Herbal Extract of Neem (Azadirachta indica) for Functionality of Antimicrobial and UV-Protection on cotton and Bamboo

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ABSTRACT

The Comprehensive focus on plant Based extract in textile coating as textile finish. This study deals with extraction of Neem (Azadirachta indica) leaves using water and methanol. The Neem (Azadirachta indica) have been applied to cotton and as well as on Bamboo fabric in presence and absence of free formaldehyde crosslinking agent (Glyoxal) using Pad-Dry-Cure method. Antimicrobial properties of treated fabric have been improved which make it more important and inevitable finish for Garments. The Azadirachta indica treated fabric exhibited antimicrobial activity against both Gram negative and Gram Positive Bacteria. The Treated cotton and Bamboo fabric have shown an excellent antimicrobial activity. The sample were examined of cotton and Bamboo including, Colour Strength Value and also the treated fabric show very good results for UV protection. The novel feature of this study was the use of SEM and FT-IR spectroscopy to identify the major chemical groups in the extract as well as its attachment on cotton and bamboo.

Keywords: Azdirachta indica leaves, Ecofriendly antimicrobial finishing, Herbal extract, cotton and Bamboo fabric.

1. INTRODUCTION

Azadirachta indica commonly known as "Neem" belongs to Meliaceae botanical family and being abundantly available in nature. The principal constituents of these leave include protein (7.1%), carbohydrates (22.9%), minerals, calcium, phosphorus, vitamin C, carotene etc. An extract from the leaves can be prepared as an alcoholic tincture or as tea and this alcohol extract has a dark green colour. The chemical composition of the extract contains glutamic acid, tyrosine, aspartic acid, alanine, praline, glutamine and cystine like amino acids, and several fatty acids (dodecanoic, tetradecanoic, elcosanic, etc.). But physically the Azadirachta indica leaves have a pleasant odor and plant pigments like chlorophyll mainly responsible for green colour [1-3]. The Azadirachta indica extract is reportedly officious against a variety of skin diseases, septic sources and infected burns. The most important quality of these compounds is that they are less toxic to warm blooded animals like human. Thus, considering its less toxicity and effectiveness against microorganism, it is expected to be one of the safest and most effective colourant cum antimicrobial agent for textile [4-6].

Table 1: Various compounds from various parts of Neem plant and their biological activity[7]

Sr. No	Compounds	Source	Biological Activity
1	Nimbin	Seed oil	Spermicidal Antifungal, Antibacterial
2	Nimbidine	Seed Oil	Antipyretic, Antiarthritic,
3	Azadirachtin	Seed Oil	Antimalarial
4	Cyclic Tetra-sulphide	Leaf	Antifungal
5	Mahmoodin	Seed Oil	Antibacterial
6	Margolone	Bark	Antibacterial
7	Gallic acid and Catechin	Bark	Anti-inflammatory
8	PolysaccrideG1A, G1B	Bark	Antitumour

9	Nimbolide	Seed Oil	Antibacterial, Antimalarial
10	Gedunin	Seed Oil	Antimalarial, Antifungal
11	NB-2 Peptidoglucan	Bark	Immunomodulatory

In recent years, the growing demand for herbal products has led to the idea of developing healthcare textile products. The present examination aims at developing an eco-friendly antibacterial finishing agents from plant extracts. Some plants were identified, selective and screened for their antibacterial activities. Their extracts were applied to cotton fabric and bamboo fabric. Herbal extracts from chamomile leaf, green tea, and sage were selected for this study. The durability of finished cotton to several washing cycles have been studied. As known, herbal extracts shown a good antibacterial property but this property was decreased after washing [8].

The present work focused on prepared and evaluate the extract from Azadirachta indica, as natural antimicrobial textile finishes. These extracts included active ingredients they are rich and contribute to controlling a variety of different diseases, -infections and allergies- but only few studies have been explored for their antimicrobial activity on textile material. This research discusses the application of different plant extract herbs on the cotton fabric in absence or presence of eco-friendly crosslinking agent (glyoxal) to help fixed it on the fabric, which in turn increase durability of treated cotton fabric to the desired properties, via herbs treatment. Experimental Material The desized, scoured and bleached cotton fabric and bamboo fabric. The fabric was purified by scouring at 100 °C for 60 min. using a solution containing Na_2CO_3 (2g/l, wetting agent, 1%), then thoroughly washed with water and dried at ambient conditions. Glyoxal, Aluminuim Sulphate.

2. EXPERIMENTAL

2.1 Material

The desized, scoured and bleached cotton fabric and purchased from local market were used for the study. The fabric was purified by scouring at 100 ^{0}C for 60 min. using a solution containing Na_2CO_3 (2g/l, wetting agent, 1%), to remove dust particles and finishing chemicals, then all the fabric were neutralized, thoroughly washed with water and dried at ambient conditions.

2.2 Methods and procedures

2.2.1 Extraction of Azadirachta indica

Neem leaves Firstly Collected form the plant and washed with water. The leaves were dried at 60-80 ^{0}C for short time in laboratory oven, so that the volatile contents are not lost. Dried Leaves were converted to fine power by grinding.

Two extraction Techniques were used to extract from the Neem (Azadirachta indica) Powder.

1. Water Extraction: The 10gm dried neem were Soaking in required volume of 100ml water for overnight. This mixture is obtained Brown coloured solution are shown in figure 1 (a) and filtered through wattmam filter paper no.1. finally, the total volume of extract was increased to 100ml with distilled water. This solution was used as stock solution of 10:100 strength.

2. Methanolic Extraction: In the case of methanolic extraction 10 gm of obtained powder of dried Neem was extracted in 100 ml of methanol. The powder soaking in methanol was overnight, this mixture is obtained green coloured solution are shown in figure 1 (b) the extract was filtered through wattmen filter paper no.1. This extract was used as stock solution of 10:100 strength.

(a) Water Extraction (b) Methanolic Extraction

Figure 1: Neem Extraction Through Obtained Coloured

2.3 Cotton and Bamboo Fabric Treatment with Azadirachta indica

The cotton fabric was treated with the product of the two extract methods (aqueous or methanol extract method). This treatment was done in absence or presence of eco-friendly crosslinking agent. Firstly, the cotton fabric was treated with herbal extract by dip method. The fabric was immersed in the two extract herbs for 30 min and dried. Then the finished cotton fabric was subjected for the antimicrobial assessment. Secondly, the cotton fabric was treated with the two previous herbal extract in presence of ecofriendly crosslinking agent as follow: 2% of herbal extract was mixed with 6% of glyoxal as crosslinking agent and 4% aluminum sulphate $Al_2(SO_4)_3$ was added as a catalyst. Cotton fabric was padded dip and nip in the finishing formula and then the treated fabric was dried at 80°C for 5 min. and cured at 120 °C for 3 min.

Pad-dry-cure method: It is the most common method, before extrusion synthetic fibers the antimicrobial agent is incorporated in it. The simplest and oldest method applied by the pad-dry-cure method is the direct application but it isn't durable.

Cross-linking: Usage of cross-linkers to create covalent intermolecular bridges between polymer chains.

2.3.1 Optimization of bath pH

In order to optimize pH of the bath, Finishing was performed in absence with 10% (owf) finishing agent concentration by exhaust technique. glyoxal as crosslinking agent and aluminum sulphate ($Al_2\,so_4\,)_3$ was added as a catalyst. Fixation was carried out in laboratory constant temperature shaking water bath at 98±2 ^{0}C for 45 min. The final result in terms of higher colour strength value was selected as optimized pH of liquor.

2.3.2 Optimum temperature

To optimize the temperature for finishing bath, experiments were conducted at different temperature ranging from room temperature to boil i.e. 40 (R.T.), 60, and 80±2 °C At optimized pH. The dyebath contains 10 % (owf) extract and with liquor ratio of 50:1.

2.3.3 Optimum time

In order to optimize time for dyeing, three baths with optimized pH and temperature with same liquor ratio of 50:1 were prepared. The temperature of these baths was raised to optimized temperature, and kept for fixation for 30, 45, and 60 minutes respectively.

2.2.3 Washing cycle procedure

The antibacterial activity of the finished fabric was evaluated after subjected to several washed cycles. The finished fabrics were washed using non-ionic detergent 2% owf at 40 ^{0} C. keeping the material to liquor ratio at 1: 50 followed by rinsing washing and drying.

2.2.4 Characterization of treated fabric

Evaluation of Dyed Samples. The dyed samples were assessed for $L*$ $a*$ $b*$ colour coordinates and K/S values (illuminate D65/10^0 observer) on spectra scan 5100 (RT) spectrophotometer (Premier Colour scan Instrument). The antibacterial

activity was checked against both Gram positive bacteria and Gram negative bacteria according to Test Methods as per AATCC - 147 for E.Coli and Bacillus subtilis (Agar well diffusion method). Ultraviolet protection factor (UPF) optimum treated and untreated sample was analysed using UV-2000F instrument make lab sphere were used for this purpose in the UV wavelength range (290 to 400nm). The surface morphology of treated fabrics was established by using scanning electron microscope (SEM). IR spectra of untreated and treated fabric samples were structural analysis in Shimadzu FTIR 8300 infrared spectrometer.

3. RESULTS AND DISCUSSION

The Cotton and Bamboo fabric sample were prepared for dyeing then dyed with Reactive dye (Coracion Blue HERD) and then Finished with Natural Bioactive Agent choice. The dyed sample were subjected to finishing with natural bioactive agent Finishing Choice for work Neem (Azadirachta Indica). This finished samples were analysed to study the antimicrobial and UV-Protection Functionality. The results include the evaluation of various of functional properties including antimicrobial and UV-Protection with the help of various physical, analytical and structural analysis of the sample obtained using various variables.

3.1 Effect of Natural Bioactive Finishing Techniques on Colour Strength Value (K/S Values)

The Cotton and Bamboo being a Cellulosic material can be dyed with Coracion Blue HERD Reactive dye then finishing with natural finishing agent such as Neem (Azadirachta indica). The control sample is considered dyed fabric is considered before finishing. In the present study the cotton and bamboo on functional finishing through the colour strength and colour co-ordinate values is evaluated and mentioned in Tables 2. The kubelka and Munk derived an equation as follow K/S= (1-R) 2/ 2R Where K is absorption coefficient, S is Scattering Coefficient and R is Reflectance of sample. The colour strength measurement of colour strength sample was evaluated by a light reflectance technique using Spectrophotometer with computer colour matching system; Spectra Scan 5100 (RT) (Premier colour scan instrument), India. The colour co-ordinate in value (Lab value), 'L*' represents colour shade i.e., lower the value of 'L*', darker the sample and vice versa. Tone of any colour is specified by two components, namely, 'a*' and 'b*'. Negative values of 'a*' indicates that tone is on greener side and positive values will indicates tone on redder side. Whereas negative values of symbol 'b*' indicates bluer tone and positive values indicate yellower tone.

Table 2: Colour strength (K/S Values) and Colour co-ordinates of Neem (Azadirachta Indica) bioactive finishing on Cotton and bamboo

Sr. No	Sample code No.	Cotton				Bamboo			
		Colour strength (K/S Values)	**Colour co-ordinates**			**Colour strength (K/S Values)**	**Colour co-ordinates**		
			L*	**a***	**b***		**L***	**a***	**b***
1	Control	2.414	49.75	-8.56	-17.95	1.894	51.51	-7.60	-14.44
2	N.W 1	1.853	46.05	-9.83	-2.77	1.581	49.22	-12.57	3.77
3	N.W 2	1.681	46..34	-11.94	1.84	1.531	49.04	-13.51	6.50
4	N.W 3	1.971	45.95	-10.58	-0.84	1.575	49.35	-12.07	2.99
5	N.W 4	2.271	47.97	-13.71	1.11	1.603	49.31	-12.05	3.56
6	N.M 1	2.883	42.37	-6.47	13.34	3.230	43.91	-5.07	16.47
7	N.M 2	3.918	41.63	-4.73	15.28	5.230	43.76	-3.06	16.79
8	N.M 3	3.617	40.98	-4.68	13.63	4.361	42.85	-3.34	13.85
9	N.M 4	4.247	41.44	-4.47	14.67	5.754	43.99	-4.02	17.89

N.W- Neem water Extraction Treated sample, **N.M**- Neem Methanolic Extraction treated sample. Here is described to parameters of the Concentration, Time, Temperature in numbers. Were, **1-** 20% Conc., 60 min, 80 ^{0}C, **2-** 30% Conc., 30 min, 80 ^{0}C, **3-** 30% Conc., 60 min, R.T (35-40 ^{0}C), **4-** 30% Conc., 60min, 80 ^{0}C.

Observation of above table in clearly indicate that cotton and Bamboo fabric sample of Colour Strength value and Colour co-ordinates value of N. W Treatment in higher is N.W 4 at 30% Conc., 60min, 80 ^{0}C. and Lower colour strength at N.W 2 at

30% Conc., 30 min, 80 ^{0}C on both textile material. The control dyed fabric has colour strength value is higher than N.W 1, N.W 2, N.W 3 and N.W 4 on both Cotton and Bamboo fabric. and N.M treated cotton and bamboo has results are shown in table 18 in higher value is N.M. 4 at 30% Conc., 60 min, 80 ^{0}C. and lower at N.M 1 at 20% Conc., 60 min, 80 C. The Neem methanolic extract has colour strength value on cotton as well as bamboo fabric sample of N. M 1, N. M 2, N. M 3, and N. M 4 is higher than the control dyed textile material.

Application of function finishing on cotton and bamboo by natural bioactive agent is present in water as single molecules (ionized) as well as clusters of many molecules (aggregates). Aggregates are too large to enter the interior of fibres at a given temperature. Raising the temperature leads to the breaking down of aggregates. So, the number of single molecules existing in the solution increases. When a single molecule deliberate form the aggregates, which are, in turn, taken up by the fabric, resulting in a complete colour strength [9].

3.2 Qualitative Evaluation of the Anti-Bacterial Activity of the Cotton and Bamboo Fabric

The control sample is considered dyed fabric is considered before finishing. The sample after finishing with under different condition described is earlier. The cotton and bamboo fabric sample were Finishing with Natural Bioactive agent are Neem (Azadirachta Indica). The antibacterial activity of treated fabric was evaluated quantitatively by measuring the number of colonies of Bacillus subtilis (Gram-positive) and E. coli (Gram-negative) as per the test method discussed in the experimental section. Qualitative assessment of the antibacterial activity of the treated cotton and bamboo fabrics were carried out by Parallel Streak Method (AATCC 147).

The zone of inhibitions obtained in the different treatments was observed and illustrated in Table 3. The untreated sample of cotton and bamboo has no antimicrobial activity was found. Therefore, antimicrobial activity for the Neem treated crosslinking with Glyoxal used of concentration of 6 o.w.f (on the weight of the fabric), and aluminium sulphate ate concentration of 4 o.w.f are the optimum concentrations for both the cotton and bamboo fabrics used. About 30% natural bio active agent of neem leaves extract is optimum concentration for getting good antibacterial activity for both the cotton and bamboo fabrics.

Table 3: Effect of natural bioactive extracts of Neem (Azadirachta Indica) on cotton and bamboo the bacterial activities

Sr. No.	Sample code No.	Cotton		Bamboo	
		Zone of inhibition "W" (mm)		**Zone of inhibition "W" (mm)**	
		Bacillus (Gram Positive)	**E. coli (Gram negative)**	**Bacillus (Gram Positive)**	**E. coli (Gram negative)**
1	Control	-	-	-	-
2	N.W 1	28	21	26	23
3	N.W 2	30	22	24	24
4	N.W 3	30	21	26	21
5	N.W 4	32	23	27	25
6	N.M 1	29	24	26	21
7	N.M 2	30	22	27	21
8	N.M 3	23	21	29	22
9	N.M 4	32	25	35	24

There is a clear in observation table 3 and the figures 2 to zone of inhibition around the fabric finishing with Neem (Azadirachta indica) bioactive agent against both the test organisms in contrast with untreated fabric sample which allowed the growth of organism. The control cotton and bamboo fabric sample found to have no antibacterial activity with zero area. The methanolic extract of Neem (Azadirachta Indica) agent Against bacteria Bacillus (gram-positive), zone of inhibition increases from 29 to 32 mm on cotton and zone of inhibition increases from 26 to 35 mm on Bamboo with increase in concentration from 20 to 30%. Similarly, an increase from 24 to 25 mm on Cotton and increase from 21 to 24 mm on Bamboo fabric sample was observed against bacteria E. coli (gram-negative) under the same conditions.

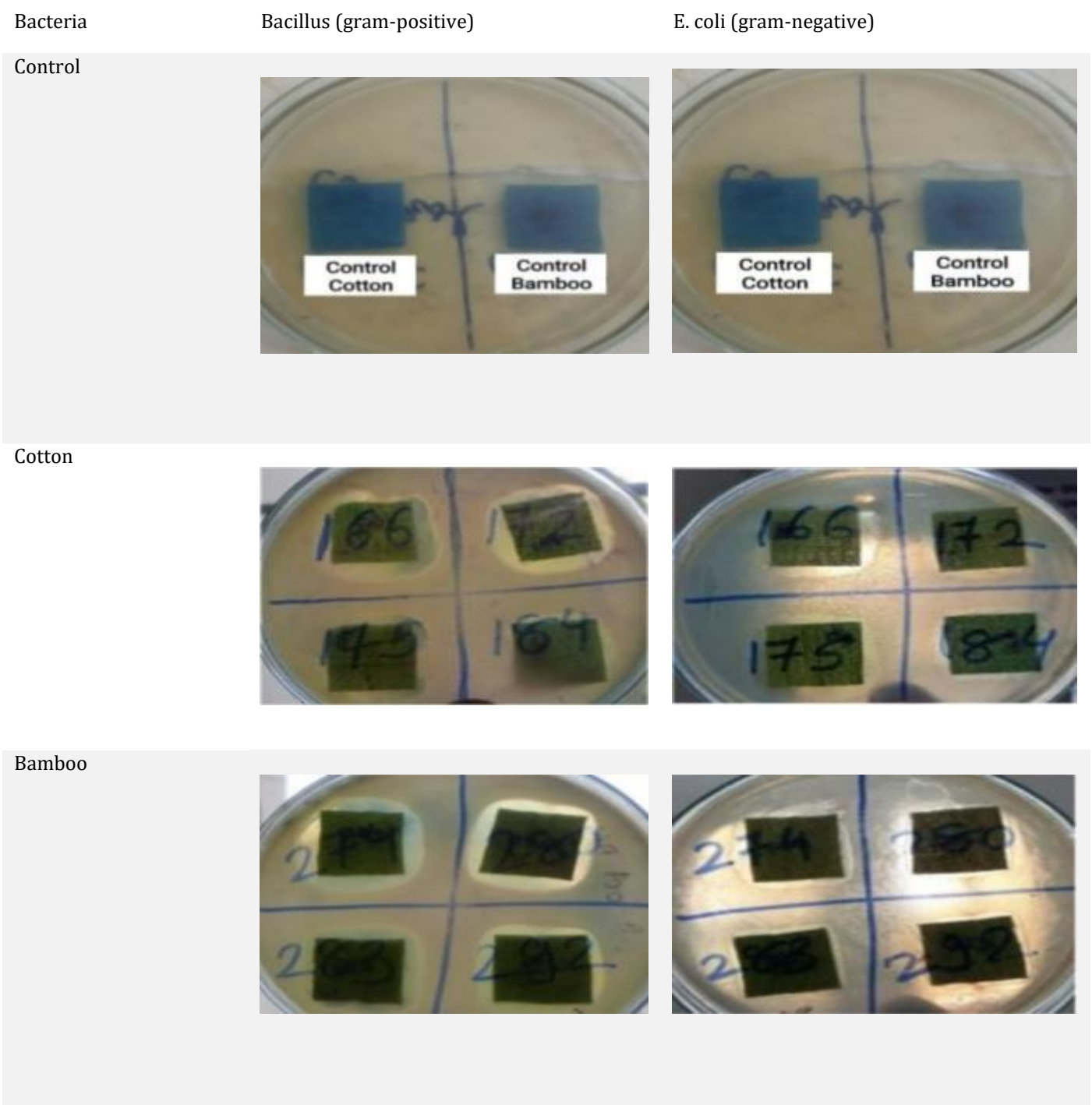


Figure 2: Evaluation of the Anti-Bacterial Activity of the sample finished with Neem (Azadirachta Indica) on cotton and bamboo

The cellulose fabrics of cotton and bamboo is actively involved in bond formation with the active ingredients of natural bioactive agent Neem extract. The active ingredients may be attached to cellulose by physical bonding and the crosslinking agent may act as a bridging material for chemical bond formation with the Neem limonoids. It is also possible that the Neem (Azadirachta indica) extract may be entrapped within the crosslinked molecular chains of the blend fabrics [10]. Antimicrobial activity, expressed as growth reduction of the microorganisms, the hydroxyl groups in neem Extract structure interfere with the bacteria. The increasing of concentration of neem extract shows more tendencies to deposit on the surface of the fibres resulting in hydroxyl groups more easily accessible to microorganisms [11]. Azadirachtin, a complex tetranortriterpenoid limonoid present in seeds, is the key constituent responsible for both antifeedant and toxic

effects in insects. Results that Alcohol extract of neem leaves to antibacterial activity against both gram negative and gram positive with greatest zones of inhibition at maximum concentration [12].

The given best results of water extract are N. W4 and methanolic Extract are N. M4 of the Natural bioactive agent is Neem (Azadirachta indica) on cotton and bamboo. Above the tables of 3 and the figures of 2, 3 and4 is conclude that when increase % of concentration, Time and temperature with increased zone inhibition in both Gram positive and Gram Negative on Cotton and Bamboo fabric. The given above best results parameter are 30% concentration, 60 min and 80 ^{0}C.

3.3 Ultraviolet (UV) protection

The ultraviolet protective factor (UPF) is a numerical value which represents the degree of protection against UV rays provided by clothing. It is defined as the ratio of the amount of time needed to produce damage on skin protected with a textile material to the amount of time needed to produce such damage on unprotected skin [13]. The UV blocking properties of textiles can be improved by the integration of metal particles, dyes, pigments or the application of a UV-absorbing finish to the fabric. UV Radiation is defined as that portion of the electromagnetic spectrum between x rays and visible light The ultraviolet radiation band consists of three regions: UV-A (320 to 400 nm), UV-B (290 to 320 nm), and UV-C (200 to 290 nm). UV-C is totally absorbed by the atmosphere and does not reach the earth. UV-A causes little visible reaction on the skin but has been shown to decrease the immunological response of skin cells. UV-B is most responsible for the development of skin cancers. The UV radiation transmission, absorption and reflection are responsible for the UV protection ability of a fabric [14, 15].

Ultra Violet Protection Factor (UPF) is measured on natural Bioactive finishing sample using standard method EN ISO 13758-1:2002 by lab sphere UV-2000F Ultra transmittance analyser. The natural Bioactive agent is used as UV blocking agent because of its non-toxic, chemical and thermal stabilities and durability. Even though they are efficient in the UV region, there is a possibility of decline mechanical properties of the textile materials. The results are as follow tables 4.

Table 4: Blocking Percentage of Cotton and Bamboo Fabric Sample

Sr. No.	Sample code No.	UVA blocking %	UVB blocking %	MEAN UPF	Calculated UPF rating	Protection Category
1	Control Cotton	24	18.8	10.08	4.2	No Protection
2	Control Bamboo	47.13	44.75	42.40	24	Good Protection
3	N. M Cotton	70.249	69.243	65.32	30	Very good Protection
4	N. M Bamboo	78.554	74.586	70.67	40	Excellent Protection

Observation of table 4 it is clearly that all treatment which describe above restricts the UV Blocking in the region between 260 nm to 440 nm in all the fabric. The UPF is strongly dependent on the chemical structure and other additives present in the fiber. A high correlation exists between the UPF and the fabric porosity but it is also influenced by the type of the fibers.

Table 4 indicate the effect of light exposure on UPF values, percentage UV Blocking for control and methanolic extract natural bioactive agent through finished treated cotton and Bamboo fabric sample. The calculated UPF value of Control cotton fabric 4.2 so, it is not protection against UV-Radiation. The UPF of methanolic extract through finishing Cotton fabric sample varies from the Neem methanolic extract N.M has UPF rating about 30. The calculated UPF value of Control bamboo fabric 24 so, it is good protection against UV-Radiation. The UPF of methanolic extract through finishing bamboo fabric sample varies from the Neem methanolic extract N.M has UPF rating about 40.

3.4 Structural Analysis

3.4.1 Scanning Electron Microscopy Analysis

A scanning electron microscope HITACHI SU1510 SEM, was used to characterize the surface morphology of the fabric samples. Scanning electron micrographs of untreated fabric and cotton and bamboo treated fabric with the natural bioactive methanolic extract are shown in Tables 5 and 6. It is clear that the dip sample, either treated with the extract

herbs alone or in presence of crosslinking agent samples are bonded well to the fabric surface. Image of fabric surface of various samples was taken on Scanning electron microscope views as follows 2 mm, 1mm, 500 um.

Surface morphology of various samples was compared at same microscope view range of 500 um in Tables 5 and 6. SEM image of cotton (C) and bamboo (C) fabric sample indicates the No deposition and it can be observed that the surface of the fabric appears to be smooth. SEM image appearance of treated with Neem (Azadirachta Indica) methanolic extract has shown deposition on cotton and Bamboo Fabric. The size of granules vary form 0.3 um to 0.8 um. This could be a deposit of natural bioactive extract on the surface of fibre. The similarly clear surface is observed in a sample treated with microwave higher Deposition shown at 500 um of Tables 5 and 6 in N.M (F) of the SEM photographs of cotton and bamboo fabric treated with pad-dry-cured method. It is clear from the photograph that methanolic extract produced are of round ribbon shape with a fairly uniform size distribution. It is clear that the natural bioactive agent of Neem (Azadirachta Indica) methanolic extract agent are firmly fixed on the fibre assembly of the fabric.

Table 5: SEM image of Cotton fabric sample at Different microscope view Range

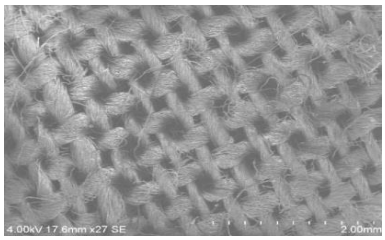
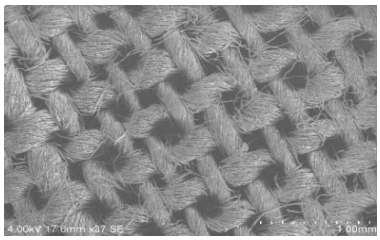
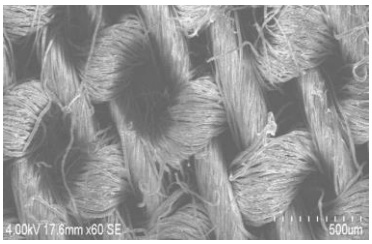
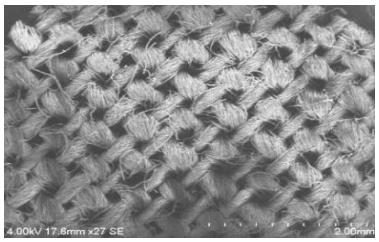
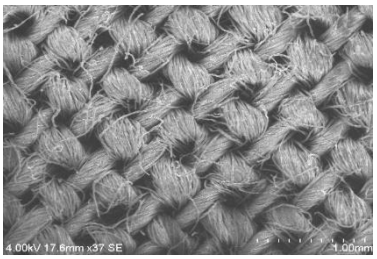
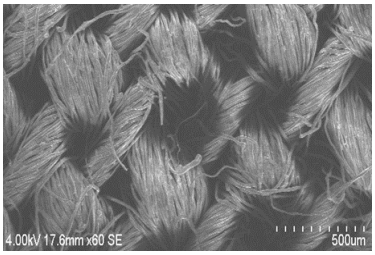
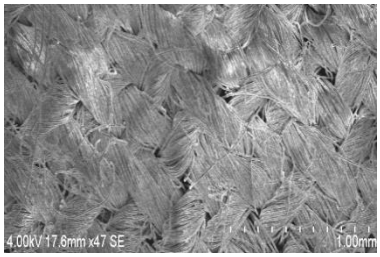
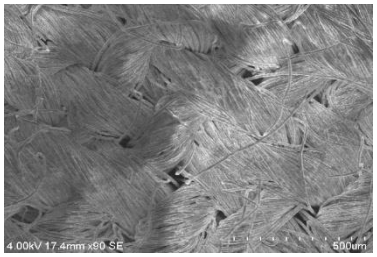
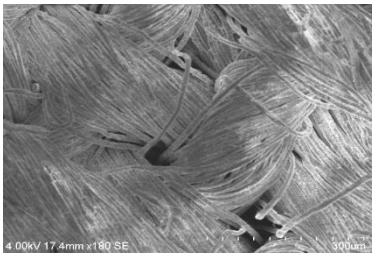
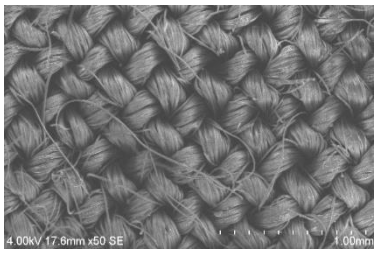
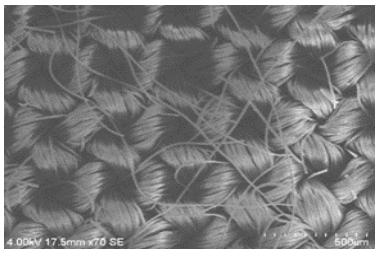
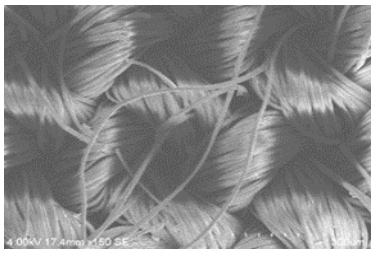
Sample code	2 mm	1 mm	500 um
Cotton Untreated Fabric	 **(A)**	 **(B)**	 **(C)**
N. M	 **(D)**	 **(E)**	 **(F)**

Table 6: SEM image of Bamboo fabric sample at Different microscope view Range

Sample code	2 mm	1 mm	500 um
Bamboo Untreated Fabric	 **(A)**	 **(B)**	 **(C)**

N. M	 **(D)**	 **(E)**	 **(F)**

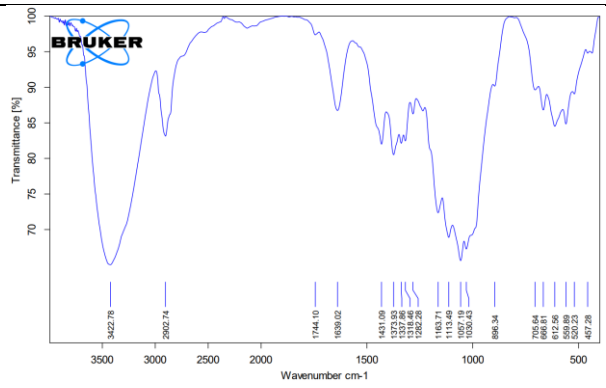
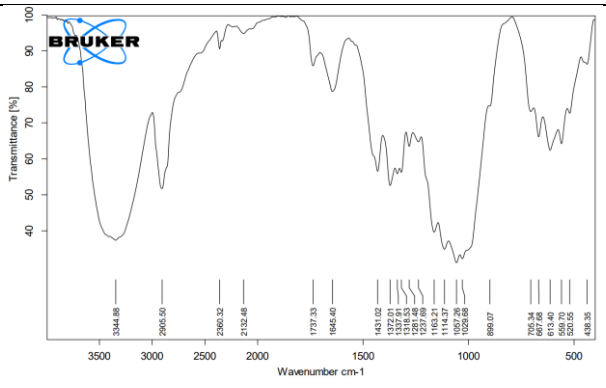
3.4.2 Fourier Transform Infra- Red (FTIR) Analysis

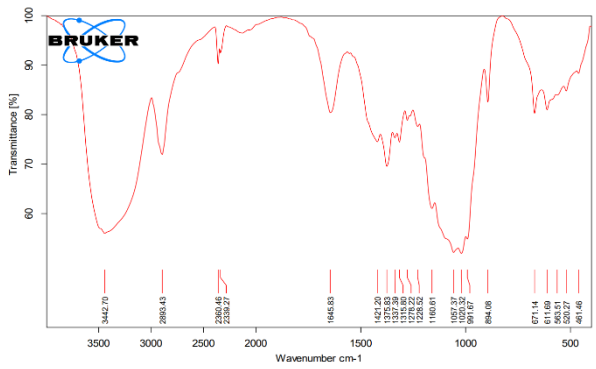
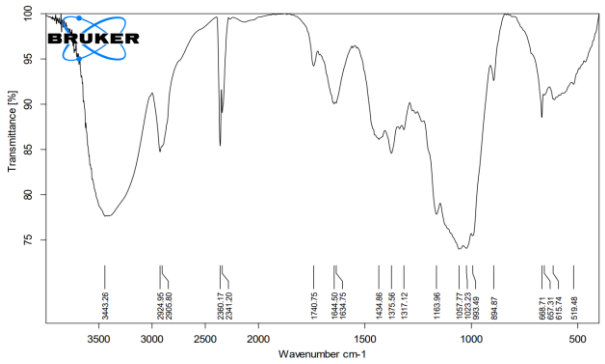
The Infra-Red (IR) spectra of selected sample (untreated and treated) were recorded on single beam Shimadzu FTIR 8300 Spectrometer using a resolution of 4 cm. A potassium bromide (KBr) pellet technique was employed. The sample was ground with KBr for 15 min in order to obtained finely dispersed mixture. IR Spectroscopy of various Treatment on Cotton and Bamboo samples

1. Neem Water Extract (N.W)
2. Neem Methanolic Extract (N.M)

Was carried out in region of 3500 cm-1 to 500 cm-1 and the spectra are shown in Table 7. It is well known that the IR absorption gives information about atomic vibration frequencies and is closely related to type of chemical bonds present. Cotton contains cellulose, pectin, and waxes. Cellulose and pectins are carbohydrate polymers. Bamboo contains hemicellulose, pectin, lignin, etc. in various compositions along with cellulose.

Table 7: FTIR analysis of Treated with Neem (Azadirachta Indica) of Cotton and Bamboo

Sample	Water Extract of Neem (Azadirachta Indica)	Methanolic Extract of Neem (Azadirachta Indica)
Cotton		

Bamboo		

Form above observation table 7 of change in intensity and position of various picks in different sample we can say that the change in a pick corresponding to a particular component indicates the change in composition of the particular component. So, compared to untreated fabric the position of picks in conventionally as well as treated sample indicates. This was confirmed from the FTIR spectrum in the frequency range 3500-500 cm^{-1} as shown in above Figure Summarises the general band assignment for fibre under the study on the basic of earlier studies, which confirmed that the OH group were all Hydrogen bonded in the Cellulose. The intensities and value of IR peaks at different stage indicate that absence and reductions of these components in the treated bamboo fibre.

The strong absorption band was seen near at 3416.42 cm^{-1}, indicate stretching of -NH stretch of amino groups –OH group mainly from phenolic groups. The peaks at 2900.69 cm^{-1} are due to the C-H stretching of alkanes compounds. The absorption peaks near at 2232.94 and 2133.95 cm^{-1} C≡N stretching of nitriles and –C≡C– stretching of alkynes. The absorption band nearer to 1643.91 cm^{-1} is indicates the presence of -C=O and -C=C- stretch respectively of aromatic rings. The absorption band near at 1430.04 cm^{-1} is C–H bend of alkanes. The FT-IR peak near at 1235 cm^{-1} indicated about C-N stretching. Weak adsorption band nearer to 1,000 cm^{-1} indicates presence of ether linkages. The Bamboo fabric treated with Neem (Azadirachta indica) methanolic extract show the peak of 1736.69 cm^{-1} C=O stretching of esters, saturated aliphatic.

3. CONCLUSIONS

The essential aim of the present study was the exploration of anti-microbial and UV-Protection properties of Neem (Azadirachta indica) extracts on cotton and Bamboo fabric, advent a new technology in consumer needs. The net results of this study were showed that the specimens treated with the extract in presence and absence of crosslinking agent have excellent disinfection properties. The Neem (Azadirachta indica) of Natural bioactive extract finishing of three different Parameters are concentration, Time and Temperature is increased, when the colour strength (K/S Value) is also increased on cotton and Bamboo. The water and methanolic extract finished at parameter of 30% conc., 60 min, and 80 ^{0}C is gives better results than all others are obtained it on both cotton as well as Bamboo material. The cotton and bamboo, the given result of Bacillus (Gram Positive) zone inhibition is better than that E. coli (Gram negative). It means that bacterial species belong to gram positive has high rate of inhibiting growth as compared to the gram negative. The conclude that when increase percentage (%) of concentration, Time and temperature with increased zone inhibition in both Gram positive and Gram Negative on Cotton and Bamboo fabric. the durability of the treated fabric to antimicrobial property good after 5 washing cyclic. The dyed bamboo fabric treated with Neem (Azadirachta Indica) methanolic Extract gives protection against UV Radiation in Excellent category. And the dyed cotton fabric treated with Neem methanolic Extract gives protection against UV radiation in very good category. The Changes take placed at micro level as a result of conventional as well as functional finishing processing were analysed through Scanning Electron Microscopy, Infra-red Spectroscopy. Cotton and Bamboo treated with Neem (Azadirachta Indica) were images of microscopic view at 500 um of the SEM photographs conclude that methanolic extract produced are of round ribbon shape with a fairly uniform size distribution. FTIR analysis investigated the presence of mainly compounds in Neem (Azadirachta Indica) extract which is known to have Antibacterial and UV-protection properties giving on Cotton and Bamboo Material. The natural bioactive agent treated on cotton and bamboo fabric at different parameter. The study of this research we conclude that increased about 30% concentration, 60 min time and 80 0C temperature is given best results of Antibacterial and UV protection.

4. REFERENCES

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