

Dyeing properties and Antibacterial activity of Nylon fabric with Cochineal.

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I . Introduction

Natural dye, unlike synthetic dye, has not only an environment-friendly merit but also various function such as antibiosis, deodorization, anti-allergy, or anti-cancer.

With the currently vigorous researches on natural dyeing, I can point several problems that the dyeing method has that are the difficulties in dyeing material storage, the complexity of dyeing process, and the limit in color realization and material available.

These problems require the excavation of more dye and the scientific method for natural dyeing

The English name of the warm used in this research is Cochineal and its technical name is *Coccus Cacti L.*. In this research, using the Cochineal powdered dyed nylon fabric. Aluminum potassium sulfate, copper(II) acetate mono-hydrate, chromium potassium sulfate, 12H₂O, Iron(II)sulfate 7H₂O, Tin(II)chloride di-hydrate were used as mordant.

II. Method and Material

I used white Nylon fabrics as experimental fabrics, purchasing them from "Clothing Experiment Institute", and also used Cochineal as dyeing material. I used Dyestuff is buy a Cochineal at a "Migoang international".

I dyed, changing temperatures, dyeing time, and pH. I used Al, Cr, Fe, Cu, and Sn as mordant and compared dyeing property based on different mordant methods such as pre-mordant methods and post-mordant methods.

For the dyeing property of dyed fabrics, I obtained the color difference in surface reflection by measuring L*, a*, and b* using computer color matching (Color Quest XE, Hunterlab, USA) according to the Kubelka-Munk way. I measured washing fastness and dry-cleaning fastness, using Launder-o-meter (ATCC Standard Instrrometer), wet and dry friction fastness, using Crock-Meter (AATCC Atlas Electronic Device), and light fastness using Fade-O-Meter (Atlas electronic Device Co.).

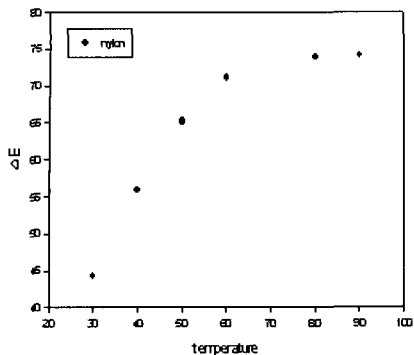


Fig. 1. Relationship between ΔE values and dyeing temperature of nylon fabric with Cochineal

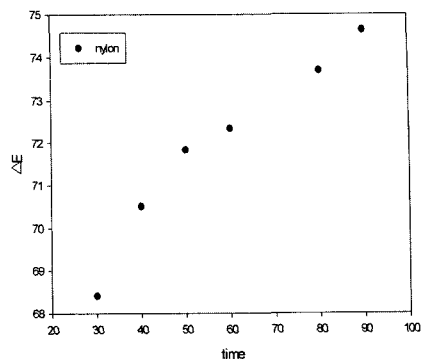


Fig. 2. Relationship between ΔE values and dyeing time of nylon fabric with Cochineal.

III. Result

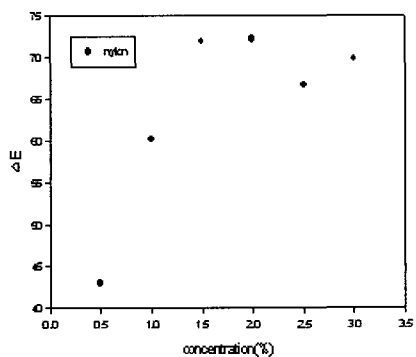


Fig. 3. Relationship between dyeing solution concentration and ΔE values of nylon fabric with Cochineal.

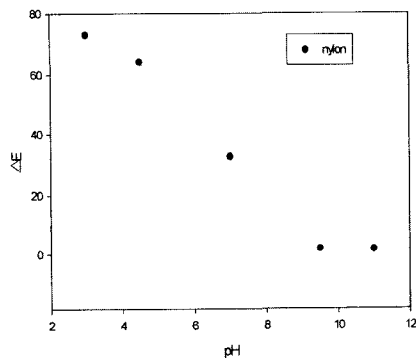


Fig. 4. Relationship between ΔE value of nylon fabric and pH value of Cochineal.

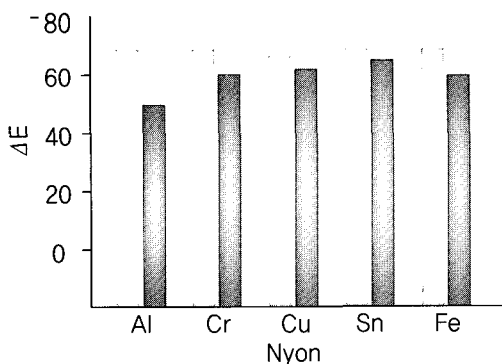


Fig. 5. Effect of mordanting methods on ΔE values of nylon fabric dyed with Cochineal.

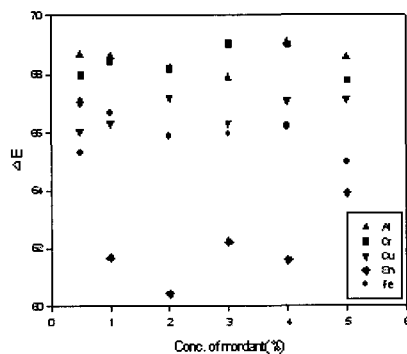


Fig. 6. Relationship between concentration of mordant and ΔE value of dyed nylon fabric under proper condition of Cochineal.

Fabric	fastness	mordant						
		non	Al	Cr	Cu	Fe	Sn	
Nylon	Light	1	1	1	1	1	1	
	Perspiration	Acidity	4	2	2	2-3	2-3	2-3
		Alkalinity	4	2	2	2-3	2-3	2-3
	Rubbing	Dryness	4-5	4	4	4-5	2-3	4
		Wet	3	3	2-3	2-3	1-2	3-4
	Dry-cleaning	4-5	4-5	4	4	3-4	4-5	
Washing	4-5	4-5	4-5	4-5	4-5	4-5		

Table 1. Fastness of pre-mordanted Nylon fabrics with Cochineal.

method	dye	Mordant	L*	a*	b*	ΔE	C	H	H V/C (1 \bar{x})	K/S	
nylon		non	92.609	-0.990	0.814		1,282	140,588			
		pre	Al	46.620	43.539	23.289	67.845	49,376	28,131	5.3 R 5/10	3,740
			Cr	45.916	43.406	23.547	68,236	48,831	28,133	5.4 R 4/10	3,668
			Cu	44,383	41,244	17,045	66,128	44,627	22,445	3.7 R 4/9	3,265
			Sn	45,775	46,807	9,127	67,432	47,689	11,029	0.4 R 4/11	2,202
			Fe	43,712	39,501	20,074	66,343	44,309	26,928	.5,0 R 4/9	3,936
		post	Al	59,643	37,442	15,821	53,104	41,047	24,182	4.2 R 6/10	1,212
			Cr	59,658	40,944	23,075	57,791	46,999	29,393	5.7 R 6/10	1,416
			Cu	40,856	31,557	1,022	61,137	31,574	1,854	7.7RP 4/7	3,249
			Sn	40,911	38,313	-0.669	64,959	38,319	359,000	6.9RP 4/9	2,637
Fe	36,559		21,403	2,954	60,396	21,606	7,855	9.6RP 4/4	3,966		

Table 2. The Colorimetric values for the dyed Nylon fabrics.

Dyed Fabrics	Antibacterial activities	Reduction ratio of colonies(%) Staphylococcus aureus
	Non	0
Nylon	Al	0
	Cr	28.2
	Cu	53.8
	Sn	96.5
	Fe	30.5

Table 3. Antibacterial activities of Nylon fabric dyed with Cochineal.

IV. Conclusion

Dyeing nylon fabrics, using powdered dye extracted from the Cochineal, we obtained the following conclusion.

The optimum dyeing concentration was 1.5%(o.w.f) and the optimum dyeing time was 90minutes, and the optimum dyeing temperature was 60°C. Under optimum dyeing condition, the optimum mordant concentration of all mordant is 0.5%. Pre-mordant method had better dyeing absorption than post-mordant method. In general, the fastness property of the nylon fabrics had a comparatively high grade except light fastness.

V. Reference

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