

## Herbal Antimicrobial Finishes for Selected Denim Blends



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## Abstract

This study focuses on the four variant of denim fabrics using three herbal extracts of *Ricinus communis*, *Senna auriculata* and *Euphorbia hirta* which were screened for their antimicrobial efficiency by finishing the methanol extracts of these herbs on the denim fabrics. Of these extracts and the condition 20kgf/cm<sup>2</sup> Pressure, 20m/min rpm were followed by pad dry cure method. To enhance the durability of the finished fabric, wash durability test were performed and the results showed good resistance for microbes even after 30 industrial washes against the *Escherichia coli* and *Staphylococcus aureus*.

## Introduction

Denim is being worn irrespective of demographic differences. Denim has gain much popularity that if you look around, you will surely notice some body wearing denim in your near by. The finishes will be a great value addition since denims are worn for an extended period of time and several properties like the antimicrobial herbal finishes are necessary for the denim fabric to inhibit the growth of microbes on the surface of the fabric, Maintains hygiene and freshness, stops bad odor, Controls or eliminates microbial staining, Improves strength and Eliminates the chances of disease transmission.

In denim fabric antimicrobial herbal finishing work is carried out not much. So an attempt has been made to improve the usage of herbal finishes in denim fabrics. With the above background information the present research work has been planned. Some selective species of plants were identified and screened for their activity and the extracts were applied to selected four fabrics. 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, to evolve the best denim fabric imparted by the herbal combination and Wash durability test carried out for the best denim fabric.

## Materials and methods

### Selection of Material - Fabric selection

The fabric was sourced from the market with respect to the expected quality requirements. The fabric chosen was

- A-68% Cotton + 32 % Polyester
- B-68% Cotton + 32 % Poly Lycra
- C-68% Cotton + 32 % Core spun Lycra
- D-100% Cotton

## **Methods**

### **Selection of herbs for antimicrobial finish**

Based on the review of literature Pilot study was conducted with 20 selected herbs, from the pilot study three best resulted herbs were selected Ricinus communis, Senna auriculata and Euphorbia herita. The combinations are (1:3:2) and the condition 20kgf/cm<sup>2</sup> Pressure, 20m/min rpm were standardized for the selected best herbs.

### **Cleaning and powdering of the herbs**

The plant parts were washed twice in fresh water to remove other extraneous matter from the plants. These herbal materials were shadow dried and powdered by using grinding machine

### **Methanol extraction**

Each 6g of the powdered plant material was mixed with 100 ml of methanol in airtight conical flask. After overnight incubation, the supernatant was filtered through Whatman no.1 filter paper and the filtrate was dried to evaporate the organic solvent at room temperature. The sediment after evaporation was used for finishing the denim fabrics.

### **Qualitative Antibacterial Assessment by AATCC 147**

The fabric samples with the diameter of 2cm ± 0.1cm were taken for the analysis. All the samples were immersed into the extract for 30 minutes and dried and surface sterilized in UV radiation. Sterile bacteriostasis agar was dispensed into Petri dishes. Broth cultures (24 hours) of the test organisms were used as inoculums. Using sterile cotton swab the test organisms (*Escherichia coli* & *Staphylococcus aureus*) were swabbed over the surface of the agar plate. Pre sterilized samples were placed over the swabbed agar surface by using sterile spatula. After placing the samples, all the plates were incubated at 37 °C for 18 to 24 hours. After incubation the plates were examined for the zone of bacterial inhibition around the fabric sample. The size of the clear zone was used to evaluate the inhibitory effect of the herbal extract.

### **Qualitative Antifungal Assessment by AATCC 30**

This Test method is to determine the susceptibility of textile materials to mildew and rot and to evaluate the efficacy of fungicides on textile materials. An inoculums of 1.0ml was evenly distributed over the surface of the agar. The fabric discs were pre wetted (not rubbed or squeezed) in water containing 0.05% of a non-ionic wetting agent (triton X-100) and placed on the agar surface. The inoculums of 0.2 ml was distributed evenly over each disc by means of a sterile pipette. All the specimens were incubated at a temperature of 28°C for seven days. At the end of the incubation period the percentage of the surface area of the discovered with the growth of the fungus was reported by observing visually and using a microscopic (40X) and interpreted as follows:

- No growth (If present, the size of the growth free zone in mm was reported)
- Microscopic growth (visible only under the microscope)
- Macroscopic growth (visible to the naked eye).
- Wash durability test

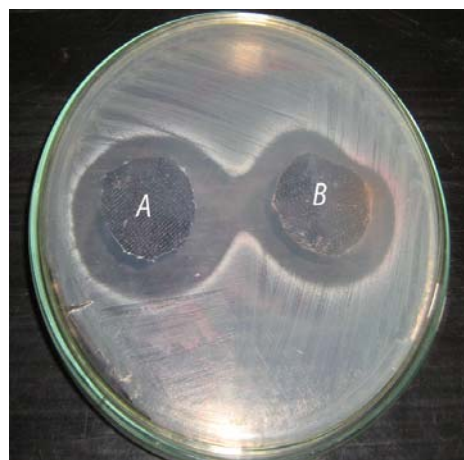
The antimicrobial activity of the finished samples was evaluated for fastness to washing after different wash cycles. Finished denim fabric was analyzed for their wash durability by subjecting the sample to washing and testing its antimicrobial efficiency was assessed after 10, 20 and 30 washes.

**Result** **and** **Discussion**

Table-i Antibacterial activity for the finished fabric AATCC 147

S. No.	Fabric samples	Bacterial reduction (in %)	
		Staphylococcus aureus	Escherichia coli
1.	Denim A	29	30
2.	Denim B	27	29
3.	Denim C	29	29
4.	Denim D	30	30

The result for antibacterial effectiveness against standard test cultures viz., E-Coli (gram negative) and Staphylococcus aureus (gram positive) organisms shows that the activity of treated samples is stronger for S.aureus and E-coli. It is attributed that bacterial inhibition is due to the slow release of active substances. From the table -i and fig- i it is clearly shows that denim D has good antimicrobial property when compared to other variants. So wash durability test has been carried out for the best sample D (100% cotton). [1] The methanol of the Punicagranatum L leaf, Peel and Termanilla chebula fruits were applied on the textile material by Pad-Dry-Cure method. The results indicates the presence of clear zone of inhibition of 27-38 mm diameter for both water and methanol extract treated fabrics against all the five selected micro organism namely



Staphylococcus aureus (gram positive), Escherichia coli, Klebsiella pneumoniae, Proteus vulgaris and Salmonella typhi (gram negative).

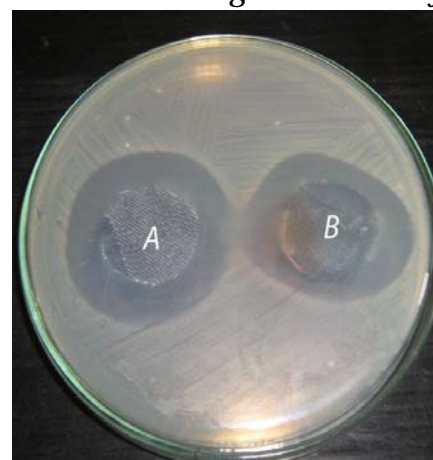






Figure i - photograph view of (a) Escherichia coli and (b) Staphylococcus aureus of the antibacterial activity of the finished fabric

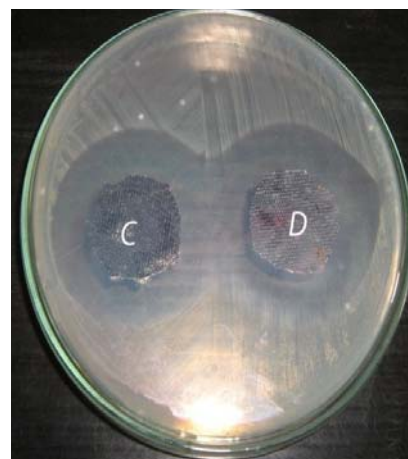


Table-ii Wash durability test (D-100% cotton denim fabric)

S. No.	Fabric samples	Bacterial reduction (in %)	
		Staphylococcus aureus	Escherichia coli
1.	Denim D sample	30	30
2.	After 10 washes	29	29
3.	After 20 washes	28	27
4.	After 30 washes	25	23

The antimicrobial activity of the finished samples was evaluated for fastness to washing after different wash cycles. The finished samples were washed using a standard detergent. The antimicrobial activity was assessed after 10, 20 and 30 washes. It is observed that the activity diminished gradually, as the above table-ii indicates that the samples are having very good antibacterial properties to both gram positive and gram negative microorganisms and the efficiency of fabric is withstanding even after 30 industrial washes.

### Antifungal Activity of the finished fabric AATCC 30

Table-iii Antifungal activity (Mycelial reduction - %) Aspergillus niger

S. No.	Name of the Denim Variants	Antifungal activity (Mycelia reduction - %) Aspergillus niger
1.	Denim A	98
2.	Denim B	80

3.	Denim C	60
4.	Denim D	100

From the table-iii and fig –ii shows the antifungal activity of the four variant of denim fabrics against *Aspergillusniger* was studied and this activity was indicated by zone of mycelia reduction. The samples Denim D have not allowed the fungal spores to colonize around it, so it is considered as best sample when compared to other 3 samples. So the wash durability test has been carried out for the best sample D. [2] The antifungal activity of the fabrics against *Aspergillusniger* was studied and this activity was indicated by zone of hypostasis. The antifungal activity of cotton fabrics with and without copper nanoparticles was evaluated. In the fabrics without copper nanoparticles (control) no zone of mycostasis was observed. However, the cotton fabrics with copper nanoparticles presented maximum zone of hypostasis.

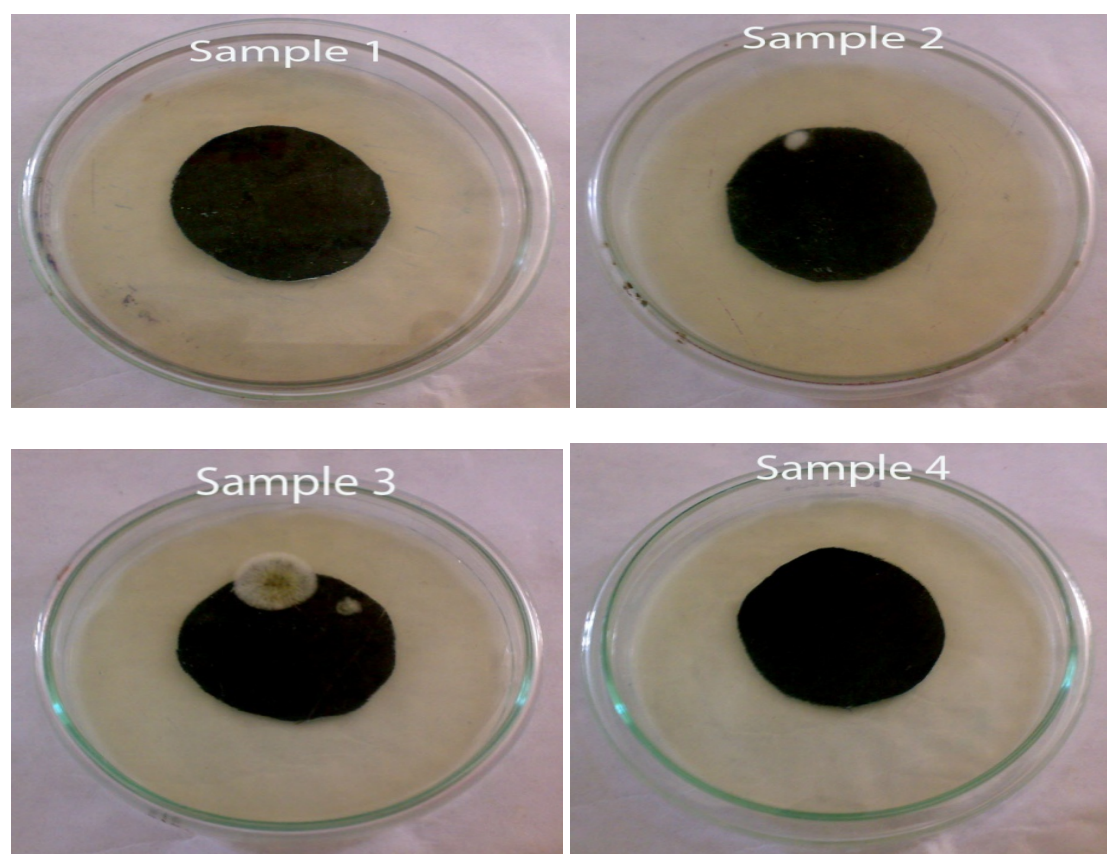


Figure ii-photograph view of the antifungal activity of the *Aspergillusniger* finished fabric

Table-iv Wash durability test (100% cotton denim fabric)

S. No.	Name of the Denim Variants	Antifungal activity (Mycelia reduction - %) <i>Aspergillus niger</i>
1.	Denim D	100
2.	After 10 washes	90
3.	After 20 washes	70
4.	After 30 washes	60

The antifungal activity of the finished samples was evaluated for fastness to washing after different wash cycles. The finished samples were washed using a standard detergent. The antifungal activity was assessed after 10, 20 and 30 washes. It is observed that the activity decreased gradually, as the above table-iv it is clearly shows that the efficiency of fabric is withstanding even after 30 industrial washes.

### Conclusion

In conclusion the necessity for antimicrobial finishes in textiles is more to avoid infections, control infestation and safeguard the textile product. The present investigation shows that the fabric is environment friendly without any harmful Chemicals. Hence the finished antimicrobial fabric is considered to be an eco friendly fabric. The durability of the herbal finishing was with stand for the washed fabrics even after 30 industrial washes against the standard strains.

### References

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