3. EXPERIMENTAL METHOD

3. EXPERIMENTAL METHOD

Introduction

Life is very fast and human being cannot remain indoors for a long even during peak summer noon. This puts a need to develop sun protective fabric which is specially designed to protect the skin from ultraviolet (UV) radiation and to understand the grading systems adopted to evaluate the capability of such UV protective products[153]. The main aim of the present work is to know the fabric performance in terms of ultraviolet radiation and moisture management. The whole experimental set up comprises of two parts, ultraviolet radiation properties and moisture management properties.

3.1 Materials

To fulfill the above mentioned aims, the fibres selected were Polyester, Viscose and Lycra filament to enhance the UV shielding and comfort properties of fabric together. Polyester fibre whose structure is best on aromatic compound absorbs more in the UV-A and UV-B region than aliphatic polyamide fibres. Blending of Polyester and Cotton in a fabric would provide significantly better protection than Cotton alone. Although Cotton fibre products are widely recognized by the consumers as being soft, natural and comfortable, but there is need to find suitable alternative to the conventional Cotton fibre due to reduction of arable land and limitation in water availability. Man-made cellulosic fibre – Viscose is a highly hydrophilic fibre and has a good absorbency which is an essential factor for comfort. Use of Lycra offers better cover as being more stretchable and hence higher protection from UV radiation. Table 3.1 depicts the properties of fibres used.

Table 3.1: Fibre properties

Fibre type	Denier	Staple length (mm)
Polyester staple fibre	1.4	44
Viscose staple fibre	1.2	44
Spandex filament (Lycra)	40 (37 Tex & 20 Tex) 20 (13 Tex)	

3.1.1. Spinning of Yarn

Form the above mentioned three blends of Polyester / Viscose and one blend of Polyester/ Viscose / Lycra were made. Lycra filament is blended at Ring frame core spinning. The machinery detail is given in appendix (see table 3.2 – a to d) and the yarn characteristics are

shown in table 3.3 (a and b). The popular blend ratios were chosen for manufacturing three different yarn counts for each blend. In all respects, the technical and machinery settings where tried to keep constant except for adjusting the draft and twist for obtaining the yarns. The Carded varieties Polyester/Viscose with Blend ratios 75/25, 60/40 and 45/55 and Polyester/Viscose/Lycra with blend ratio 70/25/5 having linear densities 13 Tex, 20 Tex and 37 Tex Ring Yarns were produced (see Table 3.4).

Table:3.4 Ring Frame yarn with blend ratio and Count

Sr. No.	Weft Yarn Count (Tex)	P/V/L
1.	37	75 /25 / -
2		60 / 40 / -
3		45 / 55 / -
4		70 / 25 / 5
5	20	75 /25 / -
6		60 / 40 / -
7		45 / 55 / -
8		70 / 25 / 5
9	13	75 /25 / -
10		60 / 40 / -
11		45 / 55 / -
12		70 / 25 / 5

*Warp Count – 20 Tex: Warp yarn Blend Ratio: 75/25
P/V/L: Polyester/Viscose/Lycra

3.1.2 Weaving of Fabric

For producing the fabric samples two weave structure were selected, one is 5-Satin weave and the other 2/3 Twill weave. In both the cases, three pick densities were chosen. Warp of 20 Tex made from 75/25 Polyester/Viscose blend with density of 125 ends per inch was kept constant for all fabric samples. To develop woven fabric which provides the adequate protection from UV radiation present in the sunlight specially for workwear along with required comfort property, Twill and Satin fabrics are commonly used. These weaves enables higher thread densities than Plain weave to get the closer structure. Warpers beam were produced on Prashant Gamatex Sectional warper with creel capacity of 512. Table 3.5 depicts the sizing machine parameter. The fabric samples were woven on same machine, Dornier make Rigid Rapier Loom. The table 3.6 indicates the Satin fabric sample coding. Table 3.7 indicates Twill fabric samples coding. In both weaves dyed fabric samples were numbered similarly ranging from DS_1 to DS_{36} and DT_1 to DT_{36} for Satin and Twill respectively.

Table 3.6: Satin Fabric Samples Coding

Fabric Sample No.	Blend Ratio P/V/L	Weft Count	Weave	Weft Density (Picks/ Inch)
RS_1	75 / 25 / -	37 Tex	Satin	55
RS_2	60 / 40 / -			
RS_3	45 / 55 / -			
RS_4	70 / 25 / 5			
RS_5	75 / 25 / -			65
RS_6	60 / 40 / -			
RS_7	45 / 55 / -			
RS_8	70 / 25 / 5			
RS_9	75 / 25 / -			70
RS_{10}	60 / 40 / -			
RS_{11}	45 / 55 / -			
RS_{12}	70 / 25 / 5			
RS_{13}	75 / 25 / -	20 Tex		65
RS_{14}	60 / 40 / -			
RS_{15}	45 / 55 / -			
RS_{16}	70 / 25 / 5			
RS_{17}	75 / 25 / -			80
RS_{18}	60 / 40 / -			
RS_{19}	45 / 55 / -			
RS_{20}	70 / 25 / 5			
RS_{21}	75 / 25 / -			95
RS_{22}	60 / 40 / -			
RS_{23}	45 / 55 / -			
RS_{24}	70 / 25 / 5			
RS_{25}	75 / 25 / -	13 Tex		65
RS_{26}	60 / 40 / -			
RS_{27}	45 / 55 / -			
RS_{28}	70 / 25 / 5			
RS_{29}	75 / 25 / -			95
RS_{30}	60 / 40 / -			
RS_{31}	45 / 55 / -			
RS_{32}	70 / 25 / 5			
RS_{33}	75 / 25 / -			105
RS_{34}	60 / 40 / -			
RS_{35}	45 / 55 / -			
RS_{36}	70 / 25 / 5			

Warp Count – 20 Tex: Warp yarn Blend Ratio: 75/25 : P/V
P/V/L: Polyester/Viscose/Lycra

Table 3.7: Twill Fabric Samples Coding

Fabric Sample No.	Blend Ratio P/V/L	Weft Count	Weave	Weft Density (Picks/ Inch)
RT_1	75 / 25 / -	37 Tex	Twill	55
RT_2	60 / 40 / -			
RT_3	45 / 55 / -			
RT_4	70 / 25 / 5			
RT_5	75 / 25 / -			65
RT_6	60 / 40 / -			
RT_7	45 / 55 / -			
RT_8	70 / 25 / 5			
RT_9	75 / 25 / -			70
RT_{10}	60 / 40 / -			
RT_{11}	45 / 55 / -			
RT_{12}	70 / 25 / 5			
RT_{13}	75 / 25 / -	20 Tex		65
RT_{14}	60 / 40 / -			
RT_{15}	45 / 55 / -			
RT_{16}	70 / 25 / 5			
RT_{17}	75 / 25 / -			80
RT_{18}	60 / 40 / -			
RT_{19}	45 / 55 / -			
RT_{20}	70 / 25 / 5			
RT_{21}	75 / 25 / -			95
RS_{22}	60 / 40 / -			
RT_{23}	45 / 55 / -			
RT_{24}	70 / 25 / 5			
RT_{25}	75 / 25 / -	13 Tex		65
RT_{26}	60 / 40 / -			
RT_{27}	45 / 55 / -			
RT_{28}	70 / 25 / 5			
RT_{29}	75 / 25 / -			95
RT_{30}	60 / 40 / -			
RT_{31}	45 / 55 / -			
RT_{32}	70 / 25 / 5			
RT_{33}	75 / 25 / -			105
RT_{34}	60 / 40 / -			
RT_{35}	45 / 55 / -			
RT_{36}	70 / 25 / 5			

Warp Count – 20 Tex: Warp yarn Blend Ratio: 75/25 : P/V
P/V/L: Polyester/Viscose/Lycra

3.1.3 Wet Processing

Woven samples were divided into two parts: ready for dyeing (RFD) and dyed. Table 3.8 depicts the wet process route and recipe followed. Table 3.9 depicts the process route and recipe followed for Lycra blends using Jet 50 machine. Table 3.10 depicts the dyeing process and recipe followed using Then machine.

3.2 Testing Procedure

Prior to testing all fabrics samples were conditioned and tested in both – undyed & dyed form in a standard atmosphere.

3.2.1 Yarn testing

Only for the academic interest and for knowing the quality, following test were made for the yarn produced:

Yarn Tensile Properties were measured on Lloyd Strength Tester version 5.0;

Yarn Twists were measured on Automatic Twist Tester;

Yarn diameter was measured using ERMASCOPE 808 T with the magnification of 100 X;

Imperfections were measured by Uster Tester 4-SX-R20 AT 400m/min for 1 min for 100 km length;

Elongation at break, tenacity and breaking force were tested on USTER Tensorapid 4.8 at speed of 5000 m/min.

3.2.2 Physical and dimensional properties of woven fabrics:

Some of the conventional fabric properties measured before testing the fabric for ultraviolet radiation:

i. Weight per surface unit, g/m^2
ii. Fabric Thickness, mm
iii. Thread Density & Fabric Cover
iv. Air Permeability Litres/Sq.m/Second

i. Weight per surface unit, g/m^2

The weight per surface unit of the fabric was determined according to ASTM D 3776-1996, IS:1964-2001, using Mettler make measuring balance, model PB 602-5. Ten test specimen of size (100 x 100) mm size were tested for each sample. g/m^2 = average weight x 100.

ii.Thickness, mm

Fabric thickness was determined according to standard ASTM:D 1777:197, IS:7702-1975 using Baker Make J02 Thickness Tester. Ten readings were taken for each samples and average value is tabulated in table 3.11, 3.12 (see Appendix).

iii.Fabric Cover Factor

The term cover factor is defined as the percentage of fabric surface area containing fibre or yarn. The more surface filled with material, the less space available for passing directly the incident UVR through the fabric[49]. Table 3.11 and 3.12 are the tabulated form of RDF Samples. Dyed Samples results are shown in Table 3.13 and 3.14 (see Appendix). Cloth Cover Factor (K_C) is calculated from the following formula:

Cloth cover (K_C) = (K_1)+ (K_2)– [(K_1 X K_2)/ 28]

Where, Warp cover factor (K_1) = Ends/inch / √warp count

Weft cover factor (K_2) = Picks/inch/ √weft count

iv.Air Permeability

The concept of 'air permeability' is widely used in the textile industry to interpret the intrinsic characteristics of fabric. Air permeability of the samples was investigated according to ASTM standard D737-1996 using SDL Atlas make Air Permeability Tester Model: MO21A (see figure 3.1). The measurements were performed at a constant pressure drop of 196 Pa (20 cm^2 test area). Ten samples were tested for each group and expressed as $l/m^2/s$.

Figure 3.1: Air permeability tester

v.UV Transmittance

The UPF of the fabric was determined by the in vitro method using an Ultraviolet Transmittance Analyser UV-2000F according to standard BSEN 13758-1:2002. The UV-2000F Ultraviolet Transmittance Analyzer is the most recent and highly application specific

ultraviolet spectroscopy. The instrument operates by measuring the diffuse transmittance of a fabric sample as a function of wavelength in the ultraviolet spectrum (250 nm to 450 nm) and does the automatic calculations of spectral transmittance, UPF, critical wavelength and UV-A:UV-B ratios. Each fabric sample were tested for five different location to cover entire length and width of fabric, the measuring area was 0.67 cm^2 and wavelength accuracy to +1 nm.

The UV transmittance was tested using UV-2000F Ultraviolet Transmittance Analyzer from Labsphere (see figure 3.2) which satisfies following standards: AS/NZ 4399:19961, EN 13758:-1:2001, AATCC TM 183-2000, GB/T18830. It measures the spectral transmittance of ultraviolet light through a sunscreen material and calculates certain characteristics parameters of the sunscreen sample using internationally recognized statistical methods. The term transmittance refers to the percentage of radiant flux transmitted through the sample, relative to the incident energy. The term spectral transmittance refers to the transmission of light at a single wavelength. It measures spectral transmittance across the 250-450 nm wavelength spectrum using an integrating sphere and two spectrometer instruments. The sample beam is generated inside the integrating sphere by a high energy ultraviolet pulsed flash-lamp.

The optical design of the UV-1000F is depicted in figure 3.3 is a side view. The integrating sphere moves up and down for sample insertion. The sample is sandwiched between the sphere port window and the collimating lens. The diameter of the viewing beam is 10 mm. The lamp used inside the integrating sphere is a xenon flash lamp. The lamp supplies sufficient energy for the instrument's spectral range of 250 nm - 450 nm while minimizing the sample exposure during its microsecond pulse interval.

During the blank scan, light collected by the integrating sphere is directed downwards, void of sunscreen product, into the lower chamber below. Ultraviolet radiation from the incident beam that is not reflected or absorbed by the blank scan is collected in the lower chamber of the optics train and measured by Spectrometer No.2 as the 100% transmittance value. During the sample scan, ultraviolet radiation is collected from the sample beam that is not reflected or absorbed by the combined medium consisting of the sunscreen material. This radiation is measured by Spectrometer No.2 and compared to the signal detected during the blank scan.

Figure 3.2: UV-2000F Ultraviolet Transmittance Analyzer

The transmittance of the measured sample is equal to the ratio of the sample beams collected from the blank and sample scans. The light collected from the integrating sphere by Spectrometer No.1 is used to correct variations of the sample beam energy from one scan to the next. The principal components inside it are the two diode array spectrometers. The spectral data recorded from these spectrometers operate in tandem for sunscreen characterization. The spectrometers are identical except that they operate as master and slave during the scanning process so that data collection from the integrating sphere and lower chamber occurs simultaneously. Spectrometer No.2 is the master unit; Spectrometer No. 1 is the slave.

The fibre optic cable that feeds Spectrometer No.2 is located in the instrument base underneath the sunscreen sample. The fibre optic cable that feeds Spectrometer No.1 collects radiation from the Spectralon integrating sphere. Both spectrometers collect spectral transmittance data across the 250-450 nm wavelength spectrum during each blank and sample scan. The 250-450 nm data from the sample scan is displayed on the UV-2000 main operating screen even though UPF and UVA:UVB calculations are performed across the more limiting 290-400 nm spectrum.

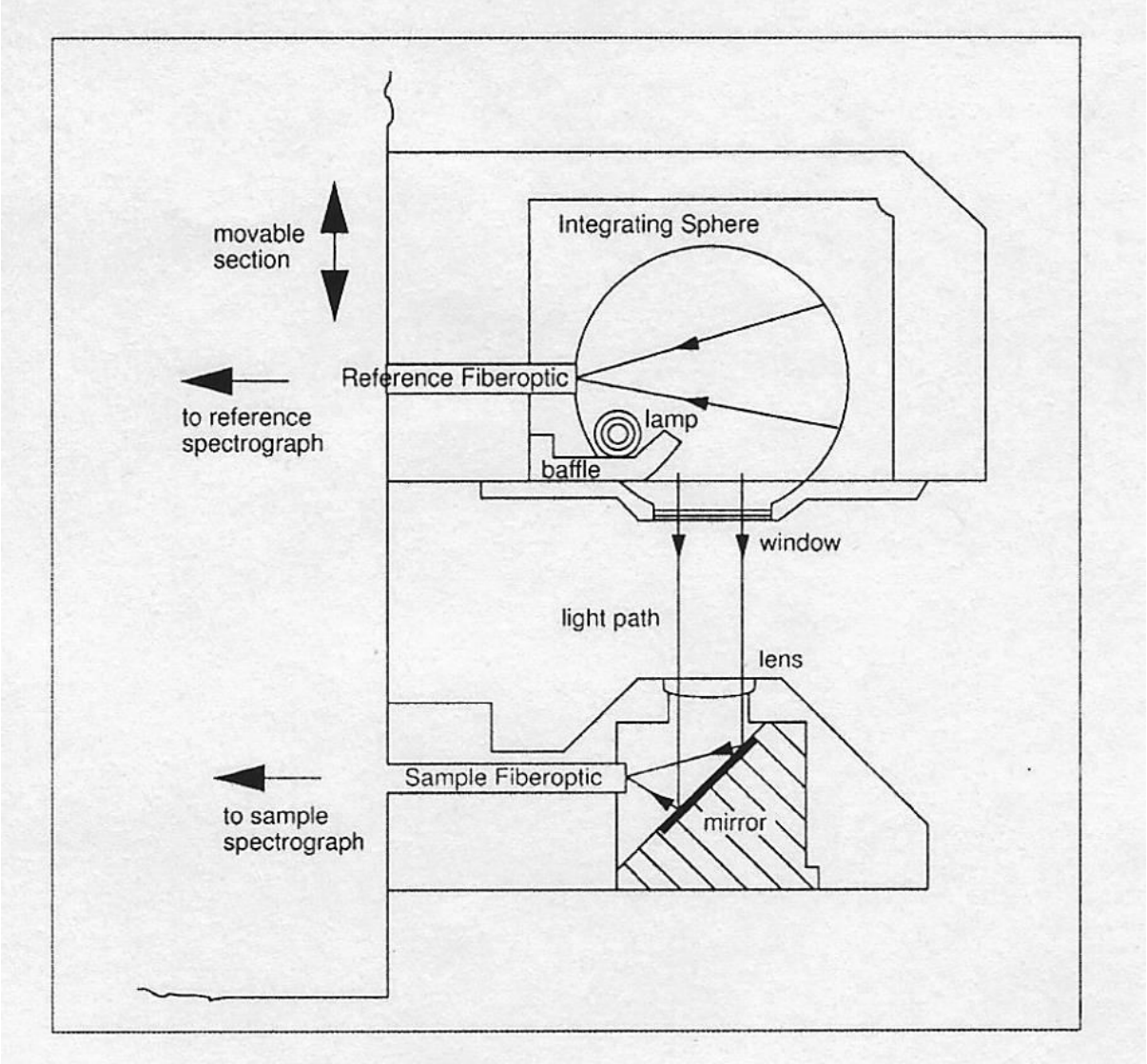

Figure 3.3: Optical design of UV-2000F Ultraviolet Transmittance Analyzer

The processed data collection from both spectrometers generates transmittance spectra according to the equation

$$T(\lambda) = \left(\frac{S2}{B2}\right)\left(\frac{B1}{S1}\right)$$

Where S1 and S2 are the sample scan recordings for Spectrometers No.1 and 2, and B1 and B2 are the blank scan recordings. All components in equation of course, exist as arrays spanning the spectrum 250- 450 nm, each component including a dark scan array.

When the dark scan data is included, the above equation can be written as:

$$T(\lambda) = \left(\frac{S2 - SD2}{B2 - BD2}\right)\left(\frac{B1 - BD1}{S1 - SD1}\right)$$

Where SD1 and BD2 are the dark recordings for Spectrometers No.1 and 2 respectively taken during the sample and blank scans. An automatic dark current measurement is

incorporated into the UV-2000 software immediately before each blank or sample scan measurement. The flash-lamp is extinguished for the length of the dark scan.

The wavelength calibration of the UV-2000 instrument is established by six calibration coefficients, three for each spectrometer, used by UV-2000 to convert photodiode array pixel number to wavelength. A set of coefficients is unique to a specific spectrometer instrument. Since spectral transmittance is relative parameter, the wavelength spectrum is the only data component that requires calibration. The three coefficients reside in spectrometer memory and are uploaded to UV-2000 when the software is launched.

Calculation of UPF

The UPF of a textile material is determined from the total spectral transmittance. The total spectral transmittance is measured by irradiating the sample with monochromatic or polychromatic UV radiation and collecting the total (diffuse and direct) transmitted radiation. In the case of polychromatic incident radiation, the transmitted radiation is collected monochromatically. The apparatus shall either irradiate the sample with a parallel beam and hemispherically and collect a parallel beam of transmitted radiation[154].

Calculation of the arithmetic mean of the UV-A transmittance (UVAi) for each sample I is as follows:

$$\mathbf{UVA_i = 1/m \sum_{\lambda=315}^{\lambda=400} Ti(\lambda)}$$

Calculation of the the arithmetic mean of the UV-B transmittance (UVBi) for each sample I is as follows:

$$\mathbf{UVB_i = 1/k \sum_{\lambda=290}^{\lambda=315} Ti(\lambda)}$$

Where: Ti(λ) is the spectral transmittance of specimen I at wavelength λ, m and k are the measurement points between 315nm and 400 nm and between 290nm and 315 nm respectively.

Calculation of the Ultraviolet Protection Factor for each specimen I is as follows:

$$\mathbf{UPF} = \frac{\sum_{\lambda=290}^{\lambda=400} E(\lambda)S(\lambda)\Delta\lambda}{\sum_{\lambda=290}^{\lambda=400} E(\lambda)S(\lambda)T(\lambda)\Delta\lambda}$$

Where E (λ) = CIE erythemal spectral effectiveness, S(λ) = solar spectral irradiance in Wm^{-2} nm^{-1}, T(λ) = spectral transmittance of fabric, Δλ = the bandwidth in nm, and λ = the wavelength in nm.

The second part of the experimental work is to measure the Moisture management properties.

vi. Moisture management properties

The liquid water transport and distribution in the fabrics was tested according to AATCC 195-2009 using a moisture management tester (MMT, a commercial testing product of SDL Atlas, figure 3.4 and figure 3.5).

Sample preparation

To reduce the influence of environmental factors on the obtained experimental results, five specimens were cut into samples of size 80 mm x 80 mm for each type of fabric.

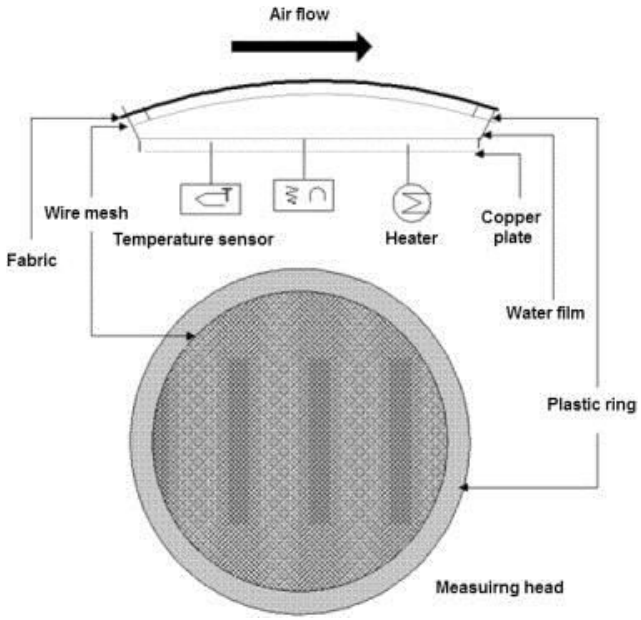

Figure 3.4: Schematic view of the tester sensors **Figure 3.5: Moisture Management Tester**

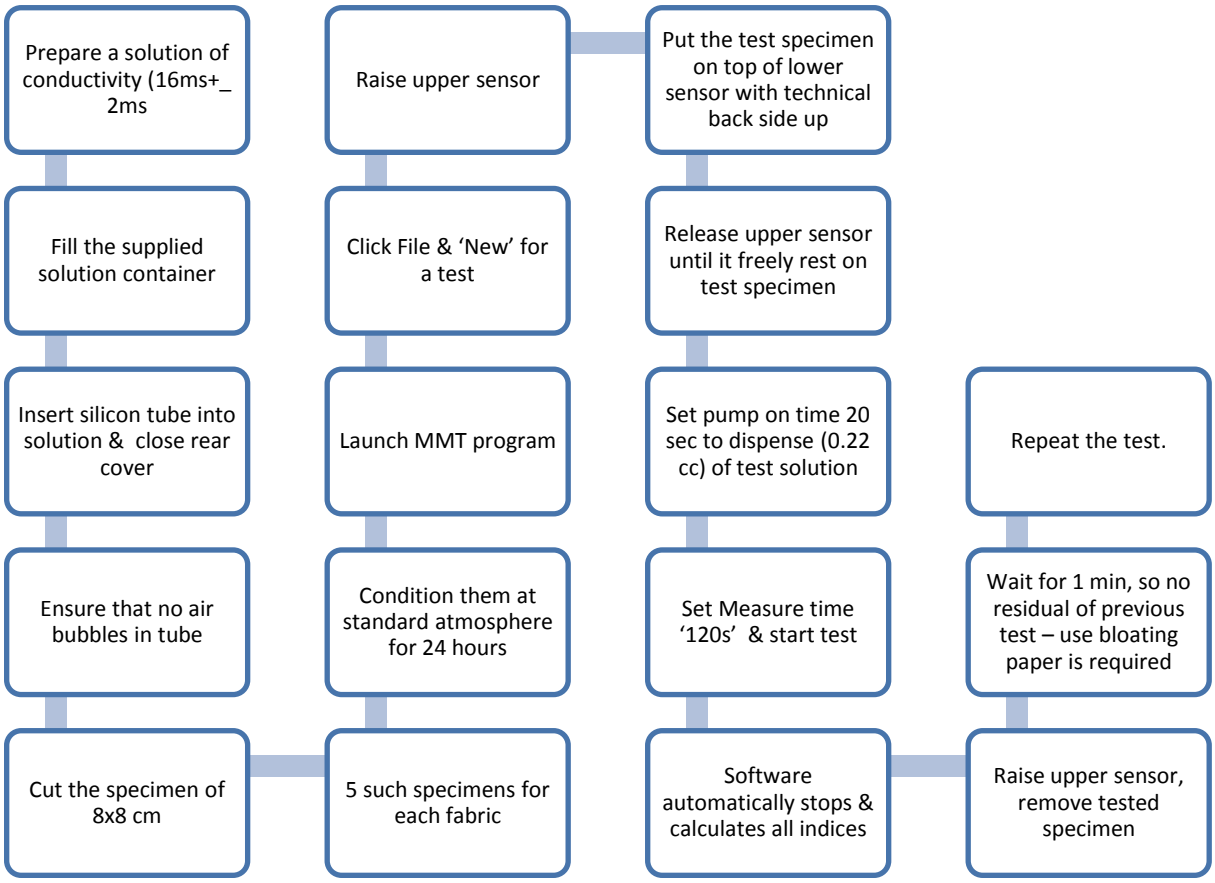

Figure 3.6: Flow chart: Moisture Management procedure

Procedure

The test solution was prepared by dissolving 9 g sodium chloride (USP Grade) in 1L of distilled water and adjust its electrical conductivity to 16± 0.2 milli Siemens (Ms) at 25°C (77°F) by adding sodium chloride or distilled water as necessary[93]. The test solution was used in order to simulate sweating and provide a conductive medium for the instrument's sensors. Manufacturer's instructions were followed for starting the instrument, addition of the test solution, and the computer set up to collect test data. The upper sensor was raised to its locked position and a paper towel was placed on the lower sensor. The "pump" button was pressed for 1-2 minute until the amount (0.22 cc) of the test solution is drawn from the container and drips onto the paper towel and no air bubbles are present inside the tubing. Then the paper towel was removed. Then the conditioned test specimen was placed on the lower sensor with the specimen's technical back up (facing the top sensor) imitating the case where the technical back is in direct contact with the skin[32, 146]. The upper sensor was released until it freely rests on the test specimen and the door of the tester was shut. It was confirmed that the "Pump-On Time" was set at 20 s to assure the predetermined amount (0.22

cc) of test solution was dispensed. For each specimen, the per cent (%) water content point on the graph should be 0.0 at the start of each test to avoid erroneous test results. The "Measure Time" was set for 120 s and the test was started. At the end of the 120 s test time, the software automatically stopped the test and calculated all of the indices. The upper sensor was raised and the tested specimen was removed. Before inserting the next specimen, the upper sensor was kept in its locked position. Between the rings of pins on both upper and lower sensors were dried using AATCC blotting paper or a soft paper towel cut into narrow (0.5 cm) strips. Waited for 1 min, or longer, to ensure there is no residual test solution present on the sensors, otherwise any leftover moisture will cause an erroneous start. If slat deposits were observed on the sensors after drying, distilled water was used to remove. A new specimen was loaded on top of the lower sensor with the fabric back surface up and the above steps were repeated. When testing was been completed for the day, distilled water was used to clean and purge the pump and tubing. The test time presented by the horizontal axis (x) is composed of two stages. The first stage is the pump time period, during which liquid is injected onto the top layer automatically. The liquid received by a fabric begins wetting its surface gradually. Then liquid tends to be accumulated on the top, and it penetrates to the bottom layer simultaneously. However, the accumulating speed is much greater than that of the penetration, and thus moisture accumulating speed plays a key role in this stage until the pump time set is exhausted. Subsequently, the other stage (called a measure time period) starts, during which only the liquid accumulated in the former stage penetrates to the bottom layer. Both the pump time and measured time in these two stages have to be set on the control panel of the MMT before testing, and the test time displayed by the final measurement figure's horizontal axis is the sum of the two (Figure 3.6).

Moisture Management Tester Indices

A series of indexes are defined and calculated to characterize liquid moisture management performance of the test specimen.

Absorption rate – (AR_t) (top surface) and (AR_b) (bottom surface), - the average speed of the liquid moisture absorption for the top and bottom surfaces of the specimen during the initial change of water content during a test.

Spreading speed- (SS_i)- the accumulated rate of surface wetting from the center of the specimen where the test solution is dropped to the maximum wetted radius.

Top surface – (T), for testing purposes, the side of a specimen that, when the specimen is placed on the lower electrical sensor, is facing the upper sensor. This is the side of the fabric that would come in contact with the skin when a garment is worn or when a product is used.

Total water content – (U) (%), - the sum of the percent water content of the top and bottom surfaces.

Wetting time – (WT_t) (top surface) and (WT_b) (bottom surface), - the time in seconds when the top and bottom surfaces of the specimen begin to be wetted after the test is started.

Accumulative one-way transport capability-(AOTI) – the difference between the area of the liquid moisture content curves of the top and bottom surfaces of a specimen with respect to time.

Maximum wetted radius-(MWR_t) and (MWR_b) (mm) –the greatest ring radius measured on the top and bottom surfaces.

Moisture management – for liquid moisture management testing, the engineered or inherent transport of aqueous liquids such as perspiration or water (relates to comfort) and includes both liquid and vapor forms of water.

Overall (liquid) moisture management capability (OMMC) – an index of the overall capability of a fabric to transport liquid moisture as calculated by combining three measured attributes of performance: the liquid moisture absorption rate on the bottom surface (AR_b), the one way liquid transport capability (AOTI), and the maximum liquid moisture spreading speed on the bottom surface (SS_B).

$OMMC = 0.25\ AR_b + 0.5AOTI + 0.25\ SS_b$

The larger the Overall (liquid) moisture management capability is the higher the overall moisture management capability of the fabric. Liquid moisture management capacity shows that liquid sweat can be easily and quickly transferred from next to the skin to the outer surface to keep the skin dry. If the Overall (liquid) moisture management capability of one fabric is in 0.6-0.8 range it means that the liquid moisture management capacity is very good. Also, for the fabric having the value higher than 0.8, the overall capability of the fabric is defined as excellent.

According to AATCC Test Method 195-2009, the indices are graded and converted from value to grade based on a five grade scale (1-5). The five grades of indices represent: 1-poor, 2-fair, 3-good, 4-very good, 5-excellent (see table 3.15)[132, 133, 134, 135].

TABLE 3.15: Grading of Indices

Index		Grade				
		1	**2**	**3**	**4**	**5**
Wetting time	**top**	≥120 No wetting	20-119 Slow	5-19 Medium	3-5 Fast	<3 Very fast
	Bottom	≥120 No wetting	20-119 Slow	5-19 Medium	3-5 Fast	<3 Very fast
Absorption rate	**Top**	0-10 Very slow	10-30 Slow	30-50 Medium	50-100 Fast	>100 Very fast
	Bottom	0-10 Very slow	10-30 Slow	30-50 Medium	50-100 Fast	>100 Very fast
Max wetted radius	**Top**	0-7 No wetting	7-12 Slow	12-17 Medium	17-22 Large	>22 Very large
	Bottom	0-7 No wetting	7-12 Slow	12-17 Medium	17-22 Large	>22 Very large
Spreading speed	**Top**	0-1 Very slow	1-2 Slow	2-3 Medium	3-4 Fast	>4 Very fast
	Bottom	0-1 Very slow	1-2 Slow	2-3 Medium	3-4 Fast	>4 Very fast
AOTI		<-50 Poor	-50 to 100 Fair	100-200 Good	200-400 Very good	>400 Excellent
OMMC		0-0.2 Poor	0.2-0.4 Fair	0.4-0.6 Good	0.6-0.8 Very good	>0.8 Excellent

3.2.3 Statistical Analysis

To address a mathematical relationship between the weft density, yarn tex, blend ratio and Sun shielding property of fabric, Linear Regression analyses were made between Sun shielding property and these parameters for each count – 13 Tex, 20 Tex and 37 Tex respectively. For each count 04 equation were established for 4 different blend ratio. So for Satin fabric total 12 equations and for Twill fabric total 12 equations were derived using MINITAB17. Equation is of the form:

$y = mx + C$

where

y = UPF (dependent variable)

x = weft density (independent variable).

Also Multiple linear regression of the form:

$y = b_1x_1 + b_2x_2 + C$

were derived for each blend ratio for both Satin & Twill fabric.

where

y = UPF (dependent variable)

x_1 = weft density (independent variable)

x_2 = yarn tex (independent variable).

For moisture management testing Multiple linear regression equation of the form:

$y = b_1x_1 + b_2x_2 + C$

were derived for each blend ratio for both Satin & Twill fabric.

where

y = OMMC (dependent variable)

x_1 = weft density (independent variable)

x_2 = yarn tex (independent variable).

To deduce whether the parameters were significant or not, p values were examined. For the evaluation of the statistical importance of the air permeability, fabric weight and fabric thickness on the overall moisture management capacity of the woven fabrics, Pearson correlation was found. In order to decide the statistical significance of the variable on the related property, p value is also used.