IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.105 ⁜ Vol. 9, Issue 9, September 2022

DOI: 10.17148/IARJSET.2022.9918

Ecofriendly Uses of Aloe Vera on Cotton and Silk Fabric

Md. Ashadur Rahman[1], Shahnaouaz Ahmed[2]

Pabna Textile Engineering College, Dhaka, Bangladesh[1,2]

Sterling Creations Ltd, Bangladesh[2]

Asadullah2015@gmail.com[1]

Shah.naouaz@gmail.com[2]

Abstract: In the current state of environmental awareness, new quality criteria stress not only the intrinsic usefulness and lifespan of the product, but also an environmental friendly manufacturing method. As a result, global interest is being generated in research on eco-friendly antimicrobial compounds based on natural materials such as Avera for textile applications. This research presents a detailed evaluation of the activity of antimicrobial characteristics of aloe vera on cotton and silk fabric, as well as its physical and chemical effect, whiteness index, and fabric zone of inhibition. The mechanism of antibacterial activity of several kinds of active components identified in natural product extracts has been addressed. The key constraints and future prospects of Avera for textile applications have also been thoroughly examined.

Keywords: Ecofriendly antimicrobial activity, aloe Vera, inhibition zone, physical effects, cotton & silk fabric.

I. INTRODUCTION

Last year, research was undertaken on emerging new technologies to provide better antibacterial activity in textiles by employing various synthetic antimicrobial agents such as triclosan, metals and their salts, organometallics, phenols, and quaternary ammonium compounds (Windler et al 03) Although synthetic antimicrobial compounds are particularly efficient against a wide range of bacteria and have a long lasting impact on textiles, they are a source of concern due to the related side effects and environmental issues such as water pollution.

As a result, there is a need and demand for antimicrobial textiles based on environmentally friendly agents such as aloe vera, which not only serve to reduce the negative effects of microbial development on textile materials but also meet with the legislative standards set by regulatory bodies. There are several natural solutions with active antimicrobial components available, with plant-based treatments covering a wide range of applications (Joshi et al 2009).

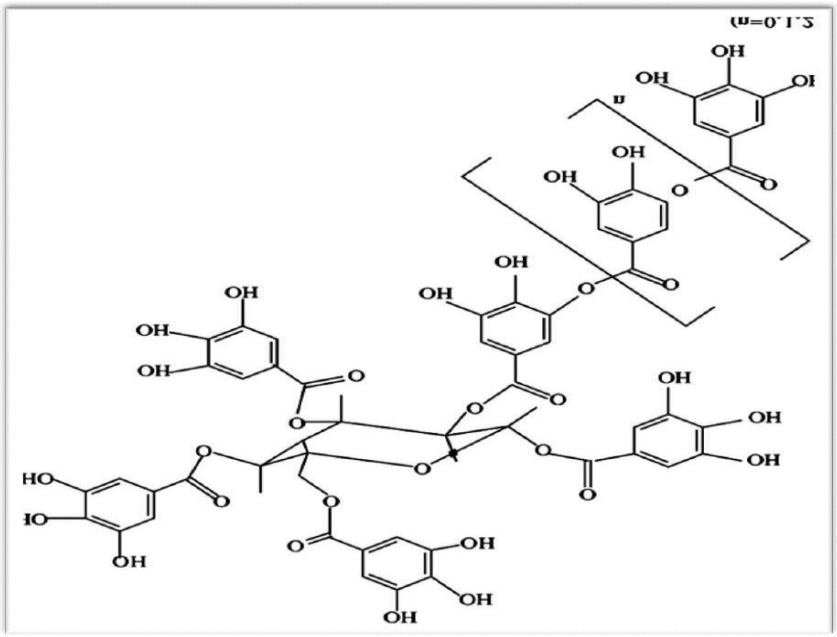

Fig1. Chemical structure of tannin

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.105 ⁜ Vol. 9, Issue 9, September 2022

DOI: 10.17148/IARJSET.2022.9918

antimicrobial coatings derived from natural sources are now popular, and they encourage a natural and eco-friendly lifestyle. Recent investigations on the action of Aloe Vera Burm.f.

(naturally occurring biopolymer) have opened up new paths in this field of study, and researchers are attempting to stay up by generating more and more effective solutions against microbios.

Microorganisms may grow swiftly when fundamental requirements are satisfied and can be found practically anywhere in the environment.

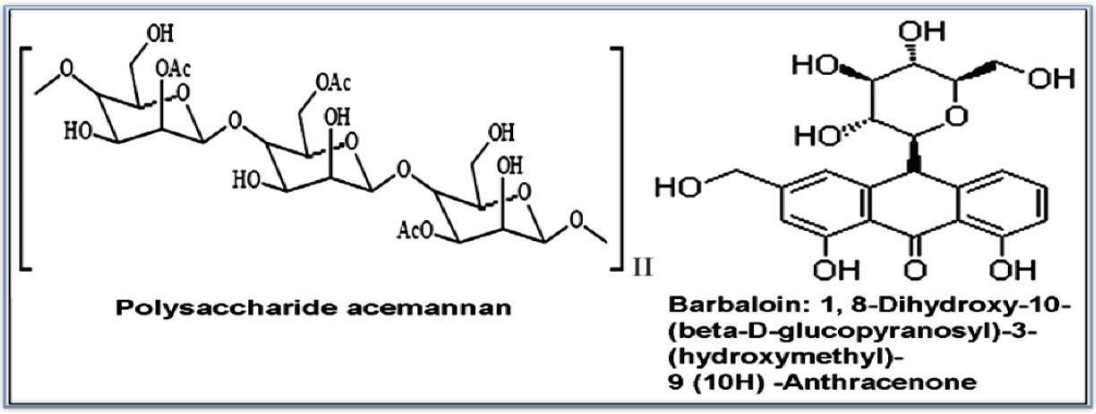

Fig2. Components in Aloevera gel responsible for antimicrobial activity

Because of their high hydrophobicity, synthetic fibers are more resistant to microbial assaults than natural fibers. Under certain situations, proteins in keratinous fibers and carbohydrates in cotton can serve as nutrition and energy sources. Microorganisms can get nutrients from soil, dust solutes from perspiration, and certain textile finishes.

For these reasons, it is particularly desired to limit the growth of germs on textiles during usage and storage. The need for sanitary clothes and active wear among consumers has generated a sizable market for antimicrobial textile products. Antimicrobial textile manufacturing in Western Europe was estimated to be 30,000 tons in 2000, with a global production of 10,000 tons. Furthermore, it was predicted that manufacturing in Western Europe expanded by more than 15% per year between 2001 and 2005, making it one of the fastest expanding segments of the textile industry. In order to obtain the best profit, an optimum treatment of textile cotton items should be used.

Aloe vera (Aloe barbadensis, Miller) of the Liliaceae family is known as the "Lily of the Desert." For almost 2000 years, it has been utilized in skin care products. Scientific study has revealed that the aloe vera leaf contains about 75 nutrients and 200 active components, including 20 minerals, 18 amino acids, and 12 vitamins. These rich ingredients offer aloe vera gel particular qualities as a skin care treatment.

Aloe vera also has antifungal and antibacterial properties that can be used in medical and textile applications such as wound dressing, sutures, bioactive textiles, and so on. Aloe vera contains a variety of polysaccharides, including glucomannan, galactogalacturan, glucogalctomannan, and acetylated mannan or acemannan.

Several techniques have been used to demonstrate the antibacterial activity of Aole vera inner gel against both gram-positive and gram-negative microorganisms. Acemannan is a long chain polymer composed of randomly acetylated linear D-mannopyranosyl units that exhibits immunomodulation, antibacterial, antifungal, and anticancer characteristics as shown in Figure 1. (17).

Many studies have identified partly acetylated mannan (or acemannan) as the major polysaccharide in the gel, whereas others have discovered pectic mannan as the main polysaccharide (18,19). The acemannan found in aloe vera is structurally different, making it a distinguishing chemical of aloe species in comparison to other well-known plant mannans that contain distinct side-chains or are un-acetylated and insoluble in water (20).

Wiyong et al. (6) investigated the antimicrobial activity of apatite-coated titanium dioxide (TiO2) against bacteria in their recent study. They proposed that the presence of apatite-coated TiO2 indicates textile applications with antimicrobial activity Mahesh and colleagues concentrated on plant-based natural dyes and other bioactive active natural extracts in textile coating as the antimicrobial textile finish has gained popularity (7).

Kedarnath and others investigated aloe vera extract's antibacterial properties against harmful microorganisms (9). Methanol extract had the greatest inhibitory efficacy against E.coli and Candida (9). By fatemeh, phytochemical contents, antioxidant capabilities, and antibacterial activities of aloe vera lyophilized leaf gel (LGE) and 95% ethanol leaf gel

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.105 ⁜ Vol. 9, Issue 9, September 2022

DOI: 10.17148/IARJSET.2022.9918

extracts were identified, quantified, and compared. (10). So far, no previous studies have addressed the current research features of aloe vera gel and its application to textile materials for both antibacterial and softness qualities. The present publication examines the antibacterial, physicochemical, and softness qualities of a natural plant aloe vera extract applied to pure cotton fabric.

II. MATERIALS

This research used a plain weave (1/1) 100% cotton fabric with a weight of 126.2 GSM, 115 ends/inch, and 90 picks/inch, with a warp and weft count of 40 Ne.
[

III. METHODS

This experiment on cotton cloth uses the pad dry cure process.

IV. APPLICATION METHOD

The aloe vera extract finish was applied as follows: pad>Dry>Curing. First, 15 x 15 inch samples were cut in accordance with the processing parameters of the lab stenter accessible in the wet processing lab, as well as the dimensional requirements for the tensile and tear test instruments (warp and weft wise). The second stage was to prepare the recipe in accordance with the experiment design. Each sample received 400 ml of liquor. The finish was then applied by padding and dried at 100°C, 120°C, and 140°C for aloe vera extract finish and antibacterial finish, respectively. The outcomes of sample application testing were examined.

V. TESTING ASSESSMENTS
ANTIMICROBIAL TESTING

The parallel streak technique AATCC-147-1998) was used to estimate the inhibition zone of established culture to visualize the antibacterial activity of aloe vera leaf gel extract placed on cotton fabric.

VI. CO-EFFICIENT OF FRICTION TESTING

The coefficient of friction technique developed by ASTMD 1894 measures how readily two surfaces in contact may glide past one another. The coefficient of friction is connected to static and dynamic quantities.

VII. BENDING TESTER

The bending test ASTMD 1388 standard procedure by using Gretagmacbeth Color Eye 7000, testing was conducted.

VIII. ANTIMICROBIAL ACTIVITY OF ALOE VERA ON COTTON AND SILK

Antimicrobial activity of A.vera completed cotton fabric was next assessed by the parallel approach against both gram positive (S. aureus) and negagive (E. coli) bacteria, according to S. Wazed Ali et al. It was observed that, no visible growth of bacteria (w/v) Aloe vera concentration on the cotton fabric treated with S. aureus and E. coli. Additionally, using the dynamic shake flask technique (AATCC-100-1999), the antibacterial activity of the treated samples at various concentrations of A. vera (1,3,5, and 7% w/v) was quantitatively assessed against both gram-positive and gram-negative bacteria (3).

More than 90% of bacteria were reduced by the treated cotton fabric's antimicrobial activity, which rose by 3% when A.Vera was added. When A.Vera concentration was increased to 7%, the rate of bacteria reduction increased to 99%. Additionally, it was shown that only fabrics treated with BTCA had bacterial retention of around 70%

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.105 ⁜ Vol. 9, Issue 9, September 2022

DOI: 10.17148/IARJSET.2022.9918

Samples cotton	Bacteria Tested			
	Staphylococcus aureus		Escherichia coli	
	Colony-forming Unit(CFU/ml)	Antimicrobial Activity (%)	Colony-forming Unit (CFU/ml)	Antimicrobial Activity (%)
Original(control)	$209x10^6$	-	$190x10^6$	-
BTCA Cross-linked(contrl)	$155x10^6$	26	$139x10^6$	27
Aloe vera(1 %) treated with BTCA	$86x10^6$	59	$61x10^6$	68
Aloe vera(3 %) treated with BTCA	$17x10^6$	92	$17x10^6$	91
Aloe vera(5%) treated with BTCA	$3x10^6$	98.5	$4x10^6$	98
Aloe vera(7%) treated with BTCA	$1x10^6$	99.5	$1x10^6$	99

Table 1: Antibacterial activity of aloe vera –treated washed cotton fabric

V Krishnaveni et al observed that, the treated with 40% gel concentration showed higher zone of inhibition of about 29 mm and 23 mm when compared to 20% gel treated (19 mm and 17 mm) and untrated samples.
The zone results indicate that 40% gel treated fabric do not support the bacterial growth to larger extent against Staphylococcus aureus and Escheria coli where as 20% gel treated fabric shows smaller extent compared to untreated samples (10).

It can be seen from the test results , proved that the phenolic groups ,amino groups and aloin compounds presents in aloe gel are responsible for its excellent antimicrobial activity fig.1 & fig.2, table 2

.

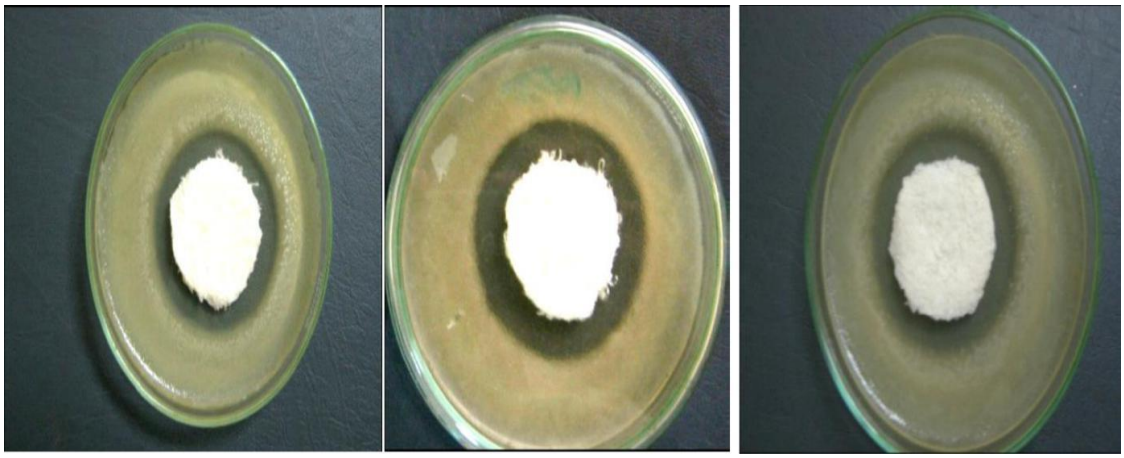

Fig3: Zone of inhibition against E. coli of samples A-10, N-10 and HCAN-10

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.105 ⁜ Vol. 9, Issue 9, September 2022

DOI: 10.17148/IARJSET.2022.9918

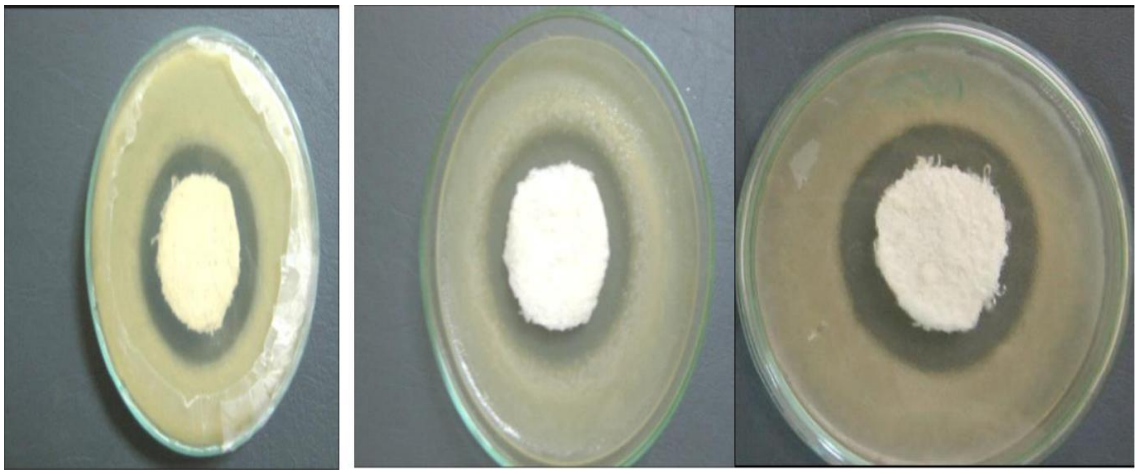

Fig4. Zone of inhibition against S. aureus of samples A-10, N-10 and HCAN-10

Samples cotton	Antimicrobial Activity of staphylococcus aureus	Antimicrobial Activity of gram positive bacteria Escheria coli.
Untreated Fabric	0	0
Aloe Gel extract micro encapsulation finished fabric (20%)	19	17
Aloe Gel extract micro encapsulation on finished fabric (40%)	29	23

Table 2: Zone of inhibition of untreated and aloe gel treated samples

Besides, the treated fabric exhibited high antimicrobial property (84.11% an 77.57%) against staphylococcus aureus when compared the E.Coli bacteria (72.81% and 66.02%) in 40% and 20% concentrations.
This is because the antimicrobial agents attached to the substrate through bond formation and as, the A.vera concentration increases, the percentage of bacterial reduction also increases on table3.

Samples cotton	Antibaterial Activity(OD at 600 nm)			
	Staphylococcus aureus positive bacteria		Escheria coli. negative bacteria	
	Absorbance(OD) Value	Reduction(%)	Absorbance(OD) Value	Reduction(%)
Untreated Fabric	1.07	0	1.03	0
Aloe Gel micro encapsulation on finished fabric (20%)	.28	72.81	.35	66.02
Aloe Gel micro encapsulation on finished fabric (40%)	.17	84.11	.24	77.57

Table3: Qualitive analysis of anti-microbial activity of untreated and aloe gel micro treated samples

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.105 ⁜ Vol. 9, Issue 9, September 2022

DOI: 10.17148/IARJSET.2022.9918

Yunhui Xu et al, The modified fabric contained 11.56% aloe anthraquinone had the good antibacterial property as compared to the control sample, the bacterial inhibition ratios of the modified fabric to E.Coli and S.aureus were all up to 91% (9).

But the bacterial inhibition yield to C.albicans was lower and only 69%. These reasons were that aloe anthraquinone has a cationic residue, which may adsorb bacterial cell wall with anions and crack peptide polysaccharide to kill bacteria. However, the fungi cell wall consist of amylase , which is different from bacteria , so resulted in a low inhibition ratio for C.albicans on table 4.

Samples	E.coli(%)	S.aureus(%)	C.albicans(%)
Original cotton fabric	44.58	41.29	31.62
Modifie cotton Fabric	91.06	93.75	69.82

Table 4: Anti-Bacterial activity of Aloe Anthraquinone modified cotton fabric.

Untreated silk cloth exhibited no decrease in the amount of bacteria, indicating that it is not antimicrobial, according to Nadiger and Shukla et al. As a biocide, aloe vera finished silk fabric with a 15% concentration, on the other hand, demonstrated good antibacterial characteristics. The treated fabric at 4,5 and 6% BTCA and 10, 15, and 20% aloe vera display great antibacterial activity; also, silk fabric treated with 100, 150, and 200 ppm silver nanoparticle exhibited outstanding antimicrobial property (16).

IX. FTIR AND X-RAY DIFFRACTION ANALYSIS FOR SILK FABRIC.

FTIR analysis was done using FTIR Spectrophotometer model-ABB Bomen instrument Canada MB 3000. The untreated and treated silk fabric samples were cut and sieved into fine powder and dried at 100 °C for 2 h. Two milligram of dried sample powder was dispersed in 198 mg of spectroscopic grade dried KBr and made into pellet (Bhat & Nadiger, 1980).

The KBr pellet was used for recording the transmission FTIR spectra. X-Ray diffractograms (XRD) of untreated and treated silk fabric samples were recorded using X' Pert PRO MPD X-ray. Diffractometer supplied by M/S PANalytical BV, The Netherlands. Silk fibres were cut into fine powder with the help of a Wiley Mill. Finely powdered sample was made into a rectangular pellet and mounted onto a rectangular sample holder using back loading method.The Cu Kα X-rays were generated using 40 kV at 30 mA on copper target. XRD scans thus obtained were analysed using X'Pert High Score X-Ray diffraction analysis software. Order factor which is directly related to the degree of crystallinity was estimated as per procedure reported (Bhat & Nadiger, 1980).

X. WASHING DURABILITY

The antimicrobial activity was retained by more 70% for up to five machine washes and more than 50% even after eight machine washes.
In other words, the covalent bonds that contains -OH formed during cross-linking of BTCA were deteriorated and loosen its structures for several washes (S Wazed Ali et al) on table 5.

	Washing cycle	Avg. dry CRA $(W+F)^0$	CV% of CRA
Untreated cotton	----	150	0.69
BTCA-treated cotton	Unwashed	248	0.56
	1 washes	242	0.40
	5 washes	241	0.65
	8 washes	240	0.71
	10 washes	218	0.48

Table5: Washing Durability 0f carboxylic acid treated cotton

Similar results were obtained when cotton fabric was finished with neem extract along with a glyoxal/ glycol cross-linking agent. The CRA as well as antimicrobial activity of the finished fabric decreases with repeated laundering (Purwar et al. 2008). In each wash cycle the antibacterial activity decreases gradually and at the end of 20^{th} wash cycle the percentage reduction of bacterial value reaches to 14 and 8 in 40% and 20% concentration on table 6.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.105 ⁜ Vol. 9, Issue 9, September 2022

DOI: 10.17148/IARJSET.2022.9918

Sample cotton	Antibacterial activity (bacterial reduction% in against S.aureus	
	40% aloe gel treated sample	20% aloe gel treated sample
Before wash	81	70
After 5 wash	66	60
After 10 wash	53	43
After 12 wash	28	17
After 15 wash	18	12
After 20 wash	15	06

Table6: Washing Durability test for aloe gel micro treated samples

Nadigar and shukla et al, silk is by and large dyed with acid, basic, and reactive dyes. It is seen that the wash fastness of silk is vulnerable when the silk is dyed with acid or basic dyes due to acidic/basic properties of soaps/ detergents (97). Hence, the wet washing is not advisable for silk textiles dyed with acid dyes. Antimicrobial properties of the treated fabric were retained after 5 cycles of dry cleaning for 15 % Aloe-Vera finished fabric indicating thereby the treatment is durable on table 7.

SL NO	Sample	Washing cycles	% Reduction S. aureus	% Reduction K.penumoniae
01	5% Aloe-Vera treated	-	97	97
02	5% Aloe-Vera treated	1wash	95	90
03	5% Aloe-Vera treated	2wash	93	89
04	5% Aloe-Vera treated	3wash	89	82
05	5% Aloe-Vera treated	4wash	80	79
06	5% Aloe-Vera treated	5wash	60	64
07	10% Aloe-Vera treated	-	98	97
08	10% Aloe-Vera treated	1wash	92	92
09	10% Aloe-Vera treated	2wash	90	93
10	10% Aloe-Vera treated	3wash	90	90
11	10% Aloe-Vera treated	4wash	80	84
12	10% Aloe-Vera treated	5wash	83	80
13	15% Aloe-Vera treated	-	98	98
14	15% Aloe-Vera treated	1wash	98	96
15	15% Aloe-Vera treated	2wash	95	94
16	15% Aloe-Vera treated	3wash	95	93
17	15% Aloe-Vera treated	4wash	93	90
18	15% Aloe-Vera treated	5wash	92	90

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.105 ⁜ Vol. 9, Issue 9, September 2022

DOI: 10.17148/IARJSET.2022.9918

Table7: Antimicrobial properties and durability of different treated silk fabric

XI. PHYSICAL PROPERTIES OF A.VERA TREATED FABRIC

The A.vera finished fabric had a higher CRA (240), higher bending length (.80) and decrease in the whiteness index (35.08) compared to untreated fabric this was due to presence of BTCA and formation of alkene double bond on cotton fabric under high temperature. Thus flexibility of the fabric did not change too much even after the finishing treatment, although the tensile strength loss was 44% (S. Wazed aliet al) on table 08.

Sample	Avg. dry CRA (W +F)°	CV % of dry CRA	Avg. Bending Length(cm)	CV % of bending length	Avg. whiteness index—CIE	Tensile strength retention (%)
Untreated cotton	156	0.69	1.8	0.65	69.08	-
Aloe vera BTCA treated cotton (washed)	240	0.57	2.3	0.80	35.08	56

Table8: Physical properties of the finished cotton fabrics

The loss of strength was mainly due to the stiffening of the molecular backbone after cross linking formation (Yang et al 1997).

Such strength loss of carboxylic acid- treated cotton has also been attributed to acid- catalyzed deporization of cellulose molecules (kang et al 1998).

It is well known that silk fiber loses its strength by 30-40 % and becomes more ductile under wet condition. Hence poor dimensional stability will be persisting and any mechanical force applied on the fabric during Wet Washing can mechanically deform the fiber and can lead to Loss of wear and tear properties.

It may be seen that add-on% increased as the aloe vera concentration increased in the recipe, although not proportionately.

The moisture regain % decreases marginally with increases in A.vera concentration. It may be due to blocking of hydrophilic end groups because of crosslinking and chemical binding by BTCA interalia A.vera .

Overall decreases in flexural rigidity also indicate that the fabric has become more pliable as compared to the control. There was overall increase in loss due to abrasion which may be attribute to high add-on%, at higher concentration of aloe vera.

The crease recovery angle increased in both warp and weft directions due to the treatment. It is reported that the finishing in certain cases reduce the strength by about 20%. The loss of strength due to the treatment ranges from 12% to 18% and as such the observed loss in strength is well within the values acceptable in the industry (Nadiger and shuklaetal) on table 09.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.105 ⁜ Vol. 9, Issue 9, September 2022

DOI: 10.17148/IARJSET.2022.9918

Sample	Add-on (%)	Moisture regain (%)	Flexural rigidity (G)	Abrasion Resistance (%)	Crease recovery (o)	Breaking strength (N)	
						Warp	Weft
Control silk	0	9.64	93.7	6.5	193	668	445
5 % Aloe-Vera treated	5.2	8.03	24.5	6.03	207	623	347
10 % Aloe-Vera treated	6.5	7.86	29.6	6.9	211	615	391
15 % Aloe-Vera treated	7.2	7.8	31.9	7.8	212	565	389

Table09. Physical properties effect of finishing of silk on different physical parameters

XII. MEDICAL TEXTILES

The involving of the developed therapeutic clothes was evaluated by conducting Scored evaluation and clinical trial at Sri Nature Cure Centre by giving it to patients with atopic dermatitis. The patients were instructed to wear the Aloe gel curative garment next to the skin 10 hrs per day especially during the sleeping time to get better results. The patients were instructed to carry out the washing of curative garments with detergents and dry them in shade to retain the medicinal values.

The performance of the curative garments was evaluated once in every week and the clinical trials were conducted for 8 weeks duration. the clinical evaluation study result shows the lesser SCORAD index rating value in both 20% and 40% Aloe vera gel micro treated samples. After the wear study, the 40% Aloe vera gel micro treated cotton (T-Shirt and Pyjama) garments showed a maximum reduction value (35.25% & 41.34%) when Compared to untreated garment rating value (0).

After the wear study and clinical evaluation, the 20% and 40% Aloe vera gel micro treated garments showed better results in reducing the erythema in the form of percentage reduction of Scorad value. The higher percentage reduction value is exhibiting the higher curing and controlling property of atopic dermatitis on table10.

Aloe vera gel contains nutrients, vitamins and antioxidants and it possess wound healing, immune modulating, antifungal, antibacterial and antiseptic properties which can be exploited for medical textile applications such as wound dressing, suture and bioactive textiles

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.105 ⁜ Vol. 9, Issue 9, September 2022

DOI: 10.17148/IARJSET.2022.9918

Samples	SCORAD Rating (Before wear study)	Scorad Rating(After wear study)	% of erythema reduction
Untreated garment	31.18	31.18	0
20% Aloe gel micro treated T-shirt	31.18	24.04	22.89
40% Aloe gel micro treatedT-shirt	31.18	20.19	35.25
20% Aloe gel micro treated Pyjama	31.18	22.97	26.33
40% Aloe gel micro treated Pyjama	31.18	18.29	41.34

Table10: SCORAD rating value of developed garments before and after wear study

Disease	Curative garment	% of Improvement	Curative performance
Atopic dermatitis	20% Aloe gel micro treated T-shirt	**78**	Significant
	40% Aloe gel micro treated T-shirt	**92**	Significant
	20% Aloe gel micro treated Pyjama	**82**	Significant
	40% Aloe gel micro treated Pyjama	96	Significant

Table 11: Curative performance of herbal treated garments in clinical trials

XIII. CONCLUSION

Application of aloe vera an useful, environmental, biodegradable agent for imparting a enduring antimicrobial finish to cotton substrates and others textile products. A minimum of 3% (w/v) A.vera was fond to be effective for obtaining good antimicrobial efficiency against both gram-positive and gram – negative bacteria. FTIR spectra confirmed the attachment of active compounds of A.vera gel to the cotton structure via physical as well as chemical bonding. The active ingredients of A.vera gel acted as an effective bacterial agent against both gram-positive and gram-negative bacteria where the cytoplasmic substance leaked out because of corrosion of the bacterial cell wall. The antimicrobial activity of the A.vera finished cotton fabric was retained for up to eight machine washes. The treated fabric showed an improved CRA.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.105 ⁜ Vol. 9, Issue 9, September 2022

DOI: 10.17148/IARJSET.2022.9918

However, the tensile strength and whiteness index of the fabric had to be compromised compared to the unprocessed one to ripen this novel functionality for its implement as a health and hygiene product for a range of niche applications.

REFERENCES

[1] Agarry OO, Olaleye MT, Michael COB (2005) Comparative antimicrobial activities of aloe vera gel and leaf. Afr J Biotechnol 4(12): 1413-1414.
[2] Ammayappam L, Moses JJ (2009) study of antimicrobial activity of aloe Vera, chitosan and curcumin on cotton wool and rabbit hair. Fibers and polym 10(2): 161-166.
[3] Choi S, Chung MH (2003) A reviews on the relationship between aloe vera components and their biologic effects. Seminars integrative Medicine, 1, 53-62, Med 1(1); 53-62.
[4] Gupta D Laha A (2007) Antimicrobial activity of cotton fabric treated with quercus infectoria extract. Indian J Fiber Text Res 32 (1): 88-92.
[5] Joshi M, Ali SW, Rajendran S (2009) Antimicrobial finishing of textiles using bioactive agents based on natural products. Indian J Fibre Text res 34(9): 295-304.
[6] KingIs Yang CQ, wei W (1998) Mechanical Strength of durable press finished cotton fabrics, effects of acid degradation and crosslinking of cellulose by polycarboxylic acids. Tex Res J 68(11): 865-870.
[7] Ramachandra CT, Rao PS (2008) Processing of aloe vera leaf gel: a review. Am J Agric boil Sci 3(2): 502-510.
[8] Reynolds T, Dweck AG (1999) Aloe Vera gel leaf: a review update. J Ethnopharmacol
[9] Yunhui Xu, Yongjin Deng , Study on preparation and properties of cotton fabric modified by anthraquinone extract from aloe vera. Advanced Materials research Vols 287-290 (20110 pp 2705-2708.
[10] V Krishnaveni , B aparna ; Microencapsulation of copper enriched aloe gel curative garment for atopic dermatitis. Indian journal of Traditional knowledge, Vol 13(4), pp 795-803.
[11] Jothi D, experimental study on antimicrobial activity of cotton fabric treated with aloe gel extract from aloe vera plant for controlling the staphylococcus aureus , African J Microbial Res. 3 (5), (2003) pp 228- 232.
[12] Santhianarayan M P, Bhat N V, Kokate S S & Walunj V E, Antimicrobial Finish for cotton fabric from herbal products, indian J Fibre Textile Res 35(3) (2010), pp 50-51,
[13] American association of textile chemists and colorists (2011b), Antimicrobial finishes on Textile materials, assessment of; AATCC test method- 100-2004, 142-144.
[14] American association of textile chemists and colorists (2011a). Antimicrobial activity assessment of textile materials, Parallel streak method; AATCC test method-147-2004, 251-252.
[15] Ibrahim W,sarwar Z, Abid S, munir U and Azeem , Aloe vera leaf gel extract for antimicrobial of softness properties of cotton ,J textile Science Eng 2017, 7:301, DOI:10.4172/2165-8064.1000301,
[16] Nadiger and Shukla, Antimicrobial activity of aloe vera treated silk, Fiber and polymers, vol.16, No.5,1012-1019, DOI: 10.1007/s12221-015-1012-y.
[17] Ganesan P, Tamil Selvi C & Ramachandran T, Micro Encapsulation of copper enriched herbals for curative garments, Indian J Tradit Knowle,11(3)(2012) 532-536.
[18] Jothi D , Experimental study on antimicrobial activity of cotton fabric treated with aloe gel extract from aloe vera plant for controlling the staphylococcus aureus(bacterium), African J Microbiol Res, 3(5) (2003) 228-232.
[19] Klaus S, All round answer to problem microbes, Int Dyer, 6 (2001)17-19.
[20] Grindlay D & Reynolds T, The Aloe vera phenomenon: A review of the properties and modern uses of the leaf parenchyma gel, J Ethnopharmacol, 16(2-3) (1986) 117-151.
[21] Hirat T & Suga T, The Efficiency of aloe plants, chemical constituents and biological activities, J Cosmetics Toiletries, 98 (1983) 105-108.
[22] Rajasekaran S K, Sivagnanam K & Subramanian S, Mineral contents of Aloe vera leaf gel and their role on Streptozotocin induced diabetic rats, Biol Trace Element Res, 108(1-3) (2005)185-195.
[23] Dinesh K R S, Swapnil R, Arora S S, Gupta P M, Renu S & Chopra A K, Study of the trace elements in Aloe vera L. (Aloe barbandensis Miller) viz. Liliaceae and its biological and environmental importance, J Chem Pharmaceut Res, 3(3) (2011) 64-68.
[24] Maenthaisong R, Chaiyakunapruk N, Niruntraporn S & Kongkaew C, The efficacy of aloe vera used for burn wound healing: a systematic review, Burns, 33(6) (2007) 713-718.
[25] Rajendran A, Narayananand V & Gnanavel I, Studies on the production of musabbar from aloe vera, J App Sci Res, 3(11) (2007)1476-1478.
[26] Sathianarayanan M P, Bhat N V, Kokate S S & Walunj V E, Antibacterial Finish for Cotton Fabric from Herbal Products, Indian J Fibre Textile Res, 35(3) (2010) 50-51.
[27] Ravi S, Kabilar P, Velmurugan S, Ashok Kumar R & Gayathri M, Spectroscopy studies on the status of aloin in aloe vera and commercial samples, J Exp Sci, 2(8) (2011) 10-13.

DOI: 10.17148/IARJSET.2022.9918

[28] Gagandeep S, Eadaoin M J, James B & Timothy J M, Evaluation of antibacterial activity of zno nano particles coated sono chemically onto textile fabrics, J Microbiol Biotechnol Food Sci, 2 (1) (2012) 106-120
[29] Yigi Y, Durability of some antibacterial treatments to repeated home launderings, J Textile Chemist Colorist and Dyestuff Rep, 32(4) (2000) 48.
[30] Vibeke R, Eva B, Susanne D N, Kim F M, Dorthe L J, Niels H V & Anders P, Effect of probiotic Lactobacillus strains in children with atopic dermatitis, J Allergy and Clinical Immuno,111(2) (2003) 389–395.
[31] Joshi M , Wazed A.S, Purwar R & Rajendran S, Eco friendly antimicrobial finishing of textiles using bioactive agents based on natural products, Indian J Fibre & Textile Res, 34(3) (2009) 295-304.
[32] Fivenson D, Arnold R J, Kaniecki D J, Cohen J L, Frech F & Finlay AY, The effect of atopic dermatitis on total burden of illness and quality of life on adults and children in a large managed care organization, J Manag Care Pharm, 8(5) (2002) 333-342.
[33] JoelleY F, Shelby D R, Kevin P W, Kristijan H K, Emmanuel B W & Kevin A S, Parents' reported preference scores for childhood atopic dermatitis disease states, BMC Pediatric,4(21) (2004)1-8.
[34] Heggers J, Kucukcelebi A, Listengarten D, Stabenau J, Ko F & Broemeling L D, Beneficial effect of aloe on wound healing in an excisional wound model, J Altern Complement Med, 2(2) (1996) 271–277.
[35] S.-W. Myung, I.-H. Choi, S.-M. Lee, J.-Y. Park, and K.-H.Lee, Desalination, 234, 158 (2008)
[36] J. H. Wu, Z. Wang, and S. Y. Xu, Food Chem., 103, 1255(2007).
[37] M. L. Gulrajani, "Department of Textile Technology",p.63, Indian Institute of Technology, New Delhi, 1988.
[38] C. M. Welch, Text. Res. J., 58, 480 (1988).
[39] C. M. Welch and B. A. Kottes Andrews, U.S. Patent 4,307,820 (1989).
[40] W. L. Xu and Y. Li, Text. Res. J., 70, 588 (2000).
[41] W. L. Xu and Y. Li, Text. Res. J., 70, 957 (2000).
[42] C. Q. Yang, X. Wang, and I. S. Kang, Text. Res. J., 67, 334(1997).
[43] B. A. K. Andrews, Text. Chem. Color., 22, 63 (1990).
[44] B. Gutarowska, W. Machnowski, and L. Kowzowicz, Fiber.Polym., 14, 415 (2013).
[45] Y.-H. Lee, E.-K. Hwang, Y.-M. Back, M.-S. Lee, D.-J.Lee, Y.-J. Jung, and H.-D. Kim, Fiber. Polym., 14, 1445(2013).
[46] A. Irvin, Ph.D. Dissertation, University of Leeds, Leeds,1999.
[47] Z. Yang and J. Hu, RJTA, 10, 46 (2006).
[48] E. Femenia, S. Sanchez, S. Simal, and C. Rossello, Carbohydr.Polym., 39, 109 (1999).
[49] A. Djeraba and P. Quere, Int. J. Immunopharmacol., 22,365 (2000).
[50] J. K. Lee, M. K. Lee, Y. P. Yun, Y. Kim, J. S. Kim, Y. S.Kim, K. Kim, S. S. Han, and C. K. Lee, Int. Immunopharmacol., 1, 1275 (2001).
[51] M. Joshi and S. W. Ali, Indian J. Fibre Text. Res., 34, 295(2009).
[52] Y. Ni, K. M. Yates, and I. R. Tizard, "Aloe Polysaccharides. In Aloes The Genus Aloe",pp.75-87. CRC Press, Boca Raton, 2004.
[53] M. Castleman, "The Healing Herbs", pp.42-44, Rodale Press, Em-maus, 1991.
[54] P. de Witte, Pharmacology, 47, 86 (1993)
[55] E. Dagne, D. Bisrat, A. Viljoen, and B.-E. Van Wyk, Curr.
[56] Org. Chem., 4, 1055 (2000).
[57] A. Femenia, E. S. Sanchez, S. Simal, and C. Rosello,Carbohydr. Polym., 39, 109 (1999).
[58] S. Choi and M. H. Chung, Semin. Integr. Med., 1, 53 (2003).
[59] T. N. Sonwalkar, "Handbook of Silk Technology", pp.170- 173, Wiley Eastern Limited, New Delhi, 1993
[60] Tomasino C. Chemistry & Technology of Fabric Preparation & Finishing. Raleigh, North Carolina, North Carolina State University, 1992, pp. 1–268.
[61] Bellini P, Bonetti F, Franzetti E, Rosace G, Vago S. Reference books of Textile Technologies- Finishing. Italy, ACIMIT, 2001, pp. 1–202.
[62] Heywood D. Textile Finishing. UK: Society of Dyers and Colourists, 2003.
[63] Risti T, Fras L, Novak M, Kralj M, Sonjak S, Cimerman G, Strnad S. Antimicrobial efciency of functionalized cellulose fbres as potential medical textiles. FORMATEX, Science, pp. 36–51, 2011. http://www.formatex.info/microbiology3/book/36-51.pdf
[64] Joshi M, Ali SW, Purwar R. Ecofriendly antimicrobial fnishing of textiles using bioactive agents based on natural products. Indian J. Fibre Text. Res. 2009; 34: 295–304.
[65] Gouveia IC. Nanobiotechnology: A new strategy to develop non-toxic antimicrobial textiles," FORMATEX, no. A new strategy to develop non-toxic antimicrobial textiles. Current research, Technology and Education Topics in Applied Microbiology and Microbial Biotechnology, A. Mendez-Vilas, pp. 407–414, 2010.
[66] Sathianarayanan MP, Chaudhari BM, Bhat NV. Development of durable antibacterial agent from ban-ajwain seed (Thymus serpyllum) for cotton fabric. Indian J. Fibre Text. Res. 2011; 36,September: 234–241.

DOI: 10.17148/IARJSET.2022.9918

[67] Chandrasekaran K, Ramachandran T, Vigneswaran C. Effect of medicinal herb extracts treated garments on selected diseases. Indian J. Tradit. Knowl. 2012; 11, July: 493–498.
[68] Rajinder Raina, Shahid Prawez, Verma PK, Pankaj NK. Medicinal Plants and their Role in Wound Healing. Vetscan 2008; 3, 1: 21.
[69] Baby J, Raj SJ. A comparative study on various properties of fve medicinally important plants. Int. J. Pharm. 2011; 7, 2: 206–211.
[70] Sarkar AK, Appidi S. Evaluation of Berberine Chloride as a New Antibacterial Agent Against GramPositive Bacteria for Medical Textiles. Fibres & Textiles in Eastern Europe 2011; 19, 4: 131–134.
[71] Johnson DB, Shringi BN, Kumar D, Sai N, Chalichem S. Screening of Antimicrobial Activity of Alcoholic & Aqueous Extract of Some Indigenous Plants. Indo-Global J. Pharm. Sci. 2011; 1, 2:186–193.
[72] Mehrotra S, Srivastava AK, Nandi SP. Comparative antimicrobial activities of Neem , Amla, Aloe , Assam Tea and Clove extracts against Vibrio cholerae , Staphylococcus aureus and Pseudomonas aeruginosa. J. Med. Plants Res. 2010; 4, 22: 2393–2398.
[73] Jothi D. Experimental study on antimicrobial activity of cotton fabric treated with aloe gel extract from Aloe vera plant for controlling the Staphylococcus aureus (bacterium). African J. Microbiol. 2009; 3, 5:228–232.
[74] Annadurai B. Antimicrobial Activity In Leaf Extract Of Neem (Azadirachta Indica Linn.). Int. J. Sci. Nat. 2012; 3, 1: 110–113.
[75] Gupta D, Khare S K & Laha A, Coloration Technol, 120 (4) (2004) 167.
[76] Gupta D, Singh R, Jain A, Panwar S & Khare S K, Dyes Pigm, 66(2) (2005) 99.
[77] Zhang Y Q, Biotech Advances, 20 (2002) 91.
[78] Han S & Yang Y, Dyes Pigm, 64 (2005) 157.
[79] Gupta D & Laha A, Indian J Fibre Text Res, 32 (1) (2007)
[80] Lu L, Liu S, Jiang S & Wu S, Acta Pharmacol Sin, 25 (2) (2004) 213.
[81] Scalbert A, Phytochemistry, 30 (1991) 3875.
[82] Rodriguez D J D, Castillo D H, Garcia R R & Sanchez J L A,Industrial Crops Products, 21 (2005) 81.
[83] Jasso de Rodriguez D, Hernandez-Castillo D, Rodriguez- Garcia R & Angul-Sanchez J L, Ind Crop Prod, 21 (2005) 81.
[84] Wasif S K & Rubal S, Proceedings, 6th International Conference - TEXSCI (Liberec, Czech Republic), 2007.
[85] http://www.fibre2fashion.com/industry-article/textile-industry-articles/an-eco-friendly-herbal-antimicrobial-finish/an-eco-friendly-herbal-antimicrobial-finish1.asp (accessed on 6th September 2008)
[86] S. Ghayempour, M. Montazer and M. Mahmoudi Rad, Carbohydr. Ploym, 2016, 136, 232-241.
[87] F.-P. Change, L.-Y. Kuang, C.-A. Huang, W.-N. Jane, Y. Hung, Y.-i. C. Hsing and C.-Y. Mou, J. Mater. Chem. B, 2013, 1, 5279-5287.
[88] R. Aladpoosh and M. Montazer, Carbohydr. Polym, 2016, 141, 116-125.
[89] A. Balji, M. V. vellayappan, A. A. John, A.P. Subramaian, S. K. Jaganathan, M. Selvakumar, A. A. b. Mohd Faudzi, E. Supriyanto and M. Yusof, RSC Adv., 2015,5,86199-86213.
[90] A. Ahmadi, Chin. J. Integr. Med., 2012, 18, 635-640.
[91] R. F Pereira, A. Carvalho, M. H. Gil, A. Mendes and P. J. Bartolo, Carbohydr. Polym., 2013, 98, 311-320.
[92] X. Guo, S. Zhang, S. L. Dial, M. D. Boudreau, Q. Xia, P. P. Fu, D. D Levy, M. M. Moore and N. Mei, Toxicol. Res., 2014, 3, 487-496.
[93] A. A. Moosavi-Movahedi, F. Ghamari, S. M. Ghaffari, M. Salami, Farivar, F.Moosavi-Movahedi, A. Johari and A. L. N. Aminin, RSC Adv., 2015, 5, 248-254.
[94] L. Ammayappan and J. Jeyakodi Moses, Fibers Polym., 2009, 10, 161-166.
[95] S.Y. Cheng, C. W.M. Yuen, C. W. Kan, K. K. L. Cheuk and J. C. O. Tang, Text. Res. J., 2010, 80, 524-536.
[96] D. Ravi, R. B. D. Lekshmi, V. Vijayabharathi and R. Parthasarathy, J. Pharm., Chem. Biol. Sci., 2014, 2, 150-157.
[97] V.G. Nadiger and S. R. Shukla, Fibers Polym., 2015, 16, 1012-1019.
[98] M. Tummalaplli, M. Berthet, B. V errier, B. L. Deopura, M. S. Alam and B. Gupta, Int. J. Biol. Macromol., 2016, 82, 104-113.
[99] S. Anjum, A. Gupta, D. Sharma, D. Gautam, S. Bhan, A. Sharma, A. Kapil and B. Gupta, Mater. Sci. Eng., C, 2016, 64, 157-166.
[100] E. Barrantes and M. a. Guinea, Life Sci., 2003, 72, 843-850.
[101] S. Heggie, G. P. Bryant, L. Tripcony, J. Keller, P. Rose, M. Glendenning and J. Heath, Canc, Nurs., 2002, 25, 442-451.
[102] A. Atiba, H. Ueno and Y. Uzuka, J. Vet. Med. Sci., 2011, 73, 583-589.
[103] A. Femenia, E. S. Sáncher, S. Simal and C. Rosselló Carbohydr. Polym., 1999, 39, 109-117.
[104] S. Ghayempour, M. Montazer and M. Mahmoudi Rad, DOI: 10.1039/c6ra22485g.

