

Effect of Various Parameters on Dyeing of Polyester Cotton Blend

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Abstract

It has been found that cotton is the most comfort giving material found in nature, but for optimizing the cost and other quality parameters, sometimes it is needed to be blended with some synthetic material. Here again to obtain comfort and aesthetic appeal it is dyed with disperse and reactive dye by varying some parameters like dispersing agent, wetting agent dyeing was carried out and the best result were studied which specified which is the optimum value of the auxiliaries for dyeing this p/c blend.

Our analysis was to choose proper dyeing recipe for polyester cotton blend so that we could get the optimum results. And from our research we came to know that the disperse reactive dye containing both temporarily anionic and non-ionic disulphide reactive groups have been applied to cotton polyester fabric by exhaust dyeing is the better one.

Keywords: Open bath dyeing, Polyester/cotton blends, Disperse / Vat dyes.

1. Introduction

Dyeing is the process of imparting colors to a textile material through a dye (color). Dyes are obtained from flowers, nuts, berries and other forms of vegetables and plants as well as from animal and mineral sources. These are known as natural dyes. The other class of dyes is known as synthetic dyes. These are based on a particular type of chemical compositions. Some of these dyes are Acid (Anionic) dyes, Basic (Cationic) dyes neutral pre metalized dyes, sulphur dyes, vat dyes, reactive dyes, pigment dyes Color is applied to fabric by different methods of dyeing for different types of fiber and at different stages of the textile production process. These methods include direct dyeing; Stock dyeing; top dyeing; Yarn dyeing; Piece dyeing; Solution is pigmenting or dope dyeing, garment dyeing etc.

Commercially polyester/cotton blended fabrics are dyed by two-bath or one-bath two-step dyeing method employing suitable dyes and chemicals for each fiber. Two bath dyeing methods are relatively long and complicated. The one-bath two-step dyeing procedure is shorter as compared to two-bath method, but the drawbacks are lower dyeability and poor reproducibility.

Meena C.R. et al¹ have revealed that for the better dyeing of P/C blend (80/20, 67/33) the combination of Disperse / Reactive can be used. Hossein Barani, et al² pointed out that how we can vary the colour properties of PET. And their conclusion was to use the liposome dyes and increase in dyestuffs for the betterment of colour strength. Najafil H. et al³ observed that in order to improve the adhesion of chitin to surface of P/C, we should change the pre-treatment process. And finally it concluded that the pre-treatment should be performed in NaOH solution in order to get better results. Malik G. M, et al⁴ pointed out that the proper combination which should be acetified to gave disperse dyes. They evaluated the fastness of the fibre when above dye was used over it at HTHP. Infrared rays and nuclear magnetic resonance were helpful in characterizing dyes.

2. Materials:

Substrate – Polyester-cotton Blend Grey Fabric.

3.1 Required Chemicals:

- Hydrochloric Acid (HCL)
- Sodium Carbonate (Na₂CO₃)
- Sodium Bicarbonate (Detergent)
- Hydrogen Peroxide (H₂O₂)
- Sodium Silicate
- Sodium Hydroxide or Caustic Soda (NaOH)
- Dispersing Agent.
- Acetic Acid
- Wetting Agent.
- Sodium Sulphate (Na₂SO₄)
- Disperse Dye.
- Vat Dye.

3.2 RECIPE:

- HCL = 20 g/l
- Na_2CO_3 = 2 g/l
- MLR = 1: 20

3.3 Mechanism of Dyeing:

The process of dyeing may be divided into three phases,

1. Adsorption of the dyestuff at the fibre surface.
2. Diffusion of the dyestuff through the internal structure of the fibre.
3. Fixation of dye molecule at the suitable location or dye site.

3.4 Application of vat dyes:**3.4.1 RECIPE:**

- Vat Dye = 1%, 3%, 5%
- Wetting agent (TRO) = 0.5%, 1%, 2%
- NaOH = 6gpl
- Na_2SO_4 = 4gpl

3. RESULT AND DISCUSSION

In this paper we have used three proportions of each dyeing parameter that is dispersing agent, dye and wetting agent.

They are as follows -

Dispersing agent: 0.5%, 1%, 2%;

Dye: 1%, 3%, 5% and

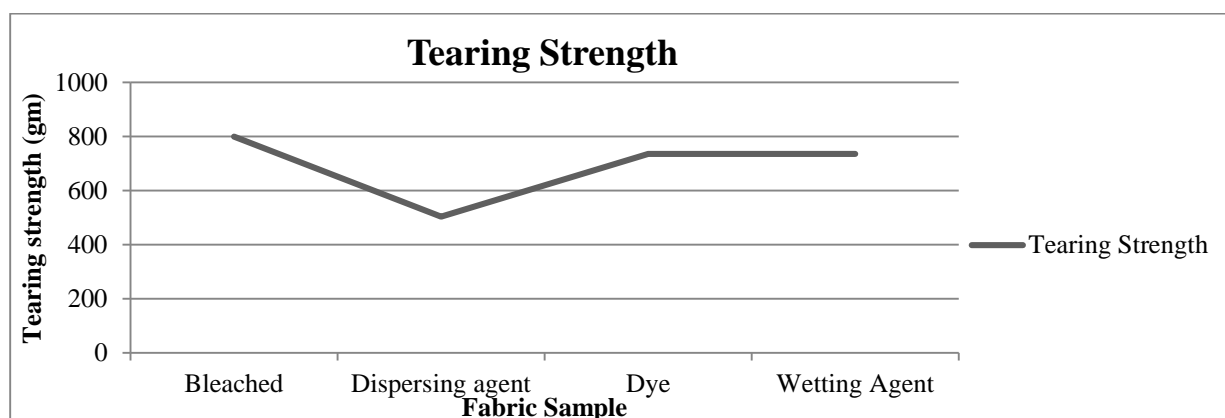
Wetting agent: 0.5%, 1%, 2%.

And the best combination of ratio for the optimum results among these parameters was found out 1% of dispersing agent, 5% of dye and 1% of wetting agent

Physical Properties: By using ASTM Standards method (Before & after Dyeing).

4.1 Tearing Strength:**Table 1: Tearing Strength**

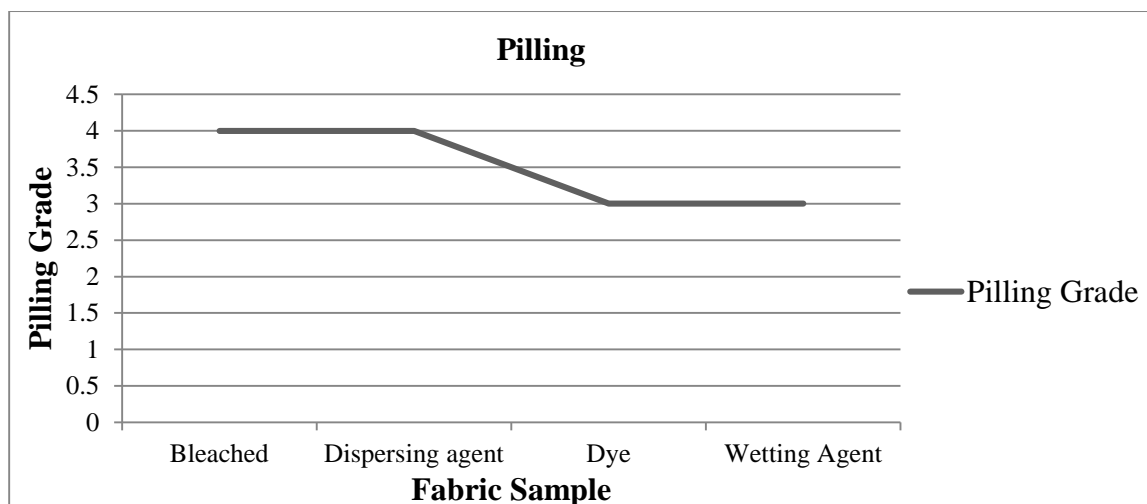
Tests	Bleached	Dispersing Agent 1%	Dye 5%	Wetting Agent 1%
Fabric tearing Strength (gm)	800.0	504.0	736.0	736.0

**Graph 4.1: Tearing Strength of Different Dyed and Undyed Fabrics.**

In table and graph shows the tearing strength of bleached fabric is more than the dyed fabrics. The tearing strength is decreased because of dye molecules weakened the p/c fibre which may be due rupturing of the cellulosic cell causes the creation of weak places in the fabric, thus 5% Dye and 1% wetting agent shows the greater strength than 1% dispersing agent dyed fabric but they less than bleached fabric.

4.2 Pilling Test:**Table 2: Pilling Grade**

Tests	Bleached	Dispersing Agent 1%	Dye 5%	Wetting Agent 1%
Pilling Grade	Slight pilling	Slight pilling	Moderate pilling	Moderate pilling



Graph 4.2: Pilling Grade of different dyed and undyed sample

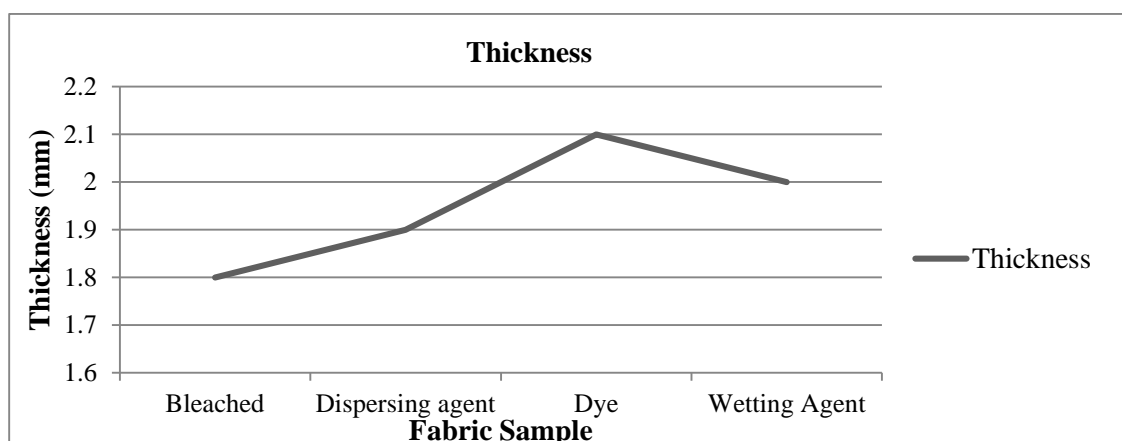
In table and graph shows the Pilling grade of bleached fabric and 1% dispersing agent dyed fabric is same. The Pilling grade of 5% Dyed and 1% Wetting agent dyed fabric is shows moderate pilling.

4.3 Thickness:

The fabric is liable to compress during measuring. Therefore the measurement of fabric thickness demands accuracy. The thickness measurement was done using IS 7702-5, R.A. 06 method, and the thickness values of both the sample were noted at ten different places to get uniform results.

Table 3: Thickness

Tests	Bleached	Dispersing Agent 1%	Dye 5%	Wetting Agent 1%
Thickness(mm)	1.8	1.9	2.1	2.0



Graph 4.3: Thickness of Different Dyed and Undyed Sample

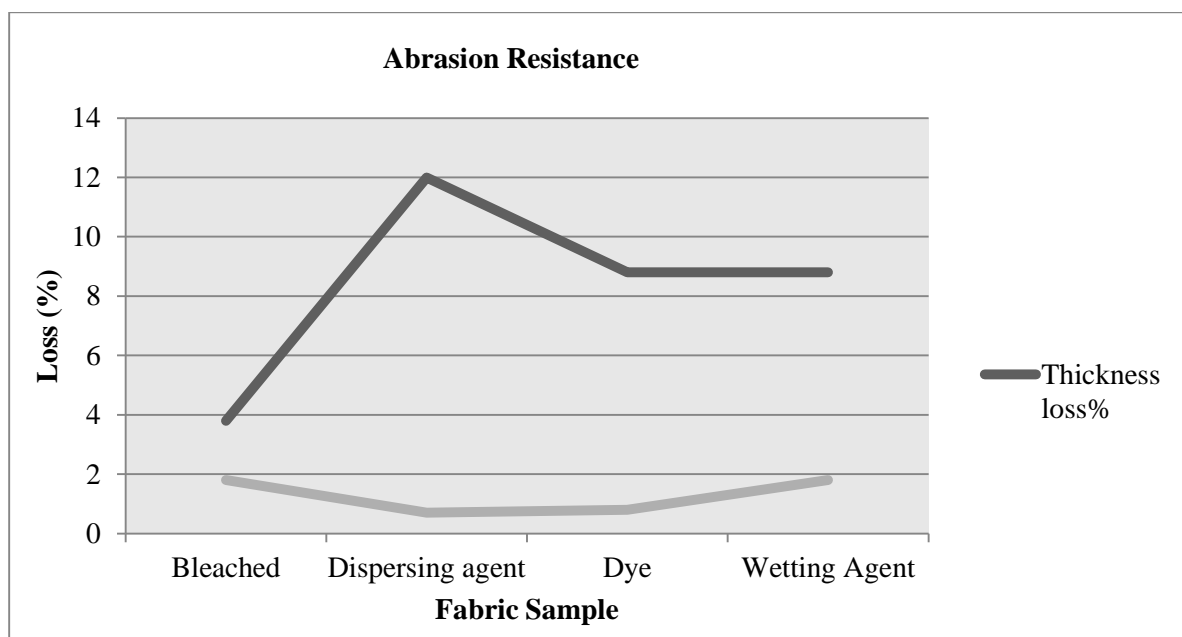
Form the results we can conclude that the thickness of the different percentage of dispersing agent sample is much higher than that of other fabric sample.

4.4 Abrasion Resistance:

Table 4: Abrasion Resistance

Tests	Bleached	Dispersing Agent 1%	Dye 5%	Wetting Agent 1%
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Weight loss %	1.8	0.7	0.8	1.8
Thickness %	3.8	12.0	8.8	8.8



Graph 4.4: Abrasion Resistance of Different dyed and Undyed fabrics

In table and graph shows the Abrasion resistance of bleached fabric is more than the dyed fabrics. The loss in weight and thickness is increased because of diffusion of dye molecules into the p/c fibre which results into increased in diameter of p/c fibres. It is also due to strong covalent bonds formed between the dye molecules and fibre molecules which results into stiffer fibres. The increase in diameter and stiffness results into less flexibility. These all factors are results into low abrasion resistance of dyed fabrics.

4. Conclusion

1. It has been found that for bleached fabric, tearing strength was good but after addition of dispersing agent tearing strength reduced. After dyeing with 5% showed good colour shades on the p/c fabric but tearing strength was reduced than bleached fabric.
2. There is slight decrease in pilling was observed in case of dyeing sample in comparison with bleached fabric, this may be due to binding of the fibres more firmly to the fabric surface thus allowing less formation of the balls of the dyed surface of the fabric.
3. Reduction in thickness observed after applying dispersing agent, which may be due the action of reducing the layer from the fabric surface, thus causing more loss, further dyeing helps to coat a layer which increases the abrasion resistance of the p/c dyed fabric.
4. It has been found that 1% dispersing agent showed very even and deep shades on fabric in comparison to other 0.5% and 2% dispersing agent.
5. Washing, perspiration and Ironing fastness of all the dyes on cotton fabric with 1% wetting agent gave excellent results.
6. Light fastness of 5% dye gave better fastness as compare to 1% and 3% dye.

Thus it can be concluded that 1% dispersing agent can be used to improve the color fastness of the vat and disperse dye.

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