Journal of Textiles, Coloration and Polymer Science
https://jtcps.journals.ekb.eg/

Some Studies on Dyeing Properties of Wool, Viscose Fabrics and Polycyclic Fibers with Tea Natural Dyes

Reem O. Ahmed

Beni seuif University, Faculty of Applied Arts, Printing, Dyeing and Finishing Department, beniseuif , Egypt

Abstract

Utilizing natural colouring substances started to decline after the revelation of man-made dyes toward the last period of 19 century. Intensive study exertions in the area of natural colorants are viewed as eco-friendly likewise these need aid renewable what's more biodegradable; are skin friendly and might be useful for the health of the wearer. Natural colored matters obtained from natural assets of animals, plants, minerals, and microbial sources were utilized for coloring different kinds of textiles. Natural colorants might be utilized for coloring most kinds of natural fibers they could additionally be used to color most of synthetic fiber.

Polyacrylic, viscose, and wool fabric were dyed with tea using a mordant Aluminum sulphate $Al_2(SO_4)_3$. Factors affecting the dyeing properties such as temperature, time of dyeing bath, L: R and environmentally friendly mordant were used in different concentrations. Colour strength (K/S) was measured for dyed samples.

Keywords: Natural dye, fabrics, mordant

1-Introduction

In recent years, the dyeing and printing textile industry must go towards developing new technologies to save water and energy to enhance ways to eco-safety and health concerns [11, 13]. Eco-friendly and non-toxic bio-resource products are regaining popularity in different spheres of our lives [9]. Natural dyes, extracted from different sources such as plants, animals, and minerals, are renewable and sustainable bio-resource products with low environmental impact and known since antiquity for their use, not only in the coloration of textiles but also as food ingredients and cosmetics [3,7-8].

Natural products have always been used to the awareness of environmental standards for health by using green technologies [6]. Natural dyes have been used for textile coloration due to having ecofriendly properties. Natural dyes have been used for textile coloration since very old times [4, 1]. Natural dye matters were obtained from natural assets of animals, plants, and minerals, [8]. Natural dyes extracted from plants, animals, and minerals are now promoting green chemistry in textiles [10], this is because natural dyes have [12, 1] a lot of medicinal benefits [2]. More than 1000 species of yarns. The same denim cloth can be combined with ring-spun and rotor-spun yarns. [4-6] are found as a source of natural colorant around the globe which is widely used in different fields nowadays [5].

Many plants act as sources of natural dyes where the tea leaves being an important member of the acreage family (figure 1a) are mostly an ever-green shrub cultivated in tropical and subtropical areas of China, Taiwan, India, and Japan [1]. This plant extract [figure 1b] has almost such potent metabolic compounds that have strong due antimicrobial, anticancer, antioxidant activity, and antifungal activity and are widely used as medicine.

*Corresponding author: Reem O. Ahmed, E-mail: reemrika15@gmail.com, Tel. 01001481609
(Received 23/09/2023, accepted 25/10/2023)
DOI: 10.21608/JTCPS.2023.237122.1241

(Figure 1)

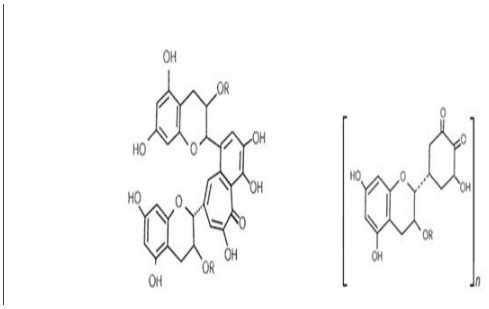
There are six types of tea. This classification is related to the processing methods employed, the degree of fermentation, and the oxidation of the polyphenols present in tea. The different classes of compounds found in tea include amino acids, caffeine, carbohydrates, carotenoids, chlorophyll, lipids, minerals, nucleotides, organic acids, polyphenols, saponins, unsaponifiable compounds, and volatile compounds [4].

Experimental

Materials

1-Natural colouring tea

A commercial sample of black tea powder (Lipton) was used. Tea leaf contains more than 10,000 natural products. However, the main biochemical colouring compounds present in the tea liquor are theaflavins and thearubigins, the structures are given in (figure 2) Theaflavins produce an intense bright red colour and thearubigins give a brown colour to the tea liquor.



(i) Theaflavins (ii) Thearubigins –

(Figure 2) coloring component of tea (Camellia sinensis)

2-Fabrics

Mill-scoured and wool fabric were kindly supplied by Fine Wool Co. Egypt.

Bleached viscose fabrics polyacrylic fibers are used.

2-Mordants

The following mordant was used: Aluminum sulphate $Al_2(SO_4)$ They were pure-grade chemicals.

Methods

1-Extraction of natural tea

The colouring matter was extracted using 4gm of the tea powder in 100 ml water at a boil for one hour, after which the solution was filtered off and left to cool down.

2-Dyeing methods

Samples were dyed with the natural colouring matter extracted from tea powder at different L: R, time and temperature without mordant and using a mordant Aluminum sulfate $Al_2(SO_4)_3$. The fabric samples were immersed in the dyeing bath at 40 °C. The fabrics were dyed for different lengths of time, different temperatures, and different L: R. The different concentrations of mordant were used. The dyed samples were rinsed with cold water and washed for 30 minutes in a bath containing 3 g/L of non-ionic detergent at 45 °C. Finally, the fabrics were rinsed and air-dried.

3-Measurements of the dyed fabrics

The colour strength (K\S) of the dyed samples was evaluated by the colour reflectance technique at λ maximum. The used spectrophotometer was of model ICS-Lexicon Ltd., Kennestside Park, Newbury, Berkshire RG 145TE, England.
This test method is designed to determine the colour strength of the fabric.

Results and Discussion

Effect of L: R

The colored solutions were extracted by boiling 4 gm. of tea in powder form in a fixed amount of water (100 ml) and the tea dye was filtered. After that the dye solution used at different L: R (20,30,40,50), for dyeing samples according to the dyeing method. The color strengths (K/S) of the dyed samples were dependent on the L: R dyeing method of the natural coloring matter.

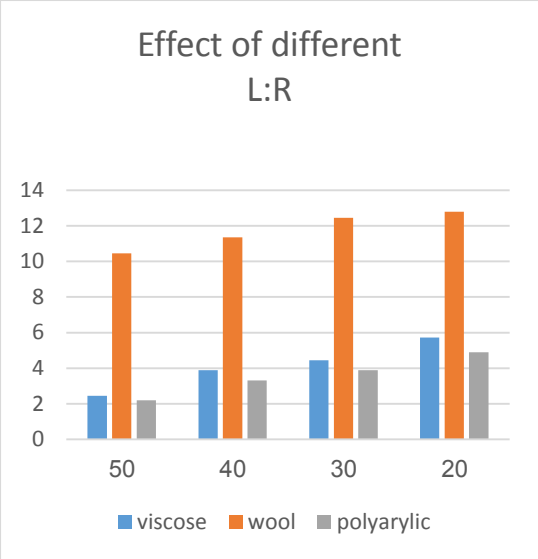


Figure 3: Effect of different L: R

The results in figure 3 shows that the colour strength, measured as K/S, decreased as the L: R ratio of the dyeing bath increased within the range that was studied. This was observed in viscose, wool, polyacrylic fiber, and fabric samples. Additionally, all samples underwent washing at 45°C. It was found that the colour strength of wool fabric was the highest across all L: R ratios in the dyeing bath (figure 3).

Effect of time

The dye solution was prepared like the previous method. After that the samples were dyed at L: R (1: 30) for different times (20-40-60-80 and 100 min). The colour strengths (K/S) of the dyed samples depended on the dye bath time.

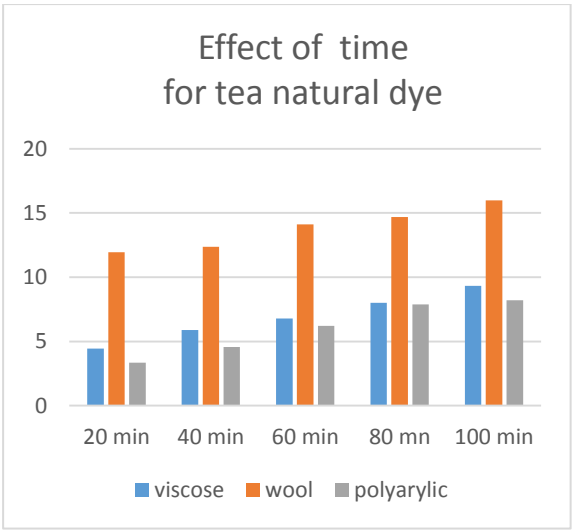


Figure 4: Effect of different time

The results in figure 4 showed that the colour strength, expressed as K/S, increases with increasing time of the dyeing bath within the range studied. These results were observed with viscose, wool fabrics, and polyacrylic fibers. All samples were subjected to washing at 45 °C.

Also, from figure 4 it was found that the colour strength of the wool fabrics was the highest in all fabrics and that was found at all times of the dyeing bath.

Effect of temperature

The dye solution was prepared like the previous method. After that the samples were dyed at L: R (1: 30) at time 60 min. for different temp (at room temp,40,60,80,90,100 °C. The colour strengths (K/S) of the dyed samples were dependent on the temperature of the dye bath.

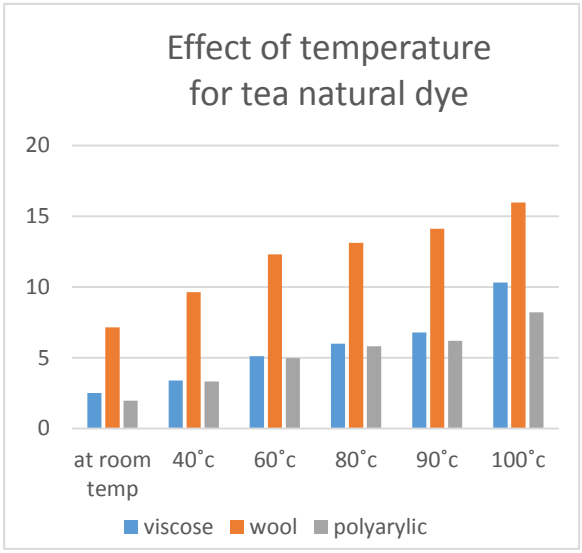


Figure 5: Effect of different temperature

The results in figure 5 showed that the colour strength, expressed as K/S, increases with the increasing temperature of the dyeing bath solution within the range studied. These results were observed with viscose, wool, fabrics, and polyacrylic fibers. All samples were subjected to washing at 45 °C.

Also, from figure 5 it was found that the colour strength of the wool fabrics was the highest in all fabrics and that was found in all temperatures the dyeing bath.

Effect of concentration of mordant

The dye solution was prepared like the previous method. After that, the samples were dyed at L: R (1: 30), time 60 min. , temp 90 °C using different

concentration of mordant Aluminum sulphate $Al_2(SO_4)_3$ (without mordant 0.5%, 1%,1.5%,2%) Aluminum sulphate $Al_2(SO_4)_3$.

. The colour strengths (K/S) of the dyed samples were dependent on the concentration of mordant.

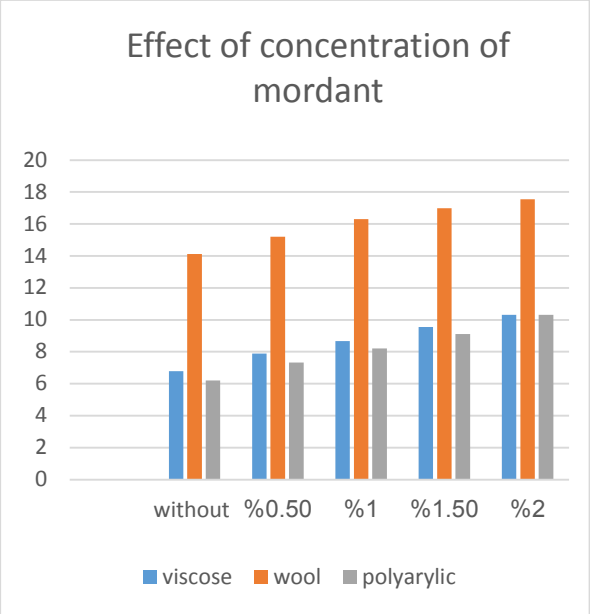


Figure 6: Effect of different concentrations of mordant

The results in figure 3 showed that the colour strength, expressed as K/S, increases with increasing concentration of mordant in the dyeing bath within the range studied. These results were observed with viscose, wool, fabrics, and polyacrylic fibers. All samples were subjected to washing at 45 °C.

Also, from figure 6 it was found that the colour strength of the wool fabric was the highest in all fabrics and that was found in all concentrations of mordant in the dyeing bath.

Conflict of interest

Author declares no conflict of interest.

Conclusion

The present work showed that tea leaves can be used as dye for colouring textiles. Different shades of colour can be obtained using different chemical and natural mordant. The colour yield of dyed samples K/S. The best result of the dyed sample was L: R 1:30, temp 90 °C for 60 min. using 2% Aluminum sulphate $Al_2(SO_4)_3$ as a mordant . The best-dyed samples of all fabrics were found when we dyed wool fabric with tea dye.

References

1. Adeel S., Anjum M., Ahmad M., Fazal-ur-Rehman, Saif M.J., Azeem M., Hassan A., Imran M. and Amin N.2021, Eco-friendly dyeing of cotton fabric with waste tea leaves-based tannin natural dye Global Nest Journal, Vol 23, No (3).
2. Athinarayanana G., Ranjitsingh A.J.A. and Padmalatha C. (2017). Toxicological studies of aesalpiniasappan wood derived dye in Wister albino rats, Food Science and Human Wellness, vol 6, No (1).
3. Eman A., 2016. Extraction of Natural Dye from Tea Leaves and its Application on Giza 86 Egyptian Cotton Fabric, International Journal of Advanced Science and Engineering Vol.3 No.4
4. Dwek, A.C., 2002. Natural ingredients for coloring and styling. International Journal of Cosmetic Science, 24, 287.
5. Hany, M.2020. Extraction Approaches of Natural Dyes for Textile Coloration, Journal of textile coloration and polymer Vol17,No 2
6. Helmy H.M. 2015, Impacts of Air Pollution on Colour Fading and Physical Properties of Wool Yarns Dyed with Some Natural Dyes in Residential Site. J ournal of Textile Science ang Engineering , vol (5) No (6).
7. Kadolph, S.J.F., 2008. Delta Kappa Gamma Bull. 75,74.Global NEST Journal, Vol 23, No 3, pp 365-369.
8. Lal, R. A., 1995. Vegetable dye and its application on textiles. Colourage, 42(1), 55-56.
9. Maynez-Rojas, M.. Casanova-González, and J.L. Ruvalcaba-Sil, 2017 Identification of natural red and purple dyes on textiles by Fiber-optics Reflectance Spectroscopy. Spectrochimica Acta Part A: Molecular and Bimolecular Spectroscopy, Vol 10, No 6
10. Ma X., Wei Y., Wang S., Zuo X. and Shen B. (2020). Sustainable ultrasound-assisted ultralow liquor ratio dyeing of cotton fabric with natural turmeric dye, Textile Research Journal, Vol 90, No (5).
11. Otutu J.O., Asiagwu A.K., Onyesom I.E., Ebigwai J.K. and Itoya P.O. (2019). Improving the efficiency of Nesogordonia papaeverifera (Danta) as a natural dye in textile making industry , bulletin of the chemical society of thiopiap Vol 33, No (3) .
12. Rajeswari M. (2020). Application of natural dye from Babool bark on cotton fabric using mordant, International Journal of Scientific Development and Research, Vol 5, No (2).
13. . Zerin, I., 2020 , Potentials of Natural Dyes for Textile Applications, in Encyclopedia of Renewable and Sustainable Materials, S. Hashmi and I.A. Choudhury, Editors. Elsevier: Oxford.

بعض الدراسات علي الخصائص اللونية لاقمشة الصوف والفسكوز وخيوط البولي اكريلك عند صباغتها بالشاي كصبغة طبيعية

ريم أسامة احمد
جامعة بني سويف - كلية الفنون التطبيقية - قسم طباعة المنسوجات والصباغة والتجهيز - بني سويف - مصر.

يعود استخدام الصبغات الطبيعية الي عهد الفراعنة عندما تم استخدام الملونات الطبيعية المستخرجة من النباتات في صباغة الجلود والاقمشة وفي اواخر القرن التاسع عشر في اعقاب الثورة الصناعية تم العودة الي استخدام الصبغات الطبيعية حيث ان الصبغات الطبيعية تعتبر مواد صديقة للبيئة لا تحتوي علي اي مواد مسرطنة وهي امنة تماما علي الجلد وخصوصا لاستخدامها لملابس الاطفال. والصبغات الطبيعية صالحة لصباغة جميع انواع الالياف الطبيعية وفي الاونة الاخيرة بدأت تدخل في صباغة بعض انواع الالياف الصناعية لذلك في هذا العمل تم اجراء دراسات علي صبغة الشاي وحيث سوف يتم صباغة اقمشة الصوف والفسكوز والبولي اكريلك بالشاي كصبغة طبيعية وباستخدام مثبت سلفات الالمونيوم سوف يتم الأتي :
دراسة العوامل التي تتوقف عليها عملية الصباغة مثل درجة الحرارة وزمن الصباغة ووتركيز مثبت سلفات الالمونيوم ويتم قياس شدة اللون للعينات .

الكلمات الافتتاحية: الصبغات الطبيعية ، الاقمشة ، المثبت.