

# Harnessing Natural Minerals and Activated Carbon a Sustainable Approach to Stain and Odour Control in Home Textiles

J.S. Dinesh Kanna<sup>1</sup> Mrs.S.Vijayalakshmi<sup>2</sup>

<sup>1</sup>UG Student, B.Sc, Department of Costume Design and Fashion, Dr. N.G.P Arts and Science College, Coimbatore

<sup>2</sup>Assistant professor, M.Sc, MBA, Department of Costume Design and Fashion, Dr. N.G.P Arts and Science College, Coimbatore

**Abstract-** Natural finishes to fabrics have been of interest to research because of the growing needs for functional, sustainable clothing. Design, development, and testing of a natural stain repellent and odour-reducing apron are the focus of this paper. Because the naturally occurring mineral salt potassium aluminium sulphate, or alum, has astringent properties and can react to prevent stain attachment, it has been investigated as a natural stain repellent. Bamboo activated charcoal, with its large surface area and adorability, has been used for the natural odour-reducing finish as well. Odour-causing molecules are encapsulated by its porosity. Its natural antimicrobial activity reduces odour caused by bacterial growth. The objective is to use as much as possible of each of alum and bamboo activated charcoal to common apron fabrics and test the resulting stain-repellence of the treated fabric against common kitchen spills, quantify the odour-reducing benefit by standard laboratory tests, and determine the longevity of the resulting treatments through a series of washer-rinsing cycles. In the research detailed here, new opportunities for creating high-performance, sustainable household kitchenware arise. The research described here addresses the emerging sustainable textile finishing market.

**Keywords:** *potassium aluminium sulphate, bamboo activated charcoal, white vinegar, bamboo fabric*

## 1. INTRODUCTION

Over the past decade, there has been a tremendous trend towards sustainability across all industries, including home textiles. The customer is now going green in his/her purchasing habits and seeking products that enhance eco-friendly living. One of the biggest issues in home textile care is the use of synthetic chemicals to remove stains and odours. Most of the traditional cleaning products are filled with harsh chemicals that not only pollute the environment

but also cause health issues like allergies, skin diseases, and respiratory disorders. Furthermore, chemical treatments shorten the life of home textiles and cause waste overtime. To combat such problems, producers and researchers are looking towards nature and environmentally friendly solutions to provide fabrics with a fresh and clean look without the ill effects of man-made chemicals.

One of the most hopeful technologies available for odour and stain control with sustainability is natural minerals and activated carbon. Such products have gained widespread recognition due to their great purification and adsorption capacities. Natural minerals like zeolites, clays, and other porous materials contain the capability of holding water and odour-producing molecules, making textiles dry and fragrant. Zeolites, in particular, have been the focus of extensive research due to their capability to eliminate foul odour through the adsorption of VOCs and ammonia, common foul odour sources of fabrics. Other clay-like structures, having large surface areas and natural antimicrobial properties, also inhibit bacterial and fungal growth, further ensuring fabric hygiene.

## 2. OBJECTIVES

- To develop a Apron with Stain resistant and Anti – odour finish.
- To give chemical free finishes
- To promote Natural finish in Home textiles.

## 3. MATERIALS AND METHODS

### 3.1 BAMBOO FABRIC:

Bamboo fabric is a new and fast-growing fabric produced from the pulp of bamboo grass. Bamboo fabric is soft and breathable and is said to be as soft as

cotton and as silky as silk, with a soft, luxurious texture against the skin. Perhaps most notable about bamboo fabric is its inherent antibacterial and moisture-wicking qualities, which prevent the body from becoming wet and smelly, and as such, is a great material for clothing, particularly sportswear and undergarments, and also bed linen and towels.

The method of converting bamboo into fabric generally employs two forms: bamboo viscose and bamboo lyocell. The most prevalent form is bamboo viscose, which is a chemical process that breaks down the bamboo fibres before spinning it into fabric. While the process produces a very soft and long-lasting fabric, it is environmentally problematic because of the use of harsh chemicals, except when it is processed in a closed-loop system. Bamboo lyocell, however, is made using a less environmentally problematic process that employs non-toxic solvents in a closed-loop process where the solvents and water are recycled, greatly reducing environmental damage.



Fig 1 bamboo fabric

### 3.2 POTTASIAM ALUMINIUM SULPHATE (ALUM SALT):

Potassium aluminium sulphate, or alum, is a naturally occurring double sulphate salt with the chemical formula  $KAl(SO_4)_2 \cdot 12H_2O$ . It has widespread application in water treatment, textiles, medicine, food processing, and cosmetics due to its coagulant, antimicrobial, and astringent properties. In water treatment, alum helps in the removal of impurities by clumping fine particles, hence making the water clearer.

In the textile process, alum serves as a mordant that fixes dyes onto fabrics, and enhances stain-resistance and antibacterial activity. It finds application in natural

deodorants, mouthwashes, and as a healing agent for wounds due to its antimicrobial action and capacity to stop minor bleeding. In culinary use, it has been utilized traditionally in pickling, baking, and clarifying drinks, although its usage has declined due to aluminium intake concerns.

Environmentally, alum is eco-friendly and biodegradable as compared to synthetic chemicals. However, limitations like low textile durability and concerns of excessive aluminium exposure make it necessary to keep innovating and exploring in the application process.

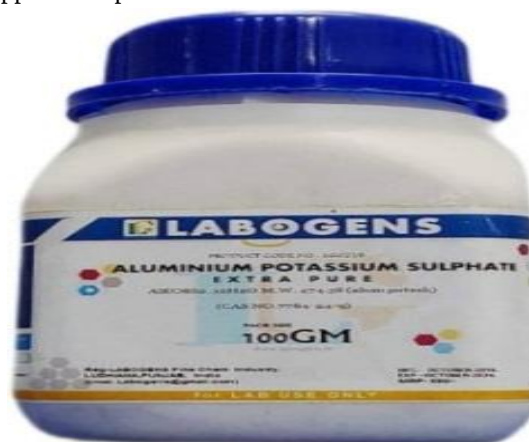


Fig 2 aluminium potassium sulphate

### 3.3 BAMBOO ACTIVATED CHARCOAL:

Bamboo activated charcoal is basically carbonized bamboo. It is an eco-friendly, porous product that is used extensively to purify air, filter water, absorb odours, and treat skin due to its large absorbent properties. Bamboo charcoal has a larger surface area to trap toxins, moisture, and odours, which is why it is believed to be much more effective than traditional wood or coconut charcoal. Bamboo activated charcoal can also be incorporated into home textiles to provide a natural way to deodorize, prevent the growth of bacteria, and wick moisture when used in textiles for bedding, towels, or active wear.

In addition to trapping toxins, bamboo activated charcoal also provides sustainable alternatives to chemical treatments due to its ability to absorb pollutants and neutralize odours. Importantly, bamboo is a renewable resource that grows quickly, which is a great environmental benefit to the product. Bamboo activated charcoal is a safe, biodegradable, and multi-use product that is increasingly recognized as a sustainable way to achieve cleaner air, fresher products, and overall eco-friendly consumer products.



Fig 3 bamboo activated charcoal

### 3.4 WHITE VINEGAR:

White vinegar is a neutral-coloured, clear liquid that has been used for various purposes from cooking to cleaning for many centuries. White vinegar is produced by fermenting grain alcohol, and transforms it into the active ingredient called acetic acid, which contributes to vinegar's pungent, tart smell and flavour. White vinegar contains between 4% and 7% acetic acid and the remaining liquid is water. This percentage is adequate enough that it can be used in food preparation, but it is strong enough to be effective for household tasks. In the kitchen, white vinegar is popular as a key ingredient in pickles, salad dressings, marinades, etc., and can be added to many dishes to give it flavour. The acidity of vinegar flavour food and preserves it by creating an environment that inhibits bacteria growth. In addition to cooking, people use white vinegar as an inexpensive, natural cleaner. White vinegar cuts through grease, dissolves mineral deposits, and neutralizes odours; therefore, white vinegar is an ideal cleaner for cleaning mirrors, windows, countertops, and other surfaces in the kitchen or bathroom. White vinegar is often used for cleaning in place of chemicals, especially for someone who doesn't like toxic chemical products.



Fig 4 white vinegar

### 3.5 APPLICATION OF STAIN RESISTANT FINISH (DIP AND DRY METHOD):

A method to make bamboo fabric stain resistant, means that the fabric can be treated with potassium aluminium sulphate, more commonly known as alum. When treating bamboo fabric with alum, the fabric soaks in a solution that consists of alum, which is a natural stain repellent. When treated with alum, the alum creates barrier on the fabric to protect it from oil, grease, and food stains. Once the fabric has soaked, and absorbed the aqueous solution, air dry the fabric. Treating the fabric is simple and affordable, as it helps the fabric stay cleaner and usable longer.



Fig 5 Alum salt mixing



Fig 6 Stain resistant finish

### 3.5.1 RINSING AND DRYING:

- The fabric is rinsed using a mild soap solution to remove the excess stain resistant finishing agents retaining its functional treatment.
- After rinsing it is dried in sunlight and heat ironed to ensure the finish is properly set.



Fig 7 Drying



Fig 8 Heat iron

### 3.6 APPLICATION OF ANTI – ODOUR FINISH (DIP AND DRY METHOD):

After the first stage of treatment for stain repellency, bamboo fabric is soaked for a period of time in a

solution of bamboo-activated charcoal and white vinegar. The bamboo-activated charcoal absorbs moisture and eliminates odours to keep the fabric fresh and dry. At the same time, white vinegar is a natural antimicrobial used to prevent odour-causing bacteria from growing over time. The fabric is first completely soaked in the solution and then hung dry completely, allowing the beneficial properties to penetrate into the fabric fibres with these claims. This treatment increases the utility of the fabric making it appropriate for clothing and active wear, as well as any other goods where cleanliness and freshness an important benefit.



Fig 9 Bamboo activated charcoal & white vinegar mixing



Fig 10 Anti – odour finish

### 3.6.1 RINSING AND DRYING:

- The fabric is rinsed using a mild soap solution to remove the excess anti – odour finishing agents retaining its functional treatment.
- After rinsing it is dried in sunlight and heat ironed to ensure the finish is properly set.



Fig 11 Drying



Fig 12 Heat iron

#### 4. RESULT AND DISCUSSION

##### 4.1 ANTI – ODOUR & STAIN RESISTANT:



#### TEST REPORT

**AGS TEXTILE TESTING LABORATORY | TEST REPORT NO: AGS202400057**

**ULR NO: TC902324000000057P**

|           |                                                                                |
|-----------|--------------------------------------------------------------------------------|
| APPLICANT | J.S DINESH KANNA                                                               |
| ADDRESS   | 8/2628, TEACHERS COLONY,<br>2 <sup>ND</sup> STREET, PANDIAN NAGAR,<br>TIRUPUR. |

|                    |                                                                          |
|--------------------|--------------------------------------------------------------------------|
| SAMPLE DESCRIPTION | APRON                                                                    |
| DATE OF RECEIVED   | 15.02.2025                                                               |
| DATE OF COMPLETION | 18.02.2025                                                               |
| REPORT ISSUED ON   | 18.02.2025                                                               |
| BUYER NAME         | SELF                                                                     |
| COLOUR             | NAVY CHECKED                                                             |
| MAIL ID            | <a href="mailto:Dineshkanna8754@gmail.com">Dineshkanna8754@gmail.com</a> |



Tests were carried out under standard atmospheric condition of temp 20 (±) 2°C RH 65 (±) 4% as per ISO 139 / temp 21 (±) 2°C RH 65 (±) 5% as per ASTM D 1776.

##### OVER ALL TESTING RESULT:

| REFERENCE | PASS | FAIL | TEST CONDUCTED     |
|-----------|------|------|--------------------|
| #         |      |      | 1. STAIN RESISTANT |
| #         |      |      | 2. ANTI ODOUR TEST |

AGS TEXTILE TESTING LABORATORY, NO 75, MAYAN CAPITAL 1<sup>ST</sup> FLOOR, BRIDGE WAY COLONY EXTENSION, TIRUPUR-641607, PH No: 0421-4254963 Email: [info@agstextiletesting.com](mailto:info@agstextiletesting.com); [service@agstextiletesting.com](mailto:service@agstextiletesting.com), Website: [www.agstextiletesting.com](http://www.agstextiletesting.com)  
This test report is issued by the company subject to its general conditions of service printed overleaf of attached. Said conditions are also available upon request or are assessable at [www.agstextiletesting.com](http://www.agstextiletesting.com). The results shown in this Test report refer only to the sample(s) tested unless otherwise stated and such sample(s) are retained for 30 days only. This test report shall not be reproduced except in full, with out written approval of the company.

Page 1 of 2



AGS/MSR/20 REV-1



INDIA



CAMBODIA



MAURITIUS



## TEST REPORT

**AGS TEXTILE TESTING LABORATORY | TEST REPORT NO: AGS202400057**

**ULR NO: TC902324000000057P**

### 1. STAIN RESISTANT: IHTM 201

| PARTICULARS     | REPORT VALUE |
|-----------------|--------------|
| STAIN RESISTANT | GRADE-4      |

### 2. ANTI ODOUR: IHTM 205

| PARTICULARS | REPORT VALUE |
|-------------|--------------|
| ANTI ODOUR  | GRADE-4      |

- NOTE:** 1. Test has been, performed as per vendor's request.  
 2. The report is for vendor's Reference only.  
 3. We have not given the pass/fail status as no desirable limit is provided by vendor, only test results are given for reference only.  
 4. The NABL symbol is published only on the page/s having NABL accredited tests.  
 5. This report is strictly CONFIDENTIAL.  
 6. Its use for publicity, arbitration or as evidence in legal disputes is forbidden.  
 7. Reference of sample(s) given by the party.  
 8. Samples are not drawn by the laboratory.  
 9. The above results are related to the samples tested.  
 10. If customer needed for complaints statement s decision rule of binary simple acceptance (w=0) has been applied.

TECHNICAL MANAGER  
(Y. PONMANI)

----- END OF THE REPORT -----

AGS TEXTILE TESTING LABORATORY, NO 75, MAYAN CAPITAL 1<sup>ST</sup> FLOOR, BRIDGE WAY COLONY EXTENSION, TIRUPUR-641607,  
 PH No: 0421-4254963 Email: info@agstextiletesting.com; service@agstextiletesting.com, Website: www.agstextiletesting.com  
 This test report is issued by the company subject to its general conditions of service printed overleaf of attached. Said conditions are also available upon request or are assessable at [www.agstextiletesting.com](http://www.agstextiletesting.com). The results shown in this Test report refer only to the sample(s) tested unless otherwise stated and such sample(s) are retained for 30 days only. This test report shall not be reproduced except in full, with out written approval of the company.

Page 2 of 2



AGS/MSR/20 REV-1



INDIA



CAMBODIA



MAURITIUS

## 5. PRODUCT DEVELOPMENT

Construction of Apron (Pattern making, Cutting, Sewing)

The fabric, after having been designed and treated with bamboo, is cut into pieces that have been shaped to the apron pattern desired. The fabric pieces are sewn

together with attention to functionality, durability, and aesthetics. This is an opportunity for options such as pockets or straps or any other detail that would enhance the user experience and incorporated as design features, or considered for their contribution to the aesthetics of the apron. At this point the apron can move from the ideation of a design to becoming a

functional work-tool in our lives, while naturally including the benefits of bamboo fabric.

## 6. SUMMERY AND CONCLUSION

The demand for sustainable home textiles has created an opportunity to investigate natural minerals and activated carbon as viable options for stain and odour management. Traditional chemical treatments often expose consumers to environmental and health risk; therefore, alternative approaches utilizing natural substances is warranted. Some of these natural substances include potassium aluminium sulphate (alum), bamboo activated charcoal, and white vinegar which exhibit outstanding utility for absorption, deodourization, and stain resistance. These natural minerals and products function using fundamental principles common in many deodourizers and can work either separately or synergistically - adsorption, antibacterial activity, and pH, for example – allowing them to deodourize and inhibit staining without degradation to fabric. The dip and dry method and other finishing techniques lend themselves to the application of these natural agents, making them suitable agents for industrial and household textiles. Moreover, the introduction of these biodegradable and non-toxic textiles enhances the global awareness concerning green and sustainable textiles. Research indicates that these methods improve the longevity of textiles while positively impacting the reduction of waste and chemical pollution in the environment.