

Relationship between Tea Dyeing Color of Different Fabrics and Nano-Dye

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Abstract: Tea dyes and nano-level dyes are soft, non-toxic, harmless, and have good compatibility with the environment. There have been many research reports on the technology of dyeing tea dyes and nano-level dyes on different fabrics. However, the low color yield and poor color fastness of tea dyes and nano-scale coatings need to be further resolved. Therefore, studying the relationship between the tea dye colors of different fabrics and nano-level dyes is of great significance to China's clothing dye industry. This work studied the dyeing process of tea dyes and nano-dye on wool fabrics, including the type of mordant, the order of mordant, and the effect of tannin as a speed enhancer on dye performance and dye stability. This paper further studied the effects of pre-mordanting and adding tannins on the color yield and color fastness of mulberry red, water-soluble turmeric and gardenia blue. In this paper, the factors affecting the direct dyeing of tea dyes and nano-level dyes on chitosan fibers were tested, and the optimal dyeing process conditions were obtained. The color fastness of tea dyes and nano-level dyes on glycan fibers was tested. This article explores the mechanism of the dye accelerator in the normal pressure boiling dyeing of polyester. It is concluded that the dye accelerator can increase the solubility of refined disperse dyes, reduce the glass transition temperature, melting temperature and crystallinity of polyester, and then significantly improve the dyeing performance of polyester. Moreover, the dye accelerator has no adverse effect on the main structure, strength and heat resistance of polyester, but it will reduce the dispersion stability of disperse dyes to a certain extent. Experimental studies have shown that when tea is used for dyeing, the dyeing process is basically balanced after 150 minutes. When dyeing with nano-stain, the dyeing process is basically balanced after 80 minutes.

1. Introduction

With the emergence of tea dyes and nano-level dyes, tea dyes and nano-level dyes have

gradually been replaced due to disadvantages such as poor fastness. In recent years, more and more varieties of synthetic dyes have been banned. Color and nano-level dyes have re-entered the human field of vision. Most tea dyes and nano-level dyes have good ecological compatibility with the environment and good biodegradability. The natural dyes currently being studied are usually non-toxic or low-toxic. Some dyes may require a specific mordant during use, and some do not require a mordant to obtain a product with high-quality coatings, good feel and gloss.

In recent years, foreign researchers have continuously explored the relationship between the color of different fabrics and different dyes. For example, Reza used two commercially available reactive dyes CI for dyeing to study the key operational grafting factors (ie pH, temperature and CS-PPI concentration.) Impact on grafting yield. Reactive Orange 122 (RO122) and C.I. Reactive Red 195 (RR195). The best graft value obtained is pH 6, temperature 70 °C and owf CS-PPI concentration 20% [1]. Nehaba proposed a dyeing mechanism that involves the formation of a complex between the metal ion of the premetallized dye and the amine group of the substrate. The wet fastness performance of 1:1 pre-metallized acid dyeing at neutral pH is at least equal to, and in many cases is greater than the wet fastness performance obtained by conventional dyeing processes at pH 4.5-5 [2]. Truskewycz can successfully dye polyester fabrics with indigo dye by controlling the ratio of sodium bisulfite and sodium hydroxide in the dye bath solution, because non-ionic reduced indigo has a higher affinity for polyester fabrics than ion reduced indigo [3]. Noor has studied the surface modification of silk fiber and dyeing ability of silk with acid anhydride grafted polysaccharide chitosan. In different solvents (dimethyl sulfoxide (DMSO) and N,N-dimethylformamide (DMF)), the silk fiber is degummed and two acid anhydrides (succinic anhydride (SA) and phthalic anhydride (PA) are used) Acylation. The effects of acid anhydride, solvent, acid anhydride concentration, liquid ratio (L:R) and reaction time on silk acylation were studied. The polysaccharide chitosan was grafted onto the acylated silk fiber and dyed with acid dye (Acid Black NB.B) [4].

In a comparative study on the relationship between the color of different fabrics and different dyes by Chinese researchers, Zheng dyed natural dyes and water extracts of tea into dark brown on wool fabrics, which were colored 2% and 5% respectively. Tea containing tannic acid as the main colorant, produces different shades with different mordant salts. Three different dyeing methods are used to dye fabrics with mordant alum, CuSO₄, FeSO₄, ZnSO₄, Na₂SO₄ and MgSO₄: intermediate dyeing and after dyeing. On the fabric color matching system, the color of the fabric is studied according to the K/S and CIE Lab color difference values [5].

In this paper, the research direction is the comparison of the relationship between the tea dyeing color of different fabrics and the nano-level dyes: red shell, red carmine and water-soluble turmeric as the research objects, the K/S value of the dyed fabric and the color fastness of the dyed fabric are evaluated degree. As an evaluation index for evaluating the type of mordant, the order of mordant and the effect of tannin as colorant and color fastness accelerator. The influence of mordant treatment on the dyeing of tea dyes and nano-level dyes on chitosan fibers: iron and aluminum ions are used as mordants, and three different dyeing methods are used, such as pre-mordant dyeing, same bath dyeing, and post-mordant dyeing. To study the effect of tea dyes and nano-level dyes on the dyeing of chitosan fibers, and explore the changes in its chromaticity, color fastness and uniformity.

2. A Comparative Study on The Relationship between The Tea Dyeing Color of Different Fabrics and Nano-Level Dyes

2.1. Tea Dyes and Nano-Level Dyes Promote the Low-Temperature Dyeing Principle of Polyester

Under the catalysis of p-toluenesulfonic acid or triethanolamine, the raw materials containing benzene ring phthalic anhydride are used to react with the epoxy-containing WLS cross-linked

cationic modifier prepared by the research team. WLS contains hydroxyl and epoxy groups [6-7]. This group reacts with phthalic anhydride at a certain temperature under acidic or basic conditions for a period of time to form a phenyl cationic compound, which is called a phenyl ester additive. At the same time, the phenyl additive has carboxyl, hydroxyl, epoxy and cationic groups, thus increasing the hydrogen bond strength between the phenyl ester-treated polyester and the dye dispersion, and increasing the polyethylene and nano-dye anionic micelles, It can promote the adsorption of tea dyes, nano dyes and the dispersion of anionic dye micelles on the surface of polyester fibers, and then diffuse into the polyester fibers through solubilizing disperse dyes at higher temperatures [8-9].

In order to further promote the adsorption and diffusion of tea dyes and nano-scale coatings under normal pressure conditions, and achieve the dyeing effect of high temperature and high pressure process, assist the application of phenyl ester binder N positive but high cost [10-11]. Mixed butyl phthalimide, in addition, in order to improve the stability of the dye solution in the polyester fabric and the dye accelerating performance of the auxiliary agent, a polyester dyeing accelerator is prepared.

2.2. Model Theory

(1) Kinetic adsorption model

In experimental research, the most commonly used kinetic adsorption models are: pseudo-first-order and pseudo-second-order kinetic equations. The equation is: Pseudo first level:

$$\log(q_e - q_t) = \log q_e - k_1/2.283(1)$$

Pseudo secondary:

$$\frac{t}{q_t} = \frac{1}{k_2 q_e^2} + \frac{1}{q_e} t(2)$$

It is more appropriate to use the first-order kinetic model to describe the adsorption process of activated modified waste AT tea in CR dyes. We can know that this adsorption process is determined by physical adsorption. At the same time, when the initial concentration gradually increases, the adsorption rate constants k_1 and k_2 of the two equations become smaller [12-13].

The expression of particle diffusion mode is as follows:

$$q_t = k_i t^{0.5} + c(3)$$

In formula (3), k_i is the particle diffusion rate constant, c is the intermediate unit of particle dispersion, and its value is the same as the initial dye concentration.

At different initial concentrations, each adsorption process obviously involves one step: the diffusion of CR macromolecules to the surface of the activated modified waste AT tea. K_{i1} is the rate constant of surface diffusion at different initial concentrations. In the constant adsorption process of each concentration, its value is the highest, indicating the fastest surface diffusion rate [14-15].

(2) Adsorption isotherm standard

The adsorption isotherm model is an important theoretical tool used to describe the difficulty of combining adsorbents with adsorbents. Here, we use three models to describe the adsorption process of AT on CR. These three models are Langmuir adsorption isotherm model, Freundlich adsorption isotherm model and Dubinin-Radushkevich adsorption isotherm model (DR). The expressions of these three adsorption isotherm models are as follows:

Langmuir :

$$\frac{C_e}{q_e} = \frac{1}{K_L q_m} + \frac{1}{q_m} C_e \quad (4)$$

Freundlich :

$$\ln q_e = \ln K_F + \frac{1}{n} \ln c_e \quad (5)$$

Dubinin-Radushkevich :

$$\ln q_e = \ln q_m - \gamma \varepsilon^2 \quad (6)$$

$$\varepsilon = RT \ln \left(1 + \frac{1}{C_e} \right) \quad (7)$$

D-R where:

γ -related to the adsorption energy of the dye on the adsorbent ($\text{mol}^2 \cdot \text{kJ}^{-2}$)

ε -is Polanyi potential energy

R — is the gas constant ($8.314 \text{ J} \cdot \text{mol}^{-1} \cdot \text{K}$)

T — is the absolute temperature (T)

Use ε^2 as the abscissa and $\ln q_e$ as the ordinate to draw the graph, and find the value of γ .

The free energy of dye adsorption on the adsorbent is E. The calculation formula is:

$$E = -\frac{1}{\sqrt{2\gamma}} \quad (8)$$

The size of E can indicate the type of adsorption. When $E = 8 \sim 16 \text{ kJ/mol}$, it is chemical adsorption. When $E < 8 \text{ kJ/mol}$, it is physical adsorption. Use nearly first-order kinetic equations to match the dye adsorption curves of many natural chitosan fibers [16-17]. The results show that the placement curve in the chitosan fiber has a large deviation, and the nearly first-order kinetic model cannot accurately describe the kinetic dyeing of chestnut shell protein, yellow sap dye and red chitosan.

2.3. Tea Dyeing Methods and Experiments

The dyeing method of tea is almost the same as other vegetable dyes. There are many studies on dyeing methods, but they are slightly different, but they are usually divided into four main steps: extraction of dye liquor-pretreatment-dyeing-mordant. The tea dye experiment in this article combines the existing researched dyeing methods, combined with the actual situation and materials of domestic fabrics, classifies the simplest and best dyeing methods in this article, and plays a practical role [18-19].

(1) Extract dye solution

When extracting tea-colored liqueur, although different scholars have proposed different methods, everything is refined by heating. The easiest way is to boil the tea and water in a pan for 20-30 minutes, and then filter [20-21]. The extraction method is to boil the tea at a ratio of 1:50 or 1:30 at 90 degrees Celsius for 30 or 60 minutes, and then repeat the extraction. After the two dyes are fused to obtain the final tea dye, the tea leaves are ground into powder and dispersed in 10 ml of distilled water, extracted at pH 8-9 and 30 °C for 30 minutes, cooled, filtered with suction and evaporated. Remove the solvent. Leave the tea dye. Taking into account the experimental equipment and functions, the method of extracting this article is to mash the dry tea leaves, put them in a glass according to the tea-water ratio of 1:5, and then put a layer of plastic wrap in the glass to reduce water evaporation during heating. Set the water temperature to 80 degrees Celsius, boil it for 120 minutes, then cool it, let it sit for 15 minutes, and then filter the tea residue.

(2) Pre-treatment

In the weaving process, there is a process called "sizing" (that is, the cotton yarn is immersed in rice water or rice water). This size is used to ensure that the yarns will not stick together during the weaving process and to ensure the stiffness of the final fabric. Although the fabric will be demodulated with clean water after casting, there is still a lot of residue. This caused trouble for tea dyeing. In order to ensure the best brown dyeing effect, it is necessary to desizing the fabric again

before dyeing, and then immerse the fabric in boiling water until the fabric is completely saturated (better scrubbing) [22-23]. Then put the homemade cloth into soy milk with a mass concentration of 5%-10% and soak for 30-40 minutes. Tests have proved that tea polyphenols have high binding fastness to protein fibers. Soy contains 35%-50% protein. Therefore, the geotextile soaked in soybean milk has better dyeing performance and higher color fastness.

(3) Cooking and dyeing

The temperature of the extracted tea dye solution was kept constant at 80 degrees Celsius, and the pretreated household cloth was absorbed into the tea dye solution for 60 minutes under continuous stirring.

(4) Mordant

The mordant solution was prepared according to the ratio of mordant to water of 1:0-1:50, and the temperature of the mordant solution was kept constant at 80 degrees Celsius. The woven fabric after the first steaming and dyeing is soaked in the mordant solution for 30 minutes with constant stirring.

(5) Counterstain

Put table salt into the tea paint solution according to the ratio of salt to water of 1:0, keep the water temperature constant at 80 degrees Celsius, take out the luxury house rag and squeeze it, then put it back in the tea paint solution and soak for 30 to 40 minutes, and Stir constantly [24-25].

2.4. Experimental Research Method of Reactive Dye Photocatalytic Peeling Kinetic Characteristics on Cotton Fabric

At present, in the process of heterogeneous photocatalytic degradation reaction, the reaction kinetics is a recognized first-order reaction relationship. The reaction relationship considers that the concentration of the reactant substrate changes with the reaction time, that is, there is a linear relationship between the natural logarithm of the concentration of the reactant substrate and the reaction time. The relationship is as follows: (9) and (10):

$$\ln\left(\frac{C_0}{C_t}\right) = at(9)$$

$$\ln C_t = -at + b(10)$$

In equations (9) and (10), C_0 is the concentration of the reactive substrate, C_t is the concentration of the reactant at time t , a is the reaction rate constant, t is the reaction time, and b is the constant.

Therefore, in most studies of photocatalytic degradation kinetic reaction experiments, the reaction kinetics is mainly determined by measuring the change in the concentration of reactive substrates over time during the reaction, and then by linear application. However, in this experiment, since the dye is dyed on the fabric during the peeling process, it is difficult to control the change of the dye concentration in the fabric with time during the peeling process. This can only be tried or evaluated by indirect methods.

The Kubelka-Munck function believes that when the pigment coating is infinitely thick and does not transmit the light radiated to the coating at all, the concentration relationship of the pigment in the solid sample is as shown in formula (11):

$$\frac{K}{S} = \frac{(1-p_\infty)^2}{2p_\infty} - \frac{(1-p_0)^2}{2p_0} = kC(11)$$

In formula (11), K is the absorption coefficient of the measured object, S is the scattering coefficient of the lateral object, p_∞ is the reflection coefficient when the measured object is infinitely thick, and 0 is the reflectance of the colorless sample. The coefficient k is the constant of proportionality, and C is the concentration of the colored substance in the solid sample.

Usually, instead of calculating the absorption coefficient (K) and the scattering coefficient (S) separately, the absorption coefficient (K/S) and the scattering coefficient (S) are calculated separately. Therefore, during the peeling process, the ratio of the absorption coefficient (K) of the fabric's shedding surface to the scattering coefficient (S) can be calculated, that is, the value of the surface coating depth (K/S) of the fabric's shedding surface is: characterize the fabric of peeling. The concentration of the dye surface changes in order to study the kinetic reaction sequence in the peeling process by changing the surface dye depth value (K/S) over time. Therefore, formulas (9) and (10) can be rewritten as:

$$\ln\left(\frac{\overline{\left(\frac{K}{S}\right)_0}}{\overline{\left(\frac{K}{S}\right)_t}}\right) = a' t \quad (12)$$

$$\ln(\overline{\left(\frac{K}{S}\right)_t}) = a' t + b \quad (13)$$

In equations (11) and (12), $\overline{\left(\frac{K}{S}\right)_0}$ is the arithmetic average of the surface color depth (K / S) of the fabric before peeling, and t is the peeling surface of the fabric at that time. This is the arithmetic mean (K/S) of the surface color depth value of t, a' is the peeling reaction rate constant, t is the peeling time constant, and b is a constant.

2.5. Chitosan Fiber Performance Test

Scanning electron microscopes can provide information such as polymer surface, port and cross-sectional topography through different magnifications. Fourier spectroscopy can provide qualitative and quantitative information about the chemical properties, three-dimensional structure, configuration and orientation of polymers. It is very useful in determining the structure of the polymer main chain, the structure of the substituent, the position of the double bond and the structure of the side chain. Wide range of applications. X-ray diffraction is an analytical method used to study information related to the appearance of atomic dots (such as crystals). The crystallinity, orientation and crystallite size of the polymer can be measured by X-ray diffraction.

Chitosan is unstable in acidic solutions, glycosidic bonds are broken, that is, part of the long chain is hydrolyzed to form many fragments with different degrees of polymerization. The chitosan fiber is placed in an acidic solution. When the solution is heated to 100 °C, the chitosan fiber is completely hydrolyzed to form glucosamine hydrochloride, and a mixture of various oligosaccharides can be obtained under milder conditions. Most natural dyes are relatively stable under acidic conditions. Under acidic conditions, the molecular chains of chitosan fibers have amino groups, which make them adsorb hydrogen ions and be positively charged. Dye molecules and dye fibers are easy to absorb. Increase the absorption of natural dyes on chitosan fibers, thereby increasing the percentage of natural dyes on chitosan fibers. Therefore, in order to study the effect of acid on the properties of chitosan fibers, in order to separate suitable acidic reagents that are not easy to cause chitosan degradation, the acidic reagents are used to adjust the bath color value of natural dyes in the fiber, chitosan and dye absorption rate, This is very important to get better dye effect.

This work uses electron microscope observation, infrared scanning, X-ray diffraction and other analytical methods to analyze and characterize the structural properties of chitosan fibers, and compare them with viscose and silk fibers. This research uses sulfuric acid, phosphoric acid, acetic acid, malic acid and citric acid to adjust the different pH values of the treatment solution to change the different properties of the chitosan fiber after treatment, and provides a theoretical reference for further determining the treatment process and method.

3. Comparative Experimental Study on The Relationship Between Tea Dyeing Color of Different Fabrics and Nano-Dye

3.1. Classification of Dispersing Leveling Agents and Their Influence on Dyeing Dispersion

In the dyeing process, the scope of action of the dispersant equalizer is the entire dye tank, where the hydrophobic groups can be attached to the van der Waals dye particles, thereby forming a strong charge layer around the dye, thereby reducing agglomeration. Particles of paint in water. The dispersion effect is mainly affected by the degree of sulfonation and shows different dispersion effects in different temperature ranges.

3.2. Optimization of the Amount of Dye Accelerator

Dye accelerators are applied to atmospheric polyester dyes for dyeing. Among them, the amount of dye accelerator is 12% (owf), and the disperse black ECT is 4% (owf), combined with the traditional high-temperature and high-pressure sewage and salicylic acid dyeing process. Methyl ester is used to compare wastewater from polyester dyeing process. No additives are added during the high temperature and high pressure dyeing process, only acetic acid is used to adjust the pH; the amount of methyl salicylate used in the dyeing process is 12% (owl). Finally, the COD of the residual liquid after dyeing is tested according to the national standard GB1914-89.

3.3. The Influence of Disperse Leveling Agent on Dyeing Color

The effect of dispersant equalizer on color is mainly the effect on the dyeing speed of disperse dyes. Generally, polyester dyes will use 3-4 kinds of dyes with completely different shades, such as red, yellow and blue. Because the particle size and effect of the dispersed paint are different, the spraying speed will vary to different degrees. One color will be drawn first and the last color will be drawn, which will cause the final color to become the last drawn color. The dispersant leveling agent will adsorb on the fiber surface and collect the dye, which can improve the difference of this dye.

3.4. Compounding of Dispersing and Leveling Agent

Commonly used dispersing and leveling agents in polyester dyes include nonionic surfactants and anionic surfactants. In this test, the synthetic non-ionic surfactant castor oil polyoxyethylene ether and anionic indicating activator tristyryl phenol polyoxyethylene ether ammonium sulfate are used as a dispersing leveling agent, and at the same time, the dispersing level of the compound is compared. For dyes, there are differences in performance between pure anionic surfactants and homopolymers and pure nonionic dispersants and homopolymers.

3.5. Experimental Method

Add pH stabilizer AD-45, dispersant equalizer and disperse dye continuously at low temperature, then heat to 130 °C at a rate of 1 °C/min and hold for 30 minutes, then cool to 60 °C, remove and scrub with cloth Then it was dried at 105 °C.

After painting, keep it in working condition, put it on the same white cloth of the same weight, repaint it under the same conditions, so that the paint in the working solution is completely absorbed, remove it after cooling and dry it, and wait for the test.

3.6. Test Data and Evaluation Method

The color evaluation in this experiment uses the CIE L*a*b* color interval system instead of using the K/S value of dye absorption, because the mixed dyes used in this experiment also have

higher requirements for color evaluation, $L^* a^* b^*$ color space is a general method for measuring the color of an object. It is one of the uniform color spaces.

4. Comparative Experimental Study and Analysis of The Relationship between The Tea Dyeing Color of Different Fabrics and Nano-Level Dyes

4.1. The Influence of Tea Dyeing and Nano-Dye Pre-Mordant Dyeing on The Color Characteristic Value of Lac Red Dyed Wool Fabric

With ferrous sulfate or aluminum sulfate as the metal mordant, the method in this paper is used to pre-mordant nano-dyeing the wool fabric, and then use lac red to dye the pre-mordant wool fabric after dyeing with the pre-mordanted wool fabric. Compare. The effect of pre-mordanting on the K/S value and color characteristic value of lac red wool dyed fabric is shown in Figure 1 and Table 1, and the effect on the color fastness of dyed fabric is shown in Table 1.

Table 1. Effect of common dye and nano-dye pre-mordant dyeing on color characteristic value of shellac red dyed wool fabric

Dyeing method	λ_{max}	K/S value	L^*	a^*	b^*
Direct dyeing	473	24.36	22.47	23.74	8.36
Iron pre-dye tea dye	470	29.46	15.37	6.09	0.15
Aluminum pre-medium nano dyeing	489	26.39	21.37	28.94	8.84

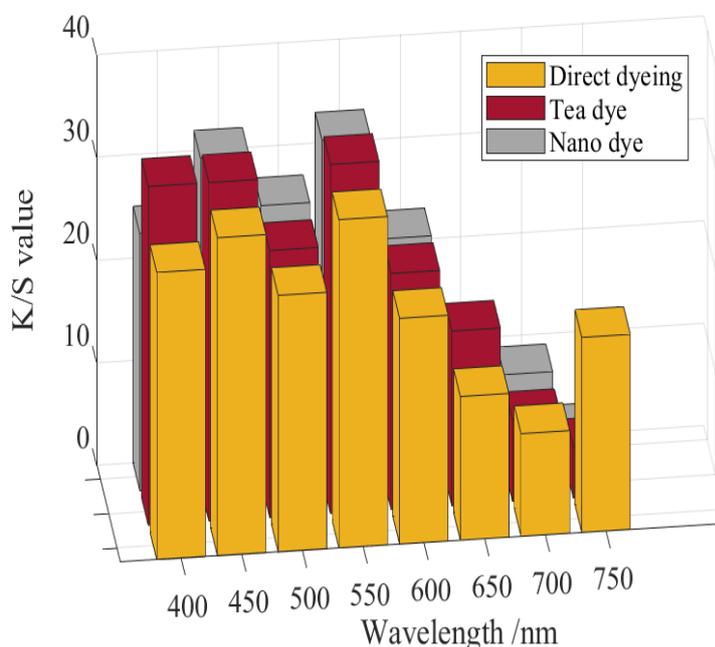


Figure 1. The effect of pre-mordant dyeing on the K/S value spectral curve of shellac red dyed wool fabric

It can be seen from Figure 1 and Table 1 that when lac red is used for dyeing, although the pre-mordant nano-dyeing has little effect on the maximum absorption wavelength of the dyed fabric, it can increase the color yield of the dyed fabric. The K/S value of lac red dyed wool fabrics dyed with iron ion pre-mordanted nanometer was the largest, and the K/S value of dyed wool fabrics

without pre-mordant dyeing was the smallest.

It can also be seen from Table 1 that pre-mordant tea dyeing has little effect on the maximum absorption wavelength of lac red dyed wool fabrics; the lightness of wool fabrics dyed after pre-mordant tea dyeing and re-dyeing decreases, especially after ferrous ion pre-mordant tea. After dyeing, the brightness of the dyed fabric is obviously reduced, which causes the color of the dyed fabric to become dark; a^* and b^* are obviously smaller because a^* is the red and green coordinates, and the positive direction is red, the negative direction is green, and b^* is the yellow-blue coordinate, and the positive direction is yellow, and the negative direction is blue. The decrease of a^* value means that the redness of the dyed fabric is weakened, and the decrease of b^* value means that the yellowness is obviously weakened. Larger changes in L^* , a^* , and b^* values enrich the color spectrum of lac red wool dyed fabrics, and give more color changes to the dyed fabrics of the same fabric with the same dye.

4.2. Dyeing Kinetics Curve of Tea Dyeing and Nano-Level Dyes on Chitosan Fiber

Draw the dyeing kinetic curve according to the experimental method and calculate the safflower yellow pigment content q_t dyed on the fiber. Study the effect of temperature and pH on the dyeing of chitosan fiber on safflower yellow pigment.

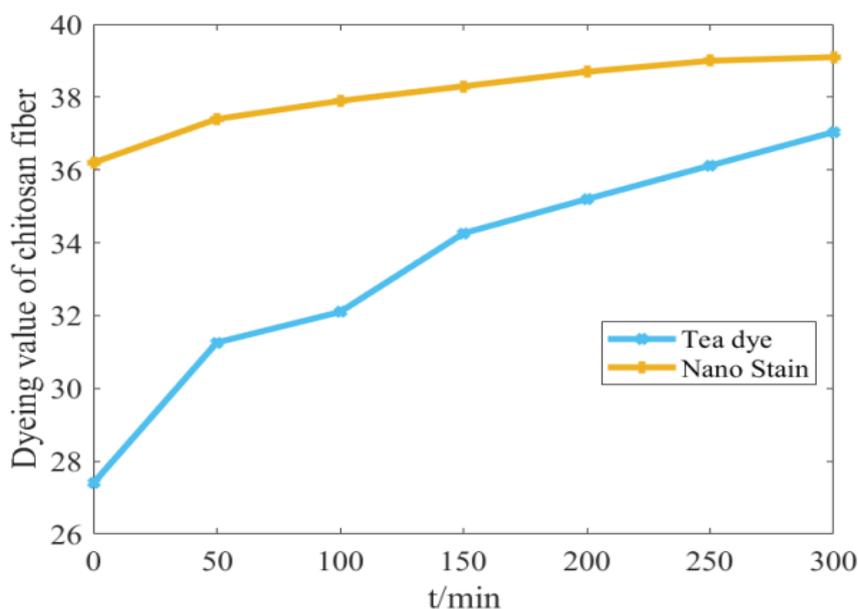


Figure 2. Adsorption curves of chitosan fibers with different temperature dyes

Figure 2 shows the adsorption curve of cochineal pigment on chitosan fibers at different temperatures. It can be seen from the figure that the temperature increases and the equilibrium adsorption amount of cochineal pigment on chitosan also increases. On the other hand, from It can be seen from the adsorption curve that the adsorption amount of the dye increases rapidly at the initial stage of dyeing. As the dyeing time increases, the increase in the adsorption amount slows down. When using tea dyeing, the dyeing process is basically balanced after 150 minutes. When dyeing with nano-stain, the dyeing process is basically balanced after 80 minutes.

4.3. Comparative Study on the Removal of Congo Red from Thermally Modified Waste Tea and Original Tea

Using original waste tea leaves and thermally modified tea leaves as adsorbents, adsorption experiments were carried out under the conditions of Congo red solution concentration of 20 mg/L and 80 mg/L, and the adsorption rate curve is shown in Figure 3.

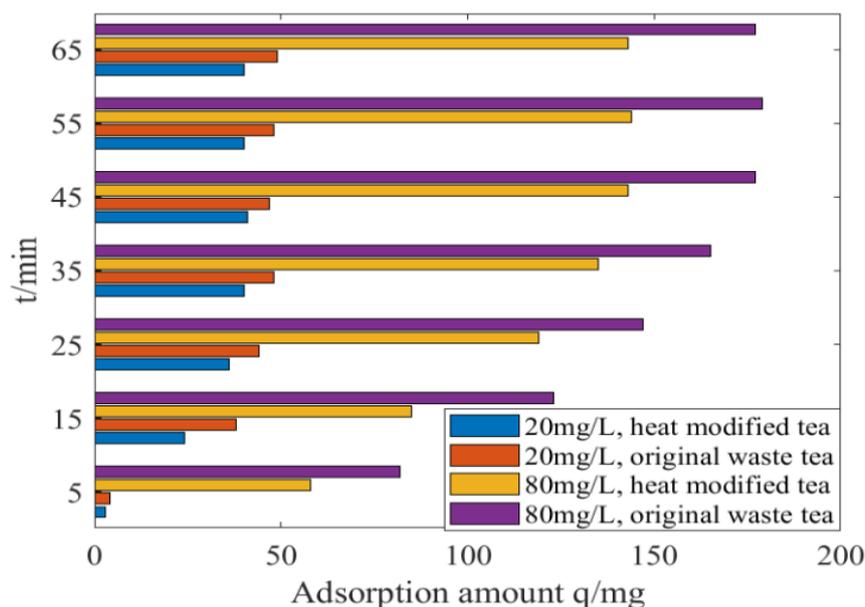


Figure 3. Comparison of the ability of HT and RT to remove CR

It can be seen that regardless of the concentration of Congo Red solution, the adsorption effect of thermally modified tea is always higher than that of the original waste tea. When the Congo Red solution concentration is 20mg/L, the maximum adsorption q_t of thermally modified tea leaves is 49.2mg/g, while the maximum adsorption q_t of original waste tea leaves is 41.3mg/g. When the Congo Red solution concentration is 80mg/L, the maximum adsorption q_t of thermally modified tea is 184.2mg/g, while the maximum adsorption q_t of the original waste tea is 156.6mg/g. This study shows that the adsorption performance of waste tea leaves after thermal modification is improved, especially when the concentration of Congo red increases, the adsorption capacity of thermally modified tea leaves increases more obviously.

4.4. Analysis of Migration

The leveling component of the disperse leveling agent aggregates on the surface of the fiber, which can dissolve part of the dye. Under high temperature conditions, it can move freely with the dye inside the fiber and the disperse leveling agent gathered on the fiber surface, and part of the dye in the original dyed fabric passes. In this way, it enters the dyeing bath and then enters the dyed fabric, and part of it remains in the dye liquor.

Table 2. The color of the dyed fabric

Disperse leveling agent	L*	a*	b*
Blank	34.28	-5.47	13.27
Tea dye	35.37	-5.76	14.33
Nano dye	36.37	-5.64	14.37

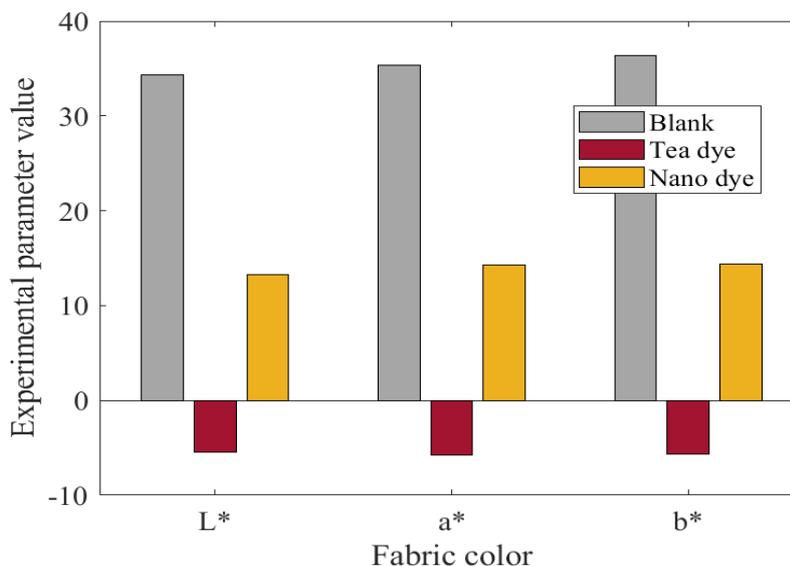


Figure 4. The color of the dyed fabric

It can be seen from Table 2 and Figure 4 that except for the slightly lighter color density of the dispersed uniform tea dye, the color change of the other colors is small. It can be considered that the color change of the transferred dyed fabric is small, and the main reason can be considered as the color change. The dyed fabric has a darker color, and a small amount of dye that is transferred has little effect on the color.

5. Conclusion

Comparing the color and luminosity of the dyed fabric, it is found that the K/S of the dyed fabric generally increases, and the influence of iron ion dyes on the color and luminosity of the fabric is greater than the K/S of the fabric. Aluminum ion. The mordant has nano-scale paint and the bathroom mordant itself. According to the laboratory value of the dyed fiber, the brightness of the fiber will usually decrease, and the light color will change after iron dyeing. After aluminum ion dyeing, the brightness of the fiber will usually increase, and the shade will change slightly. The results of the color fastness test show that the light fastness of the six colors after the mordant treatment can reach above level 3, and the stability of sage soap can reach above level 4. Meet the download requirements. The dyeing process after injection usually improves color fastness compared to the same dyeing process before marathion.

This paper studies the effect of ecological absorbent moisture on tea dye performance and nano-dye printing, and compares it with conventional urea/ammonium sulfate combination. When using natural dyes such as red shellac, red sorghum, carmine, saffron, etc. for printing, sodium pyrrolidone carboxylate can be selected as a moisture absorbent and citric acid as an acid agent. Wool printed fabric has high K/S, good soap resistance, abrasion resistance and light resistance. They can completely replace urea and ammonium sulfate in the printing of naturally dyed wool fabrics. Among them, the K/S value of lacquer red on the wool fabric is 8.57, and the color fastness can reach above level 3.

In this paper, through the dispersion penetration test and the DYE-O-METER test, the effect of the dispersibility of homogeneous tea dyes and nano-dye reagents under high temperature and high pressure on the dispersibility of polyester dyes is compared, and it is concluded that high temperature will affect the dispersion. The formation of water-insoluble concentrate particles will lead to the formation of color during the painting process, while contaminating the drum and affecting the continuous processing ability.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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