

Antimicrobial Finishing of Organic Cotton Textiles with Extract of Tanners Cassia Flowers for Skin Care Applications



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Abstract

Background: Skin care is still a challenge for the Pharmaceutical and hospital 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 *Tanners cassia flowers* are one of the exceptionally important natural plant available in all areas with abundant germ-free properties.

Methods: In this present investigate work the *Tanners cassia* flowers were collected and extracted and it was coated on organic cotton fabric.

Results: The extract was tested under qualitative antimicrobial phytochemical screening and the test results revealed the presence of antimicrobial constituents. The antibacterial and antifungal activity of *Tanners cassia flowers* ethanolic 5% and 10% concentrated extracts were analyzed using standard AATCC 147 and 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 *Tanners cassia* treated samples has superior antibacterial and antifungal activity by zone of inhibition and it can be more apt for healthcare textiles.

Keywords: *Tanners cassia*, Ethanolic extract, Phytochemical Analysis, Antibacterial activity, Anti-fungal activity Micro-organisms, Skin care applications

Introduction

Skin care and tissue 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 [1,2]. 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 [3] 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 [4]. 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 *Tanners cassia leaves* are known to be an affluent source of constituents namely flavonol morin, and morin-3-o-lyxoside, secondary metabolites and these higher plants are widely used for medicinal practices [5]. The *Tanners cassia* is a phytotherapeutic 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 an assortment of skin infections [6-9].

The cassia flower extract exhibited good antimicrobial activity against nine different strains of *Staphylococcus aureus* [10]. 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 ophthalmia and conjunctivitis [11-13]. Despite the fact that, statistics of plants are constantly being analyzed for their antimicrobial effects still there is a search for natural antibiotic [14].

Plant-derived substances have recently become variety of phytochemicals like tannins, flavanoids and phenols of great interest owing to their versatile applications [15,16]. 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 [17]. 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.

Materials and Methods

Materials

Selection of Textile fabric

Organic cotton fabric with the count of 2x42's and twill weave were selected for the study. The fabric was desized, scoured and bleached preceding to the application of finish [18].

Sourcing of Natural plant

The *Tanners cassia* flowers were selected and procured for the study based on their skin care, healing and antimicrobial properties and it was collected from Agriculture University, Coimbatore.

Extraction of herbal extract

They were *Tanners cassia* flowers were collected from the plant and it was shadow dried for about six days and converted into powder form by using automatic machines. 40gms of fine powder was uniformly mixed with 100ml 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 9hours. 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 [19,20].

Application of coating on Fabric using Extract

The organic cotton fabric samples were finished with 5% and 12% 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 were applied on to the fabric by pad dry cure method using the padding mangle and the fabric was dried and then cured at 120°C for 3 minutes [21].

Methods

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

Preliminary Phyto-chemical screening

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

Meyer's Test for Alkoloids

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

Alkaline Reagent Test for Flavanoids

The 5 drops of sodium hydroxide solution was added to the extract solution and mixed it thoroughly. After some time, the intense yellow color was formed in the solution, then added a few drops of dilute hydrochloric acid and turned into colorless which represents the presence of flavanoids.

Ferric Chloride Test for Phenols

The 2.0 ml of distilled water was added with 1.0ml of the extract followed by few drops of 10% aqueous ferric chloride solution. Blue, green, or violet color has formed indicating the presence of phenols.

Ferric Chloride Test for Tannins

Few drops of aqueous 5% Ferric chloride were mixed with 1.0ml of the extract. A bluish black color was formed which then gets disappeared in addition of few drops of dilute sulphuric acid and a yellowish-brown precipitate was formed which indicates the presence of tannins [22-24].

Foam Test for Saponins

A few drops of sodium bicarbonate solution were taken with 1.0ml of the extract, shaken vigorously and kept for 3 minutes. A honeycomb like froth will be formed and this indicates the presence of saponins

Antibacterial activity Assessment method of *Tanners cassia* ethanolic flowers extract (AATCC- 147 -Test Method)

The antibacterial activity of the *Tanners cassia* flower extract was analyzed using AATCC standard qualitative test method of agar well diffusion method.

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.

Testing of Antibacterial activity by agar well diffusion method

The antibacterial activity of *Tanners cassia* extract was evaluated using agar well diffusion method [25]. 20ml of nutrient agar was prepared and allowed for sterilization at 12°C for about 15minutes. The petri plates were autoclaved in hot air oven at 121°C for 45 minutes. The flower ethanolic extract has been converted into 100µg/ml concentration. The 20ml 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°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.

Antifungal activity Assessment method of *Tanners cassia* ethanolic flowers extract (Broth Dilution Test)

300ml Elenmeyer conical flask containing 40ml of PD broth was prepared and sterilized at 121°C 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.

Coating finish durability test

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°C and with an standard detergent.

Results and Discussion

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

Preliminary phytochemical screening

The qualitative phytochemical screening of *Tanners cassia* extract test results is shown in the Table 1. The results revealed the presence of phytochemical constituents in the extract such as flavanoids, phenols, tannins and alkaloids, in the *Tanners cassia* leaves. 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 microorganisms due to their capacity to coalesce with additional cellular soluble proteins as well as complex with bacterial cell wall [25]. The presence of tannins in the roots *Tanners cassia* 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 [22-25].

Table 1: Qualitative Phytochemical Analysis of the Ethanolic Floral Extract of *Tanners Cassia*.

S. No	Plant Constituents	Ethanolic Extract
1	Alkaloids -Meyer's Test	+
2	Flavanoids -Alkaline reagent Test	+
3	Phenols- Ferric Chloride Test	+
4	Tannins -Ferric Chloride Test	+
5	Saponins -Foam Test	+

Assessment method of antibacterial activity on *Tanners cassia* flower ethanolic extract (AATCC- 147 -Test Method)

The antibacterial activity of the *Tanners cassia* flower extract has been shown in the Table 2 and Figure 1.

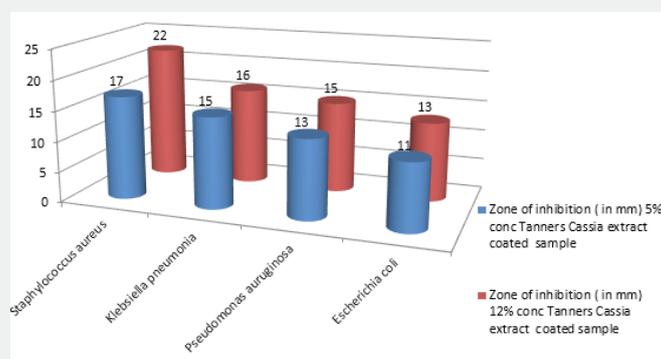


Figure 1: Antibacterial Activity of *Tanners cassia* Floral Extract Coated Fabric Samples.

The zone of inhibition test results of *Tanners cassia 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). The results of zone of inhibition showed better antibacterial activity against gram positive pathogens namely *Staphylococcus aureus* (22mm) and *Klebsiella pneumoniae* (16mm) than gram negative pathogens namely *Pseudomonas auruginosa* (15mm) and *Escherichia coli* (13mm). in 12% conc extract coated fabric sample than 5% conc extract coated fabric sample. This plant extract showed the good results in controlling the growth of positive pathogens than compared to negative pathogens.

Table 2: Antibacterial Zone of Inhibition in (mm) Against Gram Positive and Gram-Negative Bacterial Pathogens on Ethanolic Floral Extract of Tanners Cassia.

Test Organisms	Zone of Inhibition (in mm)	
	5% Conc Tanners Cassia Extract Coated Sample	12% Conc Tanners Cassia Extract Coated Sample
<i>Staphylococcus Aureus</i>	17	22
<i>Klebsiella Pneumonia</i>	15	16
<i>Pseudomonas Auruginosa</i>	13	15
<i>Escherichia Coli</i>	11	13

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

It was found that there was less growth of fungi in the conical flask containing 12% concentration sample when compared to 5% treated and untreated sample from the picture (plate -1). This indicates that the 12% treated fabric has better anti-fungal property against *Aspergillus niger* (Table 3 and plate 1).

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

Sample	Absorbance Values (at 670nm)
	<i>Aspergillus Niger</i>
Untreated fabric	1.02
12% Con Tanners Cassia extract coated Sample	0.8

Coating finish durability Test

From the assorted level of wash factor results, it can be that indicated that the herbal coated organic 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 670nm)
Uncoated Fabric	Before wash	1.09
	After 5 wash	0.87
12% Conc Tanners Cassia Treated fabric sample	After 10 wash	0.96
	After 15 wash	0.99
	After 20 wash	1.03
	After 25 wash	1.06

Conclusion

The test analysis of *Tanners cassia* floral 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 10% 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 hospital field as well as raw material of organic cotton is from 100 % natural resources, it is renewable and environmental benefits.

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Conflict of Interest

Nil.

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