SONARGAON UNIVERSITY

Department of textile Engineering

Faculty of Engineering

Project report on

Comparative study on 100% cotton woven & knit fabric with reactive & direct dye.

Course title: Project work

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A thesis submitted in partial of requirement for degree of **Bachelor of Science in Textile Engineering**

Advance in wet Processing

SUMMER-2025

DECLARATION

We hereby declare that, this project has been done by under supervision of Md.Selim lecturer &coordinator Department of textile Engineering, Faculty of engineering, Sonargaon University We also declare that, neither this project nor any part of this project submitted elsewhere for award of any degree.

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LETTER OF APPROVAL

This project report prepared by (MD.SADEKUL ISLAM, TEX2201025052) (TANMOY DEY, TEX2202026016) (TANVIR AZAD, TEX2202026031) (MASUD RANA,TEX1901016047) is approved in partial Fulfillment of Requirement for the degree of **BACHELOR OF SCIENCE IN TEXTILE ENGINEETRING.**

The said student have completed their project under my supervision. During the research period I found them sincere, hardworking and enthusiastic.

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Acknowledgement

At first,we are grateful to almighty Allah for this Divine blessing make us possible to ready the project.

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

Dedication

This project report is dedicated to our beloved parents and teachers

ABSTRACT

This project report present comparative study about rubbing fastness of reactive dye and direct dye. In this report we collect data from Sonargaon University textile lab. This report, help us to know about rubbing fastness of reactive dye and direct dye. Their dyeing process and fastness properties. From this experiment we also learn that the auxiliary need for dyeing of direct dye is less than reactive dye, but temperature need for dyeing with direct dye is more than reactive dye. Rubbing fastness of dry reactive fabric is better than direct dye. Rubbing fastness of wet fabric of reactive dye for knit and woven fabric also better than rubbing fastness of direct dyed fabric.

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Chapter 01

Introduction

Chapter-1

Introduction

1.1 Aim of the project:

- ✓ To know about effect of color fastness to rubbing of reactive and direct dye for woven and knit fabric.
- ✓ To know about dyeing procedure of Reactive dye
- ✓ To know about dyeing procedure of direct dye.
- ✓ To know comparison rubbing fastness between reactive dye and direct dye.

1.2 Limitation:

- ✓ One month is not enough time to complete this thesis.
- ✓ It was not possible to collect all data from dyeing section because of DIU Textile lab limitation.
- ✓ It has taken much time to collect data list from DIU textile lab because they were too much busy for obtaining required industrial training in time.

1.3 Background of the study:

Colorfastness is define by the American Association of textile chemist and colorist as the resistance of a material to transfer in any of its color characteristics, to transfer its colorant to adjacent material ,or both ,as a result of exposure of the material to any environment that might be encountered duringthe processing ,testing, storage ,or use of the material. ”In other word, it is a fabric ability to retain its color through its intended life cycle. There are different types of colorfastness properties that must be considered to provide the consumer with an acceptable product. The American association of textile chemist and colorist has over thirty test method that evaluate different color fastness properties. These include, but are not limited to rubbing, wash, light, crock, perspiration, abrasion, and heat. Manufacturers must know a fabric intended end use in order to make processing decision that will produce a product of acceptable performance.

Dyeing operation is performed by the reaction between fiber and dye. Somme dyes are water soluble and some are insoluble some fiber have affinity to dye and some fiber have no affinity to dye. So dyeing depend on both fiber and dyes chemical quality.

CHAPTER-2

LITERATURE REVIEW

2.1 Reactive dye:

Reactive dyes are most common dye in textile industry. Most natural fiber dyeing is done by Reactive dye. Reactive dyes have acceptance to the dyeing technologist for dyeing cotton. The dyeing of natural fiber with reactive dye energy consumption is less than dyeing with other dye. Reactive dyes make covalent bond with fiber.

Formula of Reactive dye can be written by-

D-X-Y

D=color producing group

X= bridge (covalent bond)

Y=functional group

$Cell\text{-}OH + HO^- = Cell\text{-}O + H_2O$

$Cell\text{-}O + Dye\text{–}Cl^- = Cell\text{-}O\text{-}Dye + Cl$

2.2 History of reactive dye:

Reactive dyes were first used in 1956,it was invented by steepens and Retteein Blackly in 1954,while they were working on ICI company(UK).

Reactive dye is most popular system for coloring cellulosic fibers.it can be used on nylon and wool dyeing. These fiber have low utilization property from other dyestuff.

These dyes is mainly created to dyed cellulosic fiber. The dye were invented in 3 types and name of those are-

- ✓ Procion Yellow R
- ✓ Procion brilliant Red 2B
- ✓ Procion Blue 3G

For this invention they were award gold medal of the society of dyes and colorists in 1960. These dye arrived in our country in mid-60'sand become much popular during 80's.



Figure2.1: Reactive dye

2.3 Properties of Reactive dye:

- ✓ Reactive dyes are water soluble dye
- ✓ Reactive dye create covalent bond with fiber.
- ✓ Dye has good light fastness property around 6.
- ✓ These dye cheap in cost.
- ✓ These dye have moderate rubbing fastness.
- ✓ These dyes have good perspiration fastness rating is about 4-5.
- ✓ Fixation is done in alkali medium.
- ✓ Can be found in print paste form, powder form and liquid form

2.4 Chemical structure of reactive dye:

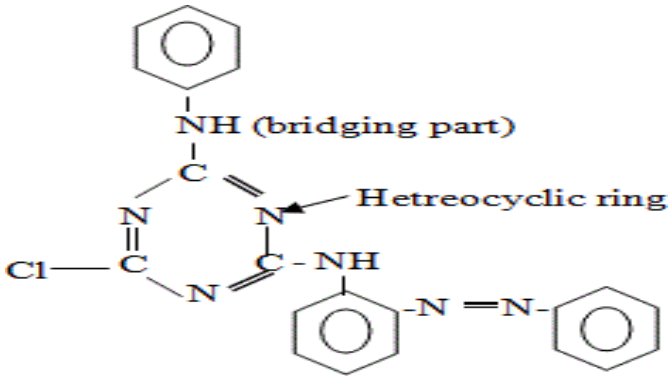


Fig: chemical structure of reactive dye

2.5 Classification of Reactive dye:

Reactive dyes are classified by many ways. Depending on chemical constitution reactive dyes can be classified as:

- ✓ Chiortriazine dyes(MCT)
- ✓ Vinyl sulphone Dyes
- ✓ Heterocyclic dyes
- ✓ Mixed dyes

Depending on application method of temperature can be classified as:

Cold brand:

This type of reactive dyes is applied in very low temperature. Temperature lies between30- 50 degree. The reactive group present in cold brand are very active.so, temperature need is very low.

Medium Brand:

This type of Reactive dyes is applied in medium temperature 60 degree. Their reactivity is medium with fiber. The reactive group present is not so active as cold brand.

Hot Brand:

These dyes are very low reactive, for dyeing with hot brand temperature is very high temperature lies between 60-90 degree Celsius. The reactive group present is very low reactive.

2.6 Dyeing mechanism of material with reactive dye:

Dye absorption:

When fiber is immersed into dye liquor, an electrolyte is added to assist the exhaustion of dye. Here NaCl or global salt used as a electrolyte. This electrolyte neutralize absorption

Fixation:

Fixation of dye means the reaction of reactive group of dye with terminal-oH or NH2 group of fiber and thus forming strong covalent bond with the fiber. These phase is very important. In this phase PH maintain by adding alkali.

Wash off:

As the dyeing is complete, a good wash must be applied to the material to remove extra and unfixed dye. Wash off is need for level dyeing and good wash fastness. It is done by a series of hot wash, cold wash and soap solution wash.

2.7 Direct dye

Direct dyes are water soluble anionic dye and have sulphonic acid group in structure. Light fastness is good but wash fastness is not good as reactive dye for its water solubility. Wash fastness of direct dye can improve through after treatment. Generally direct dye gives bright shade on fiber surface. The dyeing process of direct dye is very simple. The need of auxiliary is not so much as reactive dye, direct dyeing is normally carried out normally neutral or slight alkaline bath, at near boiling temperature. Direct dye generally used on cotton, paper, leather, wool, silk and nylon.

2.8 Types of direct dye:

- ✓ **Class A:** The dye that are self-levelling, good migration, or levelling properties.
- ✓ **Class B:** The dyes that have not self –levelling property, but which can be controlled by addition of salt to give level result.
- ✓ **Class C**:This dyes are highly sensitive to salt, Exhaustion of this dye cannot be controlled by addition of salt require temperature**,** they are described as temperature controllable**.**

2.9 Property of Direct dye:

- ✓ Direct dye are water soluble dye
- ✓ Direct dye anionic in nature
- ✓ Direct dyeing process is carried out in alkaline media
- ✓ Applied in cellulosic as well as protein fiber
- ✓ Fastness property average specially wet Fastness
- ✓ Wash fastness of direct dye is not good

2.10 Chemical structure of direct dye:

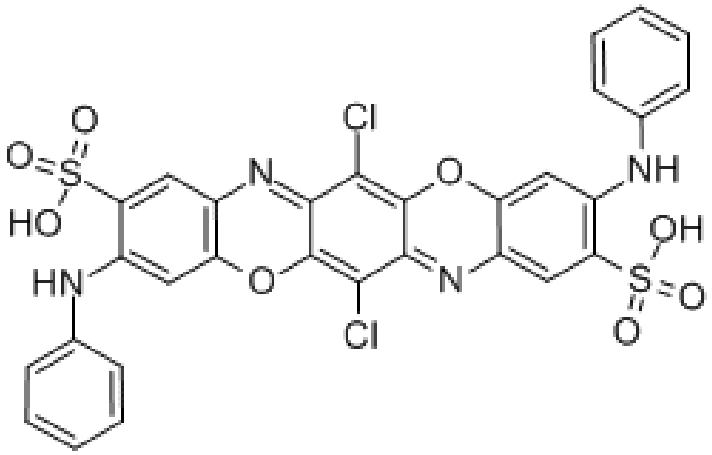


Fig: Chemical structure of direct dye

2.10.1 Dyeing mechanism of direct dye:

Direct dyes are mainly anionic dyes, are mainly applied on cellulosic fiber. Direct dye also applied wool nylon fiber. The dyeing mechanism of direct dye involve adsorption, diffusion, and migration over fiber. When cellulosic fiber is immersed into water the amorphous region of the fiber swell to produce small pores .the small size dye molecule diffuse into the fiber structure. The addition of electrolytes (Sodium chlorite, Sodium sulfate) assist the diffusion and exhaustion of direct dye anionic by neutralizing the negative surface charge of cellulosic fiber.



Figure2.2: Direct dye

2.10.2 Color variation of reactive dye:

- ✓ Light (0.25%)
- ✓ Medium (0.75%)
- ✓ Dark (2%)

2.10.3 Color variation of Direct Dye:

- ✓ Light (0.25%)
- ✓ Medium (0.75%)
- ✓ Dark (2%)

2.10.4 Reactive blue (light shade)

Figure 2.3: Reactive blue(light shade)

2.10.5 Reactive blue(Medium shade)



Figure 2.4: Reactive blue(0.75%)

2.10.6 Reactive blue (Dark shade)



Figure 2.5: Reactive blue (2%)

2.10.7 Direct dye (light shade)

Figure 2.6: direct blue(0.25%)

2.10.8 Direct dye (medium shade)

Figure 2.7: Direct blue (0.75%)

2.10.9 Direct dye (dark shade)

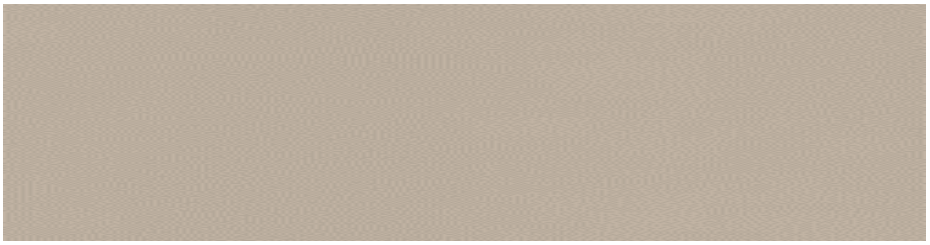


Figure 2.8: Direct blue (2%)

2.10.10 Shade variation of reactive dye and direct dye:



Light **Medium** **dark**

VS



Light **Medium** **Dark**

Chapter 3

EXPERIMENTAL PROCEDURE

3.1 Specification of the sample:

Table3.1: Specification of the fabric sample:

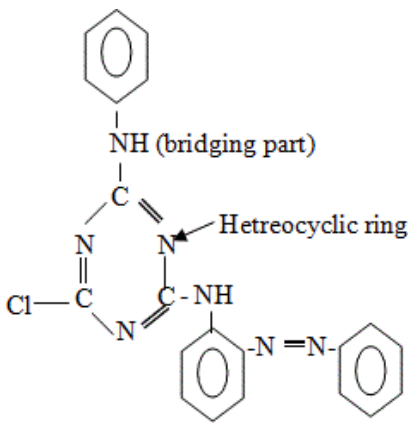
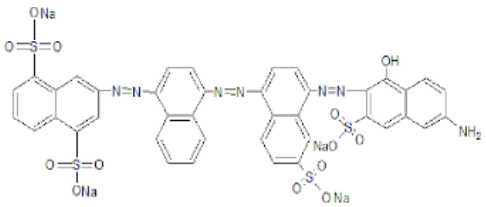
Fabric type	EPI	PPI	GSM	WPI	CPI
100%cotton woven fabric	62	60	82		
100%cotton knit fabric(single jersey)			135	38	50

3.2 Experimental procedure:

Our Experimental project based on three different shade of reactive dye and direct dye light shade, medium shade and Dark shade. Firstly we collect knit fabric and woven fabric from Knit concern group. Then knit fabric and woven fabric is dyed. After dyeing and finishing process the fabric is tested of rubbing fastness.

3.3 Basic difference between reactive dye and direct dye:

Table 3.2 difference between reactive and direct dye

Si no	**Reactive dyeing**	**Direct dyeing**
Mechanism	Covalent bond formation with fiber	Hydrogen bond, vender wall's force fiber surface and dye molecule
Solubility	Soluble in water	Soluble in water
Charge	Negatively charge	Negative charge
Fastness property	Rubbing: moderate Washing: good Perspiration: good	Rubbing: Poor Washing: weak Perspiration: Average
Cost	Cheap in price	More expensive than reactive dye
Temperature	60-90◦C	90◦C
PH	7-11	10-11
Chemical structure of direct dye		

3.4 Recipe of Reactive Dye:

Table3.3: Recipe of reactive dyeing light shade (0.25%)

Process parameter	Unit	Dossing
Reactive Blue	%	0.25
Sal (NaCl)	g/l	25
Soda ash	g/l	10
Wetting agent	g/l	0.25
Sequestering agent	g/l	0.25
Temperature	˚c	60
Time	minute	60
M:L		1:40
Fabric Type(woven)		
Fabric weight	gm	5
Fabric type(knit)		
Fabric weight	gm	5

Recipe for reactive dye medium shade(0.75%)

Process parameter	Unit	Dosing
Reactive blue	%	0.75%
Salt(NaCl)	g/l	30
Soda	g/l	15
Sequestering agent	ml/L	0.25
Leveling agent	ml/L	0.25
Temperature	˚c	60
Time	Minute	60
M:L		1:40
Woven fabric	gm	5
Knit fabric	gm	5

Process curve for reactive dye medium shade(0.75%)

Recipe for reactive dye dark shade(2%)

Parameter	Unit	Dosing
Reactive blue	%	2%
Salt(NaCl)	g/l	60
Soda	g/l	15
Sequestering agent	ml/l	0.25
Leveling agent	ml/L	0.25
Temperature	˚c	60
Time	minute	60
M:L		1:40
Woven fabric	gm	5
Knit fabric	gm	5

Process curve for reactive dye dark shade:

3.5 Dyeing recipe for direct dye:

Table3.4: Recipe of direct dye light shade(0.25%)

Process parameter	Unit	Dosing
Direct dye blue	%	0.25
Sequestering agent	g/l	0.2
Leveling agent	g/l	0.25
Salt (Nacl)	g/l	5
pH		10.5
Temperature	˚c	100
Time	minute	60
M:L		1:40
Woven fabric	gm	5
Knit fabric	gm	5

Process curve for direct dye light shade(0.25%)

Recipe of direct dye medium shade(0.75%)

Process parameter	Unit	Dosing
Direct dye blue	**%**	0.75
Salt(NaCl)	g/l	**10**
Sequestering agent	g/l	0.25
Leveling agent	g/l	0.25
pH		10.5
Temperature	˚C	100
Time	Minute	60
M:L		1:40
Woven fabric	Gm	5
Knit fabric	Gm	5

Process curve for direct medium shade(0.75%)

Recipe of direct dye dark shade(2%)

Process parameter	Unit	Dosing
Direct dye blue	**%**	2
Salt(NaCl)	g/l	15
Soda	g/l	2
Sequestering agent	g/l	0.25
Leveling agent	g/l	0.25
pH		10.5
Temperature	**˚c**	100
Time	Minute	60
M:L		**1:40**
Woven fabric	Gm	5
Knit fabric	Gm	5

Process curve for direct dye dark shade(2%)

3.6 Process flow Chart of Reactive dyeing:

Collection of pre-treated sample

|

et water level

|

Add dye solution

|

Add salt solution

|

Add Soda Ash

|

Add fabric sample

|

Raise Temperature to 60◦C

|

Run Time for 20 minute

|

Bath drop

|

Rinsing

|

Hot wash at 90◦Cfor 10 Minute

|

Dry

3.7 Process curve of reactive dye:

Fig3.1: Process curve of reactive dye

3.8 Process flow chart of direct dye:

Collection of pre-treated sample

|

Set water level

|

Add dye solution

|

Add salt solution

|

Add soda

|

Add sequestering agent

|

Raise temperature 90◦C

|

Run time 20 min

|

Bath drop

|

Rinsing

|

Cold wash

|

Drain

3.10 Dyeing sample:

3.10.1. Comparison of dyed fabric with reactive dye and direct dye woven and knit fabric(lightshade)



3.10.2:Comparison of dyed fabric with reactive dye and direct dye woven and knit fabric (medium shade)



3.10.2 Comparison of dyed fabric reactive dye with reactive dye and direct dye woven fabric and knit fabric (Dark shade):



3.10.3 Rubbing Fastness:

Rubbing fastness is one of the most important test in the color fastness of textile, that means degree of fading after friction. This test is designed to determine the degree of color which is transferred from the color fabric to the test cloth.

3.10.4 Principal:

Sample of textile is rubbed with dry rubbing cloth and with wet rubbing cloth by rubbing finger. The staining of rubbing cloth is assessed with grey scale for staining. The procedure followed by (ISO-105-X12)

3.10.5 Types of rubbing fastness:

- ✓ Dry Rub
- ✓ Wet rub

3.10.6 Apparatus Need:

- ✓ Crock meter
- ✓ Grey scale for staining

3.10.7 PROCEDURE:

- ✓ The test sample (15Cm×5Cm)is placed on the crock meter
- ✓ A square of white test fabric (5cm×5cm) that is de sized, bleached but without finish cotton fabric is taken for test
- ✓ Test cloth attached to the finger of crock meter.
- ✓ This finger is used in rubbing action on the sample specimen.
- ✓ Rubbing is done to and fro, 10 cycle at 10 second, figure pressure on the specimen is 9 N.
- ✓ Rubbing is done both warp and weft way of the a sample
- ✓ For dry and wet rubbing test separate sample is used
- ✓ For wet rubbing M:L ratio maintain 1:50,after wetting fabric is squeezed.



Fig 3.3: crock meter

3.10.8 Assessment technique:

- ✓ The tested sample is compared with dyed sample and under light box using D65 light source and rated by the help of color change gray scale.
- ✓ The Dry rubbed crock cloth also visually assessed under light box with D65 light source and rated with the help of color staining gray scale.
- ✓ In case of wet rubbed cloth at first it assessed after drying the crock cloth the procedure was same as dry rubbed crock cloth

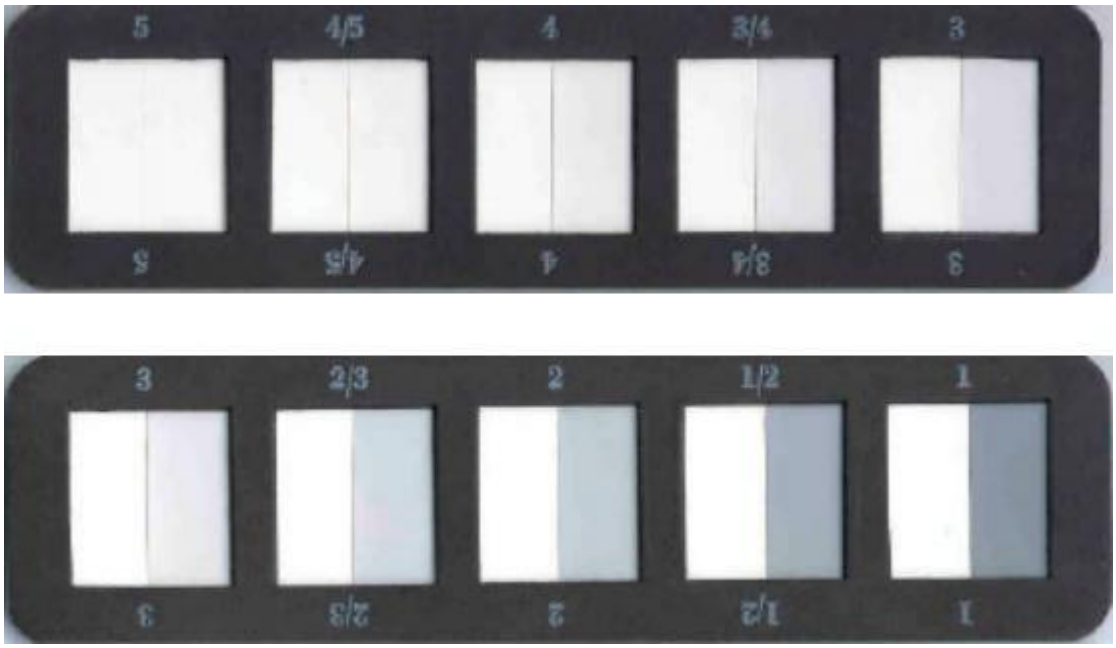


Fig3.4 : grey scale

Chapter 4

Result and discussion

4.1 Data analysis and Finding

4.2 Assessment of rubbing fastness to rubbing for woven and knit fabric

Table4.1 color fastness to rubbing for light shade

Sample	Shade	Color staining for woven fabric (light shade)			
		Reactive	Direct	Reactive	Direct
		Dry condition	Dry condition	Wet condition	Wet condition
01	0.25%	4/5	4	4	3/4
02	0.25%	4/5	4	4	3/4
033	0.25%	4/5	4	4	¾

Table4.2: color fastness to rubbing medium shade woven fabric

Sample	Shade	Color staining for woven fabric (medium shade)			
		Reactive	Direct	reactive	Direct
		Dry condition	Dry condition	Wet condition	Wet condition
01	0.75%	4/5	4	4	3
02	0.75%	4/5	4	4	3
03	0.75%	4/5	4	4	3

4.3 : color fastness to rubbing dark shade woven fabric

Sample	Shade	Color staining for woven fabric (dark shade)			
		Reactive	Direct	Reactive	Direct
		Dry condition	Dry condition	Wet condition	Wet condition
01	2%	4	3/4	3	3
02	2%	4	3/4	3	3
03	2%	4	¾	3	3

Table 4.4: Assessment for rubbing fastness of knit fabric(light shade)

Sample	Shade	Color staining for knit fabric (light shade)			
		Reactive	Direct	Reactive	Direct
		Dry condition	Dry condition	Wet condition	Wet condition
01	0.25%	4/5	3/4	4	3
02	0.25%	4/5	3/4	4	3
03	0.25%	4/5	3/4	4	3

Table4.5 : Assessment for rubbing fastness for medium shade

Sample	Shade	Color staining for woven fabric (light shade)			
		Reactive	Direct	Reactive	Direct
		Dry condition	Dry condition	Wet condition	Wet condition
01	0.75%	4	3	¾	3
02	0.75%	4	3	¾	3
03	0.75%	4	3	¾	3

Table4.6: Rubbing fastness for dark shade

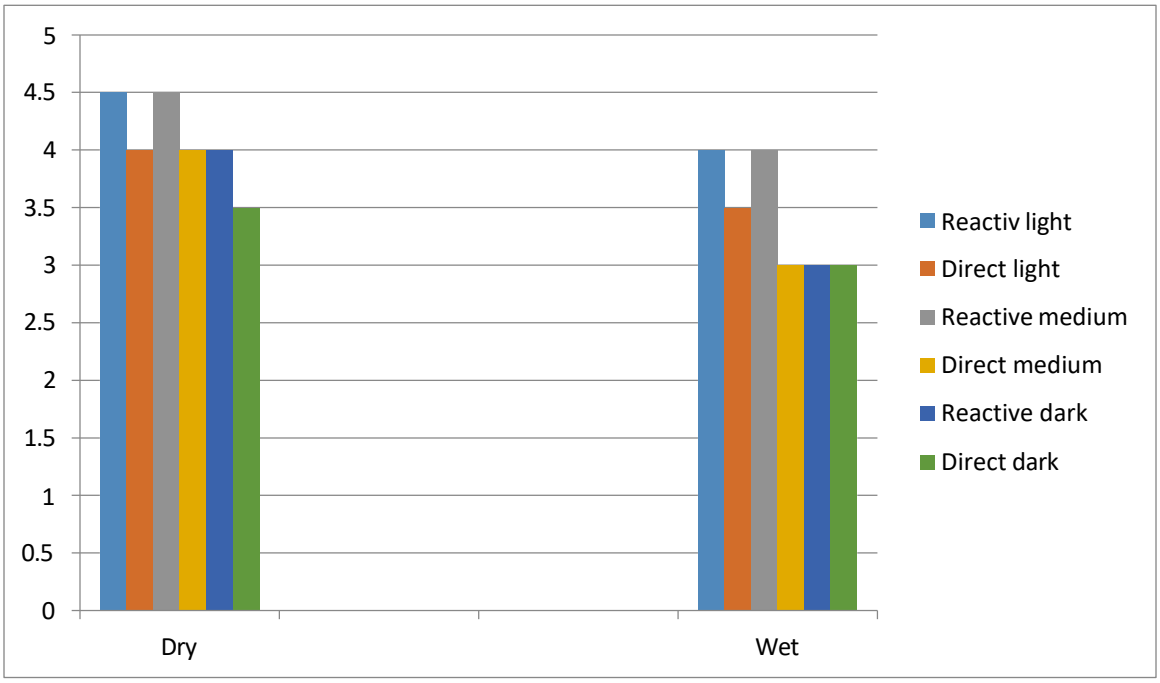
Sample	Shade	Color staining for knit fabric (light shade)			
		Reactive	Direct	Reactive	Direct
		Dry condition	Dry condition	Wet condition	Wet condition
01	2%	3/4	3	3	2
02	2%	3/4	3	3	2
03	2%	3/4	3	3	2

4.3 comparison between rubbing fastness of reactive and direct dye

Table 4.7: comparison of rubbing fastness between reactive and direct dye

Color staining for woven fabric					Color staining for knit fabric			
Shade	Reactive dry	Direct dry	Reactive wet	Direct wet	Reactive dry	Direct dry	Reactive wet	Direct wet
Light	4/5	4	4	3/4	4/5	3/4	4	3
Medium	4/5	4	4	3	4	3/4	¾	3
Dark	4	3/4	3	3	3/4	3	3	2

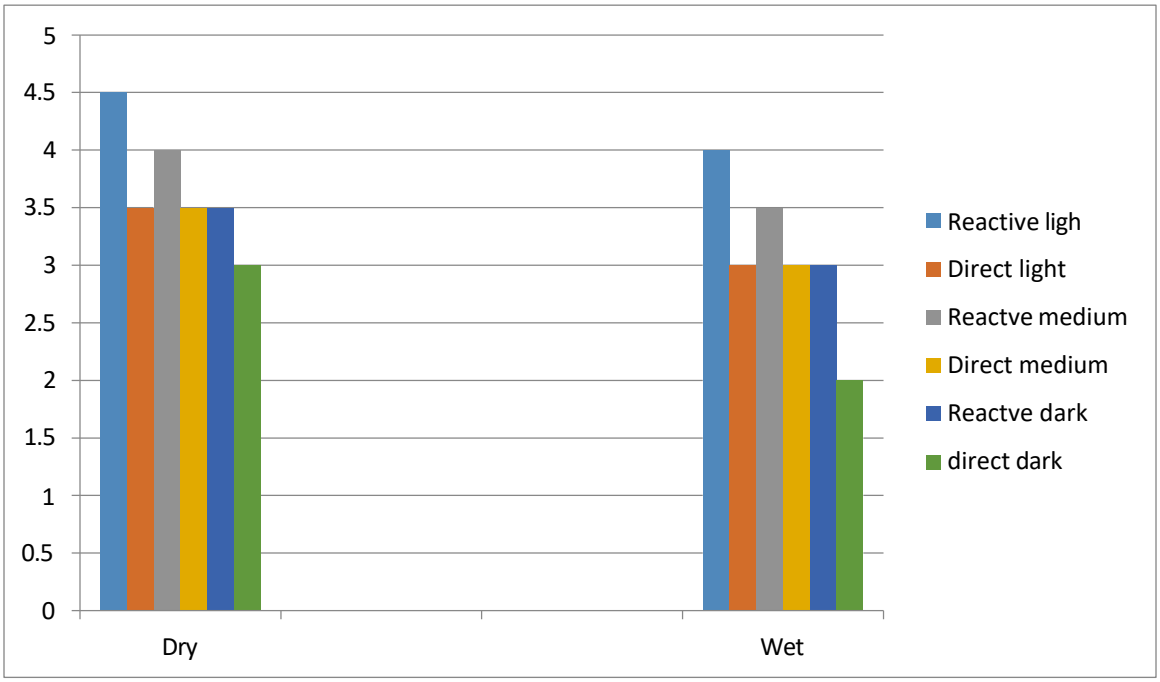
4.4 Result in chart of rubbing fastness of reactive & direct dye (Woven fabric)



Graph 4.1: Rubbing fastness result of reactive dye of woven and knit(dry and wet)

A comparison of rubbing fastness of woven fabric dyed with re-active dye and that with direct dye is shown in graph 4.1. It can be noticed that both dry and wet rubbing fastness of direct dye are poor in comparison to reactive.

4.5 Result in chart of rubbing fastness of reactive & direct dye(Knit fabric)



Graph 4.2: Rubbing fastness result of reactive& direct dye of woven (dry and wet)

A comparison of rubbing fastness of knit fabric dyed with re-active dye and that with direct dyeis shown in graph 4.2. It can be noticed that both dry and wet rubbing fastness of direct dye are poor in comparison to reactive dye.

4.3Assessment of wash fastness to washing for woven and knit fabric

4.8 Color fastness to washing for light shade (0.25%)

Sample	Shade	Color staining for woven & knit fabric light shade (0.25%)			
		Reactive (woven)	**Direct (woven)**	**Reactive (knit)**	**Direct (knit)**
01	**0.25%**	**4**	**3**	**¾**	**2/3**
02	**0.25%**	**4**	**3**	**¾**	**2/3**
03	**0.25%**	**4**	**3**	**¾**	**2/3**

4.9 Color fastness to washing for medium shade (0.75%)

Sample	**Shade**	Color stating for woven & knit fabric medium shade (0.75%)			
		Reactive	**Direct**	**Reactive**	**Direct**

		(woven)	(woven)	(knit)	(knit)
01	0.75%	¾	2/3	3	2
02	0.75%	¾	2/3	3	2
03	0.75%	¾	2/3	3	2

4.10. Color fastness to washing for dark shade(2%)

Sample	**Shade**	Color staining for woven & knit fabric dark shade (2%)			
		Reactive (woven)	**Direct (woven)**	**Reactive (knit)**	**Direct (knit)**
01	**2%**	**3**	½	**2/3**	**1**
02	**2%**	**3**	½	**2/3**	**1**
03	**2%**	**3**	½	**2/3**	**1**

4.5Result in chart Wash fastness of 100% cotton woven & knit fabric with reactive& direct dye (Color staining)

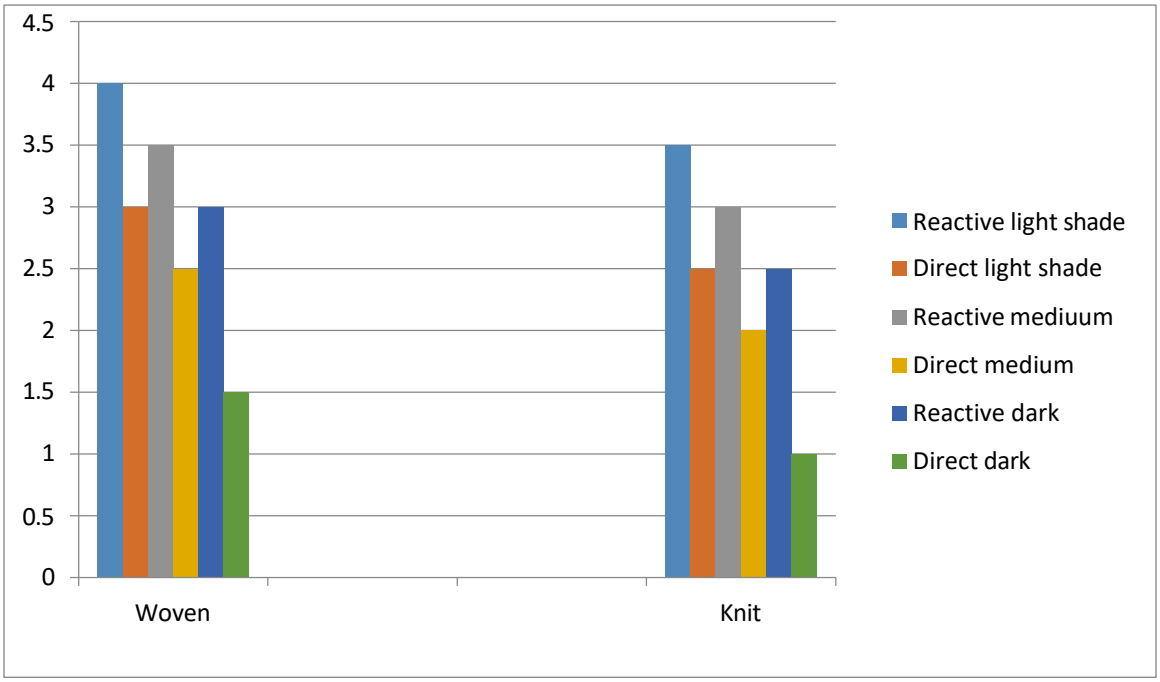


Fig 4.3Result in chart Wash fastness of 100% cotton woven & knit fabric with reactive& direct dye(Color staining)

4.10.1 :Color fastness to washing for light shade(0.25%)

Sample	shade	Color changing for woven & knit fabric light shade(0.25%)			
		Reactive (woven)	**Direct (woven)**	**Reactive (knit)**	**Direct (knit)**
01	**0.25%**	**4/5**	**4/5**	**4**	**¾**
02	**0.25%**	**4/5**	**4/5**	**4**	**¾**
03	**0.25%**	**4/5**	**4/5**	**4**	**¾**

4.10.2 :Color fastness to washing for medium shade(0.75%)

Sample	Shade	Color changing for woven & knit fabric medium shade(0.75%)			
		Reactive (woven)	**Direct (Woven)**	**Reactive (knit)**	**Reactive (knit)**
01	**0.75%**	**4**	**4**	**3/4**	**3**
02	**0.75%**	**4**	**4**	**3/4**	**3**
03	**0.75%**	**4**	**4**	**¾**	**3**

4.10.3 Color fastness to washing for dark shade(2%)

Sample	Shade				
		Reactive (woven)	Direct (woven)	Reactive (knit)	Reactive (knit)
01	2%	4	4	3/4	2/3
02	2%	4	4	3/4	2/3
03	2%	4	4	3/4	2/3

4.6Result in chart Wash fastness of 100% cotton woven & knit fabric with reactive& direct dye (Color changing)

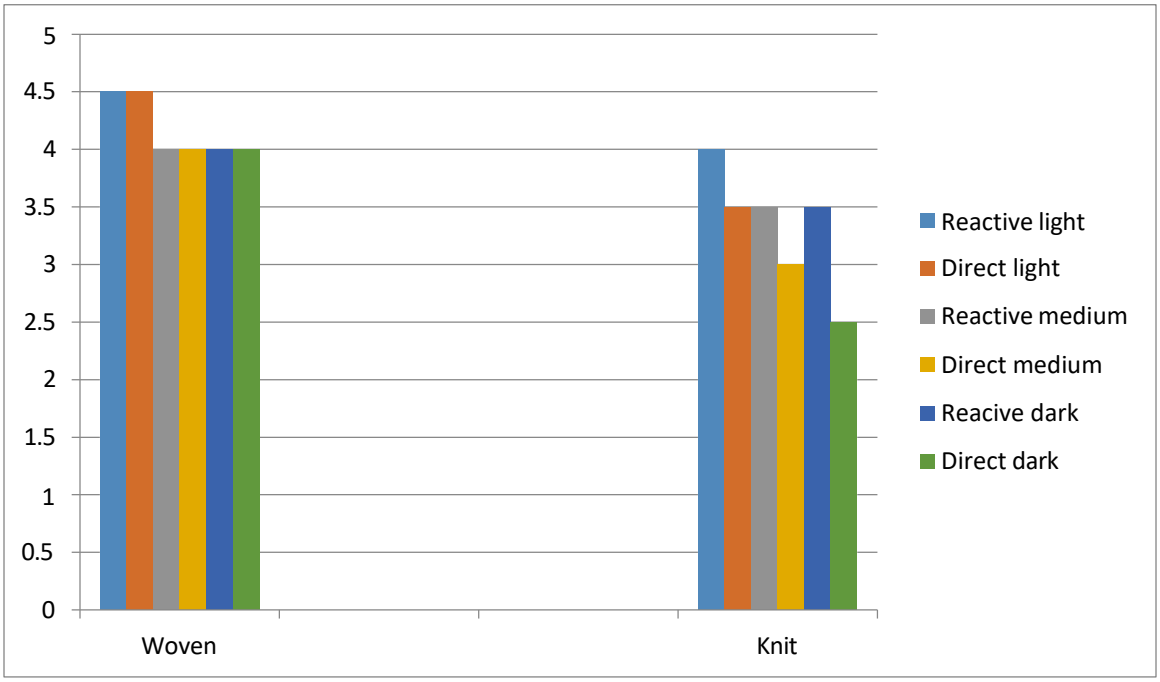


Fig:4.4 Result in chart Wash fastness of 100% cotton woven & knit fabric with reactive& direct dye (Color changing)

Chapter 5

Conclusion

Conclusion:

In our research we used 100% Cotton fabric with reactive & direct dyes to observe the rating of color fastness to rubbing & color fastness to washing. We have found that color fastness to rubbing and color fastness to wash is better in reactive than direct dye. Some information are given below.

1. In case of rubbing fastness of woven dyed fabric with reactive and direct dye:

In light, medium and dark shade the rubbing fastness of reactive dyed fabric dry condition(4/5,4/5,4) and wet condition(4,4,3) on the other hand rubbing fastness of direct dyed fabric dry condition,(4,4,3/4) and wet condition(3/4,3,3) which show that rubbing fastness of reactive dyed fabric is better than direct dyed fabric because in case of reactive dye the dye create covalent bond with fabric but direct dye create hydrogen bond with fabric.

2. In case of rubbing fastness of knit dyed fabric with reactive and direct dye:

In light, medium and dark shade the rubbing fastness of reactive dyed fabric dry condition(4/5,4,3/4) and wet condition(4,3/4,3) on the other hand rubbing fastness of direct dyed fabric dry condition,(3/4,3/4,3) and wet condition(3,3,2) which show that rubbing fastness of reactive dyed fabric is better than direct dyed fabric because in case of reactive dye the dye create covalent bond with fabric but direct dye create hydrogen bond with fabric.

3. In case of wash fastness of woven& knit dyed fabric with reactive and direct dye:

In light, medium and dark shade the Wash fastness of reactive dyed woven fabric (4,3/4/5,3) and reactive dyed knit fabric(3/4,3,2/3) on the other hand wash fastness of direct dyed woven fabric (2/3,3,1/2) and direct dyed knit fabric (2,2/3,1) which show that wash fastness of

reactive dyed fabric is better than direct dyed fabric because in case of reactive dye the dye create covalent bond with fabric but direct dye create hydrogen bond with fabric.

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