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### Sudies on the Effect of Laundering Chemicals on the Colour of Natural Dark Brown and Green Colour Cotton Fabrics.

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#### ABSTRACT

Cotton is a versatile eco-friendly fibre accepted largely for its comfortable properties among consumers. Natural Colour Cotton fabrics are historical products that have regained their importance because of their eco-friendly nature. Synthetic dyes and chemicals used in wet processing of textiles are hazardous and are known to be carcinogenic on prolonged use. Dark Brown and Green hirsutum genotypes were processed to fabric and the fabrics were subjected to various laundering agents viz., soaps, detergents and non-ionic agents to study the impact of the same on the colour parameters of the fabrics. Results revealed that the there is a significant difference in the colour of the fabrics with first wash with an alkaline detergent. However, neutral/ non-ionic soaps and detergents used for subsequent washings shall aid in prolonged retainment of colour of the fabrics. However, such eco-friendly products are precious and require eco-friendly surfactants for better performance. Eco-friendly surfactants need to be designed for such uses in the eco- industry.

**Key words:** NCC, Laundering, Soaps and detergents, fabric care.

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## INTRODUCTION

Cotton in its pure form and with blends is the principle textile fibre of the universe and is one of the world's most socially vital and economically important agricultural cash crops. Millions of people depend on cotton cultivation because it meets the basic necessity of human being and is known for its diversity, enormous utility, applicability, economic viability and advantageous properties.

The cotton grown commercially in the world is of white tint, but in recent years the colour linted cotton has gained popularity. India holds the largest area of 8 million hectares and ranked third in world's cotton production next to China and USA and second largest consumer. Out of 35 million hectares of land used for cotton cultivation globally, only 0.02 per cent is used for coloured cotton cultivation. Besides sustaining the country's textile industry, it earns precious foreign exchange by way of export both yarn as well as finished goods. Cotton with naturally coloured lint, other than white, is commonly referred as 'Natural Colour Cotton'. The natural colour is due to the plant's inherent (non-modified) genetic properties that grow in shades of green, brown and beige. Natural colour cotton is grown without harmful fertilizers or chemical pesticides which ensures environmentally sustainable production. It is one of the eco friendly products that is gaining enormous popularity among the health and environment conscious consumers.



Recent genetic investigations in colour linted *hirsutum* cottons have highlighted various positive features. Efforts are made to develop and improve the fibre quality parameters of medium brown, dark brown and green *hirsutum* varieties. However, lot of variation in the colour of Naturally Colour Cotton is reported on subsequent washing especially when dried under sunlight. Therefore the present study was undertaken with the objectives to study the effect of cleansing agents and laundering practices on the colour of Natural Dark Brown and Green fabrics [1-3].

## METHODOLOGY

### Source material

Fabric woven using Natural Dark Brown and Green Colour Cotton yarn was further subjected to tests for laundry reagents. Fabric was first assessed for its physical parameters viz., ends and picks per inch, thickness and colour



Natural Dark Brown fabric



Natural Green fabric

## Colour stability studies

### Colour measurement

Colour is a sensation which occurs when light enters the eyes. Colour of any substance decides the ultimate appearance of the article. The dark brown and green NCC fabrics were subjected to wash treatments using different cleansing agents and the colour change was recorded as colour strength (K/S) values.

### K/S value

The K/S values were obtained by measuring the reflectance of the washed samples using colour spectrophotometer (Model SS 5100A) with interface Colourlab Plus Software.

### Colour fastness to washing

Poor colourfastness in textile products is a major source of customer complaint. Textile fabrics behave differently when they come in contact with different agents. Besides, there are a number of agents that colour items encounter which can cause fading or bleeding. These factors vary with the end use for which the product is intended. The loss of colour during laundering is referred to as lack of wash-fastness or bleeding.

### Recipe

Soap/detergent	- 5gpl
MLR	- 1: 30
Time	- 15 min
Fastness	- Colour spectrophotometer (SS 5100A)

### Procedure

The fabric samples were soaked in the soap solution for 15 minutes, washed and rinsed in cold water. One set of fabric samples was sun dried and the other shade dried. Later the samples were ironed and assessed for colour fastness. The process was repeated for 20 washes.

## RESULTS AND DISCUSSION

### Fabric properties

#### Thread density (NE)

Thread density in woven textile fabric is the number of ends and picks per unit area which is influenced by the respective yarn density and fabric set. It is learnt that the ends per inch are relatively greater than picks per inch i.e., 49 x 30 (dark brown) and 48 x 46 (green) for both the fabric samples. (Table 1)

#### Thickness (mm)

Thickness is the distance between one surface to its opposite. In textiles, it is the distance between the upper and lower surface of the material, measured under a specified pressure. The results revealed that among the two NCC genotypes, dark brown fabric was relatively thicker (76.80 mm) than green fabric (48.80 mm).

**Table 1: Physical parameters of the Colour Cotton fabrics**

Sl. No.	Fabric properties	Dark Brown		Green	
		Warp	Weft	Warp	Weft
1.	Thread density (NE)	49.00	33.00	48.00	46.00
2.	Thickness (mm)	76.80		48.80	

#### Effect of laundering on colour strength values of dark brown NCC fabric

Table 2 narrates the colour strength (K/S) values of dark brown fabric samples laundered with different cleansing agents. It is observed from the Table that there is a considerable improvement in colour of fabric samples on laundering as compared to control (51.06) sample for first wash irrespective of detergent types and drying conditions. The K/S value was found to be highest in D1 washed sample (65.26 sundried & 63.81 shadedried) after first wash, which decreased to (40.17 sundried & 45.91 shadedried) after 20 launderings irrespective of drying conditions. Similarly both sun dried (59.53 D2 & 55.52 D3) and shade dried (60.11 D2 & 56.06 D3) D2 and D3 samples also exhibited decrease in K/S values from first wash to twentieth wash.

Further, it was observed from the Table that K/S values of all soap washed samples exhibited increase in colour strength after first wash irrespective of drying conditions. However, S1 sun dried sample showed maximum colour improvement (62.81) after first wash followed by S2 (62.29) and S3 (58.63) sun dried samples. Meanwhile shade dried samples also depicted similar results as that of sun dried samples.

Contrarily, the samples washed with non-ionic cleansers exhibited decrease in K/S values on first wash which in turn depicted increase in colour strength on successive launderings.

**Effect of laundering on colour strength values of green NCC fabric**

The K/S value of green NCC fabric without any treatment was recorded to be 32.74. However, a trend of increase in colour strength values was observed when treated with different cleansing agents. The K/S value of green fabric sample increased from 32.74 to 46.35 (sun dried) and 46.71 (shade dried) for first wash when laundered with D3 detergent but gradually decreased on successive launderings i.e. 20 washes. However D2 washed samples exhibited increase in K/S values (44.40 sundried & 47.35 shadedried) on successive launderings, while D1 washed sample depicted almost no change in K/S values for 20 washes (Table 3).

All the soap washed samples exhibited an increasing trend in K/S values from first wash to twentieth wash irrespective of soap types and drying conditions. Maximum increase in colour strength was observed among sundried (38.65) and shade dried (36.97) S2 samples thereby depicting increasing trend for 20 washes (43.88 sundried & 45.57 shadedried). Similarly the samples washed with non-ionic cleansers also revealed increase in colour strength from control (32.74) to twenty washes for both sun dried (37.01) and shade dried (39.32) samples.

**Table 2: Colour strength (K/S) values of dark brown fabric washed with different cleansing agents**

Sl. No.	Treatments	K/S values										
		Control	I wash		V wash		X wash		XV wash		XX wash	
			Sun dried	Shade dried	Sun dried	Shade dried	Sun dried	Shade dried	Sun dried	Shade dried	Sun dried	Shade dried
<b>I. Detergents</b>												
a.	D1 (10.39 pH)	51.06	65.26 (2.86)	63.81 (2.57)	59.48 (4.72)	61.54 (3.86)	49.51 (4.82)	55.50 (3.17)	43.99 (4.57)	48.05 (4.16)	40.17 (4.05)	45.91 (3.38)
b.	D2 (10.55 pH)	51.06	59.53 (2.65)	60.11 (3.88)	49.54 (4.47)	53.92 (4.79)	50.96 (4.08)	53.31 (3.73)	42.13 (5.12)	47.37 (4.29)	43.08 (3.61)	48.46 (3.60)
c.	D3 (10.93 pH)	51.06	55.52 (3.92)	56.06 (2.73)	52.44 (3.67)	56.34 (3.60)	49.73 (4.03)	53.98 (3.62)	39.93 (4.05)	45.69 (3.29)	38.20 (2.64)	44.57 (2.06)
<b>II. Soaps</b>												
d.	S1 (pH 9.54)	51.06	62.81 (1.63)	57.10 (2.69)	61.54 (4.43)	52.08 (4.55)	70.90 (1.09)	58.09 (4.23)	50.02 (4.48)	51.86 (4.78)	39.42 (4.26)	47.29 (3.47)
e.	S2 (pH 9.89)	51.06	62.29 (1.97)	74.25 (1.53)	54.38 (3.96)	50.42 (3.64)	52.44 (4.21)	54.50 (4.43)	51.62 (4.46)	52.49 (4.27)	43.90 (3.47)	47.61 (3.11)
f.	S3 (pH 10.54)	51.06	58.63 (3.37)	61.85 (1.65)	50.76 (3.25)	51.47 (3.96)	66.32 (1.96)	51.11 (4.76)	45.38 (4.77)	47.22 (4.92)	38.81 (4.26)	46.64 (3.04)
<b>III. Non-ionic cleansers</b>												
g.	L1 (pH 6.72)	51.06	45.65 (3.00)	46.85 (2.91)	36.34 (7.04)	39.87 (6.90)	62.60 (2.18)	53.09 (4.25)	46.70 (4.55)	52.42 (4.60)	48.11 (3.48)	47.08 (3.19)

K/S - Colour strength, Figures in parenthesis indicate total colour difference ( $\Delta E$ )

**Table 3: Colour strength of green fabric washed with different cleansing agents**

Sl. No.	Treatments	K/S values										
		Control	I wash		V wash		X wash		XV wash		XX wash	
			Sun dried	Shade dried	Sun dried	Shade dried	Sun dried	Shade dried	Sun dried	Shade dried	Sun dried	Shade dried
<b>I. Detergents</b>												
a.	D1 (10.39 pH)	32.74	42.39 (3.84)	41.24 (3.62)	48.58 (5.20)	48.80 (6.00)	47.16 (7.56)	49.40 (6.45)	41.86 (7.47)	43.97 (8.01)	35.27 (9.06)	42.15 (7.61)
b.	D2 (10.55 pH)	32.74	37.55 (4.15)	40.56 (4.27)	40.42 (5.78)	43.21 (4.75)	45.51 (6.70)	47.10 (6.43)	41.56 (8.86)	44.94 (7.79)	44.40 (8.55)	47.35 (6.98)
c.	D3 (10.93 pH)	32.74	46.35 (4.10)	46.71 (3.53)	46.73 (6.06)	47.04 (5.90)	46.77 (6.49)	46.58 (6.70)	40.83 (7.98)	44.54 (7.59)	39.70 (8.01)	44.64 (7.17)
<b>II. Soaps</b>												
a.	S1 (pH 9.54)	32.74	32.24 (2.55)	31.01 (3.50)	37.62 (4.05)	37.50 (4.62)	49.94 (4.72)	38.99 (4.49)	41.24 (7.75)	44.76 (6.89)	42.10 (8.14)	42.08 (7.71)
b.	S2 (pH 9.89)	32.74	38.65 (3.32)	36.97 (2.93)	38.75 (3.72)	40.02 (4.17)	40.56 (5.40)	42.54 (4.77)	42.22 (6.91)	48.35 (5.79)	43.88 (7.02)	45.57 (6.91)
c.	S3 (pH 10.54)	32.74	36.68 (2.63)	32.49 (3.25)	36.22 (3.65)	34.49 (3.78)	47.22 (3.56)	37.78 (4.59)	40.77 (6.31)	40.89 (5.61)	38.53 (6.91)	40.96 (6.20)
<b>III. Non-ionic cleansers</b>												
a.	L1 (pH 6.72)	32.74	29.23 (1.45)	38.14 (2.05)	32.15 (2.33)	32.51 (2.88)	49.03 (2.94)	35.50 (3.98)	41.15 (4.68)	39.36 (4.22)	37.01 (4.41)	39.32 (3.91)

K/S - Colour strength, Figures in parenthesis indicate total colour difference ( $\Delta E$ )

### CONCLUSION

Natural colour cottons are set to save the environment by way of eliminating the elaborate and resource consuming textile wet processing treatments. Besides, synthetic dyes and chemicals are known to be health hazardous to an extent that they can even cause chronic illness to the sensitive skin types. Therefore, improving the longevity of the quality of such eco-friendly products needs prime attention. Hence, a considerable improvement in colour strength of dark brown and green fabric samples was observed on laundering using reagents/surfactants with high alkalinity. Further the use of non-ionic laundering agents for subsequent washes has increased the longevity of colour even when dried under direct sunlight. Future studies on designing and development of eco-friendly surfactants for care and maintenance of such valuable textiles is a need of the day.

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