DEVELOPMENT OF MEDICAL GAUZE USING BAMBOO YARN

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ABSTRACT

Innovation in textiles has brought alternative plant-based fibres such as bamboo into the spotlight. Bamboo as a raw material is a remarkably sustainable and versatile resource but the manufacturing process is where the debate really gets heated and the sustainability and green image of bamboo is tarnished. Products made from bamboo are often labelled as 'eco-friendly', 'bio-degradable' and 'anti-microbial' irrespective of their method of manufacturing. The textiles used in the operation and post operative tasks in and around a patient and the medical practitioner are termed as medical textiles which application area embraces all those technical textiles used in non -implantable applications. To cure healing of a wounds area traditionally sterilized or non-sterilized woven gauze fabrics are used directly or indirectly to the wound respectively mainly for absorbing the liquids of the wounded area. Bamboo gauze is light and open weave fabric made of bamboo fibre when used for surgical dressing The surgical wear developed from 100% bamboo fibre result in inhibiting bacteria growth with good tensile property and provides better hygiene and safety for the medical textiles medical gauze is a light material intended for post-surgical wound applications or deep wound healing. Many medical gauze applications are for direct wound placement and maintaining a sterile environment is paramount for healthy, uninhibited healing. The gauze dressings can be medicated or impregnated with antiseptic or made for wound debridement -- specifically in cases where the wound is large and the incidence of necrotic tissue may be present. The two general categories of gauze are made from woven and non-woven materials. Below is more information on these categories and general gauze usage. Many parameters affect the mechanical properties and composite characteristics of bamboo fibres and bamboo composites, including fibre extraction methods, fibre length, fibre size, resin application, temperature, moisture content and composite preparation techniques. Mechanical extraction methods are more eco-friendly than chemical methods, and steam explosion and chemical methods significantly affect the microstructure of bamboo fibres. The development of bamboo fibre-reinforced composites and interfacial adhesion fabrication techniques must consider the type of matrix, the microstructure of bamboo and fibre extraction methods.

KEYWORDS: Bamboo fibre - Natural fibre – Anti-microbial – wound dressing – non-Implantable application – woven gauze – bamboo gauze.

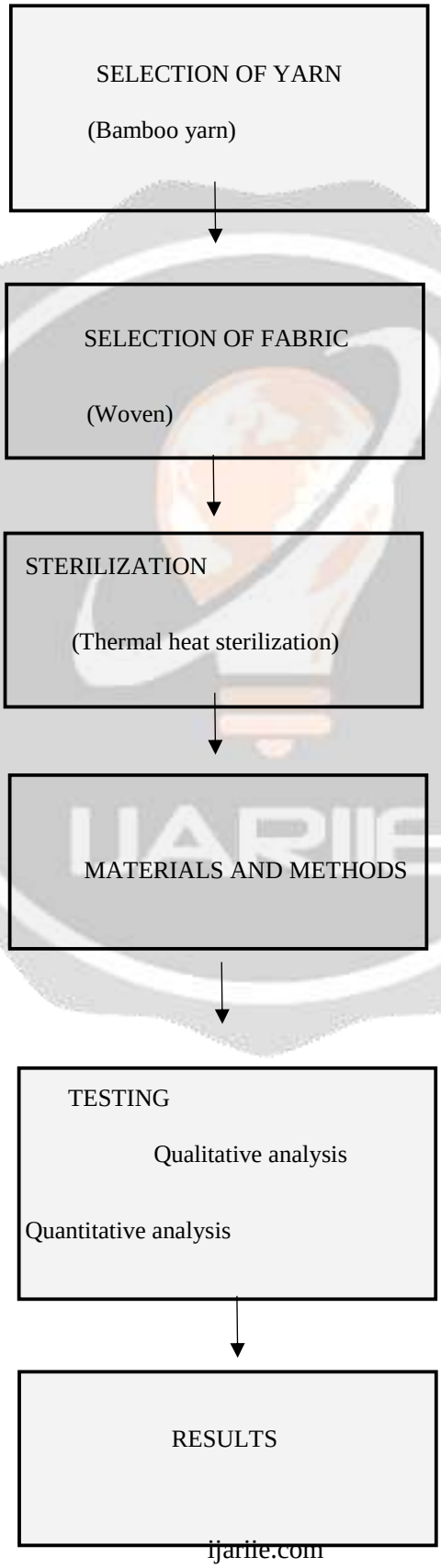
INTRODUCTION

Bamboo fibre can be directly extracted from bamboo to be used for other engineering application. Bamboo plants are found in almost all parts of world except those places having extreme cold climates like Europe though some species can be successfully introduced in mild temperate zones of Europe. The Cross-section of bamboo fibre present a hollow structure offering excellent moisture absorption ability and air permeability; and the vascular bundles of bamboo fibre are distributed along the radial direction, which is conductive to the classification and utilization of bamboo fibre. To make this gauze fabric 100% germ -free various types of sterilization process is carried out namely Thermal/ heat sterilization method. Coated are also useful to enhance different properties of gauze fabric. Bamboo gauze can be used for cleansing, packing, scrubbing, covering, and securing in a variety of wounds. Closely woven Bamboo gauze is best for extra strength or greater protection. An important field of application of textile in medicine has been developed such as wound care and preventing chronic wounds. Bandages and wound dressings are most used because they are affordable and reusable. The medical textile should have bio-compatibility, flexibility, and strength. Natural plant fibre composites have been developed to produce a variety of industrial products, with benefits including biodegradability and environmental protection. Bamboo fibre materials have attracted broad attention as reinforcement polymer composites due to their environmental sustainability, mechanical properties, and recyclability, and they can be compared with glass fibres. This review classifies and describes the various procedures that have been developed to extract fibres from raw bamboo culm. There are three main types of procedures: mechanical,

chemical, and combined mechanical and chemical extraction. Composite preparation from extracted bamboo fibres and various thermal analysis methods are also classified and analysed.

MATERIALS AND METHODS

FLOW CHART



ATERIALS AND METHODS

SELECTION OF YARN:

BAMBOO YARN:

PLATE I: Bamboo yarn

Bamboo fibre is a regenerated cellulosic fibre produced from bamboo. Starchy pulp is produced from bamboo stems and leaves through a process of alkaline hydrolysis and multi-phase bleaching.

As bamboo fibre is bestowed with the extraordinary properties, it has the strength of steel. The fibre has inherent shine and anti-bacterial properties. This property is maintained even when woven. Also, it prevents the build-up of static electricity compared to other fabrics.

It outshines other fabrics with its natural deodorizing property, to keep oneself odour free. It prevents abrasion, and is extremely permeable. The fabrics made from bamboo are tagged best quality; they meet all the yardsticks of quality standards.

The most important feature of bamboo fibre fabric is that it is environment friendly. It possesses hydroscopic properties as well. Even fabric made from bamboo fibres, mixed with cotton, has the same properties. Bamboo fibres look like cotton when not spun. Its light and airy.

STERILIZATION:

THERMAL/HEAT STERILIZATION METHOD:

Thermal sterilization uses the thermal lability of a microorganism to prevent its growth. At elevated temperatures, the probability of an organism surviving depends on the magnitude of temperature and the duration of exposure. The medium shall remain unharmed, unless it is thermally unstable. Thermal instability of media causes degradation of the desired product as well as the targeted organisms. The most common form of thermal sterilization is steam addition. Steam is an inexpensive and effective carrier of heat. Below is a high-resolution picture of bacteria in media.

Advantages:

- Most common method for controlling microbial growth
- Very effective in destroying unwanted microbes
- Low cost

TESTING AND EVALUVATION

1.QUALITATIVE ANALYSIS
ANTI-MICROBIAL TEST

Antimicrobials – including antibiotics, antivirals, antifungals and antiparasitic – are medicines used to prevent and treat infections in humans, animals, and plants.

Antimicrobial Resistance (AMR) occurs when bacteria, viruses, fungi, and parasites change over time and no longer respond to medicines making infections harder to treat and increasing the risk of disease spread, severe illness and death.

As a result of drug resistance, antibiotics and other antimicrobial medicines become ineffective and infections become increasingly difficult or impossible to treat.

2. QUANTITATIVE ANALYSIS

The developed bamboo gauze was physically evaluated by the peoples the questioner was prepared based on the usage of gauze by the people at two hours general characteristics of developed bamboo gauze and its effects were taken as major aspects. And other details of the skin where also questioned.

METHODS

CONVERTING YARN INTO GAUZE

PLATE II: Bamboo yarn

PLATE-III: Weaving process of bamboo gauze

PLATE-IV: Finishing of bamboo gauze

PLATE V: Bamboo gauze

RESULT AND DECISSION:

1. QUALITATIVE ANALYSIS:

ANTI-MICROBIAL ACTIVITY:

Well Diffusion method

The antibacterial activity and antifungal activity of crude extract extracts was determined by Well Diffusion method (Bauer *et al*., 1996). MHA plates were prepared by pouring 20ml of molten media into sterile petriplates. After solidification of media, 20-25µl suspension of bacterial inoculums was swabbed uniformly. The sterile paper discs were dipped into required solvents then placed in agar plates. Then 10-50 µl of plant extract was poured into the wells. After that, the plates were incubated at 37°C for 24 hours. Assay was carried into triplicates and control plates were also maintained. Zone of inhibition was measured from the edge of the well to the zone in mm. The tested cell suspension was spread on mullerhintonagar plate and potato dextrose agar. well, were put into the agar medium using sterile forceps. plant extract was poured on to wells. Then plates were incubated at 37°c for about 24 hours and control was also maintained. Zone of inhibition was measured from the clear zone in mm.

Antibacterial activity was performed by agar diffusion method. Van der Watt *et al.,* 2001. The stock culture of bacteria *(E. coli* and *Staphylococcus aureus)* was received by inoculating in nutrient broth media and grown at 37 % for 18 hours. The agar plates of the above media were prepared. Each plate was inoculated with 18 hours old cultures the bacteria were swab in the sterile plates. Placed the extract treated cloth and untreated cloths were placed. All the plates were incubated at 37^{o}C for 24 hours and the diameter of inhibition zone was noted in Cm.

Agar well diffusion method has been used to determine the antimicrobial activities and minimum inhibitory concentrations or plant extracts against Gram-positive, Gram-negative bacteria. The extracts exhibited antibacterial activities against tested microorganisms.

Organisms	***E. Coli***	***Staphylococcus aureus***
Thread	0.5 cm	0.3 cm
Standard (Bacteria-Chloramphenicol)	0.4 cm	0.4 cm

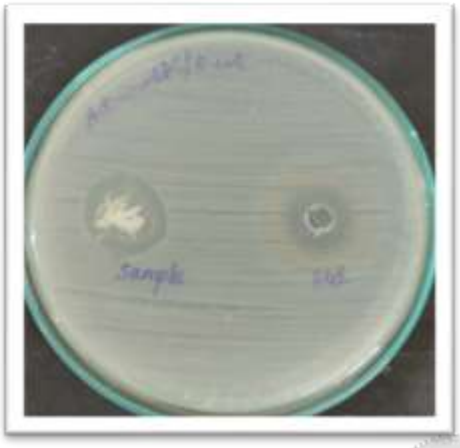


PLATE VI: ***Zone of e-coli in bamboo yarn .***

PLATE VII: ***Zone of staphylococcus aureus in bamboo yarn***

Test method:

The disc diffusion technique on an agar plate was used to evaluate the antibacterial and antifungal activity of the produced AgNP samples (Ibrahim et al. 2015; Mohamed et al. 2018). After solidification, 1 cm of each fabric sample was cut and placed in 10 mL of nutrient agar, into which 10 L of microbe culture was injected. After a 24-h incubation period at 37 °C, the diameter of the inhibitory zone around the samples was measured and recorded.

FT-IR and SEM tests were performed at the Central unit for analysis and scientific services at the National Research centre.

Tensile tests on yarn are carried out according to DIN-12562. (Elongation Test)

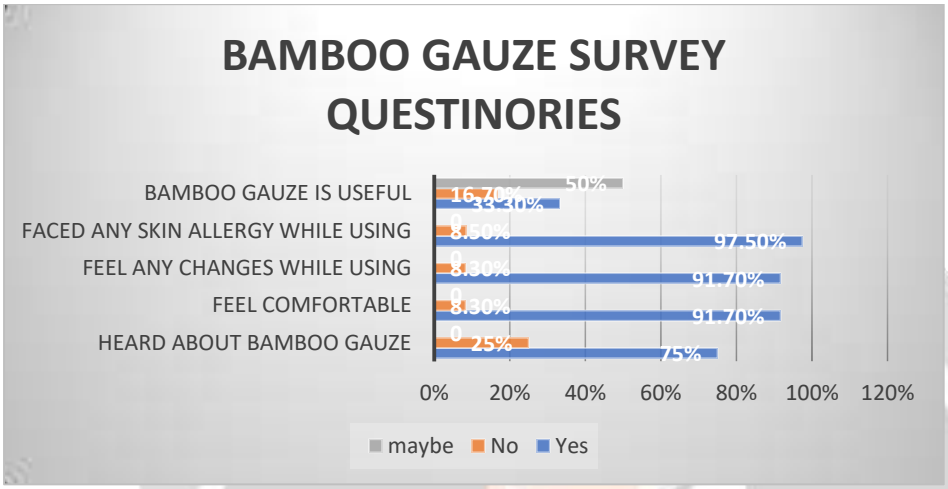
Tests yarns (in this case 0% to 300% elongation with a grip-to-grip separation of 100 mm) are loaded with 5 cycles not until break but between defined offset yields. The specimen is moved 500 mm/min between the point of load application (70% elongation) and the point of load removal.

PLATE VIII: ***Elongation test in bamboo yarn***

Report:

The given Thread heaving 75 % elongation properties. Above 300mm extension threads are breaking.

QUANTITATIVE ANALYSIS:



SERIES 1: YES **SERIES 2:NO** **SERIES 3: MAYBE**

SNO	QUESTIONS	SERIES 1	SERIES 2	SERIES 3
1	Heard about bamboo gauze	75%	25%	-
2	Feel comfortable while using	91.70%	8.30%	-
3	Feel any changes while using	91.70%	8.30%	-
4	Faced any skin allergy while using	97.50%	8.50%	-
5	Bamboo gauze is useful	33.30%	16.70%	50%

COST OF THE DEVELOPED BAMBOO GAUZE

Bamboo yarn(2kg)	700
Bamboo yarn for one gauze	15
Packing	5
Total cost	20

According to the calculated amount for raw material used for developing the medical bamboo gauze, the cost per gauze is Rs:20 it is less expensive as compared to the ones available in the market. When produces on large scale still the cost can be reduced and the gauze can be produced at the lower cost. From 2kg of yarn, we can produce 100 plus gauzes and it helps the patient.

SUMMARY AND CONCLUSION

Bamboo gauze has particular and natural functions of anti-bactria, bacteriostatic and deodorization. It is especially useful for dressing wounds where other fabrics might stick to the burn or laceration.This bamboo gauze helps the patients in promoting wound healing. It is a common fact that bamboo can thrive naturally without using any pesticide.And also helps to immoblize the injured wound of the patients. Bamboo gauze redueses infection due to its anti allergic and anti-microbial properties. Bamboo gauze will prevent and avoid pain, infection, and potential damage. Bamboo gauze.improve the quality of your wound care management. The Bamboo gauze has good water absorption and air permeability.It has absorbency properties so it helps to absorb fluid from wounded area.

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