Influence of Physical Characteristics of Wool Fibre on Dyeing

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ABSTRACT

To establish relationship between the physical attributes of wool fibre , physical characteristics and its dyeability, different wool fibre samples were collected from research centres. These wool fibres were evaluated for their physical properties. The per centage of dye absorption for wool fibres was studied. The wool quality parameters like scouring yield, medullation per centage reveals that there is a direct linkage between them foe dye absorbency.

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Fibres are the very smallest visible units from which our fabrics are made by one process or another. Fibre is a fine hair like structure of animal, vegetable, mineral or synthetic origin. All animal fibres are complex proteins views Jefferson (2005). A fibre is characterized by its high ratio of length to thickness and by its strength and flexibility comments Broadbent (2001). Wool is a natural fibre that is clipped from a sheep (fleece wool) views Swerev et al (2003).Wool is available in wide variety from very fine soft type wool to coarse long type wool. The quality of wool differs from breed to breed and region to region. Different varieties of wool are available all over India, these wool are generally of medium coarse quality and coarse quality. Some sheep, which contribute to the wool production in India, are reared in southern regions of Tamil Nadu.

Wool plays a pivotal role in the textile industry. The special feature of the fibre makes it supremely valuable as a textile fibre of outstanding importance. Wool exhibits certain very useful properties such as warmth, excellent resilience, water repellence,

flame retardance, moisture absorption, crispness, good drape, etc. Wool is an interesting fibre to study in the scientists point of view.

The use of wool has a long history. Early nomadic people raised sheep for their meat and hair. Over the centuries, people learned the rudiments of breeding that lead to an increase in wool yield. Day by day the use of wool as comfort and for, any other purposes has been increasing with a varied technique of manufacturing through sorting, blending, colouring and weaving.

Indian breeds of sheep produce wools of coarse and medium quality. The Central Sheeep and Wool Research Institute (CSWRI), Mannavanur, Kodaikanal and Sheep Breeding Research Station, Sandynallah, Ooty has developed several new geno types of sheep for production of relatively finer wool by selective inter breeding of Indian sheeps – such as "Bharat Merino Sheep" from CSWRI and "Sandyno Sheep" from Sandynallah, a cross breed of Russian Merino and the Nilgiri. The "Nilgiri Sheep" which is a native breed of the hilly district of Ooty. There are also numerous roughly classified Indian breeds, were the Kurumba of Coimbatore region called after the community that reared it and in Coimbatore and adjacent districts "Curumbaadu" is a local sheep with thick coarse wool.

The wool is used in the fabrication of various domestic articles. The wool quality determines the use of wool for various purposes. The reason being that the properties of yarn or fabric depend on a complex interrelation between the fibre arrangement and fibre properties. So, the understanding of the wool testing and quality evaluation is of vital

importance in deciding the end use suitability of wools. This article deals with the physical properties of the four selected wool fibres. Knowledge of physical properties is also necessary for blending and quality control.

To establish relationship between the physical attributes of wool fibre, physical characteristics and its dyeability, different wool fibre samples were collected from research centres. These wool fibres were evaluated for their physical properties. The per centage of dye absorption for wool fibres was studied. The wool quality parameters like scouring yield, medullation per centage reveals that there is a direct linkage between them foe dye absorbency.

METHODOLOGY

SELECTION OF WOOL FIBRE

Four wool fibres which were available locally such as Bharat Merino, Sandyno, Nilgiri and Coimbatore Kurumba wool fibres were selected.

PHYSICAL PARAMETERS OF WOOL FIBRES

The four wool fibres were tested for their physical parameters.

Physical Testing:

Because the physical characteristics of the wool fibre change under the influence of varying humidity conditions, testing must be done in a properly conditioned room. The ASTM has set up as the standard atmosphere a relative humidity of 65% at 70°F

(21°C) with a tolerance of plus or minus 2% in relative humidity and plus or minus 2°F (1°C) in temperature.

STAPLE LENGTH

Fibre length is the "the length of a fibre obtained by measuring it in the unstretched condition avoiding the tapering tip.

For measuring the length as given in IS 6653:1972, a velvet Board of adequate and convenient size of 50 cm², covered with velvet of black colour or any other colour in contrast with that of the wool. And a scale was fixed to the velvet board along the length of the board which was graduated in centimeters and millimeters. The sample specimen was taken and placed along the scale on the velvet board. Gently straighten the staple if it is in a bent state. Remove the scale without disturbing the staple on the board and carefully adjust the zero mark of the scale with the base of the staple. Read the length of the staple to the nearest 1mm to 5mm. For single fibre testing the Wilkinson tuft method is used. In this method, wool fibre, guided by a needle, is looped around a bunch of fibres and tied tightly with a slip knot. This bundle or tuft of fibres is then extracted from the test specimen. The tuft is freed from all loose fibres before the wool fibre is opened. Then all fibres present in a tuft are pulled out individually with the help of tweezers and measured in a stretched condition, with both ends held by tweezers.

The recorded results were thus calculated as:

Average Fibre Length = Total of lengths observed in cm / Total number of staples

The results of the same are given in Table I and Fig.1.

FIBRE DIAMETER AND CV %

To determine the diameter of wool fibres, short pieces of the fibres are projected on to a screen and the diameter of these images is measured by means of a graduated scale as given in IS 744:1977. From the conditioned wool fibre sample, a fibre was selected at random and the fibre was cut to lengths of 0.8 mm, 0.6 mm or 0.4 mm. Fix the fibres in the microtom and cut the middle portion into the snippets of about 0.4 mm length with the help of a sharp razor. Mix the snippet with two/three drops of liquid paraffin on the glass slide making a uniform layer. Put a cover glass gently to obtain a uniform distribution of fibres on the screen of projection microscope. Mount the slide on the stage. Focus one extreme corner of the slide. Move the specimen by 0.5 mm in the traverse direction, then move it by 0.5 mm in the lateral direction. These two movements will bring the first field on the screen. Rotate the screen until the length of the transparent ruler affixed across it is perpendicular to the fibre image. Move the ruler through its guides until a centimeter division coincides with one edge of the image. Measure the distance between the two edges of the image if the whole of the image is in focus or the distance between one edge of the image and the inside of the white Becke line among the other edge of the image. Record the diameter of that image.

The recorded results were thus calculated for mean fibre diameter using the formula,

$$n = (t^2 \times S^2) / E^2$$

Where, n = number of observations, t = 1.96, S^2 = Varience, E = desired limit in microns

$$\text{Variance } S^2 = [\Sigma (X-X)^2] / n$$

Where, n = number of observation, $\Sigma (\bar{X} - X)^2$ = the sum of the difference between mean and observation.

The results of the same are given in Table I and Fig.2.

Co-efficient of Variation of Diameter (CV %)

To determine the CV%, wool fibre samples were taken and their fibre diameter was recorded and after calculating the mean fibre diameter, the CV% was thus calculated as,

$$CV\% = (\sigma / \mu) \times 100$$

Where, σ = Standard Deviation = $\sqrt{V}$, μ = Mean Fibre Diameter

The results of the same are given in Table I and Fig.3.

Crimp

The 'Waves' or 'Curls' present in wool fibre are called 'Crimp'. Uniformity and abundance of crimp are the indices of good quality wool. Usually the crimp is assessed either by counting the number of 'waves' or 'curls' present in the fibre and expressing it as the number of 'waves' or 'curls' per unit length or by measuring the difference in length of fibre between its unstretched and stretched condition and expressing it as a per centage of the fibre length in the unstretched condition. Because, the Indian wools don't possess well defined 'waves or 'curls', this method is based on the later principle.

For measuring the crimp as given in IS 6124:1971, a velvet board with a transparent graduated scale mounted is used. From the conditioned wool fibre sample, draw at random at least 300 fibres. From these fibres take one fibre and lay it straight without stretching, on a velvet board. Place the scale over the fibre without disturbing it. Measure the unscratched length 'L' correct to nearest millimeters, from end to end of the

fibre. Take the same fibre and straighten it out by means of pair of forceps, taking care not to stretch it but merely to remove its crimp. Place it on the velvet board and measure straightened length 'L_1' to nearest millimeter from end to end of the fibre as above. Read and note the unstretched and stretched lengths of the fibre. From the recorded readings, the crimp of each fibre was thus calculated using the following formula

$$\text{Crimp Per cent} = [(L_1 - L) / L] \times 100$$

Where,
L_1 = Stretched length of fibre,
L = Unstretched length of the fibre.

Former procedure, the wool fibre sample was taken and placed along the scale on the velvet board. Count the waves on the fibre, record them along the side of its length. 30 samples were taken and their crimps per cm were recorded. The recorded results were thus calculated as

Crimps / cm = No. of waves in a Staple / Length of the Staple in cm.

The results of the same are given in Table I and Fig.4.

Medullation

Medullation per centage was checked in wool fibre samples by using micro meter following IS 2899:1965 says Rawat and Goel (2002). The conditioned wool fibre sample was mounted on a slide with glycerine and slide was kept below the objective lens of micrometer. Medullation was checked and medullation percentage was calculated using the formula

$$M\ \% = [(M_1+M2)] / T \times 100$$

Where,
M % = Medullation Percentage,
M_1 = Number of partially medullated fibres

M2 = Number of completely medullated fibres,

T = Total number of fibres

Medulla completely or partially hollow tubular space found within the cortical layer of wool fibre. So, the fibres are divided into three main categories such as Hetro, Hairy and Pure fibres. As given by Surya (1996), mount the slide on the bench of the microscope properly and observe the fibres in the magnification of 250X or 500X magnification, wool fibre samples were taken and their results recorded with the help of a telly counter dividing the fibres into pure, hetro and hairy as per their individual thickness on the scale, and their results were recorded. The recorded results were thus calculated as

Medullation %

% of fine fibres = (P / n) x 100

% of Hetro fibres = (M_1 / n) x 100

% of Hairy fibres = (M2 / n) x 100

Where, n = total number of fibres observed,

P = the number of pure fibres,

M_1 = the number of Hetro fibres,

M2 = the number of Hairy fibres

The results of the same are given in Table I and Fig.5.

MOISTURE CONTENT AND MOISTURE REGAIN

Wool is a highly hygroscopic fibre and absorbs different amount of moisture under different atmospheric conditions. Basu (2005) views most of the natural textile fibres absorb moisture due to the presence of hydrophilic molecules in the fibre, water influences the property of fibre (viz. strength, elasticity, rigidity, friction, evolution of heat). This method prescribed according to IS 6637:1972 is applicable to wool in all

forms, namely greasy wool, scoured wool, carded wool, garnetted wool, wool top, wool roving etc.

A clean weighing bottle was weighted (W1). A known weight of conditioned wool fibre sample was taken and kept immediately into the sampling container and sealed it. Determine the mass of the container with sample and found out the net mass (W2). Meanwhile, the drying oven was heated and the inside temperature was maintained as 105 to 110°C by switching the fan on. Keep the bottles inside by keeping the stopper across. Make sure to off the fan while keeping the bottles inside. Increase the temperature to 100°C and then off the fan. The sample was kept in the oven for over night (or for one hour). Remove the bottles by replacing the lid and transfer it to a desiccator to cool to room temperature.Weigh for oven dry weight (W3). Repeat again if needed for oven dry weight. The recorded readings were thus calculated as

Moisture Content % = [(W2 – W3) / (W2 – W1)] x 100

Moisture Regain % = [(W2 – W3) / (W3 – W1)] x 100

Where,

W2 = Weight of moist sample and bottle weight,

W3 = Oven dry weight, W1 = Weight of bottle

The results of the same are given in Table I and Fig.6.

SCOURING YIELD

Scouring yield is the ratio of weight of scoured wool to weight of raw wool sample taken for scouring. It is expressed in percentage as given by IS 1349:1964. Scoured wool means for the total weight of wool fibres and vegetable matter free from grease, dirt and other impurities weighed at standard atmospheric conditions, Shakyawar et al (2001) explains the scouring yield of wool is the most important criterion for fixing the wool price since it determines the actual wool content in a sample or lot. The wool

yield directly influences the wool price. According to Dagur (1996) and as explained wool fibre scouring, the scouring of wool was carried out. Wool fibre samples were drawn randomly for testing and results recorded. The same process was carried out to find the scouring yield for wool fibres. The recorded readings were thus calculated as

Lab Scouring Yield % = (W2 / W1) x 100

Where,

W1 = Conditioned weight of control sample,

W2 = Conditioned weight of scoured sample

The results of the same are given in Table I and Fig.7.

Colour

Colour of the fibre is a desirable factor to determine the wool quality says Verma and Sharma (1996). Wool is generally white in colour. Some wools are canary stained during the spring clip due to chemical reaction which cannot be easily removed says Parthasarathy (1996). This phenomenon occurs due to reaction of sweat at high temperature during summer. Wools are also found in half white, brown, black and yellowness differs from light to deep shade. Some wool fibres are lustrous. Wool from most domesticated breeds of sheep is nearly always white, through it may occur in the natural colours of gray, brown or black. The degree of whiteness may vary considerably. The mechanism of luster is described by Fronky Werry. In this mechanism, he describes luster in terms of sparkle, which can be expressed in terms of specular reflected light. He explains that when light falls on fibre, it is either absorbed or reflected. Colour and luster of wool plays a pivotal role in realising a higher price for wool. Creamy coloured and

high lustrous wool realize higher price while yellow coloured and less lustrous wool realize low price of the wool. The results of the same are given in Table I

Wax / Grease Content

In checking whether or not wool has been sufficiently scoured, the most important test is the ether and alcohol extraction as given in IS 1349:1964. The ether removes all of the free fat and small percentage of soap, whereas the alcohol removes soap and waxes. The standard method as set up by ASTM is recommended. The ether and alcohol extraction is as follows. Approximately 10gms. of loose scoured wool fibres was extracted in a soxhlet apparatus for 20 extractions, which require about 2½ hours. The ether is evaporated and the residue dried to constant weight. The extracted sample was subjected to an alcohol extraction in a soxhlet apparatus for 12 extractions with neutral (95 per cent) alcohol requiring about two hours. The alcohol is evaporated and the residue dried to constant weight.

Another method to determine the Alcoholic Extractable Matter Content of the scoured wool fibre specimen. Take 20gms. triplicate specimen sample and put one of them in oven for drying (i.e) known as control sample at 105±2° C. Two test specimen samples inserted in the thumble or warp in filter paper and put in soxhlet extractor. Fit the soxhlet extractor in round flask and condensor. Fill two third part of the extractor with neutral alcohol. Heat slowly at low temperature upto completing 20 siphoning. Twenty siphons may be completed in three to four hours. Remove the excess neutral alcohol by condensing and put the residual alcoholic matter in oven for drying at the temperature 105 ± 2°C. Now take the constant weight of Alcoholic Extractable Matter. The recorded results were thus calculated as:

$$X (\%) = (W2 / W1) \times 100$$

Where, W1 = Oven dry weight of the control sample,

W2 = Oven dry weight of the Alcoholic Extractable Matter (Residue),

X = Alcoholic Extractable Matter Content, % by weight.

Wool fibre random samples were taken and their average per cent of grease content was recorded. The same procedure was followed to obtain the average per cent of grease content in both raw and scoured wool fibres. The results are shown in Table II and Fig.8.

SINGLE FIBRE STRENGTH AND ELONGATION

The strength of wool yarn and ultimately of the fabric depends to a large extent on the tensile strength of the fibres of which the yarn is composed. To determine single fibre tenacity, the test was followed as per ASTM D - 3822 – 01. For determining single fibre strength of wool fibres, the wool sample was combed properly and parallel fibres were mounted within the fixture to be tested on the stelometer of gauge length 20 mm, 500 mg tension weight having 20mm/min as testing speed on a uniform loading machine. It records the breaking load and the extension per centage simultaneously on the same dial. The broken fibres were weighed on a horizontal balance very carefully to find out the specific fibre strength. The recorded results were thus calculated as

$$\text{Tenacity} = (KP / Wt) \times 14.9$$

Where, KP = Breaking load,

Wt = Weight of the sample in mg,

14.9 = Correction factor

The mean tenacity and elongation of the four wool fibres is displayed in Table III and Fig. 9

FIBRE DENIER

Denier is defined as the weight of yarn in grams present in 9000 meters or 9km length as per BISFA 1998. The result is displayed in Table IV and Fig.10.

Selection of Dye

French Marigold was selected for the study. The dye materials was boiled to extract the dye. The per centage for the study was 2%.

Marigolds are easy to grow and have a long flowering period. French marigolds grow to only 8-16 inches. The scent is strong and somewhat unpleasant, and is effective in repelling many garden pests. Marigolds can be grown in all but the coldest climates. Marigolds can be sown directly in the garden when danger of frost has passed, or they can be started indoors for earlier blooms. Space the plants 8-16 inches apart depending on the variety. Water deeply and regularly, especially in hot weather.

Selection of Mordants:

Bio-Mordants namely Mango Bark, was undertaken for the study. The mordant was used in 1% concentration.

Method of Mordanting:

The wool samples were mordanted by four mordanting techniques. Pre-mordanting (mordanting before dyeing), Simultaneous mordanting (mordanting and dyeing together), Post mordanting (mordanting after dyeing) and Pad mordanting (mordanting is carried out before and after dyeing).

Dyeing of Wool Fibre

After optimization of dyeing variables, known amount of wool fibre was taken were dyed with 2% dye concentration for half an hour maintaining a temperature of 60ºC to 65ºC following four mordanting techniques. After dyeing, the woolen yarns were hydro extracted and dried.

Dye Absorbtion

The wool fibre before and after dyeing was tested for dye uptake by using a spectrophotometer. The optical density of the dye solution before and after dyeing was also estimated using the spectrophotometer on the basis of the Nano metric value of the colour used. The dye absorption was calculated using the following equation

Dye absorption % = (Optical density before dyeing – O.D after dyeing) / Optical density before dyeing

RESULTS AND DISCUSSION

Physical Parameters of Wool Fibre Tests

The Physical parameters of Bharat Merino, Sandyno, Nilgiri and Coimbatore wool fibres are shown in Table I.

From the Table I, it shows that the Bharat Merino wool fibre has 8.1 cm Staple length, 23.24 µ fibre diameter and its Co-efficient of Variation of diameter was 28.53%. Bharat Merino wool has 5.13 crimp per cm. Medullation was less than 1%. Bharat Merino wool fibre has 17% moisture content and (absorbs) regains 20% moisture. The scouring yield of Bharat Merino is 50%. The colour of Bharat Merino wool is light yellow and semi lustrous. According to Chaudhury and Gupta (1990), Bharat Merino is distinctly superior fine wool.

The Sandyno wool fibre has 8.63 cm Staple length, 22.09 µ fibre diameter and its co-efficient of variation of diameter was 21.89%. Sandyno wool fibre has 5.345 crimp per cm and has zero medullation. Sandyno wool fibre has 16% moisture content and regains 19% moisture. The scouring yield of Sandyno is 55%. The colour of Sandyno wool is white and lustrous. This Sandyno comes under fine wool category.

The Nilgiri wool fibre has 7.31 cm Staple length, 31.83 µ fibre diameter and 31% as co-efficient of variation of diameter and 5.345 crimp per cm. Medullation of Nilgiri wool fibre is divided into hetero fibres as 13.19%, hair fibres as 6.27% and kemp as 5.61% with total medullation as 25.12%. It has 11% moisture content and regains 12% moisture. The scouring yield of Nilgiri wool is 60.034%. The colour of Nilgiri wool is white and lustrous and comes under medium fine category.

TABLE I

PHYSICAL PARAMETERS OF WOOL FIBRE TESTS

S.No	FIBRE TESTS	BHARAT MERINO	SANDYNO	NILGIRIS	KURUMBA
1	Fibre Staple length (cm)	8.1 ± 0.07 cm (30)	8.63 ± 0.245 cm (30)	7.31 ± 0.280 cm (30)	4.77 ± 0.084 cm (164)
2	Fibre Diameter Micron	23.24 ± 0.263 (30)	22.09 ± 0.148 (906)	31.83 ± 0.515 (1118)	47.74 ± 1.666 (164)
3	Co-efficient of Variation of diameter (CV %)	28.53 % (30)	21.89 % (30)	52.14 % (30)	74.45 % (30)
4	Staple Crimp (Raw wool) crimp per cm	5.13 ± 0.14 (110)	5.345 crimp/cm ± 0.235 (30)	NIL crimp	0.177 ± 0.009 (30)
5	Medullation %	Less than 1 %	0 (zero)	Hetero fibres 13.19 % Hair fibres 6.27 % Kemp 5.61 % Total Medullation 25.12 %	Hetero fibres 13.16 % ± 0.595 (157) Hair fibres 5.57% ± 0.446 (157) Kemp 28.92 % ± 2.316 (157) Total Medullation 47.70 % ± 3.619 (157)
6	Moisture Content %	17 %	16 %	11 %	9.67 %
7	Moisture Regain %	20 %	19 %	12 %	9.538 %
8	Scouring Yield % (Raw wool 50g)	50 %	55 % ± 2.24	50 %	80.17 % ± 0.38 (115)
9	Colour	Light yellow and semi lustrous	White and lustrous	White and lustrous	Yellow

The Coimbatore wool fibre has 4.77 cm Staple length, 47.74 μ fibre diameter and its co-efficient of variation of diameter was 74.45%. Coimbatore wool fibre is divided into hetero fibres as 13.16%, hair fibres as 5.57% and kemp as 28.92% with total medullation as 47.70%. It has 9.67% moisture content and regains 9.538% moisture. The

scouring yield of Coimbatore wool is 80.17%. The colour of Coimbatore wool is yellow and comes under medium fine / coarse category.

Wax / Grease Content in Wool Fibre

The Table II below shows the grease content in raw and scoured of selected wool fibres.

TABLE II

PER CENTAGE OF GREASE CONTENT IN RAW AND SCOURED WOOL

S.NO	TYPES OF WOOL	GREASE CONTENT (%)	
		RAW WOOL (%)	SCOURED WOOL (%)
1	Bharat Merino	7.04	0.61
2	Sandyno	8.76	0.35
3	Coimbatore Kurumba	1.09	0.49

The above Table II shows us the percentage of Grease Content in raw and scoured wool of the selected Bharat Merino, Sandyno and Coimbatore wool fibres. Bharat Merino Raw wool had 7.04% of grease content and 0.61% of grease content after it was scoured. Sandyno raw wool has 8.76% of grease content and 0.35% of grease content after it was scoured. Coimbatore raw wool had 1.09% of grease content and 0.49% of grease content after it was scoured. From this, it is evident that there has been an considerable decrease in per centage of grease content in the fibre after the fibre was scoured, which enables wool fibre for further processes like smooth spinning, dyeing etc. The per centage of grease content present in raw and scoured fibres of Bharat Merino, Sandyno and Coimbatore Kurumba wool fibres is shown in Fig.8.

Single Fibre Strength and Elongation Test

Fibre Strength is expressed in Tenacity (g/den). Tenacity (g/den) of Bharat Merino, Sandyno, Nilgiri and Coimbatore Kurumba wool fibres is shown in Table XVIII and the fibre elongation per centage is shown in the same table. The correlation co-efficient between fibre strength and elongation is shown in Table III. The mean tenacity and elongation of the four wool fibres is shown in Fig.9.

TABLE III

LINEAR REGRESSION AND CORRELATION BETWEEN FIBRE STRENGTH Vs ELONGATION

S. N	Types Of Wool Fibre	Wool Fibre Strength			Wool Fibre Elongation			Correlation	R^2	Regression Equation
		Mean Tenacity (G/Den)	S.D	CV%	Mean Elongation %	S.D	CV %			
1	Bharat Merino	1.33	0.26	19.9	37.92	7.8	20.6	0.566 **	0.30 **	y = 15.68 + 17x
2	Sandyno	1.05	0.32	30.9	28.21	10.6	37.5	0.722 **	0.50 **	y = 3.48 + 24x
3	Nilgiri	1.34	0.30	22.7	36.67	9.6	26.1	0.773 **	0.58 **	y = 4.12 + 24x
4	Coimbatore Kurumba	1.11	0.21	19.1	19.64	12.2	62.3	0.709 **	0.49 **	y = -25.69 + 41x

** - Significant at one per cent level

FIBRE DENIER

The fibre denier of of Bharat Merino, Sandyno, Nilgiri and Coimbatore wool fibres is shown in Table IV

Table IV

Fibre Denier

S.No	Type Of Wool Fibre	Fibre Denier (Den)	S.D	Cv %
1	Bharat Merino	8.18	2.20	27.0
2	Sandyno	5.55	1.11	20.0
3	Nilgiri	7.54	2.13	28.3
4	Coimbatore Kurumba	26.90	10.33	38.4

The Denier of Bharat Merino is 8.18 and its CV% is 27.00. The Denier of Sandyno is 5.55 and its CV% is 20.00. The Denier of Nilgiri is 7.54 and its CV% is 28.30 and the Denier of Coimbatore Kurumba is 26.90 and its CV% is 38.40. When comparing fineness of the four wool fibres, Sandyno stands first with 5.55 Denier, Nilgiri the second, Bharat Merino as third finer wool and Coimbatore Kurumba the coarser variety of wool. Based on performance, Bharat Merino and Sandyno share the first place, Nilgiri the second and Coimbatore Kurumba is in the third place. Based on the strength and the results shown in Table IV, Nilgiri stands first, Bharat Merino second, Coimbatore Kurumba third and Sandyno at fourth.

Per centage of Dye Absorbtion

The dye absorption per centage for each wool yarn of Bharat Merino, Sandyno, Nilgiri and Coimbatore Kurumba using pre-mordantind, simultaneous mordanting, post mordanting and pad mordanting are as shown in TableV and in Fig.11

TABLE V
PER CENTAGE OF DYE ABSORPTION

S.No.	TYPE OF WOOL FIBRE	MORDANTING TECHNIQUE	DYE ABSORPTION %
1	BHARAT MERINO	Pre Simultaneous Post Pad	78.20 80.00 72.85 85.00
2	SANDYNO	Pre Simultaneous Post Pad	76.86 75.62 70.94 80.23
3	NILGIRI	Pre Simultaneous Post Pad	75.25 73.00 65.65 66.23
4	COIMBATORE KURUMBA	Pre Simultaneous Post Pad	65.80 72.20 60.25 75.82

From the above Table V, it shows that the wool yarn dyed with French Marigold having 2% concentration and I% Mango Bark as Mordant, reveals that Pad Mordanting had a high dye absorbency in Bharat Merino, Sandyno and Coimbatore Kurumba wool fibres whereas Pre Mordanting shows a high absorbency in Nilgiri wool fibre. On the whole, the result shows that the dye absorbency of the wool fibres was really good irrespective of the mordanting techniques used. The dyeability of wool is also enhanced to a greater extent. The per centage of dye absorbancy and strength is lower for dyeings performed at room temperature but gets improved at higher temperatures of dyeing i.e 50ºC and 70ºC. At 60ºC - 65ºC, the investigation gave comparatively better dyeing performance.

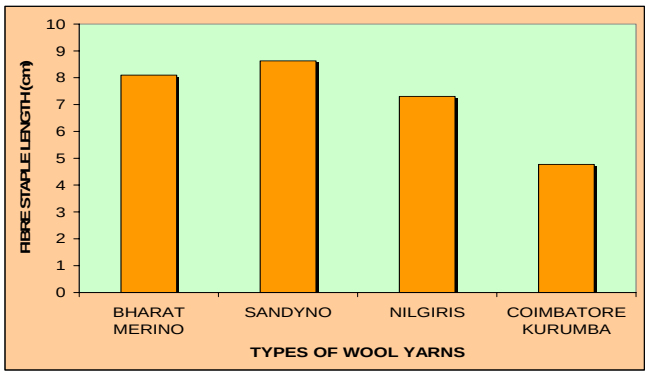

Fig. 1: FIBRE STAPLE LENGTH

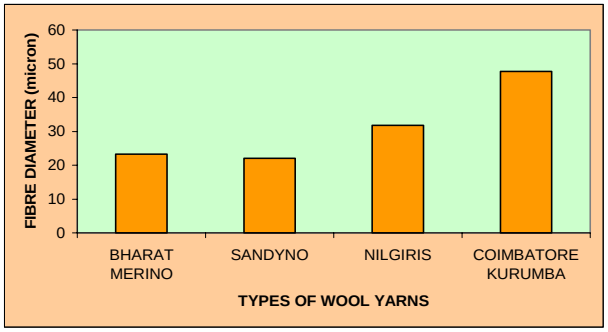

Fig. 2: FIBRE DIAMETER

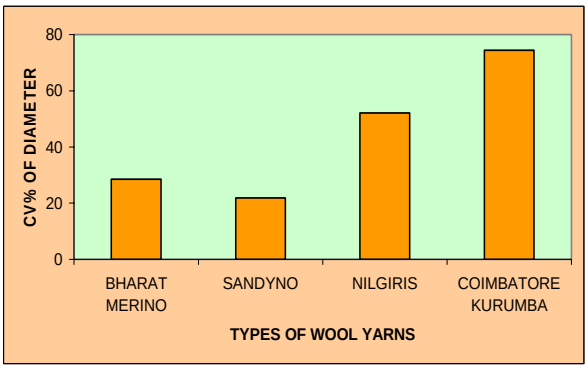

Fig. 3: CV % OF DIAMETER

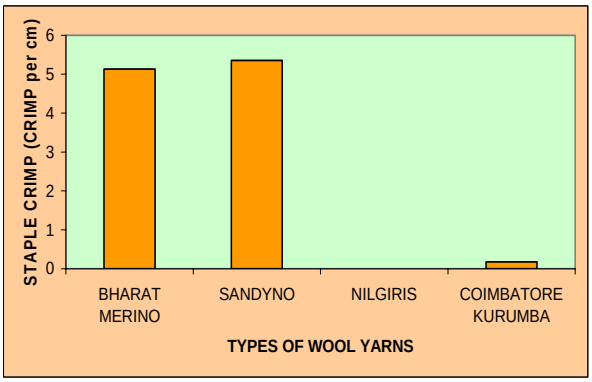

Fig. 4: FIBRE STAPLE CRIMP

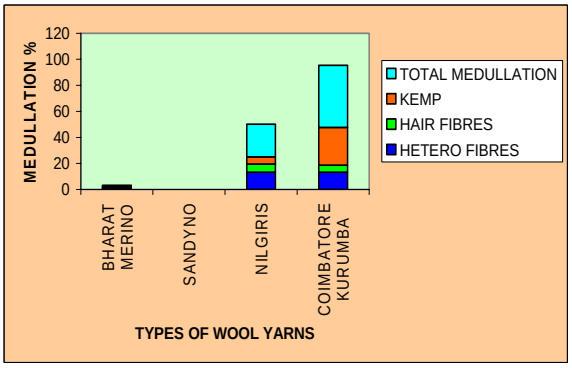

Fig. 5: MEDULLATION PER CENTAGE

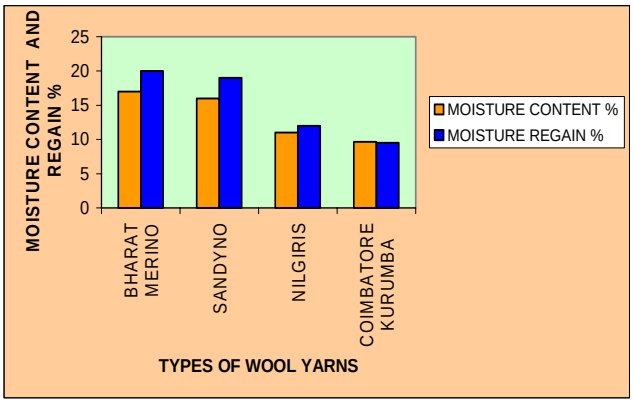

Fig. 6: MOISTURE CONTENT AND REGAIN PER CENTAGE

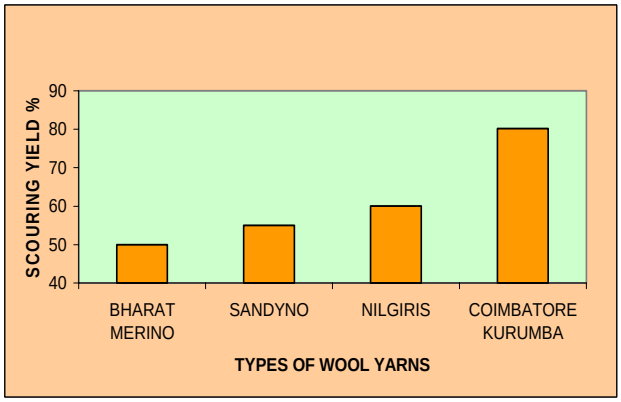

Fig. 7: SCOURING YIELD

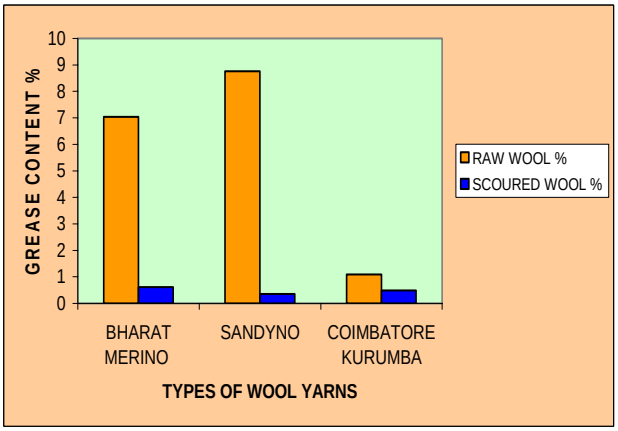

Fig. 8: GREASE CONTENT PER CENTAGE

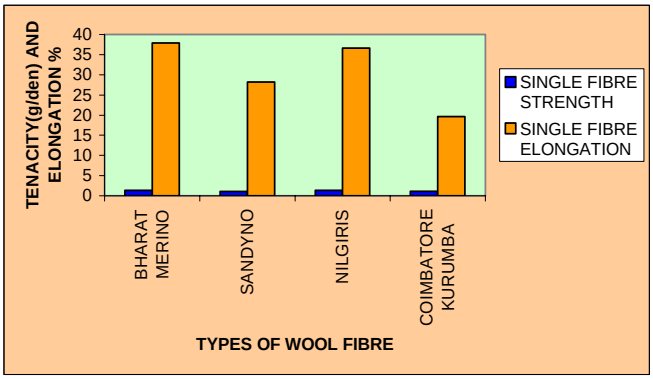

Fig. 9: SINGLE FIBRE STRENGTH AND ELONGATION

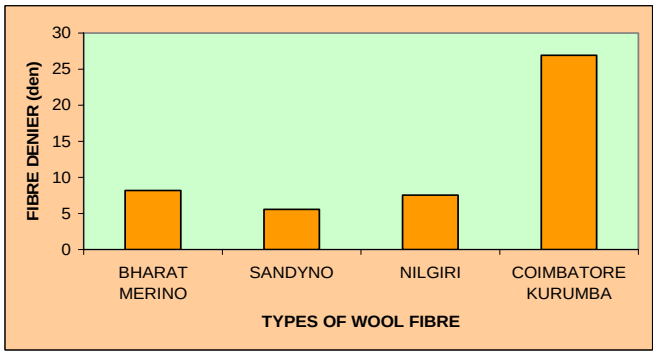

Fig. 10: FIBRE DENIER

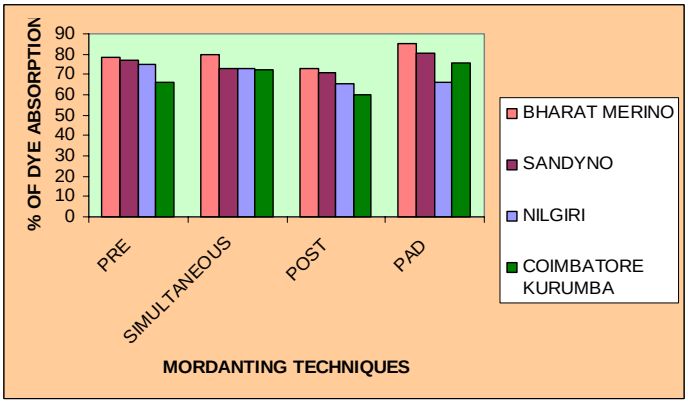

Fig. 11: PER CENTAGE OF DYE ABSORPTION

Wool is one of the most commonly used natural textile fibres with outstanding aesthetic appeal and functional properties in textile and apparel products. Wool quality parameters like scouring yield, grease content percentage and medullation percentage plays a very important role in dyeability of wool fibres. The higher the grease content and medullation, the less is the intake of dye to the fibre. The distinctive physical characteristics of wool fibre plays a significant role in dye uptake, light weight, durable, comfortable hand feel and also superior fire and thermal resistance. Wool is therefore very suitable for producing fine apparel products and home textiles.

References

- Broadbent.D.A (2001), Basic Principles of Textile Colouration, Society of Dyers and Colourists, P.64
- Dagur.R.S (1996), Laboratory Scouring Yield, Advances in Wool Blending, Special Training Course on Wool and Woolen Projects Development and Evaluation, 11th September – 10th October, Organized by Human Resources Development Section, Central Sheep and Wool Research Institute, Avikanagar, Rajasthan. Pp.8-10.
- Jefferson.S (2005), Know All About Clothing Technology, Abhishek Publications, New Delhi, P.123
- Parthasarathy.S (1996), Physical Properties of Wool, Special Training Course on Wool and Woolen Projects Development and Evaluation, 11th September – 10th October, Organized by Human Resources Development Section, Central Sheep and Wool Research Institute, Avikanagar, Rajasthan. P. 45.
- Surya.A.K. (1996), Physical Evaluation of Wool Parameters, Special Training Course on Wool and Woolen Projects Development and Evaluation, 11th September – 10th October, Organized by Human Resources Development Section, Central Sheep and Wool Research Institute, Avikanagar, Rajasthan. P.1.

- Swerev.M, Elsner.P, Hatch.K and Wigger.W (2003), What Dermatologists Should Know About Textiles, Current Problems in Dermatology, Textiles and the Skin, Karger, Sydney, Vol.31, Pp. 2, 3, 12, 13.
- Basu. G (2005), An Overview On the Influence of Fibre Characteristics On its Processibility and Yarn Characteristics with Special References to Jute, Man Made Textiles in India, August, Vol.XLVIII, No.8, SASMIRA Publications, Mumbai, P. 315.
- Rawat.S and Goel.A (2002), Physical Properties of Wool Fibres from Uttaranchal State, Man Made Textiles in India, Vol.XLV, No.2, SASMIRA Publications, Mumbai, Pp. 68,69.
- Shakyawar.D.B, Gupta.N.P, Pokharna.A.K and Dagur.R.S (2001), Influence of Wool Fibre Characteristics on its Price, Journal of the Textile Association, November – December, Vol.62, No. 4, The Textile Association, K.P. Publishers, Mumbai, P.136.
- Verma.N and Sharma.S.K (1996), Structure and Properties of Wool, Inside Wool Fibre, The Indian Textile Journal, August, Vol.CVI, No.11, A Business Press Publications, Mumbai, Pp. 38,39.