DETAILED STUDY ON IMPACT OF AGEING USING VACUUMIZED STEAMED ON YARN QUALITY

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Abstract

Textile market is becoming sensitive buyer's market. Weaver is demanding dimensioned quality with consistency from spinners. The retention of the quality of the yarn after manufacturing process especially strength is a difficult task in the subcontinent climatic conditions .The strength loss during the storage period have to be studied to bring out the importance of maintaining the ambient conditions in the packing department and also to minimize the storage period. Moisture plays a significant role in retaining the strength and several properties of the yarn . The moisture in the textile material particularly yarn will enhance its wearability which improves productivity as well as quality. The loss of moisture due to improper up keeping of ambient conditions in the packing and storage departments will detoriate the yarn quality especially strength and hairiness . The yarn conditioning is a vital process which will enhance the weavabilty and knitability by improving the several properties of yarn. The conditioning variables in the yarn conditioning process such as time and temperature will influence the quality and energy consumption .The exact setting of the time and temperature will help to achieve the optimum quality as well as economical energy usage. The ageing of yarn, conditioning variables (Time, Temperature) and their interaction will have significant influence on the yarn quality. A brief study is needed to analyze the trend of quality change . There is a lack of research in the yarn conditioning process with refer to conditioning variables and their interaction on yarn quality. And also the behavior of conditioned yarn conditioned with different time and temperature for a period of time also not studied till now. This work gives a detailed research study about the behavior of conditioned yarn with different time and temperature for different storage periods. The quality parameters such as strength, unevenness, imperfections, color are studied.

Key words*: Ageing , Conditioning, Ageing quality , Vacuumized Steamed Yarn,Yarn Quality , Moisture in Textiles , Saturated Steam , Storage Period*

INTRODUCTION

Moisture in atmosphere has great effect on physical properties of textile fibers and yarns. The amount of moisture in a sample of textile material may be expressed in terms of moisture regain or moisture content. Textile fibers are subjected to various physical operations to make in to a yarn. For example cotton fiber passes through opening, carding, drawing and spinning to become a yarn. During these phases the original moisture content on the fiber would have been lost and some static electricity would be carried by the fiber.

The storage period i.e ageing of yarn will results certain amount of moisture loss in the yarn. The yarn which lacks sufficient amount of moisture creates huge end breakages and dust liberation in the subsequent process. The moisture present in the fibers helps to create lateral binding forces among the fibers which enhance the strength slightly.

Most of the spinning mills do not have humidification system in the packing department as well as yarn Godown. When the storage period exceeds over a period of week particularly in the hot climatic conditions, then the moisture loss is tremendous over a period of time which deteriorate the yarn quality to some extent. We need an extensive research about the influence of ageing of yarn on its quality. The aim of yarn conditioning is to provide an economical device for supplying the necessary moisture in a short time, in order to achieve a lasting improvement in

quality. The Cotton fiber is hygroscopic material and has the ability to absorb water in the form of steam. It is quite evident that the hygroscopic property of cotton fibers depends on the relative humidity. The increase in the relative atmospheric humidity causes a rise in the moisture content of the cotton fiber. The fiber strength and elasticity increase proportionately with the increase in humidity. If the water content of the cotton fiber is increased the fiber is able to swell, resulting in increased fiber to fiber friction in the twisted yarn structure.

The proper utilization of the conditioning variables such as time and temperature helps to achieve optimized quality with minimum energy consumption. The optimum time and temperature for various end use applications such as warp, weft and hosiery is very important to achieve the optimum results in terms of quality and energy. The improper conditioning time and temperature sometimes deteriorates the yarn quality parameters such as strength, color, hairiness and unevenness. The correct usage of conditioning variables facilitates positive quality results.

There is a lack of research in the yarn conditioning process with refer to conditioning variables and their interaction on yarn quality. And also the behavior of conditioned yarn conditioned with different time and temperature for a period of time also not studied till now. This research work gives a detailed study about the behavior of yarn conditioned with different time and temperature for different storage periods. The quality parameters such as strength, unevenness, imperfections, color are studied.

2. MATERIALS AND METHODS

The following materials (Table 1) are used for studying the behavior of yarn conditioned with different time and temperature for different storage periods

Table 1 TYPE OF YARN USED

S.No	Count details of yarn	Details
1	30^{S} Carded (Warp).	Ring Spun yarn
2	40^{s} Combed (Hosiery).	
3	40^{S} Combed (Warp).	
4	40^{S} Combed (Compact Warp).	
5	80^{S} Carded (Warp).	
6	$2/80^{S}$ S Carded (Warp).	Ring spun/Ring doubler
	20^{S} Carded Yarn	OE yarn

The conditioning technical specifications of the conditioning machine used for conditioning the yarn is given in the Table 2

Table 2 Technical Specifications of yarn conditioning machine

SI NO	PARAMETER	VALUE
01	Volume	1395 liters
02	Transport weight	900 kgs
03	Operating width	2265 kgs
04	Heating flange	120 kgs
05	Feed water connection	Max 95^{0} C
06	Total hardness	Less than 20 PPM
07	Max pressure	-1/1 bar
08	Max temperature	120^{0}c
09	Compressed air pressure	6 bar
10	Heating capacity	6 x 36 KW,4400 V / 50 Hz

Details the experimental methods are given in the table 3

Table 3 Experimental methods

Yarn type	Yarn	Ageing	Quality evaluation tests &	Testing Standards

	conditioning process	frequency	analysis	
30 S carded warp 40 S combed warp 40 S combed hosiery 40 S combed warp (compact) 80 S carded warp 2/80 S carded warp 20 S rotor spun yarn	50C & 40 MINS 58 C & 25 MINS 70 C & 20 MINS	1,7,15,30 days	1.Count C.V % of yarn 2. Strength C.V % of yarn 3.CSP	ASTM D6612 - 00(2006)
			4.RKM	ASTM D1578 – 93
			5.Moisture content of the yarn	CHECK LINE (TEM-1) METER
			6.Unevenness % 7.Neps + 200% 8.Thick + 50 % 9.Thin - 50 % 10.Total imperfections	(ASTM D1425 / D1425M – 09
			11.Hairiness	ASTM D-5467-07
			12.Color assessment	AATCC 173:2004

3. RESULTS

3.1 INFLUENCE OF AGEING ON MOISTURE CONTENT % IN THE YARN

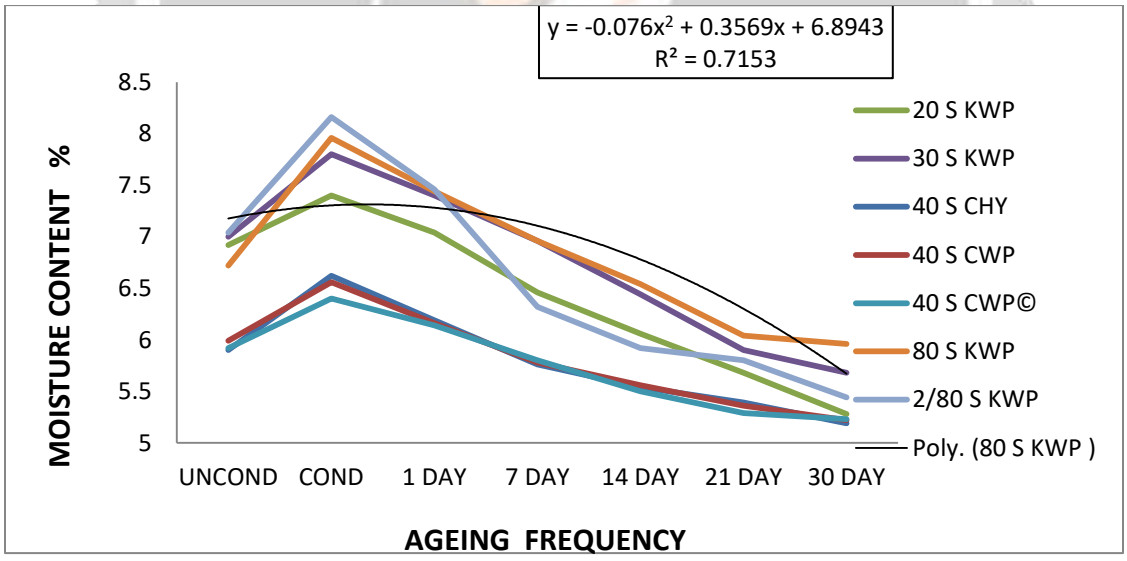

Fig Fig 3.1 Influence of Ageing on Moisture content % in the Yarn

The loss of moisture content % is higher during the initial 7 day period immediately after conditioning process. The loss of moisture content % is in a slower trend after 7 day to 30 day period.This shows the yarn reaches equilibrium stage mostly in 30 days period and there is significantly little amount of moisture content % loss after 30 days .The conditioned and unconditioned yarn similar pattern for various types of yarn .The moisture content of unconditioned yarn of all counts are 0.5-1.0% lower compared to conditioned yarn. The conditioning process constantly increasing moisture content of about 0.5-1.0% irrespective of count and end use application. The loss of moisture content % immediately after 1 day found that 0.2 -0.5% in all samples.The moisture content % is

constantly getting decreased after 7,14,21,30 days. but there is only 0.5 -1.2 %loss of moisture from 7 th day to 30 th day was observed in all samples .

3.2 INFLUENCE OF AGEING ON COUNT C.V % IN THE YARN.

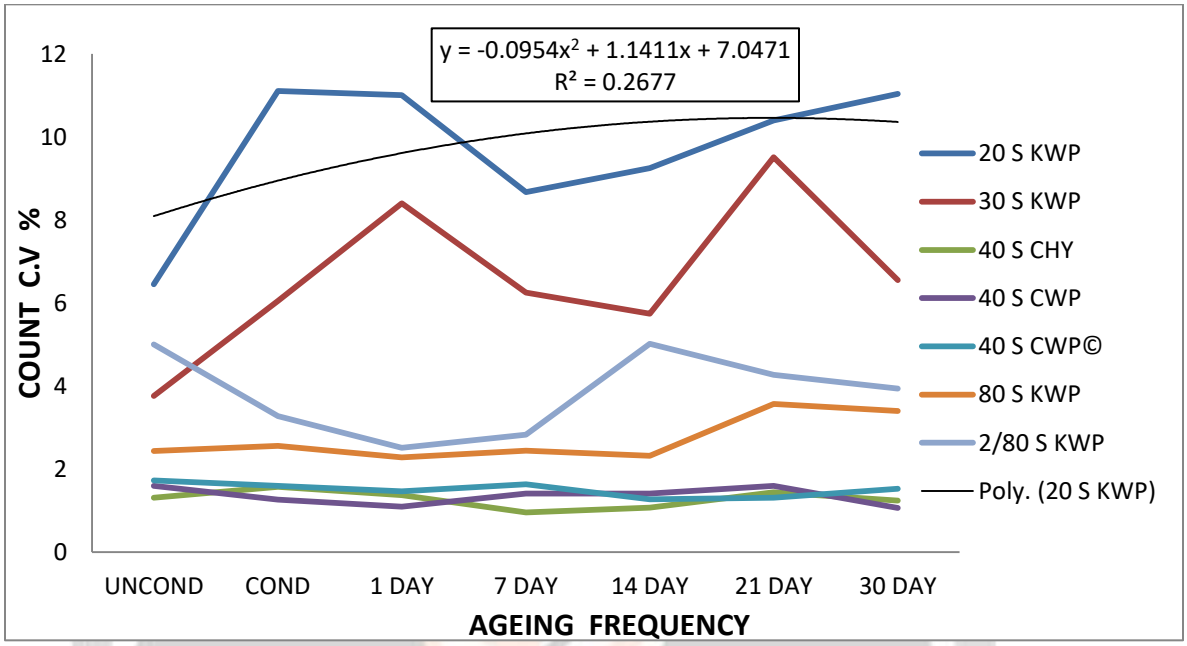

Fig 3.2 Influence of Ageing on Count C.V % in the Yarn.

The yarn conditioning process significantly influences the count C.V % irrespective of all count and process. The reason for change in count C.V % after conditioning process as well as during ageing may be due to absorption and desorption of moisture will in turn alter the count depends on moisture absorption throughout the yarn.

3.3. INFLUENCE OF AGEING ON STRENGTH C.V % IN THE YARN.

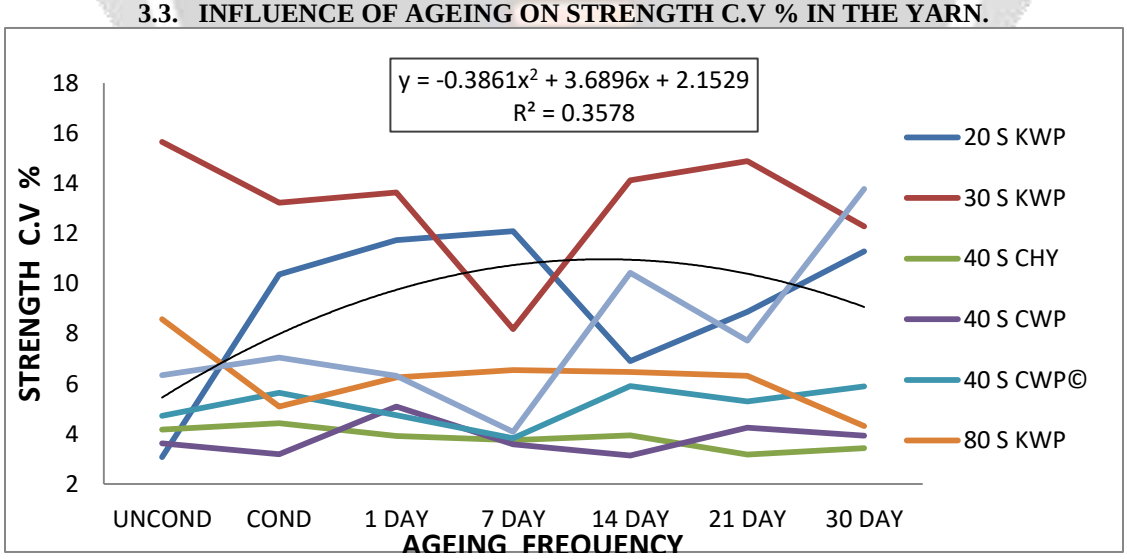

Fig 3.3 Influence of Ageing on strength C.V % in the Yarn

Strength C.V % of carded warp shows tremendous change after conditioning and during the storage period. This may be due to improper absorption and desorption of moisture from core to sheath of the yarn because of high twist. Strength C.V % of combed process in turn shows slight fluctuations may be due to better orientation and absence of short fibers.

3.4 INFLUENCE OF AGEING ON UNEVENNESS % IN THE YARN.

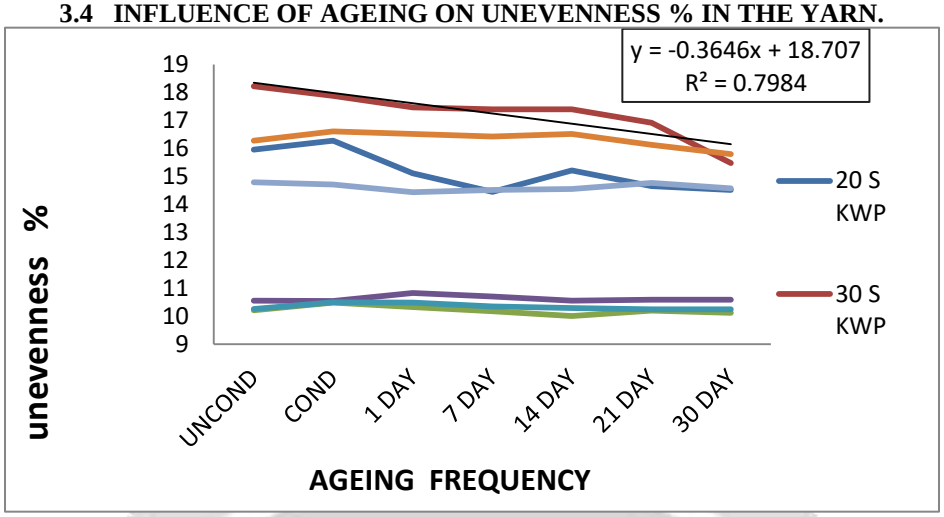

Fig 3.4 Influence of Ageing on Unevenness % in the yarn

Absorption and desorption of moisture in the yarn leads to variations in the yarn diameter which in turn unevenness also. The changes in unevenness found both increasing and decreasing patterns. The changes in unevenness observed until the 30 day storage period.

4. INTERACTION EFFECT OF TEMPERATURE AND AGEING PERIOD ON YARN QUALITY.

1.1 INFLUENCE OF AGEING ON MOISTURE CONTENT % IN THE YARN WITH RESPECT TO TEMPERATURE.

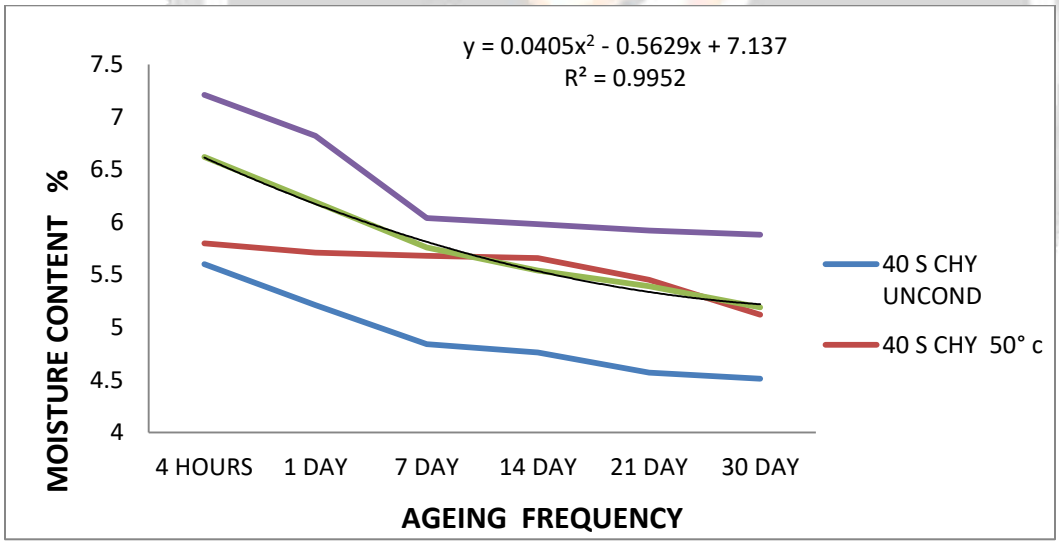

Fig 4.1 Influence of Ageing on Moisture content % in the Yarn.

Moisture loss is commonly observed in all the samples during ageing. 40 ^{s} CHY conditioned with 50 ^{0} C shows 8.5 % decrease in moisture content for a period of 30 days . 40 ^{s} CHY conditioned with 58 ^{0} C shows 18 % decrease in moisture content for a period of 30 days shows 16 % decrease in moisture content over a period of 30 days. The study shows 40 ^{s} CHY conditioned with 50 ^{0} C have good result in terms of moisture loss and also conditioning in 50 ^{0} C is economical compared to 58 ^{0} C and 70 ^{0} C.

4.2 INFLUENCE OF AGEING ON COUNT C.V % IN THE YARN WITH RESPECT TO TEMPERATURE.

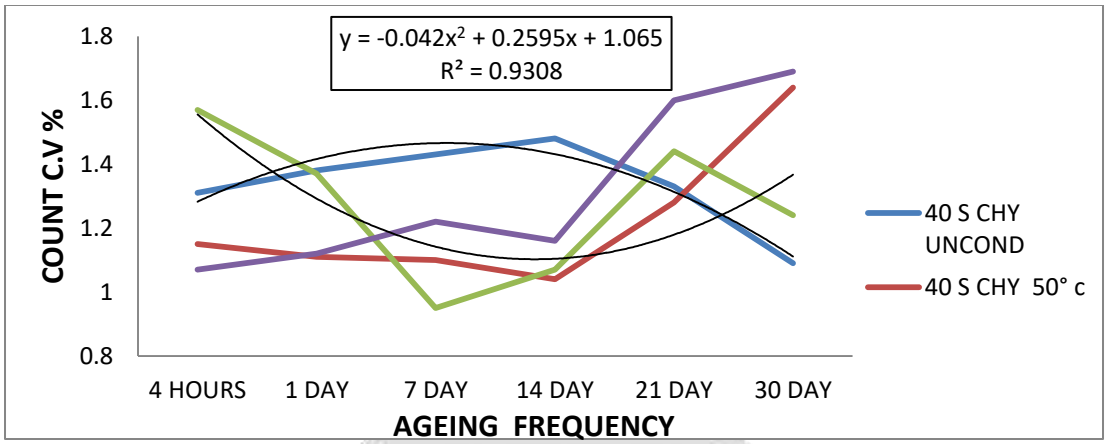

Fig 4.2 Influence of Ageing on Count C.V % in the yarn

Count C.V % of all the process showing tremendous fluctuations over a period of time. Unconditioned yarn shows increase in C.V % up to 14 days and the C.V% drops down after that gradually. Conditioned yarn with different temperatures showing different patterns.

4.3 INFLUENCE OF AGEING ON STRENGTH PROPERTIES IN THE YARN WITH RESPECT TO TEMPERATURE.

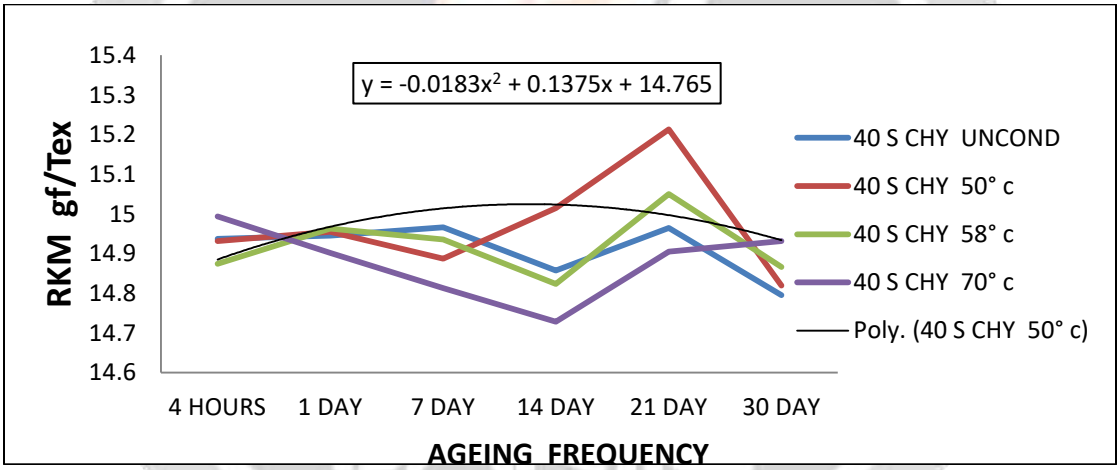

Fig 4.3 Influence of Ageing on RKM value in the yarn

RKM value of 40 ^{s} CHY conditioned at 70 ^{0} C following downward trend up to 14 days and rising afterwards .This may be due to high temperature results moisture desorption. Unconditioned yarn 40 ^{s} CHY with 50 ^{0} C and 58 ^{0} C showing in significant changes in RKM value up to 7 days gradually rising afterwards may be due to change of moisture becomes rapid .

4.4 INFLUENCE OF AGEING ON UNEVENNESS PROPERTIES IN THE YARN WITH RESPECT TO TEMPERATURE.

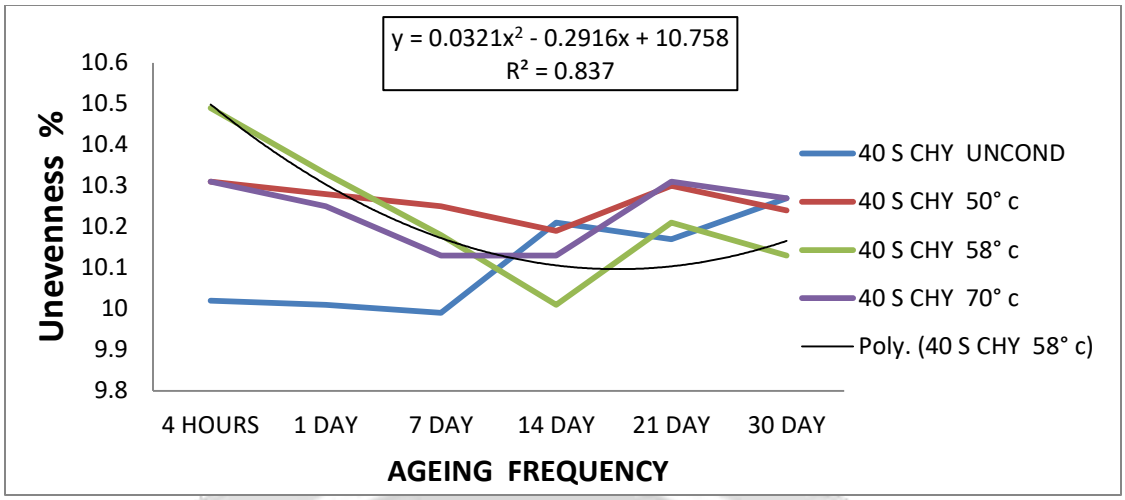

Fig 4.4 Influence of Ageing on Unevenness % in the yarn

Unevenness U % of yarn 40 ^{s} CHY (50 ^{0} C) getting rapidly decreasing up to 14 days and rising afterwards .Unevenness U% of yarns 40 ^{s} CHY (58 ^{0} C and 70 ^{0} C) showing insignificant changes.

5. INFLUENCE OF AGEING ON HAIRINESS IN THE YARN.

Table 4 Influence of Ageing on Hairiness in the Yarn.

PARAMETER	40 s CHY UNCONDITIONED	40 s CHY CONDITIONED (15 DAYS AGED)	40 s CHY CONDITIONED (30 DAYS AGED)
S3	1907	2249	1723
Hairiness Index (HI)	211	249	160
Hairiness C.V %	8.81	24.57	25.95

Hairiness of conditioned yarn after 15 days found increased by about 15 %. S3 of the same yarn after 15 days found increased by about 20 % when compared to unconditioned yarn. Hairiness of conditioned yarn after 30 days found decreased by about 10 %. S3 Value getting drop by about 20 % when compared to unconditioned yarn.

6. INFLUENCE OF AGEING ON COLOR IN THE YARN

Table 5 Influence of Ageing on Color in the Yarn

Standard Name	L*	a*	b*	C*	hº		
40s cbd hsy	80.11	16.40	47.65	50.39	71.00		
Trial Name	DL *	Da *	Db*	DC*	DH *	DEcmc	P/F DEcmc
15 days cbd hy (COND)	-0.26D	0.31 R	-0.20B	-0.08D	-0.35R	0.31	Passed
30 days cbd hy (COND)	0.45 L	-0.39 G	-0.96B	-1.04D	0.06G	0.44	Passed

The color of the conditioned yarn after 15 days and 30 days time period found no significant change when compared to unconditioned yarn.

7. CONCLUSION

The yarn conditioning process significantly influences the Count C.V % irrespective of all count and process. The reason for change in Count C.V % after conditioning process as well as during ageing may be due to absorption and desorption of moisture will in turn alter the count depends on moisture absorption throughout the yarn.

Strength C.V % of carded warp shows tremendous change after conditioning and during the storage period. This may be due to improper absorption and desorption of moisture from core to sheath of the yarn because of high twist .Strength C.V % of combed process in turn shows slight fluctuations may be due to better orientation and absence of short fibers.

The trend is of similar pattern is observed in all counts that increase after conditioning imperfections rises and lowered during storage period. Combed yarns shows significant change in imperfections level after conditioning and during ageing.

In the interaction effect Imperfections level is getting decreased immediately after the process up to 14 days ageing period .After 14 days, imperfections level get slightly raise.

The color of the conditioned yarn after 15 days and 30 days time period found no significant change when compared to unconditioned yarn.

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