

# “Development of Hygienic Comfort Sweat Underarm Pad Using Natural 100% Bamboo Non-Woven fabric”

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## ABSTRACT

In this study, a sweat-absorbing underarm pad that is both aesthetically pleasing and eco-friendly is made using natural extracts with antimicrobial properties. Natural herbs like Papaya (*Carica papaya*) leaves are utilized in this research. The Soxhlet extraction techniques were used to maintain ratio levels and carry out extraction procedures. For this research work, non-woven fabric made entirely of bamboo is utilized. The performance of the 100% bamboo non-woven fabric that has been herbal-coated can be improved by using padding techniques. The herbal-coated 100% bamboo non-woven fabric was then evaluated using the absorbency test, antibacterial activity test, Fourier Transform Infrared Spectroscopy (FTIR), and pH value analysis. According to research results, the herbal-infused underarm pad was found to be pleasant due to its high absorbency, effective antibacterial properties, and optimal pH balance. Consequently, the underarm sweat pads were developed.

**Keywords:** Absorbency, Antibacterial activity, 100%bamboo non-woven fabric, FTIR, Natural Herbs, Papaya (*Carica papaya*) leaves , pH Value, Underarm Pad,

## I. INTRODUCTION

Sweating is a typical biological process that is also connected to cleansing the body. Even though each person produces sweat to a different degree, it always occurs in a hot, muggy environment, according to the article written by Srikrishnan (2022). Sweat and bacteria on the skin's surface combine to produce the distinctive scent that is called body odor or sweat odor. Although sweat doesn't smell, the bacteria that grow on the skin naturally break down its components, especially its proteins and fatty acids, to generate

molecules that do (Kothari, 2008). The smell and detection of sweaty underarms can be awkward for many people, particularly for those who sweat heavily. Various materials are used in the unique designs of sweat pads, which primarily function to absorb sweat, reduce odor, and prevent clothing from staining. Staining can lead to embarrassment and discomfort in social situations. According to this article written by Et-al Gikunda, M.(2022). Nonwoven fabrics have a smooth soft feel to them because of the inherent softness of bamboo. as well as Chinana (2016). It functions well under several situation where comfort is the most crucial element because of its inherent softness. Bamboo fiber can be used in a wide range of sanitary applications, including bandages, masks, sanitary towels, underarm pads, absorbent pads, surgical garments, nurse's uniforms, and more, because of its natural sterilizing and bacteriostatic qualities as pointed by Sharma & Goel (2010). Papaya (*Carica papaya*) leaves have recently gained significant attention due to their strong medicinal properties, especially their antibacterial activity. With the increasing global challenge of antibiotic resistance, there is a heightened need to investigate plant-based alternatives. Several studies have demonstrated that papaya leaf extracts are rich in bioactive compounds, including flavonoids, alkaloids, and phenolic acids, which play a significant role in their antimicrobial effectiveness (et al., 2021). Recent studies have shown that papaya leaf extract has notable inhibitory effects on both Gram-positive and Gram-negative bacteria, indicating its potential for developing new antibacterial agents (Ahmed & Tan, 2023). Every individual sweats regularly, but using underarm sweat pads can help manage its side effects. By absorbing perspiration, these sweat pads reduce the likelihood of an unpleasant odor. et-al (2024) Therefore, choosing

the right sweatpad can greatly enhance personal hygiene and boost confidence throughout the day.

**OBJECTIVE**

To identify natural herbs like Carica Papaya L with antibacterial properties.  
 To select 100% bamboo non-woven fabric for sweat underarm pads.  
 To selected 100% bamboo non-woven fabric using ratio level in soxhelt extraction methods.

To finish 100% bamboo non-woven fabrics using the paddle mangle method.  
 To evaluated absorption test, antibacterial activity and FTIR, Ph test.  
 To develop sweat underarm pads.

**II. MATERIAL AND METHODS**

**Selection of herbs:**

The following table show the scientific Name, Parts used common name and of the selected herbs was choose for study

SNO	COMMON NAME	BOTANICAL NAME	PARTS USED
1	Papaya	CaricaPapayaL	Leaves

Table .1 Selected Natural Herbs

Carica papaya obtainable herbs that contain natural antibacterial properties, making them appropriate for research.

**COLLECTION OF HERBS**

The herbs like carica papya were collected around the area tirupur and near uthukuli rs.



Figure1 Caricapapaya.L



Figure 2 Shadow drying Caricapapayadry leaves

**Grinding process**

The choosed herbal part was dry and grain in grinder mixers. Subsequently the dirt and unfriendly particles were eliminated using the sieve, resulting in fine powder. One technique, the solexlet extraction process was used to accomplish the extraction



Figure 3 Caricapapayapowder

**PERPARATION OF MEDICAL HERBS FOR SWEAT UNDERARM PAD**

**Extraction process of herbs**

After the herbal plants were gathered and divided, the herbal portions were dried and ground into a powder using a machine the grinds for future study, the powder herbs were kept in a glass jar. Three steps comprised the extraction process.  
 Drying, Grinding and Extraction

**Drying of Herbs**

The gathered plants were air-dried at the room temperature. It need to be dried in order to prevent the disintegration of crucial components otherwise bacteria and other microbes will contaminated. After drying, dust and other unnecessary material were removed from the dry herbs.

**SOXHELT EXTRACTION METHODS**

**CARICA PAPAYAS OXHELET EXTRACTION METHODS**

Recipe:  
 Caricapapaya powder: 20 grams

Ethanol: 500ml  
Temperature: Room Temperature  
Time: 48 hrs

- The solvent (500ml of ethanol and aqueous solution separately) is added to a round bottom flask, which is attached to soxhelt extraction and condenser on an isomantle.
- The herbs A (Caricapapaya) 20g are loaded into the thimble, which is place inside the soxhlet extractor.
- The solvent is heated sing the isomantle and will begin to evaporate, moving through the apparatus to the condenser.
- The condensate the drips into the reservoir containing the thimble
- Once the level of solvent reaches the siphon, it pours back into the flask and the cycle begins again.
- The process is run for a total of 48hrs yield% is calculated



Figure 4Carica papaya

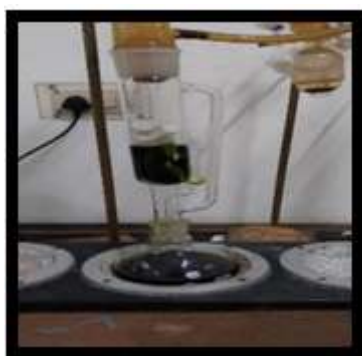


Figure 5 Carica papaya solution

### Extraction methods

#### SELECTION OF FABRIC

The sample fabric was identified as 100% non-woven bamboo fabric respectively. In sample fifteen meters were randomly selected for this research. Five meters of bamboo fabric were placed aside as the original sample and the remaining fabric sample were extracted through the padding mangle process. The antibacterial activity test,

absorbency characteristics, pH value and FTIR test were performed on this completed cloth.



Figure 6 100%Natural Bamboo non-woven fabric

#### FINISHING OF BAMBOONON WOVEN FABRIC SAMPLE

The natural herbs extraction is coated with 100% bamboo non-woven fabric using padding mangle method. The extraction is coated with 100% bamboonon-woven fabric. A sample are coated with herb extraction. The finished 100%bamboo non-woven fabric is show below.



Figure 7Finished 100% bamboo Caricapapaya

#### EVALUATION OF ABSORBENCY ASSESSMENT (AATCC/ASTMDTS-018)

The ability of textile material to abs or band retain liquids within its structure. Absorbance has two components capture and hold.

**Capture:** The ability to trap moisture rably a the speed it is delivered without run off.

**Hold:** The amount of moisture material can hold when saturated under normal operating condition. Good absorbance required rapid capture and superior holding capacity.

#### TESTING METHODS

Sample is placed over the top of beaker so that the center is unsupported. A measured drop of water is placed on the fabric 1 cm from surface. Time is record until the water drop absorbs completely

### Measure pH Value of Sample

- If sample is textile cut small pieces less than 2mm
- Weigh two grams by using calibrated weighing balance
- Take 3 no of conical flask and Put the sample inside of each conical flask & pour the 100ml grade 3 water each conical flask
- Shake the conical flask for 2 hours by using shaker
- Before check the pH, Ensure pH meters should be calibrated with standard buffer solution (7, 4, 9) if required adjust using tuning
- Electrode Wash with Trial-1 conical flask sample and then check with trial 2 & 3 sample, when meter is show constant value, Record the pH value.

### TESTING OF FINISHED BAMBOO NON-WOVEN FABRIC SAMPLE

#### EVALUATION OF ANTIBACTERIAL ASSESSMENT ISO 20743 SAMPLE PREPARATION

- Cut circular swatches,  $4.8 \pm 0.1$  cm diameter from the fabric using steel die.
- Place the swatches separately in a Petri dish to determine the number of swatches required to absorb  $1.0 \pm 0.1$  ml of distilled water without leaving free liquid in the plate.
- Cut and check the absorbency of control sample (if provided) as above

#### Test Organism Used:

- Staphylococcus aureus
- Place the determined no. of cut/sterilized treated and untreated swatches separately in a petri dishes and evenly distribute 0.2 ml of diluted S.a and K. pneumoniae separately. Stack all the swatches together and transfer aseptically to the screw cap bottle labeled as 0 and 24 hr sterility meduration

### EVALUATION OF FOURIER TRANSFORM SPECTROSCOPY (FTIR)

FTIR (Fourier transform infrared spectroscopy) was an analytical technique used to determine the type of chemicals deposited on the

cloth sample. The degree to which the finishing chemical molecules are bonded to the specimen's fabric molecules is also helpful to know. FTIR spectroscopy was used to examine the materials for changes in their chemical groups. A chemical analysis method called infrared (IR) spectroscopy calculates how much of various IR frequencies are absorbed by a sample that is placed in the path beam. The same test was carried out by M. Sumithra (2012)

The analysis of the molecular functional groups present in the sample was the main objective of the IR spectroscopy study. Various functional groups absorb infrared radiation at different frequencies. According to study of et-al (2023)

### DEVELOPMENT OF UNDERARM PADS

Hence the product (sweat under arm pad) is developed using 100% bamboo non-woven fabric.

#### PREPARATION PROCEDURE FOR SWEAT UNDER ARM PAD

##### Sweat Pad Size:

- Total length of sweat under arm pad- 13.5cm
- Total upper width of sweat under arm pad- 12cm
- Total lower width of sweat under arm pad- 13cm

##### Procedure:

- The top layer is finished with a bamboo non-woven fabric.
- The Bamboo non-woven fabric with a herb coating finishes the core layer.
- The final layer is impermeable, biodegradable, and ecologically friendly.
- There are actually three layers in the first process: the biodegradable impervious layer, the intermediate layer, and the top layer.
- Were placed in the right order one by one.
- An ultrasonic sewing machine was then used to finish the top layer, middle layer, and impermeable layer, as well as the sides and corners of the sweat underarm pad.
- Additionally, place the stick-releasing paper on the sweat underarm pad's back.

**NOMENCLATURE**

SNO	SAMPLE	SAMPLE ABBREVIATIONS
1	BCP (Coated fabric)	100% Bamboo Carica papaya

**TABLE 2** The Nomenclature Of Samples

**III. RESULTS AND DISCUSSION**

**EVALUATION WATER ABSORBENCY TEST ISO 62:2008**

In this test time taken to absorb a water drop on the fabric is measured in seconds; it show in the table

**Evaluation of Absorbency**

SNO	FABRICSAMPLE	TIMETAKEN (Hours: Minutes: Seconds)
1	BCP	15to20sec

**TABLE 3** Water Absorbency Test

From this table show that BCP more absorbing capacity. In this study the fabricis more absorbed then other samples.

**EVALUATION OF PH VALUE TEST ISO3071:2014**

**Evaluation of PH Value**

SNO	FABRIC SAMPLE	PH VALUE
5	BCP	6.2@25°C

**TABLE 4** Ph Value Test Method

The Sample 6.2@25°C It has more pH value then other fabric sample and the mean pH value is 6 to 8.5

**ANTIBACTERIALASSESSMENTQUANTITATIVEISO20743-2021**

**Evaluation of Antibacterial finishing**

SNO	SAMPLE	STAPHYLOCOCCUSARUE USA AT C-6538		GROWTH VALUE(F)	GROWTHV ALUE(G)	ANTIBACTE RIALACTIVI TYVALUE
		CFU	SPECIMENS			
1	Bamboo (Carica papaya100%)	2.6x10 <sup>5</sup>	0	1.01	-5.39	6.40

**TABLE 5** Antibacterial Activity In Finished Fabric

The Antibacterial activity was standardized by the ISO 20743-2021by using the organism which is Staphylococcus aureus AATC-6538. According to the table value the antibacterial

activity noted was 6.40 and the growth value of (G) is -5.39 and growth value of (F) is 1.01.

## FOURIER TRANSFORM INFRARED ANALYSIS

FTIR stands for (Fourier Transform Infrared Spectroscopy) which is a powerful tool to analysis functional groups present in the material, this technique uses in fraredrayas sources to find molecular vibration. Each and every sample used in the experiment were analyzed through FTIR spectroscopy with standard light source at a scanning speed of 2mim/sec and resolution of  $4\text{cm}^{-1}$  in ATR mode.

### BCP SAMPLE

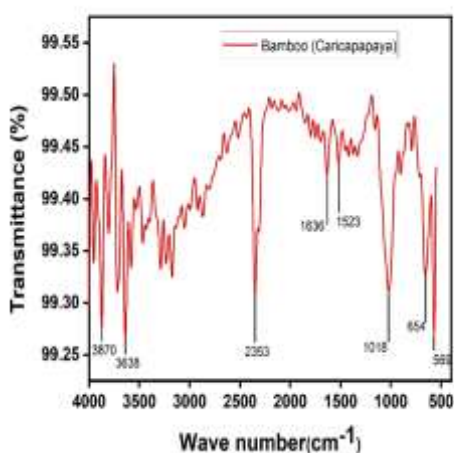


Figure 8 BCP FTIR sample

The strong IR band in  $3870$  and  $3683\text{ cm}^{-1}$  indicates -OH stretching. The sharp peak at  $2353\text{ cm}^{-1}$  shows the presence of  $\text{O}=\text{C}=\text{O}$  stretching. The small absorption band at  $1636$  and  $1523\text{ cm}^{-1}$  reveals the presence of  $\text{C}=\text{O}$  stretching. The strong peak at  $654\text{ cm}^{-1}$  is due to the  $-\text{C}=\text{C}-$  bending.

### DEVELOPMENT OF UNDER ARM PAD



Figure 9 Finished sweat under arm pad

This Underarm pads provide comfort and cleanliness, especially for people with hyperhidrosis or in hot areas, by absorbing perspiration, preventing stains on clothes, and reducing body odor. Caricapapaya is one natural antibacterial that may be used to reduce odor and

stop germs from growing. Pads are made to fit the underarm area, taking into account size and shape to guarantee they remain in position when moving and seem discrete under clothes.

## IV. CONCLUSION

The use of natural herbs, such as, in developing a comfortable underarm sweat pad has proven to be an effective strategy for enhancing antibacterial properties. The pH level analysis verified that the sample of finished 100% bamboo non-woven fabric stays in a skin-friendly range, comfort and lowering the possibility of discomfort, and absorbency level will be increasing. The pad's efficiency in removing perspiration, keeping the underarms dry, and FTIR analysis verified the existence of crucial functional groups in finished samples of 100% bamboo non-woven fabric. Then sample underarm sweat pads are developed. Overall, the study shows promise for natural herbal extracts as a skin-safe and environmentally responsible substitute for sweat-absorbing underarm pads.

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