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To Study the Synergic Effect of Catharanthus Roseus, Senna Auriculata and Acacia Nilotica Based Textiles for Health Care Application.

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A B S T R A C T

Microbial organisms are bacteria and fungi that coexist with humans. Antimicrobial characteristics are critical for hospital clothes, sporting, and everyday clothing. The goal is to optimize the concentration levels of Catharanthus roseus, senna auriculata and acacia nilotica flowers in developing health care applications using bamboo fabric and bamboo-cotton blend fabric to improve its antimicrobial efficacy, which can have important ramifications for a variety of applications, including medical textiles, personal protective equipment, and health care environments. Bamboo fabric is a great choice for healthcare textiles due to its softness, breathability, and antibacterial qualities. The functional qualities of these fabrics may be improved by the addition of organic plant extracts having therapeutic qualities. Each plant species' flowers are used to extract bioactive components for analysis, which includes examining each compound's unique antibacterial properties. These extracts will then be mixed in various concentrations to evaluate any possible synergistic effects. Utilizing a range of analytical methods, including SEM, FTIR and microbiological analysis, the synergistic effects will be characterized. The flower extracts are integrated into the fabrics using finishing process and then tested for antimicrobial porperties in various concentrations. It is anticipated that the research's conclusions would offer insightful information on the development of useful healthcare textiles made of bamboo and bamboo-cotton blend fabric.

Keywords: **Anti-microbial, flower extract, Catharanthus roses, senna auriculata, acacia Nilotic, health care applications, bamboo fabric, bamboo-cotton blend, bioactive component.**

1.INTRODUCTION

Natural medicinal cures and sustainable textiles have garnered increasing attention in recent years. Bamboo fabric has drawn a lot of interest in the textile industry because of its reputation for softness, breathability, and environmental friendliness. The scientific community is becoming more interested in botanical extracts as they are investigated for their potential therapeutic benefits. In this regard, the proposed project intends to investigate the synergistic effects on bamboo fabric and bamboo cotton blend fabric for healthcare applications of three botanical extracts: Senna Auriculata, Catharanthus Roseus, also known as Madagascar Periwinkle, and Acacia nilotica, also known as Gum Arabic tree. Bamboo is a rapidly expanding renewable resource that is naturally antibacterial, hypoallergenic, and moisture-wicking, which makes it a perfect choice for textiles used in healthcare. On the other hand, increasing its capabilities with plant extracts may greatly increase its medicinal potential. The combination of these plant compounds with bamboo and bamboo-cotton blend fabrics has potential uses in the medical field. better moisture management, better antibacterial and antifungal properties, skin-friendly qualities, and possible therapeutic effects like dermatological benefits are just a few of the potential advantages. This research has implications for a wide range of healthcare applications, such as surgical masks, hospital linens, and personal care textiles. We hope to contribute to the creation of novel, eco-friendly, and health-promoting textiles by utilizing the synergies between botanical extracts and bamboo fibers. This will help to create a more sustainable and healthier future for the healthcare industry.

Nomenclature

Title: To study the synergic effect of catharanthus roseus, senna auriculata and acacia nilotica based textiles for healthcare products

1.1. Background of the Work

1.1.1 CATHARANTHUS ROSEUS:

Catharanthus Roseus is a medicinal plant with antibacterial qualities that can be used for masks and other medical purposes. Bioactive substances, especially alkaloids like vincristine and vinblastine, which have strong antibacterial action against a variety of pathogens like bacteria, fungus, and viruses, are found in the flowers of the Catharanthus Roseus plant. Particularly, it has been discovered that vincristine and vinblastine cause microbial cell membrane disruption, prevent nucleic acid synthesis, and obstruct vital cellular functions. These effects ultimately result in the inhibition of microbial growth and proliferation.

1.1.2 SENNA AURICULATA:

Senna Auriculata, sometimes referred to as Avaram Senna or Tanner's Cassia, is a plant that has strong antibacterial qualities that make it appropriate for use in masks and other medical textiles. Senna Auriculata flowers are rich in flavonoids, tannins, and saponins, among other bioactive substances that support the plant's antibacterial properties. The capacity of Senna auriculata to damage bacteria cell membranes and obstruct vital metabolic processes is one of its primary antimicrobial actions. It has been demonstrated that the flavonoids and tannins found in Senna Auriculata flowers suppress the growth of a variety of harmful microbes, such as fungus, viruses, and bacteria. These substances have anti-inflammatory and antioxidant qualities, which increase how effective they are at fighting microbial infections. Senna Auriculata flower extracts can be added to masks to assist suppress the growth of pathogenic bacteria on the mask's surface, lowering the risk of infection and transmission. This is especially crucial in medical environments where it's necessary to prevent the spread of infectious diseases.

1.1.3 ACACIA NILOTICA:

The polyphenol content of Acacia Nilotica is one of the main ways that it demonstrates antibacterial properties. The potential of polyphenols to impede the growth and spread of harmful microbes, such as bacteria, fungus, and viruses, has been the subject of much research. Furthermore, the soluble fiber in Acacia Nilotica flowers has the potential to function as a prebiotic, encouraging the development of good bacteria in the microbiome while suppressing the growth of bad bacteria. Acacia Nilotica flower extracts can lessen the chance of infection and transfer by preventing harmful bacteria from colonizing on the mask's surface. This is especially crucial in medical environments where respiratory infections are a potential risk.

1.1.4 BAMBOO FABRIC:

An antibacterial bio-agent found naturally in bamboo fibers is called "bamboo kun." A compound called bamboo kun is present in bamboo plants and has natural antibacterial qualities that prevent bacteria and other microbes from growing and proliferating. Bamboo fabric has a built-in antibacterial property that persists even after processing, which makes it the perfect material for masks when protection and cleanliness are crucial. Additionally, bamboo fabric's porous structure promotes greater air circulation, which keeps the mask dry and inhibits the growth of microorganisms. Because of the fabric's ability to wick away moisture, an atmosphere that is kept dry and free from bacteria and fungi is less likely to flourish. Bamboo fabric is also hypoallergenic, which makes it appropriate for sensitive skin types and lowers the possibility of allergic responses that are frequently associated with synthetic materials

1.2 OBJECTIVES:

- To study the synergic effect of catharanthus roseus, senna auriculata and acacia nilotica in textile for health care applications which involves exploring their individual and combined properties for potential benefits.
- To assess the antimicrobial properties and other properties when integrated into textile material.
- Determine the viability and safety of using these textiles in health care settings, considering their durability, comfort and potential allergic reactions.

1.3 PROPOSED WORK

1.3.1 EXTRACTION OF BIOACTIVE COMPONENTS USING SOXHLET APPARATUS:

The bioactive components from each flower is extracted using soxhlet apparatus. The extraction of compounds from Catharanthus roseus, Senna auriculata, and Acacia nilotica using a Soxhlet apparatus with water involves several steps. First, finely powdered plant material is packed into the

Soxhlet thimble. Water, acting as the solvent, is heated in the flask, causing it to vaporize and condense through the material repeatedly. This cyclic process allows for the extraction of compounds from the plant material. The water-extract mixture is then collected in the flask and subjected to evaporation to remove the water, resulting in the crude extract containing the desired compounds from Catharanthus roseus, Senna auriculata, or Acacia nilotica.

Fig 1. SOXHLET APPARATUS

Fig 2. CATHARANTHUS ROSEUS

Fig 3. SENNA AURICULATA

Fig 4. ACACIA NILOLICA

1.3.2 TREATMENT OF FABRIC USING EXHAUSTION METHOD:

The extracted component is treated on fabric using exhaustion process. For this, the bamboo fabric and bamboo-cotton blended fabric are cut in the size of 10*10 cm. In total 9 samples from each type of fabric is cut which makes a total of 18 fabric samples. In exhaustion process, the fabric is treated with the extraction along with the help and salt and fixing agents. The extract mixture formed is kept in the dye bath for about 20 minutes in 80 degree celcius. Three concentrations of each flower extract such as 1%, 3% and 5% are taken. The dye bath mixture is made by varying the concentration of each extract inorder to analyze the antimicrobial efficiency of each concentration of extract for optimization purposes. After 20 minutes, all 18 samples are washed and dried in hot air oven.

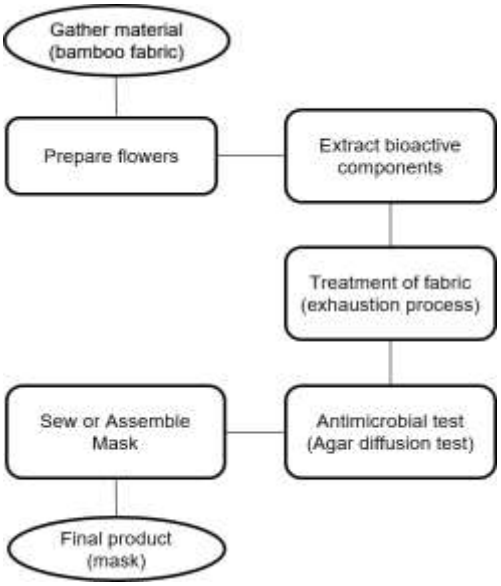
1.3.3 AGAR DIFFUSION TEST:

To determine if treated bamboo and bamboo cotton fabric are suitable for antimicrobial mask applications, it is essential to test their antimicrobial efficiency against common diseases, including Gram-positive Escherichia coli and Gram-negative Streptococcus bacterium. Disc diffusion assays and other qualitative evaluation methods are commonly used to examine the effectiveness of antibiotics. Placed on agar plates inoculated with the corresponding microorganisms are sterile cloth samples treated with plant extracts. The presence of distinct zones of inhibition surrounding the fabric samples after an incubation period shows how well the treatment inhibits bacterial growth. An effective antimicrobial treatment for Gram-positive E. coli would show observable zones of inhibition around the fabric samples, indicating the treatment's capacity to prevent the bacteria's development. Similarly, the development of distinct zones of inhibition for Gram-negative Streptococcus would indicate that the treatment was successful in halting the growth of the bacteria.

1.3.4.FOURIER TRANSFORM INFRARED (FTIR) ANALYSIS:

Fourier Transform Infrared (FTIR) analysis for several reasons, particularly concerning the characterization of the antimicrobial treatment applied to bamboo and bamboo cotton fabric. The presence of functional groups in the treated cloth and antimicrobial compounds can be identified using FTIR spectroscopy. Researchers can learn more about the makeup of the treatment and any chemical changes brought about by the treatment procedure by examining the fabric's infrared absorption spectra to identify the chemical bonds and groups that are present. It aids in verifying if antimicrobial substances have been incorporated into the fabric matrix. In the treated cloth spectrum, specific absorption peaks that match to the antimicrobial agents' functional groups can be found, signifying that the impregnation or surface modification was successful. To guarantee that the antimicrobial treatment is effective, this verification is essential.

1.4 FLOW CHART



1.5 SYNERFIC EFFECT FINISH

Fig 5. BAMBOO COTTON BLENDED FABRIC

Fig 6. BAMBOO FABRIC

1.6 RESULT AND DISSCUSION

Fig 7. BAMBOO FABRIC (E.COLI)

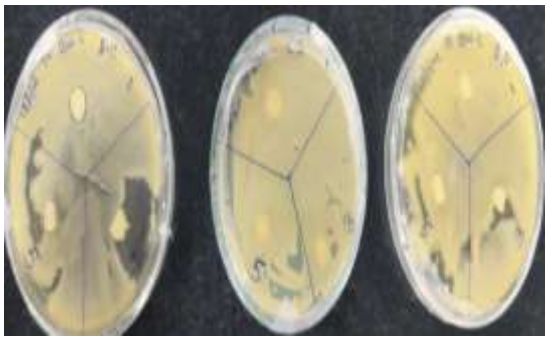


Fig 8. BAMBOO FABRIC (STREPTOCOCCUS)

TABLE 1. ZONE OF INHIBITION FOR BAMBOO FABRIC

Samples (bamboo fabric)	Zone of inhibition (mm) (E.coli bacteria)	Samples (bamboo fabric)	Zone of inhibition(mm) Streptococcus bacteria
1	1mm	1	2mm
2	2mm	2	3mm
3	2.5mm	3	2mm
4	5mm	4	1mm
5	4.5mm	5	1.5mm
6	3mm	6	3mm
7	2mm	7	2mm
8	3.5mm	8	3.5mm
9	1mm	9	4mm

Fig 9. BAMBOO COTTON FABRIC (E.COLI)

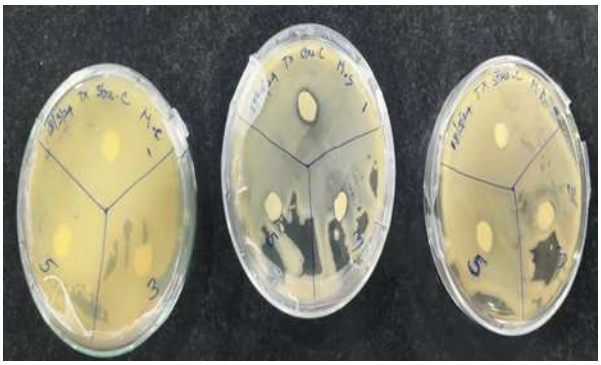


Fig 10. BAMBOO COTTON FABRIC (STREPTOCOCCUS)

TABLE 2. ZONE OF INHIBITION FOR BAMBOO COTTON FABRIC

Samples (bamboo cotton fabric)	Zone of inhibition (mm) (E.coli bacteria)	Samples (bamboo cotton fabric)	Zone of inhibition(mm) Streptococcus bacteria
1	2mm	1	0.5mm
2	3mm	2	2mm
3	1mm	3	2mm
4	4mm	4	4.5mm
5	2.5mm	5	3.5mm
6	2mm	6	4.5mm
7	0.5mm	7	2mm
8	1.5mm	8	2mm
9	1mm	9	4.5mm

SYNERGIC EFFECT RESULTS

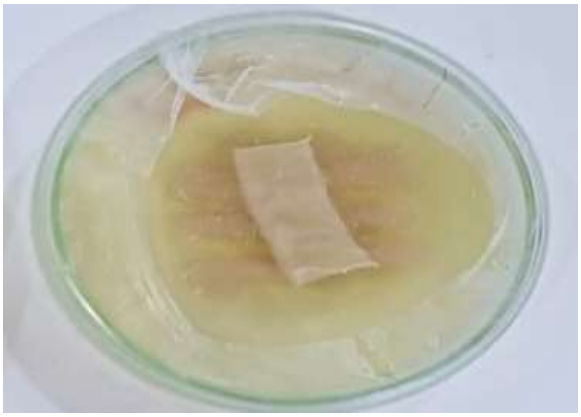


Fig 11. BAMBOO COTTON FABRIC (STREPTOCOCCUS)

FIG 12.BAMBOO FABRIC (STREPTOCOCCUS)

FIG 13. BAMBOO FABRIC (E.COLI)

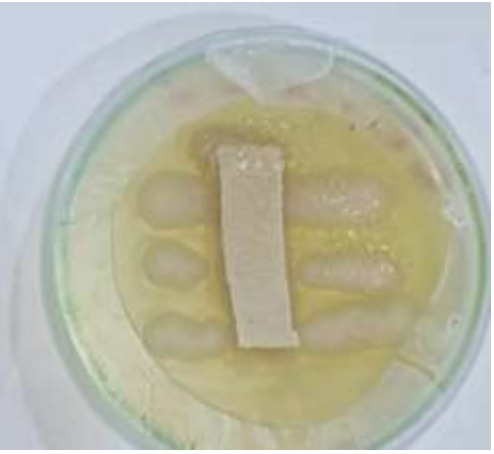


FIG 14. BAMBOO COTTON FABRIC (STREPTOCOCCUS)

TABLE 3. ZONE OF INHIBITION FOR SYNERGIC EFFECT

Samples	Zone of inhibition (mm)
1	5mm
2	4.5mm
3	2mm
4	4mm

The result of synergic effect on bamboo cotton fabric at the concentration of 1:3:5 (senna auriculata:catharanthus roseus:acacia nilolica), the zone of inhibition is higher at 5mm for gram positive bacteria and 4mm for gram negative bacteria. Whereas the combination of the extracts on bamboo fabric at concentration of 1:1:3 (senna auriculata:catharanthus roseus:acacia nilolica), the zone of inhibition is 4.5mm for gram positive bacteria and 2mm for gram negative bacteria. It is concluded that 70% bamboo and 30 % cotton blended fabric shows higher zone of inhibition than 100% bamboo fabric. The final healthcare product mask is constructed using bamboo cotton fabric which has higher antimicrobial properties.

FOURIER TRANSFORM INFRARED (FTIR) ANALYSIS RESULTS:

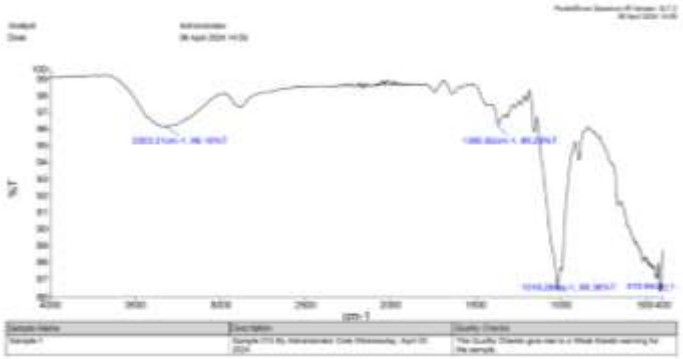


FIG 15. BEFORE TREATMENT OF BAMBOO COTTON FABRIC

FIG 16. SYNERGIC TREATMENT OF BAMBOO FABRIC

FIG 17. SYNERGIC TREATMENT OF BAMBOO COTTON FABRIC

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