AN EXPERIMENT IN ANTIFUNGAL FINISHING WITH HERBS FOR TEXTILE APPLICATIONS

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Abstract: The current study focuses on herbs (*Carica papaya L., Ziziphus jujuba and Thespesia populnea*) utilized in cotton fabrics with an antifungal finish. The herbal extract was applied to the fabric using the dip and dry procedure. The antifungal activity has been evaluated using the AATCC-30 test technique. Even after ten washes, the eco-friendly treated cotton cloth had exceptional antifungal activity. The samples were evaluated for SEM and physical cotton qualities such as tensile strength and stiffness test.

Key Words: Antifungal finish, Cotton, *Carica papaya L., Ziziphus jujuba, Thespesia populnea*, Dip and Dry method and SEM analysis.

1. INTRODUCTION

Environmentally friendly items are in high demand these days. Many studies have been conducted to employ natural herbal plant extracts for antimicrobial finishing in textiles due to their strong antibacterial and antifungal capabilities. These natural antibacterial agents can be employed as an antibacterial finish since they are less harmful, less irritating, and biodegradable. The demand for antimicrobial finished clothing is increasing as customers become more conscious of the hygienic and potentially dangerous impacts of microorganisms.

Many plant extracts with antibacterial qualities can be utilised as finishing agents in textiles. The majority of antimicrobial agents available on the market for textile applications are synthetic-based and may be harmful to the environment. The fast development of unique finishing processes has offered numerous opportunities while also posing obstacles to producers[(1)].

It is extremely important and appropriate to improve textiles with antimicrobial finishes since clothing come into direct touch with the human body. Finishes must also be economically viable and environmentally friendly [(2)].

As a result, many consumers are turning away from herbal antimicrobial treatments for textiles. An antimicrobial coating on a textile not only protects the fabric, but also the user, from microbial invasion. Cotton is known as the "King of Fibers" because it is a highly preferred conventional and adaptable natural cellulosic fibre in the global textile sector. It is well-known for its intriguing feel, comfort, and adaptability [(3)]. In high humidity, the fibre absorbs moisture and feels pleasant on the skin. Moisture freely travels through the cloth, assisting evaporation and cooling [(4)].

2. MATERIALS AND METHODS

2.1 Fabric Selection

Cotton is a fibre that can be used in a variety of ways. Cotton is easier to wash and preserve than fabrics created from other natural and synthetic fibres. Cotton does not adhere to the skin, odour, pill, or irritate it. Cotton is very inexpensive when compared to other fibres. Cotton does not absorb odours, so you can wear it more and wash it less.

2.2 Herbs chosen for their antifungal characteristics

The herbal plant was identified and harvested in its purest form from natural resources. Thespesia populnea (poovarasu leaves), Carica papaya, and other natural herbs are used. For antifungal action, L. (Papaya leaves) and Ziziphus jujuba (Ilanthai leaves) were chosen.

2.3 Solute Herbal extraction

The required amount of dry powder was combined with methanol; the container was sealed and left overnight. The extract was filtered via filter paper after an overnight incubation. Condensation / evaporation Methanolic solvents were evaporated after filtering the herb extract, and the herb extract was condensed. Herbs were extracted using this approach by preparing an aqueous solution of the dried leaves, bark, and stem (3.3 g in 100 ml distilled water) and extracting them for 2 hours at a temperature range of 50^{o}C - 95^{o}C**.**

2.4 Mordant Selection

Alum is soluble in water and reacts in a regular octahedral structure. When heated, the water of crystallization is pushed off, the salt froths and expands, and finally an amorphous powder remains.

2.5 Selection of finishing methods:

2.5.1 Method of Dip and Dry

The extract was finished with a dip and dry process on organic cotton fabric. The fabric was soaked in the desired amount of herbal extract for 30 minutes before drying.

2.5.2 Pre-Mordant

The fabric was immersed in the mordant bath for 30 minutes before being immersed in the appropriate dye bath for 30 minutes.

2.5.3 Post-Mordant

In this process alternatively fabric treated with dyeing solution after that the same fabric finished with the mordant solution.

2.6 Antifungal Activity Assessment by AATCC-30 test Method

A 1.0 ml income was uniformly placed across the surface of the agar. The fabric discs were placed on the agar surface after being pre-wetted (not rubbed or squeezed) in water containing 0.05 percent non-ionic wetting agent (triton X-100). Treated fabric samples were in close contact with potato dextrose agar that had previously been inoculated (mat culture) with broth suspension culture of test organisms (Mucor and Aspergillus Niger). After incubation, a clear area of uninterrupted development beneath and along the side of the test material demonstrates that the fabric is antifungal.

3.Results and Discussion

3.1Antifungal Assessment by AATCC 30 Test Method: (Mucor)

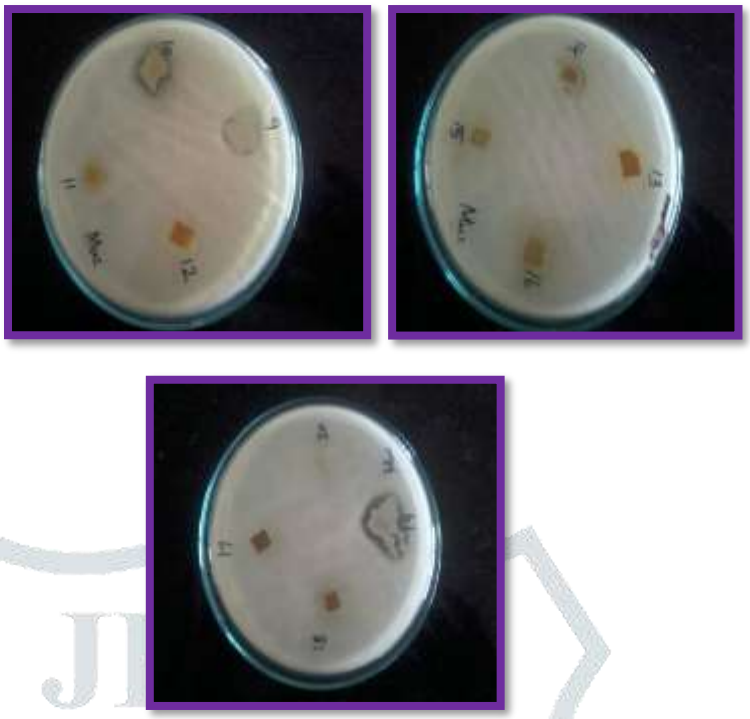
Table-1: Antifungal assessment (Mucor)

Sample	PM	POM
1	1.3	2
2	0	0.9
3	0	0

**PM-Pre mordant ,POM-Post mordant

According to Table 1, the antifungal activity of the PM sample showed a 1.3mm zone of inhibition, whereas the POM sample exhibited a 2mm zone of inhibition, the second POM sample showed 0.9mm, and the third sample showed no zone of inhibition.

PLATE-1 Antifungal assessment(mucor and aspergillus niger)

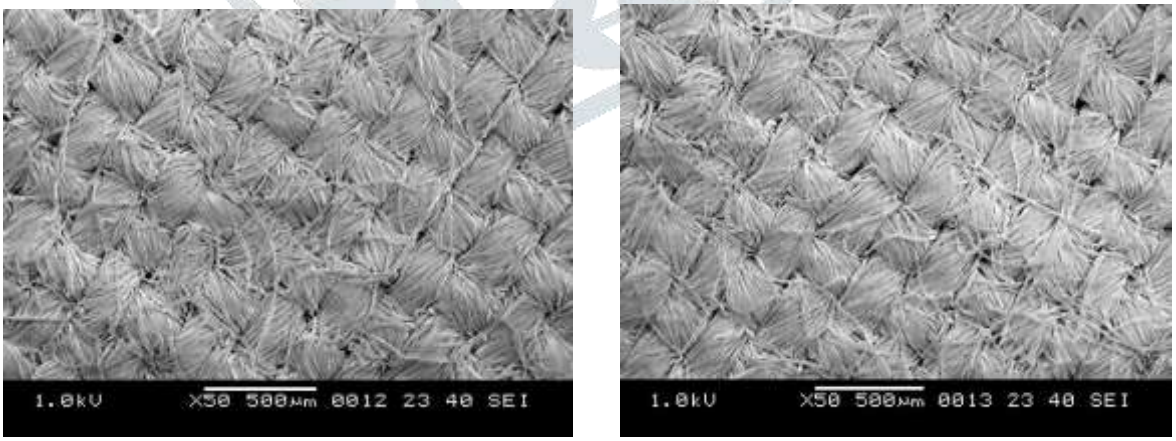


The above plate-1, sample was placed in the culture there is no movement of microbes at further development in a subsequent duration and environment condition.

3.2 Analysis of SEM

The Scanning Electron Microscope (SEM) allows visualization of surface features of a solid sample by scanning through an electron beam. SEMs produce images by focusing an electron beam onto the substrate material, raster scanning across the surface of a specimen, collecting the surface emitted electrons and displaying the surface topography on a screen. SEM has better resolution capability and depth of field than a light microscope. Therefore, good quality three-dimensional like images are obtained.

PLATE:2 SEM micrographic of treated pre-mordant and post mordant fabric sample



Scanning Electron microscopy (SEM) of cotton fabric samples was done to analyze the effect of herbal finish imparted using plant extract on fabric of pre-mordant & post mordanting methods. The analysis was carried out using standard methods. The surface morphology of the control (untreated) and treated cotton fabrics were studied using SEM. SEM micrographs confirmed that the proturdation and the interstitial pore size increased for the treated samples when compared to untreated samples. SEM results confirmed that the treatment has indeed etched the hair like projections which were present on the surface of the fabric. The mean diameter of the pores present in the fabric matrix was also increased. This improved the hydrophilicity of the fabric.

3.3 Fabric Thickness

TABLE-2 Fabric thickness in mm

S.NO	WTS	Thickness(mm)	
		FTS	
		PM	POM
1	0.24	0.25	0.25
2	0.25	0.27	0.27
3	0.23	0.26	0.25
4	0.24	0.25	0.26

The above Table-2 shows the untreated sample WTS 0.24mm, 0.25mm,0.23mm whereas the PM treated sample Showed good fabric thickness such as 0.25mm,0.26mm & 0.27mm and the POM sample also showed good thickness same as PM sample respectively. When compared with the WTS samples the PM & POM sample showed good thickness results.

3.4 Fabric Weight

TABLE-3 Fabric weight in gms

Sl.No	WTS	Fabric weight	
		FTS	
		PM	POM
1	1.742	1.756	1.756
2	1.740	1.750	1.751
3	1.738	1.753	1.753
4	1.740	1.757	1.754

The above Table-3, the untreated sample WTS showed 1.742 gms,1.740 gms, 1.738 gms &1.740gms whereas the PM treated sample Showed good fabric weight such as 1.756 gms,1.750 gms, 1.753 gms & 1.757 gms and the POM sample also showed good GSM same as PM sample respectively.

CONCLUSION

From the research work, it is concluded that cotton fabric treated for antifungal activity showed good result in post mordant techniques and the sample is also tested for its physical properties such as fabric weight, fabric thickness. Among this both the Pre mordant and Post mordant samples showed good results when compared with untreated samples.

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