber From Prosopis Juliflora and Morinda Tinctora

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Abstract- *An attempt has been made to develop novel polymer based Fiber composite material reinforced with natural fiber, increased performance in terms of Chemical and Mechanical properties. This work involves development of a new natural Fiber-composite material consisting of LY-556 epoxy resin, HY-951 Hardener. A suitable surface modification method is employed for natural fiber treatment in order to adhere the Fiber-particles, this paper shall be dealing with the surface adhesion. Surfactants like NaOH were applied on the fibers. Fibers used as a reinforcement with epoxy to form composite material to enhance the adhesion between the fillers and holding matrix alkalisation. To determine interferential adhesion and homogeneous distribution of fibers in the holding matrix Spectroscopic analysis such as Fourier transform infrared (FTIR) and X-ray diffraction (XRD) were conducted. Mechanical testing like Hardness test in Shore Durometer was carried out. Among the varied 0.5% of NaOH treated natural fibers composite materials. From the shore d hardness test values the alkali treated natural fiber composite materials have low hardness strength compare to untreated natural fiber composite materials because of after the alkali treatment natural fibers were lost their cellulose contents. The untreated natural fiber composite materials are harder than the cellulose removed alkali treated natural fiber composite material.*

I. INTRODUCTION

Materials considered exclusively as assurance routinely comes as free fills supported with foil or paper. The conventional outlining materials are surely not skilled to get the need of such uncommon properties, for example, fantastic, bring down thickness and lower leading property. The energy on an exceptionally fundamental level continuing, financially shrewd and light weight protection materials is thus developing very much requested. Composite materials are supplanting conventional materials, as a result of their unrivalled properties, for example, high quality to-weight proportion, high mechanical quality and least warm extension. Prosopis Juliflora and Morinda Tinctoria fibers are the two fillers utilized as a touch of present examination fortified just in epoxy reign to convey two methodologies of composites by carefully assembled structure. The proposed model is then bolstered through testing that drove in controlled research focus circumstances.

In setting of this, the ebb and flow investigate has been attempted to deliver a move at the aftereffects of including the isolative short fibers the mechanical property of polymer gum. The present work concentrates on the inconvenience composites of epoxy reign. For this the Prosopis Juliflora and Morinda Tinctoria strands and glass filaments are used for enhancing the farthest traverse. There are numerous components that can affect the execution of normal fiber fortified composites.

Another essential component that on a very basic level effects the properties and interfacial qualities of the composites is the get ready parameters used. Accordingly, suitable get ready techniques and parameters must be meticulously picked remembering the true objective to yield the perfect composite things. This article hopes to review the reported wears down the effects of fiber stacking, engineered medications, delivering strategies and process parameters on malleable properties of consistent fiber sustained composites. A composite material including a polymer framework inserted with surprising reliable strands, Prosopis Juliflora and Morinda Tinctoria, polymers can be sorted out into two portrayals. So these polymers tend to make gentler at a raised warmth range and move back their properties all through cooling. Then again, thermos sets polymer can be portrayed as fundamentally cross-related polymers which cured utilizing just warmth, or utilizing warmth and weight, furthermore light lighting up.

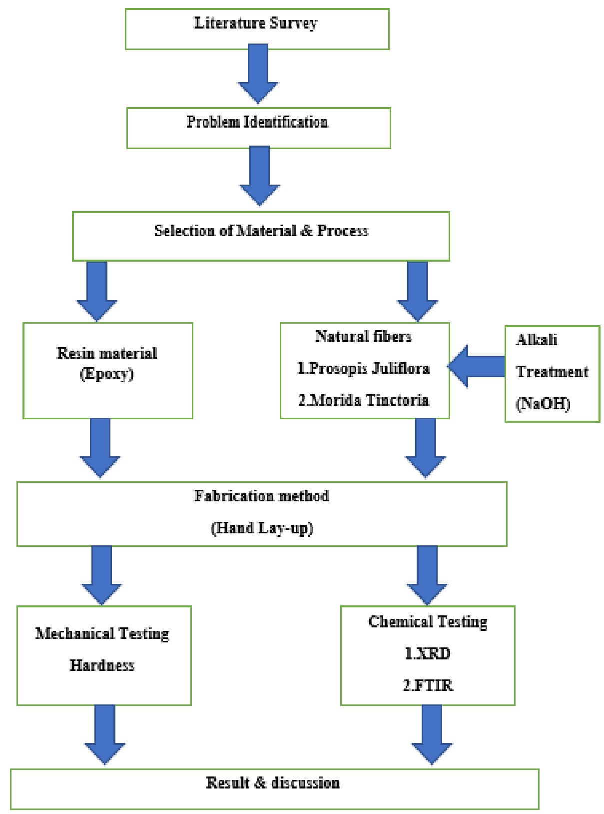
A composite material can be delineated as a mix of no under two materials that results in favoured properties over those of the individual pieces used alone. Rather than metallic reinforces, each material holds its contrasting blend, physical and mechanical properties. The vivifying time of the composites gives the quality and dauntlessness, to make them harder, more grounded and stiffer than the system. The support is customarily as a fiber or a particulate. The length-to-width degree is known as the point of view degree and can differentiate on a very basic level for strands in light of the way that the length of the fiber is altogether more detectable than its estimation.

II. LITERATURE SURVEY

M.S. Santhosh [1] et al. (2019) investigated the Mechanical and morphological behavior of rice husk/prosopis juliflora reinforced bio composites. Author reported that the inclusion of rice husk significantly improves the mechanical behaviour of PREHC up to 45% than unfilled Prosopis Juliflora/Epoxy composites (PJEC). The proposed outcome of the research is suitable for structural and automobile engineering components. S.R. Benin [2] et al. (2020) investigated the Mechanical characterization of prosopis juliflora reinforced polymer matrix composites with filler material. The samples were examined with the tensile test, flexural test, and impact test. It was observed that the sample with a 12% weight of filler shows good improvement in the mechanical properties. Moreover, the surface morphology was analysed using scanning electron microscopy. S.S. Saravanakumar [3] et al. (2012) investigated the Characterization of a novel natural cellulosic fiber from Prosopis juliflora bark. The free chemical groups on it were studied by FTIR and XRD. It had a tensile strength of 558 ± 13.4 MPa with an average strain rate of 1.77 ± 0.04% and micro fibril angle of 10.64◦ ± 0.45◦. Thermal analyses (TG and DTG) showed that it started degrading at a temperature of 217 ◦C with kinetic activation energy of 76.72 kJ/mol. P. Venkateshwar Reddy [4] et al. (2019) investigated the Influence of fillers on mechanical properties of prosopis juliflora fiber reinforced hybrid composites. Composite with Al_2O_3 filler material attained highest mechanical properties than the other two filler materials. SEM analysis also proved that the bonding between the reinforcements and matrix are uniformly dispersed.

Barbara Vermes [5] et al. (1980) investigated the synthesis and structure proof of morindone 6.0 gentiobioside from morinda tinctoria. The naturally occurring 1, 5-dihydroxy-2-methyl-6-o-B-gentiobiosylanthraquinone was synthesized and its structure confirmed.

III. METHODOLOGY



IV. PROBLEM IDENTIFICATION

The extraction of natural fiber from municipal solid waste of prosopis juliflora plant need to be improved. Less amount of research carried in the field Prosopis Juliflora and Morinda Tinctoria pre-processing using alkali treatment. The characterization of pre-processed Prosopis Juliflora, Morinda Tinctoria and its composite materials.

V. MATERIALS AND EXPERIMENTAL METHODS

Epoxy resin (LY-556): The resin itself is made of biphenyl (and there is more than one type) and epichlorohydrin. The most common type of biphenyl is a combination of acetone and phenol. According to adhesives.org, epoxy resins, when cured, provide “rigid but tough bond lines and have excellent adhesion to metals. Properties of Epoxy Resin (LY-556) as shown in Table 5.1

Table 5.1 Properties of Epoxy Resin (LY-556)

S. No.	Properties	Hardener HY951
1	Aspect (visual)	Clear liquid
2	Viscosity	10–20 mPas (25°C)
3	Density	0.95 g/cm3
4	Flash point	110°C
5	Storage temperature	Room Temperature

Hardener (HY-951): Hardener is a curing agent for epoxy or fiberglass. Epoxy resin requires a hardener to initiate curing; it is also called as catalyst, the substance that hardens the adhesive when mixed with resin. It is the specific selection and combination of the epoxy and hardener components that determines the final characteristics and suitability of the epoxy coating for given environment.

Table 5.2 Properties of Hardener (HY-951)

S. No.	Properties	Araldite LY556
1	Aspect (visual)	Clear pale-yellow liquid
2	Viscosity	10000–12000 mPa
3	Density	1.3 g/cm3
4	Flash point	>200°C
5	Storage temperature	2–40°C

Prosopis Juliflora: Prosopis juliflora is a shrub or small tree in the family Fabaceae, a kind of mesquite. It is native to Mexico, South America and the Caribbean. It has become established as an invasive weed in Africa, Asia, Australia and elsewhere. It is a contributing factor to continuing transmission of malaria, especially during dry periods when sugar sources from native plants are largely unavailable to mosquitoes.

Fig 5.1 Natural Fiber of Prosopis Juliflora

X-ray Diffraction (XRD) Test: Ray diffraction is used for the investigation of crystalline materials. All crystalline materials have one thing in common: their components (atoms, ions or molecules) are arranged in a regular manner. This is a necessary requirement for XRD as diffraction can only occur, if X-rays are scattered by a periodic array of particles with long-range order.

In words this equation can be described as follows: constructive interference occurs only if the path difference (given by 2d sinθ) is a multiple (n=1, 2...) of the used wavelength of the X-ray beam. As the wavelength in XRD experiments is known and the angles at which constructive interference occurs are measured, the use of the Bragg equation allows determining the distance between the lattice planes of the material. The result of the measurement is a so called diffract to gram. This is a plot of X-ray intensity on the y-axis versus the angle 2θ (2θ is defined as the angle between the incident and the diffracted beam) on the x-axis. The scattered X-rays from the sample interfere with each other either constructively or destructively. This means that detectors can read-out a signal only at angles where constructive interference occurs. This is schematically shown in the next picture. The dots in the graph correspond to the building blocks of a crystalline material. Due to the crystalline nature, the atoms are arranged periodically. The incident X-ray beam is scattered at different planes of the material. The resulting diffracted X-rays therefore have a different optical path length to travel. The magnitude of this path length only depends on the distance between the crystal planes and the incident angle of the X-ray beam. This is summarized in the famous Bragg – Equation: $n\lambda=2d\sin\theta$.

VI. RESULTS AND DISCUSSION

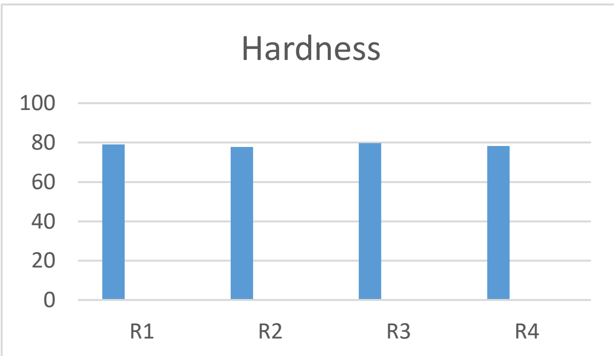
6.1 HARDNESS VALUE

Table 6.1 Hardness Value

S.NO	COMPOSITION	HARDNESS SHORE DUROMETER
R_1	Un Processed prosopis Juliflora	79.1
R_2	Processed prosopis Juliflora	77.8
R_3	Un Processed Morinda Tinctoria	79.8
R_4	Processed Morinda Tinctoria	78.2

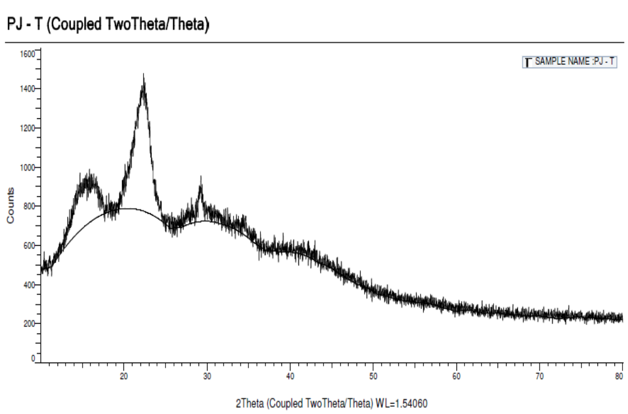
From the shore d hardness test values the alkali treated natural fiber composite materials have low hardness strength compare to untreated natural fiber composite materials because after the alkali treatment natural fibers were lost their cellulose contents. After removal of cellulose content from the natural fibers, it became weak material compare to untreated natural fiber composite. the untreated natural fiber composite materials are harder than the cellulose removed alkali treated natural fiber composite material. From the results, after the cellulose remove from the natural fiber, it reduces the hardness of the material as shown in figure 6.1.

6.1.1 Hardness Test Graph



X-RAY DIFFRACTION RESULT DISCUSSION OF PROSOPIS JULIFLORA

From the XRD results, alkali treated prosopis juliflora sample has first peak value was 950 counts and this peak formed in value of 10 2 Theta, second peak value was 1500 counts and this peak formed in value of 25 2Theta as shown in Figure 5.4 whereas untreated prosopis juliflora the first peak value was 1100 counts and this peak formed in value of 12 2Theta, second peak value was 1600 counts this peak formed in value of 24 2Theta as shown in figure 5.3. In addition of moisture contents and chemical contents in alkali treated prosopis juliflora fiber, it has third peak value 900 counts and this peak formed in value of 28 2Theta as shown in figure 6.2



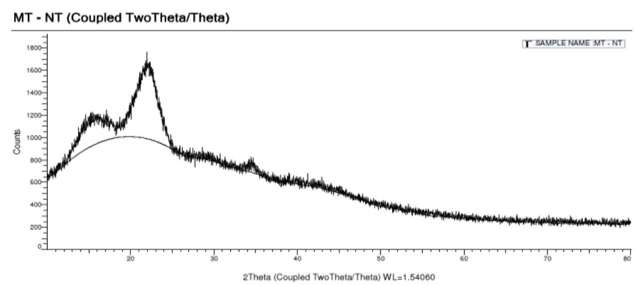
Index	Name	Scan	Angle	D Valve	Net Intensity	Gross Indensity	Rel.Indensity
0	Peak#1	PJ - T.raw#1	19.914	4.4550	2 122	909	19.4%
1	Peak #2	PJ - T.raw#1	20.912	4.2445	4 302	1090	47.9%
2	Peak #3	PJ - T.raw#1	22.201	4.0009	4 631	1408	100.0%

X-RAY DIFFRACTION MORINDA TINCTORIA UNPROCESSED VALVES

Table 5.4 x-ray diffraction morinda tinctoria unprocessed valves

Index	Name	Scan	Angle	D Valve	Net Intensity	Gross Indensity	Rel.Ind ensity
0	Peak #1 MT	NT.raw#1	66.361	1.407 50	56.3	303	100.0%

X-ray Diffraction Morinda Tinctoria Unprocessed Graph



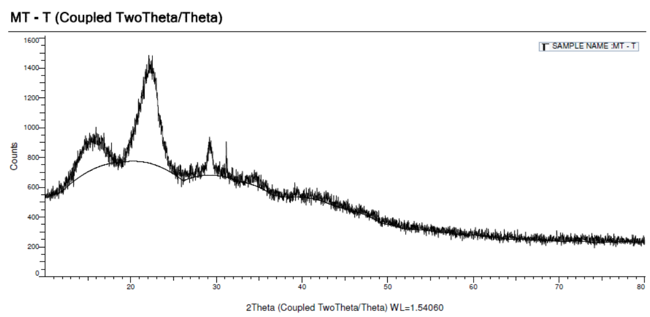
X-RAY DIFFRACTION RESULT DISCUSSION OF MORINDA TINCTORIA

From the XRD results of untreated morinda tinctoria fiber sample has first peak was in 1200 counts and this peak formed in value of 10 2Theta, second peak was in 1650 counts and this peak formed in value of 25 2Theta as shown in figure 5.5 whereas alkali treated morinda tinctoria the first peak value was 950 counts and this peak formed in value of 12 2Theta, second peak was 1400 counts and this peak formed in value of 26 2Theta as shown in figure 5.6. In addition of moisture contents and chemical contents in alkali treated prosopis juliflora fiber, it has third peak value was 850 counts and this peak formed in value of 28 2Theta as shown in figure 6.3.

X-RAY DIFFRACTION MORINDA TINCTORIA PROCESSED VALVES

Index	Name	Scan	Angle	D Valve	Net Intensity	Gross Intensity	Rel. Intensity
0	Peak #1 MT -	T.raw#1	14.687	6.02674	209	902	82.2%
1	Peak #2 MT -	T.raw#1	29.207	3.05519	255	935	100.0%

X-ray Diffraction Morinda Tinctoria Processed Graph



CONCLUSION

The Prosopis juliflora and Morinda tinctoria fiber reinforced composites were manufactured with untreated and alkali treated (NaOH) 0 to 16 wt% of Sodium Hydroxide with epoxy resin using a conventional hand layup process. Hardness was measured by shore durometer also XRD, FTIR were anlysed for 4 samples. Hardness Test results shows that the untreated prosopis juliflora composite and untreated morinda tinctoria composite were higher than the NaOH treated prosopis juliflora and the NaOH treated morinda tinctoria composites. The alkali treated natural fiber composite materials have low hardness strength compare to untreated natural fiber composite materials because after the alkali treatment natural fibers were lost their cellulose contents. After removal of cellulose content from the natural fibers, it became weak material compare to untreated natural fiber composite. the untreated natural fiber composite materials are harder than the cellulose removed alkali treated natural fiber composite material. From the results, after the cellulose removed from the natural fiber, it reduces the hardness of the material.

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