

A study of *Chrysanthemum coronarium* antibacterial efficacy on cotton for hospital textiles

V. Krishnaveni, G. Rajkumar

Department of Fashion Technology, Kumaraguru College of Technology, Coimbatore, Tamil Nadu, India

Abstract

Background: Bacterial control coating mechanisms are flourishing in the present day life. Antimicrobial coating on textiles will diminish the transmission of microorganisms onto the wearer. The medicinal plants bring into being in nature and it exhibits excellent antimicrobial properties. **Materials and Methods:** The research work has been imparted to analyze the efficacy of antimicrobial controlling power on fabrics using the flower extract of *Coronarium* which were screened for their antimicrobial activity. The antibacterial effect is evaluated in herbal-coated samples by AATCC 147 and AATCC 100 tests against positive and negative bacteria. **Results and Discussions:** The outcome of results exhibits the better microbial inhibition in floral extract-coated fabric with adhesive mordant in the M: L ratio of 1:10 against Gram-positive and Gram-negative bacteria. **Conclusion:** The application of herbal extract on fabrics lasts up to 12 washes in pad-dry-treated fabrics.

Key words: Agar well diffusion, antibacterial activity, broth dilution, *Chrysanthemum coronarium*, ethanolic extract, microorganisms

INTRODUCTION

In the present day world, the hygiene of human beings is frequently affected by the environmental climates and pollution. The pollute substances will create the hazard effect in health conditions through various microorganisms. Hence, we make sure that protection and comfort from microbial substances are required using the technology as a token of our protection. With gaze at the textile sector, the protective materials are keen to fulfill the demand of hospital barrier controls.^[1]

As a outcome, the textile materials should possess protective microbial control with value-added multi functional finish particularly for medicinal clothes, are greatly appreciated, and there is a necessity of textile product with antimicrobial properties.^[2] The exploit of herbal plants and plant products such as flowers, barks, roots, and leaves could be traced for medicinal purposes.^[3] Nature has endowed an abundant botanical wealth of plants and trees with numerous disease curing properties and medicinal values in all over the world.^[4]

The Asteraceae family of *Chrysanthemum coronarium* is a commonly available plant in

all areas and climates which possess a mixture of bioactive compounds for curing the assorted skin infections. The *Coronarium* has miracle medicinal values with vibrant curing properties such as the leaves are expectorant and flowers are stomachic.^[5]

The major aim of the work is to develop a sustainable antimicrobial finished product from natural finish for hospital textile application. A widespread study was conducted to assess the antimicrobial effectiveness of the herbs by employing standard test methods, and the findings are discussed in this paper.

MATERIALS AND METHODS

Selection of Textile Material

In the research work, the cotton yarn was specially made into

Address for correspondence:

V. Krishnaveni, Department of Fashion Technology, Kumaraguru College of Technology, Coimbatore - 641 049, Tamil Nadu, India.
E-mail: krishnaveni.v.ft@kct.ac.in

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sateen weave and the count of 2×41 's which is most suitable for hospital textile materials. After that, the woven fabric has sent for some kind of cleaning process such as scoured and bleached before the finish on raw cotton.^[6]

Selection of Antimicrobial Herb

The *C. coronarium* was the plant species preferred for the study based on our requirements of end use. This herb has a high level of bacterial control with antimicrobial activity. The flowers of *C. coronarium* were collected and shade dried and made into a fine particles using grinding machine.^[6]

Extraction Method of *C. coronarium* Solution

The *Coronarium* powder of 10 g was taken and added the 100 ml of ethanol solvent in a conical flask. Then, airtight the conical flask with cotton and the same was kept inside the shaker for 24 h. Then, the extract was separated from the extrude and reserved for solvent evaporation for 3 h in hot air oven. The final crude extract precipitate was taken and diluted as per the end use.^[7-9]

Finish Application Method on Cotton Fabric

The *C. coronarium* extract was applied on to the cotton fabric with the optimized finish process parameters such as temperature - 40°C, time - 1 h, and concentrations - 5%, 15%, and 25% by pad-dry-cure method at M: L ratio of 1:10. Then, for fixation of finish, the mordant alum was used as a binding agent to fix the herbal extracts on to fabric. After some time, the fabric was then dried at 80°C for 10 min to remove the moisture, and then, it was cured at 100°C.^[10] At the final point, the antimicrobial efficacy of coated fabric samples was checked by standard test conditions.

AATCC-147 Qualitative Assessment of Antibacterial Activity by Agar well Diffusion Method

The antibacterial efficacy of extract was analyzed using agar well diffusion method.^[11] About 25 ml of nutrient agar

was allowed for sterilization at 111°C for about 20 min. The autoclaved Petri plates were taken and add a nutrient agar of 20 ml to the Petri plates, and then, it was allowed to solidify. The extract was converted into 100 µg/ml concentration and poured in the developed well, and the plates were incubated for 24 h at 37°C. After 24 h, the antibacterial activity was assessed against the test organisms of Gram-positive and Gram-negative bacteria by measuring the zone of inhibition.

RESULT

The agar diffusion test results of *Coronarium* extracts for antimicrobial effectiveness against Gram-positive and Gram-negative bacteria such as *Staphylococcus aureus* and *Escherichia coli* bacterial organisms are given in Table 1. The bacterial zone is point out by a halo around the samples.^[12-14] After 24 hrs of time duration, the bacterial growth was observed through the number of colonies accessible on plates, and the zone of inhibition was observed on each plate. The results indicated that there was a lesser amount of colonies in the extract-coated fabric than uncoated fabrics.

The broth dilution test results of uncoated and extract-coated cotton fabric sample reduction rates at different concentrations are given in Table 2. The results were expressed that when increase the extract concentration, automatically a number of colonies will get reduced. Then, the bacterial reduction percentage effectiveness was measured by the absorbance values of each sample. The outcome of result exhibits that the 25% extract concentration-coated fabric absorbance value was very low (0.27 and 0.33) compared to 5% concentration-coated fabric (0.50 and 0.68), from Table 2.

The durability of antimicrobial efficacy was analyzed on the herbal-coated samples by fastness to washing through various level of wash cycles, and the percentage of antimicrobial effect is presented in Table 3. The 25% extract-treated samples showed better antimicrobial finish durability when compared to 15% and 5% *Coronarium*-treated samples of each wash cycle. All the herbal-coated samples exhibit the higher level of durability, but it is based on the concentration of finish given on the fabric samples.

Table 1: Qualitative zone of inhibition of *coronarium* extracts finished and unfinished cotton fabric samples

Samples	Antibacterial activity against <i>Staphylococcus aureus</i> bacteria (mm)	Antibacterial activity against <i>Escherichia coli</i> bacteria (mm)
Uncoated cotton sample	0	0
<i>Coronarium</i> extract-coated cotton fabric sample (5%)	11	12
<i>Coronarium</i> extract-coated cotton fabric sample (15%)	20	18
<i>Coronarium</i> extract-coated cotton fabric sample (25%)	28	26

Table 2: Quantitative test results of *coronarium* extracts finished and unfinished cotton fabric samples

Samples	Antibacterial activity (absorbance value OD at 600 nm)			
	<i>Staphylococcus aureus</i> Gram-positive bacteria		<i>Escherichia coli</i> Gram-negative bacteria	
	Absorbance value	Percentage reduction of bacteria after treatment	Absorbance value	Percentage reduction of bacteria after treatment
Uncoated cotton sample	1.07	0	1.03	0
<i>Coronarium</i> extract-coated cotton fabric sample (5%)	0.50	51.46	0.64	35.45
<i>Coronarium</i> extract-coated cotton fabric sample (15%)	0.39	63.55	0.40	60.16
<i>Coronarium</i> extract-coated cotton fabric sample (25%)	0.27	78.50	0.33	67.93

Table 3: Durability of antimicrobial effect of finished sample after 25 washes

<i>Staphylococcus aureus</i> bacteria		<i>Escherichia coli</i> bacteria	
Wash cycles	Zone of inhibition (mm)	Wash cycles	Zone of inhibition (mm)
1	16	1	15
3	13	3	13
5	11	5	10
10	10	10	8
15	8	15	6
20	6	20	3
25	2	25	1

DISCUSSION

The 25% of *Coronarium* extract-coated cotton fabric samples illustrate a maximum zone of inhibition of about 28 mm and 26 mm when compared to 5% extract-coated (11 mm and 12 mm) and uncoated cotton samples by agar diffusion test method.

From Table 1, the results showed that the 25% extract-coated cotton fabric does not prolong any bacterial growth to over a period of time against Gram-positive *S. aureus* and Gram-negative *E. coli* bacteria. Whereas 5% and 15% *Coronarium* coated cotton fabric samples also provide a better bacterial control to a particular period of time when compared to the uncoated fabric sample.

The quantitative analysis results indicate that the 25% extract-coated cotton fabric does not support the growth of *S. aureus* and *E. coli* compared to others in Table 2.

The highest concentration of floral extract-coated samples proved the superior bacterial reduction percentage against the Gram-positive and Gram-negative bacterial organisms after the finish application on samples.

From Table 3, the test results of antimicrobial effect revealed that all the chrysanthemum herbal finished samples showed a certain degree of durability.

The highest concentration-coated samples stayed for 10 washes than other coated samples. It was observed that the activity diminished gradually as the number of wash cycles increase. Hence, the durability factor only gives the life span of any textile finished materials or product.

CONCLUSION

The *C. coronarium* extract finished fabric samples give better antibacterial activity against Gram-positive and Gram-negative bacteria in all the concentrations of extracts. The 25% chrysanthemum extract finished samples exhibited maximum antibacterial activity in all the tests. The *C. coronarium* finishes increase the durability and antibacterial activity of finished fabric to a greater extent. The extract finished fabric is found to be extremely germ free as well as manufacturing the cloth with softer. This finish is cost-effective and sustainable, and also, it will be a renewable source of finish. Hence, this chrysanthemum extract finish

will be more appropriate for the hospital textile application to control the bacterial infections.

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