ECOFRIENDLY ANTIMICROBIAL FINISHING OF TEXTILES USING NATURAL EXTRACT

S.GEETHA MARGRET*
DR. S. KAVITHA**

*Assistant Professor, Dept. of Costume Design and Fashion, Sri Krishna Arts and Science College, Coimbatore, Tamil Nadu, India
**Associate Professor (Textiles), Dept. of Home Science, Mother Teresa Women’s University, Kodaikanal, Tamil Nadu, India

ABSTRACT

Natural dyes are considered as sustainable and eco-friendly dyes. Therefore, research on environment friendly antimicrobial agents based on natural products for textile application is gaining worldwide interest. This paper report the extracts obtained from natural herbal products such as Acacia catechu and Rubia Cordifolia applied on bamboo knitted fabric for antimicrobial finishing of textile substrates. The results show good antimicrobial activity. The identification of these potential dyes as antimicrobial agents will be helpful in replacing some commercially synthesized antimicrobial drugs.

KEYWORDS: Antimicrobial, Eco Friendly, Herbs

1. INTRODUCTION

Increasing global competition in textiles has created many challenges for textile researchers and industrialists. The rapid growth in technical textiles and their end uses has generated many opportunities for the application of innovative finishes. Novel finishes of high added value for apparel fabrics are also greatly appreciated by a more discerning and demanding consumer market. Antimicrobial textiles with improved functionality find a variety of applications such as health and hygiene products, specially the garments worn close to the skin and several medical applications, such as infection control and barrier material.[1]

In recent years new finishing technologies and growing awareness about healthier lifestyle, a wide range of synthetic antimicrobial agents were developed and also available in the market place. Although the synthetic antimicrobial agents are effective against microbes and durable in textile, it also has its own disadvantage associated with its side effects. Hence there is a high demand for antimicrobial textiles based on eco friendly natural dyes. There is vast source of medicinal plants with active antimicrobial ingredients. Although, there are many natural products rich in antimicrobial agents, the study on their use in textiles is very limited and not accurately documented. Recent developments in natural dyes have paved way
for new avenues in this area of research. Therefore this paper focuses in extracts of natural dye Acacia catechu and it antimicrobial action.

ANTIMIROBIAL FINISH FOR TEXTILES

Microorganism may be classified as bacteria and fungus. Bacteria are categorized as gram negative and gram positive. [2] In bacteria family gram positive is staphylococcus and gram negative is E-Coli. Some specific types of bacteria are pathogenic and cause cross infection. They stain the fabric and deteriorate the performance properties of the fabric. [3] Antimicrobial textile and ancillary materials have been used for decades. The main aim was to prevent the microbial attack on them and to prolong their useful life. The product of microbial growth and metabolism lead to many problems such as unpleasant odours which can persist even with frequent cleaning. From hygienic standpoint, the growth of pathogenic microorganisms or germs may contribute to the spread of disease and infection.

NECESSITY OF ANTIMICROBIAL FINISHES

Antimicrobial treatment for textile materials is necessary to fulfill the following objectives

- To control microorganisms
- To reduce odor from perspiration, stains and other soil on textile material
- To reduce the risk of cross infection by pathogenic microorganisms
- To control spread of diseases and danger of infection following injury
- To control the deterioration of textiles particularly fabrics made from natural fibre caused by mildew.

2. MATERIAL AND METHODS

For the study single jersey bamboo knitted fabric was chosen. Bamboo is a regenerated cellulosic fibre produced from bamboo pulp. Bamboo possesses a unique antibacterial and bacteriostatic bio-agent named ‘bamboo kun’. [4] Knitting process was carried out for converting the bamboo yarn into single jersey fabric. Natural Dye was extracted from Acacia Catechu and Rubiacordifolia. Acacia Catechu consists of colouring matter catechu and catechtannic acid. The colouring component produces copper red colour and good washing and light fastness. RubiaCordifolia is an ancient dye coloured fragments of madder dyed cloth have been found in the ruins of Indus valley civilization. [5] Cold –Pad-batch technique was used for applying Acacia Catechu and RubiaCordifolia and combination
of Acacia and Rubia extracts to Bamboo fabric. The padding liquor contains natural extract 20% and Copper Sulphate 5%. After padding samples were mordant with 5% of Potassium Dichromate. Padding samples were batched carefully. The samples were stored for 24 hours at room temperature. After the process the samples were rinsed in 5% soap solution. Finally the samples were dried in shade.

3. EXPERIMENTAL PLAN

Identification and Collection of Natural dyes

Natural dyes such as Acacia Catechu and RubiaCardifolia were purchased in powder form from Aranya dyeing unit, Munnar, India and used for dyeing process.

Preparation and Method of Dye Extraction

Required quantity of powder dye material was taken and soaked in water for 24 hours. The material to liquor ratio was kept 1:20. After soaking 24 hours it is boiled at simmering point for 30 minutes to one hour. Until the dye raw material is exhausted then it is filtered through a clean cotton cloth. The filtrate obtained is extracted liquid dye. This extracted liquid dye is used for dyeing.

Antibacterial Assessment of the herb used

Natural dyes with medicinal properties should be tested against an appropriate microbial model to confirm the activity and to ascertain the parameters associated with it. The antibacterial activity for herbal extract was done using “quantitative test ”against test organisms of gram positive organism (Staphylococcus aureus) and gram negative organism (Escherichia coli).

4. RESULTS AND DISCUSSION

Antibacterial Assessment by Quantitative Bacterial Reduction Test (AATCC test method 100 - 2004)

About 5.0 cm diameter of the treated fabric was taken and it was immersed in sterile AATCC broth with 0.1ml inoculum of each culture (Staphylococcus aureus and Escherichia coli) and left overnight at 37° C in shaker. Control was also maintained with untreated fabric. After incubation, the plates were observed for bacterial growth. Then the numbers of colonies were
counted the each plate. The bacterial reduction was compared with original, dyed and washed samples.

Figure 1 Antibacterial Activity of Bamboo knitted fabric dyed with Acacia Catechu, Rubia Cordifolia and Combination of Acacia and Rubia.

Note: The bamboo Fabric is knitted and dyed with Acacia Catechu, Rubia Cordifolia and Combination of Acacia and Rubia. The results are interpreted with dyed and washed samples against E.Coli and S.Aureas.

The Knitted Bamboo fabric was tested for bacterial reduction and the same fabric was dyed with Acacia Catechu, Rubia Cordifolia and Acacia and Rubia. The samples were washed with reeta nut and tested for bacterial reduction. The samples were washed for eight washes. the samples treated with three combinations of dye is shown in plate 1, plate 2 and plate 3.

The comparative results of antimicrobial property of bamboo knitted samples treated with Acacia Catechu and Rubia Cordifolia and combination of Acacia and Rubia are given in Figure 1 The ratings are given by percentage. From the results it can been seen that the sample treated with Acacia extract posses fine resistance against the growth of microorganism and washed sample shows higher percentage of bacterial reduction. The sample treated with Acacia and Rubia Combination shows very good bacterial reduction when compared within them. In this study it reveals that the bamboo fabric has antibacterial property in additive it is dyed with natural extract and washed with reeta nut which significantly helps in bacterial reduction. The ethanol and chloroform extracts of reeta nut inhibit anti bacterial property.
Plate-1 Antibacterial activity of knitted dyed and washed with *Acacia catechu*
Quantitative method-AATCC 100

1. Activity against *Escherichia coli*

<table>
<thead>
<tr>
<th>Knitted dyed - <em>Acacia catechu</em></th>
<th>Knitted washed - <em>Acacia catechu</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Plate 1 (a)" /></td>
<td><img src="image2" alt="Plate 1 (b)" /></td>
</tr>
</tbody>
</table>

2. Activity against *Staphylococcus aureus*

<table>
<thead>
<tr>
<th>Knitted dyed - <em>Acacia catechu</em></th>
<th>Knitted washed - <em>Acacia catechu</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Plate 1 (c)" /></td>
<td><img src="image4" alt="Plate 1 (d)" /></td>
</tr>
</tbody>
</table>

Plate-2 Antibacterial activity of knitted dyed and washed with *Rubia cordifolia*
Quantitative method-AATCC 100

1. Activity against *Escherichia coli*

<table>
<thead>
<tr>
<th>Knitted dyed - <em>Rubia cordifolia</em></th>
<th>Knitted washed - <em>Rubia cordifolia</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5" alt="Plate- 2 (a)" /></td>
<td><img src="image6" alt="Plate- 2 (b)" /></td>
</tr>
</tbody>
</table>
2. Activity against *Staphylococcus aureus*

Plate- 3 Antibacterial activity of knitted dyed and washed with Acacia catechu & Rubia cordifolia Quantitative method-AATCC 100

1. Activity against *Escherichia coli*

2. Activity against *Staphylococcus aureus*
6. CONCLUSION
The natural extract of Acacia catechu, Rubiacaordifolia and combination of Acacia and Rubia was successfully applied on bamboo fabric by cold – pad batch technique. The samples treated with Acacia catechu and combination of Acacia and Rubia shows good resistance to microbial activity. In today’s competitive textile market the ability to address hygiene need and innovative products and clear marketing message will yield significant value to both industry and consumer. Improving performance and cost effectiveness, while meeting environmental and toxicity requirements, will continue to challenge those working in this field.

REFERENCES
1. Joshi; Ali Wized; Purwar; Rajendran S; Ecofriendly antimicrobial finishing of textiles using bioactive agents based on natural products; Indian Journal of Fibre & Textile Research 2009,34,295
2. Sampath V R; Functional Garments; The Indian Textile Journal, 2003,51
3. Gopalakrishnan D; Antimicrobial finishes; Man-made textiles in India; 2006 49, 10, 372
6. Patel; Naik; Bhavsar; Dyeing and Antimicrobial finishing of cotton; Man- made textiles in India, 2005, 427.