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A Comparative Study on Mosquito Repellency in Knitted Fabric using Herbal Extracts and Oils

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Abstract: *The textile industry has an over whelming presence in the economic life of our country but it is facing a challenging condition in the field of quality and productivity due to globalization of the world market. So, leading the movement for Eco-friendly textiles should be the management mantra for Indian textile industry to become a successful player in the global arena of textiles with many avenues to capture in coming times in the eco-conscious scenario. A Textiles demand varies from year to year with the changing fashion; the consumer's preference influences the demand for different types of finishes. The increase in the world demand for textile s is expected to continue not only due to increase in the world population but also due to the standards of living. Therefore, the focus of research has shifted towards the exploration of the new finishes and their combinations with the older ones.*

Keywords: Fabric, textile, fiber etc.,

I. INTRODUCTION

The word "textile" was originally used to define a woven fabric and the processes invo1ved in weaving. Over the years the term has ta ken on broad connotations, including the following:
(1) Staple filaments and s for use in yarns or preparation of woven, knitted, tufted or nonwoven fabrics, (2) yarns made from natural or man-made s, (3) fabrics and other products made from s or from yarns, and (4) apparel or other articles fabricated from the above that retain the flexibility and drape of the original fabrics. This broad definition will generally cover all of the products produced by the textile industry intended for intermediate structures or final products. Textile fabrics are planar structures produced by interlacing or entangling yarns or in some manner.
Usually, the polymeric molecular chains found in s have a definite chemical sequence which repeats itself along the length of the molecule. The total number of units which repeat themselves in a chain (n) varies from a few units to several hundred and is referred to as the degree of polymerization (DP) for molecules within that. Textiles have been used to make cloth for several thousand years. Until 1888, when the first manufacture was produced commercially, were produced by plants and animals. The most commonly used were wool, flax, cotton, and silk. These four natural continued to be used and value today, although their economic importance related to all has decreased.

Objectives:

- To select 100% bamboo fabric.
- To pre treat the bamboo fabric with sourcing and bleaching.
- To select the herbs and oil which is having mosquito repellent activity?
- To analyze and select the best fabric by physical and functional testing.
- To evaluate the wash durability of the selected fabric

II. REVIEW OF LITERATURE

Clothing is designed to maintain a hygienic and comfortable zone for the human body in which one feels well, even if inner or outer influences change rapidly. The zone in which the temperature, moisture andair circulation are properly matched is called the “comfort zone” (Subhasis das and Kothari, 2016).

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The most commonly used fabric forming methods are knitting, braiding, tufting, and non woven manufacturing. In recent years there has been a very fast growth in the knitting section of the textile industry. A demand for weft knitted garments has increased many folds over the years in the domestic and export markets. Dimensional stability of knitted fabrics has been one of the most discussed areas in the textile industry as well as in research fields (Sakthivel and Anbumani, 2016)

Innovation doesn't mean that it should be expensive and people at a very nominal cost. As for durability, an innovative durable product should definitely have a life span of more than 50 washes to last market says (Gokarneshan et al., 2016).

Bamboo:

Bamboo is a tribe of flowering perennial evergreen plants in the grass family Poaceae, subfamily Bambusoideae, tribe Bambuseae. Giant bamboos are the largest members of the grass family. In bamboos, the intermodal regions of the stem are hollow and the vascular bundles in the cross section are scattered throughout the stem instead of in a cylindrical arrangement. The dicotyledonous woody xylem is also absent. The absence of secondary growth wood causes the stems of monocots, even of palms and large bamboos, to be columnar rather than tapering. Bamboos are some of the fastest-growing plants in the world, due to a unique rhizome-dependent system. In fact, within a 24 hour period, bamboo can grow four feet. Bamboos are of notable economic and cultural significance in South Asia, Southeast Asia and East

Asia, being used for building materials, as a food source, and as a versatile raw product. Bamboo has a higher compressive strength than wood, brick or concrete and a tensile strength that rivals steel.

Bamboo is one of the fastest-growing plants on Earth, with reported growth rates of 250 cm (98 in) in 24 hours. However, the growth rate is dependent on local soil and climatic conditions, as well as species, and a more typical growth rate for many commonly cultivated bamboos in temperate climates is in the range of 3–10 centimetres (1.2–3.9 in) per day during the growing period. Primarily growing in regions of warmer climates during the late cretaceous period, vast fields existed in what is now Asia. Some of the largest timber bamboo can grow over 30 m (98 ft) tall, and be as large as 15–20 cm (5.9–7.9 in) in diameter.

Commercial Timber:

Timber is harvested from both cultivated and wild stands, and some of the larger bamboos, particularly species in the genus Phyllostachys, are known as "timber bamboos".

Harvesting:

Bamboo used for construction purposes must be harvested when the culms reach their greatest strength and when sugar levels in the sap are at their lowest, as high sugar content increases the ease and rate of pest infestation.

Annual cycle: As all growth of new bamboo occurs during the wet season, disturbing the clump during this phase will potentially damage the upcoming crop. Also during this high rainfall period, sap levels are at their highest, and then diminish towards the dry season. Picking immediately prior to the wet/growth season may also damage new shoots. Hence, harvesting is best a few months prior to the start of the wet season.

Daily cycle: During the height of the day, photosynthesis is at its peak, producing the highest levels of sugar in sap, making this the least ideal time of day to harvest. Many traditional practitioners believe the best time to harvest is at dawn or dusk on a waning moon.

De-Odorizing:

Bamboo-charcoal has a porous structure similar to that found in charcoal gas filters. Thus, Eco-fabric absorbs and decomposes benzene, phenol, methyl alcohol, and other harmful substances.

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Anti-Bacterial and Anti-Fungal:
Bamboo-charcoal retains the natural antibacterial and antifungal traits of natural bamboo. It is also a bacteriostatic material: it inhibits bacterial metabolism, and causes fewer allergic skin reaction than other fibers sterilized with antimicrobial agents.

Breathable and Dry:
Bamboo-charcoal yarn has a cross-section filled with various micro-gaps and micro-holes, hence compared to other conventional fabric; it has better moisture absorption and ventilation. Eco-fabric productscan absorb and disperse sweat fast, making them feel dry and comfortable. They also do not stick to skin on hot summer days.

Thermal regulation:
Due to the porous nature of bamboo charcoal, Eco-fabric products not only feel dry during hot days, but they are also excellent insulators against the cold.

Absorption and Emission of Far Infrared Energy:
Bamboo-charcoal nano particles can absorb far infrared energy from the environment, and emit it to help cell activation, promotes blood circulation and general health in the long run.

Wash Durability:
As the bamboo-charcoal nano particles are embedded in the fabric rather than simply coated on their surface, Eco-fabric is washable without diminished effectiveness of the charcoal powder's special qualities, even after 50 washes. The active ingredients will last for 2 years in packaging or 6 months with usage.

Environmental impact of bamboo:
People who are concerned about the environment know that one of the best advantages of bamboo is that it is environmentally friendly. Not only is cotton biodegradable, it is also a renewable resource. Many people who are concerned with the environment chose to get clothes that are made with organic bamboo. This is cotton that is grown without the use of pesticides. Being hypoallergenic and dust mite resistant is one of the great advantages of bamboo. This is why bamboo is the best choice for people with allergies or asthma. Hypoallergenic people who are prone to skin irritation love wearing bamboo in general.
Since bamboo is a natural fiber, many environmentally sensitive consumers believe it is a good choice. However, although bamboo is renewable resource, it cannot be produced without some environment impact. Mainstream farming methods make extensive use of agriculture chemicals to fertilize the soil, fight insects and diseases, control plant growth, and strip the leaves for harvest. Excess rain can create problems with run of contaminated with these chemicals, many of which or toxic to other plants, insects, animals, and people. Bamboo also uses large quantizes of water, energy and chemicals to clean the fiber and finish and dye the fabrics.

Knitting:
Knitting is a method by which yarn is manipulated to create a textile or fabric. Knitting creates multiple loops of yarn, called stitches, in a line or tube. Knitting has multiple active stitches on the needle at one time. Knitted fabric consists of a number of consecutive rows of interlocking loops. As each row progresses, a newly created loop is pulled through one or more loops from the prior row, placed on the gaining needle, and the loops from the prior row are then pulled off the other needle.

Properties of fabrics:
The topology of a knitted fabric is relatively complex. Unlike woven fabrics, where strands usually run straight horizontally and vertically, yarn that has been knitted follows a looped path along its row, as with the red strand in the diagram at left, in which the loops of one row have all been pulled through the loops of the row below it

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Color:

Plenty of finished knitting projects never use more than a single color of yarn, but there are many ways to work in multiple colors. Some yarns are dyed to be either variegated (changing color every few stitches in a random fashion) or self-striping (changing every few rows). More complicated techniques permit large fields of color (intarsia, for example), busy small-scale patterns of color (such as Fair Isle), or both

Tools

The process of knitting has three basic tasks:

- The active (unsecured) stitches must be held so they don't drop
- These stitches must be released sometime after they are secured

New bights of yarn must be passed through the fabric, usually through active stitches, thus securing them.

Commercial applications:

Industrially, metal wire is also knitted into a metal fabric for a wide range of uses including the filter material in cafeterias, catalytic converters for cars and many other uses. These fabrics are usually manufactured on circular knitting machines that would be recognised by conventional knitters as sock machines.

Holy basil:

Ocimum tenuiflorum (synonym Ocimum sanctum), commonly known as holy basil, tulasi (sometimes spelled thulasi) or tulsi, is an aromatic perennial plant in the family Lamiaceae. It is native to the Indian subcontinent and widespread as a cultivated plant throughout the Southeast Asian tropics.

III. METHODOLOGY

Flow chart

Selection of the fabric (100% bamboo)
↓
Selection of pretreatment using scouring and bleaching.
↓
Selection of herbs and oils (Mentha x piperita , Ocimum basilicum)
↓
Extraction (powder and oil)
↓
Selection of finish (by excito chamber)
↓
Evaluation of physical & functional testing

Selection of the fabric:

The fabric selected for finishing of herbs and oils are 100% bamboo knitted fabric. Generally, the bamboo fabric is ecofriendly and has anti-bacterial activity of its own, so this fabric is used for the further finishes using herb extract and oil

Pre-treatment:

Bio scouring:

The knitted fabric contains oils, fats, waxes, minerals, leafy matter and motes as impurities thatinterfere with finishing. Synthetic fibers contain producer spin finishes, coning oils and/or knitting oils, mill grease used to lubricate processing equipment, mill dirt, temporary fabric markings and the like maycontaminate fabrics as they are being produced.

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Recipe

- Alkali (NaOH) - 2 to 5 gm per litre.
- Soda ash - x gm per litre to adjust ph (ph required for scouring is 10.5).
- Wetting agent - 1 gm per litre.
- Sequestering agent - 1 gm per litre.
- Detergent - 1 to 2 gm per litre.
- Temperature - 100 to 1250c.
- Time - 6 hours (close vessel) and 8 hours (open vessel)
- M : l - 1 : 10

Bleaching:

Hydrogen peroxide is virtually the only bleaching agent available for protein fibers and it is also used very extensively for the cellulosic fibers. Hydrogen peroxide is a colorless liquid soluble in water in all proportions. It is reasonably stable when the ph is below 7, but tends to become unstable as the alkalinity increases. Commercial hydrogen peroxide, therefore, is made slightly acid so that it will not lose strength during storage. Solutions of hydrogen peroxide of more than 20 volumes cause intense irritation when they come into contact with skin and should be washed away immediately.

Recipe

- NaOH 17ml/kg
- Soap 2ml/kg
- H_2O_2 30ml/kg
- reaction time (25minutes)
- Speed 0-70m/minutes

IV. EQUIPMENT'S AND APPARATUS USED:

There are various types of apparatus which are needed for this study. Generally glass wares of specialized origin have been utilized based on the need. The commonly used apparatus are culture tubes, Petri plates, conical flask of various sizes, supporting beakers, measuring jar, pipettes and funnels for measuring and preserving. Inoculating needle loops desiccators cotton, sprit lamp, Bunsen burner, glass rod, glass tube, bloating filter paper, scissors and forceps etc.., are needed.

Collection of herb:

The selected sources were keenly and safely collected that is free from disease and contamination then washed with soft water to remove the dust particles. After rinsing thoroughly the leaves and petals were wiped well with a clean cloth. The collected sources were dried under shade. After drying, the grinding was carried out to break down the leaves into fine powder.

Mosquito repellence testing:

The mosquito repellency efficiency of the two different samples Mentha piperita & Holy Basil (herb & oil) finished in 100% bamboo knitted fabric was evaluated by modified excite chamber method. There have been numerous attempts to accurately measure the behavioral responses of mosquitoes to insecticides using various types of excito-repellency test systems. The test method adopted in the present study for testing the mosquito repellent property is modified excito chamber method.

Mosquito collection:

Anopheles mosquitoes were identified based on morphologic keys and they were collected during the evening hours. All mosquitoes were starved of blood and sugar of 4 hours before the tests.

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V. SUMMARY

Today consumers are becoming of much aware of the quality for which they are paying for. They want the textiles to be durable, functional, comfortable, easy to maintain and aesthetical. These expectations have led to major opportunities for the textile industry in general and textile finishes in particular. In today's environment conscious times there is a revival of interest in chemical free raw materials which is minimally handled and involves eco-friendly production stages.

In recent years considerable attention is being given to the development and utilization of the natural fibers. Researches and innovation has led to the development of innovative natural fibers and new natural fibers have been introduced each and every day.

Bamboo is the world's leading textile fiber and is still reigning in the apparel industry in spite of the developments in the synthetic and natural fibers. Bamboo is a natural, regenerated cellulose fiber and also it is a biodegradable textile material and is quickly emerging now in the fashion world. Bamboo textiles have many fantastic properties that in combination make this a truly amazing product.

VI. CONCLUSION

From the Research it could be concluded, that bamboo knitted possess all the desired properties that are required for apparel. The above fabrics are treated with mosquito repellent finish increases the awareness about the medicinal herbs and also effective utilization of the same. While comparing the all the above herbs and oils it is concluded that Peppermint oil has much more properties and excellent results than that of the other herbs and oil.

Thus knitted fabric from bamboo will face the demand of green consumers with welcoming hands. The search of innovative application of natural herbs and oils finish for textile and fashion industries can be fulfilled to achieve the best mosquito repellent fabrics.

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