

Dyeing of Wool and Silk Fabrics with Left over Tea Extract and Tesu Flower Dye Extract

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Abstract

This study was carried out to find out the effect of left over tea extract and tesu flower dye extract on wool and silk fabrics. Different variables of dyeing namely dye extraction time, dyeing time, temperature, dye concentration were optimized and a constant recipe for dyeing was selected on the basis of personal judgment and expert suggestion. It was found that the optimum extraction time for dye was 60 min, optimum dyeing time was 60 and 90 min for wool and 90 min for silk, optimum dyeing temperature was 60°C and 80°C for wool and 80°C for silk, optimum dye concentration was 10% and 30% dye for wool, 30% dye for silk and 10% dye for combination of both dyes. Dyeing was carried out with left over tea extract, tesu flower dye extract and their combinations. Colorfastness of dyed sample towards rubbing, ironing, washing and sunlight was assessed. It was found that wool and silk fabrics dyed with both natural dyes

shows very good to excellent colorfastness towards rubbing, good to excellent towards ironing, moderate to very good towards washing and very good to excellent towards sunlight. K/S value of dyed sample was assessed. Depth of shade and evenness of shade was also evaluated. It was observed that samples show even to very even effect on both fabrics. Depth of shade also shows medium to deep shade effect on wool and silk fabrics.

Keywords: Fashion | Wool Fibre | Silk Fibre | Tesu flower | Tea Extract | Dye Extract

Introduction

Nature always wears the colors of the spirit

The use of natural dyes in world is increasing everyday as natural dyes are non-toxic and eco-friendly in nature. Natural dyes are dye or colorants obtained from naturally occurring sources such as plants, insects, animals, and minerals without any chemical treatment. Natural dyes are very advantageous and have great affinity towards the natural fabrics thus wool and silk fabrics have been selected for dyeing with natural dyes.

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Wool is a natural highly crimped protein hair fiber derived from sheep. Wool is a fiber of moderate lustre. Wool fibers possess very high elongation at break. They have excellent resiliency and is highly moisture absorbent.

Silk is a natural protein fiber. Silk is produced by the larvae of moth. It has a unique natural luster, good moisture absorption, draping qualities and high strength.

Natural dyes are obtained from various sources. Plant sources are majorly contributed in dyeing of various fibers. These natural sources are renewable and less costly as compared to synthetic dyes. Among various plant sources, tea and tesu flowers have been selected for dyeing.

Tea is an aromatic beverage commonly prepared by pouring hot or boiling water over cured leaves of the *Camellia Sinensis*, an evergreen shrub native to Asia. Tea contains tannin, which stains and colors, so material dyed with tea has good light-fast properties.

Tea creates a palette of warm browns, tans and rusts

Tesu flowers (*Butea Monosperma*) is commonly known as 'flame of forest' or 'palash' and various other names in India. It is found in the forest of central India. The plant is well known for its natural dyes. Dyes extracted from tesu flowers have several advantages such as; eco-friendly, cheap, does not have hazardous effect on human health. Flowers of palash tree are used to make vegetable dye color as they produce orange-red color.

Materials and Methods

Collection of raw material: The collection of raw material includes the textile material, dye material and mordants.

Fabric

Two types of protein fabrics viz. wool and silk were selected for the study.

Dye material

Two types of natural dyes were used. Left over tea and tesu flowers were collected for the extraction of dyes.

Determination of preliminary data of fabric

Thread count, thickness and weight of the fabrics were assessed for the determination of the preliminary data of the fabrics.

Pre-treatment of the fabric: 2 pre-treatments were given to the fabrics i.e. scouring of wool and degumming of silk.

Optimization of different variables for dyeing

Dyeing was done at different variables to optimize a constant recipe for dyeing. These variables are dye concentration, time and temperature and mordanting method. The procedure followed to determine optimum value for each variable is being explained below:

Determination of dye extraction from tesu flower

Tesu dye was extracted by boiling 10 gm and 30 gm tesu flower in 500 ml water by maintaining the liquor value constant. The tesu flowers were boiled for 1 hour at 80°C-100°C and then the flowers were taken out from the liquor and the dye liquor was prepared.

Determination of dye from left over tea

Left over tea was collected and then the dye liquor was extracted by boiling 10 gm and 30gm tea in 100 ml water by maintaining the liquor value constant. The left over tea was

boiled for 1 hour at 80°C - 100°C and then the tea extract was filtered for dyeing.

Optimization of dyeing time

After the extraction of dye from left over tea and tesu flower, the dyeing was carried out for two different time duration i.e. 60 min and 90 min.

Both variables were considered during with tea and tesu extract and the combination of both.

Optimization of dyeing temperature

The dyeing was carried out at 2 different temperatures *i.e.* 80°C and 100°C for both dyes.

Optimization of dye concentration for combination dyeing with left over tea extract and tesu flower dye

Combination dyeing was done by using left over tea extract and tesu flower dye at

different percentage *i.e.* 50:50, 72:25, 25:75, 60:40, 40:60.

Determination of colorfastness of dyed sample

Color fastness is a term used in the dyeing of textile materials, meaning resistance of the material's color to fading or running. Light fastness, wash fastness, rub fastness and sunlight fastness are the main forms of color fastness that were assessed.

K/S value of dyed sample

K/S value of dyed samples was assessed with the help of spectrophotometer. The K/S value of wool and silk fabrics dyed with both natural dyes was determined at 540 nm.

Subjective analysis of dyed sample

For assessment of depth of shade and evenness, subjective analysis was done.

Results and Discussion

						
Tea (10%)	Tea (30%)	Tesu (10%)	Tesu (30%)	Tea:Tesu 50:50 (10%)	Tea:Tesu 25:75 (10%)	Tea:Tesu 40:60 (10%)

Effect of natural dyes on wool fabric at different concentration

				
Tea (30%)	Tea (30%)	Tea:Tesu 50:50 (10%)	Tea:Tesu 25:75 (10%)	Tea:Tesu 40:60 (10%)

Effect of natural dyes on silk fabric at different concentration

Dye	%	Washing		Rubbing				Ironing						Sunlight
		C	S	CC		S		CC			S			
				D	W	D	W	D	W	D'	D	W	D	
T	10	4/5	4/5	5	4/5	4/5	4	5	4/5	4/5	5	4	4	4/5
Te	10	3/4	3/4	5	4/5	4/5	3/4	5	4/5	4/5	5	4	4/5	4/5
T+Te (50:50)	10	4/5	4/5	5	4/5	4/5	4	5	4/5	4/5	5	4/5	4/5	4/5
T+Te (25:75)	10	4	4	5	4/5	4/5	4	5	4/5	4	5	4/5	4	4/5
T+Te (40:60)	10	4/5	4/5	5	4/5	4/5	4	5	4/5	4/5	5	4/5	4/5	5
T	30	4/5	4/5	5	4/5	5	4	5	5	4/5	5	4	4/5	5
Te	30	3/4	3/4	5	4/5	4/5	3/4	5	4/5	4/5	5	4	4	5

*T= Tea, Te= Tesu, CC= Color Change, S= Staining, D= Dry, W= Wet, D'=Damp

Table 1: Colorfastness of wool fabric with natural dyes at different concentration

This table shows good to very good colorfastness towards washing, very good to excellent colorfastness towards rubbing, good

to excellent colorfastness towards ironing and good to excellent colorfastness towards sunlight.

Dye	%	Washing		Rubbing				Ironing						Sunlight
		CC	S	CC		S		CC			S			
				D	W	D	W	D	W	D'	D	W	D	
T	30	4	4/5	5	4/5	4/5	3/4	5	4/5	4/5	5	4/5	4/5	4/5
Te	30	4	4	5	4/5	4/5	3/4	5	4/5	4/5	5	4/5	4/5	4/5
T+Te (50:50)	10	4	4	5	4/5	4/5	3/4	4/5	4/5	4/5	4/5	4/5	4/5	4/5
T+Te (25:75)	10	4	4	5	4/5	4/5	3/4	4/5	4	4/5	4/5	4	4/5	5
T+Te (40:60)	10	4/5	4/5	5	4/5	4/5	3/4	4/5	4/5	4/5	4/5	4/5	4/5	5

*T= Tea, Te= Tesu, CC= Color Change, S= Staining, D= Dry, W= Wet, D'=Damp

Table 2: Colorfastness of silk fabric with natural dyes at different concentration

This table shows good to very good colorfastness towards washing, moderate to excellent colorfastness towards rubbing, good

to excellent colorfastness towards ironing and very good to excellent colorfastness towards sunlight.

Dye	Dye %	Depth of shade	Evenness of shade	K/S value
T	10	2.28	2.72	28.94
Te	10	2.8*	2.8*	23.4
Te+T (50:50)	10	2.28	2.68	37.22
Te+T(75:25)	10	2.64	2.8*	35.94
Te+T(60:40)	10	2.8*	2.8*	22.23
T	30	2.6	2.68	36.98
Te	30	2.8*	2.4	15.06

Table 3: Depth of shade, evenness of shade and K/S value of wool fabric dyed with natural dyes

This table shows even to very even evenness of shade and medium to deep depth of shade and it was observed that K/S value of wool fabric dyed with 30% left over tea extract and the combination of both dyes at 75:25 and

50:50 were rated as high. This table shows darker color intensity. On the other hand, wool fabric dyed with 10% and 30% tesu flower dye extract shows lighter color intensity.

Dye	Dye %	Depth of shade	Evenness of shade	K/S value
Te+T (50:50)	10	2.8*	2.68*	21.5
Te+T (75:25)	10	2.16	2.6	24.5
Te+T (60:40)	10	2.6	2.4	29.1
T	30	2.8*	2.28	31.7
Te	30	2.5	2.68*	19.88

Table 4: Depth of shade, evenness of shade and K/S value of silk fabric dyed with natural dyes

This table shows even to very even evenness of shade and medium to deep depth of shade and it was observed that K/S value of silk fabric dyed with 30% left over tea extract and the combination of both dyes at 60:40 were rated as high. This table shows darker color intensity. On the other hand, silk fabric dyed with 30% tesu flower dye extract and the combination of both at 50:50 shows lighter color intensity.

Conclusion

The present study was carried out to evaluate the dyeing of wool and silk fabrics with natural dyes extracted from left over tea and tesu flowers by keeping environment friendly procedures as well.

1. The optimized conditions for aqueous extraction of color component for tesu flowers are 60 min extraction time, 80°C-100°C temperature, 500 ml water and aqueous extraction of color component for left over tea are 60 min extraction time, 80°C-100°C temperature, 100 ml water.

2. The optimized conditions for dyeing of wool fabric with left over tea extract and tesu flower dye extract are:

60 min time, 60 temperature, 10gm dye, 1:50 MLR and 90 min time, 80°C temperature, 30gm dye, 1:50 MLR.

The optimized conditions for dyeing of silk fabric with left over tea extract and tesu flower

dye extract are:

90 min time, 80°C temperature, 30gm dye, 1:50 MLR.

The optimized conditions for dyeing of wool and silk fabrics with the combination of left over tea extract and tesu flower dye extract are:

90 min time, 80°C temperature, 10gm dye with 3 combinations of tea and tesu; 50:50, 25:75, 40:60, and 1:50 MLR.

3. It was concluded from the results that both natural dyes shows very good to excellent colorfastness towards rubbing, good to excellent towards ironing, moderate to very good towards washing and very good to excellent towards sunlight.

4. K/S value of dyed sample was assessed at 540 nm by spectrophotometer. It shows very good to good results.

5. It was also observed that samples shows even to very even effect on both fabrics. Depth of shade also shows medium to deep shade effect on wool and silk fabric.

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