

Original Article

Antibacterial Activity of Dyed Fabric Material by *Alstonia scholaris* Dye Source

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Abstract

This research work is performed to determine the antibacterial activity of dyed cotton fabric material by *Saptaparni* (*Alstonia scholaris*) as natural dye source. This dye was extracted by ethyl alcohol solvent from bark of *Saptaparni* plant and then applied to the white and clean cotton fabric material through aqueous solution of dye bath. In this research the antibacterial activity of this dyed fabric material is evaluated against some gram positive and gram negative bacteria such as *Bacillus cereus* bacteria, *Staphylococcus aureus* bacteria, *Escherichia coli* bacteria and *Proteus mirabilis* bacteria. The well diffusion method was used for this determination of antibacterial activity of dyed cotton material. The antimicrobial effect of these dyed cotton material was also analyzed after repeated washing of fabric through clean water. Ecofriendly and natural properties of the product can increase the demand of that product by the consumer. The medicinal properties of this *Saptaparni* or *Alstonia scholaris* can be developed by doing further research in the medicinal work. The medicinal properties of this *Saptaparni* plant is used for dyeing textile material as the development of textile material. This natural way of dyeing of fabric by *Saptaparni* *Alstonia scholaris* dye can gives the richness to the fabric material and also can increase the hygienic properties of that dyed material. This research work will provide useful data for the production of antibacterial textile material by textile industries.

Keywords: Dye, Fabric, Antibacterial activity

Introduction

The textile and pharmaceutical industries are giving challenges to the researchers. The interest is increases to achieve best quality of natural dyed fabric material. The synthetic dyes and material have some toxic environmental and health effects. The antibacterial natural products can be used as ecofriendly and nontoxic material. The consumer is aware about healthy and hygienic products. Antimicrobial products have pharmaceutical and medicinal applications [1]. Some natural sources are used as antimicrobial compounds in textile and in cosmetic industries [2]. Natural dyed materials are nontoxic and biodegradable properties. The textile products are come in contact to the animal body parts Thus, development in antibacterial textile material is essential. [3]. the antibacterial sources are used for textile development fabric. The growth of harmful microbes is also controlled by these antibacterial products. The *Saptaparni* (*Alstonia scholaris*) dye is used as natural dye and this dye have antimicrobial activity [4]. The use of required equipments and technology is increased in the textile and pharmaceutical industries. The production of textile and antimicrobial products are increased as per demand of the customers.

Objective:

1. This research work involves evaluation of antibacterial activity of fabric material which can be useful to develop quality of textile material.
2. The result and data obtained from this work can be useful to increase the use of hygienic and natural dyed product by the consumer.
3. This research is providing interest towards ecofriendly and natural development.

Data and Methodology:

Materials:

Source of *Saptaparni* plant dye, clean Cotton Fabric, Dye bath, Agar plates Water, Soap, DMSO,

Method for Extraction of dye:

The bark of *saptaparni* (*Alstonia scholaris*) as natural source of dye was taken from the market.

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This bark as wild source of saptaparni dye can be collected from forest. The pale yellow colour bark pieces of this saptaparni plant were dried in sunlight for three days. Then this dried saptaparni dye source was carefully stored in normal room temperature. After two days this dried source was crushed into the power form by using blender machine. The 5g powder of this source was then added into the 20 ml of water and also in 10% ethyl alcohol solvent. The dye source and solvent was then boiled for 1hr. The yellow colour solution of this dye source in water and also in ethyl alcohol solvent was separately collected in beakers during filtration. And then this filtrate is evaporated to get good concentration of dye. The 10 % ethanol solvent gave more concentration of dye than aqueous solvent.

Method for Dyeing of fabric:

The dyeing of fabric was done by 10 g of clean and white cotton fabric as textile material was taken and dyed by yellow colored saptaparni dye. The dyeing machine is used for dyeing this cotton fabric by 1:30 liquor ratio. And this dyeing was done at 60 °C for 50 min. in aqueous medium. And this dyed cotton material then washed under cold water. After washing, this dyed fabric is dried in air. This dyeing was performed in the dye bath of saptaparni dye solution under aqueous medium. This dye gives yellowish shade to the cotton fabric. And this dyed fabric material of cotton was then taken for the analysis of antibacterial textile against *Bacillus cereus*, *Staphylococcus aureus*, *Proteus mirabilis* and *Escherichia coli* bacteria.

Antibacterial activity determination:

The antibacterial activity of saptaparni dye against activity against *Bacillus cereus*, *Staphylococcus aureus*, *Escherichia coli* and *Proteus mirabilis* bacteria is analyzed for dyed cotton fabric. This antibacterial activity of dyed cotton material against (G+) and (G-) bacteria was determined through the diffusion agents and inhibition zone. The cotton fabric is good textile material For industrial purposes. This textile material gives more application in textile industries. The synthetic dye can show toxicity through skin due to absorption. [5]. By using this antibacterial dyed fabric material the toxicity of such a synthetic dye can be minimized. The toxicity of such a synthetic dye is determined by lethal dose process. The antibacterial activity of this dyed cotton was determined by the diffusion method and agar plates. This method is called as well diffusion method. The evaluation of the antibacterial effect of dyed cotton fabric is performed by standard diffusion methods. The agar plate was taken as culture. And these agar plates were carefully inoculated by 1.5000 cfu / ml standardized inoculums of the bacteria. Then by sterile borer about 5mm sized well was created in that selected culture plates. During formation of this well the content of agar was taken to cover lower side. The cotton material which was dyed by saptaparni dye was dissolved into the DMSO and water. From above stock solution the 20µl, 40µl & 60µl of increasing volume solutions were prepared. These above increasing volume then added into the well. And by using antibiotic disc the negative control was taken. These plates then kept for diffusion up to 10 Min at 400 C. And kept at 300C for 15 hrs incubation. The antibacterial activity of fabric material is determined in mm unit by observing inhibition zone. And this inhibition zone was measured by compass.

The Antibacterial activity is taken only for the diameter greater than 7 mm. This given antibacterial activity is considered as weak for inhibition zone from 7mm to 10 mm in diameter. And this antibacterial activity is considered as good for inhibition zone from 11 mm to 15 mm. And for inhibition zone greater than 15mm the antibacterial activity was considered as very strong activity. [6]. the uninoculated sterile medium was taken as blank. The active group or composition of dye molecule is responsible for antibacterial activity. The growth of pathogen is controlled by this active group as antibacterial activity of molecule. The molecule can have more than one antibacterial activity. The antibacterial effects of Saptaparni dyed fabric against two types of bacteria were determined in this research work. This anti-bacterial activity of dyed cotton fabric material is given in following table.

Table 1.a: Antibacterial activity of the dyed fabric material by diffusion method.

Bacteria (organisms)	Solutions for fabric		
	20µl	40µl	60µl
<i>Bacillus cereus</i> (G+)	6	7	9
<i>St. aureus</i> (G+)	4	6	7
<i>Escherichia coli</i> (G-)	5	5	6
<i>Proteus mirabilis</i> (G-)	2	4	4

The well diffusion method was performed to evaluate the antibacterial effects of solution from dyed fabric having different volumes. The antibacterial activity is determined for cotton material through saptaparni dye. This antibacterial effects of dyed cotton material was determined after 3W, 6W and 9W washing cycles. The antibacterial activity after washing was done for 60µl solution. The antibacterial activity was almost same for all above washing. The use of mordant such as alum can increase the attachment of the dye molecule on this material. The antibacterial effect of dyed fabric was determined by considering decrease in availability of dye due to washing. This natural dye have good attachment to the cotton substrate [7]. The dye can be available on fabric due to good bonding even after washing this fabric many times. The fabric material is dyed by natural source to avoid harmful side effects through fabric material. The antibacterial effect of dye molecules on the cotton fabric is measured after washing of fabric.

Table 1.b: Antibacterial activity of the dyed fabric material by washing cycle. (W: washing cycle)

Bacteria (organisms)	Washing for fabric		
	3 W	6W	9W
<i>Bacillus cereus</i> (G+)	8	8	6
<i>St. aureus</i> (G+)	7	6	4
<i>Escherichia coli</i> (G-)	5	4	2
<i>Proteus mirabilis</i> (G-)	4	4	3

This antibacterial effect of dye of the fabric against gram positive and negative bacteria is recorded by taking three readings after this washing. The following table gives values for antibacterial activity of dyed fabric samples after washing this fabric material.

Conclusion:

This research work is focused on antibacterial activity of dyed cotton fabric material from Saptaparni dye source. The given fabric material have good antibacterial effect against selected examples of bacteria. The dye and cotton substrate gave good bonding therefore the antibacterial activity can be determined after number of washing of fabric. The dye solution of high concentration has high antibacterial activity. The *Bacillus cereus* bacteria (G+) and *E.coli* (G-) have more antibacterial activity than other remaining bacteria. This dye is useful for increasing the quality of textile industries.

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