



EVALUATION OF THE ECOLOGICAL PROPERTIES OF COTTON FABRIC AND SILK FABRIC DYED WITH COLORANTS EXTRACTED FROM THE TERMINALIA T. CATAPPA LEAVES

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Abstract:

This paper presents some results of the evaluation of the Ecological properties of cotton fabric and silk fabric dyed with colorants extracted from the Terminalia T. catappa leaves. The ecological criteria are standardized according Okotex: pH value of Cotton fabric is 6.2, of silk fabrics is 6.5; dyed fabric does not contain formaldehyde and azo Amin (are the carcinogenic substances and skin allergies), colorfastness to washing of both fabrics are fairly high (level 3-4 and 4), colorfastness to perspiration alkaline of silk grade 4-5, the Cotton grade 4; colorfastness to perspiration acidity of silk grade 4, of Cotton grade 3-4; on the fabric no heavy metals.

Keywords: natural colorants, ecological properties, silk, cotton.

1. INTRODUCTION

Along with the development of the global market, current demand for products with environmentally friendly, ensuring ecological criteria, the product of natural origin, safety and health are being crowded Vietnam consumers are interested in, there is also the inevitable trend of the society. A number of scientific research projects on the natural product has finishing process cotton and silk dyed with natural colorants with industrial scale and have achieved good results in color and colorfastness [1,2,3]. Products from the two fabrics as washcloth, bath towel, silk scarves, toys etc. newborn was launched markets and customers are very interested. To confirm the advantages of this type of natural product [4,5,6], there should be the exact scientific evidence according to the international standards in terms of ecology, so the subject has done this content, and achieve reliable results hope to announce to consumers.

2. METHOD OF STUDY

2.1. Research Raw materials for dyeing:

Terminalia T. catappa leaves selected because it is very easy to collect leaves across the country from rural Vietnam-mountains to the city and easy renewable [2,7], extraction and dyeing technology solution quite simple, do not use chemicals [3,5]. Use chopped fresh Almond leaves added to water and extracted in boiling time of 15 minutes/1; extraction repeated three times until the water is almost all the color extraction. After extraction, the dye solution is mixed into the general dye solution.

Cotton Fabric: (MC) Model): knitted fabrics (single) 100% cotton offered by Trung Thu Textile Dyeing Company; Yarn count: 36, weight: 150g/m² was scoring-bleaching and mercerisation then dyed according to technological processes: the weight of fabric is 100% compared with fresh leaves, liquor ratio of 30: 1 (amount of liquid 30 times the amount of fabric), with a pH = 6, the temperature of dyeing is 100°C, dyeing time of 70 minutes.

Silk fabrics (MT): 100% silk fabrics, offered by textile-dyeing enterprises Thuy Mui - Nha Xa village, Duy Tien district, Ha Nam province. Fabrics were degummed serixin then dyed according to the following technologies: the weight of fabric is 80% compared to weight fresh leaves, liquor ratio of 20: 1 (amount of liquid 30 times the amount of fabric), with a pH = 6, the temperature of dyeing is 90°C, dyeing time 60 minutes.

Both fabrics are dyed with dark yellow with high colorfastness to washing reached from level 4 to level 4 - 5/5, colorfastness to light is grade 4 and 5/8 higher than the fabrics dyed with other natural colorants and equivalents with the fabric dyed with synthetic dyes.

2.2. Content of the study the ecological properties

The the ecological criteria are evaluated according to the standards of Vietnam and under the "OEKO-TEX ® Standard 100" with the following assessment criteria:

2.2.1. The pH value of dyed fabric

Indicators are evaluated by the method ISO 3071: 2005, performed at the Textile Testing Center

(VILAS) – TEXTILE RESEACH INSTITUTE.

The pH value of the solution extracted from the dyed fabric is measured by the voltage of the the electrodes of glass at room temperature. 3 extraction solution extracted samples at room temperature as follows: For each sample to 100 mL to extract [or water (5.1) or potassium chloride solution (5.2)] in a flask with grinding button (6.1). Average user once shook hands to ensure wetting samples are then carried out mechanical shaking in $2h \pm 5$ minutes. Record the results of extraction solution and is shown in Table 1.

2.2.2. Determination of harmful Azoamine

Criteria were assessed by standard methods EN 14362/1: 2003, performed at the Textile Testing Center (VILAS) – TEXTILE RESEACH INSTITUTE.

This standard describes the process by making the use of azo dyes that can not be used in the production or processing of products are stained with the dye can be extracted.

Results K.p.h.t = not found, is shown in Table 2.

2.2.3. Determination of formaldehyde content

Formaldehyde is specified for each product group.

Indicators are evaluated by means of TCVN 7421-2: 2004 (ISO 14184-2: 1998), performed at the Textile Testing Center (VILAS) – TEXTILE RESEACH INSTITUTE.

This standard specifies the method for the determination of free formaldehyde and formaldehyde partially hydrolysed by water extraction method. This method can apply to all types of textile materials. Methods for determination of formaldehyde released from fabrics specified in formaldehyde is extracted from the sample with water at 40°C. The formaldehyde content is then determined by the spectral color measurement methods. The results are shown in Table 3.

2.2.4. Determination of heavy metals (metals with a specific weight of $> 2.5\text{g/cm}^3$)

Indicators are evaluated by means of ISO 105-E04, performed at the Textile Testing Center

(VILAS) – TEXTILE RESEACH INSTITUTE. The results are shown in Table 4.

2.2.5. Determination of color fastness to washing and perspiration

Criteria were assessed by standard methods (ISO 14184-1: 1998), (ISO 105 E04: 2008), (ISO 105 E04: 2008), performed at the Textile Testing Center (VILAS) – TEXTILE RESEACH INSTITUTE

Colorfastness to washing and perspiration is the degree of fading of the sample and the possibility of staining sample on the fabric together during treatment with washing solution and artificial perspiration under conditions of temperature and time specified. Fabric samples were washed after dyeing process, the fabric exposed to the same type and multi fiber fabric together (triacetate, Cotton, Polyamid, Polyester, Acrylic, Viscose) outsourcing of washing solution and artificial perspiration under heat conditions and the specified time, then washed and dried (drying cabinet maintained at $37^\circ\text{C} \pm 2^\circ\text{C}$ temperature, and test instruments Persirometer). Result color fading and staining are shown in Table 5.

3. EXPERIMENTAL RESULTS AND DISCUSSION

Table 1. Evaluation results pH values

Indicator	Testing method	Silk fabric	Cotton fabric
pH values	ISO 3071:2005	6,5	6,2

Comment: With the value achieved within safe for the group I (products for children) and group II (direct contact with skin) pH is $4.0 \div 7.5$ [7]

Table 2. The results determination of amino azo banned and Formaldehyde

Indicator	Testing method	Silk fabric MT	Cotton fabric MC
24 amino azo [7]	EN 14362/1: 2003	K.p.h.t	K.p.h.t
Formaldehyde	ISO 14184-1: 1998	*K.p.h.t	*K.p.h.t

K.p.h.t = did not detect; *K.p.h.t (results of the analysis $< 20\text{mg/kg}$)

Table 3. The results Determination of content heavy metals

Indicator			Testing method	MT	MC
Heavy Metals	MDL (1)		Internal methods sets (Samples is solution extraction)	K.p.h.t	K.p.h.t
	Sb	0,20		K.p.h.t	K.p.h.t

metal may extract (Mg/kg)	As	0,20	with Acid perspiration artificially. ISO 105-E04 and determined by machine AAS	K.p.h.t	K.p.h.t
	Cd	0,10		K.p.h.t	K.p.h.t
	Cr	0,10		K.p.h.t	K.p.h.t
	Co	0,10		K.p.h.t	K.p.h.t
	Pb	0,20			
	Hg	0,05		K.p.h.t	K.p.h.t
	Ni	0,10		K.p.h.t	K.p.h.t

Table 4. The results determines colorfastness to washing and perspiration

Indicator	Testing method	Change (Fading)		Staining	
Samples		MT	MC	MT	MC
Colorfastness to washing	(ISO 14184-1: 1998)	4	3-4	4-5	4-5
Colorfastness to perspiration alkaline	(ISO 105 E04:2008)	4-5	4	4-5	4-5
Colorfastness to perspiration acidity	(ISO 105 E04:2008)	4	3-4	4-5	4-5

4. Conclusions

The results determines formaldehyde content and Amin banned AZO dye fabric with natural colorants were not found, have determined the pH value of the dyed fabric with natural colors and the results showed that levels meet regulation under Oeko-Tex standard 100 and safer than fabric dyed

with synthetic dyes. This creates trust to customers when using these products, they fully guarantee the human body ecological immediate and permanent

Determined colorfastness to washing and perspiration of fabrics dyed with natural colorants equivalent to fabric dyed with synthetic dyes.

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ĐÁNH GIÁ TÍNH SINH THÁI CỦA VẢI TƠ TẦM VÀ VẢI COTTON ĐƯỢC NHUỘM BẰNG DUNG DỊCH CHẤT MÀU TÁCH CHIẾT TỪ LÁ BÀNG

Tóm tắt:

Trong bài báo này trình bày một số kết quả đánh giá tính sinh thái của vải cotton và tơ tằm được nhuộm bằng chất màu chiết tách từ lá bàng. Các chỉ tiêu sinh thái đều đạt tiêu chuẩn theo Okotex: giá trị pH vải Cotton là 6,2, vải tơ tằm là 6,5; vải nhuộm không chứa formaldehyt, không chứa các chất màu azo bị cấm (là các chất gây ung thư và dị ứng da), độ bền màu với giặt của cả hai loại vải đều đạt khá (cấp 3-4 và 4), độ bền màu với mồ hôi kiềm của tơ tằm đạt cấp 4-5, của Cotton đạt cấp 4; độ bền màu với mồ hôi axit của tơ tằm đạt cấp 4, của cotton đạt cấp 3-4 và trên vải không có kim loại nặng.

Từ khóa: chất màu tự nhiên, tính sinh thái, tơ tằm, Cotton.