

Extraction of Natural Dye from Phellodendron Amurense and Its Photofading^{*}

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Abstract

Phellodendron amurense was used as natural dye source. Orthogonal experiment was carried out to select optimal extract process of phellodendron amurense dye. The orthogonal analysis results showed extract temperature was the most important factor. Stability investigation showed phellodendron amurense extract was stable to weak acid and alkaloid environment. Common metal ion had little effects on absorbance of phellodendron amurense extraction. Wool fabric and silk fabric had been dyed with phellodendron amurense aqueous solution. Solarization experiment showed high concentration dyeing sped up photofading rate and the dyed silk fabric was more sensible to the solarization. Vitamin C acid treatment slowed down photofading rate.

Keywords: Natural Dye; Phellodendron Amurense; Extraction; Photofading

1 Introduction

Textile dyes are considered one of source leading to the severe pollution of water and soil. With the increasing awareness of environmental protection, some stringent environmental standards have been imposed on the toxic and allergic reactions associated with synthetic dyes[1]. Natural dyes exhibit better compatibility and biodegradability with the environment, therefore the interest in the use of natural dyes have been revived. In recent years, natural dyes are widely used in the dyeing of natural fiber such as wool, silk and cotton fiber [2-6], and the dyeing of synthetic fibers [7-10]. And considerable research on natural dyes has been reported [11-13].

Natural dyes are found in minerals plants and animals; most of natural dyes are extracted from plants which are Chinese medicine. According to the chemical structure, the natural plant dye can be classified into 8 types. They are indigo dye, anthraquinone dye, flavone dye, alkaloids dye, polyhydroxybenzene dye, diketone dye, benzopyran dye, and carotenoid dye [14, 15]. Berberine dye is a widely distributed berberidacean alkaloids that has been employed in traditional medicine as an antiprotozoal and antidiarrheal agent [16, 17]. It has been found that most of berberine lies

^{*}Project supported by Education Department of Hubei Modern Textile Engineering and Technology Research Center of Wuhan Textile University (2016), China for financial support.

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in the roots of *Rhizoma coptidis* and stems of *Phellodendron amurense*. *Phellodendron amurense* is the dried bark of Rutaceae *Clausena lansium* tree or Amur corktree, which can be found near mountain forests or in the valley streams of north, west to the middle of China. The Latin name of *Phellodendron amurense* is *Cortex Phellodendri Chinensis*. Nowadays, except for the wild resources, *Phellodendron amurense* can also be artificially cultivated.

As a yellow natural plant dye, *Phellodendron amurense* extraction is usually used for the dyeing of natural fiber. To examine its stability in fiber, in this work, *Phellodendron amurense* dye was used to dye natural protein fiber. Wool fabric and silk fabric were dyed with *Phellodendron amurense* aqueous solution and the photofading rate of *Phellodendron amurense* dye was studied.

2 Experimental

2.1 Materials

Wool twill fabric and silk taffe (75 g/m²) were obtained commercially. *Phellodendron amurense* was obtained from medicine market. All other reagents were of analytical grade.

2.2 Extraction of *Phellodendron Amurense* Dye

L₉(3⁴) orthogonal extraction experiment was designed. Three factors were water addition, extraction temperature and extraction time, and each factor adopted three levels. 2.5 g dried *Phellodendron amurense* was minced and soaked in distilled water at constant temperature for some time, then the content was cooled at room temperature and filtrated. The filtrate was concentrated to 500 mL and the absorbance of the solution was measured. Optimal extraction process was selected by orthogonal analysis and the extraction was taken as the original extract.

2.3 UV-Vis Spectrum of *Phellodendron Amurense* Extract

UV/visible absorption spectrum of extraction solution of *Phellodendron amurense* were measured in the range of 200–800 nm on a Shimadzu 2550 UV/visible spectrophotometer.

2.4 Measurement of Extraction Stability

The stability of *Phellodendron amurense* extract under different conditions was investigated by spectrometry analysis and color change observation.

Different ion solution (10 mg/mL) was added into the corresponding extract respectively, and the absorbance of each solution was determined after 24 h.

The pH value of the original extract was adjusted with sodium hydroxide and hydrochloric acid. The absorbance of the extract under different pH value was measured and the color was observed.