

## **Pilot study of bamboo/cotton and bamboo/polyester blended fabrics herbal finished by selected herbs**

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The textile industry is going through revolutionary changes which are aimed to fulfil the function of comfort, aesthetic, safety and ecological requirements. These characteristics, by and large, defined the sensibility of the textile products. Textile industry is the second largest industry in the world next to agriculture. In India, the textile industry contributes substantially to the foreign exchange earned by the country. The Indian textile industry is estimated to be about \$52 billion. In the eleventh Five Year Plan, textile industry was expected to grow at 16% per annum and attain a size of \$ 115bn by 2012.

Cotton is the backbone of the world's textile trade. It is also known as "King of fibre" and "White gold". Due to its unique fibre structure it can absorb water up to 2.7 times of its own weight. Cotton is the most important apparel fibre. Its combination of properties like pleasing appearance, comfort, easy care and durability makes cotton ideal for warm weather clothing, active wear, work clothes, upholstery, draperies, area rugs, towels and bedding. Cotton is good for use in hot and humid weather. The fibre absorbs moisture and feels good against the skin in high humidity. Moisture passes freely through the fabric, thus aiding evaporation and cooling, (Kadolph, 2011).

The well-known characteristics of bamboo material are its antibacterial property, incredible capability to breath and its intrinsic coolness, pleasant luster, better drape and tremendously comfortable soft feel. Bamboo naturally provides added protection against the sun's harmful UV rays. Currently, regenerated bamboo fibres have high demands in market and are being used in apparels including underwear, T-shirt, sports textiles, socks, towels, bathing suits, sanitary napkins, absorbing pads, bandages and surgical gowns, (Badr, 2013).

Consumers are now increasingly aware of the hygienic lifestyle and there is necessity and expectation for a wide range of textile products, finished with antibacterial properties. Microbes are the tiniest creatures not seen by the naked eyes. They include a variety of microorganisms like bacteria, fungi, algae and viruses. Bacteria are uni-cellular organisms, which grow very rapidly under warmth and moisture. This growth is another factor that has resulted in development of antibacterial finish. Consumers are looking for solutions to odour and microbial problem and the unique benefits provided by antibacterial finish. Scientists found that bamboo owns a unique antibacterial and bio-agent named "Bamboo Kun". This substance combined with bamboo cellulose molecular, tightly all along during the process of being produced into bamboo fibre, (Kumar, 2012).

Among manmade fibres, polyester is the most important synthetic fibre today. It offers the possibility of blending with cotton in order to impart desirable properties such as comfort and also reduction in the cost of final product with increased service life. Also polyester is the most engineerable and diverse polymer that mankind has developed.

It has an environment-friendly production process and disposal method. It is recyclable and resists water spotting, sun fading and yellowing. Now to meet the raw material crisis of natural fibres and to provide the textile industry with a low priced substitute of that natural fibre and thus meeting the demands of increasing population, blending of manmade fibres and natural fibres is essential. In a country like India, with extremes of temperature and humidity, garments made from natural fibres in cotton or blends of manmade and natural fibres are certainly preferred to pure synthetics for reason of environment and health, (Sangwan, 2006).

Blending of different types of fibres is a widely practiced means of enhancing the performance and the aesthetic qualities of a fabric. Blended yarns from natural and synthetic fibres have the particular advantage of successfully combining the good properties of both fibre components, such as comfort of wear

with easy care properties. These advantages also permit an increased variety of products to be made, and yield a stronger marketing advantage, (Baykal, 2006).

Microencapsulation is a process of surrounding or enveloping one substance within another substance on a very small scale, creating capsules ranging from less than one micron to several hundred microns in size. All the three states of matter viz., solid, liquid and gas can be microencapsulated. The core materials which are encapsulated are then released gradually through the capsule walls known as “controlled release mechanism”. The external conditions trigger the capsule walls to rupture. The technology is successfully utilised to incorporate various finishing textiles, like antibacterial finishing, fragrance finishes, insect repellents, phase change materials, moth repellency, flame retardancy, (Sathianarayana *et al.*, 2010).

The study was started with the production of knitted fabrics. Some selective species of plants were identified and screened for their antibacterial activities and their extracts were applied on to hundred percent bamboo, 50:50 bamboo/polyester and 80:20 bamboo/cotton fabrics. This thesis address the assessment of the antibacterial effectiveness of the herbs by employing standard test methods with the topic titled “ **Pilot study of bamboo/cotton and bamboo/polyester blended fabrics herbal finished by selected herbs**”.

**The objectives of the study are:**

- To investigate the antibacterial activity of selected herbs.
- To carry out pilot studies on fabrics to optimise the selected herbal content for imparting antibacterial finish.
- To apply the antibacterial finish by the process of microencapsulation and to assess their properties.
- To assess the finished fabrics for antibacterial activity.

The application and evaluation of antimicrobial property of the three knitted fabrics were discussed. The results consist of development of microcapsules, for the selected herb for antibacterial finished samples B3, BC3 and BP3 fabric samples compared with original samples B1, BC1, BP1 were evaluated for the antibacterial and antifungal activity .

**4.4. Selection of Herb**

Based on the pilot study and literature survey, *Leucas aspera* was selected as a natural herbal source for the present study. The selected herb was shade dried and ground into a powder. The grounded powder was used for methanolic extraction.

**4.4.1. Application of herbal source at different concentrations**

The selected three single jersey knitted fabrics were finished with the herbal extraction of *Leucas aspera* at 50%, 75% and 100% concentration using padding mangle method. The finished fabrics were evaluated using standard testing methods, ENISO 20645, AATCC-100 and AATCC-147 for antibacterial activity and also AATCC 30 for evaluating antifungal activity.

**4.4.2. Evaluation of antibacterial activity**

**4.4.2.1. Preliminary assessment of antibacterial activity of selected herbal extracts by disc diffusion test method.**

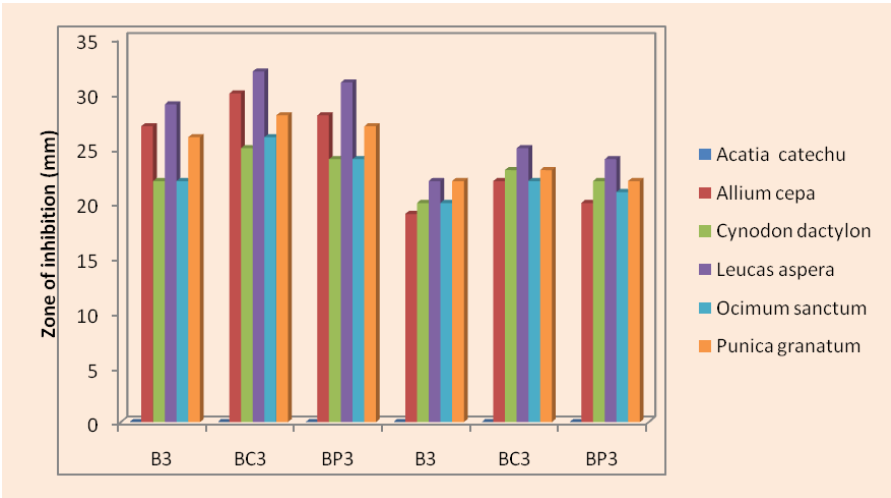
The following Table 1, Figures 1 and Plates 1,2 depict the preliminary assessment of antibacterial activity of the herbal finished B3, BC3 and BP3 fabric samples compared with original samples of B1, BC1, BP1.

**Table 1**  
**Preliminary assessment of antibacterial activity of selected herbal extracts by disc diffusion test method**

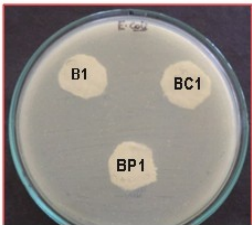
S.No.	Herbs	Antibacterial activity					
		Zone of bacteriostasis (mm)					
		<i>S.aureus</i>			<i>E.coli</i>		
		B3	BC3	BP3	B3	BC3	BP3
1	<i>Acatia catechu</i>	+	+	+	+	+	+
2	<i>Allium cepa</i>	27	30	28	19	22	20
3	<i>Cynodon dactylon</i>	22	25	24	20	23	22
4	<i>Leucas aspera</i>	29	32	31	22	25	24

5	<i>Ocimum sanctum</i>	22	26	24	20	22	21
6	<i>Punica granatum</i>	26	28	27	22	23	22

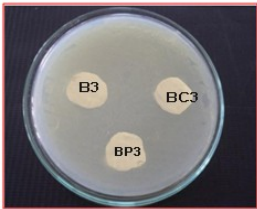
(+) = No growth beneath the sheet



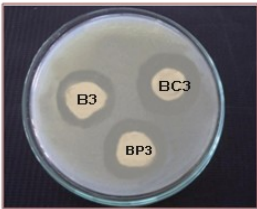
**Figure 1**  
**Preliminary assessment of antibacterial activity of selected herbal extracts by disc diffusion test method B3 (100% bamboo)**



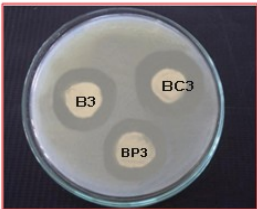
Original samples



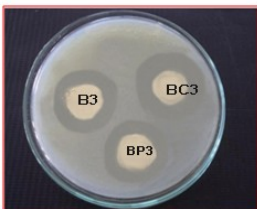
*Acatia catechu*



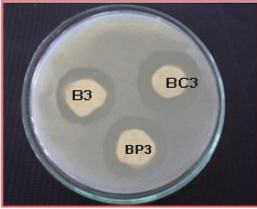
*Allium cepa*



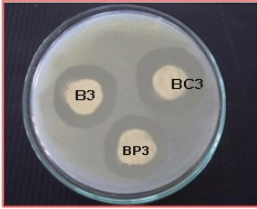
*Cynodon dactylon*



*Leucas aspera*



*Punica granatum*



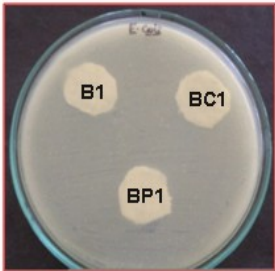
*Ocimum sanctum*

- B1 – 100% bamboo (original)
- BC1 – 80:20 bamboo/cotton (original)
- BP1 – 50:50 bamboo/polyester (original)
- B3 – Microencapsulated antibacterial finished 100% bamboo fabric
- BC3 – Microencapsulated antibacterial finished 80:20 bamboo/cotton fabric

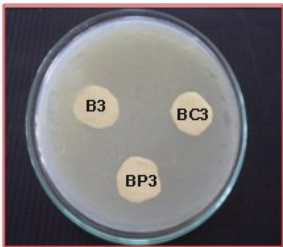
BP3 – Microencapsulated antibacterial finished 50:50 bamboo/polyester

Plate 1

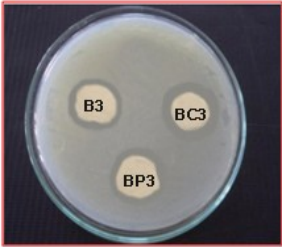
Preliminary assessment of antibacterial activity of selected herbal extract finished fabrics by disc diffusion method (*Staphylococcus aureus*)



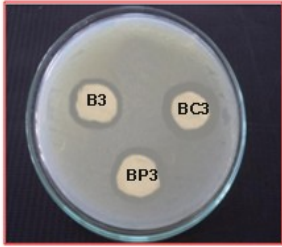
Original samples



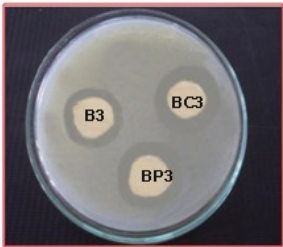
*Acatia catechu*



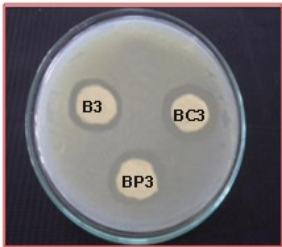
*Allium cepa*



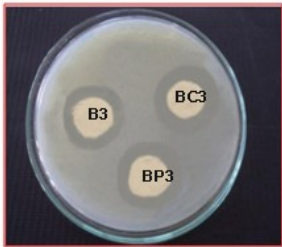
*Cynodon dactylon*



*Leucas aspera*



*Ocimum sanctum*



*Punica granatum*

- B1 – 100% bamboo (original)
- BC1 – 80:20 bamboo/cotton (original)
- BP1 – 50:50 bamboo/polyester (original)
- B3 – Microencapsulated antibacterial finished 100% bamboo fabric
- BC3 – Microencapsulated antibacterial finished 80:20 bamboo/cotton fabric
- BP3 – Microencapsulated antibacterial finished 50:50 bamboo/polyester

Plate 2

Preliminary assessment of antibacterial activity of selected herbal extract finished fabrics by disc diffusion test method (*Escherichia Coli*)

Among the six selected herbs *Leucas aspera* extract finished samples BC3, BP3 and B3 exhibited maximum zone of inhibition against *S.aureus* by 32mm, 31mm, 29mm and *E.coli* by 25mm, 24mm and 22mm respectively. From the preliminary antibacterial assessment, it can be concluded that *Leucas aspera* extract finished (BC3) microencapsulated antibacterial finished 80:20 bamboo/cotton sample exhibited maximum zone of inhibition. Hence the *Leucas aspera* herbal extract was selected for the study.

## Conclusion

The quality of the fibre is ranked with polyester fibre standing first in terms of good quality followed by bamboo and cotton fibre. The fibres and finishes used for providing antibacterial finishes have been found to be useful in developing innovative products which will be suitable for humanity. Since the fibres are found to be ecofriendly and herbal finishes have been used, the demand for products amongst the consumers is expected to be good.

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