Faculty of Engineering
Department of Textile Engineering

“A comparative study of color strength and color fastness among different cellulosic fabrics”

Course code: TE-4214 Course Title: Project (Thesis)

Submitted By

Md.Salauddin Anik
ID: 151-23-4143

Shuvo Biswas
ID: 151-23-4192

Supervised by:

Ms. Nawshin Farzana
Senior Lecturer
Department Of Textile Engineering
Daffodil International University

This thesis submitted in partial fulfillment of the requirements for the degree of
Bachelor of Science in Textile Engineering
Advance in Wet Processing Technology

Fall-2018

DECLARATION

We hereby declare that, this internship has been done by us under the supervision of **Ms. Nawshin Farzana,** Senior Lecturer, Department of Textile Engineering, Faculty of Engineering, Daffodil International University. We also declare that, neither this report nor any part of this has been submitted elsewhere for award of any degree or diploma.

Md.Salauddin Anik
ID: 151-23-4143
Department of TE
Daffodil International University

Shuvo Biswas
ID: 151-23-4192
Department of TE
Daffodil International University

LETTER OF APPROVAL

This project report prepared by Md. Salauddin Anik (ID: 151-23-4143), Shuvo Biswas (ID: 151-23-4192) is approved in Partial Fulfillment of the Requirement for the Degree of BACHELOR OF SCIENCE IN TEXTILE ENGINEERING. The said students have completed their project work entitled **"A comparative study of color strength and color fastness among different cellulosic fabrics"** under my supervision. During the research period I found them sincere, hardworking and enthusiastic.

Ms. Nawshin Farzana

Senior lecturer

Department of textile engineering

Faculty of Engineering

Daffodil international university

ABSTRACT

Reactive dyes are very popular for cellulosic fiber because they are environmentally safe and having well overall fastness properties. The application of those dyes necessary in a very high intentness of salt. The salt released from fiber dyeing rising salinity in flow-out water stream which has a negatory influence on environmental ecology. Here we have done reactive dye 1% shade blue color in 100% cotton, 100% viscose & 50/50 cotton/viscose blend fabric in exhaust dyeing method. After getting our desired shade & color we checked 3 sample color strength value by spectrophotometer. After the checking of color strength value, we calculated this value in kubelka monk theory & got color strength is better for 100% viscose than 100% cotton & 50/50 cotton viscose fabric. Then we have done color fastness test 3 of sample. Color fastness to rubbing, color fastness to wash, color fastness to water & colr fastnes to perspiration. Here we got, color fastness to rubbing of 100% cotton is better than 100% viscose & 50/50 cotton/viscose fabric. Color fastness to water is better for 100% viscose than 100% cotton & 50/50 cotton/viscose. Color fastness to washing is better for 100% cotton & color fastness to perspiration (acid medium) result is better for 100% viscose & color fastness to perspiration (alkali medium) result 100% cotton is better.

Acknowledgement

All delight goes to Almighty Allah who has given us the capacity and solidarity to finish our Industrial Attachment.

Ms.Nawshin Farzana our scholarly administrator, to whom we are to a great degree grateful for her huge help and direction all through our proposal report. Being working with her we have earned significant information as well as enlivened by her inventiveness witch advanced our experience all things considered. Her ides and method for working was really astounding. We trust this report couldn't be done on the off chance that she didn't help us consistently.

We might want to say thanks to Professor **Dr.Mahabubul Haque**, Head, Department to of material designing, Daffodil International University, for his appropriate administration and taking important methodology about proposal report.

Our most profound gratefulness goes to **Mr.Shohag** the delegate chief Of **Epyllion Group**, Rajendropur,Gazipur Dhaka, We are additionally especially appreciative to **Mr.Nazrul kabir** lab incharge; **Mrs Newton,**Assistant general Manager (Dyeing &Finishing); **Mr.Sumon ,**Senior Executive officer for giving true help in all organization and specialized issues while working in the business.

We would like to deliver thanks to our entire course mates in Daffodil International University, who took part in the discussion while completing the course work.

Finally, we would like to express a sense of gratitude to our beloved parents and friends for their mental support, strength and assistance throughout writing the project report.

Dedicated

To our Beloved

“Parents”

TABLE OF CONTENTS

List of Figure

LIST OF TABLES

CHAPTER -1

INTRODUCTION

1.1 INTRODUCTION:

Cotton is a delicate, fleecy staple fiber that develops in a boll, or defensive case, around the seeds of cotton plants of the class Gossypium. The fiber is relatively unadulterated cellulose. Under normal conditions, the cotton bolls will in general increment the scattering of the seeds. The plant is a bush local to tropical and subtropical districts the world over, including the Americas, Africa, and India. The best assorted variety of wild cotton species is found in Mexico, trailed by Australia and Africa. Cotton was autonomously trained in the Old and New Worlds..Cotton alluded to as the "Ruler of filaments" is most critical material fiber on the planet. Cotton is a vegetable fiber which encompasses the seeds of the cotton plant. Cotton has been developed for over 5000 years. Cotton plant has a place with the family "GOSSYPIUM".

The cotton fiber is comprised of innumerable cellulose molecules.Cotton is expelled mechanically from the seed bolls by the cotton ginning.The ginned cotton is then squeezed into parcels and sent to the production lines to be spun into yarns.The cotton filaments utilized in material business are the dried cell dividers of some time ago living cells. Organically, cotton strands are trichomes or seed coat hairs that separate from epidermal cells of the creating cottonseed. The cotton blossom sprouts just for one day and rapidly winds up senescent from that point. Upon the arrival of full blossom, or anthesis, the bloom petals are unadulterated white in most hirsutum assortments. Continuously after anthesis, the petals turn splendid pink in shading and, for the most part constantly day after anthesis, the petals tumble off the creating carpel (boll).

Types of Cotton There are four industrially developed types of cotton: Gossypium hirsutum – upland cotton, local to Central America, Mexico Gossypium barbadense – known as additional long staple cotton, local to tropical South America Gossypium arboreum – local to India and Pakistan Gossypium herbaceum – cotton, local to Southern AfricaCotton strands and textures, being characteristic cellulose polymers, are biodegradable under vigorous conditions. Autonomous lab results have likewise demonstrated that cotton is compostable. For the situation demonstrated as follows, 100% cotton wet wipe hydroentangled textures were tried for fertilizer capacity utilizing ASTM technique 6400. The test methodology calls for at any rate 90% weight reduction to comprise finish biodegradability.

Thick is a kind of rayon. Initially known as counterfeit silk, in the late nineteenth century, the expression "rayon" became effective in 1924. The name "viscose" got from the manner in which this fiber is fabricated; a thick natural fluid used to make both rayon and cellophane.

What this means in English? viscose is the summed up term for a recovered fabricated fiber, produced using cellulose, gotten by the thick procedure. As a produced recovered cellulose fiber, it is neither genuinely characteristic (like cotton, fleece or silk) nor really engineered (like nylon or polyester) – it falls some place in the middle. Thick is an ease texture, which is well known on account of its horde of characteristics. It tends to be found in cotton end utilizes, and in addition lavish

velvet's and taffeta's. Thick can likewise be found in ladylike. Cleanliness items, and in addition tire strings. Artificially, gooey takes after cotton, however it can likewise go up against various characteristics relying upon how it is fabricated. On the off chance that a fiber is produced, it is produced using cellulose or protein. Cellulose is a sugar and the main segment in the dividers of plants. There is a contrast among engineered and fabricated strands, which has any kind of effect in their maintainability. Gooey is produced using wood mash, making it a cellulosic fiber, similar to cotton or cloth. It is frequently viewed as just in part artificial. Made filaments get from normally happening cellulose, or protein, while engineered strands don't – they are totally synthetic. Things being what they are, in the event that they originated from a characteristic source, for what reason don't they fall under the "regular fiber" classification? Since they require broad preparing to get to the completed outcome. Thusly, the classification of fabricated filaments is regularly alluded to as "recovered cellulose."

Since viscose is produced using inexhaustible plants, it is as often as possible refered to as being earth benevolent, and economical. VISCOSE is the most seasoned fabricated fiber, first being delivered in 1883 as a shabby option in contrast to silk. Viscose generation by and large starts with wood mash, and there are a few compound and assembling systems to make it.To make thick, and make it confront customary wearing and washing, it must be artificially treated

The reused wood mash is treated with synthetics, for example, harsh soft drink, smelling salts, CH3)2CO, and sulphuric corrosive. We accordingly have a texture, which originates from a characteristic and maintainable source, yet that is made with synthetics. Since thick is produced using cellulose, there is a contention to state that it is a more economical fiber then other manufactured filaments, for example, polyester. Thick is progressively being fabricated utilizing the Lyocell procedure. This uses N-Methlymorpholine N-oxide as the dissolvable. This strategy creates minimal waste item, making it unmistakably more eco-accommodating. At the point when a texture isn't named as "common" at that point buyers can pass judgment on it brutally, with no obvious comprehension of the texture. Thick is likely the most misjudged

all things considered, artificial or normal. It's anything but a characteristic fiber, however nor is it manufactured.

Concerning the utilization of synthetic concoctions in the generation of Viscose, as texture innovation propels, numerous makers are attempting impressive and positive endeavors to guarantee clean creation. As we keep on taking a stab at a green-accommodating world, expanding work is being put into the maintainability of filaments, for example, gooey. Thick has numerous attractive characteristics, which makes it a great fiber to work with from various perspectives. On account of its one of a kind flexibility, numerous businesses utilize thick, from form, to the medicinal calling, to regular things in the home. There can be no uncertainty that thick is a famous texture. In any case, what makes it so famous? For a certain something, gooey is a generally minimal effort texture. In any case, that isn't the main motivation behind why it is so mainstream. Some portion of the achievement of gooey is gotten from the way that this texture has a wide range of characteristics. On account of its numerous characteristics, thick can be utilized blended with velvet, fabric and it cotton end utilized. In any case, gooey is additionally found in some cleanliness items.

Thick has numerous incredible qualities including its adaptability, its abnormal state of assimilation, its smoothness, its quality, its shading maintenance, its breathability, its daintiness, and its minimal effort. Viscose works extremely well with cotton due to the offer a comparative synthetic make-up. Be that as it may, varicose can have diverse characteristics from cotton as per how it is fabricated. The way to the utilizations, the characteristics, and the ubiquity of thick is standing out it is fabricated. Thick, more ordinarily known in the U.S. as Rayon, is a man-made fiber made from cellulose artificially removed from trees. It's somewhat weaker in quality than cotton, and in this way is regularly used to make fragile, lighter attire. Mix Fabric is attractive when a mix of attributes are required in a solitary texture. The expansion of elastane to cotton takes into consideration an enhanced measure of stretch similarly as the expansion of thick enables a material to be thermoset or granted with an irreversible wrap up

Despite the fact that it is a characteristic fiber and it is a cellulosic fiber with the goal that receptive color is most regularly use for cotton coloring. It is utilized to color extensive variety of shades like light shades to dull shades of cotton texture. In current practice, cellulosic filaments are dominatingly colored with receptive colors within the sight of a lot of salt and settled under antacid conditions. Be that as it may, color obsession effectiveness on cellulosic,

strands is commonly low (changing structure 50-90%). This, results in an exceedingly hued color emanating, which is negative on ecological grounds. Moreover, the high fixations (40-100g/1) of electrolyte and salt (5-20g/1) required in cellulose fiber coloring may represent extra gushing issues.

In this work, another fiber-alteration strategy on cationic acrylic copolymer. Pretreatment of cellulosic fiber with polymer is accepted to offer an open door for expanding both the substantively and reactivity of filaments towards receptive colors under nonpartisan conditions. The idea of a receptive polymer pitch is to such an extent that it might respond with nucleophilic sires in cellulosic strands or in the polymer itself, along these lines settling the polymer to the substrate. Amid resulting coloring, further responses between the polymer and the dyestuff, and the fiber and the dyestuff, and the fiber and the polymer and can be relied upon to occur, framing crosslink inside the strands. The retreating ground water levels, the high water contamination because of effluents from material preparing units and the extraordinary consciousness of the general population and law authorizing specialists, all assembled are the main thrust for discovering a genuine minimal effort.[2 ,3, 4]

Chapter-2

Literature Review

Author Hossen M[1] already worked with cotton fabric with reactive dye of .5%, 1% & 1.5% solution. The aim of his work was observed the effect of dyed sample when he dyed the 3 Fabric in the same solution. One thing he deliberately thought about that the whole three examples are likewise prepared and the quickness properties like shading fastness to wash; shading fastness to rubbing is entirely controlled. At that point he watched the profundity of the shed with the assistance of information shading programming (CCMS).

The utilization of reactive colored items has significantly expanded in the course of the most recent 50 years. Responsive shading segments are latent into materials which are clung to the base substrate by the utilization of soda ash which go about as fixing agent. Here before dyeing they treated the fabric sample was treated with bleaching agent so that the sample will be white & absorbency increased. Then the bleached sample was dyed with reactive dye of 0.5%, 1% & 1.5 % of blue. They were used exhaust dyeing method for dyeing the sample. Subsequent to coloring they check the 3 test was checked to watch the shading quality of various reactive colors which chips away at Kubelka-Munk condition. After checked the sample, they found 1.5% solution sample have more color strength than other 2 sample. And color fastness to rubbing, wash and water is better for 1% solution dyed sample than other 2 sample.[7]

Author Md. Hasan-Al Mamun1 worked with Modal fiber is a recovered cellulosic fiber with reactive color and it was more retentive than cotton or other engineered fiber. The
point of their undertaking work was to color the modular texture with two kinds of receptive color i.e MFT+VS type responsive color and MCT+VS
type reactive dye. What's more, watched the shading yield on modular texture and likewise looked at the wash and rubbing speed on colored material.
For this they was created 4 kind of shade 0.5, 1.5, and 4 utilizing MFT+VS and MCT+VS type responsive color. Here they found that shading yield on modular texture if there should be an occurrence of MCT+VS type reactive dye is superior to MFT+VS type responsive color. Likewise they were seen that
wash and rubbing quickness of MCT+VS type responsive color is superior to MFT+VS type reactive dye.[9]

Author Ahu **Demiroz Gun,** worked the color, abrasion and color fastness properties of plain knitted fabrics made from 100% modal viscose fibers in different fiber fineness's such as microfiber and conventional fiber, their 50/50 blends with cotton fiber and 100% cotton fiber. Abrasion behaviors of the fabrics were assessed by measuring the weight loss and color values

after four different abrasion cycles. All the results was compared with respect to both the fiber fineness and blend proportion of cotton fiber in the fabrics. The L* and K/S values of the fabrics after abrasion reveal a similar tendency to that of the fabrics before abrasion. Before and after abrasion cycles, the fabrics with microfiber revealed lower K/S and C* values and higher L* values than those with conventional fiber. With an increased in the cotton amount, the K/S values of the fabrics decreased and the L* values of the fabrics increase.

The effect of alkali concentrations has been studied on the color strength (K/S) and color fastness properties of single jersey cotton knitted fabrics dyed with 1% Novacron Red S-B reactive dye. Same bath scouring and bleaching are performed and conventional exhaust dyeing method employed by IR laboratory sample dyeing machine. Various alkali concentrations such as 6, 7, 8, 9 and 10 g/L are employed and other parameters are kept fixed. The color strength (K/S) and color fastness to wash and rubbing are examined and evaluated. It is revealed that with the increase in alkali concentration from 6 g/L to 8 g/L the value of K/S increases and then up to 10 g/L the value decreases. The overall color fastness properties to washing and rubbing for the dyed samples range from good to excellent.

Here our work are different from the other is that we take 100% cotton , 100% viscose & cotton/viscose blend of 3 sample &Scoured and bleaching & dyeing with reactive dye of 1% shade in Exhaust dyeing process. After dyeing color strength are measured by spectrophotometer all of the sample. Then color fastness to rubbing, washing, water & perspiration are tested all of 3 sample.[8]

CHAPTER- 3

THEORITICAL BACKGROUND

3.1- Definition of color & dye:

Color-

Modern concept of color was founded in 1774 by Isaac Newton.

Newton separated white day light in to a sequence of colored light call spectrum (VIBGYOR). According to the committee of colorimetry of the optical society of America Color is the sensation which occurs when light enters the Eyes. It is rising from the activity of the retina of the eye and its attached nervous mechanisms. This activity is being , in nearly every case in the normal individual a specific response to radiant energy of certain wavelength and intensity.Color perception depends on three factors. We are generally describing color using the three terms hue, sensation, and lightness.

The hue refers to the actual color sensation (red, blue, yellow), the sensation or chroma(depth of color) to the degree of differentiation from grey(dull of vivid), and lightness to the amount of light reflected from the object (light or dark). In the Munsell color system, these attributes are assigned alphabetic and numerical levels.

#Light: That aspect of radiant energy of which a human observer is aware through visual sensations arising from stimulation of the retina by the radiant energy. The wavelength of perceived colors of visible spectral light are between 380 to 740 (as shown in table one).[1]

Dye-

A dye is a hued natural intensify that assimilates light unequivocally in the obvious district and can immovably connect to the fiber by uprightness of compound and physical holding between gathering of the color and gathering on the fiber. To be of business significance a color ought to be quick to light, rubbing and water. Shading and color have constantly assumed an imperative job in the life of man from time immemorial.[5]

3.2- History and definition of Reactive dye:

A reactive dye, as per a helpful definition by Rys and Zollinger, is a hued compound which has an appropriate gathering empower of framing a covalent security between a carbon iota of a hydroxyl, an amino or a mercapturic aggregate separately of the substrate.

The possibility that the foundation of a covalent security among color and substrate would result in enhanced wash speed contrasted and that of conventional color substrate frameworks where weaker powers were agent is an old one. Endeavors were made by different color firm s from around 1906 onwards to accomplish this point however it was not until 1956 that the main fruitful receptive colors, the Procions , were presented by ICI for the coloring and printing of cellulose strands, following crafted by Rattee and Stephen from 1954 onwards. The creation comprised in the amalgamation of colors containing a receptive gathering, the 2,4,6-dichlorotriazinylamino aggregate which has two labile chlorine molecules actuated by the electron pulling back activity of the three N particles.

The principal responsive color, the color which responds with the fiber amid coloring process shaping a synthetic covalent bond with the fiber structure as against the regular colors which are physically bound to the fiber structure, was found by Rattee and collaborators of ICI shockingly, while inspecting the coloring character of specific colors containing dynamic chlorine appended to thiazine ring, and prior known to give quick coloring particularly to washing on cotton. A responsive color in the wake of coloring by a reasonable technique stays appended to the fiber in view of substance servitude and its washing speed is of elevated requirement. After a progression of triazinyl class of reactive dye was presented by ICI, numerous dyestuff firms thought their innovative work exploring novel frameworks for the generation of responsive colors. Dyestuffs containing a few gatherings of reactive frameworks were protected and few of them were monetarily abused.Hoechst introduced B-sulphato ethyl sulphone called as vinyl sulphone reactive dyes, which were superior in their dyeing properties to triazine class.

Chemical reaction:

$D\text{-}SO_2\text{-}CH_2\text{-}CH_2\text{-}OSO_3Na + OH\text{-}CELLULOSE \rightarrow D\text{-}SO_2\text{-}CH_2\text{-}CH_2\text{-}O\ CELLULOSE + NaHSO_3$ [5]

3.3-AN ANALYTICAL VIEW TO REACTIVE DYEING

Introduction:

In the most straightforward terms, every single reactive dyes are comprised of three essential units, a chromophore , an extension and a responsive gathering/gatherings (either a haloheteocycle or an enacted twofold bond). These colors are utilized for coloring of cellulosic strands and when these are connected to a cellulosic fiber in a soluble color shower, they shape a covalent bond with hydroxyl gathering of the fiber by synthetically responding with fiber. The covalent bond framed between the color atom and fiber make color particle a piece of the fiber particle.[5]

General Structure of Reactive Dye:

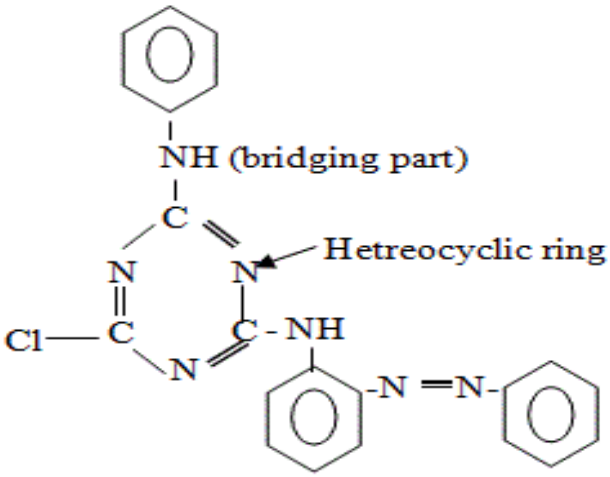

Fig-3.1- Chemical structure of reactive dyes.

General Dye Feature of Reactive Dye:

The Reactive Dye can be represented as : **W-D-O-RG-X**

Here-

W is the water solubilizing group.

D is the Chromogen.

O is the bridging group.

RG is the reactive group.

Solubilizing group: -NH2, -NH CH3, -OH, -NO3, -COOH, -SO3Na

Bridging group: -NH-, -NH-CO-, -NH-CO-NH-

Reactive Group: Vinyl Sulphone, Monochlorotrizine, Dichlorotriazine, Pyrimidine, Triazine

Leaving Group: -Cl, -Br, -SH, -OCH

3.4- Properties of reactive dye:

1. Reactive dyes are anionic dyes which are used for dyeing cellulosic protein polyamide fibers.

2. Reactive dyes are found in powder, liquid and print paste from. During dyeing, the reactive group of this dye forms covalent bond with fibre polymer and becomes an integral part of fiber.

3. Reactive dyes are soluble in water.

4. They have very good light fastness with rating about 6.

5. The dyes have very stable electron arrangement and the degrading effect ultraviolet ray.

6. Reactive dyes give brighter shads and have moderate rubbing fastness.

7. Reactive dyes are comparatively cheap.

8. Reactive dyes have good perspiration fastness with rating 4-5

9. Fixation occurs in alkaline condition.[5]

3.5- Reasons of popularity of reactive dye:

- Good Washing Fastness
- Cheap
- Simple Dyeing Method
- Good Reproducibility
- Less Temperature Dying
- Bright Shades
- Good Light Fastness Property

3.6-Classification of reactive dyes:

On The basis of Reactive Group:

- Hetero cyclic compound
- Triazine gathering
- Pyrimidine subsidiaries
- Quinonaline subsidiaries

On the basis of Reactivity:

- Lower Reactive Dyes

•Reactivity of these colors is low, so profoundly antacid condition required for the obsession of these colors with the substrates. Here pH is kept up 12-12.5 by utilizing NaOH in Bath. Ex: Drimarine, Cibacron C.

•Medium Reactive Dyes

•These colors are bring down Reactive color. Here pH is kept up 11-12 by utilizing Na2CO3 in the Bath. Ex: Remazol.

•Higher Reactive Dyes

•These Dyes are very reactive. So obsession of these colors are simple and lower antacid medium is kept. Here pH is kept up 10-12by utilizing NaHCO3 in the color Bath. Ex: Procion MX

.On the basis of Dyeing Temperature & Method:

They are of three types-

Cold Brand Dyes

These types of dyes are highly reactive. So dyeing of these dyes can be done in lower temperature i.e. 32-60®C. Ex: Procion MX.

Medium Brand Dyes

These types of dyes contain reactive group of moderate reactivity. So dyeing is done in higher temperature. Here temperature is kept between 60-70®C.

Hot Brand Dyes

These types of dyes contain reactive group of least reactivity. So high temperature is required. Here temperature is kept between 72-90®C. [5]

Recent Classification:

- Alkali Controllable Reactive Dyes
- Salt Controllable Reactive Dyes
- Temperature Controllable Reactive Dyes

3.7-Reaction between cellulose & reactive dyes:

Dyeing of cellulosic fibres with reactive dyes consists of two phases:

Firstly, exhaustion phase, where dye is absorbed by material in neutral medium
Secondly fixation phases, where reaction between dye & fibre takes place.
Cellulose in its response with reactive dyes is considered as liquor. Electro cynicism of oxygen molecules administers inclination of hydroxyl gathering to ionize. Cellulose is thusly ionized under antacid conditions and can go about as nucleophilic reagent and shows ensuing responses with corrosive halides (nucleophilic substitution).

Cellulose in its response with reactive dyes is considered as liquor. Electro cynicism of oxygen molecules administers inclination of hydroxyl gathering to ionize. Cellulose is thusly ionized under antacid conditions and can go about as nucleophilic reagent and shows ensuing responses with corrosive halides (nucleophilic substitution). System of nucleophilic substitution is:

3.8- History of vicose fiber:

Rayon is the conventional term for fiber (and the subsequent yarn and texture) made of recovered cellulose by any of six procedures. Its significance as a fiber lies in its adaptability, and in the way that it was the primary practical made fiber. As far back as 1664, english naturalist robert hooke conjectured that fake fibers may be spun from a substance like what silkworms emit to make silk. This was frequently attempted by researchers in the following years who looked for a "fake silk", yet nobody was to prevail until in 1855 the frenchman did as such, george audemars. By dunking a needle into a thick arrangement of mulberry bark mash and sticky elastic, he could make a string. While fascinating from a logical point of view, this

procedure was not really practical monetarily - it was moderate, and required a lot of expertise and exactness. The principal business engineered fiber was delivered by hilaire de bernigaud, count of chardonnay (1839-1924) following 29 years of research, was protected in 1884, and produced by him in 1889. This cellulose-based texture known as chardonnay silk was pretty yet entirely combustible, it was expelled from the market. Before long, the english physicist charles frederick cross and his teammates edward john bevan and clayton beadle found the thick procedure in the mid 1890ies. Courtaulds fibers delivered the main business gooey rayon in 1905; the first in the united states was in 1910 by the american viscose company. At first rayon was classified "counterfeit silk", and numerous different names. Mid 1920ies, an advisory group shaped by the u.s. Division of commerce and different business affiliations settled on the name "rayon". It was designated "rayon" for one of two reasons: either as a result of its splendor and likenesses in structure with cotton (sun = beam, - on = cotton). Or then again on the grounds that the naming advisory group couldn't discover a name from the thousands participated in a challenge they supported, and who would have liked to shed a "beam of light" regarding the matter (from rayon, french for beam). French researcher and industrialist hilaire de chardonnet (1838– 1924)— who imagined the primary fake material fiber, fake silk—made viscose.[7] british researchers charles frederick cross and edward john bevan took out british patent no. 8,700, "enhancements in dissolving cellulose and allied compounds" in may, 1892.[8] in 1893 they shaped the viscose syndicate to give licenses, and in 1896 framed the british viscoid co. Ltd. To misuse the procedure. The utilization of viscose is declining. Rather, rayon might be fabricated utilizing the lyocell procedure, which utilizes n-methylmorpholine n-oxide as the dissolvable and creates minimal waste item, making it moderately eco-accommodating.[5]

3.9-Vicose:-

Viscose is a semi-manufactured fiber. "thick" can mean:

•A thick arrangement of cellulose, which can be made into rayon or cellophane

•A equivalent word for rayon

•A explicit term for thick rayon—rayon made utilizing the gooey (cellulose xanthate) process. The viscose breaks down mash with fluid sodium hydroxide within the sight of carbon disulfide. This thick arrangement bears the name viscose. The cellulose arrangement is utilized to turn the viscose rayon fiber, which may likewise be called thick. Thick rayon fiber is a delicate fiber normally utilized in dresses, linings, shirts, shorts, coats, coats, and other outerwear. It is additionally utilized in mechanical yarns (tire line), upholstery and rugs, and in the throwing of cellophane.of all the fiber, rayon - likewise called viscose or rayon thick - is

presumably one of the all the more perflexing to clients. It very well may be found in cotton-like end utilizes, and in addition luxurious velvets and fabrics. It might work effectively in permeable cleanliness and incontinence cushions and similarly well giving quality in tire lines. What is this fiber that has such a large number of appearances?

Rayon was the primary produced fiber. The term rayon was formally embraced by the material business. Not at all like most man-made filaments, rayon isn't manufactured. It is produced using wood mash, a normally happening, cellulose-based crude material. Therefore, rayon's properties are more like those of common cellulosic filaments, for example, cotton or material, than those of thermoplastic, oil based engineered strands, for example, nylon or polyester.

Rayon viscose is produced using wood mash, a generally reasonable and sustainable asset, preparing requires high water and vitality utilize, and has added to air and water contamination. Modernization of assembling plants and procedures joined with accessibility of crude materials has expanded rayon's intensity in the market.[1]

3.10- Properties of viscose:-

General attributes :-

Rayon as a fabric is delicate and agreeable. It wraps well, which is one reason it is so attractive as a clothing texture. Most attributes are variable relying upon handling, added substances and completing medications, also texture development. [1]

Spongy:

Rayon is the spongiest of all cellulose strands, significantly more so than cotton and cloth. Along these lines, rayon assimilates sweat and enables it to dissipate far from the skin, making it an incredible summer texture. Its high permeableness applies similarly to colors, permitting delightful, profound, rich hues.

Improved stretch:

It loses a lot of solidarity when wet. Along these lines, it stretches and therapists more than cotton.

Scraped area obstruction :

Poor because of inelasticity of the strands. It is effortlessly harmed by scratching and will pill on the surface of the material.

Exceptionally combustible :

Due to its exorbitant combustibility, it motivated the Flammable Fabrics Act. The FFA was ordered by the U.S. Bureau of Commerce in 1953 because of open worry over various genuine

copy mishaps including brushed rayon high heap sweaters (alluded to as "burn sweaters") and kids' rancher chaps which could undoubtedly burst into flames and glimmer copy.

Static :

No static develop. Artificially responsive in light of the fact that it is a cellulose fiber, it is harmed by even moderately powerless acids.

Others:

Gooey Rayon has a silk-like stylish with magnificent wrap and believe and holds its rich splendid hues. Its cellulosic base contributes numerous properties like those of cotton or other normal cellulosic filaments. Rayon is dampness retentive (more so than cotton), breathable, agreeable to wear, and effortlessly colored in clear hues. It doesn't develop friction based electricity, nor will it pill except if the texture is produced using short, low-curve yarns.

Rayon is agreeable, delicate to the skin, and has moderate dry quality and scraped spot opposition. Like other cellulosic filaments, it isn't flexible, which implies that it will wrinkle. Rayon withstands pressing temperatures marginally not exactly those of cotton. It might be assaulted by silverfish and termites, yet for the most part opposes creepy crawly harm. It will buildup, however that for the most part isn't an issue.

One of rayon's qualities is its flexibility and capacity to mix effectively with numerous filaments—at times to diminish cost, different occasions for radiance, delicateness, or receptiveness and coming about solace.

Rayon has moderate protection from acids and antacids and by and large the fiber itself isn't harmed by blanches; be that as it may, colors utilized in the texture may encounter shading change. As a cellulosic fiber, rayon will copy, yet fire resistant completions can be connected.[1]

3.11-Below table compares characteristics of cotton, viscose and polyester:

material	cotton	viscose	polyester
moisture regain	good	very good	poor
thermal protection	good	very good	poor
air permeability	very good	good	poor
softness	good	very good	poor
smoothness	poor	good	very good
static dissipation	good	very good	poor
drape	good	very good	poor
luster	poor	very good	very good
crease recovery	poor	poor	very good
uniformity	poor	very good	good
antipiling	good	very good	poor
wash & wear	good	poor	very good

Fig 3.2- compares characteristics of Cotton, Viscose and Polyester.

3.12-APPLICATIONS OF RAYON VISCOSE

Viscose rayon is utilized in a huge number of uses:

•yarns

Weaving string, chenille, rope, curiosity yarns

•fabrics

Crepe, gabardine, suiting, bind, outerwear textures and linig for fur garments and outerwear

•apparel

Pullovers, dresses, saris, coats, unmentionables, linings, milinerey (caps), slacks, sport shirts, sportswear, suits, ties, work garments

•domestic materials

Builts, covers, blinds, draperies, sheets, slip covers, tablecloths, upholstery

Mechanical materials

High constancy rayon is utilized as support to mechanical elastic merchandise (tires, transport lines, hoses), applications inside the aviation, rural and material ventures, plaited rope, tape.[1]

3.13- HISTORY COTTON FIBRE:

Cotton was utilized for garments in present-day Peru and Mexico maybe up to 5,000 years prior. Likewise, cotton was developed, spun, and woven in antiquated India, China, Egypt, and Pakistan, around 3000 B.C. Cotton isn't local to Western Europe. Around A.D. 800, Arabic brokers likely acquainted cotton with Spaniards. By the fourteenth century, Mediterranean ranchers were developing the cotton plant and transporting the fiber to the Netherlands for turning and weaving. English advancements in the late 1700s incorporate water-controlled turning hardware, a grand enhancement over hand-turning. An American named Samuel Slater, who worked with British apparatus, retained the plans for a machine spinner and came back to Rhode Island to set up Slater Mill,the first American material plant to use machine spinners. This factory speaks to the start of the U.S. Modern Revolution, based on the system of the cotton business. Two improvements prodded the development of American cotton: cotton spinners and the cotton gin. The cotton gin, created by Eli Whitney in 1793, effortlessly expelled industrious cottonseeds. Southern manor proprietors started planting cotton because of these advancements, utilizing oppressed work for collecting the cotton. Lively cotton development in the South utilizing oppressed work is viewed as one purpose behind grinding among North and South that prompted the Civil War Southern cotton was sent to New England processes in enormous amounts. Because of machine turning, weaving, and printing, Americans could economically buy calico and it turned out to be all around worn. In any case, work costs were huge in New England. Plant proprietors discovered approaches to lessen those costs, first by utilizing ladies and foreigners who were regularly paid inadequately, at that point by utilizing youthful kids in the production lines. After abusive work rehearses were to a great extent ended, numerous production lines moved toward the South where work was less expensive. (Unionizing endeavors influenced the benefits of those factories.) Today, a decent lot of cotton is woven outside the United States where work is less exorbitant. Polyester, a manufactured, is regularly utilized alongside cotton, however has minimal possibility of overriding the normal fiber.[1]

3.14- Cotton:

Cotton is a delicate fiber that develops around the seeds of the cotton plant . The fiber is regularly spun into string and used to make a delicate, breathable material. Cotton is a significant product in light of the fact that just about 10% of the crude weight is lost in preparing. When hints of wax, protein, and so on are evacuated, the rest of a characteristic

polymer of unadulterated cellulose. This cellulose is organized in a way that gives cotton one of a kind properties of solidarity, solidness, and sponginess. Every fiber is comprised of twenty to thirty layers of cellulose looped in a slick arrangement of normal springs. At the point when the cotton bowl (seed case) is opened the strands dry into level, wound, lace like shapes and progress toward becoming wrinkled together and interlocked. This interlocked frame is perfect for turning into a fine yarn.

Figure:3.3- Cotton ball

3.15- Botanical classification cotton:

There are mainly four types of Botanical classification cotton this are written below

1. *Gossypiumharbacceum*

Plant length: 3-6`

Flower colour: yellow

2. *Gossypiumharsutum*: (87% of total produced cotton)

Plant length: 6

Flower colour: Red

Both are mainly cultivated in America and India

3. *Gossypiumperuvinum*:They are mainly produced in Pure and other South-American

Plant length: 10-15

Flower color: yellow, Brownish yellow

4. Gossypiumharbacceum

Plant length: 6-15

Flower color: yellow

They produce fine silky Sea Island cotton

3.16- Types of commercial cotton:

There are five types of cotton which are cultivated on commercial basis around the world. These include the Egyptian cotton, Sea Island cotton, American Prima cotton, Asiatic cotton and American Upland cotton. Each of these types has been brief about in the following description. Know more on the history of cotton.

1.Egyptian cotton:

As the name proposes, this fine, shiny cotton has long and more slender strands. These cotton filaments is light darker in shading and are perfect for making solid yarns. This is the motivation behind why it is a standout amongst the most prominent kinds of cotton utilized for bed sheets, pad covers, and so forth.

2.Ocean Island Cotton

Ocean Island Cotton happens to be an 'expensive undertaking' for its development and preparing in the realm of cottons. Its long staple and smooth surface make it to be utilized in the best cotton checks and blended with silk. Along these lines, at whatever point you see the name of 'ocean island cotton' on shirt, realize that the piece may get somewhat overwhelming on your pockets. Motivate a few hints on the most proficient method to develop cotton. [1]

3.Pima Cotton

The pima cotton has a place with the ELS (additional long staple) kinds of cotton and is mainstream for its long, smooth strands. It has a quality that is tantamount to that of the Egyptian cotton. The quality, delicateness, solidness and retentiveness of the Pima cotton make it one of the mainstream and best sorts of cotton for garments, towels and sheets.

4.Asiatic Cotton

India, China and the close east are the spots which are the cultivators of this sort of cotton. It has coarse and brutal strands and along these lines, is appropriate for

assembling items like covers, channels, coarse garments, cushioning materials and such.

5.American Upland Cotton

A standout amongst the most normally utilized sorts of cotton is the American Upland cotton. It is more affordable and of a fundamental quality, and is likewise used to make a few sorts of textures. The adaptability of the cotton makes it usable for assembling costly shirts and denim

2.5 Other types of cotton:

Cotton is delegated pursues as per staple size:

1. Long-staple cotton: long-staple cotton > 35 mm, e.g. Egyptian cotton, maco cotton; fine, with a velvety shine and by and large cream-shaded.

2. Medium-staple cotton:

Medium-staple cotton 25 - 35 mm, e.g. Upland cotton (80% of world generation), american cotton; white to yellowy-white.

3. Short-staple cotton;

Short-staple cotton< 25 mm, e.g. Indian cotton; for the most part yellowy-white to earthy and of lower quality, since frequently non uniform and hard

3.17- End use of cotton:

1. Cotton textures consolidate noteworthy toughness with alluring wearing characteristics. Cotton fabrics have a charming vibe or handle. They are cool in sweltering climate.

2. Cotton is utilized in incredible amount as a texture for sweltering climate wear; it can provide warmth also.

3. Cotton pieces of clothing are in this way agreeable and cool, passing on the sweat fromthe body into the encompassing air.

4. The sponginess of cotton makes it a great material for house-hold textures such assheets and towels as well.

5. Cotton is broadly utilized in making rainwear textures.

6. The flexibility of cotton has made it into the most generally utilized of all material fibers.cotton is made into each kind of piece of clothing and house-hold texture. It goes into boots andshoes, carpetsand shades, dress and caps.

7. Overwhelming cotton yarns and materials areused for tire strings and marquees, coverings and mechanical textures of all portrayal.[1]

3.18- Reactive dyes:

In the simplest terms, all reactive dyes are comprised of three fundamental units, a chormophore, an extension and a reactive group/gathering (either a haloheteocycle or an actuated twofold tie). These colors are utilized for coloring of cellulosic strands and when these are connected to a cellulodsic fiber in a basic color shower, they shape a covalent bond with hydroxyl gathering of the fiber by synthetically responding with fiber. The covalent bond framed between the color atom and fiber make color particle a piece of the fiber atom.

3.19- Definition:

In a reactive dye a chromophore contains a substituent that is initiated and permitted to specifically respond to the surface of the substrate.reactive dyes have great fastness properties inferable from the holding that happens amid coloring. Reactive dyes are most regularly utilized in passing on of cellulose like cotton or flax, yet in addition fleece is are with responsive colors.

Figure: 3.4- Reactive Dyes

3.20- Typical brand name of reactive dye:

Procion H (Zeneca)

Procion MX (Zenace)

Clibacron F (CGY)

Drimarene X (S)

Drimarene K (S)

Levafix E (BAY)

Remezol (HOE)

Remezol D (HOE)

Procion Z-E (Zenace) &Kayacelon React (KYK)

Sunfix Super (NSK) &Cibscron C (CGY)

There dyes are also classified based on their exhaustion properties as well as on their application temperature such as cold brand and hot brand reactive dyes.These are water soluble dyes and hence applied from aqueous bath under neutral to weakly acidic conditions, electrolyte is added to hence to exhaust the dyes on the fiber from the dye bath and then exhausted dye is fixed on the fiber by adjusting the pH suitable for making a covalent bond between the dye molecule and fiber , with the help of alkali. The unexhausted dye which remains in the liquor is hydrolysed (hydrolysed dye is formed by the reaction of dye molecule with water under alkaline conditions) and loses its reactivity with cellulosic fiber, that too is absorbed by the fiber. Therefore washing and soaping treatment is done to remove the hydrolysed and excess dye to improve the color fastness of the dyed substrate. The overellcolorfastness achieved is good when the material is dyed and washed properly.

The general reaction between the Dye molecule & the fiber are as below:

D-SO2-CH2-CH2 OSO3Na + Cell-OH ----- SO2-CH2-CH2-O-cell + NAHSO3[10]

3.21-Dyeing cycle and important factors/phases in reactive dyeing

- pH of the substrate before coloring
- pH of the color shower
- pretreatment of the substrate
- solubility of the dyestuff
- dyeing temperature
- Quality of water and salt
- electrolyte focus
- dyeing timeWashing off sequence
- Type of alkali

3.21- Types of reactive dyes

Bi-useful dyes –

Dyestuffs containing two gatherings are known as bifunctional dyestuffs. These responsive colors are structured in such a way to have the ability to respond with the fiber in excess of a solitary way.

Vinyl sulphone dye (vs) - vinylsulphone dyes are modestly receptive. The coloring temperature is commonly 600c and ph is 11.5 that get connected by using a blend of soft drink fiery remains and acidic soft drink. These colors demonstrate magnificent obsession properties under appropriate soluble condition. A run of the mill precedent is the remazol black b (ci reactive black 5)

Monochlorotriazine dye (mct) - normally these colors are less receptive than vinylsulphone colors. Response can happen in more enthusiastic response conditions. That is commonly 800 degree and ph estimation of 10.5, are basic for a legitimate obsession with cellulosic strands. A commonplace monochlorotriazine color is appeared here.[10]

3.22- Advantages of the reactive dyes

•Show enhanced quickness properties

•Simplify coloring strategy

•Easy wash capacity

•Permanency of the shading

•Good compound official

•Allows for a wide assortment of chronophers to be utilize

3.23-Scouring & bleaching

Scouring and blanching should be mellow in nature. The textures ought to dependably be scoured and never placed straight into color since it is imperative to expel any leftover sulfur to anticipate color decrease. Turning greases utilized on thick will in general yellow with warmth, thus ought to be evacuated for best whites and splendid pastels. The alcohol proportion may should be somewhat higher than for cotton, on account of the higher water maintenance yet in addition due to the high swelling. (Lessen stream limit) Break outs are dependably an

issue on gooey, especially where there is lengthways strain on the texture. Best kept away from by sewing the texture at a point, not straight over. Utilize various "crisscross" sewing for extra security. Textures will in general harden in tight developments so oil is imperative. There ought to be as meager strain on the texture as could reasonably be expected, in light of the low wet modulus it will extend effortlessly and dimensional solidness may never be accomplished. Generally implies slower turnaround times and coloring machines with winches to help the texture into the fly, or the stogie type machines with the texture development into the stream being downwards (like the Gaston County Futura or Hisaka). The more ―soft stream? the coloring machine – the preferable Better base white over cotton, accordingly fading basically required just for full white or pastel shades.[10]

3.24- Relax / scouring:

Viscose rayon fibers, in contrast to common cellulosic strands, are free from regular fats and waxes, bits and seeds, and the scouring procedure, thusly, require not be as serious with respect to cotton, and can be founded on soft drink slag or tetra sodium pyrophosphate formulas instead of scathing soft drink. A run of the mill scouring formula on a 5 box ceaseless open width washing range.

3.25 Scouring of blends containing viscose:

Standard viscose and polynosic rayons are blended with cotton for improved physic-chemical properties of the blended fabric. The expansion in elasticity achieved by mixing fleece with thick is notable. Textures containing around 65% triacetate with gooey might be given strong creases. Built or finished nylon is once in a while utilized with gooey rayon for textures. Scouring Conditions for Blends Containing Viscose,Blend Treatment conditions: Viscose/Cotton, Viscose/Wool, Viscose/Acetate, Viscose/Acrylic, Viscose/Nylon.

3.26-Fastness properties:

The fastness properties of the cotton textures colored at different focuses were assessed and are given in Table The outcomes demonstrate that the colorfastness to rubbing and washing for both of the coloring forms were pretty much the equivalent, contingent upon the color obsession rate. The dry and wet rubbing speed of the majority of the dyeings appear to be high. This high quickness was most likely because of the way that the colors were receptive and infiltrated the cotton fiber well. The washing quickness was inspected as far as shading evolving. [11, 12,13]

We found that the wash fastness of the cotton colored with the cationized color was superior to anything that of the cotton colored generally. Notwithstanding, the best washing speed esteem was gotten with the Rucomor BUR cationizing specialists. Washing quickness was analyzed regarding recoloring. We found that the washing fastnesses of the cotton colored with cationized color and customary color were roughly the equivalent. Be that as it may, the best washing quickness to recoloring was gotten with the Optifix F cationizing operator.

Even though reactive dyes have excellent wash fastness properties, often buyers complain of poor wash fastness. This is mainly due to adherence of hydrolyzed dyes onto cotton. If they are not washed off after dyeing, they behave like direct dyes and bleed during the initial washings carried out by the customers. In order to avoid the complaints, some dyers take extra precautions by providing more than the required number of washings. Therefore the second objective of the present study is to develop a quick method to optimize the number of washings to be given after reactive dyeing to achieve good wash fastness properties, especially for dark and medium shades.

3.27-DEFINITION OF FASTNESS:

Fastness is the resistance of textile materials to resist a load or destructive factor such as abrasion, heat, light, perspiration, wearing, acidic and alkaline condition. Fastness is the property of colored material. It is not the property of colorant or substrate in isolation.

Categories of Fastness:

- Producers fastness
- Users fastness
- Colorfastness to Wash
- Colorfastness to rubbing
- Colorfastness to Perspiration
- Colorfastness to Light
- Colorfastness to Hot Press etc.

Test for Strength e.g.

- Breaking Strength
- Tearing Strength
- Bursting Strength
- Seam Strength etc

Test for Performance:

- Pilling Resistance
- Abrasion & Pilling
- Water Repellency
- Flammability etc

Objects of fastness testing:

- Research
- Selection of raw material for manufacturing
- Process Control
- Process Development
- Product development as per standards
- Specification testing etc.

What Kinds of changes a colored substrate may undergo:

- Change in depth
- Change in hue
- Change in luster

The degree of fading and staining depends on:

• Temperature

• The types of detergent used

• The amount of detergent used

• Mechanical action (No of steel ball used)

• The washing liquor ratio

• The hardness of water

• The rinsing, drying or pressing method used to restore the sample after the washing.

3.28- Some common color fastness:

Color fastness to Rubbing

Figure 3.5-Rubbing tester m/c.

Principle: This test is done to decide the level of shading which might be transfer from the surface of a hued texture to an explicit test material for rubbing (dry + wet).

Equipment:

1. Crock meter
2. Cotton rubbing cotton
3. Grey Scale
4. Stop watch
5. Color matching cabinet.

Size of fabric: 14 cm x 5 cm three sample

Test procedure:

1. Test example 15cm×5CM is set on the base of the Crock meter.

2. A square of white test material (5cm×5cm) which is of plain weave, desized, faded however without completed cotton texture is taken.

3. White test material is mounted to the finger of the container meter.

4.This finger is utilized in rubbing activity on the example. Rubbing is done forward and backward, 10 cycles at 10 seconds and finger weight on the example is 9N.

5.Rubbing test is done both for twist way and weft way. For dry and wet rubbing test, separate example is utilized.

6.For wet rubbing, the example is dry yet crocking fabric is wet.

7.For wetting, M:L proportion is kept up at least 1:50, water is depleted in the wake of wetting and not crushed.

Color Fastness to Washing:

color fastness to washing implies, An example of the material, in contact with a couple of determined nearby textures, is mechanically upset under depicted states of time and temperature in a cleanser arrangement, at that point flushed and dried. The adjustment in shade of the example and the recoloring of the adjoining texture are surveyed with the dim scales. As far as I can tell, if there should arise an occurrence of speed test shading speed to washing is the first and most imperative prerequisites of purchasers. There are various ISO test for shading fastness to washing.[11]

Instruments:

1. Rota wash / Gyro wash,
2. Stainless Still Ball,
3. Multi-fiber fabric,
4. Grey scale,
5. Thermometer,
6. Color matching cabinet
7. Sewing machine,

Recipe:

Sodium Perborate……..1 gm/liter
ECE Phosphate……..4 gm/liter

Sample Preparation:

Sample Fabric…….10cm*4cm
Multi fiber fabric……10 cm*4 cm

Working Procedure:

Gather the example from colored fabric and then molding for 04 to 06 hours

↓

Making an example of 04 cm*10 cm in size.

↓

Sewing the example with multi-fiber texture of same size at one corner.

↓

Making the arrangement of 4gm/liter ECE cleanser and 1 gm/liter sodium perborate

↓

Putting the example with multi-fiber texture into the arrangement in Rotawash m/c

Temp.: 60OC/40OC Time: 30 min Still ball: 25 pcs

↓

Flushing with high temp water individually.

↓

crushing with cool water of the example is done (Hand Wash).

↓

At that point drying is done at a temperature noticeable all around not surpassing 60OC

↓

The sewing is then broken out aside from on one of the shorter end.

↓

Estimating the recoloring and shading change by dim scale and make a test report.

Color Fastness Test to Water (ISO 105 EO1)

Color fastness to water is intended to gauge the protection from water of colored, printed, or generally hued material yarns and fabrics.The test strategy by which this test is done is ISO 105 E01. This technique is to evaluate the level of cross recoloring which may happen when pieces of clothing are left in contact when sodden. The test estimates the protection from water of any hued material

Apparatus:

1. Perspiration Tester
2. Oven
3. Multi fiber fabric
4. Grey scale
5. Color matching cabinet
6. Glass plate or Acrylic resin plates
7. Weight 12.5 kPa or 5kg pressure
8. Glass beaker
9. Stirring rod

Reagent:

Distilled water or de-ionized water is used in this test method because natural (tap) water is variable in composition.

Sample Preparation:

Cut the specimen & multi-fibre at 10×4cm & sewn together. This is the composite test sample.

Working Procedure:

Wet in distilled water at room temperature & it will suck water.

↓

Place it in acrylic resin plates & put the weight on to the plates.

↓

Keep it in oven & keep the temperature at 37± 2°C for 4hrs.

↓

Open the specimen & dry it in the air hot exceeding 60°C.

↓

Change in color is assessed with the help of Grey Scale.

Color fastness to perspiration:

Color fastness to perspiration refers to the ability not to fade and not to stain when dyed fabric is perspired. The pieces of clothing which come into contact with the body where sweat is overwhelming may endure genuine nearby staining. This test is planned to decide the obstruction of shade of colored material to the activity of acidic and soluble sweat. This sort of

test is exceptionally connected for the games wear and overwhelming dresses which is utilized extraordinarily. Ordinary materials is additionally tried by sweat test. This test is intended for use in evaluating the speed of the colored, printed, or generally hued material yarns and textures of assorted types to the impacts of human sweat. Any adjustment in shade of the examples and recoloring of the multifibre is then evaluated with the comparing Gray scales for shading change and recoloring.

Equipment required:

- Per spirometer
- BOD Incubator
- Acrylic plate (11)
- Petri dish
- Glass plates
- Hot Oven

Sample preparation

- A 10x4 sample size is taken and stitched with a 10x4 multifibre from all sides.
- Multifibre consists of six fibres i.e., acetate, cotton, nylon, polyester, acrylic and wool.

Preparation of solution for ISO:

Acid

M: L= 1:50

PH= 5.5±0.2

0.5gpl L-Hysidinemonohydrochloride monohydrate ($C_6H_9O_2N_3.HCL.H_2O$)

5gpl of Sodium Chloride (NaCL)

2.2gpl of Sodium di Hydrogen orthophodphatedyhydrate ($NaH_2H_2PO_4.2H_2O$)

Alkaline

M: L= 1:50

PH= 8.0±0.2

0.5gpl L-Hysidinemonohydrochloride monohydrate ($C_6H_9O_2N_3.HCL.H_2O$)

5gpl of Sodium Chloride (NaCL)

2.5gpl of Sodium di Hydrogen orthophodphatedyhydrate ($NaH_2H_2PO_4.2H_2O$)

Procedure:

- Three pieces of sample were taken and put in different petri dish.
- In one petri dish water is poured and in other two ISO acid and ISO alkaline is poured respectively.
- The fabric is tapped with glass plate for 3 times in between 30 minutes.
- Then the fabric is kept in between the 11 slides of acrylic plate, and given a weight of 5 kg.
- Then it is put inside a BOD Incubator for 4 hrs at 37°C.
- After 4 hrs fabric is taken to hot oven and dried at 45°c- 50°c.
- Finally mounting is done..[12]

3.29- Spectrophotometer:

Spectrophotometer investigate light vitality reflected or transmitted by a sanple.They measure the photometric attributes of the material in the obvious range and create ghostly charts of tests. From the ghastly vitality dispersion of at least one enlightenments (A, F,

Colorimetric investigation is a strategy for deciding the convergence of a concoction component or synthetic compound in an answer with the guide of a shading reagent. It is relevant to both natural mixes and inorganic mixes and might be utilized with or without an enzymatic stage. The technique is generally utilized in therapeutic research facilities and for mechanical purposes, e.g. the examination of water tests regarding mechanical water treatment.

A spectrophotometer is an instrument that estimates the measure of light consumed by an example. Spectrophotometer procedures are utilized to gauge the centralization of solutes in arrangement by estimating the measure of the light that is consumed by the arrangement in a cuvette put in the spectrophotometer.[10]

How work-

• It does this by:

1. Diffracting the light pillar into a range of wavelengths

2. Guide it to a question

3. Getting the light reflected or came back from the protest

4. Identifying the powers with a charge-coupled gadget

5. Showing the outcomes as a diagram on the identifier and the showcase gadget.

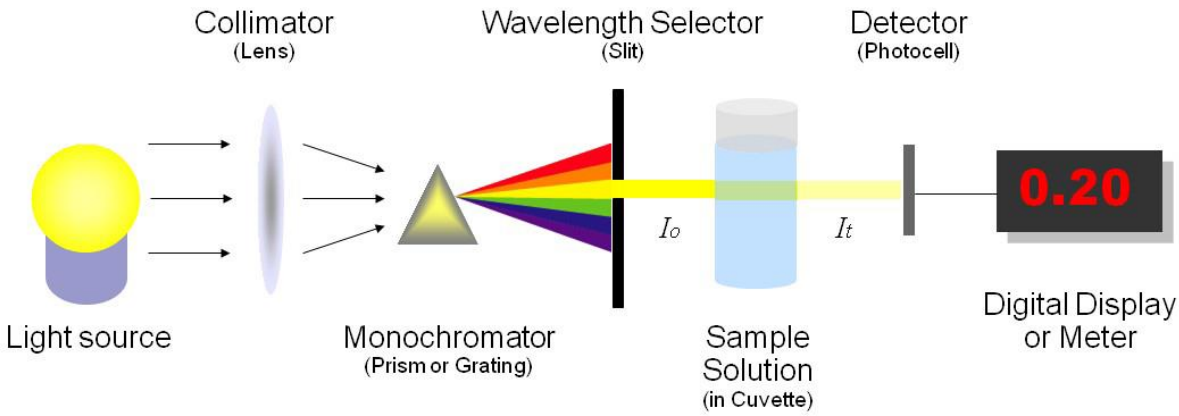

Fig 3.6- Spectrophotometer mechanism.

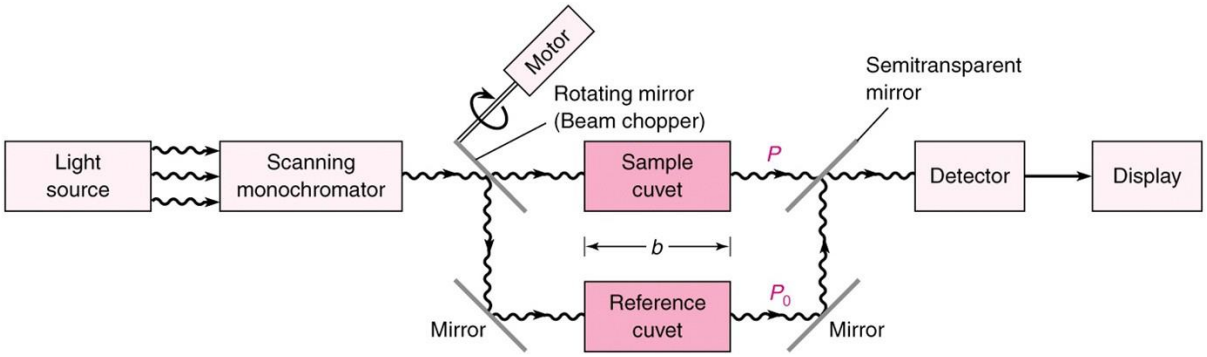

Fig 3.7- Spectrophotometer mechanism

i) Color match prediction.

ii) Color difference calculation.

iii) Determine metamerism.

iv) Pass/Fail option.

v) Color-fasting rating.

vi) Cost Comparison.

vii) Strength evaluation of dyes.

viii) Whiteness indices.

ix) Reflectance curve and K/S curve.

x) Production of shade library. Etc.[10]

3.29-Colour strength:

Colour strength is numerical value indicating the relative strength of the colour . A complex mathematical expression is required to relate dye concentration to light reflectance and the kubelka-Munk equation is widely used, relating the reflectance to the absorption and scattering of light. The Kubelka-Munk equation is as follows K/S= (1-R)2/2R

Where: K and S are the absorption coefficient and scattering coefficient of a colorant at a given wavelength and R is reflectance. The K/S value is directly proportional to the amount of dye present on the dyed fibre and is calculated using the above equation from the reflectance at the wavelength of maximum absorption.[10]

Chapter-4

Material & Method

4.1 MATERIAL

4.1.1- FABRIC

Table 4.1- 100% cotton fabric specification.

Fabric name	Fabric type	Parameter	Quantity
100% cotton	Single jersey	Gsm	140

		Wpi	42
		Cpi	60
		Count	30 Ne
		Stitch length	2.70mm

Table 4.2- 100% viscose fabric specification

Fabric name	Fabric type	Parameter	Quantity
100% viscose	Single jersey	Gsm	150
		wpi	37
		Cpi	45
		Count	28 Ne
		Stitch length	2.59 mm

Table 4.3- 50/50 cotton/viscose fabric specification

Fabric name	Fabric type	Parameter	Quantity
50/50 cotton/viscose	Rib	Gsm	170
		wpi	38
		Cpi	48
		Count	26 Ne
		Stitch length	2.52

4.2.2-DYES & CHEMICALS

Table 4.4: Comercial name of dyes and chemicals.

Serial	Chemical name	Comercial name
1.	Reactive blue	Levafix Blue CA
2.	Levelling agent	Levegal RLC
3.	Sequestering agent	Verolan NBA

4.	Salt	Glauber salt
5.	Soda	Soda ash 2210
6.	Detergent	Hasulyn NOF
7.	Caustic soda	Caustic soda Flake
8.	Hydrogen peroxide	Hydrogen Peroxide 50%
9.	Peroxide stabilizer	Terminoox ultra 50L
10.	Soap	Rucogen SOC

4.2 METHOD

4.2.1 Dyeing method:

Exhaust dyeing

4.2.1.1- Recipe

Table 4.5-Scouring & Bleaching for cotton, viscose & blended fabric

Serial	Parameter	Amount
1.	Detargent	1 g/l
2.	Hydrogen peroxide	4 g/l
3.	soda ash	3 g/l
4.	Time	40 min
5.	Temperature	100 ̊c
6.	M:L	1:6
7.	Sample wt.	10 gm

Table 4.6-Dyeing of 100% cotton, 100% viscose & cotton/viscose blend with reactive dye of 1% s.soln.

Serial	Parameter	Dossing
1.	Reactive Blue	1 g/l

2.	Levelling agent	1 g/l
3.	Salt	25 g/l
4.	Soda	10 g/l
5.	Time	60 min
6.	Temperature	60 c̊
7.	ph	11.5
8.	sample wt	10 gm
9.	M:L	1:6

4.2.1.2- Procedure of scouring and bleaching of cotton/viscose/ cotton/viscose blend:

1. Collection of cotton or viscose or cotton/viscose blended fabric.

2. Scouring and bleaching at 100 degre for 40 min.

3. Bath drain and cold rinsing the fabric.

4. Hot wash the fabric.

5. Cold rinsing the fabric.

6. Drying the fabric.

4.2.1.3- Curve of scouring and bleaching of cotton/viscose/ cotton/viscose blend:

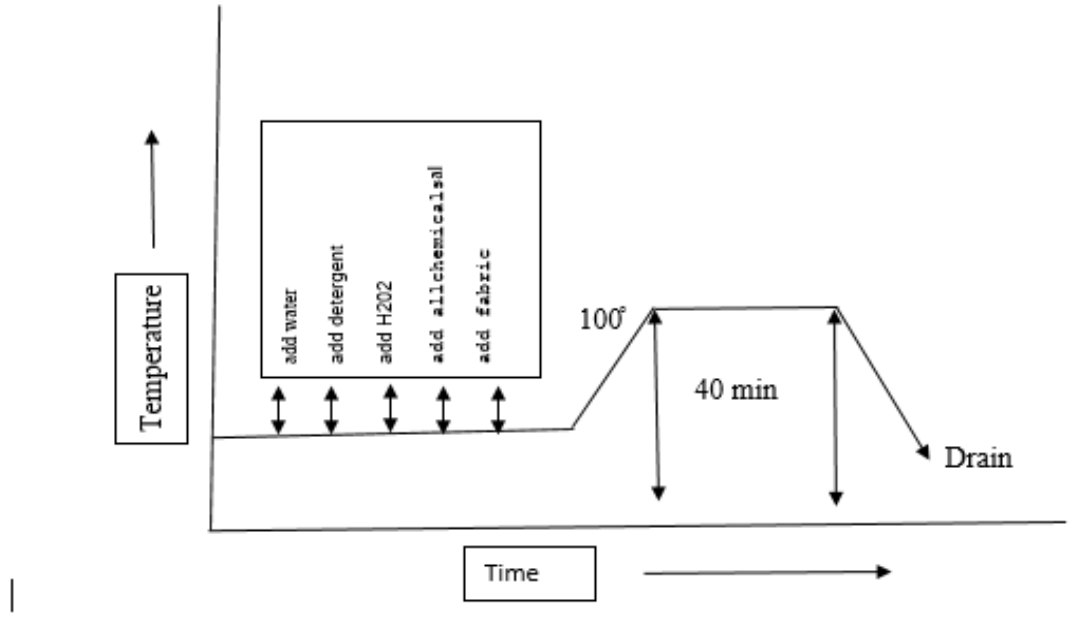

Fig 4.1-Scouring and bleaching of 100% cotton , 100% viscose & 50/50 cotton/viscose blend.:

4.2.1.4- Procedure of 100% cotton, 100% viscose & cotton/viscose dyeing with reactive dye of 1% s.soln.:

1. Collection of 100% cotton, 100% viscose & cotton/viscose fabric.
2. Add chemical and dyes & salt, soda in dye bath.
3. Dyeing at 60° C for 60 min .
4. Then dath drop.
5. Cold rinsing .
6. Soaping at 95 degree C for 10 min.
7. Drying at 100 degree C for 3 min.
8. Unload the fabric.

4.2.2.5- Curve of 100% cotton , 100% viscose & 50/50 cotton/viscose fabric with reactive dye 1% shade of blue color.

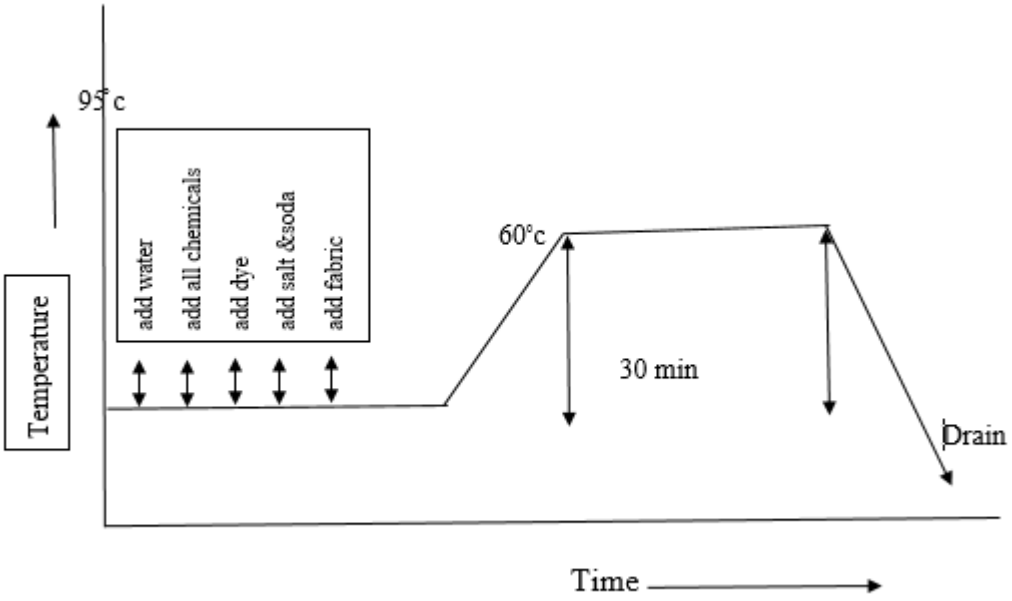

Fig 4.2- 100%cotton, 100% viscose & 50/50 cotton/viscose blend dyeing with reactive dye 1% shade of blue color.

4.2.2- Test method: Spectral analysis

By using spectrophotometer to find out Reflectance values and curves of the dyed fabrics were determined in the visible portion of the spectrum (400-700 nm) and the standard illuminant was D-65, TL-83/TL-84, A/F with 10° observer. K/S values of the minimum reflectance value were obtained using the Kubelka-Munk equation.

$$\frac{K}{S} = \frac{(1-R)^2}{2R} \text{ ---------- } \mathbf{1}$$

K/S= absorption function

R= minimum reflectance value at a wavelength of maximum absorption

4.2.3- ISO-105-X12(Color fastness to rubbing/crocking).

4.2.4-ISO 105 EO1 (Color Fastness Test to Water).

4.2.5-ISO 105 C06 (Color Fastness to Wash).

4.2.6-ISO 105-E04 (Color fatness to perspiration)

CHAPTER-5

RESULT & DISCUSSION

5.1-SPECTRAL TEST: REFECTANCE & COLOR STRENGTH

Now, For 100% cotton Rmin at 63o nm,

K/S=(1−R)2/2R= 4.316

Now, For 100% viscose Rmin at 63o nm,

K/S=(1−R)2/2R= 4.823

Now, For cotton/viscose Rmin at 63o nm,

K/S=(1−R)2/2R= 4.283

Table 5.1-Reflectance and k/s value of 100% cotton, 100% viscose & 50/50 cotton/viscose sample at Rmin.

Sample	Minimum R% at 630nm	k/s value
100% viscose	8.65	4.823
100% cotton	9.49	4.316
50/50 (cotton/viscose)	9.55	4.283

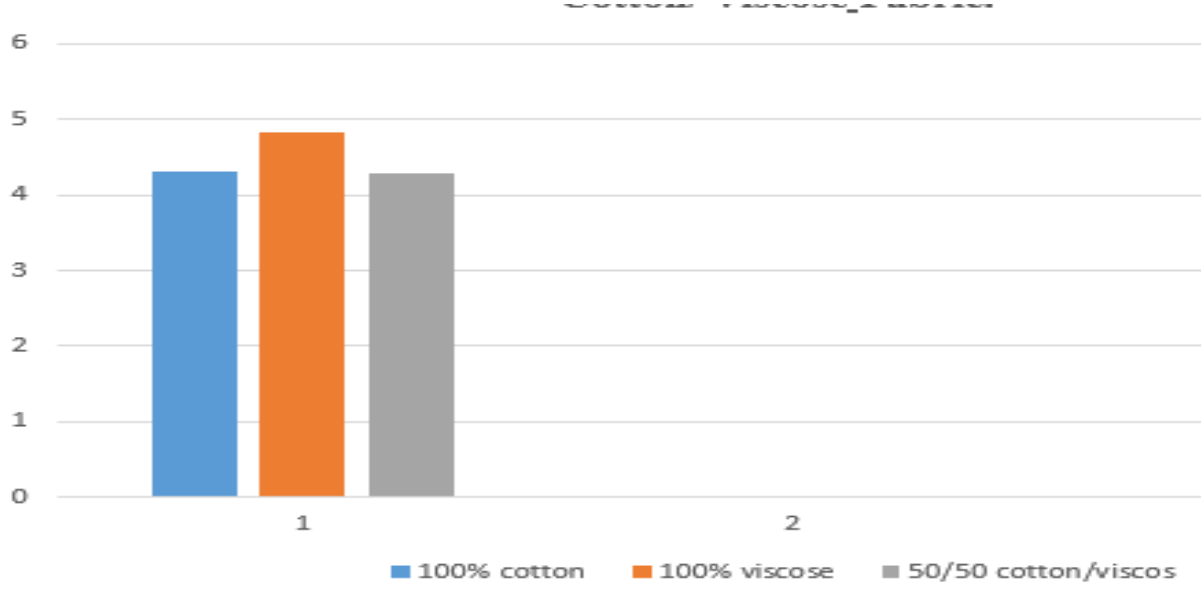

Fig 5.1- Bar diagram of Rmin at 630nm of 100% cotton, 100% viscose & Cotton/ Viscose Fabric.

Using spectrophotometer some value of light reflectance of 100% cotton , 100% viscose, 50/50 cotton/viscose blend.

Table 5.2- Light reflectance of 100% cotton, 100% viscose, and 50/50 cotton/viscose blend by using spectrophotometer.

Wave length	100% Cotton	100% Viscose	50/50 Cotton/viscose
370 nm	18.19	17.14	20.25
390 nm	20.84	25.96	26.09
410 nm	33.14	32.38	32.25
430 nm	35.79	35.14	34.99
450 nm	34.32	33.81	33.86
470 nm	30.75	30.23	30.50
490 nm	26.31	25.66	26.16
510 nm	22.39	21.68	22.33
530 nm	18.67	17.89	18.69
550 nm	15.69	14.91	15.80
570 nm	12.73	11.93	12.86
590 nm	10.61	9.73	10.67
610 nm	9.80	8.89	9.83
630 nm	9.49	8.65	9.55
650 nm	11.93	11.24	12.05
670 nm	18.43	18.07	18.59
690 nm	28.52	28.75	28.81
700nm	33.73	34.22	34.09

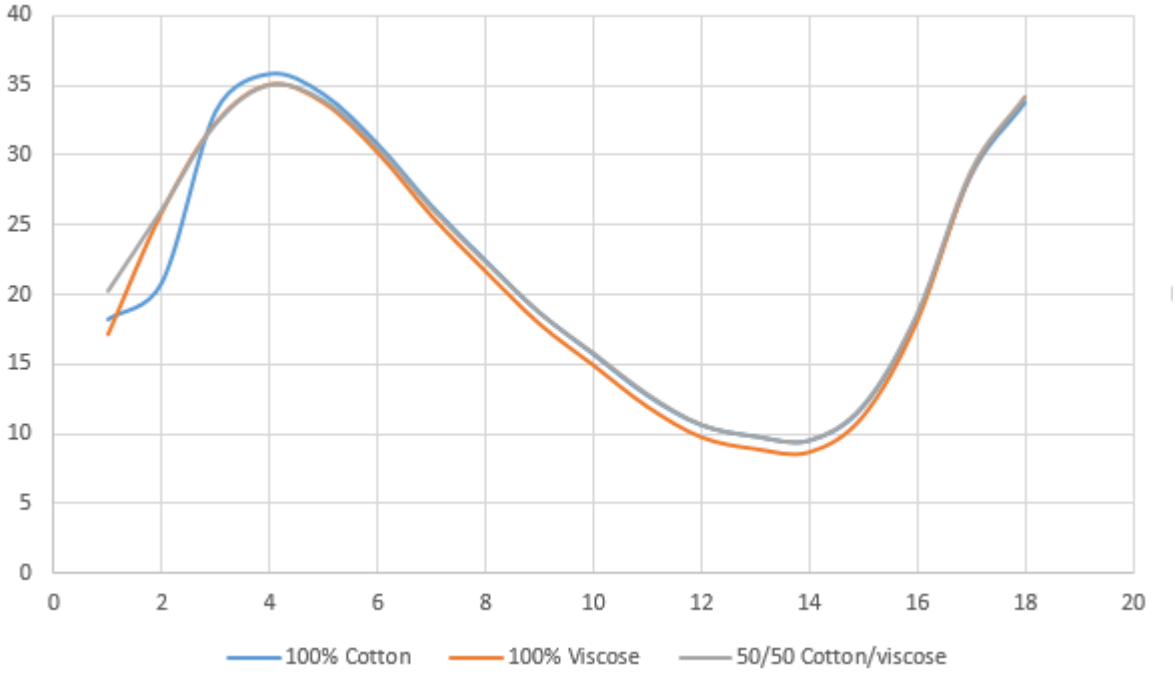

Fig 5.2: Curve of wave length & reflectance value of 100% cotton, 100% viscose & 50/50 cotton/viscose fabric.

Discussion:

K/S values of 100% cotton, 100% viscose and 50/50 cotton/viscose with reactive dyed samples for 1% shade (Blue color)-

Here we get,

For 100% cotton=4.316

100% visocose-4.823

50/50 cotton/viscose-4.283

We already known that, if the value of k/s is increase then the color strength will be increased and shade will be darker. Here we can see that k/s value is more in 100% viscose fabric so the color strength of viscose fabric is more than 100% cotton fabric and 50/50 cotton/viscose fabric.

5.2- Color fastness to rubbing result-

Table 5.3- Color fastness to rubbing grade for 100% cotton, 100% viscose and 50/50 cotton/viscose.

Sample	Scale	
	Dry rubbing	Wet rubbing
100% cotton	5	4
100% viscose	5	4
50/50 cotton/viscose	5	4

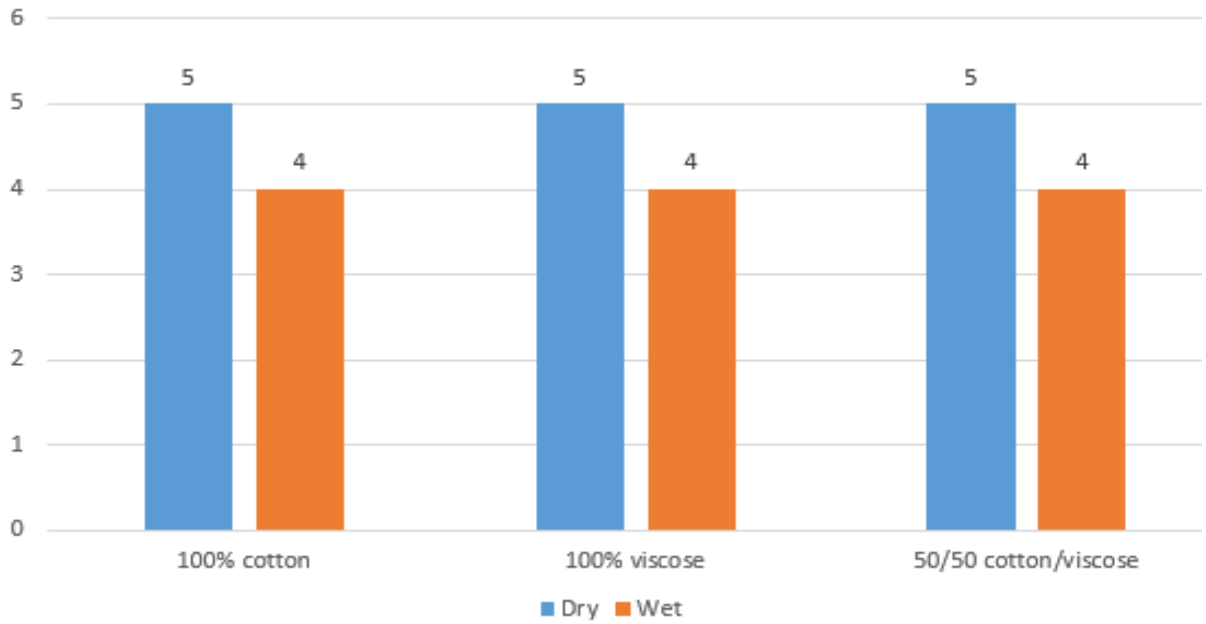

Fig 5.3: Bar diagram of rubbing fastness test.

Discussion-

Here we can say that, color fastness to rubbing dry is same for 100% cotton, 100% viscose and 50/50 cotton/viscose & its grading scale is 5 & color fastness to rubbing dry is same for 100% cotton, 100% viscos and 50/50 cotton/viscose & its grading scale is 4.

5.3- Color fastness to water result-

Table 5.4- color fastness to water grade for 100% cotton, 100% viscose and 50/50 cotton/viscose

Sample		Grading scale (staining)					
	Color change	Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
100% cotton	4.5	4.5	4	4.5	4.5	4.5	4
100% viscose	4.5	5	4	5	5	5	4
50/50 cotton/viscose	4.5	4	4	4	4	4	4

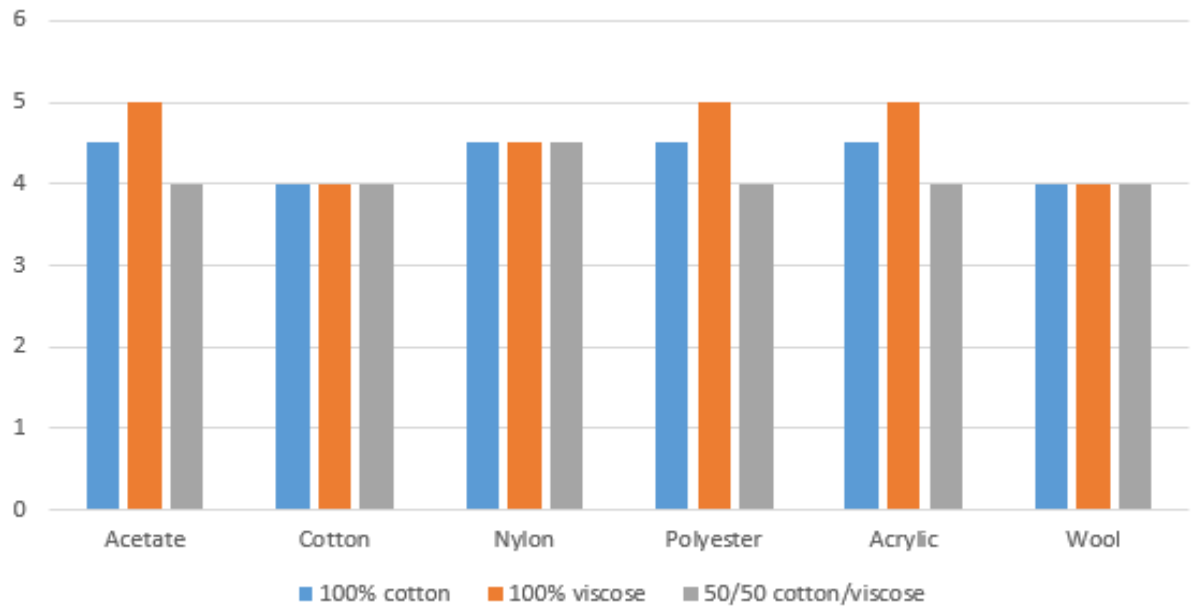

Fig 5.4: Bar diagram of water grade for 100% cotton, 100% viscose and 50/50 cotton/viscose

Discussion-

Here we can say, color fastness to water is excellent for 100% viscose fabric than 100% cotton and 50/50 cotton/viscose & its grading scale is 4-5.

5.4- Color fastness to washing result-

Table 5.5- color fastness to washing grade for 100% cotton, 100% viscose and 50/50 cotton/viscose

Sample		Grading scale (staining)					
	Color change	acetate	cotton	nylon	polyester	acrylic	wool
100% cotton	4.5	4	4	5	5	5	4
100% viscose	4.5	4.5	3.5	4.5	4.5	4.5	3.5
50/50 cotton/viscose	4.5	4	4	4	4	4	4

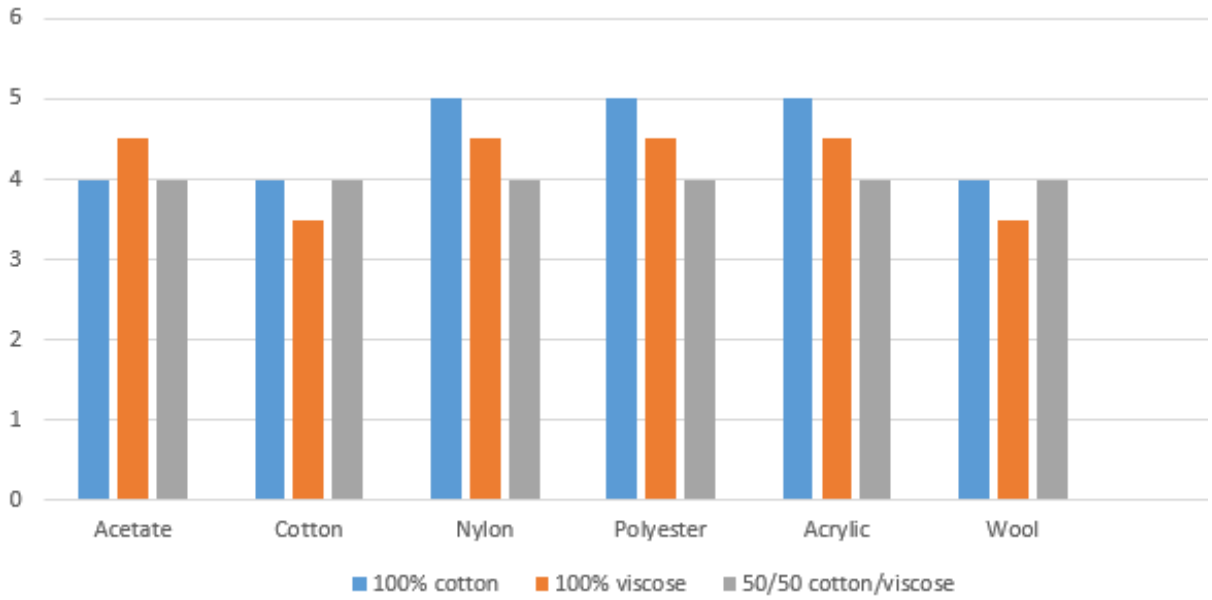

Fig 5.5: Bar diagram of washing grade for 100% cotton, 100% viscose and 50/50 cotton/viscose.

Discussion:

Here we can say, color fastness to wash is excellent for 100% cotton fabric than 100% viscose and 50/50 cotton/viscose & its grading scale is 4-5.

5.5- Color fastness to perspiration result-

For acid medium

Table 5.6- color fastness to perspiration grade for 100% cotton, 100% viscose and 50/50 cotton/viscose.

Sample		Grading scale (s)					
	Color change	acetate	cotton	nylon	polyester	acrylic	wool
100% cotton	4.5	4.5	4.5	4.5	4.5	4.5	4.5
100% viscose	4.5	5	5	5	5	5	5
50/50 cotton/viscose	4.5	4	4	4	4	4	4

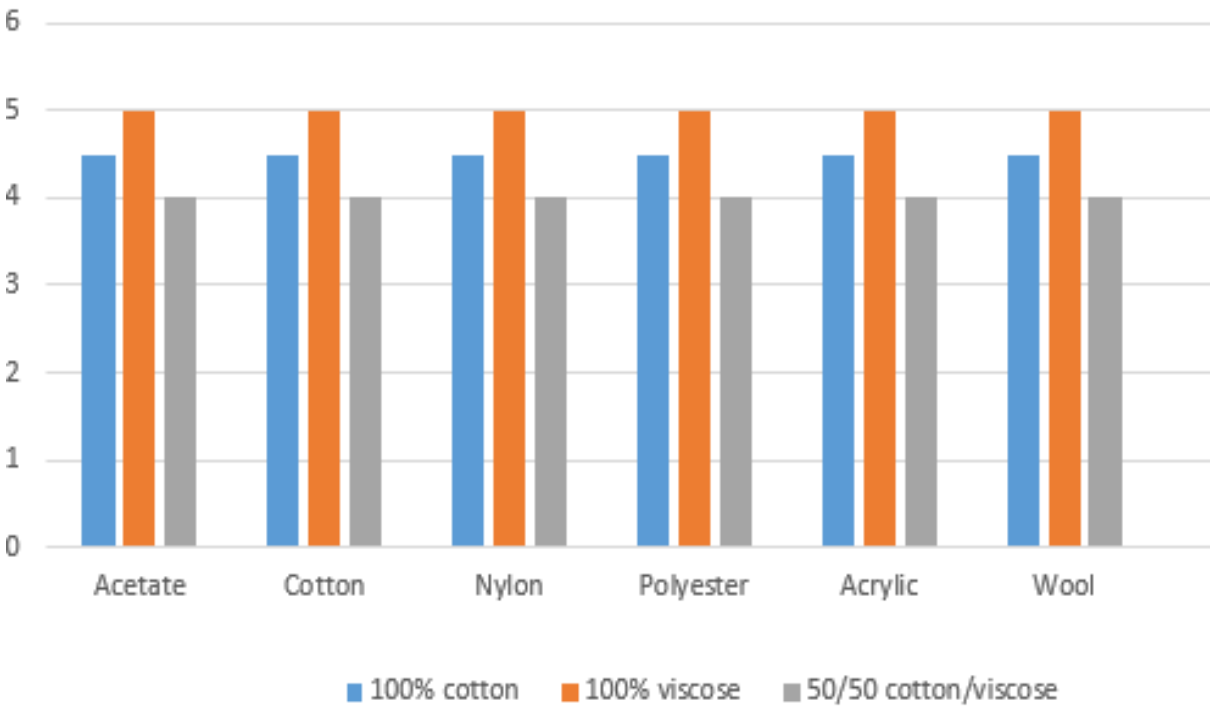

Fig 5.6-Bar diagram of perspiration test for 100% cotton, 100% viscose and 50/50 cotton/viscose fabric.

For alkali medium

Table 5.7- color fastness to perspiration grade for 100% cotton, 100% viscose and 50/50 cotton/viscose.

Sample		Grading scale (s)					
	Color change	acetate	cotton	nylon	polyester	acrylic	wool
100% cotton	4.5	5	3.4	5	5	5	4
100% viscose	4.5	4.5	3.4	4.5	4.5	4.5	4
50/50 cotton/viscose	4.5	4	3.4	4	4	4	4

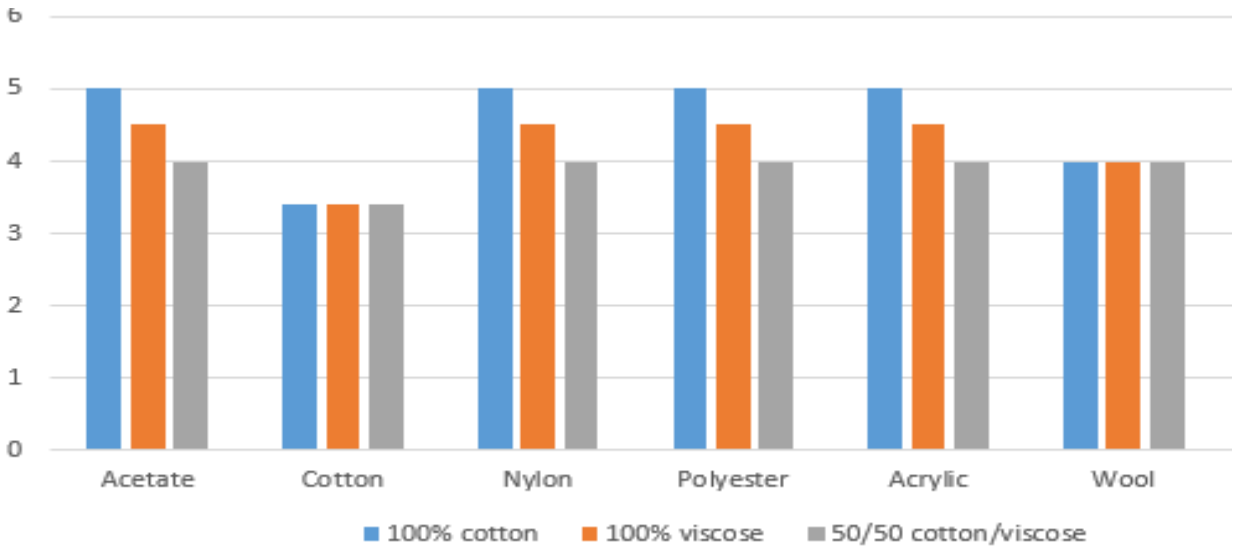

Fig 5.7: Bar diagram of perspiration test for 100% cotton, 100% viscose and 50/50 cotton/viscose fabric.

Discussion

Here we can say, color fastness to perspiration (acid medium) is excellent for 100% viscose fabric than 100% cotton and 50/50 cotton/viscose & color fastness to perspiration (alkali medium) is excellent for 100% cotton fabric than 100% viscose and 50/50 cotton/viscose its grading scale is 4-5.

CHAPTER-6

Conclusion

Final outcomes

1. Here Rmin at 630 nm of 3 sample are –

   100% cotton=4.316, 100% visocose-4.823 & 50/50 cotton/viscose-4.283

   So we say that, color strength & reflectance is better for 100% viscose fabric.

2. **Color Fastness results-**

   i. Rubbing fastness range of dry condition of 100% cotton, 100%viscose and cotton/viscose blended are 5 ,5,5.So rubbing fastness all the sample is same result (Excellent) & Rubbing fastness range of wet condition of 100% cotton, 100%viscose and cotton/viscose blended are 4 , 4 4.So rubbing fastness all the sample is same result (Good).

   ii. Here we can say, color fastness to wash is excellent for 100% cotton fabric than 100% viscose and 50/50 cotton/viscose & its grading scale is 4-5.

   iii. Here we can say, color fastness to water is excellent for 100% viscose fabric than 100% cotton and 50/50 cotton/viscose & its grading scale is 4-5

   iv. Color fastness to perspiration (acid medium) is excellent for 100% viscose fabric than 100% cotton and 50/50 cotton/viscose & color fastness to perspiration (alkali medium) is excellent for 100% cotton fabric than 100% viscose and 50/50 cotton/viscose its grading scale is 4-5.

   .

REFERENCE

1. www.textileblogspot.com/cotton&viscosefibreproperties.
2. http://www.sapub.org/global/showpaperpdf.aspx?doi=10.5923/j.clothing.20170401.02
3. http://article.sapub.org/10.5923.j.textile.20170606.04.html
4. https://www.slideshare.net/rajeevsharan/colour-fastness.
5. https://www.slideshare.net/.../eco-friendly-dyeing-of-viscose-fabric-with-reactive-dyes
6. http://www.textileinstruments.net/news_pro.asp?id=354&Color-Fastness-To-Rubbing-%7C-Textile-Sample%A1%AFs-Color-Measurement.asp
7. Author Hossain m, P.S., R. Shanker, and A. Verma, Enzymatic natural dyeing of cotton and silk fabrics without metal mordants.Journal of Cleaner Production, 2007. 15(15): p. 1441-1450.[2]
8. Demiroz Gun ,Effect of cellulase treatment on the extent of post-finishing and dyeing of cotton fabrics. Journal of Materials Processing Technology, 2005. 160(1): p. 99-106.
9. Author hasan al mamun., The application of catalase for the elimination of hydrogen peroxide residues after bleaching of cotton fabrics. Anais da Academia Brasileira de Ciências, 2002. 74(3): p. 433-436.
10. J. R. Aspland , "Textile Dyeing and Coloration", American Association of Textile Chemists and Colorists,1997,PP:186
11. ISO 105 E01: Textile—Tests for color fastness—part E01:colour fastness to water, 2013
12. ISO 105 E04: Textile—Tests for color fastness—part cE04:colour fastness to perspiration,2013
13. ISO 105 X12: Textile—Tests for color fastness—part X12:colour fastness to rubbing,2001.