



# Indian Acalypha : Herbal antimicrobial finishing of garments for skin diseases

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**T**he population explosion and the environmental pollution in the recent years have forced the researchers to find new health and hygiene related products for the well being of mankind. The nuisance is caused by

This concern, accompanied by a recent boom in the interest of healthy living, has made consumers very conscious of textiles that are hygienic. Clothing and textile materials are not only the carriers of microorganisms such as pathogenic bacteria, odour generating bacteria and mould fungi, but are also excellent media for the growth of the microorganisms. The inherent properties of the textile fibres provide room for the growth of microorganisms. Besides, the structure of the substrates and the chemical processes may induce the growth of microbes. Humid and warm environment still aggravate the problem. Infestation by microbes cause cross infection by pathogens and development of odour where the fabric is worn next to skin. In addition, the staining

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microbes which are minute organisms, but can be most dangerous for creating harm to our lifestyle. Over the past century, much focus has been placed on the sustainability of the earth's environment.

and loss of the performance properties of textile substrates are the results of microbial attacks.

Basically, with a view to protect the wearer and the textile substrate itself, antimicrobial finish is applied to textile materials. Though the use of antimicrobials has been known for the decades, it is only in the recent couple of years that several attempts have been made on finishing textiles with antimicrobial compounds. The consumers are now increasingly aware of

the hygienic lifestyle, and there is a necessity and expectation for a wide range of textile products finished with antimicrobial properties. A wide palette of antimicrobial compounds is now in use but differs in its mode of action. Many commercial antimicrobial agents are effective, but they are not compatible with skin and the environment. So, the natural herbal products can be used for antimicrobial finishes since there is a tremendous source of medicinal plants with antimicrobial composition to be the effective candidates in bringing out herbal textiles. The present research work aims at developing an eco-friendly natural antimicrobial finished from the natural herb Indian *Acalypha* for textile application. The herb has the remarkable properties of curing skin diseases like syphilitic ulcer, bedsores, maggot infested sores and wounds, rashes, and rheumatism. The Indian *Acalypha* extracts (50%, 75% and 100% respectively) are applied on cotton fabric in pad dry cure method. An attempt is also made to assess the healing activity of the Indian *Acalypha* treated shirt on skin allergies and rashes. An extensive study was conducted to assess the antimicrobial effectiveness of the herb by employing standard test methods and findings that are discussed in this paper.

## Materials and methods

### Materials

Cotton fabric with the count of 2x 40s and plain weave was selected for the study. The fabric was desized, scoured and bleached prior to the application of finish.

### Antimicrobial herb

Indian *Acalypha* (*Kuppivaeni*) is the plant species chosen for the study. Fresh leaves of *acalypha* were shadow dried and made into a fine powder.

### Methods

#### Finish application

Ethanollic extracts of herb were

applied to cotton fabric by dipping in bath at M:L ratio 1:10. The fabric was then dried at 80°C for 10 minutes to remove the moisture. Finally, the fabric samples were tested for antimicrobial activity as per the standard test methods.

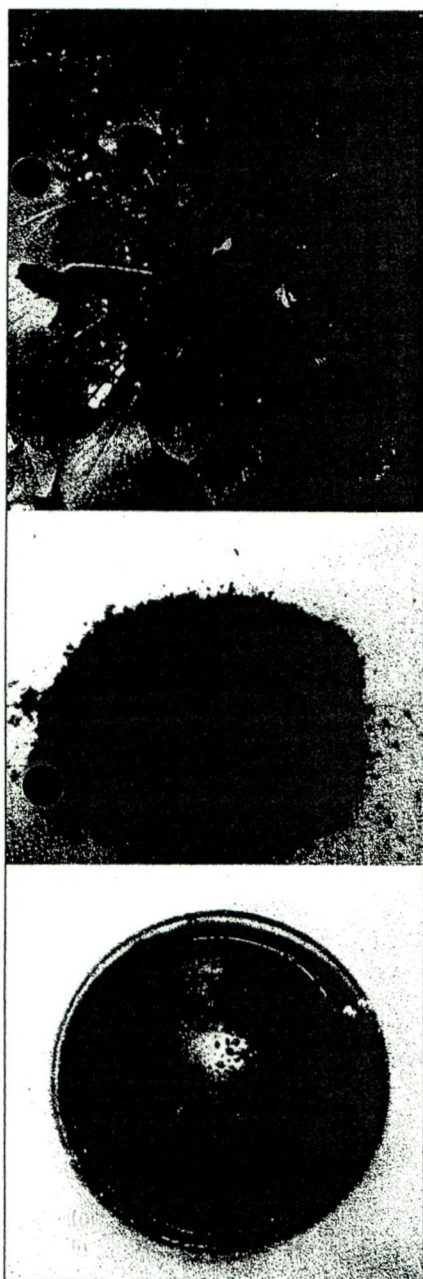
## Standard quantitative test methods

### Anti bacterial activity

- AATCC-100-1998 (USA) : Quantitative assessment of antibacterial finishes on textiles measures the degree of antibacterial activity - Agar diffusion test : The 2"x 2" samples were prepared from the Indian *Acalypha* samples (untreated, 50%, 75% and 100% treated). 500 ml Elenmeyer conical flasks containing 50 ml of nutrients broth were prepared and sterilised at 121°C for 15 minutes. It was then allowed to cool. The fabric samples were then transferred aseptically into the conical flasks respectively. These were incubated at 37°C for 24 hours in shaker at 121 rpm. After incubation, their absorbance were measured at 600 nm.
- AATCC-147-1998 (USA) : Qualitative Antibacterial Assessment of diffusible antibacterial agents 'Quick method' - Agar diffusion test : 50 ml of nutrient agar was prepared and sterilised at 121°C for 15 minutes. Petri plates were autoclaved in hot air oven at 121°C for 30 minutes. 20 ml of the nutrient agar was poured into each of these plates and allowed to solidify.

A series of 8 test tubes containing 4.5 ml of sterile water was taken. 0.5 ml of culture from nutrient broth containing the 100% treated samples was transferred aseptically into the first test tube. Serial dilution was carried out until its reduced dilution was  $10^{-8}$ .

100 micro litres of  $10^{-8}$  diluted culture was taken aseptically and poured onto the Petri plates. This was spreaded by using L rod. The plates were incubated at 37°C for 16-18 hours. Similar procedure was



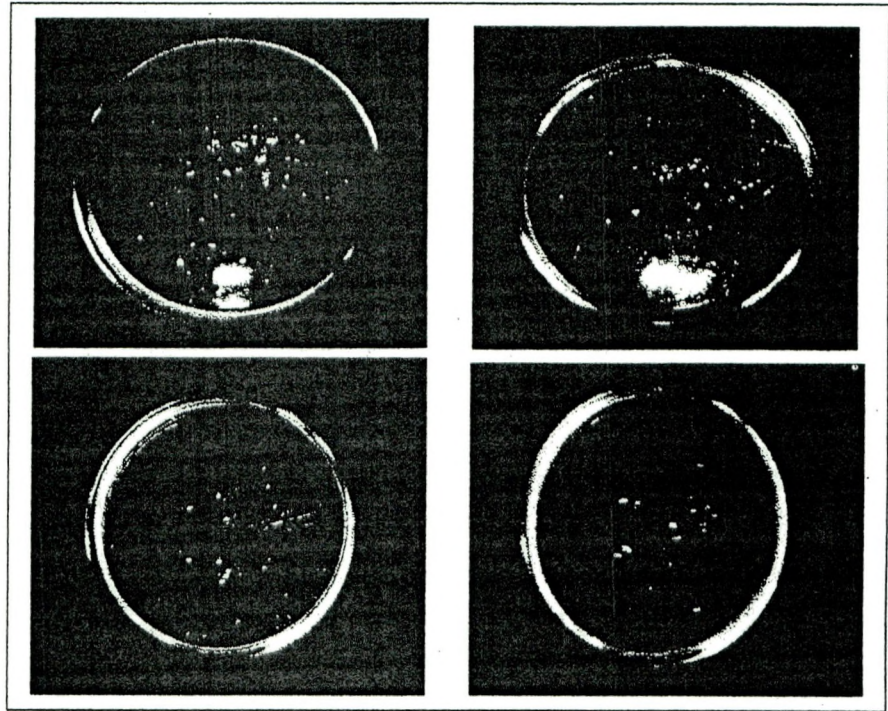
Indian *Acalypha* & its ethanolic extracts

carried out for untreated sample, and sample treated with 50% and 75% and 100% concentrations.

**Antifungal activity**

- AATCC 30-1993 : Antifungal activity and assessment of textile material : Mildew and rot resistance of textile material - Agar diffusion test : 500 ml Elenmeyer conical flask containing 50 ml of PD broth was prepared and sterilised at 121°C for 15 minutes. It was then allowed to cool. The fabric samples were transferred aseptically into the conical flasks respectively. These were kept at room temperature for 3 days. Then the growth of fungi in the conical flask was observed after 7 days.

- Mycelia growth test : 50 ml of PD agar was prepared and sterilised at 121°C for 15 minutes. 20 ml of agar was poured. Then the 1x1 inch fabric was placed on the agar. The mycelia growth on the fabric was measured.



Antibacterial activity of Indian Acalypha leaf treated fabric

**Results and discussion**

- AATCC-100-1998 : Absorbance of the sample is directly proportional to the concentration of the cells in the sample. The absorbance values of all the five samples were compared and it was found that the sample treated with 100% concentration gives low absorbance value. This indicates that the 100% treated samples do not support much the growth of bacteria compared to others. The samples taken from the fabric treated with 75% concentration also gives low absorbance value when compared to the untreated sample.

- AATCC-147-1998 : After incubation, the plates were observed for bacterial growth. Then the numbers of colonies

were counted for each plate. This showed that 100% treated samples received less number of colonies when compared to other samples. Samples treated with 75% concentration also received less number of colonies when compared to untreated sample.

The results indicate that the 100% treated sample does not support the bacterial growth to a larger extent, whereas 50% and 75% treated samples do so to a smaller extent when compared to the untreated sample.

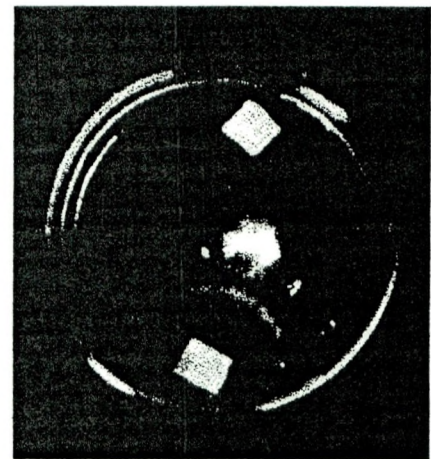
- AATCC 30-1993 : It was found that there is no growth of fungi in the conical flask containing 100% treated acalypha fabric. This indicates that 100% treated fabric gives good antifungal finishing. There is some growth of fungi in the conical flasks containing 50% and 75% treated acalypha fabric when compared to 100% treated fabric, but there is less growth when compared to the untreated fabric. This indicates that other treated fabric also has better antifungal activity.

- Mycelia growth test (Acalypha) : There is a reduction in the growth of mycelia in all the treated samples when compared to untreated fabric samples.

The 100% treated sample shows maximum antifungal activity than others.

**Wear sample study**

The garment men's shirt was especially developed for controlling the skin rashes, itching and ringworms in the internal body parts like neck, arms and elbows. As per the questionnaires filled by the wearers and the comments stated by them, it was understood that the garment did not cause any rashes, irritations or allergies to the body. They stated that the handle of the garment



Mycelia growth test

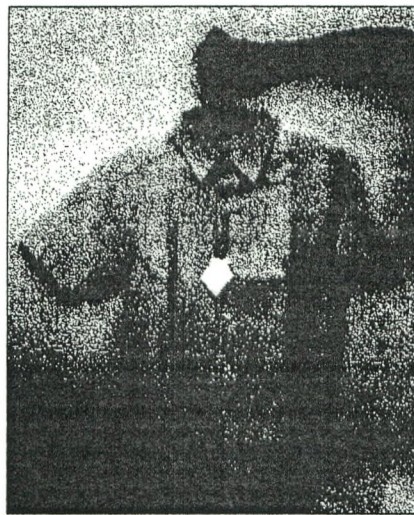
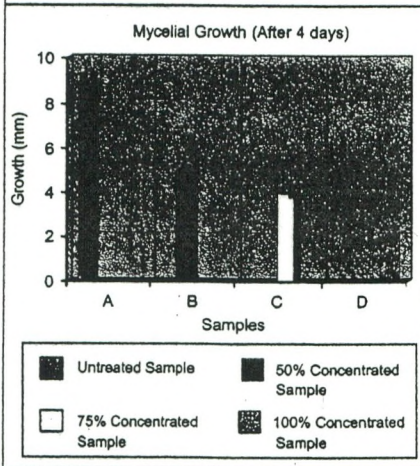
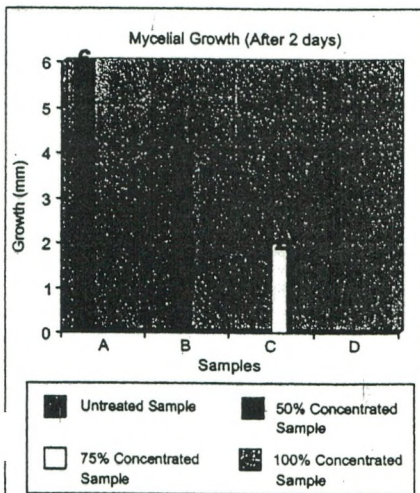
Sample	Indian Acalypha
Untreated sample	1.09
50% treated sample	0.93
75% treated sample	0.87
100% gel treated sample	0.82

Mycelia growth measurement		
Sample	Indian Acalypha	
	2 days	4 days
Untreated sample	6 mm	9 mm
50% treated sample	4 mm	5 mm
75% treated sample	2 mm	4 mm
100% treated sample	1 mm	2 mm

was very soft and also helped in curing and reducing skin rashes and itching day-by-day.

**Wash durability of finishes**

The antimicrobial activity of the finished samples was evaluated for fastness to washing after different wash cycles. The finished samples were washed using the standard detergent (1% owf) and sodium carbonate

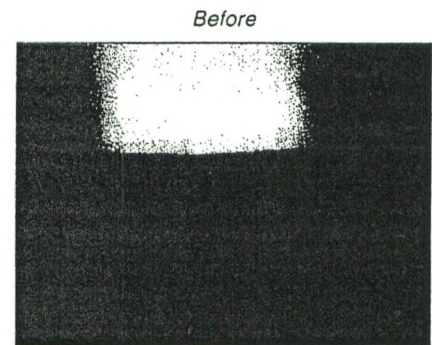


Indian Acalypha treated product : Men's shirt

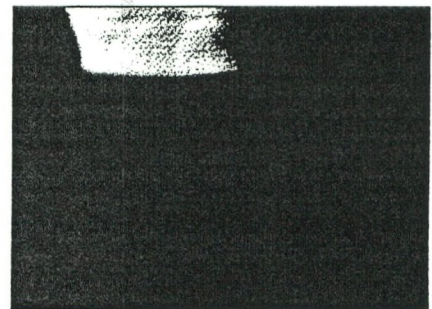
(1% owf) at 40°C. The antimicrobial activity was assessed after 10,15,20,25 washes by the challenge test. The washing fastness tests carried out revealed that 50% concentration of all the samples lasted for 15 washes; 75% concentration samples lasted for 20 washes; and 100% concentration of all the treated samples stood for about 25 washes. It is observed that the activity diminished gradually as the number of wash frequencies increase.

**Conclusion**

This research work has given a new idea in finishing of cotton with herbs for antimicrobial activity (Indian Acalypha). The antimicrobial activity on cotton has added a colorful feather to the cotton finish. From the studies conducted, Indian Acalypha is found to contain active antimicrobial substances that can control the growth of microbes and also cures skin rashes and itching. 100% treated samples exhibited maximum antimicrobial activity in all the tests. The treated fabric is found



Before



After



Before



After

Skin allergies - Wear study results

Sample	After 10 Washes Indian Acalypha	After 20 Washes Indian Acalypha	After 30 Washes Indian Acalypha
Untreated	16	23	-
50% conc	7	10	13
75% conc	5	8	11
100% conc	4	5	7

to be very hygienic with less fungi and bacteria as well as making the cloth much softer than before. The finish is cost effective and eco-friendly. It will also lay the foundation for medical textiles, where research can be carried out on the applications of Indian Acala-processed cotton for remedy of various skin diseases. Furthermore, the study will definitely enhance the export quality of cotton fabrics, especially when Indian exporters face tough competition after globalisation. In a nutshell, this study has opened doors for production of better and eco-friendly medically treated cotton fabrics.

**References**

- 1 Mucha H, Hoter D, and Swerev M, Antimicrobial finishes and modifications, Melliand International Dyer, May 2002, Vol 8, pp 148-151
- 2 Ian Holme, Antimicrobials Impart Durable Freshness, International Dyer, December 2002, pp 9-11
- 3 S Rajendran and S C Anand, Development

of versatile antimicrobial finish for textile materials for health care and hygiene applications. Bolton Institute, UK

- 4 D Gupta, Antimicrobial finishing of Textiles. www.resil.com
- 5 E Menezes, Antimicrobial Finishing of Textiles, The Textile Industry and Trade Journal, January-February 2002, pp 35-38
- 6 A K Rakshit and M A Hira, Developments in Healthcare Textiles, Man Made Textiles In India, Vol XLIII, No 1, January 2003, pp 21-25
- 7 Abha Bhargava and Mukesh Kumar Singh, Protective Norms, Safty Standards, The Indian Textile Journal, June 2006, pp 99-103
- 8 C W Can and C W M Yuen, Antimicrobial Finishes, Textile Asia, Vol XXXVII, No 7 July 2006, pp 32-36
- 9 Molan P C, The Antibacterial Activity of Honey Part 1 and Part 2, Bee World 73 : 5-76, 1992
- 10 Chevallier A, The Encyclopedia of Medicinal Plant, New York, NY : DK Publishing Inc, 1996
- 11 Lee (2004) Wound Healers Cause Skin

Disease Science Daily, 2004, Vol 15, pp 45-67

- 12 Edward M, Mrinal C, Special Finishes and Effects, AATCC Review, March, pp, 29, 30 (2007)
13. Edward, Antimicrobial finishing for speciality textiles, International Dyer, December 2002, pp 67-69
- 14 Deepti Gupta, Astha Jain and Shikha Panwar, Anti-UV and antimicrobial properties of some natural dyes on cotton, Indian Journal of Fibre and Textile Research, Vol 30, June 2005, pp 190-195
- 15 Aly Sayed Aly, Ali Hashem and Samaha Sayed Hussein, Utilisation of chitosan citrate as crease-resistant and antimicrobial finishing agent for cotton fabric, Indian Journal of Fibre and Textile Research, Vol 29, June 2004, pp 218-222.

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## DuPont's Sustainable Solutions to strengthen presence

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## Novozymes opens R&D centre in Bangalore

Novozymes, the world's largest enzyme manufacturer, has opened its new R&D centre in Bangalore, India. The new centre is a state-of-the-art facility that will play an important role in the company's efforts to discover new applications and technologies globally and locally. The new centre is a state-of-the-art facility that will play an important role in the company's efforts to discover new applications and technologies globally and locally.