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Assessment of Antimicrobial Activity of Carica Papaya Leave In Khadi Fabric

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Abstract

The increased significance in natural materials and renewable resources has come to the forefront, which motivates the investigation of natural dyes. Carica papaya is known with many other common name such as papaya, papaw, pawpaw. Various different parts of carica papaya plants extracts have shown protective effects against many diseases such as intestinal worms infection and different type of wounds. This study was aimed to extracts the carica papaya leaves with suitable mordants coated cotton khadi fabric. The extracted dyes were optimized and evaluated using UV-visible spectrophotometer. The treated khadi fabric was tested against common pathogens *escherichia coli (12mm), staphylococcus aureus (18.7mm), aspergillus niger (6.2mm) and candida albican*. The surface morphological study was done by Scanning Electron Microscopic.The dyed fabric was assessed in terms of physical properties tensile strength, thickness, stiffness, abrasion resistance and drape meter in accordance of ASTM standards.

Keywords: Natural dye, *Carica papaya leaves*,Khadi fabric, UV-VIS spectrophotometer, Mordant, Antimicrobial activity, Physical properties.

Introduction

Textile material find substantial application in day to day life. The use of natural dyes for the textile coloration has been raised due to their recently discovered deodorizing ,antimicrobial(1),anti feedant(2),UV protection(3) properties, in addition to the sober and elegant shades on the different shades of fabrics. Globally , significant research work has already been done on the assessment of natural dyes, colorimetric and fatness properties.(4,5,6,7) In recent year there has been increasing tendency towards the evaluation of microbial pigments and prevention of microbial attack on textiles.(7,8). These textile material provide a large surface area and absorb moisture, which facilitates microbial growth. Hence there has been growing

demand to develop the antimicrobial finishing for the textile material which offers improved protection to users against microbes destroying the desirable characteristics.(6,7) Carica papaya leaves belongs to the family caricaceae.(9) Papaya posses excellent medicinal properties for treatment of different aliments. Carica papaya having a two important bioactive compounds which includes the chymenopapain and papain. The papin is a bioactive compound which is used for treatment of arthritis.(10).The chemical compound of karpain ,has been found in leaves of papaya plant which compounds are to kill the microorganisms often interfere with digestive function.(11) In earlier studies reported that the papaya had positive effect against bacterial effect.(12) It was found that treatment of wound with Carica papaya improved efficiency of phagocytic cells that destroy bacteria [13] The purpose of this research is to optimize and assess the antimicrobial activity and physical properties of khadi treated with carica papaya leaves.

Materials and Methods

2.1. SELECTION OF SOURCE AND MATERIAL

Carica papaya leave were collected from in and around area of coimbatore district. The leaves were shade dried for three to four days in room temperature. Then it was ground in a blender to produce the fine powder form, for the experimental work. Khadi fabric was chosen and purchased from Khadi Bhavan shop, Gandhigram, Dindigul district, Tamilnadu.

2.2 EXTRACTION OF DYE

Water was chosen as the solvent extraction of the dye from *Carica* papaya plant. About 10 gm of dried powder source were soaked in 100ml of aqueous solvent in a conical flask and then subjected to the water bath for an hour. After the leaves extract was filtered with No-24 WhatMan filter paper. Concentrated extracts were preserved in refrigerator at 4˚C for further use.

Plate-1carica papaya plant Plate-2 carica papaya powder Plate-3carica papaya extracts

For optimization the aqueous extraction of dye liquor was carried out underlaying conditions, such as concentration of dye, material to liquor ratio, temperature of extraction, pH and time of extraction. In each

case, the optical absorbance value at a particular maximum absorbance wavelength at λ 296 nm for the aqueous extract of plant were estimated by using UV-VIS absorbance spectrometer.

2.3MORDANTING AND DYEING OF MATERIAL

In mordanting, pre mordanting, methods were used for this study. Alum chosen as suitable mordant. About 1-3 % of the mordant has been taken for 90 mints at 110^{o}C with material to liquor ratio 1:30.Among these mordanting methods, the pre mordanting methods were found to give better shade. Pre-treated khadi fabric was dyed with optimized conditions such as concentration of dye at 6%, dye extracted time at 90 mints, temperature 110^{o}C, pH is 8 and material to liquor ratio is 1:30.

2.4ASSESSMENT OF PHYSICAL PROPERTIES

Fabric bending length were measured using Shirley stiffness tester as per standard ASTM D1388 and thickness of the fabric determined using Shirley thickness gauge as per ASTM D1777.Fabric drape, tensile strength were measured by using drape meter and tensile tester as per standards following IS8357, D4966 and ASTM D50359.

2.5ASSESSMENT OF ANTI MICROBIAL PROPERTIES

The antimicrobial (both bacteria and fungal activity) test were carried out in the carica papaya leaves extracts.

2.5.1 Parallel streak method- bacteria (AATCC test method 147-1988)

Test cultures used : *Escherichia coli*, and *Staphylococcus aureus* were the standard Gram positive and Gram negative cultures for the assessment of antibacterial activity of textile substrates as per the recommendation of AATCC.

Procedure : In sterile petridishes,sterile AATCC bacteriostasis agar was dispensed. 24 hrs broth cultures of test organisms were used as an inoculum sterile 4mm inoculating loopwere used and a loop full of culture was loaded and transmitted to the surface of the agar plate by assembling the five parallel inoculum streaks around 60mm in length and spaced 10mm covering the central area of the petri dish without refilling the loop. The test specimen was gently pressed diagonally, across the five inoculums of streaks to ensure near contact with agar surface. The plates were incubated at the temperature of 37^{o}C and it was maintained for 18 to 24 hours.

Evaluation: Observation were done in the inoculated plates for the interruption of growth along the streaks of inoculum bottom the fabric and for a clear zone of inhibition beyond the fabric edge. The average width of the zone of inhibition around the test specimen was calculated in mm using the formula (1).

Zone of inhibition (mm) = (T-I)/2 …….. (1)

where **T** referred to width of zone of inhibition and **I** referred to width of specimen(14,15)

2.5.2 Agar diffusion method-fungus (AATCC 30)

Test Organism: *Aspergillus niger* and *Candida albicans*

Culture medium: The stock culture of *Aspergillus niger* and *Candida albicans* was maintained on potato dextrose agar slants.

Potato dextrose agar

Dextrose	– 20 g
Infusion from potatoes	– 500 ml
Agar	– 20 g
Distilled water	– 500 ml
pH	– 3.5

Fresh potato (200 g) were cut into small slices.Then it was allowed to boiled in 500 ml of distilled water and squeezed by using cheesecloth to get as much pulp as possible. Then dextrose (20 g) and agar agar (20 g) were added to potato extract and the final volume was made up to 1litre with distilled water. A amount of 10.0 ± 0.5 ml was dispensed in conservative culture tubes (125 x 17 mm), sterilized then the slants were prepared.

Inoculum : The scrapings from a ripe in 7-14 days.The fruiting culture of the fungus were added to sterile Erlenmeyer flasks containing 50 ± 1 ml of sterile water and a few glass beads. Then flask was thoroughly shaken and to get the spores into suspension. It is used as the inoculum.

Procedure : The prepared Potato dextrose agar medium was dispensed in petridish and the spores of the fungi were inoculated into 50±2 ml of sterile distilled water containing few glass beads and shaken strongly to get the spores into suspension. About 1.0±0.1 ml of inoculum was dispersed equally over the surface of the agar. The test specimens were located in contact with hardened agar medium over which 0.2±0.001 ml of the inoculums was equally dispersed by means of a sterile pipette. The plates were incubated at 27^0C and maintainted for 5 days.

Evaluation : The antifungal activity was reported by measuring the zone of mycostasis underneath and alongside of the fabric at the end of the incubation period (14,15)

2.6 **Surface Morphological Studies using Scanning Electron Microscopy (SEM)**

The scanning electron microscope (SEM) uses a focal point beam of high-energy electrons to make a variety of signals at the surface of solid specimens. The signals obtained from electron-sample interactions reveal information regarding the specimen including external morphology (texture), chemical composition, crystalline structure , orientation of materials making up the specimen. Mostly in SEM applications data are collected over a chosen area of the surface of the specimen, and a 2-dimensional image is generated that displays spatial variations in these properties. Approximately areas range from 1 cm to 5 microns in width can be imaged in a scanning mode by conventional SEM techniques (magnification ranging from 20X to approximately 30,000X, a spatial resolution of 50 to 100 nm). The SEM is also competent in performing analyses of selected point locations on the sample.This approach is particularly useful for determining chemical compositions (using EDS), crystalline structure, and crystal orientations (using EBSD) in qualitatively or semi-quantitatively.

3. Results and Discussion

3.1 Assessment of antimicrobial test

3.1.1 Parallel streak method- bacteria (AATCC test method 147-1988)

S.No	Samples	Antibacterial activity (Zone of bacteriostasis in mm)	
		Test organisms	
		Escherichia coli	*Staphylococcus aureus*
1	Control	-	-
2	Treated sample	12	18.7

Table-1 Parallel streak method- Antibacterial activity

Table-1 indicates that the zone of inhibition in the treated sample followed by E.coli an S.aures of 12mm and 18.7mm respectively.

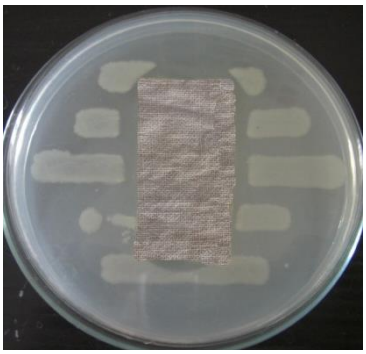

Plate-4 E.coli

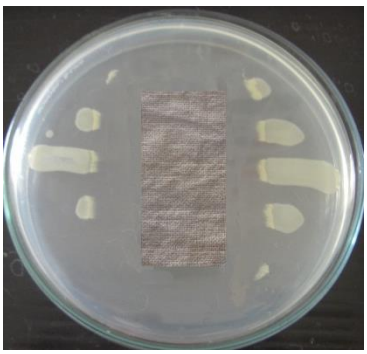

Plate-5 S.aureus

3.1.2 Agar diffusion method-fungus (AATCC 30)

Table-2 Agar diffusion method-fungus

Table-2 indicates the zone of inhibition of the treated sample is A.niger of 6.2mm and there no activity were found in C.albicans.

S.No	Samples	Antibacterial activity (Zone of bacteriostasis in mm)	
		Test organisms	
		Aspergillus niger	*Candida albicans*
1	Control	-	-
2	Treated sample	6.2	No activity

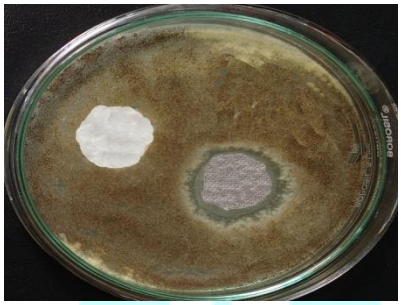

Plate- 6 A.niger

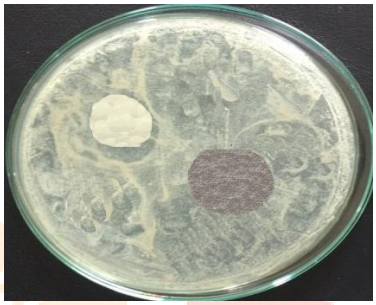

Plate-7 C.albicans

3.2 Scanning Electron Microscopy

The surface morphology of the fabrics has been studied using Scanning electron microscopic analysis .The surface morphology of the untreated and the herbal treated cotton fabrics were studied using SEM (JEOL-JSAL 6360).

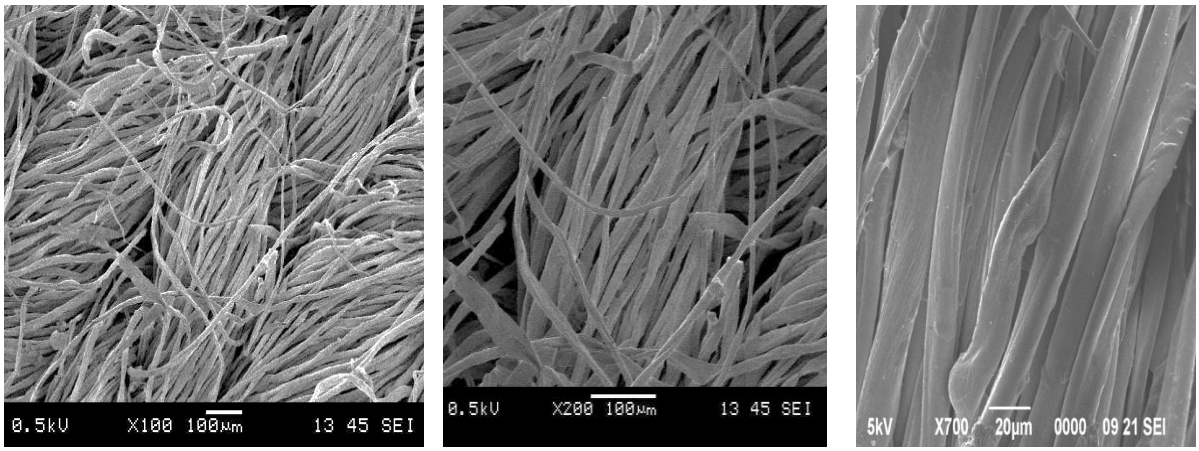

Figure-1Untreated fabric

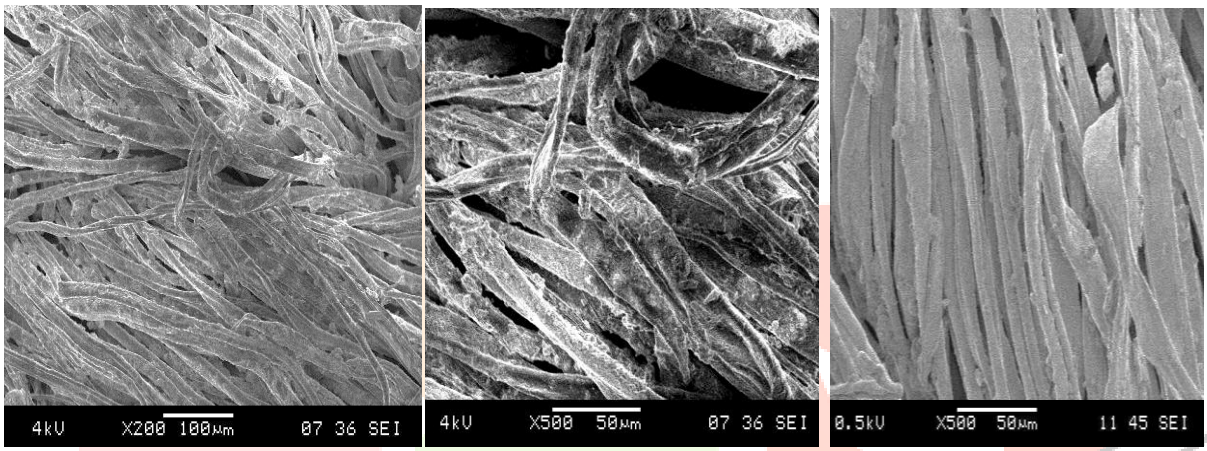

Figure-2Treated fabric

3.3 Assessment of physical properties

Table-3 Effect of Physical Properties of Khadi Dyed Fabric

Physical Properties	Controlled (Untreatedkhadi fabric)	Pre-treated bleached Khadi fabric	Dyed Khadi with alum mordant
Thickness (mm)			
Thickness	0.42	0.39	0.41
% Change	-	6.67	5.77
Stiffness in bending length(cm)			
Warp	2.86	2.60	2.16
% Change	_	-9.09	-26.92
Weft	2.44	2.12	1.92
% Change	_	-13.11	-24.53
Drape co-efficient(%)			
Drape (mg)	0.74	0.58	0.62
% Change	-	27.58	-16.21
Tensile strength(lb)			
Warp	87.20	85.60	80.80
% Change	_	-1.83	-7.48
Weft	83.20	79.60	64.0
% Change	_	-4.33	-24.12
Elongation (%)			
Warp	28.40	26.20	31.00
% Change	_	-7.75	+9.92
Weft	23.60	21.60	19.40
% Change	-	-8.47	-19.44

+ positive and - negative indicates gain/loss of the properties

Table 3 shown that the physical properties of thickness, stiffness, drape co-efficient and tensile strength. From this table it is noticed that the thickness of fabric has increased in the treated fabric when comparing to the pretreated fabric . From the data it is clear that the stiffness of fabric showed the decrease in both direction that is warp and weft direction when comparing with controlled sample. Drape co efficient has decreased in the pre treated and treated samples when compared to the control sample. The maximum reduction of drape co efficient was found in the pre treated sample. From the data shown that the tensile strength of the fabric in both direction has been decreased in pre treated and treated sample by -1.83%,-7.48

% and -4.43 %,-24.12 percent respectively. From this table it is perceptible that the fabric elongation has decreased in the pre treated and treated samples when compared to the control sample.

4. Conclusion

From this concluded that the Carica papaya leaves are the best for the antimicrobial agent in khadi fabric. The leaves extracts shown the better zone of inhibition was found in E.coli and S.aures by 12mm and 18.7mm and fungal activity of A.niger shown as 6.2mm. These leaves have the great potential for antimicrobial finish. When natural antimicrobial finishing is applied to the khadi fabric it was observed that good in microbes resistant which are non –toxic, non-allergic and also eco friendly.

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