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INFLUENCE OF PLASMA TREATMENT ON FASTNESS PROPERTIES OF NATURAL DYES APPLIED ON HANDLOOM COTTON FABRICS

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Abstract: *Many unconventional methods and techniques are tried in wet processing of textile material to have better environmental pollution free and eco-friendly process. The plasma is the one of techniques which enable to modify the surface structure of textile materials. In this work, plasma technique is adopted to develop surface modified handloom cotton fabric. The treated cotton fabric is subjected to dye using natural materials like Camellia sinensis (Tea leaves powder), Vulgaris Conditiva (Beet root) and Curcuma longa (Turmeric). There is a significant improvement in colour fastness both washing and rubbing of plasma treated fabric when compared to untreated fabric. This study has very good scope for the value addition of handloom fabrics which inturn enhance the livelihood condition of the handloom society.*

Keywords: Natural dyes , Plasma, Mordant and Handloom Fabric

1. Introduction

The plasma is the one of techniques which enable to modify the surface structure of textile materials. Since the plasma treated fabric having better absorbancy characteristic, it saves water, chemicals and energy during wet processing. The natural dyes are widely being accepted due to its biodegradability and low toxicity when compare to synthetic dyes. Plasma treatment and natural dyeing are having very good scope due to eco-friendly, less allergic to skin, biodegradability and low toxicity.
So the plasma technique was experimented in this study, to modify the surface property of the handloom cotton fabrics which inturn improves the absorbency characteristic of the fabric. This enhances dyeability and fastness properties of the handloom cotton fabrics at affortable cost. Due to this attempt, the value addtion of handloom cotton fabrics tends to enhance the socioeconomic conditions of handloom cotton weavers.

2. Materials and Methods

2.1 Materials

The handloom cotton fabric of plain weave was selected for this study. The warp count is $2/40^{S,}$ weft count is $14^{S,}$ with 54 Ends per inch and 42 Picks per inch. The Natural dyes such as *Camellia sinensis* (Tea Leaves Powder) , *Vulgaris* Conditiva (Beet Root), and *Curcuma longa* (Turmeric) have been used for this study.

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Most of the vegetable ingredients do not colour the cellulosic materials directly. It requires a metallic or vegetable mordant to retain the colour on the material. Commonly used mordents are Alum and Myrobolan. Myrobolan is a universal vegetable mordant containing tannic acid which act as a mordant to combine with metallic salt to anchor the natural dyes.

2.2 Methods

The Plasma System with frequency of 60KHZ and an Aluminum & Electrode with Gap of 7.5 cm with the high voltage of 300 volts X 50m.amp have been used. The Oxygen and Organ gases with a Pressure of 5 X 10^{-2}m.bar are used. Then the handloom cotton samples were dyed using the above mentioned natural dyes. The assessment of colour fastness has been carried out as per ISO namely ISO 105-C10: 2006 for washing fastness and ISO 105- X12: 2001 for rubbing fastness.

3. Result & Discussion

The test results of handloom cotton fabrics of plasma treated and untreated samples dyed with natural dyes such as *Camellia sinensis* (Tea Leaves Powder) , *Vulgaris* Conditiva (Beet Root), and *Curcuma longa* (Turmeric) with Myrobolan and Alum as mordants have been shown.

Table 1 Colour fastness test results of treated and untreated plasma handloom cotton fabric

Sl No	Sample	Details		Washing Fastness		Rubbing Fastness	
				Change in color	Staining	Staining	
						Dry	Wet
1	Sample 1 *Camellia sinensis* (Tea leaves Powder) with Myrobolan	Untreated Fabric	-	1	1	1	1
		Treated Fabric	Oxygen	2	2	2	1
			Organ	2	2	2	1
2	Sample 2 *Camellia sinensis* (Tea leaves Powder) with Alum	Untreated Fabric	-	1	1	1	1
		Treated Fabric	Oxygen	2	2	2	1
			Organ	2	2	2	1
3	Sample 3 *Vulgaris* Conditiva (Beet Root) with Myrobolan	Untreated Fabric	-	1	1	1	1
		Treated Fabric	Oxygen	2	2	2	1
			Organ	2	2	2	1
4	Sample 4 *Vulgaris* Conditiva (Beet Root) with Alum	Untreated Fabric	-	1	1	1	1
		Treated Fabric	Oxygen	2	2	2	1
			Organ	2	2	2	1
5	Sample 5 *Curcuma longa* (Turmeric) with Myrobolan	Untreated Fabric	-	1-2	2	1-2	1
		Treated Fabric	Oxygen	2-3	2-3	2-3	2-3
			Organ	2-3	2-3	2-3	2-3
6	Sample 6 *Curcuma longa* (Turmeric) with Alum	Untreated Fabric	-	1-2	2	1-2	1
		Treated Fabric	Oxygen	3	3	3	3
			Organ	3	3	3	3
7	Sample 7 *Curcuma longa* (Turmeric) with Myrobolan & Alum	Untreated Fabric	-	2-3	2-3	2-3	2-3
		Treated Fabric	Oxygen	4-5	4	4-5	4
			Organ	4	4	4	4

From the table 1, *Camellia sinensis* (Tea leaves Powder) and *Vulgaris* Conditiva (Beet Root) natural dyes with Alum and Myropolan mordants have poor fastness property. *Curcuma longa* (Turmeric) natural dye with Alum mordant with oxygen gas plasma show good fastness property (sample 6). *Curcuma longa* (Turmeric) natural dye with Alum and Myrobolan double mordants with oxygen gas plasma shows better fastness property (sample 7) than *Curcuma longa* (Turmeric) natural dye with alum single mordant (sample 6).

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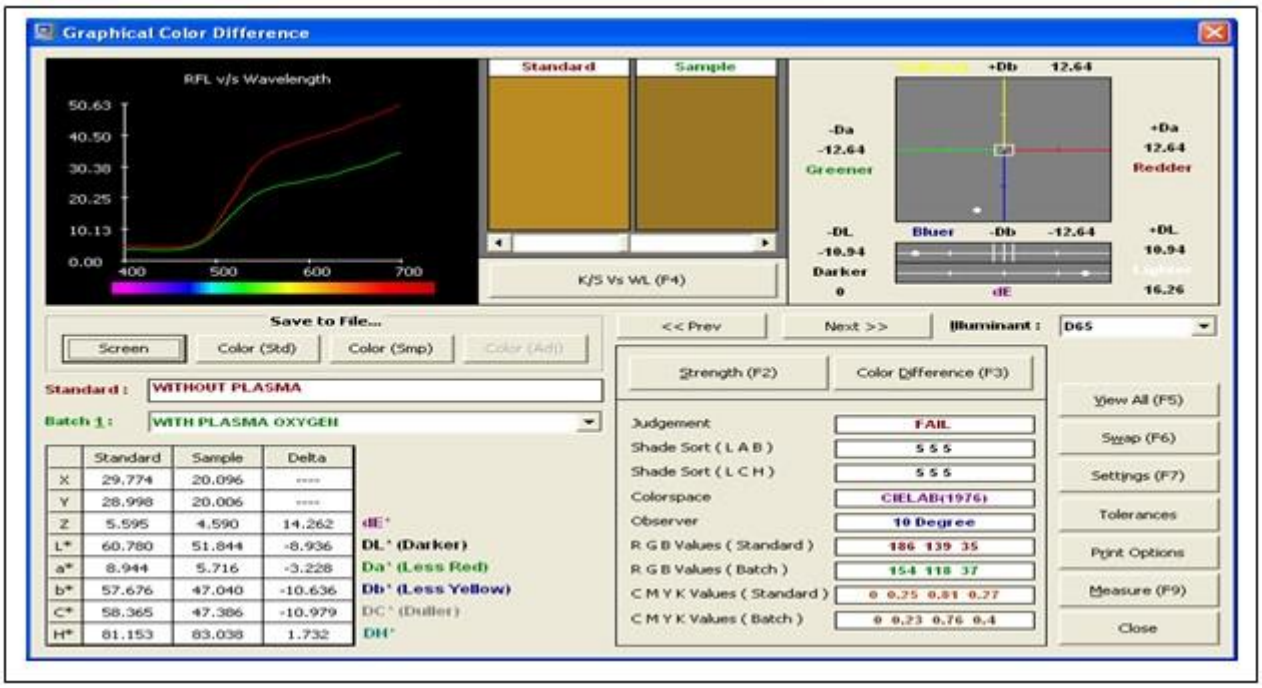

Figure 1 Computer colour matching results of treated and untreated plasma with oxygen gas on handloom cotton Fabric.

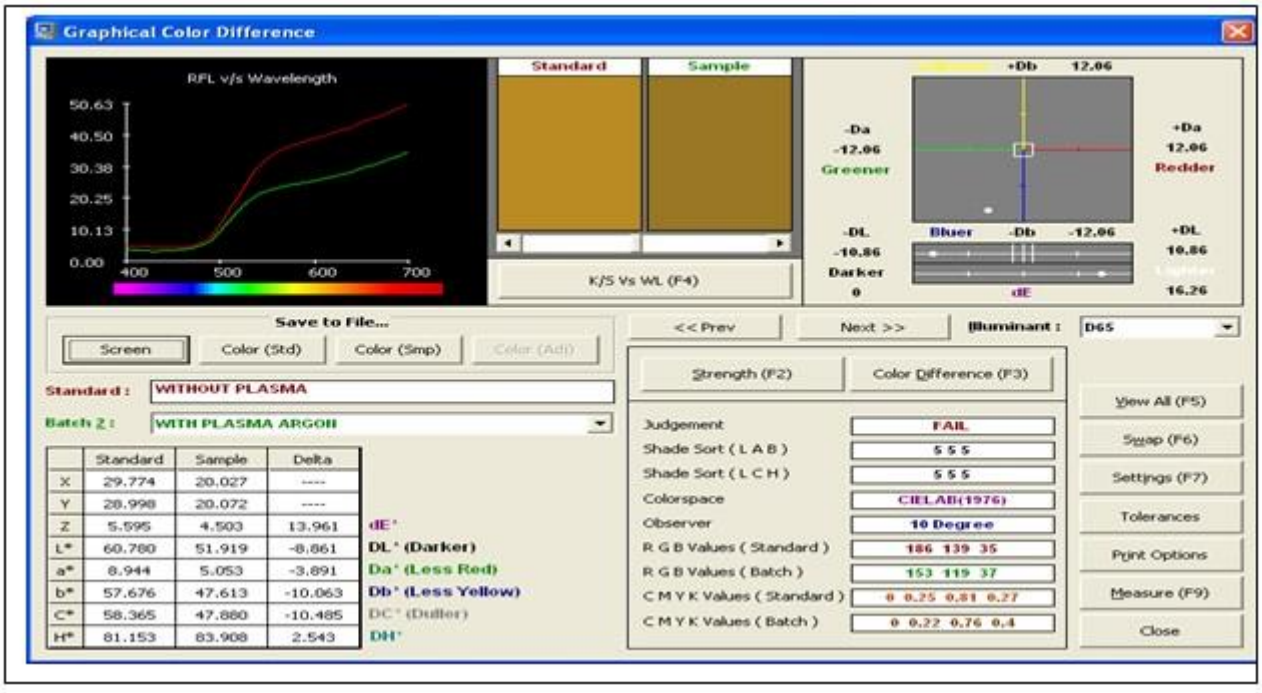

Figure 2 Computer colour matching results of treated and untreated plasma with argon gas on handloom cotton fabric

From figure 1 and 2 dE colour value for oxygen gas plasma treated with *Curcuma longa* (Turmeric) natural dyed handloom cotton fabric has better value of 14.262 than that of organ gas plasma treated *Curcuma longa* (Turmeric) natural dyed handloom cotton fabric has better dE value 13.961.

4. Conclusion

The Myrobolan and Alum double mordants natural dye *Curcuma longa* (Turmeric) on handloom cotton fabric treated with oxygen gas plasma has better washing and rubbing colour fastness than Myrobolan or Alum single mordant. Simillarly the computer colour

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matching results also shows that the Myrobolan and Alum combined mordants with natural dye *Curcuma longa* (Turmeric) on handloom cotton fabric treated with oxygen gas has better dE value of 14.262 than that of organ gas plasma treated dE value of 13.961. Hence for the value addition of handloom cotton fabric can be done by using natural dye namely *Curcuma longa* (Turmeric) on plasma treated handloom cotton fabrics.

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