Reactive dyes on the wood veneer dyeing research

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Key words: Wood dyeing; Reactive dyes; Pretreatment; Best technology

Abstract: In the course of the study as the main materials to choose oak wood dyeing experiments, deal with to temperature, before ultrasonic oscillations time, microwave drying time as the main factors of orthogonal test, the dyeing process to dye concentration, temperature, dyeing time as the main factors of orthogonal test, the active dyes used to search for the best wood dyeing process.

Wood products raw materials from the forest resources .However, because human woodiness product special love, the increasing demand, leading to a global forest resources excessive logging, natural forest resources serious damage.

Wood dyeing is dye and wood occur chemical or physical chemical combination, make lumber has certain fast color processing process, is to improve the wood surface quality, improve wood visual characteristics and an important means of improving wood added value can effectively solve the existing ,in the wood dyeing technology of the dyeing depth color fastness (resistance to erosion resistance and light fastness) problem.

Materials and methods

Materials and equipment

Instrument Electric constant temperature water bath, AL204 electronic balance (one over ten thousand), spectrophotometer, etc.

Reagent Reactive dye red blue yellow, accelerating agent sodium sulphate Na2SO4·10H20, fixing agent, sodium hydroxide: are chemically pure.

Test Materials Oak thickness 3 mm, sample length-width 10 mmx10mm.

Reactive dye performance and selected.

1) Reactive dye structure, generally contain sulfonic group (- S03Na), because of its water solubility can are quite good, to hard water have higher stability.

2) Reactive dye to fiber with low affinity, high permeability, so levelling performance is good. Because of its molecular is lesser, can quickly into the fiber interior.

3) Reactive dye dyeing, with fiber up chemical integration function, dye fixation after basically has become part of the fiber, so wash rubbing etc fastness are quite good.

This paper selected M type reactive dyes on the wood for dyeing.

Former processing experiment on the wood dyeing performance influence

Dye ratio

With black walnut timber for target samples dyeing experiments, the color of the dye matching: blue, red, yellow = 2:2:1, dye concentration is 1% (dye on the wood heavy), bath ratio of 1:20.

Dyeing process

Preparation→dyeing→ fixation→ stoving.

Pretreatment experiment

Will test materials into the beaker, bath ratio , sodium hydroxide dosage 8 g/L, dipping time 8 h, respectively according to the above-mentioned experimental factors on 9 group orthogonal experiments, the best dye penetrant depth group.

Dyeing conditions: dyeing temperature of 70 ~ 80, dyeing time 8 h, accelerating agent sodium sulphate 40 g/L fixing agent 10 ml.

This experiment investigated three factors factors A (temperature) factor B (ultrasonic oscillations time) factors C (microwave drying time).

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Table 1 oak wood dyeing pretreatment experiment scheme

serial number	(A) temperature	(B) ultrasonic oscillations min/h	(C) microwave drying	dye-uptake %
1	70	10	2	
2	70	20	4	
3	70	30	3	
4	80	20	3	
5	80	10	2	
6	80	30	4	
7	90	10	4	
8	90	30	3	
9	90	20	2	

Test method

Dyeing after drying to dyeing before the moisture content of 12%, by means of measuring the dyeing rate to judge the best process before.

reactive dyeing process experiment

Dye ratio

With a kind of annatto commercial timber for reference samples dyeing experiments, the color of the dye matching: red, yellow = 2:1, dye dosage is 1.0% (dye on the wood heavy).

Process

Preparation→dyeing→ fixation→ stoving.

Temperature on oak veneer dyeing effect

Dye dosage 1.0%, sodium sulphate 40 g/L, fixing agent 10 ml, dyeing time 8 h, compare different temperature on the dyeing effect.

Time on oak veneer dyeing effect

Dye dosage is 1.0%, dyeing temperature of 70 ~ 80, sodium sulphate 40 g/L, fixing agent 10 ml, change the dyeing time, compare different time on dyeing effect.

Accelerating agent content on the oak veneer dyeing effect

Dye dosage is 1.0%, dyeing temperature of 70 ~ 80, dyeing time 3 h, fixing agent 10 ml, change the amount of sodium sulphate, compare different amount of accelerating agent on the dyeing effect.

Dyeing rate measurement

The dyeing rate (%) = [(A0- A1) / A0] X 100%.Type of A0 is before dyeing of dye solution absorbance, A1 is dyed after dyeing residual fluid absorbance.

Results and discussion

Oak treatment before the experiment

Wood in the extract

Wood extract contains many kinds of material, basically have tannin resin gum turpentine pigment alkaloid fat wax sugar starch and silicide, etc.

Rretreatment of experimental analysis

serial number	(A) temperature	(B) ultrasonic oscillations min/h	(C) microwave drying	dye-uptake %
1	70	10	2	25.45
2	70	20	4	37.33
3	70	30	3	42.97
4	80	20	3	50.25
5	80	10	2	43.57
6	80	30	4	47.88

7	90	10	4	41.11
8	90	30	3	56.75
9	90	20	2	51.46
K1	105.73	110.13	120.48	
K2	141.70	139.04	149.97	
K3	149.32	147.60	126.32	
$\overline{K}_1$	35.24	36.71	40.16	
$\overline{K}_2$	47.23	46.34	49.99	
$\overline{K}_3$	49.77	49.20	42.10	
R	14.53	12.49	9.83	

Through the above analysis concluded that, oak wood dyeing best pretreatment process conditions for: sodium hydroxide concentration is 8 g/L, the processing time 8 h, control temperature in 90 ~ 95, ultrasonic oscillations time for 30 min/h, microwave drying time 3 min.

Oak veneer of reactive dyeing.

Temperature on veneer dyeing effect.

With temperature rise, dye and wood of the reaction rate increases, the dyeing rate higher dye molecules on the wood cellulose happen adsorption and diffusion of at the same time, it will happen hydrolysis and solid color reaction when the temperature more than 80, dye hydrolysis rate is greater than the dye and lumber reaction rate and dyeing rate it down; At the same time, dyeing temperature is too high, resulting in reaction speed too fast, levelness and through dyeing property variation after dyed veneer after cutting cutting section analysis, dyeing temperature is too high, there is wood table core color difference phenomenon according to the experimental results, wood dyeing temperature control between 70 and 80 as well.

Time on dyeing effect

It is difficult to dye through short time after dyeing, although veneer surface color is consistent, but for cutting section analysis, we can see that cores incomplete dye penetration, there exists table core color difference with dyeing time extension, wood fiber can make full absorption dyes to dye migration, 8 h after dyeing, the dyeing rate has no obvious increase, the section after visual oak veneer basic can achieve the same color table core.

Accelerating agent content on the dyeing effect

With the increase of the content of the accelerating agent, dyeing speed and dyeing rate increased, when accelerating agent 40 g/L, dyeing rate was the largest, add accelerating agent on the dyeing rate has no obvious influence.

Sodium sulphate for reactive dye has accelerating effect of a very important reason is that they can reduce or overcome wood dyeing process charge on wood to dye pigment ion of the coulomb repulsion.

The experiment shows that the points secondary to join sodium sulphate, can be very good control dyeing speed, make dye in the wood in uniform diffusion and dye migration, thus reducing table core color difference.

Conclusions and Suggestions

The main conclusion

1) More optimal dyeing pretreatment process conditions for: sodium hydroxide concentration is 8 g/L, the processing time 8 h, control temperature in 90 ~ 95, ultrasonic oscillations time for 30 min/h, microwave drying time 3 min.

2) After oxidation hydrogen bleaching pretreatment of oak wood, texture clear, color shallow and uniform, the outward appearance is natural and beautiful.

3) After dyeing of oak the visual can achieve this goal wood natural effect.

4) More optimal reactive dye veneer dyeing conditions for: dyeing temperature of 70 ~ 80, dyeing time is 8 h, accelerating agent sodium sulphate 40 g/L, fixing agent mL this process conditions, reactive dye dyeing rate best.

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5)It is a kind of worth development promotion of wood dyeing technology.

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