

Summary and Conclusion

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The king of fiber Cotton is a divine gift of nature. Cotton conducts heat away from the body allows the cooler temperatures to reach the body, so it is a cool fabric for summer. Cotton is also used for home furnishings. Towels are most common as it high in absorbency, wide range of colors, wash ability and durability. Sheets and pillowcases are mostly made of pure cotton. Curtains and upholstery fabrics are made of cotton and its blends. Cotton is a cool, soft, comfortable, and principal clothing fiber of the world.

The textile Industry has the biggest customer base in the world; there will be more focus for the future advances in the customer- oriented products with nanotechnology applications. There is no doubt that in the coming years nanotechnology will penetrate into every area of textile industry. There is a considerable potential for profitable applications of nanotechnology can be extended to achieve the performance enhancement of textile industry. The recent rise of nanotechnology has increased the usage of spray dryer systems to produce nanoparticles with a good yield and a narrow size distribution spray drying is a simple, rapid, reproducible, economic and easy to scale-up production process.

The greatest challenge of the present era is to develop nature friendly sustainable technologies that would make life easy and productive for the current as well as future generations. Antimicrobial finishes using natural sources has been the current vogue that promotes natural and eco-friendly life style. The natural antimicrobial substances are not only eco-friendly but also taken from renewable sources. The microbes such as Bacteria and fungi can grow on fabrics. Microbial growth, especially bacteria, in textile materials is responsible for deterioration of fabric properties, development of foul smells, skins irritation and cross infections.

Mosquitoes are extremely unsafe insects and are responsible for propagating ailments like malaria, encephalitis and dengue fever. At present, there are very few durable repellents that can be applied to clothing and almost all the repellents are designed to be applied directly on the skin. Around the world, millions of people

make use of chemical based mosquito repellents to get complete protection from mosquito bites, but the most common insect repellents and sprays used in several homes may be poisonous and are able to produce health problems in people especially for the children. Thus also pose many adverse effects to the life of pets, domestic animals and even plants. The exposure to chemicals or insect repellents are susceptible to young children for change their brain chemistry. This is because of the fact that the skin of children tends to absorb more chemicals. There are lots of plants and their parts were proposed as natural mosquito repellent.

Fragrance finishing is the process by which textile materials are treated with the pleasant smell which yields better beneficial effects. The pleasant smells can be created by the herbs have pharmacological effects like antibacterial, antifungal, antiviral, etc. and mood elevating effects.

Objectives

- The following are the objectives of the study
- Extraction of finishing agent from *Eucalyptus globulus* (Eucalyptus leaves), *Santalum album* (Sandalwood) and *Hemidesmus indicus* (Sarsaparilla)
- Conversion of extract into Nano particles,
- Application of Nano particles into selected cotton fabric
- Evaluation of multi-functional properties of Nano finished cotton fabric.
- To develop the pillow case using Nano finished cotton fabric

Methodology

Cotton is the most significant fiber in textiles. So 100 percent cotton fabric was selected for this study. The selected cotton fabric was pretreated for the removal of impurities and natural coloring matters present in the fabric. The necessary pretreatment for cotton fabric are Desizing, Scouring and Bleaching. Desizing was carried out with detergent to remove sizing particles. The scouring was done using NaOH and Sodium silicate, and bleaching was undertaken using Hydrogen peroxide to remove the natural coloring matter. This pretreatment increased the whiteness and absorbency of the fabric. Pilot study was carried out to selection of herbs and suitable solvent for extraction. The herbal solution was extracted from Eucalyptus leaf, Sandal

wood, and Sarsaparilla root with Ethanol by soxhelt extractor. The herbal solution was applied on the pretreated cotton fabric by three different finishing methods. In conventional method the fabric was treated with herbal solution in the dye bath with 1:10 liquor ratio at 60°C for 45 minutes. In second method the herbal solution was coated on fabric by ultrasonic atomizer with the selected parameters. In the third method, the herbal solution was converted into nano particles using nano spray dryer with optimized parameters. The nano particles were collected in a powder form. It was mixed with distilled water and applied on the fabric by ultrasonic atomizer.

The conventionally finished sample (B), ultrasonic atomized sample (C), nano finished sample (D) were evaluated visually by a panel of judges. All the treated samples such as B, C, D and control sample (A) were then tested in a laboratory to analyze the physical properties, mechanical properties and comfort properties in comparison with control sample and the results were analyzed statistically. The functional property tests such as antibacterial test, cage test for mosquito repellent finish and fragrance finishing test were carried out for the finished samples.

Findings

In the **sensorial evaluation**, the nano finished sample (D) was rated as excellent in selected criteria such as color, Appearance, Texture, and Fragrance.

Fabric weight of the samples was evaluated, from the results maximum gain in weight was found in nano finished sample (D) when compare with other samples. The nano finished sample (D), had significant improvement in thickness from its control sample. In the physical properties test, best results was obtained in sample D because nano finishing.

The **strength and elongation** of the fabrics were evaluated by Tensile strength tester. Higher the reading indicates more in strength and elongation. On comparing all the four samples it was observed that the best results were attained on sample D in warp and weft direction. It proves that nano finishing improved the tensile strength and elongation of the fabric.

The **abrasion resistance** of the samples was evaluated by Martindale abrasion tester. The best result was found in nano finished sample and ultra sonic atomized sample.

Stiffness test was performed in the Shirley stiffness tester. The significant gain in **stiffness** was observed in all the finished fabric. Thus the finishing treatment improved the stiffness of the fabric.

Crease recovery of the samples was measured by Eureka crease recovery tester. Least value of crease recovery indicates higher in crease recovery, from the results the highest crease recovery was seen in sample D and sample C when compare its control sample along both warp and weft direction.

The **drape co-efficient** of samples was analyzed by drape meter. The result shows that all the finished samples were decreased in drape co-efficient, because the finishes improved the stiffness of the fabric.

The **absorbency of samples** was evaluated by drop test, sinking test, capillary rise test. All the treated samples have significant improvement in absorbency, but the maximum level of absorbency was found in sample D.

From the objective evaluation, it can be concluded that sample D shows the best result when compare with its control sample and other samples due to nano finishing.

The **antibacterial activity** of control and treated samples against Staphylococcus (gram positive) and E.Coli (gram negative) were evaluated by Disc diffusion method. The highest diameter of inhibition zone was found in sample D and next in sample C. the nano particles improved the efficiency of the antibacterial activity.

The **concentration and release rate of fragrance** was measured using Nano visual spectrophotometer. The nano finished sample showed highest concentration and release rate, even after eight days the same result was obtained because the deep penetration of nano particles.

The **mosquito repellency** of the finished and unfinished samples was evaluated by Cage test. The repellency of mosquito was seen in finished sample because of the finishing agent.

It will be concluded that the functional properties, such as antibacterial activity, mosquito repellency, and fragrance finishing were improved by nano finishing on cotton fabric with selected herbs and their performance is highly satisfactory even after repeated washing.

The **SEM analysis** showed the adherence of nano particles with fabric. The size of nano particles varied from 30 nm to 65 nm.

An existing methods **nano finishing** is carried out using many chemicals. Where as in this method spray drier is used to convert the extract to nano particles without the usage of any chemicals. Hence it is considered as Eco-friendly method of finishing.

Recommendation

The finished fabric can be advised for bedding materials in hospitals as it has given antibacterial, mosquito repellent, fragrance finishes. It is also recommended for curtains and upholstery fabrics at home. Finishes with different types of aroma is also suggested for further studies.