Effect of Concentration of TCA Solution in PV blended Fabric on TCA Dyeing Method

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ABSTRACT

Dyeing of fabric blend such as polyester /cotton, polyester /viscous is presently done with two chemically different classes of dyes Manley disperse for polyester and reactive for cotton, in TCA process. Experiment work was carried out on finding the possibility of dyeing the p/v, p/c blend in single bath one step dyeing in different concentration of TCA (TriChloro Acetic) Acid solution. As mentioned earlier, the thermosol process is economical for dyeing of polyester and reactive dyes can also be fixed on cellulosic fiber by dry heat treatment. Therefore, fixation of disperse and reactive dyes can by carried out simultaneously during thermosol treatment. This process disperse dye are used in alkali resistant &reactive dye are preferably in h-brand suitable for single bath one step dyeing there are good color fastness property in disperse &reactive dyes. It has becomes necessary to look for energy efficient techniques which used less energy, water etc. this paper is manly focusing on basic principle and recommended dyes for TCA process.

This articles gives detailed information about the changing of concentration of alkali i.e. we are concentrating on it basic principle and possible shades it is dyes and fiber requirement.as it is more economical, eco-friendly, times consuming. It has been commercialized.

INTRODUCTION

A new process for batch coloration of a polyester /cotton, polyester /viscous blend has recently been introduced by TCA in this process alkali stable disperse dye and high temperature reactive dyes (H-E Brand) are used. The high stability of H-E Brand reactive dyes (staple up to 110) allow application of both disperse and reactive dyes from a single bath at boil. After dying at boil for the required length of time, the bath is cooled to 70 to 80 and the alkali added for the fixation of reactive dyes. The disperse dye used in the process are stable to alkali in the required temperature /pH range and the alkali performs the function of clearing the disperse dye. Thus the advantages of reduced time of dyeing. It is not advisable to dye conventional reactive dyes by the one bath process because high temperature conditions necessary for polyester dying are likely to affect them resulting in weaker shades. The TCA dyeing process for light and medium depth of shades the conventional sequences of dyeing can be reversed to achieve saving in energy and machine time. The processes of most suitable dyeing with disperse and reactive dyes in single bath one step method are TCA dyeing in continuous range of dyeing. Not all disperse are suitable for this process. Some of them undergo a change in shades and their colour yield is affected considerably during the thermosol treatment in alkaline medium. Therefore, the disperse dyes which are resistant to alkali should only be used. The alkali used in this process is 0 g/l, 10 g/l, 15 g/l, 20 g/l, 25g/l or 10g/l soda ash. Pad at room temperature taking usual precautions as mentioned during disperse /reactive dye applications, dry at 100-110 c followed by thermo fixation at 200-210 c from 80-60 sec during which disperse and reactive dyes are fixed simultaneously on polyester and cotton components, respectively. This is followed by soaping at boil using open soaper. The disperse dyes used in this process should have minimum staining on cellulosic fiber, no interaction with reactive dyes and good stability in alkaline conditions. The liquid disperse dyes are not suitable because the reactive dyes are liable to react with the hydroxyl group of the glycol present in them. This paper tried to describe the influence of two dyeing parameters, alkali &parameters (who are mainly responsible for dye fixation) of disperse and reactive dye for TCA dyeing. They were compared not only the by the fixation percent but also studied with the colour coordinates found from reflectance spectroscopy so that result can be obtained from a different view point.

BULK PROCESS

Process parameters of TCA dyeing on polycotton & polyviscose fabrics -

PH of dye bath	9 – 10
Alkali to Dye ratio	1 : 4
Nip pressure	L (24 N/mm), M (32 N/mm), 29 (N/mm)
Pick up %	65 %
Temp in 1st chamber	120°C
Temp in 2nd chamber	120°C
Temp in 3rd chamber	210°C
Speed of m/c	35 m/min
Dwell time for curing	80 - 90 sec in each chamber

IR Temp range	600 to 800°C
Exhaust fan speed	13, 13, 40 %
Blower fan speed	50, 50, 70 %
Moisture in chambers	25, 25, 7 %

Chemicals used in TCA dyeing

Chemical Name	Function	Std. Gpl	PH
Seragal MIP	Antimigrating agent	10	7
Serasperse MIS	Dispersing agent	5	7
Serawet CAS	Wetting agent	2	6 – 7
Seralube H	Lubricating agent	1	6 – 7
Seraquest MPP	Sequestering agent	2	6.5

Alkali used in process

Sodium Bicarbonate (NaHCO3)	20 gpl
Sodium Carbonate (Na2CO3)	10 gpl
Caustic lye	2 gpl

Process sequence of TCA dyeing (P/V & P/C Blend)

1) Padding with liquor containing disperse dyes, Reactive Dye, antimigrating agent, Dispersing agent, Wetting agent, Lubricating agent, Sequestering agent, TCA Solutiosn and
2) Soda Ash at pH 9 to 10 acid.
3) Pad liquid temp. 20 - 30°C.
4) IR pre-drying (residual moisture/semi dry up to 30 %)
5) Intermidiate drying at 120 to 120°C .
6) Thermosol fixation temp (curing) at 210°C for 80 - 90 sec. (depend on the depth of shade & fabric weight.
7) After Treatment

After treatment for (P/V Blend) dyed fabrics –

1) Carbonization on dyed fabric
2) Check depth of shade,

Fabric preparation prior to dyeing

The essential requirements are that the material must be made available for dyeing in neutral, uniform and radially absorbent state residual size must be always removed from woven goods because of the risk of dye wastage by reaction with hydroxyl groups on size components. It is imperative to check that all traces of residual chlorine or proxy compound are removed prior to dyeing otherwise loss of reactivity and even partial destruction of some dye can occur. There is considerable variation in ability of reactive dyes to cover dead or immature cellulose. For this reason it may sometime must be necessary to mercerize woven fabrics in order to achieve a satisfactory appearance such pretreatments give the further advantage of better color yield.

LITERATURE SURVEY

Disperse dyes are synthetic dyes. Disperse dye is one kind of organic substances which is free of ionizing group. Disperse dyes are less soluble in water and used for dyeing synthetic textile materials. Disperse dyes is mainly used for dyeing polyester yarn of fabric. in the other hand, Reactive dyes are used for coloring cotton or cellulosic fiber. A question could be appear in your mind that why this dye is called disperse dyes? It has a simple answer. Disperse dye is so called because it is non soluble and molecularly dispersed therefore dispersing agent is necessary for coloration with disperse dyes. Polyester fiber is a "manufactured fiber in which the fiber forming substance is any long chain synthetic polymer composed at least 85% by weight of an ester of a dihydric alcohol (HOROH) and terephthalic acid (p-HOOC-C 6H4COOH)". The most widely used polyester fiber is made from the linear polymer poly (ethylene terephtalate), and this polyester class is generally referred to simply as PET. High strength, high modulus, low shrinkage, heat set stability, light fastness and chemical resistance account for the great versatility of PET. Polyethylene Teraphthalate (PET) is a condensation polymer and is industrially produced by either terephthalic acid or dimethyl terephthalate with ethylene glycol.

EXPERIMENTAL WORK

METHOD

TCA dyeing method

Concentration of stock solutions

Dye solution	01 %
Soda ash solution	20 g/l
TCA Solution	20 g/l
Seragal MIP	10 g/l
Serawet CAS (Wetting agent)	2.5 g/l
Seraperse MIS	5 g/l
Seralube H	1 g/l
Triqest 2005	2 g/l

Given:

Weight of material = 10 gm

Material to Liquor Ratio (MLR) – 1:4

Alkali to Color (dye) Ratio -

The Ratio of dyes and alkali is to be 1 : 4 (1 ltr of alkali & 4 ltr of dye). Due to variation of these ratio, variation in shade observes or fixation of dyes in fiber is improper. Stock solution of soda ash and TCA Solution is prepared by 5 times stronger than required standard solution. If 10 gpl of soda ash is required in dyeing process then it prepared 50 gpl, and 20 gpl of TCA Solution is prepared by 100 gpl. Because of in 1 ltr of alkali, extra 4 ltr of water (with dyes + chemicals) is added automatically. If 1 ltr of 100 gpl stock solution of alkali is mixed with 4 ltr stock solution of dyes + chemicals then it completed 20 gpl of alkali by the set ratio of 1 : 4

Ex – 100 gpl stock solution of alkali / 5 (1 ltr alkali + 4 ltr dyes = 5 ltr) = 20 g/l

If alkali is prepared by std. Recipe then alkali is more diluted and hence not proper fixation of dyes, then shade is mor lighter than std. Shade

20 gpl / 5 ltr = 4 gpl of alkali

Laboratory Dyeing Procedure

1. In the laboratory, as per the dyeing recipe the dyes were dispensed and the dye solutions were prepared as per the calculations.
2. The dyeing trials of different concentration of alkali were taken and samples were dyed by same pressure and speed of the padding mangle in the lab and 5^{th} shades were prepared as follows.
3. After padding the dyed samples are kept for Digi Oven at temp- 60^0 c and time 30 mint for dye fixation of reactive dye.
4. After Digi Oven Dyed sample are kept for mini thermosol machine for temp - 210^0 c and time 1.02 sec.

Washing off the sample

- After the fixation of the dye, cold wash was given to the sample.
- Then the hot with the TCA solution was carried out at 95^0C to 100^0C.
- And the finally sample was wash with cold water and neutralized with acetic acid and again wash with cold water.
- After the washing, the sample were squeezed through the nip squeezer and dried with Tex press iron.

Evaluation of colour values of dyed sample

Colour values are evaluated Using computer colour matching (Spectrophotometer) in terms of.

1) K/s – Values and % Strength
2) L,a,b,C,H,dE – Values
3) Washing fastness
4) Rubbing fastness

RESULT AND DISCUSSION

RECIPE A : - (LIGHT YELLOW)

A. Polyster dyes:-
   1. Dianix Yellow Brown - 2.200 %
   2. Dianix Rubine S_2G – 0.340 %
   3. Cebene Blue F_2RC – 0.370 %

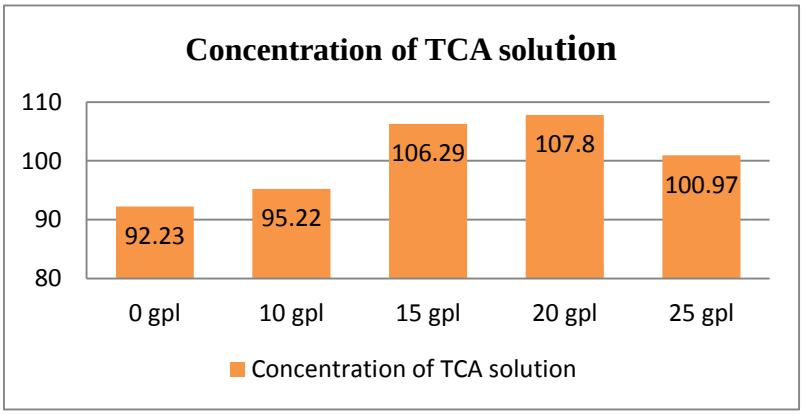
B. Cotton dyes:-

1. Jakazol Yellow DDR – 2.650 %
2. Jakafix Red eco – 1.250 %
3. Jakazol Blue CE – 1.200 %

Table 1: - Effect of conc. Of TCA solution in PV blended fabric with recipe A

Sr.no	GPL	% Strength	Decmc	Da*	Db*	Dc*	DH*	DL	P/F
1	0 gpl	92.23	1.39	0.49	1.69	1.67	0.55	0	fail
2	10 gpl	95.22	0.75	-0.08	0.04	-0.01	0.09	0	pass
3	15 gpl	106.29	0.38	0.11	-0.06	0.02	-0.12	0	pass
4	20 gpl	107.8	0.23	0.08	-0.08	-0.02	-0.11	0	pass
5	25 gpl	100.97	0.52	0.2	0.37	0.42	0.05	0	pass

Above bar diagram shows the % strength value of different Concentration of TCA Solution.
The P/V blended dyed sample were dyed with recipe A and the results for color difference, Color strength values are give Table 1 and presented in figure 1. From Table 1 it was observed that the color strength, DE valve are good in 20 gpl. TCA Solutions so better fixation of disperse dye & Reactive dye in this concentration. As the concentration of TCA solution increased the color strength of dyed sample increased.



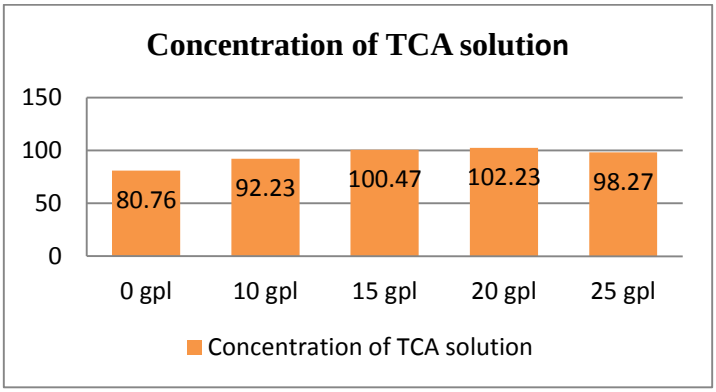
RECIPE B : - (BLACK)

A. Polyster dyes:-
   1. Dianix Yellow Brown S2R – 0.10 %
   2. Cebene Black kb –4.500 %

B. Cotton dyes:-
   1. Bodactive Orang GB – 1.512 %
   2. Bodactive Caramine CE– 1.106 %
   3. Jakazol Nevy CE – 4.20 %

Table 2: - Effect of conc. Of TCA solution in PV blended fabric with recipe B

Sr.no	GPL	% Strength	Decmc	Da*	Db*	Dc*	DH*	DL	P/F
1	0 gpl	80.76	2.25	-0.01	-0.65	0.47	-0.44	2	Failed
2	10 gpl	92.23	0.8	0.04	-0.14	0.12	-0.08	0	Pass
3	15 gpl	100.47	0.12	-0.09	0.01	-0.07	-0.05	0	Pass
4	20 gpl	102.23	0.21	-0.03	-0.13	0.06	-0.12	0	Pass
5	25 gpl	98.27	0.65	0	0.04	-0.02	0.04	0	Pass



Above bar diagram shows the % strength value of different Concentration of TCA Solution.

The P/V blended dyed sample were dyed with Recipe B and the results for color difference, Color strength values are give Table 2and presented in figure 2. From Table 2 it was observed that the color strength, DE valve are good in 20 gpl. TCA Solutions so better fixation of disperse dye & Reactive dye in this concentration. As the concentration of TCA solution increased the color strength of dyed sample increased.

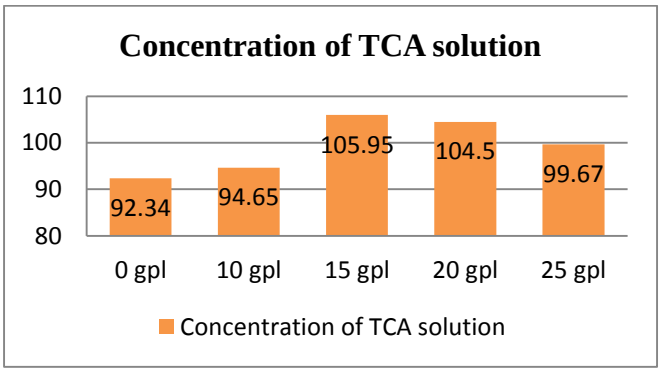
RECIPE C : - (LIGHT GREEN)

A. Polyster dyes:-
1. Dianix Yellow CC – 1.09 %
2. Dianix Yellow brown S2R – 0.18 %
3. T-Blue – XF – 0.912 %

B. Cotton dyes:-
1. Bodactive Yellow CG – 2.64 %
2. Bodactive Red Eco – 0.044 %
3. TWF – 0.8 %

Table 3: - Effect of conc. Of TCA solution in PV blended fabric with recipe C

Sr.no	GPL	% Strength	Decmc	Da*	Db*	Dc*	DH*	DL	P/F
1	0 gpl	92.34	1.94	0.74	-4.9	-4.96	-0.01	-2	Fail
2	10 gpl	94.65	0.76	0.73	1.63	1.51	-0.95	0	Pass
3	15 gpl	105.95	0.34	-0.45	0.11	0.18	0.43	0	Pass
4	20 gpl	104.5	0.53	0.2	-0.91	-93	-0.06	-1	Pass
5	25 gpl	99.67	0.48	-0.1	-0.12	-11	0.12	0	Pass



Above bar diagram shows the % strength value of different Concentration of TCA Solution.

The P/V blended dyed sample were dyed with Recipe C and the results for color difference, Color strength values are give Table 3 and presented in figure 3. From Table 3 it was observed that the color strength, DE valve are good in 15 gpl. TCA Solutions so better fixation of disperse dye & Reactive dye in this concentration. As the concentration of TCA solution increased the color strength of dyed sample increased.

RECIPE D : - (DARK BROWN)

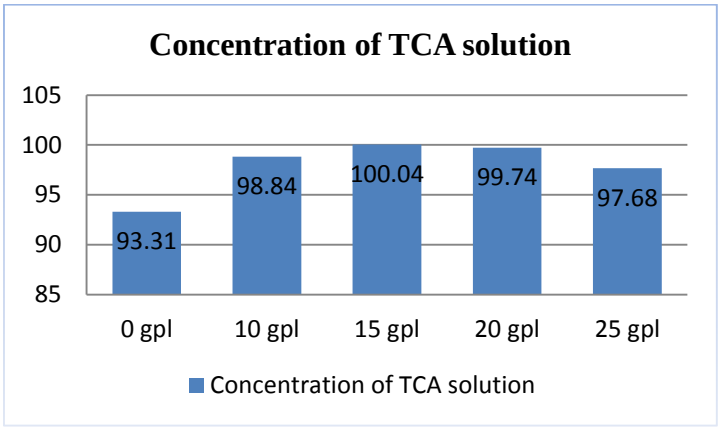
A. Polyster dyes:-
1. Dianix Rubin S2G – 0.34 %
2. Dianix Yellow brown S2R – 2.2 %
3. Cebene Blue F2Rl – 0.34 %

B. Cotton dyes:-
1. JakaZol Yellow DDR – 2.65 %

2. Bodactive Red Eco – 1.25 %
3. Blue CR – 1.30 %

Table 4: - Effect of conc. Of TCA solution in PV blended fabric with recipe D

Sr.no	GPL	% Strength	Decmc	Da*	Db*	Dc*	DH*	DL	P/F
1	0 gpl	93.31	1.55	-0.72	-0.28	-0.61	0.47	0	Fail
2	10 gpl	98.84	0.88	-0.95	0.08	-0.43	0.85	0	Pass
3	15 gpl	100.04	0.35	-0.5	-0.27	-0.49	0.29	0	Pass
4	20 gpl	99.74	0.14	-0.02	-1.16	-0.33	-1.63	0	Pass
5	25 gpl	97.68	0.65	1.2	0.23	-0.21	-0.1	0	Pass



Above bar diagram shows the % strength value of different Concentration of TCA Solution

The P/V blended dyed sample were dyed with Recipe D and the results for color difference, Color strength values are give Table 4 and presented in figure 4. From Table 4 it was observed that the color strength, DE valve are good in 20 gpl. TCA Solutions so better fixation of disperse dye & Reactive dye in this concentration. As the concentration of TCA solution increased the color strength of dyed sample increased.

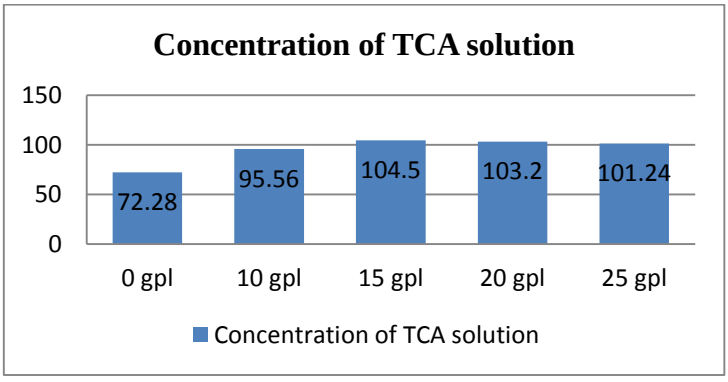
RECIPE E : - (RED MAROON)

A. Polyster dyes:-
1. Dianix Yellow S6GN – 1.70 %
2. Dianix Rubin S2G – 0.079 %
3. Cebene Blue F2Rl – 0.66 %

B. Cotton dyes:-
1. Bodactive Yellow CG – 2 %
2. JakaZol Red Eco – 0.50 %
3. JakaZol T-Blue G – 5.50 %

Table no 5: - Effect of conc. Of TCA solution in PV blended fabric with recipe D

Sr.no	GPL	% Strength	Decmc	Da*	Db*	Dc*	DH*	DL	P/F
1	0 gpl	72.28	2.49	-2.63	-3.47	-3.21	-2.95	2	fail
2	10 gpl	95.56	0.51	-0.31	0.4	-0.22	0.46	0	pass
3	15 gpl	104.5	0.35	-0.85	-0.25	-0.88	-0.07	0	pass
4	20 gpl	103.2	0.12	-0.28	0.13	0.3	0.07	0	pass
5	25 gpl	101.24	0.25	0.4	0.37	0.46	0.28	0	pass



Above bar diagram shows the % strength value of different Concentration of TCA Solution.
The P/V blended dyed sample were dyed with Recipe E and the results for color difference, Color strength values are given Table 5 and presented in figure 5. From Table 5 it was observed that the color strength, DE valve are good in 20 gpl. TCA Solutions so better fixation of disperse dye & Reactive dye in this concentration. As the concentration of TCA solution increased the color strength of dyed sample increased.

CONCLUSION

Alkali increase the dye fixation percent up to certain level.so as in increase in alkali amount in dye bath can decrease the dye loss. All the shades of each dye become darker and higher alkali. Increase of bluish tone can be possible by increasing alkali shades the Yellower tone is increase. The PV blend dyed sample were dyed with different concentration using Recipe A and the result of evaluation for color different, and color strength values are given Table I and presented in Figure . There are result are concluded the 20 GPL % Strength and DE values are good in Different GPL

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