



Research Article

APPLICATION OF ANTI MICROBIAL FINISHING ON CELLULOSIC FABRICS WITH *ABUTILON INDICUM* LEAF EXTRACT

T.R. Indumathi¹, E. Devaki^{2*}

¹M.Phil Scholar, Department of Costume design and Fashion, PSG College of arts and Science, India

²Assistant Professor, Department of Costume design and Fashion, PSG College of arts and Science, India

*Corresponding Author Email: trindumathi@gmail.com

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ABSTRACT

There are many synthetic agents like triclosan, phenols, organometallics, etc. are in trend for textile antimicrobial finishing, which are harmful as toxic and having environmental issues. Several medicinal herbs are identified for its potential as antimicrobial agent to compensate these issues. This article reveals that, herb -*Abutilon Indicum* (leaf extract) finished on cellulosic fabrics shows maximum inhibition on human pathogenic microorganisms such as *Escherichia Coli*, *Staphylococcus aureus*, *Candida Tropicalis*, and *Candida Albicans* which are responsible for harmful human infections in various conditions. Thus this paper shows the possibilities of using these herbal finishes for antimicrobial activity on cellulosic fabrics for developing health care products in medical textiles.

Keywords: *Abutilon Indicum*, Antimicrobials, pathogenic organisms, cellulosic fabrics, health care, medical textiles.

INTRODUCTION

Now a days people turn on to natural way of obtaining protection through medicated herbal finishing on textile materials through the method of micro encapsulation, Nano-technology, etc^{1,2}. These medicinal values of herbs are immense in several developing countries due to their safety, efficiency easy availability and lesser side effects³. These medicinal herbs also reflects the cultural acceptability used from centuries for health care^{4,5}.

Abutilon Indicum of family Malvaceae commonly known as Thuthi is distributed throughout the hotter parts of India⁶, which possess great medicinal values⁷. It is of 29 different varieties, also called as mallow in English⁸. Its medicinal benefits includes as cooling agent, Anti-inflammation, antimicrobial, antioxidant, healing of wounds^{9, 10}, etc. Due to the developing trend these herbal extracts are used in textile materials as antimicrobial finishing agent acts as an ecofriendly component.

This study is to investigate the potential of anti-microbial activity of two cellulosic fabrics (cotton and viscose) finished by *Abutilon Indicum* leaf extract against two types of human bacterial and fungal pathogens like *Escherichia Coli*, *Staphylococcus aureus*, *Candida Tropicalis*, and *Candida Albicans* using aqueous solution. The antibacterial and antifungal activities of woven and nonwoven herbal finished fabrics were assessed with AATCC 476 method and AATCC 30 test methods.^{11, 12}

In this research work an attempt has been made to prepare an eco-friendly, biodegradable, chemical free material. As a result, maximum antibacterial and antifungal activities were assessed in both fabrics finished with herbal extract, can be used for the development of medical products in future.

MATERIALS AND METHODS

Selection of fabric

Cellulosic fabrics were selected for this study. The particulars are given in table 1.

Table 1

Materials	Particulars
Cotton fabric	Plain weave
Viscose fabric	Nonwoven, spun laced

Selection of medicinal herb

The plant that has been used for this research is identified based on its potential properties, are as given below.

Common name: Thuthi

Botanical name: *Abutilon Indicum*

Family: Malvacea

Part used: Leaves



Fig 1: *Abutilon Indicum*- Thuthi

Identification and collection of medicinal herb

The plant require for the study were collected from the interior villages of Coimbatore, which are grown under optimal environmental condition. The leaves are fresh and disease free, identified as dark green colour with heart shaped.



Fig 2 (a): Thuthi- Dried leaves

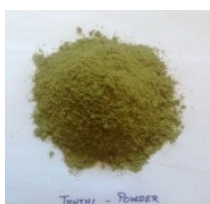


Fig 2 (b): Thuthi- Fine powder

Herbal extraction process

The collected herb *Abutilon Indicum – Thuthi* (leaves) were shadow dried within a temperature range of 37- 40° C. After drying the grinding was carried out to breakdown the leaves of the plant into fine powder. Antimicrobial active substances were extracted from the plant by aqueous extraction method, by adding 20g of herbal powder in 100ml of water for 24hrs.

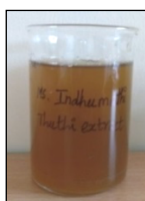


Fig 3: Thuthi- Extraction

Imparting herbal finish to the selected fabric

The fabric samples were treated with herbal extract using citric acid as cross-linking agent. Aqueous extract of *Abutilon Indicum* was applied onto the fabrics by pad-dry-cure method with material- to liquor ratio of 1:20 at 50°C using 8% citric acid concentration. After padding for 30 min, the samples were taken and dried at 100-120°C for 5min and cured at 180°C for 3min.



Cotton



Viscose

Fig 4: Dip-dry finishing of fabrics with *Abutilon Indicum – Thuthi* extracts

Antibacterial assessment for herbal finished medicated fabrics

The given fabrics cotton and non-woven viscose (finished with thuthi) were analyzed for their antibacterial testing using the standard AATCC – 147 test method (parallel streak method) against test organisms of gram positive organism (*Staphylococcus aureus*) and gram negative organism (*Escherichia coli*).



Cotton



Viscose

Fig 5: Herbal finished medicated fabric

Test specimens (fabrics) were cut into pieces (25mm*50mm). A 50mm length permits the specimen to lay across parallel inoculums streaks each of diminishing width from both 8mm to 4mm wide. Sterile ATCC bacteriostatic agar plates were prepared. Using sterile 4mm inoculating loop, one loop full of culture (*E.Coli* ATCC 25922 and *S.Aureus* ATCC 6538) was loaded and transferred to the surface of the agar plate by making five parallel streaks.

Most of the human pathogenic organisms grow at 37°C. The culture media after inoculation is incubated at 37°C for 18-24 hours. The inoculated plates were examined for the interruption of growth along the streaks of inoculum beneath the fabric and for a clear zone of inhibition beyond the fabric edge. The average width of the zone of inhibition around the test specimen calculated in mm.

Antifungal assessment of herbal finished medicated fabrics

The given fabrics finished with *Abutilon Indicum- Thuthi* extract were analyzed for their antifungal testing using the standard AATCC -33 test method, against the pathogenic organisms *candida albicans* and *candida tropicalis*.

Test specimens were cut into pieces (50mm in diameter). Sterile potato dextrose agar plates were prepared. Using sterile cotton

swab the test fungal cultures (*Candida albicans* and *Candida tropicalis*) was transferred by swabbing all around the surface of the agar plate and also covering the central area of the Petridis. The plates were incubated at 30°C for 72 hours. The inoculated plates were examined for the interruption of growth along the

swabs of inoculum beneath the fabric and for a clear zone of inhibition beyond the fabric edge. The average width of the zone of inhibition around the test specimen calculated in mm.

RESULTS AND DISCUSSIONS

ANTIMICROBIAL ASSESSMENT OF HERBAL FINISHED COTTON FABRICS

Table 2: Assessment of qualitative antibacterial and antifungal activity of Cotton finished with herbal extracts (AATCC-147 test method)

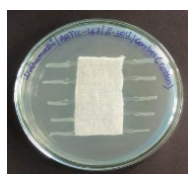
S.NO	FABRICS	ANTIBACTERIAL		ANTIFUNGAL	
		<i>Escherichia coli</i> ATCC 25922	<i>Staphylococcus aureus</i> ATCC 6538	<i>Candida albicans</i>	<i>Candida tropicalis</i>
1	CONTROL	Nil	Nil	Nil	Nil
2	HERBAL FINISHED	30.8	31.6	60	59

The table-2 reveals that herbal finished cotton fabric shows, positive approach in both the organisms.

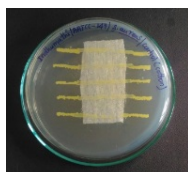
phytochemical compounds in the plant extracts like alkaloids, phenol and terpenoids which need to be identified separately.

ASSESSMENT OF ANTIBACTERIAL ACTIVITY OF COTTON FABRIC

ASSESSMENT OF ANTIFUNGAL ACTIVITY ON COTTON FABRIC

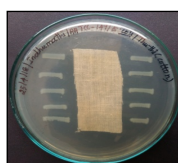


Control sample *E. coli*

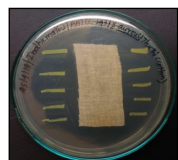


Control sample *S. aureus*

Plate 1: (a) Influence of bacteria on Cotton control fabric sample



Escherichia coli



Staphylococcus aureus

Plate 1: (b) Antibacterial activity (AATCC-147 test method) of Cotton finished with *Abutilon Indicum* – Thuthi

Cotton Fabric sample finished with *Abutilon Indicum*- thuthi extract shows excellent antibacterial activity. Gram positive bacteria (*Staphylococcus aureus*) show better result than gram negative bacteria (*Escherichia coli*). The antibacterial inhibitory zone obtained for the finished fabrics against the two test bacteria shows maximum inhibitory zone by the presence of different

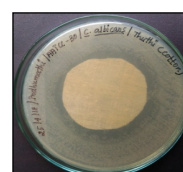


Candida albicans



Candida tropicalis

Plate 2: (a) influence of fungus on cotton control fabric



Candida albicans (HS)



Candida tropicalis (HS)

Plate-2: (b) Antifungal activity (AATCC-30 test method) of Cotton finished with *Abutilon Indicum* – Thuthi

The antifungal inhibitory zone obtained for the finished cotton fabric against the two test fungus shows maximum inhibitory zone. The antifungal activity obtained in the present research was attributed by the presence of different phytochemical compounds

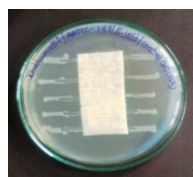
in the plant extracts like alkaloids, phenol and terpenoids which need to be identified separately.

Table 3: Assessment of qualitative Antibacterial and Antifungal activity of Non-woven viscose finished with herbal extracts (AATCC-30 test method)

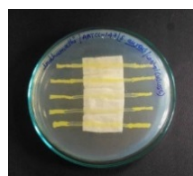
S.NO	FABRICS	ANTIBACTERIAL		ANTIFUNGAL	
		<i>Escherichia coli</i> ATCC 25922	<i>Staphylococcus aureus</i> ATCC 6538	<i>Candida albicans</i>	<i>Candida tropicalis</i>
1	CONTROL	Nil	Nil	Nil	Nil
2	HERBAL FINISHED	32.2	30.8	59	61

The table-3 reveals that herbal finished viscose fabric shows, positive approach in both the organisms.

ASSESSMENT OF ANTIBACTERIAL ACTIVITY OF VISCOSE FABRIC

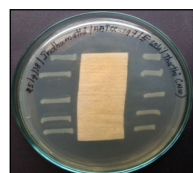


Escherichia coli ATCC 25922

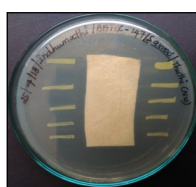


Staphylococcus aureus ATCC 6538

Plate 3: (a) Influence of bacteria on viscose control fabric samples



Escherichia coli ATCC 25922



Staphylococcus aureus ATCC 6538

Plate 3: (b) Antibacterial activity (AATCC-147 test method) of Non-woven viscose finished with *Abutilon Indicum* – Thuthi

Viscose Fabric sample finished with *Abutilon Indicum*- Thuthi extract shows excellent antibacterial activity. Gram negative bacteria (*Escherichia coli*) shows better result than gram positive bacteria (*Staphylococcus aureus*).

ASSESSMENT OF ANTIFUNGAL ACTIVITY OF VISCOSE FABRIC

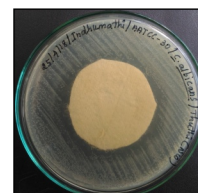


Candida albicans

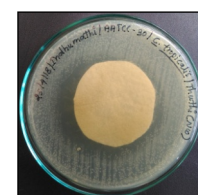


Candida tropicalis

Plate 4: (a) Influence of fungus on Viscose Non-woven control fabric



Candida albicans



Candida tropicalis

Plate 4: (b) Antifungal activity (AATCC-30 test method) of Non-woven viscose finished with *Abutilon Indicum* – Thuthi

Viscose fabric finished with *Abutilon Indicum* – Thuthi extracts exhibited good antifungal activity against the test organisms during the study. *Candida tropicalis* shows better result than *Candida albicans*. This method confirmed the presence of phytochemical compounds like phenol, alkaloids, flavonoids and terpenoids which are proved to be attributing for enhanced antifungal activity.

CONCLUSION

The human body is a good medium for the growth of micro organism due to the biological and various environmental conditions. Protection from these microorganisms is must to avoid several infections through natural way. Thus this condition led the researchers, to develop these medicated herbal textiles for medical textile products. Developing of bio degradable and sustainable fabric increase the concern on safe textile products and reduces the textile chemicals impact on the environment. These bioactive herbal finishing by *Abutilon Indicum- Thuthi*, on cellulosic fabrics like 100% cotton and viscose can be used in specified products in the field of medical textile, as for wound dressing material, bandages, personal hygiene products such as sanitary napkin, panty liners etc., in order to avoid infections and adverse effects of chemicals on human health.

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