ATISH DIPANKAR UNIVERSITY
OF SCIENCE & TECHNOLOGY(ADUST)

COMMONWEALTH of LEARNING

Athabasca University

PROJECT REPORT ON
FASTNESS OF REACTIVE DYES

"Quality technical Study on Fastness of Reactive Dyes"

Athabasca University
CANADA'S OPEN UNIVERSITY
Technology – enabled learning
Canter for distance Education.

A Project by

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DECLARATION

It is hereby declared that the work presented in this project or any part of this project has not been submitted elsewhere for the award of any degree or diploma.

Signatures

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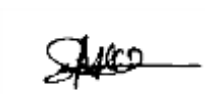

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Dr. Nathaniel Ostashewski
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To,

Dr. Nathaniel Ostashewski
Associate Professor
Of Open, Digital and Distance Education.
Athabasca University in Alberta, Canada.

Ref : Letter of Transmittal.

Dear Sir,

I am very glad to let you know that we have already completed the project on "Quality technical Study on Fastness of Reactive Dyes".
That you assigned me as a partial fulfillment of the course. During preparing this paper I have tried my best to make it rich covering all the concerning matters. I believe that this report will be able to give you a brief picture about Yarn Dyeing Process.

Now I humbly request you to accept this report for your consideration. It will be a privilege for me if you kindly accept this Project paper.

Sincerely yours,

(Palash Kanti Mazumder)
Member Id: 583
Link: http://www.telresources.org/member5843

Acknowledgement

At first my gratefulness goes to Almighty God to give me strength and ability to Complete this project report. Then I wish to take this excellent opportunity to thank a lot of people who have assisted and inspired me in the completion of my project report. My Supervisor, **Dr. Nathaniel Ostashewski,** Associate Professor of Open, Digital and Distance Education, Athabasca University in Alberta, Canada. to whom I am extremely indebted for his tremendous support and guidance to complete my project. His thoughtful advice assistance logical direction & efforts have made it possible to implement the report faithfully.
I would like to thank **Mrs**. **SYEDA MAHANOW UMMUL WARA**, Lecturer, Department of Textile Engineering Atish Dipankar University of Science & Technology to whom I am extremely indebted for his tremendous support and advice to complete my project.

I would like to thank the management of the Esquire Knit Composite Ltd. for giving me the opportunity to permit me for doing the project works in the mills. My deepest Appreciation goes to **Mr. Hafizur Rahman**, General Manager (Fabric Dyeing) Esquire Knit Composite Ltd. for his permission to conduct my project work without which it would be incomplete. His generous support is greatly appreciated for my project works.

TABLE OF CONTANTS

CHAPTER-1

INTRODUCTION

INTRODUCTION:

The stability of color or its fastness is one of the most important requirements of valuable customers. During use, a dyed material is exposed to a variety of agencies that can cause its color fade. i.e. The color decay from deeper to paler shade. These changes occur because o removal of dye molecules into the external medium. The colored textile show different resistance power to different agencies such as light, wash, rubbing, perspiration, water, bleach, acid alkali etc. And the aspect of these agencies may colorfastness tests are using to determine the stability of color in textile. Dyes and printed materials are affected (Color fade/bleed) by some agencies, such as washing, light, water, dry-cleaning, perspiration and ironing. Color fastness is the resistance of the color to fade or bleed by these agencies.

Color Fastness is usually assessed separately with respect to:

1. Change in the color of the specimen being tested that is color fading.
2. Staining of un dyed material which is in contact with the specimen during the test that is bleeding of color.

In order to give numerical assessment of each of these effects two sets of standard grey scales are used, one for color change and another for color staining.

We also assess the some other properties of knitted goods such as pilling, abrasion, shrinkage, etc.

Objectives:

This project has the following profound objectives:

1. To study the different color fastness properties of knit dyed fabric.
2. To compare different fastness properties between reactive and vat dyes.
3. To find the other properties of knit dyed fabrics.

CHAPTER-2

LITERATURE REVIEW

Defintion of Colorfastness:

By Sarah Aguirre, About.com
See More About: color fastness laundry definitions
Definition: Clothing is colorfast if its colors and dyes do not bleed or run from the clothing. Clothing should be tested for colorfastness before using any type of bleach or bleaching solution, or strong cleaning product.

How to Test:

To test for colorfastness, find a hidden seam of the garment or an hidden spot. Apply the cleaner to the garment and then dab the area with a clean cotton cloth. If the color removes itself from the garment onto the cloth, you should not use the cleaning product on the clothing.

Colour Fastness:

This is only a brief discussion of the causes o colour fastness, and specific cases will be mentioned on individual dye pages.
A definition of fastness

The Etherington and Roberts Dictionary (reference 10) states that colour fastness is: "That property of a pigment or dye, or the leather, cloth, paper, ink, etc. Containing the coloring matter, to retain its original hue, especially without fading, running, or changing when wetter, washed, cleaned, or stored under normal conditions when exposed to light, heat, or other influences".

Essentially, this means that different dyes will have different fastnesses on different materials. For example, linen is much harder to dye than silk or cotton (although indigo dyes both cotton and linen well- see later). A dye which works well on leather will probably not be suitable for wool.

Running

Running occurs principally during washing and exposure to detergents and solvents – everyone knows what happens if a red sock or blue pats are accidentally put in a white wash. Often it takes many washes for an article of clothing to stop leaching dye during the wash, but by that time, it may be so faded that you wouldn't want to wear it anyway!

A dye will run if it has a weak affinity for the material it is attached to, or a much stronger affinity for a non- aqueous solvent. Detergents may cause running because they help to stabilize the hydrophobic regions of dye molecules due to their ability to firm micelles.

Nowadays, dyes are specifically designed to bind strongly to the fibres of cloth, to minimize running. For example, Cibacron F, a fibre- reactive dye produced by CIBA-Geigy Ltd 11, and Procion MX, produced by ICI. Find more o the Fibre- Reactive Dyes page.

Fading

Fading is caused by the chemical alteration of unstable dye molecules to a less strongly colored or colorless form. This is often caused by the action of sunlight, or by the oxidizing action of the atmosphere 10. The UV radiation in sunlight has enough energy to cause unstable bonds to break or reform. Oxygen and atmospheric water will react with unstable bonds to alter the structure and affect its color. There is no way to stop an unstable dye from fading.

Grey Scale for Assessing Change in Shade

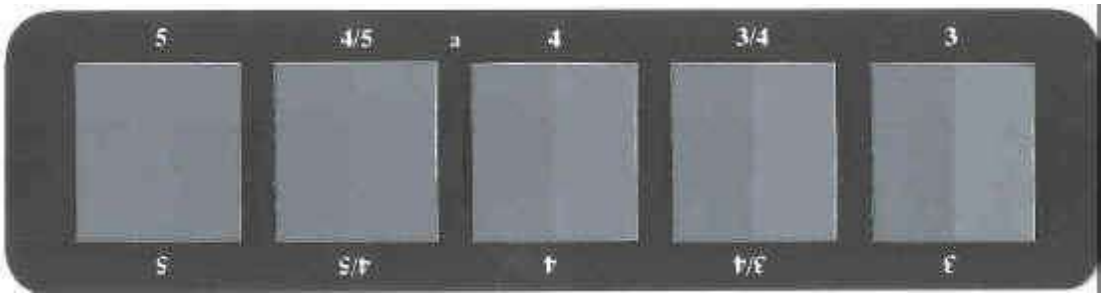
EN ISO 105 – A03 / IUF 132 / VESLIC C 1211

This Grey Scale is or assessing the degree of change in shade caused to a dyed Textile fabric/ yarn in color fastness tests. For example, the change of shade of wool and cotton fabrics in the wash fastness, perspiration fastness, etc.

The scale consists of nine pairs of gray color chips each representing a visual difference and contrast
The fastness rating goes step – wise from:

Note 5 = no visual change (best rating) to Note 1 = a large visual change (worst rating).
The gray scale has the 9 possible values:

5, 4 – 5, 4, 3 – 4, 3, 2 – 3, 2, 1 – 2, 1.



It is now quite common to measure the Grey Scale change in color instrumentally. This is made using a suitable reflectance spectrophotometer according to the test method procedure,

EN ISO 105 – A05.

Grey Scale for Assessing Staining

EN ISO 105 – A03 / IUF 132 / VESLIC C 1211

This Grey Scale is for assessing the degree of staining caused by a dyed Textile / Yarn in color fastness tests. For example, the staining of wool and cotton fabrics in the wash fastness, perspiration fastness, etc.

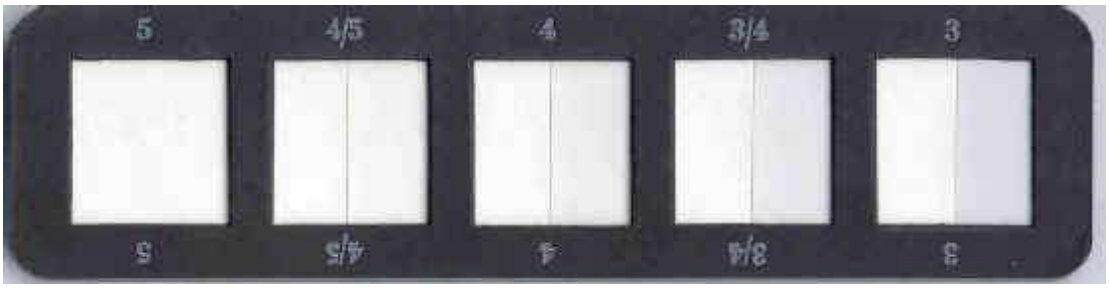
The scale consists of nine pairs of gray color chips each representing a visual difference and contrast.

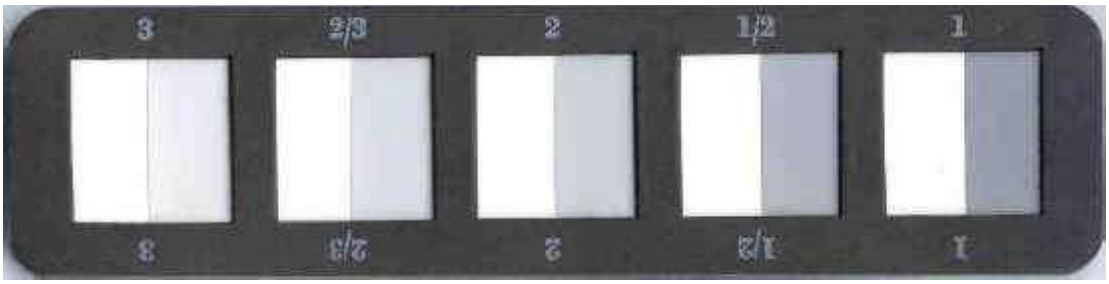
The fastness rating goes step-wise from:

Note 5 = no visual change (best rating) to Note 1 = a large visual change (worst rating).

The gray scale has the 9 possible values:

5, 4 – 5, 4, 3 – 4, 3, 2 – 3, 2, 1 – 2, 1.





It is now quite common to measure the Grey Scale for assessing staining instrumentally.This is made using a suitable reflectance spectrophotometer according to the test method procedure, EN ISO 105-A04.

Colorfastness to Light:

The purpose of this test is to determine how much the color will fade when exposed to a known light source. The proper test method is AATCC Test Method 16. Option A uses a Carbon Arc light source while Option E uses the more popular Xenon source. The option used will depend on the equipment available. The test duration will be 10 AATCC fade units minimum for both colors and whites unless otherwise specified. Ten AATCC fade units are the equivalent to 2.5 to 3 continuous twenty four hour days of direct sunlight while 20 AATCC fade units are equivalent to 5-6 days of direct sunlight.

The evaluation will be done as described in the test method with the exception of whites. Whites will be evaluated with the AATCC Gray Scale for Staining because the issue is more often yellowing of the white color.

Pilling:

Pilling appear in the case when separate threads of the fabric insinuate themselves into the surface under external effect.

Pilling is usual for different fabrics. Cleaning the fabrics and moving away the pill is essential part of the constant care of the fabrics. Pill should be moved with a special machine with rotating knife. It is not recommended to use blades and other instrument.

Upholstery fabrics :
Test : IWS 196
Result : 3−4 (min)

Martindale pilling test

Samples are placed on the Martindale taster. A sample of the same fabrics is placed instead of the abrasive material. Then the samples are exposed to the rubbing with low pressure during 100 rub. The pilling level is estimated comparing the samples with the photos made before the test.

CHAPTER-3

THEORY OF DYEING OF REACTIVE DYE

Fibre-Reactive Dyes

Definition

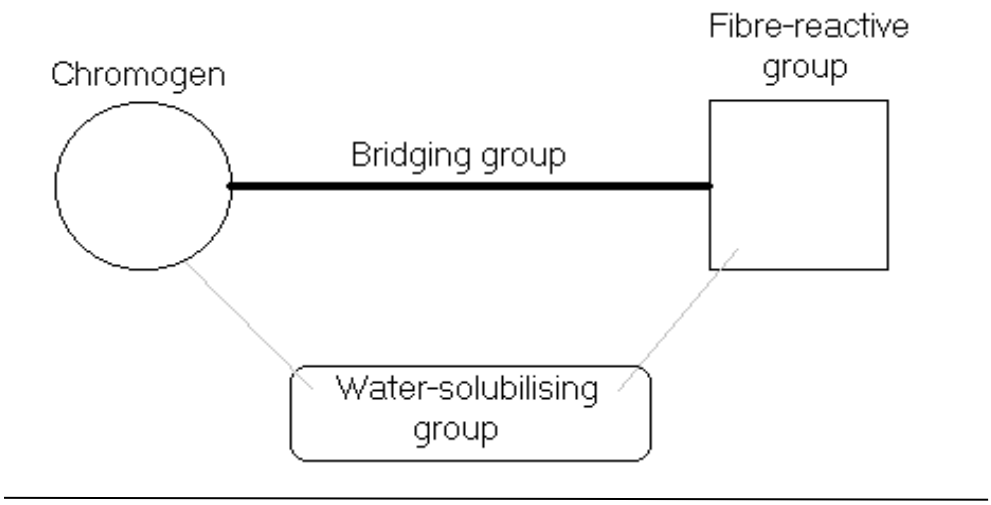
A fibre-reactive dye will form a covalent bond with the appropriate textile functionality. This is of great interest, since, once attached, they are very difficult to remove2.
Early fibre-reactive dyes

The first fibre-reactive dyes were designed for cellulose fibres, and they are still used mostly in this way. There are also commercially available fibre-reactive dyes for protein and polyamide fibres. In theory, fibre-reactive dyes have been developed for other fibres, but these are not yet practical commercially2.

Although fiber-reactive dyes have been a goal for quite some time, the breakthrough came fairly late, in 1954. Prior to then, attempts to react the dye and fibres involved harsh conditions that often resulted in degradation of the textile2.

The first fibre-reactive dyes contained the 1, 3-5-triazinyl group, and were shown by Rattee and Stephen to react with cellulose in mild alkali solution. No significant fiber degradation occurred. ICI launched a range of dyes based on this chemistry, called the Procion dyes. This new range was superior in every way to vat and direct dyes, having excellent wash fastness and a wide range of brilliant colours. Procion dyes could also be applied in batches, or continuously2.

The general structure of a fibre-reactive dye is shown below:



Note the four different components of the dye.
The chromogen is as mentioned before (azo, carbonyl or phthalocyanine class).

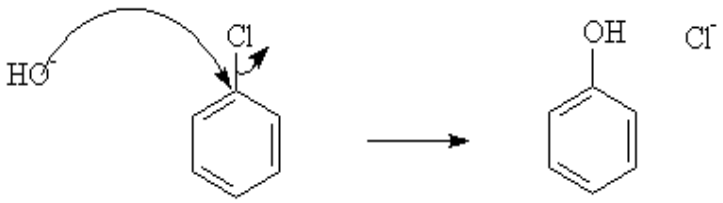
The water solubilizing group (ionic groups, often sulphonate salts), which has the expected effect of improving the solubility, since reactive dyes must be in solution for application to fibers. This means that reactive dyes are not unlike acid dyes in nature.

The bridging group links the chromogen and the fibre-reactive group. Frequently the bridging group is an amino, $-NH^-$, group. This is usually for convenience rather than or any specific purpose.

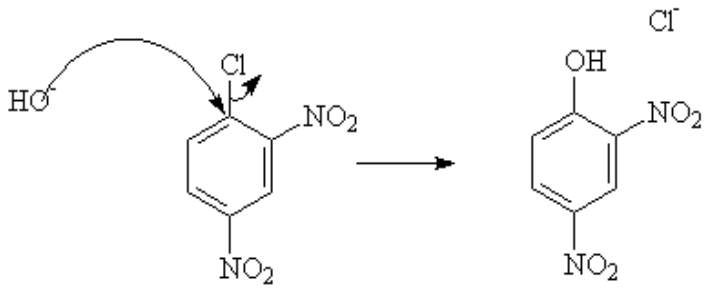
The fiber-reactive group is the only part of the molecule able to react with the fibre. The different types of fibre-reactive group will be discussed below.

A cellulose polymer has Hydroxy functional groups, and it is these that the reactive dyes utilize as nucleophiles. Under alkali conditions, the cellulose
– OH groups are encouraged to deprotonate to give cellulose $-O^-$ groups. These can then attack electron – poor regions of the fiber-reactive group and perform either aromatic nucleophilic substitution to aromatics or nucleophilic addition to alkenes2.
Nucleophilic substitution Aromatic rings are electronically very stable and will attempt to retain this. This means that instead of the nucleophilic addition that occurs with alkenes, they undergo nucleophilic substitution, and keep the favorable p-electron system. However, nucleophilic substitutions are not very common on aromatics, given their already high electron density. To encourage nucleophilic substitution, groups can be added to the aromatic ring which will decrease the electron density at a position and facilitate attack.

For example2:



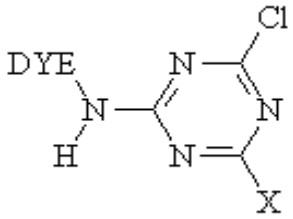
But this requires harsh conditions. To improve the rate under mild conditions, powerful electron-withdrawing groups such as –
NO_2 may be added2.



However, this will only work if there is a good leaving group, such as –Cl or – N_2.

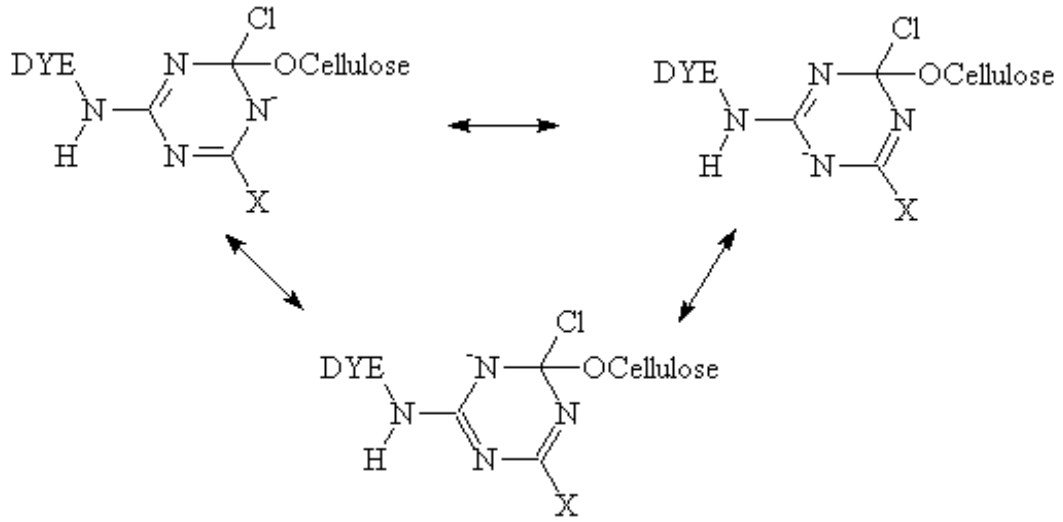
The major fibre-reactive group which reacts this way contains six-membered, heterocyclic, aromatic rings, with halogen

substituents. For example, the procion dye2: (this is the same as the chime molecule at the top of the page).



Where X = Cl, NHR, OR. Nucleophilic substitution is facilitated by the electron withdrawing properties of the aromatic nitrogens, and the chlorine, and the anionic

intermediate is resonance stabilized as well. This resonance means that the negative charge is delocalized onto the electronegative nitrogens2:

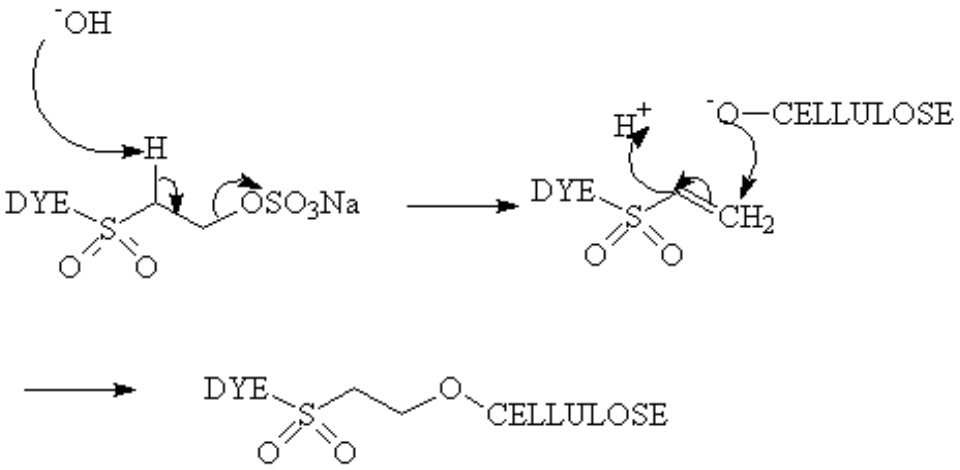


One problem is that instead of reacting with the –OH grous on the cellulose, the fibre-reactive group may react with the HO^- ions in the alkali solution and become hydrolysed. The two reactions compete, and this unfavourable because the hydrolysed dye cannot react further. This must be washed out of the fabric before use, to prevvnt any leakage of dye, and not only increases the cost of the textile, but adds to possible environmental damage from contaminated water2.

Nucleophilic addition

Alkenes are quite reactive due to the electron-rich p-bond. They normally undergo electrophilic addition reactions. Again, nucleophilic additions are less favoured generally, because of the repulsion between the Nu- and the electron- rich p-bond. However, they will occur if there are sufficient electron withdrawing groups are attached to the alkene, much as before, with aromatic substitution. In this case, the process is known as Michael addition or Conjugate addition2.

For this reaction type, the most important dye class is the Remazol reactive dye. This dye type reacts in the presence of a base such as HO^-. The mechanism for the reaction of one of these dyes is shown below:



A sbefore, the intermediate is resonance stabilized, but this has not been show

Reactive dyes

Applicability

Reactive dyes are mainly used for dyeing cellulose fibres such as cotton and viscose, but they are also increasingly gaining importance ffor wool and polyamide.

Properties

They provide high wet fastness (better than the less expensive direct dyes), but their use is not always viable because of the difficulty in obtaining level dyeing. Chlorine fastness is slightly poorer than that of vat dyes, as is light fastness under severe conditions.

The range of available reactive dyes is wide and enables a large number of dyeing techniques to be used.

Chemical characteristics

Reactive dyes are unique in that they contain specific chemical groups capable of forming covalent links with the textile substrate.

The energy required to break this bond is similar to that required to degrade the substrate itself, thus accounting for the high wet fastness of these dyes.

The structure of Reactive Black 5, one of the most important reactive dyestuffs in terms of volumes consumed, is illustrated in Figure 9.10.

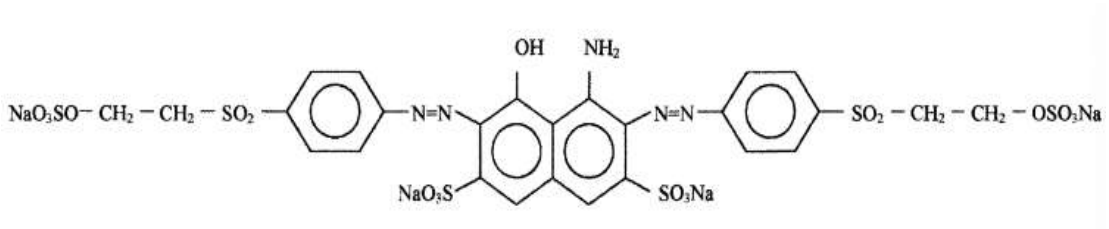


Figure 9.10: Reactive Black 5

Chemical structure of reactive dyes can be schematically represented by the following formula:

Col – B – R, where:

• Col is the chromophore that is in general constituted by monoazoic, anthraquinone, phthalocyanine and metal – complex compounds.

• B is the linking group between the chromophore and the reactive group

• R represents the reactive group (anchor system with the leaving group). The anchor systems are characterized by their reactivity. Based on this, they are classified as hot, warm or cold dyers.

Anchor system
Denomination
Commercial name

Dichloro – s – triazine (cold dyer)
Procion MX

Amino – fluoro – s – triazine (warm dyer)
Cibacron F

Trichloro – pyrimidine (hot dyer)
Cibacron T – E

Dimaren X, Z

$- SO_2 - CH_2 - CH_2 - O - SO_3Na$.
Beta – sulphate – ethyl – sulphone (warm dyer)

Remazol

Anchor system
Denomination
Commercial name

2,4 – difluoro 5 – chloro pyrimidine.

Verofix

Drimalan F

$-SO_2 - CH_2 - CH_2 - O - SO_3Na$
Aeta – sulphate – ethyl − sulphone
Remazolan

$- SO_2 - NH - CH_2 - CH_2 - O - SO_3H$
Sulphate – ethyl sulphonamide
Levafix

$- NHCO - CBr = CH_2$
Bromoacrylamide
Lanasol

DYEING PROCESS OF REACTIVE DYE

DYEING WITH COLD BRAND REACTIVE DYE:

SEQUENCE OF DYEING:

Fabric preparation

⬇

Dyeing

⬇

Washing (Cold)

⬇

Washing (Hot)

⬇

Soaping

⬇

Hot rinse

⬇

Cold rinse.

✸ Dyeing recipe for 1% Shade:

Reactive Red 3BS	1 %	Reactive Yellow 3RS	1 %	Reactive Blue RR	1 %
G. Salt	40 gm/l	G. Salt	40 gm/l	G. Salt	40 gm/l
Soda ash	10 gm/l	Soda ash	10 gm/l	Soda ash	10 gm/l
Wetting agent	1 gm/l	Wetting agent	1 gm/l	Wetting agent	1 gm/l
Sequestering agent	.75 gm/l	Sequestering agent	.75 gm/l	Sequestering agent	.75 gm/l
M : L	1 : 8	M : L	1 : 8	M : L	1 : 8
Temp.	60^0 C	Temp.	60^0 C	Temp.	60^0 C

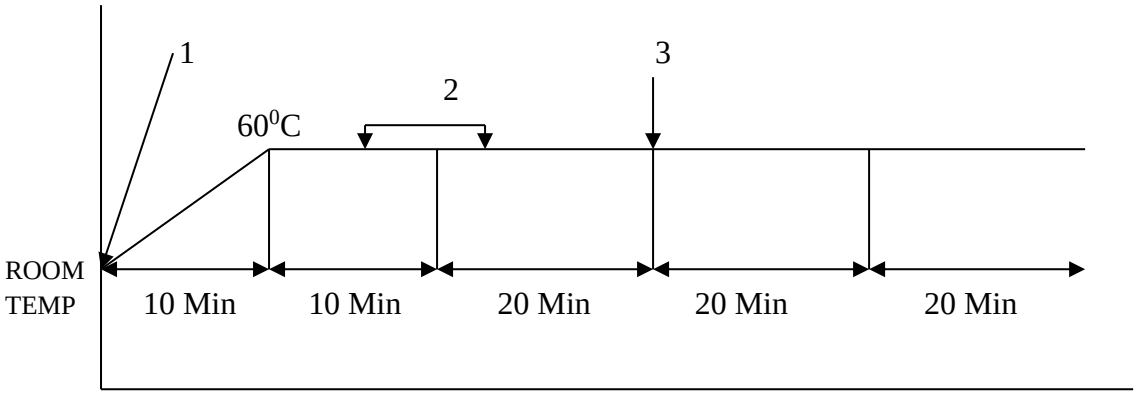
✸ Dyeing recipe for 2% Shade:

Reactive Red 3BS	2 %	Reactive Yellow 3RS	2 %	Reactive Blue RR	2 %
G. Salt	50 gm/l	G. Salt	50 gm/l	G. Salt	50 gm/l
Soda ash	12 gm/l	Soda ash	12 gm/l	Soda ash	12 gm/l
Wetting agent	1 gm/l	Wetting agent	1 gm/l	Wetting agent	1 gm/l
Sequestering agent	.75 gm/l	Sequestering agent	.75 gm/l	Sequestering agent	.75 gm/l
M : L	1 : 8	M : L	1 : 8	M : L	1 : 8
Temp.	60^0 C	Temp.	60^0 C	Temp.	60^0 C

✸ Dyeing recipe for 4% Shade:

Reactive Red 3BS	4 %	Reactive Yellow 3RS	4 %	Reactive Blue RR	4 %
G. Salt	80 gm/l	G. Salt	80 gm/l	G. Salt	80 gm/l
Soda ash	20 gm/l	Soda ash	20 gm/l	Soda ash	20 gm/l
Wetting agent	1 gm/l	Wetting agent	1 gm/l	Wetting agent	1 gm/l
Sequestering agent	.75 gm/l	Sequestering agent	.75 gm/l	Sequestering agent	.75 gm/l
M : L	1 : 8	M : L	1 : 8	M : L	1 : 8
Temp.	60^0 C	Temp.	60^0 C	Temp.	60^0 C

DYEING CURVE :



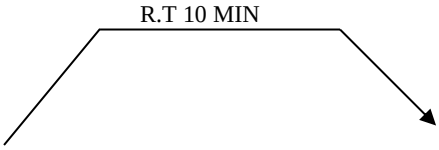
1. Dye stuff & Other auxiliaries
2. Salt
3. Soda Ash

PROCEDURE:

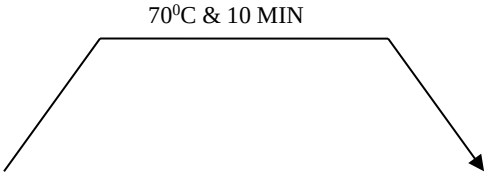
According to dyeing curve at first auxiliaries and water are added in the dye bath. And it is kept for 5 min. Then malt & dye is added respectively. Then the temp rise to 60^0C in 10 min and Salt is added & kept for 20 min then Soda is added & kept for 20 min.

AFTER TREATMENT:

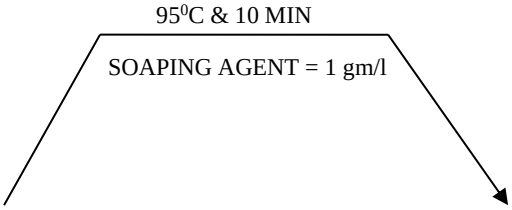
1.COID WASH :



2. HOT WASH :



2. SOAPING :



3. HOT RINSING
4. COLD RINSING

SAMPLE :

Shad %	S / J	Rib
1% React Red 3BS		
2 % React Red 3BS		
4 % React Red 3BS		
1 % React Blue RR		
2 % React Blue RR		
4 % React Blue RR		

SAMPLE :

Shad %	S / J	Rib
1% React Yellow 3RS		
2 % React Yellow 3RS		
4 % React Yellow 3RS		

REMARKES :

The dyeing process is done satisfactory thought the dyeing is not so good of the lab that's why we have to bring some dyes and chemical from market and industry.

CHAPTER-4

EXPERIMENTAL WORK

Color fastness to washing and laundering Color fastness to domestic and commercial laundering
Bs 1006 : 1990
Part C06 :

Introduction

The test methods in this parts of ISO 105 are intended to reflect the effect of comprehensive laundering by either domestic or commercial procedures, as distinct from from the washing test methods giving the ISO 105-C05.

Fig : Gyro wash

1. Scope and field of application

1.1 This part of ISO 105 specifies method intended for determining the resistance of the color of textiles of all kinds in all forms to domestic or commercial laundering procedures used for normal household articles. Industrial and hospital articles maybe subjected to special laundering procedures which maybe more sever in some respects.

1.2 The colour and staining resulting from desorption and /or abrasive action in one "S" (single) test closely approximates to one commercial or domestic laundering. The results of one "M" (multiple) test may in some cases be approximated by the results of up to five domestic or commercial launderings at temperatures not exceeding 70^0 C. The "M" tests are more severe than the "S" tests because of an increase in mechanical action.

1.3 These methods do not reflect the effect of optical brighteners present in commercial washing products.

2 References

ISO 105, Textiles – Tests for colour fastness −

Part A01 : General principles of testing
Part A02 : Grey scale for assessing change in colour.
Part A03 : Grey scale for assessing staining.
Part F01 : Specification for reference adjacent fabric: Wool
Part F02 : Specification for reference adjacent fabric: Cotton and Viscose.
Part F03 : Specification for reference adjacent fabric: Polyamide.
Part F04 : Specification for reference adjacent fabric: Polyester.
Part F05 : Specification for reference adjacent fabric: Acrylic.
Part F06 : Specification for reference adjacent fabric: Silk.
Part F07 : Specification for reference adjacent fabric: Secondary acetate.
Part F08 : Specification for reference adjacent fabric: Triacetate.
Part F10 : Specification for reference adjacent fabric: Multifibre.

3 Principle

A specimen of the textile in contact with speciied adjacent fabric or fabrics is laundered, rinsed and dried. Specimens are laundered under appropriate conditions of temperature, alkalinity, bleaching and abrasive action such that the result is obtained in a conveniently short time. The abrasive action is accomplished by the use of a low liquor ratio and an appropriate number of steel balls. The change in colour of the specimen and the staining of the adjacent fabric or fabrics are assessed wits the grey scales.

4 Apparatus and reagents

4.1 Suitable mechanical device (see 8.1), consisting of a water bath containing a rotatable shaft which supports, radially, stainless steel containers 175 ± 5mm diameter x 125 ± 10mm high of capacity 550 ± 50ml, the bottom of the containers being 45 ± 10mm from the centre of the shaft.

The shift/container assembly is rotated at a frequency of 40 ± 2 min^{-1}. The temperature of the water bath is thermostatically controlled to maintain the test solution at the prescribed temperature ± 2^0C.

4.2 Non – corrodible (stainless) steel balls, approximately 0.6 cm in diameter.
4.3 Adjacent fabrics.

Either:

4.3.1 A multifiber adjacent fabric, complying with ISO 105 – F10, according to the temperature used.

-- a multifibre adjacent fabric (DW) containing wool and acetate (tests at 40^0C and 50^0C and in certain cases –see note –also at 60^0C),

NOTE – These cases should be indicated in the test report [see 7a].

-- a multifibre adjacent fabric (TV) not containing wool and acetate (in certain tests at 60^0C, and in all tests at 70^0C and 95^0C).

Or:

4.3.2 Two single–fibre adjacent fabrics, one of the same fibre or the predominant fibre in the case of blends/ as the fabric uder test and the second made of the fibre specified in table 1 or as otherwise specified

Table 1 – Pairs of adjacent fabrics.

4.3.3 If required, a non-dyeable fabric (e.g. polypropylene).

4.4 Detergent, without optical brightener (see 8.2).

4.5 If required, sodium carbonate (Na_2CO_3).

4.6 Sodium hypochlorite or lithium hypochlorite (see 8.3).

4.7 If required, sodium perborate tetrahydrate ($NaBO_3.4H_2O$).

4.8 Distilled water (see 8.4).

4.9 Grey scales for assessing change in colour and staining (see clause 2).

4.10 If required for pressing treatment, flat-iron, of mass not exceeding 2,5kg and capable of giving the temperature indicated in 6.9 b).

4.11 If required for souring treatment, acetic acid solution containing 0,2 9 of glacial acetic acid per litre.

5 Test specimen

5.1 If the textile to be tested is fabric, either:

a) Attach a specimen 10cm × 4cm to a piece of the multifibre adjacent fabric (4.3.1), also 10cm × 4cm, by sewing along one of the shorter edges, with the multifibre adjacent fabric next to the face side of the specimen, or

b) Attach a specimen 10cm × 4cm between the two single-fibre adjacent fabrics (4.3.2) by swing along one of the shorter edges.

5.2 Yarn may be knitted into fabric and tested in this form.

Where yarns or loose fibers are to be tested. Take a mass of the yarn or loose fibre approximately equal to one-half of the combined mass of the adjacent fabrics and either:

a)Place it between a 10cm × 4cm piece of the multiffibre fabric (4.3.1) and a 10cm × 4cm piece of the non-dyeable fabric (4.3.3) and sew them along all four sides (see subclause 8.6 of ISO 105 – A01), or

b) Place it between 10cm × 4cm pieces of the two specified single-fibre fabrics (4.3.2) and sew them along all four sides. **6 Test**

Procedures

6.1 Prepare the wash liquor by dissolving 4 9 of detergent per litre of distilled water (see 8.4). For all C. D or E tests, adjust the p^H as stated in table 2 by the addition of approximately 1gm of sodium carbonate per litre of solution. The liquor should be cooled to 20^0C before the p^H is measured. For the A and B tests, no adjustment of p^H is required.

6.2 For teste where perborate is employed, prepare the washing solution containing perborate at the time of use by heating the liquor to a maximum temperature of 60^0C for not more than 30min.

6.3 For tests D3S and D3M, add to the wash liquor sufficient sodium hypochlorite solution or lithium hypochlorite solution to provide the concentration of available chlorine specified in table 2.

6.4 Add to each container the volume of wash liquor specified in table 2. Except for tests D2S and E2S, adjust the temperature of the liquor to within ± 2^0C of the specified temperature and then place in the container the specimen together with the specified number o steel balls. Close the container and operate the machine at the temperature and for the time specified in table 2.

6.5 For tests D2S and E2S, place the specimen in the container at a temperature of approximately 60^0C, close the container and raise the temperature to within ± 2^0C of the specified temperature in not more than 10min. Begin timing the test as soon as the container is closed. Operate the machine at the temperature and for the time specified in table 2.

6.6 For all tests, remove the composite specimen at the end of the wash and rinse twice for 1min in two separate 100ml portions of water at 40^0C.

6.7 In countries where the practice is to sour at the end of the washing operation, the following optional operation may be conducted.

Treat each composite specimen in a 100ml portion of the acetic acid reagent (4.11) for 1min at 30^0C. Then rinse each composite specimen in a 100ml portion of water for 1min at 30^0C.

6.8 For all methods, extract the excess water from the composite specimen.

6.9 For all methods, dry the specimen by one of the following procedures:

a) by hanging it in air at a temperature not exceeding 60^0C, with the parts in contact only at the line of stitching.

b) In countries where the practice is to dry fabrics by pressing, each specimen may be dried by pressing it with the flat-iron (4.10) at the temperature appropriate to the fabric under test, but in no case at a temperature above 150^0C, with the adjacent fabric uppermost and in contact with the face of the specimen.

6.10 Assess the change in colour of the specimen and the staining of the adjacent fabric using the grey scales

a) AATCC Reference Detergent WOB with the following properties and composition:

The detergent is low sudsing, the surfactants composing the detergent are anionic with a small proportion of nonionic. They are biodegradable.

Nominal composition: %	(m/m)
	(± 0, 2%)
Linear alkyl sulfonate, sodium salt (LAS)	14,00
Alcohol ethoxylate	2,30

Soap – high molecular mass	2.50
Sodium tripolyphosphate	48,00
Sodium silicate (SiO_2/Na_2O = 2/1)	9,70
Sodium sulfate	15,40
Carboxymethylcellulose (CMC)	0,25
	7,85
Water	100,00 mass,

formula by

b) In countries where perborates are used in laundering the ECE Reference. Detergent for colour fastness testing, without optical brightener, may be used.

NOTE – Information of the availability of this detergent can be obtained from national standards organizations.

The composition of the ECE Detergent is as follows:

	Compostion as such % (m/m) (± 0, 02%)
Linear sodium alkyl benzene sulfonate (mean length of alkane chain C 11,5)	
Ethoxylated tallow alcohol (14 EO)	
Sodium soap, chain length	
C12 – C16 : 13 – 26%	
C18 – C22 : 74 – 87%	
Sodium tripolyphosphate	
Sodium silicate (SiO_2/Na_2O = 3,3/1)	
Magnesium silicate	
Carboxymethylcellulose (CMC)	
EDTA, sodium salt	
Sodium sulfate	
Water	
Linear sodium alkyl benzene sulfonate	

(mean length of alkane chain C 11,5)	8.0
Ethoxylated tallow alcohol (14 EO)	2.9
Sodium soap, chain length C12 – C16 : 13 – 26 % C18 – C22 : 74 – 87 %	3.5
Sodium tripolyphosphate	43.7
Sodium silicate (SiO_2/Na_2O = 3,3/1)	7.5
Magnesium silicate	1.9
Carboxymethylcellulose (CMC)	1.2
EDTA, sodium salt	0.2
Sodium sulfate	21.2
Water	9.9

	100.0

8.3 The p^H value and available chlorine content of a large number of trade- named products of sodinm hypochlorite (NaOCl) vary from p^H 9,8 to 12,8 and the C12 content from 40 to 160 gm/l. The actual available chlorine shall be determined before use and the following method is suggested

Pipette a 1,00 ml portion of the stock sodium hypochlorite solution into a conical flask and dilute to 100 ml with distilled water. Add 20 ml of 294 gm/l sulfuric acid (H_2SO_4) solution and 6 ml of 120 gm/l potassium iodide (K 1) solution. Titrate with standard volumetric sodium thiosulfate solution, c ($Na_2S_2O_3$. $5H_2O$) = 0,1 mol/l.

The available chlorine (Cl 2) content is given, as a percentage by mass, by the formula

$$\frac{V \times c \times 0.0355}{Vo \times Qo} \times 100$$

Where,

Vo is the volume, in milliliters, of sodium hypochlorite solution taken.

Q is the density, in grams per milliliter, of the sodium hypochlorite solution. V is the volume, in milliliters, of sodium thiosulfate solution used.

c is the amount-of- substance conaentration, in moles per litre, of the sodium thiosulfate solution.

8.4 Distilled water or water of near-zero hardness (not over 5 ppm) shall be used to dissolve the detergent for the test solution.

A minimum volume of 1 litre of detergent solution shall be prepared because of possible lack off homogeneity o the detergent powder.

Colour fastness to wash

Apparatus and Materials:

1. Wash-wheel with a thermostatically controlled water bath and rotating
   speed of 40 + / − 2 rpm.
2. Stainless steel container (Capacity 55 + / − 5 ml)
3. Stainless steel ball (diameter = 0.6cm, wt = 1gm)
4. SDC (Society of Dyers and Colourist) Multi-fibre Fabric (DW: Acetate, Cotton, Nylon, polyester, Acrylic, Wool, for 40^0c, 50^0c and certain at 60^0c. TV: Triacetate, Cotton, Nylon, Polyester, Acrylic, Viscose, for certain test at 60^0c and all test at 70^0c and 95^0c)
5. Non-dyeable fabric (e.g. polypropylene)
6. Thermometer (0 – 100^0C)
7. Sewing machine
8. Dryer.
9. ISO type Grey Scale for changing.
10. ISO type Grey Scale for staining
11. Colour matching Cabinet (light box)

Reagents:

1. ECE Reference Detergent (without optical brightener)
2. Sodium carbonate / sodium perborate tetrahydrate.
3. Distilled / de-ionized water.
4. Sodium hypochlorite.
5. Acetic acid.

Test specimen:

Textile to be tested is knitted fabric: Cut out a specimen of 10cm × 4cm.
and make sure all colours are included (if necessary use additional.
specimens) in it. Sew it along all four edges with the same size of multi-
fibre fabric. This is the composite test specimen.

Test procedure:

Recipe for ISO wash fastness test:

Test	Temp.(^{0}C)	Time	Steel Balls	Chemicals
ISO 105 C01	40	30 min	0	Soap (5gm/l)
ISO 105 C02	50	30 min	0	Soap(5gm/l)
ISO 105 C03	60	30 min	0	Soap(5gm/l) + Soda(2gm/l)
ISO 105 C04	95	30 min	10	Soap(5gm/l) + Soda(2gm/l)
ISO 105 C05	95	4 hr	10	Soap(5gm/l) + Soda(2gm/l)

Here, we follow ISO 105C03 method for wash fastness test. According to this method, now test procedure is described below.

The composite specimen is treated in awash wheel or an equivalent apparatus at 60+/−2c for 30 min using the ECE colour fastness test detergent 77 (ISO std. Soap) 5gm/l and 2gm/l soda ash to give a liquor ratio of 50 : 1.

SAMPLE:

Shade %	Treated Fabric (Dyed) S/J		Treated Fabric (White) Rib	
	Before Wash	After Wash	Before Wash	After Wash
1 % Red				
2 % Red				
4 % Red				
1 % Blue				
2 % Blue				
4% Blue				
1% Yellow				
2% Yellow				
4 % Yellow				

EVALUATION:

Numerically rate color change and staining of each test specimen under std. Lighting (D65 artificial daylight) using the Gray scales for color change and staining.

Color Fastness to wash:

Shade %	S/J		Rib	
	Colour Chang	Colour Staining	Colour Chang	Colour Staining
1% Red	4 – 5	4	4 – 5	4
2% Red	3 – 4	3	3 – 4	3
4% Red	3	2 – 3	3	2 – 3
1% Blue	4 – 5	4	4 – 5	4
2% Blue	4	3 – 4	4	3 – 4
4% Blue	3 – 4	3	3 – 4	3
1% Yellow	4 – 5	4	4 – 5	4
2% Yellow	4 – 5	4	4 – 5	4
4% Yellow	4	3 – 4	4	3 – 4

Interpretation of Grade:

(5) Excellent
(4) Good
(3) Fair
(2) Poor
(1) Very Poor

COLOR FASTNESS TO RUBBING

(TEST METHOD : ISO 105* 12: 1993; BS EN ISO105* 12: 1995)

INTRODUCTION

Electronic Crock meter/Rubbing Fastness Test. To determine the color fastness of textile to dry or wet rubbing. Provided with a crocking finger of 16mm diameter with a downward force of 9 Newtons and the facility for mounting standard crocking fabric. A Pinned acrylic sample holder ensures rapid sample mounting and repeatability of results. Fitted with a pre-determined electronic counter for strokes up to 1000. It is electronically driven to minimize operator variation and is designed to enable extra weights to be added for non standard tests.

APPLICATION
ISO 105 BS JIS L0849

SPECIFCTION

(1) Loading pressure of brush and size 9N
Round: Diameter 16mm
(2) Motion range of abrader head 100mm
Shuttle time 2 – 9999 (programmable)
(3) Rotational soeed of winch 60rpm
(4) Abrader head standard brush
(5) Mix size of specimen 220 × 110 × 5mm
(6) Power supply AC220V (−) 10% 50Hz 40w (or specified by user)
(7) Instrument Size 760 ×270 × 240mm (L × W × H)
(8) Instrument Weight 15kg

FEATURES

(1) Simple operation
(2) purpose-designed test mode
(3) Automatic flame application

Apparatus and materials:

1. Suitable Crockmeter.
2. Cotton Rubbing Cloth (desized, bleached, without finish)
3. Grey scale for staining.
4. Stopwatch
5. Standard lighting chamber.

1. Y331A

2. Y321

3. Y311

4. Y802N

5. YG981D

Color fastness to rubbing AATCC crockmeter ISO crockmeter

Test Specimen:

The textile to be tested is knitted fabric. Two pieces not less than 14cm × 5cm are required for dry rubbing and two for wet rubbing. One specimen of each pair shall have the long direction parallel to the warp yarns or wales and the other parallel to the weft yarns or courses.

Test Procedure:

1. Dry rubbing test:

- Lock the test specimen onto the base of the crockmeter so that it lies flat and taut for testing. The length or width direction of the test specimen should be parallel to the direction in which the rubbing is to be conducted.
- Using the spiral spring clip, set a 5cm × 5cm square of the white, cotton rubbing test cloth to the finger (peg) of the crock meter. The weave of the test cloth should be parallel to the direction of rubbing (i. e. angular deflection should be avoided)

- Lower the covered finger onto the test sample.
- Turn the handcrank and make ten complete turns of the crank, at the rate of one turn per second (10 ×10s). May use a stopwatch to verify the rate of hand cranking.
- Remove the white rubbing test cloth from the finger and evaluate color transfer using the grey scale for staining under standard lighting, D65 (Artificial Daylight)
- One test is done to warp/wales direction and another for weft/course direction.

2. Wet rubbing test:

- Repeat procedure on another sampal with the white test cloth wetted in distilled water .Ensure that the rubbing test cloth will be wetted with water to 100% take up (1 gm fabric is increased to 2.0 gms of fabric)
- Air dries the cotton test cloth at the room temperature before evaluation.

FOR REACTIVE (COLD) BRAND:

SAMPLE:

Shade %	Treated Fabric S/j		Treated Fabric Rib	
	Dry	Wet	Dry	Wet
1 % Red				
2 % Red				
4 % Red				
1 % Blue				
2 % Blue				
4 % Blue				
1% Yellow				
2% Yellow				
4 % Yellow				

EVALUATION:

Numerically rate color change and staining of each test specimen under std. Lighting (D65 artificial daylight) using the Gray scales for color change and staining.

Rubbing Fastness:

Shade %	S/J		Rib	
	Dry	Wet	Dry	Wet
1% Red	4 – 5	3 – 4	4 – 5	3 – 4
2% Red	4	3 – 4	4	3 – 4
4% Red	3 – 4	2 – 3	3 – 4	2 – 3
1% Blue	4 – 5	4	4 – 5	4
2% Blue	4	3 – 4	4	3 – 4
4% Blue	4	3	4	3
1% Yellow	4 – 5	4	4 – 5	4
2% Yellow	4	3 – 4	4	3 – 4
4% Yellow	3 – 4	3	3 – 4	3

Interpretation of Grade:

(5) Excellent
(4) Good
(3) Fair
(2) Poor
(1) Very Poor

COLOR FASTNESS TO PERSPIRATION

(TEST METHOD :ISO 105 E04 BS EN ISO105E04 1996)

Principal:

The garments which come into contact with the body where perspiration is heavy may suffer serious local discoloration. This test is intended to determine the resistance of color of dyed textiles to the action of acid and alkali perspiration.

APPARATUS AND MATERIALS:

1. Pespiretion tester ,perspirometer
2. Oven
3. Multifibre test fabric,
4. Grey scale for coior changing,
5. Grey scale for staining,
6. Std. lighting chamber,
7. Acid and alkaline solution ,
8. Glass or acrylic plate

PERSPIROMETRE

ISO 105 E01 : Color fastness to water ISO 105 E02 : Color fastness to sea water ISO 105 E04 and AATCC 15 : Color fastness to perspiration. Phenolic yellowing – Courtaulds test

Leaflets Download leaflet
JHEAL_Perspirometre_ENG.pdf

Product' standards

ISO 105 E01 : 1994

ISO 105 E02 : 1994

ISO 105 E04 : 2008

ISO 105 X18 : 2007

Products related

Fig: Perspirometer

Fig: Incubator.

Test specimen: The test fabric is knitted fabric.

1. Cut two identical 10cm × 4cm specimen

2. If the fabric sample is multicolored take as many specimens as necessary to ensure that all colors in contact with each other.

3. Attach the multifiber adjacent fabric of equal size to test specimen by sewing along one of the shorter sides with the multifiber fabric in contact with face of the specimen produce composite teat specimen.

REAGENT:

The test solutions are as follows for alkaline and acid perspiration test:

	Alkaline	Acid
1-histidine mono-hydrochloride mono hydrate	0.5gm	0.5m
Sodium chloride (NaCl)	5.0gm	5.0gm
Disodium hydrogen	2.5gm	2.2gm
Orthophosphate distilled water	1000ml	1000ml
P^H (adjusted with 0.1 N NaOH)	8.0	5.5

TEST PROCEDURE:

1. The composite specimen is wetted I perspiration solution A and is kept for 30 mins at room temp.
2. The liquor is poured off (sample should not squeezed).
3. The specimen is placed between two glass plate (acrylic resin plate - 11.5cm × 6.0cm × 0.15cm) and 4.5kg pressure is applied using weight for 4 hrs. at over(incubator) at temp. $(37 + 2)^0$C or $(37 - 2)^0$C.
4. Pressure is released and the undyed and specimen are separated.
5. Then dried in air at temp . not above 60^0C .
6. The procedure is repeated with solution 'B'.

SAMPLE:

Shade %	S/J		Rib	
	Alkali Media	Acid Media	Alkali Media	Acid Media
1 % Red				
2 % Red				
4 % Red				
1 % Blue				
2 % Blue				
4% Blue				
1% Yellow				
2% Yellow				
4 % Yellow				

EVALUATION:

Numerically rate color change and staining of each test specimen under std. Lighting (D65 artificial daylight) using the Gray scales for color change and staining.

Perspiration Test:

Shade %	S/J		Rib	
	Alkali Media	Acid Media	Alkali Media	Acid Media
1% Red	4	4	4	4
2% Red	3 – 4	3 – 4	3 – 4	3 – 4
4% Red	3	3	3	3
1% Blue	4	4	4	4
2% Blue	3 – 4	3 – 4	3 – 4	3 – 4
4% Blue	3	3	3	3
1% Yellow	4 – 5	4 – 5	4 – 5	4 – 5
2% Yellow	4	4	4	4
4% Yellow	4	3 – 4	4	3 – 4

Interpretation of Grade:

(5) Excellent
(4) Good
(3) Fair
(2) Poor
(1) Very Poor

Pilling Test

Principal : The garments which come into contact with the body where pilling is heavy may suffer serious local boblin. This test is intended determine the resistance of abrasion to the action of friction.

Apparatus and materials :

a. Scissorses
b. Sewing m/c
c. Rubber
d. Format
e. Pilling tester
f. Grading paper

Procedure:

At first the fabric is made tube safe. Then a rubber pipe is entered in this tube fabric. Then this fabric is entered in the pilling tester m/c and it circle 14000.After this circle the fabric unload from this m/c and test the pilling by grading paper.

Grading paper scale :

(5) Excellent
(4) Good
(3) Fair
(2) Poor
(1) Very Poor

Fig: Pilling Tester

Fig: Grading paper

SAMPLE:

Shade %	S/J		Rib	
	Std Swatch	After Test Fabric	Std Swatch	After Test Fabric
1 % Red				
2 % Red				
4 % Red				
1 % Blue				
2 % Blue				
4% Blue				
1% Yellow				
2% Yellow				
4 % Yellow				

EVALUATION:

Numerically rate color change and staining of each test specimen under std. Lighting (D65 artificial daylight) using the Gray scales for color change and staining.

Pilling Test:

Shade %	S/J	Rib
1% Red	3 – 4	3 – 4
2% Red	3	3
4% Red	2 – 3	2 – 3
1% Blue	3 – 4	3 – 4
2% Blue	3	3
4% Blue	2 – 3	2 – 3
1% Yellow	3 – 4	3 – 4
2% Yellow	3	3
4% Yellow	2 – 3	2 – 3

Interpretation of Grade:

(5) Excellent
(4) Good
(3) Fair
(2) Poor
(1) Very Poor.

Color fastness to light

The textile to be tested is knitted fabric one pcs not less than 12cm × 5cm are requied for light fastness test. It keep the near 500w electrical light.

Test Procedure:

At first joint should be weft wise. Use the tep for joint

- ✶ The fabric hanging inside the
- ✶ Now switchon the light.
- ✶ This light contain on 48 hrs.

- ✶ Inside the light have ultraviolet.
- ✶ Than after 45 hrs off the light switch.
- ✶ Finally collect the sample should be relax.
- ✶ Than measure change the variation shade.

Fig: Light fastness tester.

SAMPLE:

Shade %	S/J Std Swatch	S/J After Test Fabric	Rib Std Swatch	Rib After Test Fabric
1 % Red				
2 % Red				
4 % Red				
1 % Blue				
2 % Blue				

4% Blue				
1% Yellow				
2% Yellow				
4 % Yellow				

EVALUATION:

Numerically rate color change and staining of each test specimen under std. Lighting (D65 artificial daylight) using the Gray scales for color change and staining.

Color fastness to light:

Shade %	S/J	Rib
1% Red	4 – 5	4
2% Red	3 – 4	3 – 4
4% Red	3	3
1% Blue	4 – 5	4
2% Blue	3 – 4	4
4% Blue	3	3
1% Yellow	4 – 5	4 – 5
2% Yellow	4	3 – 4
4% Yellow	3 – 4	3

Interpretation of Grade:

(5) Excellent
(4) Good
(3) Fair
(2) Poor
(1) Very Poor.

CHAPTER-5

RESULT ANALYSIS AND DISCUSSION

Result analysis of color fastness to wash:

Shade %	S/J	Rib
1% Red	4	4 – 5
2% Red	3 – 4	3 – 4
4% Red	3	3
1% Blue	4 – 5	4
2% Blue	3 – 4	4
4% Blue	3	3
1% Yellow	4 – 5	4 – 5
2% Yellow	4	3 – 4
4% Yellow	3 – 4	3

Interpretation of Grade:

(5) Excellent
(4) Good
(3) Fair
(2) Poor
(1) Very Poor.

Comments:

From the above tables containing results we noticed that fastness to wash properly (both staining & color in side) of S/J fabric is better among rib.

Result analysis of color fastness to Rubbing:

Shade %	S/J		Rib	
	Dry	Wet	Dry	Wet
1% Red	4 – 5	3 – 4	4	3 – 4
2% Red	4	3 – 4	4	3 – 4
4% Red	3 – 4	3	3 – 4	3
1% Blue	4 – 5	4	4 – 5	4
2% Blue	4 – 5	4	4	4
4% Blue	4	3	4	3
1% Yellow	4 – 5	4	4 – 5	4
2% Yellow	4	3 – 4	4 – 5	4
4% Yellow	4	3 – 4	4	3 – 4

Interpretation of Grade:

(5) Excellent
(4) Good
(3) Fair
(2) Poor
(1) Very Poor.

Comments:

From the above containing results we noticed that fastness to rubbing properly of color change in staining of rib fabric. Fastness to rubbing property (for color change in staining) of S/J more similar rib fabric. Again fastness to rubbing properly in wet state is comparatively better than dry state.

Result analysis of color fastness to Perspiration:

Shade %	S/J		Rib	
	Alkali Media	Acid Media	Alkali Media	Acid Media
1% Red	4	4	4	4
2% Red	3 – 4	3 – 4	3 – 4	3 – 4
4% Red	3	3	3	3
1% Blue	4	4	4	4
2% Blue	3 – 4	3 – 4	3 – 4	3 – 4
4% Blue	3	3	3	3
1% Yellow	4 – 5	4 – 5	4 – 5	4 – 5
2% Yellow	4	4	4	4
4% Yellow	4	3 – 4	4	3 – 4

Interpretation of Grade:

(5) Excellent
(4) Good
(3) Fair
(2) Poor
(1) Very Poor.

Comments:

From the above tables containing results we noticed that fastness to perspiration properly (booth staining and color change in shade). Reactive dye of cold brand, light shade perspiration result is better than dark shade.

Result analysis of color fastness to Pilling:

Shade %	S/J	Rib
1% Red	3 – 4	3 – 4
2% Red	3	3
4% Red	2 – 3	2 – 3
1% Blue	3 – 4	3 – 4
2% Blue	3	3
4% Blue	2 – 3	2 – 3
1% Yellow	3 – 4	3 – 4
2% Yellow	3	3
4% Yellow	2 – 3	2 – 3

Interpretation of Grade:

(5) Excellent
(4) Good
(3) Fair
(2) Poor
(1) Very Poor.

Comments:

From the above tables containing results we noticed that color fastness to light for cold brand reactive dye S/J,Rib , 2% and 4% shade is better then 1% shade . S/J fabric better then among that rib ----- fabric.

Result analysis of color fastness to Light:

Shade %	S/J	Rib
1% Red	4 – 5	4
2% Red	3 – 4	3 – 4
4% Red	3	3
1% Blue	4 – 5	4
2% Blue	3 – 4	4
4% Blue	3	3
1% Yellow	4 – 5	4 – 5
2% Yellow	4	3 – 4
4% Yellow	3 – 4	3

Interpretation of Grade:

(5) Excellent
(4) Good
(3) Fair
(2) Poor
(1) Very Poor.

Comments:

From the above tables containing results we noticed that color fastness to light for cold brand reactive dye S/J,Rib , 1% and 2% shade is better than 4% shade .

CHAPTER-6

CONCLUSION

CONCLUSION

By this project works we have gathered a lot of knowledge about color fastness & other properties dyed with reactive respectively. This is a very important task to ensure appropriate quality of knit dyed fabric.

The results are compared among single jersey, Rib and fabrics of different effect.

Project work also gives us some idea about group study as well as working barriers due to circumstance and facilities. Sometimes we also faced laced lack of our knowledge during our project work.
At last, we wish that in spite of several difficulties our project will achieve its objectives successfully by overcoming all its limitation.

CHAPTER-7

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Innovation

How does a particular innovation spread to integrate itself into society? The features which determine to cover the promptness of innovation are:
(1) Relative advantage – how the innovation is relatively better than present ideas
(2) Compatibility – with existing values and beliefs.

Thank you all