STUDY OF ULTRAVIOLET PROTECTION PROPERTIES OF WOVEN FABRIC OF DIFFERENT WEAVES

BY

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UNDER THE GUIDANCE OF

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DKTE

Promoting Excellence in Teaching Learning & Research

D.K.T.E. SOCIETY'S

TEXTILE AND ENGINEERING INSTITUTE,ICHALKARANJI

(AN AUTONOMOUS INSTITUTE)

2019 – 2020

CHAPTER 1

INTRODUCTION

1.1 GENERAL

One of the factors adversely affecting the human organism is ultraviolet radiation (UV radiation). Ultraviolet radiation, sometimes also called ultraviolet light, is invisible electromagnetic radiation of the same nature as visible light, but having shorter wavelengths and higher energies. The wavelength ranges and common names of the UV radiation bands are UV-C: 100 - 280 nm, UV-B: 280 - 315 nm and UV-A: 315 - 400 nm. Two types of UV radiation can be distinguished: natural - which is a component of solar radiation and artificial - generated by electric devices - mainly different kinds of lamps. Of natural radiation, only UVA and about10% of the UVB rays reach the Earth's surface. UVC rays are totally absorbed by the atmospheric ozone. Artificial sources of UV radiation are used in many different ways in the working environment. The wavelength ranges of artificial sources of UV radiation can be from 100to 400 nm. In some cases, workers are exposed to some radiation, normally by reflection or scattering from adjacent surfaces. Typical industry processes where high intensity UV radiation is used are curing processes based on photo –initiators such as curing adhesives, overprints functionalizing textiles, sterilization and disinfection, welding, etc. When the human body, especially skin and eyes are exposed to UV radiation dangerous path -physiological processes can be observed. They may lead to many dangerous illnesses, which can be divided into five basic groups [1, 2]: genetic and metabolic, photo -allergic, cancers, degenerative illnesses intensified under the influence of UV radiation and phototoxic and photo immunological diseases. Thus it is necessary to protect the human body against UV radiation in order to prevent these adverse effects. These are primarily suitable protective creams containing UV filters, goggles with UV filters, and clothing protecting body parts especially exposed to the sun. In the case of flat textiles, UV radiation permeability depends on the structure of fabric and the material of fibers. As far as the structure of fabric is concerned, the following elements are important in the permeability of UV radiation: construction parameters of the product and porosity (e.g. weave, stitch, cover factor, density of threads, linear Density of yarns). When it comes to the material of fiber important are: physicochemical structure of the fiber, color, finishing methods, surface modifications using various chemical compounds and others. The first group of factors influences mainly the transmitted radiation, whereas the second group of factors impacts the absorbed radiation. Modern scientific research concentrated on constructing flat textiles with high UV barrier properties brings new solutions in the area of these elements. A broad analysis of various factors affecting the UV barrier properties of textile materials together with an advanced literature study was presented by Saravanan. It was found out that color has the greatest impact on the attenuation of UV radiation. The type of weave and fabric cover significantly affects the attenuation of UV radiation in the case of fabrics of bright pastel colors. It was assumed that UV radiation is transmitted only through the fabric clearances and is completely suppressed by the material of the fabric threads. Additionally in the spaces between threads UV radiation is not reflected and absorbed. A large dependence was observed between thevisible light penetration and the weave of the fabric, as well as in the angle between the beam and fabric surface. Interesting

solutions increasing the UV barrier properties of textiles are connected with modifications of the textile surface. These achievements are largely related to the deposition of ZnO, TiO2 and ZrO nanoparticles on the surface of textiles. It was found that by surface embedding ZnO nanoparticles, it is possible to obtain UPF values from 30 to 50. Before treatment, UPF values for the fabric were from 8 to 15. The deposition of TiO2 nanoparticles makes it possible to obtain UPF values of 50+. The deposition technology used in the tests is characterized by very good adhesion of nanoparticles to the textile surface, which allows obtaining good washing resistance.

Prolong and frequent exposure of human being against sun causes different dermatological problems. The short-term exposure to ultraviolet radiation (UVR) causes sunburn and in medical science it is erythema. Prolong sunburn leads to photo ageing of skin and results in terms of both non-melanoma and melanoma skin cancer. Divinely, nature has stratospheric ozone layer in atmosphere to absorb UVB and UVC and to block it to reach on earth surface The intensity of UVR is the highest in Australia and some part of eastern and southern Europe ,so protection of adolescentsand children (skin thickness is very less) than adults and outdoor workers is very essential.

In professional journals, daily papers and internet sides a lot of different subscriptions can be noticed, where dermatologists, meteorologist, biologist and other professionals warn us about UV radiation, ozone depletion and give us some recommendations for effective protection. The problem ofUV radiation is interdisciplinary – it is also the subject of textile scientists. Behavior outdoorscan significantly affect exposure to solar UVR and use of items of personal protection can provide a substantial reduction in the UVR dose received. Clothing made from woven fabric scan provide convenient personal protection however not all fabrics offer sufficient UV protection.

This study is aimed at studying the UV protection property of woven fabrics from a fundamental level by considering how the modification of woven fabrics can improve the UV protective Ability of fabrics, instead of using a chemical approach as a secondary level. Fabric construction is deemed to present the simplest and cheapest solution to achieve good UV protection without additional finishing processes. From the literature review, fabric construction has been proposed as one of the most important variables affecting UVR transmission, especially when light pastel color fabrics were used as UV protective clothing.

1.2 OBJECTIVE:

1. To develop the woven fabric with different weaves and pick density.
2. To study UPF (Ultra Violet Protection Factor) of the fabric in order to produce UV Radiation Safety Fabric.

1.3 SCOPE:

Due to alarming issue of skin cancers and different diseases due to UV rays fabric having better ultraviolet protection factor is needed. Effect of different fabric structures and pick density influencing the UPF value of fabric are studied as to produce UV rays protective fabric which can help people in preventing many harmful skin diseases. The study will help to produce a better Woven fabric of higher UV protection

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Clothing has the ability to protect the skin from incident solar radiation because the fabric from which it is made can reflect, absorb and scatter solar wavelengths. Each fabric must be tested to determine its ability to protect from solar radiation, as this cannot be known from visual observation nor calculated from descriptions of the fabric's composition and structure. To determine this so called Ultraviolet Protection Factor (UPF), special test standards and methods are required as offered by different associations.

Formation of a fabric with lower UPF value, by studying the effect of different fabric geometries and other parameters on UPF value, and thus providing with a better solution to UV protection fabrics to reduce the risk of skin diseases caused because of it.

2.2 Literature Review

D. Saravanan [1] studied that ultraviolet rays constitute a very low fraction in the solar spectrum but influence all living organisms and their metabolisms. These radiations can cause a range of effects from simple tanning to highly malignant skin cancers, if unprotected. Sunscreen lotions, clothing and shade structures provide protection from the deleterious effects of ultraviolet raditions'. Alterations in the construction parameters of fabrics with appropriate light absorbers and suitable finishing methods can be employed as UV protection fabrics.

Zbigniew Stempień [2] Has studied about production processes artificial UV sources are frequently used, which can generate UV radiation within the range from 200 nm to 400 nm. The intensity of UV radiation generated by artificial sources and affecting the body may be hundreds of times larger than natural solar UV radiation. Exposure of the human body to this type of radiation leads to dangerous patho-physiological changes. Typical protective clothing against UV radiation is made of woven fabric where different sizes of clearances make it possible to transmit high intensive UV radiation directly on the human body. In order to analyse UV radiation intensity transmitted by different structures of woven fabric, a stepper motor driven scanner with aUV sensor based on a photodiode was constructed. The scanning resolution was about 0.1mm × 0.1 mm. As an artificial UV source, a high pressure mercury lamp emitting UV radiation within the range from 210 nm to 400 nm was chosen. Among the woven fabrics tested, which were woven using the same yarn type and weft & warp densities, the most effective UV barriers are plain weave fabrics. A slightly lower value of the coefficient is observed for twill weave fabrics. For satin weave fabrics the attenuation coefficient is the lowest. Distribution images of UV radiation intensity transmitted by the woven fabric samples show irregular areas of different sizes, significantly exceeding the size of individual clearances, which was due to the photosensitive element of the photodiode moving away by 2 - 3 mm from the reverse side of the woven fabric, with the phenomena of UV radiation dispersion passing by the woven fabric clearances.

Biswa Ranjan Das [3] studied about incidence of skin cancer has been rising worldwide due to excessive exposure to sunlight. Elevated exposure to ultraviolet radiation component of sunlight results in skin damages; such as sunburn, premature skin ageing, allergies and skin cancer. Medical experts suggest several means of protection of human skin against ultraviolet radiation; use of sunscreens, avoidance of the sun at its highest intensities, wearing clothing that covers as much of the skin surface. However, this paper gives an insight about how textile clothing can be efficiently utilized for protecting human skin from the harmful ultraviolet radiations. The various influential clothing parameters, offering resistance to penetration of ultraviolet radiation through the fabrics are briefly summarized. The determinant factors of ultraviolet radiation are elaborated.

Mukesh Kumar Singhand Annika Singh[4] Has studied on the increasing emission of greenhouse gases has evoked the human being to save the ozone layer and minimize the risk of ultraviolet radiation (UVR). Various fabric structures have been explored to achieve desired ultraviolet protection factor(UPF) in various situations. In this study, the effect of various filament configurations like twisted, flat, intermingled, and textured in multifilament yarns on fabric in different combinations is assessed in order to engineer a fabric of better ultravioletprotection factor (UPF).In order to engineer a fabric having optimum UV protection with sufficient comfort level in multifilament woven fabrics, four different yarn configurations, intermingled, textured, twisted, and flat, were used to develop twelve different fabric samples. The most UV absorbing and most demanding fiber polyethylene terephthalate (PET) was considered indifferent filament configuration. The combinations of intermingled warp with flat, intermingled, and textured weft provided excellent UVR protection comparatively at about 22.5mg/cm2 fabric areal density. The presence of twisted yarn reduced the UV protection due to enhanced openness in fabric structure. The appropriate combination of warp and weft threads of Different configuration should be selected judiciously in order to extract maximum UV protection and wear comfort attributes in multifilament woven PET fabrics.

Dakuri Arjun[5] has studied skin cancer has been increasing worldwide due to higher exposure to sunlight. Ultraviolet rays influence all living organisms and their metabolisms. Higher exposure to ultraviolet radiation component of sunlight results in skin damages such as sunburn, premature skin ageing and skin cancer. Modification in the construction parameters of fabrics with appropriate light absorbers and suitable finishing methods can be used as UV protection fabrics. This paper gives an insight about efficient textile clothing can be used for protecting human skin from the harmful ultraviolet radiations. The various influential clothing parameters offering resistance to penetration of ultraviolet radiations through the fabric.

Mohammad Ghane, Ehsan Ghorbani [6] together studied the destructive effects of sun UV radiation on human skins are now very clear to everyone. Most of the present studies were focused on the fabrics' structural parameters such as density, warp and weft yarns finenesses, fabricpattern and printing or finishing treatments applied to the fabrics. The aim of this work is achieving a technique through which the produced fabrics possess a higher UV-protection ability. For this purpose, two different metals includingaluminium and copper yarns were employed in fabrics production process and their effects on UV-protection abilityof the produced fabrics were investigated. Six different fabric samples comprised of either cotton/polyester, nylon yarns as the warp yarns as well as either aluminium or copper yarns as the weft yarns were produced. Using the spectrophotometer technique, which is known as one of the UPF measuring method, the absorbency and reflectivity of fabrics within the specified range of electromagnetic waves (specially the UV radiation) were determined. The results illustrated that the higher UV absorbency was related to the fabric possessing the copper yarns in their structures. It was concluded that the absorption ability of nylon fabrics is higher than that of the cotton/polyester samples.

Cheryl A. Wilson[7] studied about UV protection programmes promote the message to cover up and minimise exposure of skin surfaces to the sun. However, from a consumer's perspective what information isavailable to support selection of garments that will optimize protection? UPF rating provides information about fabrics that have achieved high ratings for protection, and by implication, indicates that garments made from these fabrics will minimize exposure. However, most clothing and textile products are not tested and do not carry UPF ratings. Credited with the highest rates of skin cancer in the world New Zealanders and Australians are increasingly aware of the health risks associated with overexposure toUV radiation. The need to slip, slop, slap and wrap has been extensively promoted, along with the importance of utilising shade and personal shade (including clothing)during high UV index times of day and year

Omer Kamal and Tao Zhao[8] has studied that In recent years, there is a progressive increase in UV radiation on human skin caused by the depletion of the ozone in the earth’s atmosphere. As long-term exposure to UV light can result in a series of negative health effects such as acceleration of skin aging, photodermatosis (acne), erythema (skin reddening), and even skin cancer. Developing textiles with UV protection functionality has been widely researched up to now. This review summarized the interaction between UV radiation and cotton surfaces and presents recent researches focused on the topic. The review also reported the relation between ultraviolet light and the structural, physical, and chemical properties of textiles. Moreover, conventional and novel chemicals and techniques of UV protection for cotton fabric such as UV absorbers, nanoparticles, and layer-by-layer self assembly (LbL) have been discussed.

Polona Dobnik Dubrovski[9] studied about the increasing awareness of negative effects of ultraviolet radiation and regular, effective protection are actual themes in general public in many countries. In professional journals, daily papers and internet sides a lot of different subscriptions can be noticed, where dermatologists, meteorologist, biologist and other professionals warn us about UV radiation, ozone depletion and give us some recommendations for effective protection. The problem of UV radiation is interdisciplinary – it is also the subject of textile scientists. Behaviour outdoor scan significantly affect exposure to solar UVR and use of items of personal protection can provide a substantial reduction in the UVR dose received. Clothing made from woven fabrics can provide convenient personal protection however not all fabrics offer sufficient UV protection. This chapter gives the short overview of the role of UV radiation on human health, protection against UV radiation with the emphasis on woven fabric construction and other factors influencing the UV protection properties of woven fabrics.

PIYALI HATUA [10] Has studied on ultraviolet rays (UVR) are human carcinogen. Over-exposure to UVR from solar or artificial origin has a potential risk to human health. Hence adequate level of skin protection from UVR is essential. Use of clothing is the most simple and convenient way of UV protection. UV protective properties of fabrics and clothing are evaluated by their ultraviolet protection factor (UPF).The UV protection characteristics of almost all known apparel fibres such as cotton, silk, polyester etc. had been explored by various researchers. Recently, regenerated bamboo viscose fibre has emerged as a promising material for the apparel use. From the results reported in literatures, conflicting views regarding the better UV protection property of bamboo viscose with respect to that of natural cotton have emerged. A systematic investigation on the in vitro UV protection property of bamboo viscose fibre with respect to that of natural cotton was carried out to clarify this conflict. Fabric samples were produced from cotton and bamboo viscose yarns and their UPF were tested. The UPF of both cotton and bamboo viscose fabrics was predicted by empirical models using fabric cover % and areal density as input variables. A comparative analysis of UPF was carried out between cotton and bamboo viscose fabrics using curve fitting technique. The analysis showed that the apparently higher UPF of bamboo viscose fabric scan be attributed to their higher areal density and cover resulting from higher shrinkage though the fabrics were woven using same yarn count and thread density. The areal density based UPF predictive model developed for cotton performed equally well for bamboo viscose fabrics bolstering the fact that there is no distinguishable differences in the UV protection property of these two fibres. The fabrics woven from cotton and bamboo viscose yarns having similar cover % and areal density showed similar UPF and UV transmittance behaviour.

S Vihodceva,S Kukle [11]Has studied about pure cotton textile was successfully modified by zinc oxide nano-sol prepared by the sol-gel method. The cotton fabric was dipped in the nano-sol solution for 10minutes, dried at 90 °C for 10 minutes with further thermal post-treatment at 120 °C, 140 °C or160 °C for 2 minutes. Comparison of coating of samples prepared using different thermal posttreatmentswas made. Before and after laundering tests ultraviolet protective properties of thetextile samples were determined according to the standards, results show that textiles after treatment with nanosol have excellent ultraviolet protection properties, as well treated samples
after laundering tests (50 washing-drying cycles) still provide excellent ultraviolet protection.Analyses based on the scanning electron microscopy and spectrophotometer measurements show that obtained textile coatings are distributed evenly, not only on the surface of yarns but in the depth of textile material as well, and are resistant to exploitation process that indicates about very good adhesion between the coating and the fabric surface.

RAJNI YADAV, ANJALI KAROLIA [12] Has studied about ozone layer functions as a protective screen against the detrimental effects of sun's hazardous UV radiations. It filters out the uv radiation coming out of the sun and prevents the human being from severe skin disease. But due to air monoxide and hydrocarbons, etc ,present in the environment, a deep imbalance is created in the ecosystem a deep imbalance is created in the eco-environment system. clothing has the ability to protect the skin the skin from incident solar radiation because the fabric from which it is made can reflect, absorb and scatter solar wavelengths so that itb does not penetrate the textile materials. The skin does not therefore come into contact with the radiation. This is however a borderline case. Fabrics differ in their ability to attenuate light in this way because they differ in fibre composition and moisture content as wll as in type and concentration of dye, optical whiteners or UV absorbing finishes adsorbed to fibres.

DEBMALYA BANERJEE [13] studied on ultraviolet protection factor (UPF) for single jersey 1x1 rib knitted fabrics has been investigated. the influenceof yarn fineness, loop length, carriage speed and yarn input tension as well as their interactions are studied. The effect of unavoidable and uncontrolled random variables on UPF has also been investigated for both the types of the knitted fabrics. Orthogonal block box and behken design of experiment is used only to study the effect of the uncontrolled random variables as well as controlled variables like yarn fineness, carriage speed, yarn input tension, loop length, and their interactions. The results show thst the uncontrolled random variables, during preparation of samples do not have significant effect on the resultant UPF.

HOFFMANN.K, GAMBICHLER.T[14] has studied ultraviolet (UV) radiation is the carcinogenic factor in sunlight. Damage to skin cells from repeated UV exposure can lead to the development of skin cancer. Apart from avoidance of the sun, the most frequently used form of UV protection has been the application of sunscreens. The use of textiles as a means of sun protection has been underrated in previous educational campaigns, even though suitable clothing offers usually simple and effective broadband protection against the sun. Apart from skin cancer formation, exacerbation of photosensitive disorders and premature skin aging could be prevented by suitable UV-protective clothing. Nevertheless, several studies have recently shown that, contrary to popular opinion, some textiles provide only limited UV protection. It has been found that one-third of commercial summer clothing items provide a

UV protection factor (UPF) less than 15. Given the increasing interest in sun protection, recreationally and occupationally, test methods and a rating scheme for clothing were needed that would ensure sufficient UV protection. Various textile parameters have an influence on the UPF of a finished garment. Important parameters are the fabric porosity, type, color, weight and thickness. The application of UV absorbers into the yarns significantly improves the UPF of a garment. Under the conditions of wear and use several factors can alter the UV-protective properties of a textile, e.g., stretch, wetness and laundering. The use of UV-blocking cloths can provide excellent protection against the hazards of sunlight; this is especially true for garments manufactured as UV-protective clothing. However, further educational efforts are necessary to change people's sun behavior and raise awareness for the use of adequate sun-protective clothing.

ANA MARIJA GRANCARIC, ANITA TARBUK [15] has studied due the depletion of the ozone layer, shorter but high energy UV-B rays and longer energy UV-A rays causing known skin aging and recently the formation of skin malignant neoplasm are reaching the surface of earth. The paper deals with the influence of different fabric construction on ultraviolet skin protection expressed as the ultraviolet protection factor (UPF). It is well known that clothing provides some protection against damage by ultraviolet radiation, but it highly depends on fabric construction, especially for longer exposure to sun light. Fabric openness or porosity is a key parameter influencing ultraviolet (UV-R) transmission. The effect of fabric density and cover factor using twelve woven fabrics from the same cotton fibers and yarn count, but different in type of weaving and fabric density were investigated. UPF and UV-A and UV-B transmission were measured using a transmission spectrophotometer Gary 50 Solar screen (Varian) according to the AATCC Test Method 183-2000.
ANA KOCIC, MANTEJKA BIZJAK, DUSAN POPOVIC [16] studied in the last decades the media have highlighted the ozone depletion as major environmental problem resulting in an increase in ultraviolet radiation (UVR)

reaching the earth's surface. Besides the beneficial effects of human exposure to UVR, this radiation is capable of causing damage to human population. The healthy lifestyle is becoming widely accepted by the public, and the UV protection provided by clothing becomes the significant subject of interest of the producers and consumers of textile fabrics. Natural cellulose fibres are commonly used in summer clothing due to their excellent comfort properties. However, these fibres have very poor UV protection ability. In this project, the UV protection property of textile fabrics made of natural and regenerated cellulose fibers have been compared and analyzed in order to highlight the potential of hemp fiber for the development of more sustainable and healthy functionalized (UV protective) textile products. A group of homogeneous and blended cellulose textile fabrics were manufactured in a knitwear factory, evaluated in terms of the structure, and spectrophotometrically assessed to indicate their UV protection ability. Relatively high values of the Ultraviolet Protection Factor (UPF) of the cellulose materials resulted from the interaction of fiber type, yarn geometry, fabric properties and common processing techniques. The increased UVR transparency of the pure hemp fabric, which resulted from hemp elasticity limitations, overcame by blending with other softer and more elastic cellulose fibres (cotton, viscose). The engineering approach proposed in this study was confirmed as an effective way to create more sustainable (more sustainable resource, pollution prevention, energy and cost savings) textile products with high level of UV protection at the knitting production stage avoiding the use of any additional mechanical and chemical treatments. These results revealed that the future application of hemp fibres in textile products with high added-value are promising. A coordinated effort of different subjects of the agro- and textile-industry production chain need to continue so as to overcome the limitations associated with hemp production and fibres properties.

SANDRA DAVIS, NANCY KERR [17] Has studied about increasing levels of solar ultraviolet radiation (UVR) in the earths near environment and evidence that exposure to UVR contributes to skin cancer, cataracts, and photo aging, protection of the skin is imperative during exposure to the sun. The purpose of this study was to examine the effectiveness of various fabrics in screening UVR and to determine if specific characteristics of fabric are directly related to the amount of protection provided. Methods Transmission of UVR was measured using spectrophotometric techniques. This transmission, as a function of wavelength over the range 250–400 nm, was weighted with solar and biological spectral data to determine a “sun protection factor” (SPF) for each fabric. Results The transmission of UVR through fabric depends on the wavelength and varies with factors such as type of fiber, fabric mass, cover, and color. Conclusions of 28 white fabrics tested, 19 offered less protection than a sunscreen with SPF 15, Polyester fabrics offered increased protection over cotton. The presence of dyes increased protection considerably.

JALANTA BATOG, MALGORZATA ZIMNIEWSKA [18] Has studied about ultraviolet radiation, which is harmful for human health, sets requirements for textiles to ensure sufficient protection in sunny conditions. This chapter discusses the key aspects of ultraviolet barrier properties of textiles. Natural fibres, thanks to their chemical composition, have the ability to absorb ultraviolet rays. The chapter describes methods of additional improvements of the ultraviolet properties of textiles made of natural fibres, such as changes in the textile structure, use of ultraviolet ray absorbers, dyes (including natural dyestuffs) and Nano lignin.

A.K SARKAR [19] Has studied on ultraviolet (UV) radiation band consists of three regions: UVA (320 to 400 nm), UVB (290 to 320 nm), and UVC (200 to 290 nm). UVC is totally absorbed by the atmosphere and does not reach the earth. UVA causes little visible reaction on the skin but has been shown to decrease the immunological response of skin cells. UVB is most responsible for the development of skin cancers. The most common types of skin cancer are squamous cell and basal cell carcinoma, both of which can be cured either by excision or topical treatments. Quantitative tests to assess the ability of a textile to protect against ultraviolet radiation can be performed either through laboratory testing in vivo or instrumental measurement in vitro. Accordingly, two terms are used; Sun Protection Factor (SPF) for in vivo testing and Ultraviolet Protection Factor (UPF) for instrumental evaluation in vitro.

COLIN ROY, PETER GIES, SIMON TOOMEY [20] Has studied about protection against solar ultraviolet radiation (UVR) among the general public in Australia has been increasing steadily as a result of the `SunSmart' campaigns run by the various state cancer councils. This increasing awareness is due in part to the requirements for occupational protection of outdoor workers and to provision of UVR protection for the recreational market. Behaviour outdoors can significantly affect exposure to solar UVR and use of items of personal protection can provide a substantial reduction in the UVR dose received. The protective properties of sunscreens, sunglasses, hats and clothing against UVR have been the subject of considerable research for some time, and over the last few years' interest has extended to the provision of shade structures and the UVR protection provided by various commonly used materials. These materials include shadecloth, plastics, glass, windscreens and applicable tints. Work on the various standards is continuing. The maximum allowed `sun protection factor' (SPF) limit for sunscreens may be increased to SPF 30+ in the near future, and additions to the sun protective textiles standard are also planned. This paper discusses measurement methods, results, the rationale used in formulating the Australian Standards and the current state of UVR protection in Australia.

Research gap identified through Literature review

From the above literature review, it has been found that there are many ways of UV protection but none of them shown 100% effectiveness with respected to desired application. The UV protective fabrics were studied with respect to different factors such as types of fabrics likes woven, non-woven, knitted,etc. In woven specially things that matter are physio-chemical structure of the yarn, yarn type, ends density ,pick density, yarn count, type of weave, cover factor, gsm of the fabric , dyes , colours uses as well special finishes used all these things go in hand to hand.

Now-a-days UV protection is a alarming case because of depletion of ozone layer effects of it are seen in the Australia and New Zealand and also in some parts of europe many methods were established like sunscreen , lotions ,googles ,eye. But the most effective can only be the clothing which wears for the 24 hours. After producing the fabric its UPF value is checked to get proper knowledge of the work done. UPF value should be above 50 for best UV protective fabric. There are ways to measure the UPF values such as spectrometer technique or using of UV200- F machine these machines requires 0.2 mtr of fabric.

Seeing alarming condition UV protective fabric has become a need of the society as there are serious diseases caused by the UV radiation

CHAPTER 3
PLAN OF WORK

3.1 Introduction:

After carrying out the literature survey, the line of action for our experimental work is prepared and is as given below.

Procurement of the yarn

↓

Yarn testing

↓

Yarn Sizing

↓

Fabric weaving

↓

Chemical processing of Fabric

↓

Finished Fabric testing

↓

Results & Discussions

↓

Conclusion

3.2 Materials:

To analyze the effect of the basic structure on UV protection, woven fabric is chosen ; as there are no studies evaluating the particular for better UV protection.

In order to carry out the given experimental study the raw material will be procured in the form of 40^s yarn from the spinning mill.

Other things to be varied for making woven fabric are yarn count, pick density, weave, dyes and color used.

3.3 Machines

Machines to be used for making of required fabric are Sample weaving

Machines

1. Sample Loom

    Model :SL 8900

    Width : 500MM

    Weft colours :6

    Shedding : Pneumatic,20 frames

2. Sample Warper

    Model : SW550

    Width : 550 MM

    Warping Length : 3M

3. Sample Sizing

    Model: SS560

    Speed : 43 to 110 MPM

3.4 Methodology

Different woven fabrics will be produced for the study of their UV protection properties.

PICK DENSITY	WEAVE				
	PLAIN	TWILL	I-BIRD	BROKEN TWILL(W)	
LOW	A_1	B_1	C_1		
MEDIUM	A_2	B_2	C_2		
HIGH	A_3	B_3	C_3		

3.5 Testing:

The fabrics produced under the study will be tested for the following properties:-

1. UPF (ultraviolet protection factor)
2. Tensile properties
3. Comfort properties
4. Aesthetic properties

UV Transmittance Analyzer is used to determine UV resistance of untreated and treated samples.

Description:

The UV 2000-F rapidly measures the diffuse transmittance of textile samples in the ultraviolet wavelength region from 250-450 nm and achieves accurate UPF, critical wavelength and UVA:UVB ratio of samples.

Specifications required for test:

Amount of material required: 0.20 square meter

Duration of testing: Immediate

Standard:

The standard used for testing is AATCC 183:2010 –Transmittance or Blocking of ErythemallyWeighted. Ultraviolet Radiation through fabrics.

3.5 STATISTICAL ANALYSIS

The data obtained from the from the above experimental study will be analyzed by using statistical tool which is nothing but the Two Way ANOVA.

REFERNCES

1. D. Saravanan, “*UV protection textile materials*,” Autex Research Journal, vol. 7, no. 1, pp. 53–62, 2007.

2. M. K. Singh, “*Sun protective clothing*,” Asian Textile Journal, vol. 14, no. 1-2, pp. 91–97, 2005.

3. C. A.Wilson and A. V. Parisi, “*Protection from solar erythemal ultraviolet radiation—simulated wear and laboratory testing*, Textile Research Journal, vol. 76, no. 3, pp. 216–225, 2006.

4. Omer Kamal Alebeid & Tao Zhao “*The Journal of The Textile Institute, 2017*”VOL . 108, NO . 12, 2027–2039

5. Polona Dobnik Dubrovski “*Woven Fabrics and Ultraviolet Protection*” Woven Fabric Engineering 272-298

6. Bajaj P., Kothari V.K., Ghosh S.B.,” *Some Innovations in UV Protective Clothing*”, Indian J. ofFibres and Textile Research 35 (4) 2000 315 – 329

7. Gupta K.K., Tripathi V.S., Ram H., Raj H., “*Sun Protective Coatings*”, Colourage 2002 (6) 35 –40.

8. Zbigniew Stempień, Justyna Dominiak, Magdalena Sulerzycka-Bil “Protection Properties of Woven Fabrics AgainstHigh-Intensity UV Radiation Emitted by Artificial Sources” FIBRES & TEXTILES in Eastern Europe 2013, Vol. 21, No. 2(98)

9. T.A. Perenich, “*Textiles as preventive measures for skin cancer*”,Colorage, vol. 45, pp. 71-73, Annual 1998.

10. S Vihodceva and S Kukle “*Improvement of UV Protection Properties of the Textile from Natural Fibres by the Sol-gel Method*” IOP Conf. Series: Materials Science and Engineering 49 (2013)

11. Dubrovski, P.D., Golob, D., (2009), Effects of Woven Fabric Construction and Color on Ultraviolet Protection,Textile Research Journal, 79(4), 351-359.

12. C. Eckhardt, and J. Rohwer, “*UV protector for cotton fabrics*”,Text. Chem. Color., vol. 32, no. 4, pp. 21-23, 2000.

13. Dakuri Arjun, Ayodya Kavitha, J.Hiranmayee “*TEXTILE MATERIALS USED FOR UV PROTECTION*”IJARET Volume 4, Issue 7, November-December 2013, pp. 53-59

14. Grancaric, A.M., Penava, Z., Tarbuk, A. (2005). UV Protection of Cotton-The Influence of Weaving Structure. HemijskaIndustrijaJournal, 59, 230-234.

15. B.R.DAS “*UV Radiation Protective Clothing*” The Open Textile Journal, 2010 3, 14-21

*16.*S. B. Stankovic,D. Popovic, G. B. Poparic, andM. Bizjak, “*Ultraviolet protection factor of gray-state plain cotton knitted fabrics*,”Textile Research

Journal, vol. 79, no. 11, pp. 1034–1042,2009.

17. Mukesh Kumar Singh and Annika Singh "*Ultraviolet Protection by Fabric Engineering*" Hindawi Publishing Corporation Journal of Textiles Volume 2013, Article ID 579129, 6 pages

18. Mohammad Ghane, Ehsan Ghorbani "*Investigation into the UV-Protection of Woven Fabrics Composed of Metallic Weft Yarns*" AUTEX Research Journal, /aut-2015-0021

19. Crews, P.C., Kachman, S., Beyer, A.G., (1999), Influences on UVR transmission of undyed woven fabrics, Textile Chemist and Colorist, 31(6),

20. Algaba I., Va A.R., Crews P.C., "*Influence of Fiber Type and Fabric Porosity on the UPF*",AATCC 4(2) 2004 26 – 29.

21. Crews P.C., Kachman S., "*Influences on UVR Transmission of Undyed Woven Fabrics*",AATCC Review 31 (6) 1999 17 – 26.

22. Hoffmann.K, Gambichler.T, "*Role of clothes in sun protection*", Department of dermatology, 2002;160:15-25.

23. Peter Gies, Colin Roy , Simon Toomey, "*Protection against solar ultraviolet radiation*", Mutation Research, Issue: 1, Volume: 422, Pages: 15-22.Nov 9, 1998.

24. Zeljko Penava , Anita Tarbuk , "*UV protection of cotton: The influence of weaving structure*", Mutation Research, Issue: 1, Volume: 422, Pages: 15-22.

25. Malgorzata Zimniewska, Batog, "*Ultraviolet-blocking properties of natural*

fibres", Handbook of natural fibres. Processing and applications, Edition: Vol. 2, No. 119, Chapter: Ultraviolet-blocking properties of natural fibres,

26. Sandra Davis, Kerr, "*Clothing as protection from ultraviolet radiation: Which fabric is most effective?",* International journal of dermatology 36(5):374 - 379 .

27. A K Sarkar, "*Textiles for UV protection*", Textiles for Protection, Pages: 355 -377.