SJIF Impact Factor: 5.464

WORLD JOURNAL OF ADVANCE HEALTHCARE RESEARCH

ISSN: 2457-0400
Volume: 5.
Issue: 4.
Page N. 165-170
Year: 2021

Research Article www.wjahr.com

EFFICACY OF ANTIMICROBIAL COATING ON BANANA COTTON FABRIC USING *SENNA TORA* EXTRACT FOR HEALTHCARE APPLICATIONS

Krishnaveni Vasudevan*

*Associate Professor, Department of Fashion Technology, Kumaraguru College of Technology, Coimbatore – 641049, Tamilnadu, India.

Received date: 26 January 2021 **Revised date:** 15 February 2021 **Accepted date:** 07 March 2021

***Corresponding author: Krishnaveni Vasudevan**

Associate Professor, Department of Fashion Technology, Kumaraguru College of Technology, Coimbatore – 641049, Tamilnadu, India.

ABSTRACT

Background: Sustainability and Healthcare is still a challenge for the Pharmaceutical and healthcare concerns, in spite of being more advanced nowadays. The purposeful necessities of skin care textiles have led to the pioneering use of diversity of natural plants with therapeutic properties for medical applications. The *Senna tora flowers* are one of the exceptionally important natural plant available in the all areas with abundant germ-free properties**. Methods:** In this present investigate work the *Senna tora* flowers were collected and extracted and it was coated on sustainable banana cotton fabric. **Results:** The extract was tested under qualitative antimicrobial phytochemical screening and the test results revealed the presence of antimicrobial constituents. The anti bacterial and antifungal activity of *Senna tora flowers* ethanolic 4% and 8% concentrated extracts were analyzed using standard AATCC 147and AATCC 100 tests against both gram positive and gram negative bacterial pathogens *staphylococcus aureus*, *klebsiella pneumoniae*, *pseudomonas auruginosa*, *escherichia coli* and aspergillus nigar fungi. The extract was tested under qualitative phytochemical screening, the results expressed the occurrence of major phytochemicals. **Conclusion:** The activity test result also shows that the *Senna tora* treated samples has superior antibacterial and antifungal activity by zone of inhibition and it can be more apt for developing sustainable products using textiles.

KEYWORDS: *Senna tora*, Ethanolic extract, Phytochemical Analysis, Antibacterial activity, Anti fungal activity Microorganisms.

1. INTRODUCTION

Skin care and sustainable engineering is very important for survival mechanism to retain the function of tissues. Skin care is still a challenge for the pharmaceutical industry, despite of being more intricate at the moment. The 1-5 % of drugs only used in western pharmacopeias for curing and healing of infections in the skin. The natural plants hold massive potential to come up with extensive solution for the wound healing and various ailments.[1,24] The appropriate and ample nourishment is very much essence for dealing with skin and allied infections. In addition, medicinal plants are at the moment considered as prosperous source for management of skin and health care systems and an exciting number of modern drugs have been isolated from natural resources[2] Natural plants have been used for centuries as remedy for human diseases and propose a new source of biologically active chemical compounds as antimicrobial agent.[3] The wound protective materials are interrelated to the skin and are mandatory to undergo rigorous testing and germ-free criteria, which led to novel exercise of diversity of plant parts. From the plant kingdom, one of the copious sources of natural tree is *Senna tora leavrs* are known to be a affluent source of constituents namely flavonol morin, and morin-3-o-lyxoside, secondary metabolites and these higher plants are widely used for medicinal practices.[4] The *Senna tora* is a phytotherapic plant which is very important in folk and traditional medicine and it is believed to have active bio components that smooth the progress to cure a assortment of skin infections.[5-8]

The senna flower extract exihibited good antimicrobial activity against nine different strains of *Staphylococcus aureus*.[9] The plant kingdom contains many species of plants possessing substances of medicinal value that had to be discovered Roots and flowers are useful in cures tumors, skin diseases. Decorticated seed powder and paste are treasured local applications to purulent opthalamia and conjunctivitis.[10-11,25] Despite the fact

that, statistics of plants are constantly being analyzed for their antimicrobial effects still there is a search for natural antibiotic.[12]

Plant-derived substances have recently become variety of phytochemicals like tannins, flavanoids and phenols of great interest owing to their versatile applications.[13,14] Plants containing favorable phytochemicals may supplement the requirements of the human body by acting as natural antioxidants and the solvent ethanol which may have yielded a great number of active constituents responsible for antimicrobial activity.[15] Apart from wound applications, the plant is used to develop medicated products. Hence the present research work aims at developing antimicrobial medicated fabrics for healthcare applications.

2. MATERIALS AND METHODS

2.1 Materials

2.1.1 Selection of Sustainable Textile fabric

Sustainable banana cotton fabric with the count of 2x 42's and twill weave was selected for the study. The fabric was desized, scoured and bleached preceding to the application of finish.[20]

2.1.2 Sourcing of natural plant

The *Senna tora* flowers were selected and procured for the study on the basis of their skin care, healing and antimicrobial properties and it was collected from Agriculture University, Coimbatore.

2.1.3 Extraction of herbal extract

The were *Senna tora* flowers were collected from the plant and it was shadow dried for about six days and converted into powder form by using automatic machines. 40 gms of fine powder was uniformly mixed with 100 ml of ethanol for seven hours using soxhlet apparatus by hot extraction method. After the extraction process, the solution was kept for solvent evaporation for about 9 hours. Then the residue of the extract was collected and stored with tight lid in the refrigerator at 4°C. Based on the need of requirement, the extract was diluted and utilized for further end use.[16,17]

2.1.4.Application of coating on Fabric using Extract

The sustainable banana cotton fabric samples were finished with 4% and 8% concentrated herbal extract using the material liquor ratio of 1:10 with optimized conditions like 30 pascal pressure at 40°C temperature for about 1hr time duration with alum mordant as cross linking agent. The extracts was applied on to the fabric by pad dry cure method using the padding mangle and the fabric was dried and then cured at 120 ºC for 3 minutes.[18]

2.2 Methods

The various methods are used for identifying the phytochemical constituents in the *Senna tora* flowers extracted solution and antimicrobial activity on treated fabric samples.

2.2.1 Preliminary phyto-chemical screening

The qualitative method of phytochemical analysis is used to identify the presence of active phyto constituents in *Senna tora extract* such as alkaloids, flavanoids, phenols saponin and tannins. The preface investigation was conducted as per standard test conditions.

2.2.1.1 Meyer's Test for Alkoloids

Few drops of Meyer's reagent were mixed with 1.0 ml of the extract, after some time the precipitate was formed in yellow creamy colour that indicates the occurrence of alkoloids.

2.2.1.2 Ferric Chloride Test for Tannins

Few drops of aqueous 5% Ferric chloride were mixed with 1.0 ml of the extract. A bluish black color was formed which then gets disappeared in addition of few drops of dilute sulphuric acid and an yellowish brown precipitate was formed which indicates the presence of tannins.[21-23]

2.2.2) Antibacterial activity Assessment method of *Senna tora* ethanolic flowers extract (AATCC- 147 - Test Method)

The antibacterial activity of the *Senna tora* leaf extract was analyzed using AATCC standard qualitative test method of agar well diffusion method.

2.2.2.1 Preparation of bacterial cultures

The different four bacterial cultures and two different fungal cultures were developed from Microbial Type Culture Collection (MTCC), Department of biotechnology Laboratory, Kumaraguru College of Technology, Coimbatore, India. The developed bacterial and fungal cultures for the study were namely gram positive bacterial pathogens *Staphylococcus aureus* and *Klebsiella pneumonia* gram negative bacterial pathogens namely *Pseudomonas auruginosa* and *Escherichia coli*. The developed bacterial cultures were maintained on nutrient agar slant and were also isolated, stored separately in a refrigerator at 4°C.

2.2.2.2 Testing of Antibacterial activity by agar well diffusion method

The antibacterial activity of *Senna tora* extract was evaluated using agar well diffusion method.[22] 20 ml of nutrient agar was prepared and allowed for sterilization at 121ºC for about 15 minutes. The petri plates were autoclaved in hot air oven at 121^{o}C for 45 minutes. The leaf ethanolic extract has been converted into 100 µg/ml concentration. The 20 ml nutrient agar was poured into the petri plates and it was permitted to solidify for about 2 hours. Then the plant extract was poured in the developed well and the plates were incubated for 24 hours at 37^{o}C. After 24 hours, the antibacterial activity was assessed against the test organisms *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas auruginosa* and *Escherichia coli* by measuring the zone of inhibition.

2.2.3) Antifungal activity Assessment method of *Senna tora* ethanolic flowers extract (Broth Dilution Test)
300ml Elenmeyer conical flask containing 40 ml of PD broth was prepared and sterilized at 121 ℃ for 20 minutes.After that it was allowed to cool. Then the fabric samples were transferred aseptically into the conical flasks and were kept at room temperature for about 3 days. After the 3 days the fungi growth was observed and measured.

2.4.4) Coating finish durability test on sustainable fabrics
The durability of the coated organic fabric was conducted for the sample of size 4x4cm. The extract coated sample chosen for the test was washed for about 5-25 cycles in standard temperature 37 ºc and with an standard detergent.

3. RESULTS AND DISCUSSION

The preliminary phytochemical screening and antimicrobial activity test results were discussed.

3.1 Preliminary phytochemical screening

The qualitative phytochemical screening of *Senna tora* extract test results are shown in the table 1.

Table 1: Qualitative Phytochemical analysis of the ethanolic extract of *Senna tora.*

S.No	Plant constituents	Ethanolic extract
1	Alkaloids -Meyer's test	+
2	Flavanoids -Alkaline reagent test	+
3	Tannins- Ferric chloride test	+

The results revealed the presence of phytochemical constituents in the extract such as flavanoids, phenols, tannins and alkaloids, in the *Senna tora* flowers. The precipitate color represents the presence of these components induces either individually or in combination to posses' antimicrobial activity. The active antimicrobial components such as Flavonoids are found in the extract solution and act as a barrier to control a extensive range of micro organisms due to their capacity to coalesce with additional cellular soluble proteins as well as complex with bacterial cell wall.[26] The presence of tannins in the roots *Senna tora* of implied that tannin may be the active compound which was responsible for antimicrobial activity in this study. The component tannin expresses better antibacterial activity.[21,22,23]

3.2 Assessment method of antibacterial activity on *Senna tora flower* ethanolic extract (AATCC- 147 - Test Method)

The antibacterial activity of the *Senna tora leaf* extract has been shown in the table 2 and figure-1.

The zone of inhibition test results of *Senna tora flower*extract against gram positive bacterial pathogens namely *Klebsiella pneumoniae*, *Staphylococcus aureus* and gram negative bacterial pathogens namely *Pseudomonas auruginosa and* Escherichia *coli* by agar well diffusion method were shown in table 2.

Table 2: Antibacterial zone of inhibition in (mm) against gram positive and gram negative bacterial pathogens on ethanolic extract of *Senna tora* flowers.

Test organisms	Zone of inhibition (in mm)	
	4% conc extract coated sample	8% conc extract coated sample
Staphylococcus aureus	17	22
Klebsiella pneumonia	15	16
Pseudomonas auruginosa	13	15
Escherichia coli	11	13

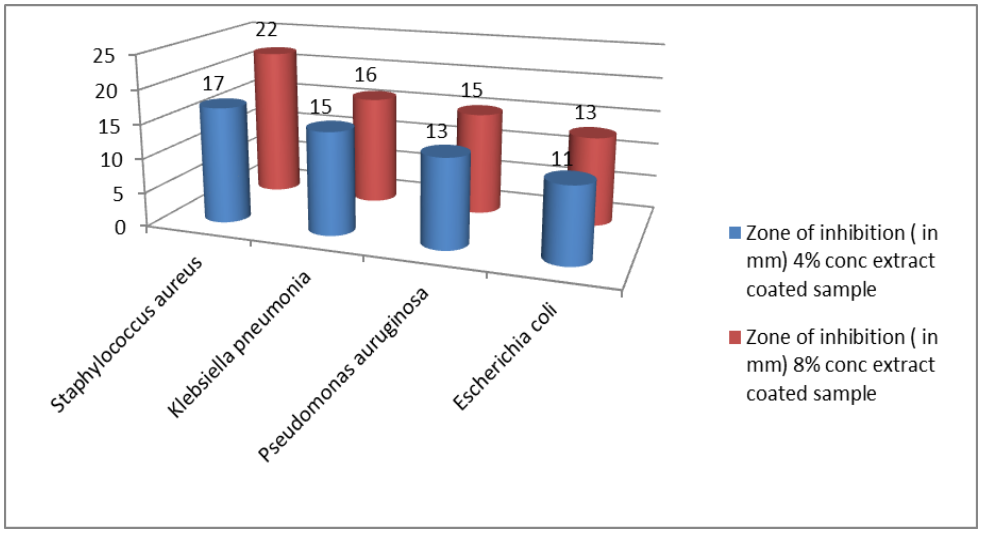

Figure 1: Testing of antibacterial activity- zone of inhibition in mm.

The results of zone of inhibition showed better antibacterial activity against gram positive pathogens namely *Staphylococcus aureus* (22 mm) and *Klebsiella pneumoniae* (16 mm) than gram negative pathogens namely *Pseudomonas auruginosa* (15 mm) and *Escherichia coli* (13 mm). in 8% conc extract coated fabric sample than 4% conc extract coated fabric sample. This plant extract showed the good results in controlling the growth of positive pathogens than compared to negative pathogens.

3.3 AATCC-30-1993:Anti-Fungal Activity- Broth Dilution Test)

It was found that there was less growth of fungi in the conical flask containing 8% concentration sample when compared to 4% treated and untreated sample from the picture (plate -1). This indicates that the 8% treated fabric has better anti fungal property against *Aspergillus niger* (Table-3).

Table 3: AATCC-30 Absorbance Tests at 670 Nm.

Sample	Absorbance Values (at 670nm)
	Aspergillus niger
Untreated fabric	1.02
8% Con extract sustainable coated Sample	0.80

3.4 Coating finish durability test

From the assorted level of wash factor results, it can be that indicated that the herbal coated sustainable banana cotton sample can withstand up to 15- 18 wash cycles is shown in table-4.

Table 4: Coating Durability Test.

Wash durability		Absorbance Value (at 670 nm)
Untreated fabric	Before wash	1.09
8% Conc Treated fabric sample	After 5 wash	0.87
	After 10 wash	0.96
	After 15 wash	0.99
	After 20 wash	1.03
	After 25 wash	1.06

4. CONCLUSION

The test analysis of *Senna tora* leave extract results proved the phytochemical constituents present in the extract includes flavanoids, phenols, alkaloids and tannins. The presence of phytocomponents such as tannins and flavanoids in the extract exhibits better antimicrobial activity. The antibacterial test results also showed superior levels of antibacterial activity in 8% conc extract treated fabric sample against gram positive bacterial pathogens namely *S. aureus* and *K. pneumoniae* than gram negative bacterial pathogens *P. auruginosa* and *E. coli*. The study reveals that the plant extract coated fabric is found to be very hygienic with less fungi and bacteria as well as making the cloth much softer than before. This finish is very much cost effective and eco-friendly. Based on the qualitative phytochemical screening and antibacterial activity assessments, the plant extract treated fabric samples confirmed that it will be more suitable for the skin care applications. Hence, this research work will give an idea for developing sustainable antimicrobial coated dressings for medical and protective applications in healthcare

field as well as raw material of sustainable banana cotton is from 100 % natural resources, it is renewable and environmental benefits.

ACKNOWLEDGEMENTS

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

Conflict of interest- NIL

5. REFERENCES

1. Csupor D, Blazo G, Balogh A, Hohmann J. Traditional Hungarian Medicinal plant Centaurea sadleriana Janka accelerates wound healing in rats, 2010; J Ethano, 127: 193-195.
2. Devprakash, K.K.Srinivasan, T.Subburaju, Sachin kumar singh. Antimicrobial activity of alcoholic and aqueous extracts of Vetiveria zizanioides. J. Phar Res, 2011; 4(5): 1343-1344.
3. Tanaka J, Da Silva C, De Oliveira A, Nakamura C, Dias Filho B. Antibacterial activity of indole alkaloids from Aspidosperma ramiflorum. Brazilian journal of medical and biological research, 2006; 39: 387-391.
4. Ajiboye, Adeyinka Elizabeth, Ameen, Muhammad Tukur and Adedayo, Majekodunmi. Antimicrobial activity and phytochemical screening of the fruit pulp of *Dialium guineense* (Velvet Tamarind) on some microbial isolates. J Micr ant, 2015; 7(4): 33-41.
5. Abdelrahim, Almagboul, Omer, and Elegami. "Antimicrobial activity of *Senna tora* L.," *Fitoterapia*, 2002; 73(7-8): 713–715.
6. Jaiarj, Khoohaswan, Wongkrajanga Peungvicha, Suriyawong, Saraya. *Anticough and antimicrobial activities of Senna tora Linn. leaf extract*. *J Ethnopharm*, 1999; 67(2): 203–212.
7. Lutterodt, Inhibition of Microlax-induced experimental diarrhoea with narcotic-like extracts of *Senna tora* leaf in rats, *J Ethnopharm*, 1992; 37(2): 151–157.
8. Bipul Biswas, Kimberly Rogers, Fredrick McLaughlin,Dwayne Daniels, and Anand Yadav, Antimicrobial Activities of Leaf Extracts of Guava (*Senna tora* L.) on Two Gram-Negativeand Gram-Positive Bacteria,Inter J Micro, 2013; 10: 1-7.
9. Krishnaveni vasudevan, Effect of Imparting Antimicrobial Coating on Organic Sustainable banana cotton Fabric Using Yashtimadhu for Medical Application, J Textile Eng Fashion Technol, 2017; 3(3): 1-4.
10. Ravikumar V, Shivashangari K.S and Devaki T, Effect of Tridax procumbens on liver antioxidant defense system during lipopolsaccharid- induced in Dgalactosomine sensitized rats. Mol. Cell Biochem, 2005; 269(1-2): 131-6.
11. Vyas P Suresh, Tiwari Umesh, Rastogi Bhawna, and Singh Paramjit, Immunomodulatory effects of aqueous extract of Tridax procumbens in experimental animals; Journal of Ethnopharmacologoly, 2004; 92: 113-119.
12. Shelar, P. S, Reddy, G, Shelar and Reddy, V. Medicinal value of mangroves and its antimicrobial properties - A review Continental. J. Fish Aqua. Sci, 2012; 6: 26-37.
13. Gislene G, Nascimenta F, Locatelli J, Freitas PC and Silva GL. Antibacterial activity of plant extract and phytochemicals on antibiotic resistant bacteria. Brazilian J Microbiol, 2000; 31: 247-246.
14. Krishnaveni, V, Srinivasan, J" Investigation Of Phytochemical And Anti-Bacterial Activity On *RHIZOPHORA APICULATA* Ethanolic Extract For Medical Textile Applications," A. J. Micr, Bio Env Sci, 2017; 19(11): S8-S11.
15. Boots, A.W.; Haenen, G.R.; Bast, A. Health effects of quercetin: From antioxidant to nutraceutical. Eur. J. Pharmacol, 2008; 585: 325–337.
16. Krishnaveni, V; Investigation Of Phytochemical And Anti-Bacterial Activity On *Agave Americana* Methanolic Extract For Medical Applications," Int J Phar Bio Sci, 2017; 8(3) (B): 500–505.
17. Viji Saral Elezabeth and Ramachandran. Microbiological Investigation On *Vetiveria Lawsonii*. Int J Pharm Bio Sci, 2015; 6(3): 472–475.
18. Krishnaveni,V, Aparna, B., "Micro Encapsulation of Copper Enriched Aloe Gel Curative Garment for Atopic Dermatitis", Ind J Trad Kno, 2014; 13(4): 795-803.
19. Solomon Charles Ugochukwu, Arukwe Uche I. and Onuoha Ifeanyi. Preliminary phytochemical screening of different solvent extracts of stem bark and roots of Dennetia tripetala G. Baker. Asian J. Plant Sci and Res, 2013; 3(3): 10-13.
20. Krishnaveni, V; Ampritha, S., Analysis of Phytochemical And Anti-Microbial Activity On *Vetiveriazizanioides* Ethanolic Extract For Healthcare Applications" 2016, I J Phar Bio Sci, 7(2) (B): 758–765.
21. Basari DF and Fan SH. The potential of aqueous and acetone extracts of galls of Quercus infectoria as bacterial agents. Indian J Pharmacol, 2009; 1: 26-29.
22. Krishnaveni, V., Ampritha.S' Application Of Vetiver Extract On Sustainable banana cotton Fabric For Developing Healthcare Products ", in Chapter 3 in the book *on* Sustainability in Fashion and Apparels: Challenges, 2018,WPI Publishing, CRC Press, Tayler And Francis Group, 21-27.
23. U.S.Patil and O.S.Deshmukh. Preliminary phytochemical screening of six medicinal plants used as traditional medicine. Int J Pharm Bio Sci, 2016; 7(1): 77–81.
24. J.K.Mensah, R.I.Okoli, A.A. Turay, etal, Phytochemical analysis of medicinal plants used for the management of hypertension by Esan people of Edostate, Nigeria, Ethnobot. Leaflets, 2009; 13: 1273–1287.
25. K.Devados, Raja, S.J Nattanmai, M. Rajappan, In vitro antimicrobial activity and phytochemical

analysis of Cassia auriculata Linn, Int Cur Phar J, 2013; 2(6): 105-108.
26. M.P Mahesha, A.V Kanivebagilu, V.A Airody, Extraction, characterization and biological studies of phytochemicals from Mammea suriga, J Pharm Ana, 2015; 5(3): 182–189.