Variation of Knit Dyed Fabric Quality on Different Percentage of Silicon Softener

[1]Md. Shahidul Islam, [2]Md. Mofizur Rahman Sazal, [2]Md. Mazedul Islam Ripon

Abstract— This research was carried out to observe the effect of knit dyed fabric quality on different silicon softener percentage. Three different percentage of silicon softener was applied on the single jersy lacoste medium shade in the padder of the squeezer machine. Then fabric is dried in the dryer and stentoring accordingly. Finally spirality, Shrinkage and bursting strength test was done for each sample. It has been observed that spirality, shrinkage and bursting strength is increased with the increasing percentage of silicon. Beside this fastness result of the fabric was also observed. Though fastness of the fabric not varies much, but the increasing rate of rubbing fastness was noticeable. Final shade has been observed and compared in the spectophometer. It has been found that the shade become reddish and less saturated with the increasing rate of silicon softener.

Index Terms— Silicon softener, knit dyed fabric, Spirality, Shrinkage, Bursting strength, l* a* b* value, Wash fastness, rubbing fastness

1 INTRODUCTION

Cotton is most widely used fabric in Bangladesh. This fabric is subjected to various chemical and physical finishing during its entire process. Softening is one of the important finishing processes which can be done at the last stage of dyeing or after dyeing finishing. Fabric softener is a substance that is used at some point during the process that is designated to impart or restore softness to a fabric and which may alter other physical properties too. A lubricant can be defined as a substance having the ability to make the fabric surface slippery and reduce its friction(1).Fabric softening is also important to remedy problem like stiffness, harshness and other unwanted laundering effect in the fabric(2).Technically, there are three types of fabric softeners(3) .and these are : (4)

Non-ionic softeners
Anionic softeners
Cationic softeners

On the consumer-level, fabric softeners are labeled by when used in the laundering process—wash-cycle, rinse-cycle, or drying phase. Sollenberger (5) classified the agents as substantive or no substantive depending upon their reactions to fiber molecules. Despite having lot of positive effect on the fabric softener has some adverse effect too. It may cause yellowing, staining, and reduce absorbency to the fabric.(6) Beside this strength , spirality and shrinkage properties also can be altered by softening. We need more study and experiment to draw a conclusion for these physical properties. But fastness of the fabric is improved after using softener on the fabric (7).

There is another type of softener called silicon softener; these are generally polysiloxane derivatives of low molecular weight. They consists long linear chain with alternate silicon and oxygen atoms. Usually, two organic groups such as methyl groups are attached to each silicon atom. This can better described as polysiloxane chain lies flat on the fabric surface and produces a soft handle. Besides the soft handle they improve other physical properties such as strength, abrasion and creases as well. They are insoluble in water, and therefore must be applied on fabrics after dissolution in organic solvents, or in the form of disperse products. They feature quite good fastness to washing. They create a lubricating and moderately waterproof film on the surface and give fabrics a velvety silky hand. (4)

Though the application of silicon softener is basically improving the handle, drape and sewing properties. (8.) But this work is aimed to investigate the effect of cotton fabric on different percentage of silicon softener. After applying different percentage of softener we will find the value of fastness, spirality and shrinkage of the fabric. And we also observe the shade in spectrophotometer for any changes.

2. MATERIALS AND METHOD:

2.1Raw materials:

In this project we use single jersey lacoste fabrics made from 100% cotton carded yarn. Remazol reactive dye used for dyeing. Enzyme was done after dyeing. Fabric is scoured and bleached at 100 degree with 0.5% soda ash and 0.7% peroxide for 30 minutes. After completion of dyeing, neutralization and cationic softener is applied in the dye bath.

2.2 Fabrics treatment:

In this research first of all we have taken single jersey lacoste fabric. First of all we scoured and bleached this fabric at 100 degree temperature for 30 minutes with 0.5% Soda ash and 0.7% Hydrogen peroxide and some other necessary auxiliaries.

- *[1]Md. Shahidul Islam, Lecturer, Department of Textile Engineering, Southeast University*
- *[2]Md. Mofizur Rahman Sazal & [2]Md. Mazedul Islam Ripon ,Textile Graduate, Southeast University*

After that, dyeing is done at the temperature of 60 degree with above mentioned dyes. After dyeing fabric is neutralized and cationic softener is applied to complete the dyeing process. Here enzyme was applied after dyeing and before softening.

2.3Softner Application:

We used 1%, 4% and 0% silicon in this knit dyed fabric. We used this silicon in squeezing machine. After squeezing, fabric is dried in the drier machine. Then we have tested the fabric according to following methods for our experiment

Spirality test: Spirality test is done in ISO 6330 method where sample size was 30x30 cm. We use sodium perborate tetra hydrate and detergent in a machine to wash the fabric at 50 degree temperature for one hour.

Shrinkage test: Shrinkage test was done in ISO 6330 method with 30x30 cm sample. Here we also used sodium perborate tetra hydrate and detergent in a washing machine and wash the fabric at 50 degree temperature for one hour.

Color fastness to wash: Wash fastness test is done in ISO 105:C06. We took 10x4 cm sample for this test. We use sodium perborate tetra hydrate and detergent and some still ball for this test. We wash the sample with multifiber in a washing machine at 60 degree temperature for 30 minutes.

Color fastness to rubbing: We use ISO 105x 12 methods for rubbing fastness test. We took 14x 5 cm fabric sample and 5x5 cm rubbing fabric for this test. Then we rub the fabric in rubbing crocking master machine 10 times both dry and wet condition.

Bursting strength test: We use ISO 13938-2-199 method for bursting strength test. This standard describes a pneumatic pressure method for the determination of bursting strength.

3 RESULT AND DISCUSSION

Spirality:

Spirality can be defined as a fabric condition resulting when the knitted wales and courses are angularly displaced from that ideal perpendicular angle.

Table 1: Spirality percentage on different percentage of silicon softener

Silicon softener percentage	Spirality Percentage
0% silicon	0%
1% silicon	0.7%
4% silicon	0.75%

Spirality arises due to the distortion of single jersy knitted fabric. Silicon can be worked as water repellent elastomeric finishes and coatings. So it will not allow fabric to distort. Thus spirality should reduce with the increasing rate of silicon softener.

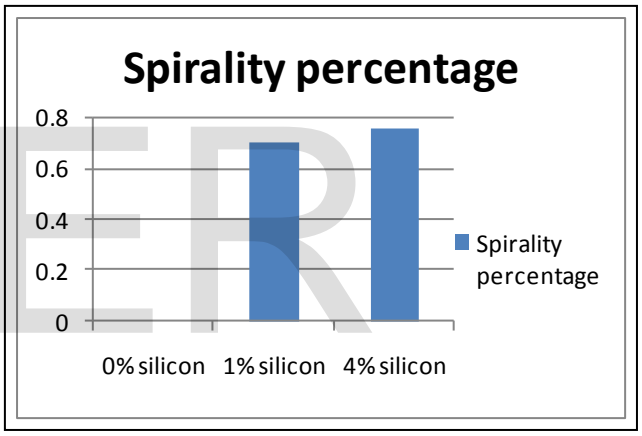

Fig 1: Spirality percentage on different Percentage of silicon softener

From table 1 we see that spirality is 0% when we use no silicon and spirality is maximum at 4% silicon softener. So it can be said that spirality is increasing with the increasing rate of silicon softener

Shrinkage:

Table 2: Results of Shrinkage test

Serial no	Length wise	Width wise
0% silicon	3.3%	0%
1% silicon	2.3%	0%
4% silicon	1.6%	3.3%

Shrinkage of cotton fabrics is primarily caused due to their ability to absorb moisture because of the presence of hydroxyl groups in the cellulose. As softener imparts water absorbency of it can reduce shrinkage as well. There is no width wise

shrinkage in 0% silicon and 1% silicon, but when we use 4% silicon softener we found both length and width wise shrinkage. Length wise shrinkage is reduced with the increasing rate of silicon percentage.

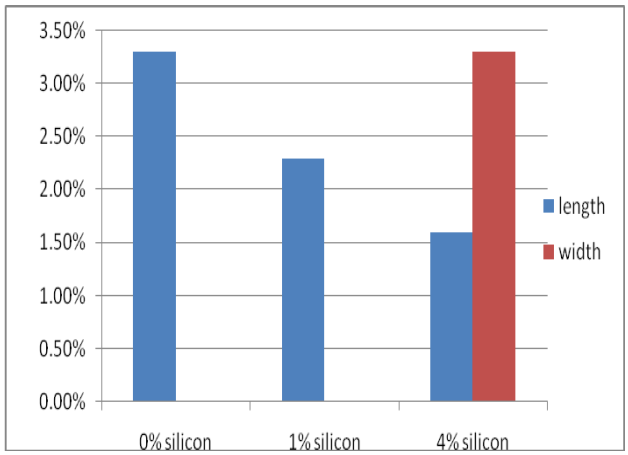

Fig 2: Length and width wise shrinkage on different softening percentage

Rubbing Fastness:

Table: 3: Results of Rubbing Fastness test

Serial no	Dry rub	Wet rub
0% silicon	4-5	1
1% silicon	3-4	2
4% silicon	4	3

Rubbing fastness is another important characteristic of fabric. Softener creates a coating in the fabric so it has some positive effect in fastness. Dry rubbing fastness is best at 0% silicon softening. But in the case of wet rubbing we see the opposite result. Here rubbing fastness is increased with the increasing rate of silicon softener.

Color fastness to wash:

Table: 4: Results of color fastness to wash with multifiber on different silicon percentage

Serial no	acetate	cotton	nylon	polyester	acrylic	wool
0% silicon	4-5	3	5	4-5	5	4-5
1% silicon	4-5	4	4-5	4-5	4-5	4-5
4% silicon	4-5	4-5	4-5	4-5	4-5	4-5

Here in table 4 we can see the color fastness to wash result with multifiber. Wash fastness result is very good for all percentage of silicon with all the fabric of multifiber except cotton. We can see cotton fabric fastness is increasing with the higher percentage of silicon softener. When there is no silicon softener used, we get average fastness result. But fastness becomes excellent when we use 4% silicon softener.

Bursting strength:

Table: 5: Bursting strength (kilo Pascal) on different Silicon softening percentage

Softener Percentage	Bursting Strength (kilo pascal)
0% silicon	340
1% silicon	346
4% silicon	354

Bursting strength is another important properties for cotton fabric. From the table 5 we can see bursting strength is increasing with the increasing rate of silicon softening. So it can be said that strength is increasing when we use more silicon in the fabric.

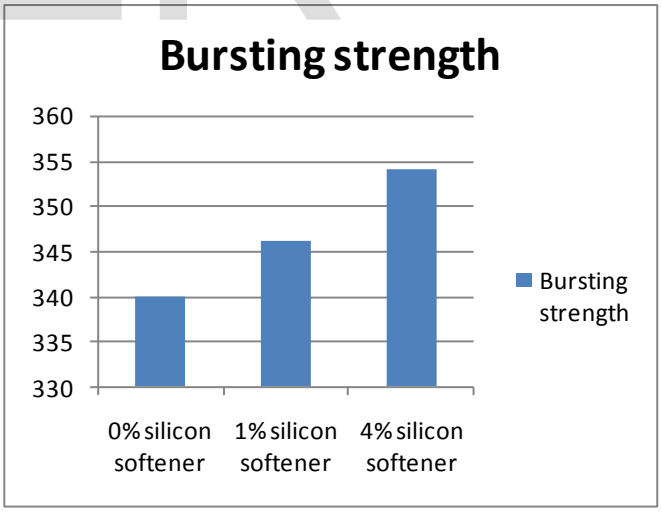

Fig-3: Bursting strength (kilo Pascal) on different silicon softening percentag

Spectrophotometer test:

Applying softener can make fabric yellowish and reddish. From the spectrophotometer we find the same findings. We take 1% silicon wash fabrics as standard

Table 6: l* a* b* value of 0% silicon finished fabric and 4% silicon finished fabric comparing with 1% silicon finished fabric as standard.

Serial no	Dl*	Da*	Db*	Dc*	Dh*
0% silicon washed fabrics Result according to 1% silicon washed fabrics	-0.29	0.48	-0.17	-0.48	-0.18
4% silicon washed fabrics Result according to 1% silicon washed fabrics	-0.82	0.44	0.10	-0.43	0.12

We can see 0% silicon finish fabric is darker, saturated and greenish comparing with 1% silicon finish fabrics, and again 4% silicon finish fabric is less dark, less saturated and reddish comparing with 1% silicon finished fabrics. So we can say that the more silicon we use the batch become more reddish and less saturated eventually.

4. CONCLUSION:

Silicon softening is an important task in fabric processing. Though most of the times cationic or anionic softener is usually applied in the dyeing machine after dyeing and neutralization, but additionally some silicon softener is also applied in the squeezing padder and stentoring padder for further softness. It reduces the roughness and ensures good sewing ability for garments manufacturing. Here we have found less spirality and shrinkage and more bursting strength at higher softener percentage. Fastness of the fabric has also been improved by using more silicon softener. Though we found some interesting result by using softener but further research is required to draw any conclusion on this.

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