

# Man Made Textiles in India

OCTOBER 2010 Vol. XXXVIII No. 10

Annual Subscription Rs. 600.00

Single Copy Rs. 60.00

Textile In Footwear

Block Printed Organic Cotton

Rock Fibre (Basalt)

Eco-friendly Antimicrobial Finish

Comparative Study on Dyeing

53<sup>rd</sup> Year of Publication

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# Development Of Eco-friendly Antimicrobial Finish On Cotton Using Calendula Officinalis (Marigold)

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**A new approach is made to make the textile material antimicrobial using natural medicinal herbal extracts on cotton fabrics. The herb, Marigold is available plant in Tamil Nadu, was chosen for the study. The plant extract was screened by qualitative antimicrobial test for the presence of active principles. It involves the applications of Marigold petals extracts of the plant onto cotton fabric by optimizing the process conditions-pH, time and temperature.**

## INTRODUCTION

Health care professionals have an increasing concern over exposure and transfer of, various microorganisms that are commonly carried through bodily fluids. In the present day world, Hygiene is Headline news and consumers are very conscious of textiles that are hygienic. Healthcare is a serious business which is not only influenced by practicing medical professionals. Good hygiene is an aid to health, comfort and social interactions. It directly aids in disease prevention or disease isolation. With the increasing threat from new strains of bacteria and viruses growing problems. Textiles come to our help in every walk of life, in either conspicuous or in conspicuous form the fields of application of technical textiles are unlimited and the ideas often revolutionary. Textiles being vulnerable to microorganisms attack would cause many cross infections and allergic reactions. Clothing and textile materials are not only the carriers of micro-organisms such as

pathogenic bacteria, odour generating bacteria and mould fungi, but also excellent media for the growth of the microorganisms [1,2].

Obvious smell from the inner garments such as socks, spread of diseases, staining and degradation of textiles are some of the detrimental effects of bad microbes. The number of bio-functional textiles with an antimicrobial activity has increased considerably over the last few years. The consumers are now increasingly aware of the hygienic life style and there is a necessity and expectation for a wide range of textile products finished with antimicrobial properties [3-6].

The present work aims at developing an eco -friendly natural antimicrobial finish from natural herbs for textile application. The Marigold (*Calendula Officinalis*) petal extracts (50%, 75% and 100% respectively) are applied on cotton fabric in pad dry cure method. An extensive study was conducted to assess the antimicrobial effectiveness of the herbs by employing standard test methods and the findings are discussed in this paper.

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## PREPARATION OF MARIGOLD EXTRACTION

The Fresh petals of marigold were shadow dried and made into a fine powder. Dry Powder is then mixed with 99.9 % absolute ethanol in the ratio of 1:5 in a beaker. The beaker is placed in the shaker and allowed overnight at 40°C. so that the ethanol takes in the active components of the petals. Then the solution is centrifuged and filtered using Wattman filter paper. The clear solution is poured onto the petri plates and placed in the hot air oven. The oven is set at 80°C and ethanol is allowed to evaporate for 1 hour



Ethanolic extracts of Marigold

## OPTIMIZATION OF PROCESS CONDITIONS

The process conditions are optimized using spectrophotometer at 360nm. And the optimized process conditions are 60°C, 75 Mins and pH- 6.

## FINISH APPLICATION

The processed extracts (50%, 75% and 100% conc.) was mixed with the mordant (alum) in the ratio 9:1. The liquor was finished onto the cotton fabric (Honey Comb Weave) at the optimized conditions in the ratio 1:20 in the water bath. (pad - dry - cure). The fabric was then dried at 80°C for fifteen minutes to remove the moisture. Finally, the fabric samples were tested for antimicrobial activity as per the standard test methods [7-10].

## STANDARD QUANTITATIVE TEST METHODS

### a) ANTI BACTERIAL ACTIVITY

- 1) AATCC-100-1998 (USA): Quantitative Assessment of Antibacterial finishes on textiles-measures the degree of antibacterial activity- Agar diffusion Test

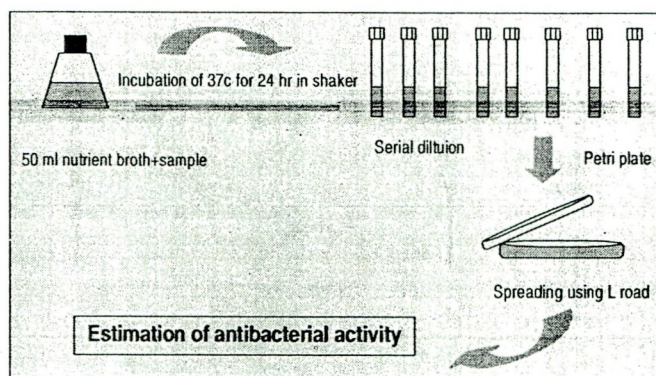
The 2"x 2" Samples were prepared from the Marigold (untreated, 50%, 75% and 100% treated). 500ml Elenmeyer conical flasks containing 50ml of nutrients broth were prepared and sterilized at 121°C for 15 minutes. It was then allowed to cool. The fabric samples were then transferred aseptically into the conical flasks respectively. These were incubated at 37°C for 24 hours in shaker at 121rpm. After incubation their absorbance were measured at 600nm.

- 2) AATCC-147-1998 (USA): Qualitative Antibacterial Assessment of diffusible antibacterial agents ("quick method")-Agar diffusion Test

50ml of nutrient agar was prepared and sterilized at 121°C for 15 minutes. Petri plates were autoclaved in hot air oven at 121°C for 30 minutes. 20ml of Nutrient agar was poured into each of these plates and were allowed to solidify.

A series of 8 test tubes containing 4.5ml of sterile water was taken. 0.5ml 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 liters 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 carried out for untreated sample, sample treated with 50% and 75% concentrations.



### b) ANTI FUNGAL ACTIVITY

- 1) AATCC 30-1993: Antifungal activity, Assessment of textile material: mildew and rot resistance of textile material-Agar Diffusion Test

500ml Elenmeyer conical flask containing 50ml of PD broth was prepared and sterilized 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 3 days.

- 2) Mycelial growth test:

50ml of PD agar was prepared and sterilized at 121°C for 15 minutes. 20ml of agar was poured. Then the 1x1 inch fabric was placed on the agar. Then the mycelial growth on the fabric was measured.

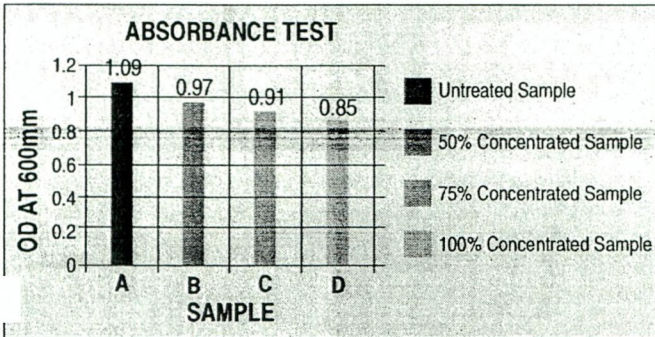
## RESULTS AND DISCUSSION

- 1) AATCC-100-1998 (USA): Quantitative Assessment of Antibacterial finishes on textiles-measures the degree of antibacterial activity- Agar diffusion Test

Absorbance of the sample is directly proportional to the concentration of the cells in the sample. The absorbance values of all five samples were compared. It was found that the sample treated with 100% concentration gives low absorbance value. This indicates that 100% conc. treated fabric do not support the growth of bacteria compared to others. The samples taken from the fabric treated with 50% and 75% concentration of petal extract also gives low absorbance value when compared to untreated sample which indicates their antimicrobial activity.

ABSORBANCE TESTS AT 600 nm

Sample	Marigold
Untreated sample	1.09
50% treated sample	0.97
75 % treated sample	0.91
100 % gel treated sample	0.85



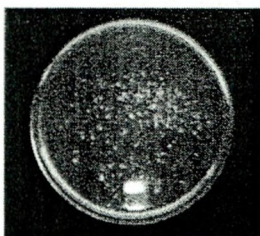
2) AATCC-147-1998 (USA): Qualitative Antibacterial Assessment of diffusible antibacterial agents ("quick method")-Agar diffusion Test.

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 has got less number of colonies when compared to other samples.

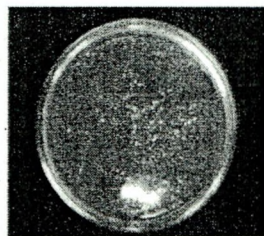
Samples treated with 75% concentration also got less number of colonies when compared to untreated sample.

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

Antibacterial activity of Marigold petal treated fabric



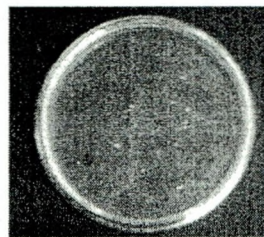
Untreated Sample



50% Treated Sample



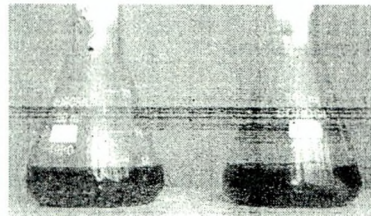
75% Treated Sample



100% Treated Sample

3) AATCC 30-1993: Antifungal activity, Assessment of textile material: mildew and rot resistance of textile material-Agar Diffusion Test

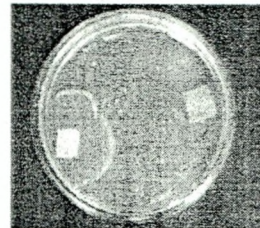
It was found that there is no growth of fungi in the conical flask containing 100% treated marigold fabric. This indicates that 100% treated fabric gives good anti fungal finishing. There is some growth of fungi in the conical flasks containing 50% and 75% treated marigold fabric when compared to 100% treated fabric. But there is less growth when compared to untreated fabric. This indicates that other treated fabric also has better anti fungal activity.



AATCC-30 TEST FOR MARIGOLD

4) MYCELIAL GROWTH TEST:

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 anti fungal activity than others.

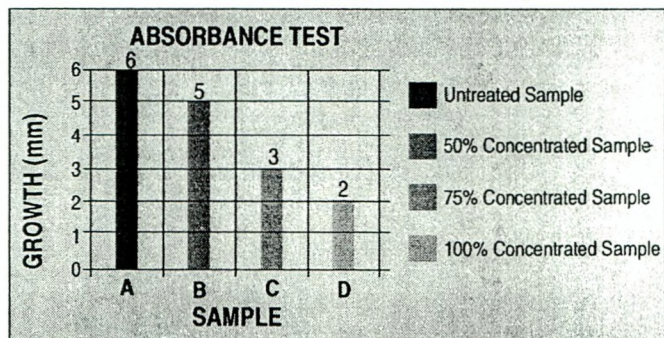


MYCELIAL GROWTH TEST (MARIGOLD)

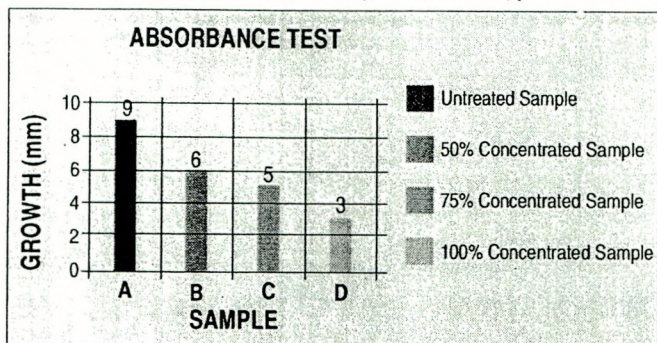
Sample	Growth in 2 days	Growth in 4 days
Untreated sample	6 mm	9 mm
50% Concentration sample	5 mm	6 mm
75% Concentration sample	3 mm	4 mm
100% Concentration sample	2 mm	3 mm

MYCELIAL GROWTH MEASUREMENT

MYCELIAL GROWTH (AFTER 2 DAYS)



## MYCELIAL GROWTH (AFTER 4 DAYS)



### 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 (1% owf) at 40C. The antimicrobial activity was assessed after 10,15,20,25 washes by challenge test. The washing fastness tests carried out revealed that 50% concentration of all the samples lasted for 10 washes, 75% concentration samples lasted for 14 washes and 100% concentration of all the treated samples stood for about 18 washes. It is observed that the activity diminished gradually as the number of wash frequencies increase.

### CONCLUSION

From the study conducted, the Marigold flowers are found to contain active antimicrobial substances that can control the growth of microbes. The 100% treated sample exhibited a maximum antimicrobial activity in all tests. The washing fastness tests carried out revealed that 100% concentration of all the treated samples stood for about 18 washes. In addition this flower has the property of curing itching and rashes. So, the further work on bonding the active substances on textile substrates would help to resolve the issues like rashes, itching in baby diapers, diminishing activity of finishes and special end uses. This natural antimicrobial finishes will be an alternative for the harmful chemicals and also to develop a eco-friendly product and environment.

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