A REVIEW ON EFFECT OF FIBER TREATMENT ON TENSILE STRENGTH OF NATURAL FIBER COMPOSITES

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***ABSTRACT* -** A composite material occupies major part in modern era due to its leads by light weight, good stiffness and high specific strength. Natural fiber composites is famous for its ecofriendly behavior and having wide range of applications. Hence, mechanical properties of a natural fiber composites is an important aspect in the applications of composites. In present study, a review is carried out of fiber treatment and its method for the improvement of the mechanical properties of composites and reported the effect of fiber treatment on tensile strength of Natural fiber reinforced composites. The paper signifies an outcome as, alkali treatment is the best treatment for improve the tensile strength and 5% alkaline solution gives the best results.

***Key words:* Natural Fiber Composites, Fiber Treatment, Tensile strength.**

I. INTRODUCTION

The natural fibers have less strength comparatively manmade fibers, so that to improve their mechanical properties like tensile strength it is important to do fiber treatments. Among the physical, chemical and biological treatments chemical treatments are more popular and effective treatments.in chemical treatments alkali treatment and saline treatments are mostly used because they are easy to do then other treatments. Alkali treatment is the best choice from all the fiber treatments because there is very less chance to harm the fiber material.

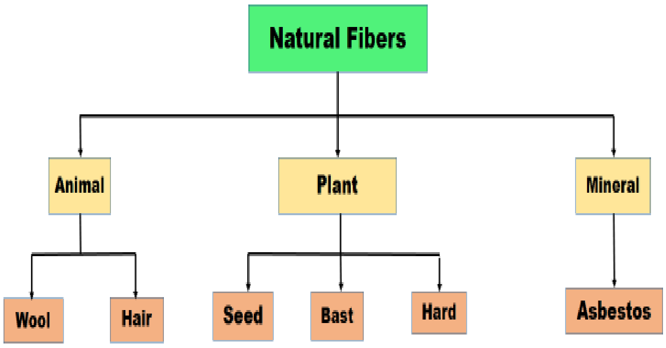


Fig.1 Natural fiber composite material

II. EFFECT OF FIBER TREATMENT ON TENSILE STRENGTH

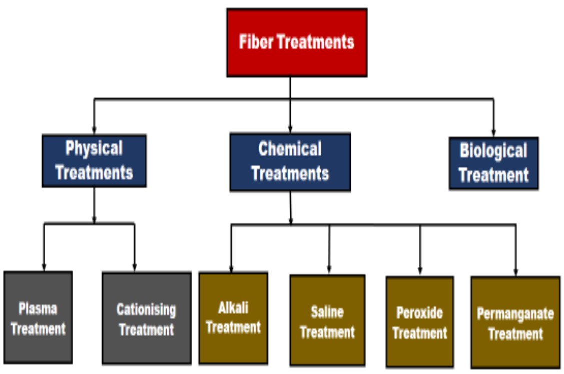


Fig 2. Types of fiber treatment

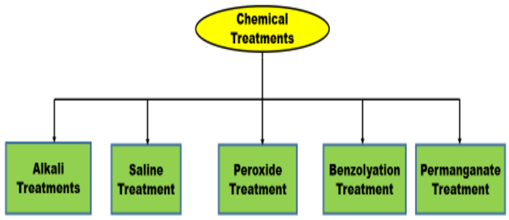


Fig.3 Types of chemical fiber treatments

There are different types of fiber treatments are available. In the physical treatments plasma treatment is mostly used.

Plasma treatment: plasma is a reactive treatment process where a positive and negative ions, electrons, and radicals react and collide as long as an electric potential difference exists .plasma treatment improves the fiber-matrix adhesion it also improves the flexural properties of the fibers, it is also use for cleaning the surface of the fibers. (18)

Biological treatment: In this treatment 5-6% bacterial cellulose deposited on the surface of natural fibers. By this treatment improvement occurs in the interface of fiber & matrix. (16)

Among all 3 types of treatments chemical treatments are more effective. There are various types of chemical treatments but alkali treatment and saline treatment are most popular treatments. There is a mixture of these two treatments called alkaline-saline treatment.

Alkali treatment

The reaction that happens in light of salt treatment is following

Fiber – OH + NaOH → Fiber – O– Na+ + H2O.

To evaluate the effect of the sodium hydroxide course of action obsession, the hemp strands were dealt with using 1 wt. % and 5 wt. % sodium hydroxide course of action in water. Each sheet was ingested the stomach settling agent respond in due order regarding 30 min using an extent between the volume game plan and the weight of the sheet equal to 45 ml/g. In this manner, the alkalized strands were washed with refined water until the point that the moment that all the sodium hydroxide was wiped out and the pH of the water was comparable to 7. The washed fibers were then dried in a stove at 70 °C for 24 h. (1)

Saline treatment: natural fibers having hydrophilic nature and polymer matrix has a hydrophobic nature. So to improve the adhesion bonding between them there is a requirement of treatment on the fibers. Saline coupling agents make the bond with OH bonds and eliminate the part of water from the fiber. Saline treatment is use to improve the mechanical properties of the natural fiber composite material. (1)

Peroxide treatment: peroxide induced grafting of polymer adheres on to the fiber surface, it initiate free radicals react with hydroxyl group so that adhesion property increases. It also improves the interfacial property. This treatment also reduced moisture absorption tendency of the fibers (16)

Benzolyation treatment: This treatment uses benzoyl chloride to decrease the hydrophilic nature of the fiber and improves the inter facial adhesion of the fiber & matrix material. This treatment also gives the thermal stability to the material it gives higher tensile strength of the material (16).

Permanganate treatment: this treatment used potassium permanganate in solution. Treatment forms highly reactive permanganate ions which reacts with hydroxyl groups. This treatment enhances chemical interlocking at the inter face & provide good thermal stability to the material it also provides high tensile strength (16).

The fiber package rigidity of FPF untreated and treated with various substance medicines. , it can be seen that fundamental (FPF/ALK) and antacid saline (FPF/ALKSIL) medicines enhanced the rigidity, while the salted treatment (FPF/SIL) lessened the elasticity of FPF. The request of rigidity is FPF/ALK (816 MPa) > FPF/ALKSIL (729 MPa) > FPF (678 MPa) > FPF/SIL (583 MPa). Increment in rigidity of soluble and basic saline-treated FPF may be ascribed to the change of cellulose chain pressing request. The soluble treatment of regular strands can cause a diminishment in the winding point of cellulose smaller scale fibrils which thus took into consideration the revamp of the cellulose chains and results in the enhanced rigidity (14). The basic treatment can build the surface harshness and normality, because of the expulsion of the polluting influences. The aftereffect of mechanical interlocking will be better and augmentation the measure of cellulose uncovered on the fiber surface so surface pressure is lower (13).After the synthetic treatment elasticity will be improve(2).

Cane sugar were sliced into 7 cm to 11 cm length. Prior to any composite creation, normal filaments experienced concoction treatment. Right off the bat, filaments were submerged in water containing 3% NaOH answer for around 8 hours. At that point the strands were dried in stove at 60oC for 4 hours. The filaments were then left for 24 hours to dry at room temperature before being utilized. Concoction treatment was utilized to enhance the similarity and holding between the fiber and lattice

Alkali treatment on cellulose fiber

Mechanical mash, secured from Domtar Canada, was dealt with preceding mechanical defibrillation with an underlying arrangement of 2.5%, and 4% NaOH at 60ºC for 1 h. Furthermore, a control or untreated cluster was set up in a comparable manner. The arrangement was set up by consolidating fine mechanical mash filaments, NaOH pellets, and refined water in a 1:20 fiber: solution proportion inside a substantial recepticle that was then placed over a Corning PC-351 Hot Plate and along these lines blended with a Canlab Caframo mechanical stirrer. After the 1 h treatment, the mash was then washed completely with refined water through a 75 µm sifter until the point when all the sodium hydroxide was wiped out and the mash was soluble base free, as dictated by checking the pH occasionally utilizing pH paper. In the wake of breaking down the killed mash for 10 min, the mash was then put away at 4ºC out of an icy room. (8)

Table 1. Tensile strength of treated and non-treated cellulose fiber

Sample	Tensile Strength(MPa)	Young's modulus(GPa)	Coefficient of tensile strength (%)	Coefficient of Young's modulus (%)
Non treated	149.20	8.87	2.78	3.36
2.5% treated	179.87	8.94	12.16	12.74
4% treated	186.60	11.09	4.01	4.51

Table 2. Tensile strength of treated and non-treated natural fibers

Sr. No.	Fibre name	Tensile Strength(MPa)				Reference no.
		Non-Treated	alkali	saline	Alkali-saline	
1	ramie	59.5	66.8	59.3	64.2	17
2	jute	393	773	550	625	16
3	sisal	468	640	510	570	16
4	palf	413	1627	1120	1375	16
5	cotton	287	800	457	675	16
6	Industrial hemp	500	625	550	575	12.

Table 3. Elastic Modulus of treated and non-treated natural fibers

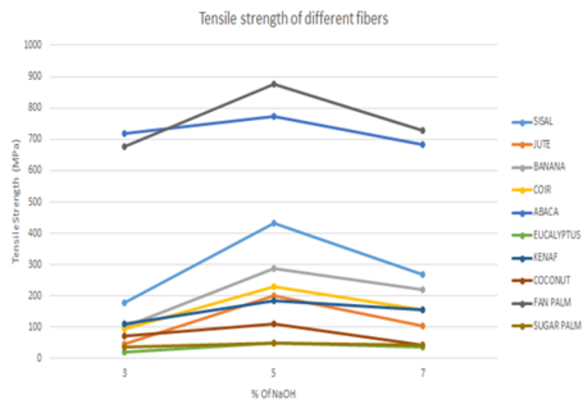
SR.NO.	Fiber name	Elastic modulus(GPa)				References
		Non treated	Alkali	Saline	Alkali-saline	
1	ramie	61.4	128	75.5	110	17
2	jute	13	26.5	18	23.5	16
3	sisal	9.4	22.0	15.4	19.5	16
4	palf	34.5	82.51	57.76	70.85	16
5	cotton	5.5	12.5	7.7	8.9	16
6	Industrial hemp	27.5	35	30	32.5	12.

III. Outcome

In this literature survey the outcome is to increase the tensile strength of the NFRP materials to do the chemical treatment on the natural fibers. Alkali treatment is very much safe and reliable treatment to be done on the fibers. There is a table which show this.

Table 4. Tensile strength of the material after alkali treatment

Name of the Author	Name of the fiber	% of NaOH			Tensile Strength (MPa)			Reference
Jai inderpritsingh	sisal	3%	5%	7%	179	432	269	6
Satish kumar	jute	3%	5%	7%	48	200	105	4
Kapil Jangid	banana	3%	5%	7%	102	288	219	6
Libo Yan	coir	3%	5%	7%	95	202	157	3
Ming cai	abaca	3%	5%	7%	717	773	682	10
Luisa granda	eucalyptus	3%	5%	7%	21.28	49.69	35.75	11
K.veenkata	kenaf	3%	5%	7%	110	185	155	8
Jose de silva	coconut	3%	5%	7%	72	110	42	7
Hendri Hestiawan, Jamasri & Kusmono	Fan Palm	3%	5%	7%	816	990	790	2
D. bochitar	Sugar palm	3%	5%	7%	37.56	49.88	41.88	9



IV. Fig.4 graph of tensile strength of natural fiber Conclusion

The following significant outcomes are concluded below.

- Natural fibers have relatively low strength. To increase the strength of natural fiber, treatment is the best option.
- Alkali treatment is good because there is a lesser chance to harm the material.
- In alkali treatment: the solution with 5% NaOH gives the best results in the terms of tensile strength.

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