Assessment of Environmental Friendly Ultra Violet Protection Finished Fabric by Herbal Extracts Using Microencapsulation Method

[1]A.Priyanka* &[2]Banupriya.J
[1]M.Phil scholar, Department of Costume Design & Fashion, PSG College of Arts & Science, Coimbatore.
[2]Supervisor and Assistant professor, Department of Costume Design & Fashion, PSG College of Arts & Science, Coimbatore.

Abstract: Technology need to support the sustainability of ecology but the use of non biodegradable chemicals and materials is adversely affecting the ecosystem. Textiles are an integral part of everyone's life. Due to global warming, nowadays the UV rays gets more harder. So that the present study focuses on the development of herbal UV resistance finishing for clothing. The medicinal plants part of (*Annona Reticulate, Hibiscus Rosa Sinensis and Rosa Damascene*) has been extracted. The application is done on 100% bamboo knitted fabric by Microencapsulation method. The finished fabric is assessed for the Ultra Violet Protection factor. And the analysis of Field Emission Scanning Electron Microscopic is done. Finally the selected herbs shown a good result on bamboo fabric.

IndexTerms: 100% Bamboo knitted fabric, Microencapsulation, Ultra Violet Protection, A*nnona Reticulate, Hibiscus Rosa Sinensisand Rosa Damascene* herbs.

I. Introduction

A rise in environment concerns and demands for environment friendly processing of textiles has led to the development of many new cleaner and greener technologies. Growing demands on the functionality of textiles as well as the environment friendliness of the finishing processes increase the interest in physical induced techniques for surface modification and coating of textiles. Nowadays textile industry is going through advancements of technology in every field. To ensure our security and safety from the future hazards, we need equal development in the technology for our protection. In developed countries, the textile industries reaches a new value into the medical and technical textiles for example has encouraged the industry to use micro encapsulation processes for the impart finish and property on textiles which were not possible or cost-effective using other technology. The other functional application includes dyes, insect repellent finish, antimicrobial, phase change materials and in specific medical applications, antibiotics, and some other advance finishes were used in the textile industries.

Bamboo has good durability, softness, lustre, stability, moderate tenacity, good spin ability. Bamboo products are additionally characterized by its good hydrophilic nature, brilliant permeability, soft feel, brilliant dyeing actions and its antimicrobial property(3). It is facts that Linen, Hemp based fabrics are coarser than bamboo fabric. Bamboo fiber has natural functions of Antibacteria, Ultra Violet Protective, breathable cool, strong flexible, soft and has a luxurious shiny appearance and deodorization character(6).

Microencapsulation is a process in which small capsules of many useful properties are made by using tiny particles or droplets surrounded by a coating. The material inside the microcapsule is called as the core material whereas the wall is called a shell, coating, or membrane. Usually, microcapsules have diameters between a few micrometers and a few millimeters. Science has come up with many technologies for the Eco processing of textiles, which includes, Enzymatic Finishing of textiles, Plasma Technology, Finishing by Natural products and Microencapsulation.

Recently, considerable attention has been paid to the textiles designed for protective clothing, including the protection against Ultra Violet radiation. This term of consideration is due to the increase of cancer and sunburns percent over the world due to the ozone depletion that caused an increase in the incident Ultra Violet rays. In daily life people inevitably come into contact with different kinds of bacteria, such as fungi and other microbes, which excessively invade the human body and cause serious danger to the human health. Meanwhile, there is increasing concern about Ultra Violet harm to living things and humans due to atmospheric ozone depletion. Therefore, it is particularly urgent to make effective antibacterial and Ultra Violet protecting textiles to decrease skin injury caused by bacterial invasion and Ultra Violet radiation[4].

II. Materials and methods

2.1 Selection of fabric

The 100 percent bamboo knitted fabric was selected for this study. Because bamboo finer has natural functions of Ultra Violet resistance and gives cool feel. The selected bamboo fabric were desized and bleached to remove impurities and natural coloring matters present in the fabric.

2.2 Selection of herbs (*Annona Reticulata*, *Hibiscus Rosa Sinensis* and *Rosa Damascena*)

Annona Reticulata

Plate- 1

Annona Reticulata is a small deciduous or semi-evergreen tree in the plant family Annonaceae. It is finest known for its fruit, called custard apple. In Indian folk medicine, various species of *Annona* have been used as vermifuges, anti-inflammatory agents, in wound healing, as antimalarial agents and in the treatment of diarrhoea and dysentery. The plant has also been used as anti-anxiety, anti-stress, anti-mutagenic and spasmolytic agent. Leaf and stem extract shows isotropic, positive chronotropic and spasmolytic activities[1]. The plant is traditionally used for the treatment of epilepsy, dysentery, cardiac

problem, worm infection, constipation, haemorrhage, antibacterial infection, dysuria, fever, and ulcer. It also has anti fertility, anti-tumour and abortifacient properties.

Hibiscus Rosa Sinensis

Plate- 2

Hibiscus Rosa Sinensis, recognized colloquially as Chinese hibiscus, China rose, Hawaiian hibiscus, rose mallow and shoe black plant, is a species of steamy hibiscus, a flowering plant in the Hibisceae tribe of the family Malvaceae, resident to East Asia. In medicine, the red flowered variety is preferred. The leaves and flowers are observed to be promoters of hair growth and aid in healing of ulcers. Flowers have been found to be effective in the treatment of arterial hypertension and to have significant anti-fertility effect. It is a sweet, astringent, cooling herb that checks bleeding, soothes irritated tissues and relaxes spasms. The leaves are anodyne, aperient, emollient and laxative[(5)]. It is careful to have a numeral of medical uses in Chinese herb logy. It can have a few possible in cosmetic skin care; for example, an extract from the flowers of *Hibiscus Rosa Sinensis* has been exposed to purpose as an anti-solar agent by absorbing ultraviolet radiation. It has been evaluated for an array of diseases like heart disorders, tumours, convulsion, diabetes, inflammation, oxidative stress, diarrhoea, ulcer.

Rosa Damascena

Plate- 3

Common name is Rosa and the Tamil name for *Rosa Damascena* is paneer rose. Family is Rosaceae and its scientific name is *Rosa Damascena.* Roses have always been popular plants, beloved for their long blooming period, fragrance and beauty, although these things vary depending on species and cultivar[(2)]. Roses are best called as ornamental plants grown for their flowers in the garden, landscape plants and sometimes indoors. It is also used for commercial perfumery and cut flower crops. They also have minor medicinal uses.

2.3 Collection and Processing of *Annona Reticulata, Hibiscus Rosa Sinensis* and *Rosa Damascena*

The selected herbs was collected all around Coimbatore. The collected flower and leaves were shade dried at room temperature to reduce the moisture content less than 14 percent with proper drying. Then grinding process is done for dried flowers and leaves. In that the flower and leaves is grind into very small units ranging from larger course fragments to fine powder. The fine powder obtained after grinding was used for extraction and the fine powered was stored under good condition to reduce the risk of the contamination.

2.4 Ethanolic Eextraction of collected *Annona Reticulata, Hibiscus Rosa Sinensis* and *Rosa Damascena*powder

Extraction was carried out by dissolving six grams of *Annona Reticulata, Hibiscus Rosa Sinensis* and *Rosa Damascena* powders in 100 ml of 80% ethanol, kept overnight under shaking condition in an air tight container without space. Then the extracts was filtered using Whatmann no.1 filter paper (0.4µm), filtrate was collected and evaporated at room temperature. The concentrated extracts was stored at 4 degree Celsius and used for further UV resistnce studies.

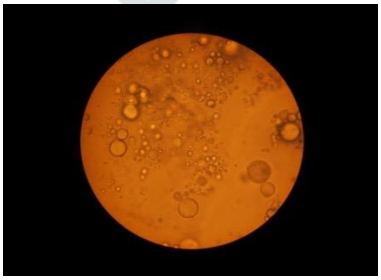
2.5 Microencapsulation of Herbal Nanoparticle Extract

2.5.1 Microencapsulation of *Annona Reticulata, Hibiscus Rosa Sinensis* and *RosaDamascena* and composite herbs by ionic gelation process:

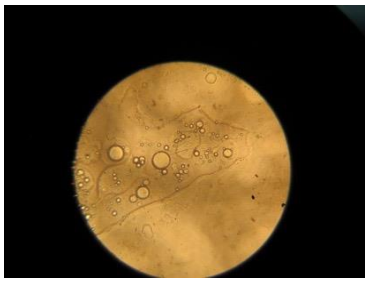
Microcapsules containing extracts of *Annona Reticulata, Hibiscus Rosa Sinensis* and *Rosa Damascena* of three herbs were prepared employing sodium alginate. Three percent sodium alginate was prepared and added two percent of nanoparticles. This was sprayed into 0.5M calcium chloride solution by means of a sprayer. The droplets were hang on to calcium chloride for 15 minutes. The microcapsules were obtained by separation and repeated washing with is propyl alcohol followed by drying at 45 °C for 12 hours. As shown in(Plate-4). Then the microcapsules were used for finishing on the selected fabrics.

Plate-4 Microencapsulated of herbal nanoparticles

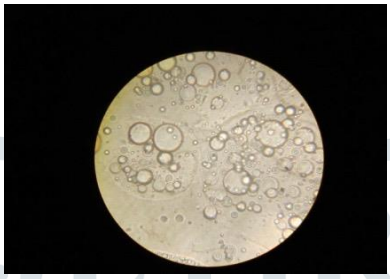
(a) Microencapsulated of *Annona Reticulata*



(b) Microencapsulated of*Hibiscus Rosa Sinensis*



(c) Microencapsulated of *Rosa Damascena*



2.6 Finishing by Exhaust Method

The fabric sample was finished with the prepared herbal nanoparticle microcapsules according to the following recipe with eight percent citric acid. One liter of solution containing 800 grams of capsules is used to finish one meter of fabric. The fabric was immersed in the solution with eight percent citric acid as a binder for 30 minutes under 50ºC in oven. After 30 minutes, the fabric was taken out from the dub and air dried in shade.

Recipe

Fabric	- 100% Bamboo knitted fabric (.25m)
Herbal powder (core)	- 30 grams
Material liquor ratio	-2:2
Sodium alginate (wall)	- 3%
Time	- 2 hours
Temperature	- 45 °C
Solvent	- Calcium chloride

2.7Analysis of Ultraviolet Protection Factor

The ultraviolet protection of a fabric is expressed by the Ultraviolet Protection Factor (UPF). The UPF evaluates the reduction in the amount of the UV radiation that passes through the fabric to the skin. For example, when a fabric has an UPF of 20, only $1/20^{th}$ of UV radiation reaches the skin. UV transmittance through the fabric samples was determined within a wave length range from of 280 to 400 nm using a Shimadzu UV/V is Spectrophotometer. The standard method used for determining the UPF was AATCC 183 – 1999 (Transmittance or Blocking of Erythemally weighted Ultraviolet Radiation through fabrics).

The ultraviolet protection of a fabric is expressed by the Ultraviolet Protection Factor, (UPF). The UPF evaluates the reduction in the amount of the UV radiation that passes through the fabric to the skin. For example, when a fabric has an UPF of 20, only 1/20th of UV radiation reaches the skin. The AATCC (183-1999) Transmittance or Blocking of Erythemally weighted Ultraviolet Radiation through fabrics using Shimadzu UV/V is Spectrophotometer in 100 to 400 nm wavelength. **2.7.1 Ultraviolet Protection Test**

Protection against ultra violet rays was accessed by Ultra Violet transmittance analyzer of shimadzu Ultra Violet-2600 Ultra Violet-vis spectrophotometer equipped with AS_NZS 4399 standard. The Ultra Violet protection factor (UPF) is the ratio of the average effective Ultra Violet Radiation (UVR) irradiance calculated for unprotected skin to the average effective irradiance calculated for skin protected by the test fabric.

2.7.2 UPF Measurement System

Appropriate precautions which were applied while carrying out the measurement should be sufficient to collect all the scattered and transmitted lights through an integrating sphere, to include all the erythemal active wavelength (UVA & UVB) spectral measurements without any influence of fluorescence from FWA, if it is present in the fabric. There are currently 12 sites in Australia and Antarctica installed with broadband Ultra Violet Radiation detectors to measure the total energy received over a range of wavelength in Ultra Violet Radiation region in both direct and diffuse radiation. Polysulphone films have been used in the construction of personal dosimeters, which absorb highly in the UV B region.

III. Results and discussion

3.1Analysis of Ultraviolet Protection Factor

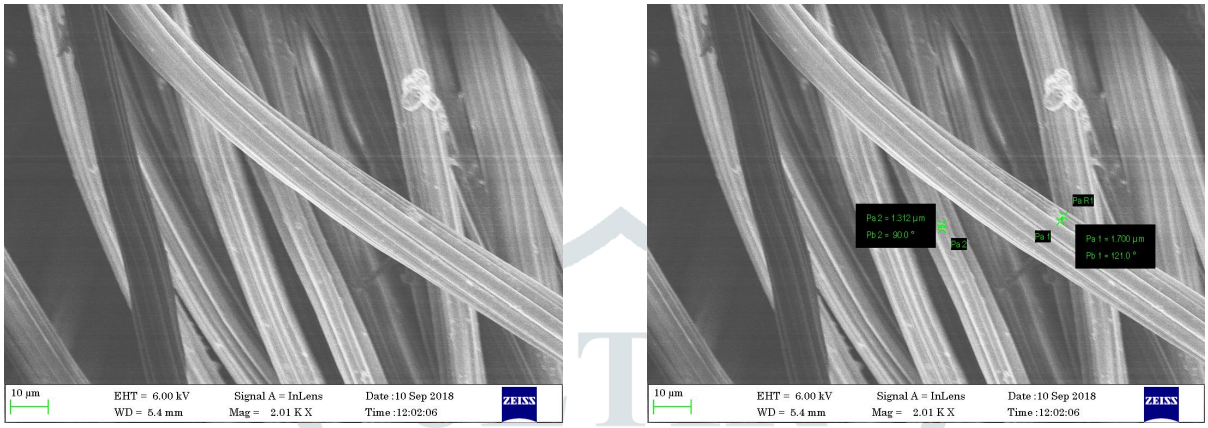
Table : 1 Ultra violet production factor analysis

S.No	Fabric Samples	UPF Range	%UV Radiation Blocked	Protection Category
1	*Annona Reticulata*	30	91.4	Very Good
2	*Hibiscus Rosa Sinensis*	26	75.4	Good
3	*Rosa Damascena*	28	86.2	Good

From the above Table-1: The following results are obtained for the evaluation of Ultra Violet Production of Microencapsulated herbal extract finished fabrics by exhaust method. It shows that the *Annona Reticulata* microencapsulated herbal extract finished fabric has a high value of 91.4 percent of blockedwhile comparing with*Hibiscus Rosa Sinensis* microencapsulated herbal extract finished fabric showed 75.4 percent whereas, *Rosa Damascena* showed 86.2 percent. In the protection category the *Annona Reticulata* of microencapsulated extract finished fabric has gained very good category while comparing to the other two finished samples.

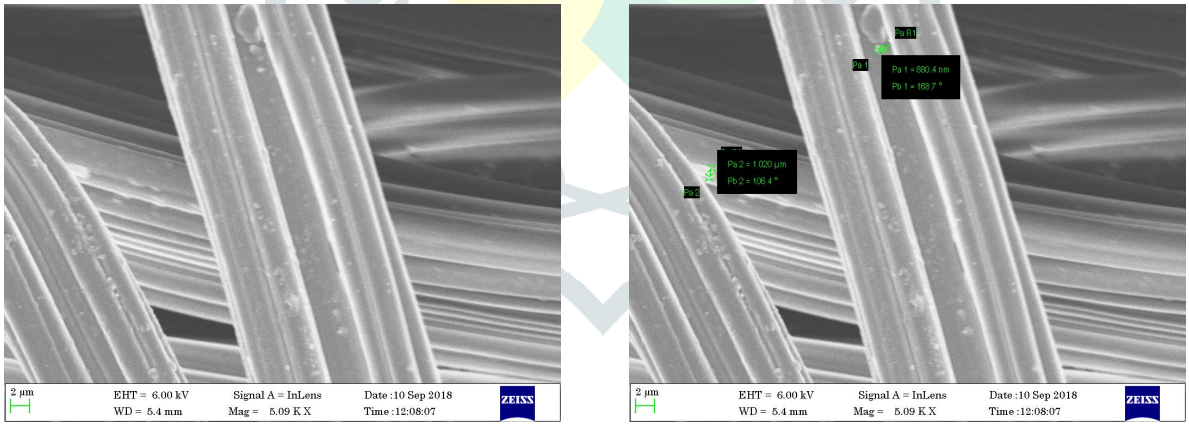
3.2 Analysis of Field Emission Scanning Electron Microscopic (FESEM) of Microencapsulated Fabrics

The surface topography of the Microencapsulated herbal extract finished fabric were observed using Field EmissionScanning Electron Microscopic.



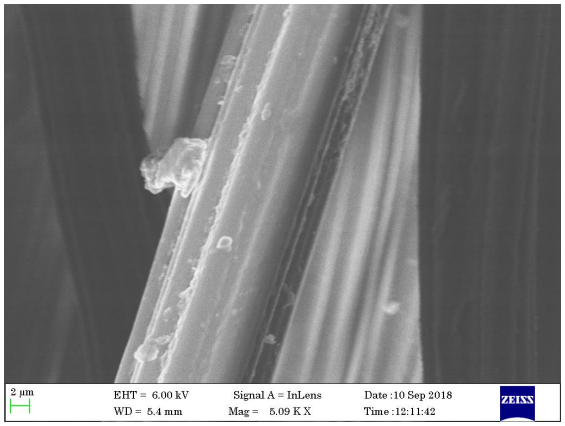
Analysis of FESEM imagining of Microencapsulated fabric (*Annona Reticulata*)

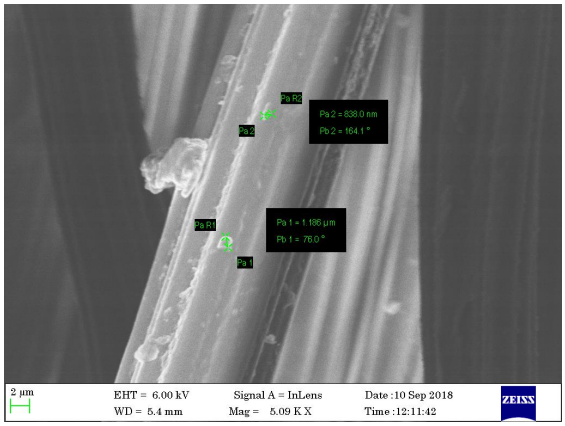
The above image shows the Field Emission Scanning Electron Microscopic image of Microencapsulated fabric of *Annona Reticulata*. The magnification is done at 2.01KX. And the micro particles sizes are measured.



Analysis of FESEM imagining of Microencapsulated fabric (*Hibiscus Rosa Sinensis*)

The above image shows the Field Emission Scanning Electron Microscopic image of Microencapsulated fabric of *Hibiscus Rosa Sinensis.* The magnification is done at 5.09KX. And the micro particles sizes are measured.





Analysis of FESEM imagining of Microencapsulated fabric (*Rosa Damascena*)

The above image shows the Field Emission Scanning Electron Microscopic image of Microencapsulated fabric of *Rosa Damascena*. The magnification is done at 5.09KX. And the micro particles sizes are measured.

IV. Conclusion

The selected herbs showed excellent characteristics in Ultra Violet protection activity. Particularly finished with 100% bamboo fabric shows a good result. Due to ultraviolet ray many skin problems are raises, even it led to human skin cancers. Protecting human skin against harmful Ultra Violet radiation is an acute problem nowadays. Therefore, an adequate level of the sun protection is necessary for the protection of human skin. By using this study the human skin problem caused by Ultra Violet ray can be Protected. The finished fabric samples can be construed as hand gloves, T-shirts, etc.

V. Reference

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