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THE CONTEMPORARY VALUE OF TRADITIONAL CHINESE BOTANICAL DYEING TECHNIQUES IN ECOLOGICAL TEXTILE DESIGN

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Chinese traditional botanical dyeing techniques demonstrate significant application value. Research indicates this eco-friendly craft originated over 4,000 years ago, evolving through the Tang and Song dynasties into a cornerstone of the Silk Road trade by integrating with textile craftsmanship. Contemporary environmental issues from chemical dyes have sparked global revitalization of natural dyeing techniques. The study examines implementation pathways for botanical dyeing in ecological textile design, proposing three core principles: ecologizing production processes (reducing chemical pollution), ensuring usage safety (eliminating hazardous substances), and achieving environmental compatibility post-disposal (preventing secondary pollution). This investigation further explores the ecological values and implications of sustainability-oriented textile design.

Key words: *plant dyeing techniques; environmentally friendly; textile design, modern design, fashion design, textile techniques, eco-oriented friendly textile design*

INTRODUCTION

Historical records reveal that over four millennia ago, Chinese ancestors began extracting natural pigments from plants and mineral sources to dye fabrics, establishing the foundational “five-color system” of cyan, vermilion, yellow, white, and black [1]. By the Tang and Song dynasties, China’s botanical dyeing techniques and textile design capabilities had achieved sophisticated levels, with substantial quantities of fabric materials annually exported through border trade routes later collectively termed the “Silk Road”. However, the modern proliferation of low-cost chemical dyes with high coloring efficiency precipitated severe environmental consequences, including soil and water contamination as well as air quality degradation. This environmental crisis has driven renewed demand for ecologically-conscious textile design, evidenced by significantly increased market requirements for sustainable fabrics. Contemporary analysis confirms that traditional botanical dyes still utilized in China exhibit non-toxic properties, free from carcinogenic or allergic triggers to human skin, rendering them authentically natural

and ecologically sound colorants. Consequently, textile products synergizing ancestral botanical dyeing techniques with modern design principles demonstrate expansive developmental potential within current industry paradigms.

PURPOSE

The objective of this study is to concentrate on the traditional Chinese botanical dyeing techniques, to systematically explore their application potential and innovative pathways in the design of ecological textiles. Through analyzing the characteristics of these techniques, conducting design experiments, and investigating future directions for inheritance and innovation within the industry, the research aims to deepen the understanding of eco-friendly textile materials and dyeing technologies. It seeks to uncover their practical value in the realm of modern fashion and the environmental movement.

RESULTS AND DISCUSSION

Research has revealed that to achieve ecologically-oriented textile design, it is essential to avoid the use of synthetic chemical materials throughout the entire process, from the selection of textile raw materials to fabric processing and final product manufacturing. Moreover, the entire design process must adhere to three key principles:

– ecological Production Processes. From raw materials to the finished textile product, the use of chemical materials and pollution should be minimized;

– safety in Use. Since textile products come into direct or indirect contact with the human body, it is crucial to ensure that they do not release any harmful substances;

– ecological Disposal. It is important to ensure that textile products, when discarded or released into the natural environment, do not cause secondary pollution.

Additionally, the study found that the structure of different fibers influences the dyeing process of fabrics. Not all fabrics can be dyed using plant-based methods, as fibers and pigments often require mordants to bond effectively. Therefore, most natural colors are achieved through the use of mordants and repeated dyeing processes [2]. For example, to create traditional Chinese yellow-brown color series, materials such as pomegranate peel, chinese knotweed, Cassia seeds, Spatholobus suberectus, madder, sappanwood, gardenia, and Phellodendron amurense (fig. 1). These materials can be combined to produce various shades of yellow.

Taking the dyeing of 100% pure cotton fabric as an example: fig. 2 shows the finished textile product obtained by using a dyeing and mordanting technique with a solution made from boiled pomegranate peel and gardenia on white cotton fabric. From the color, it is evident that plant-dyed textiles are hardly distinguishable from those dyed with synthetic chemicals, and the dye stability is also quite good, with a soft and delicate texture. The fabric retains a subtle botanical fragrance, and different dyeing techniques can produce varied color effects, offering inspiration for pattern design. Therefore, compared to chemical dyeing, natural plant dyeing demonstrates diversified practical value and artistic expression in guiding the ecological orientation of textiles.

In contemporary society, heightened emphasis on quality of life has spotlighted the safety, non-toxicity, and eco-friendliness of intimate textile fabrics, with consumer awareness of these attributes steadily increasing. In this context, ecologically oriented textile products are gradually emerging as one of the key criteria for consumer choice. Notably, products designed using natural plant dyeing and related techniques have demonstrated significant market demand in areas such as home textiles, underwear, and infant products.

Fig.1, a – *h*. Plant-based dyeing materials for traditional Chinese yellow-brown color series: *a* – pomegranate peel; *b* – chinese knotweed; *c* – cassia seeds; *d* – spatholobus suberectus; *e* – madder; *f* – sappanwood; *g* – gardenia; *h* – phellodendron amurense

Fig. 2. Practice of Traditional Plant Dyeing Techniques

Moreover, the plants utilized in traditional Chinese botanical dyeing techniques often possess medicinal properties, offering certain health and wellness benefits to users. It is foreseeable that these natural plant-dyed products will largely replace some chemical textiles in the future, providing healthier and more environmentally friendly options for humanity. At the same time, integrating this

traditional craftsmanship into modern fashion and artistic design will spark innovative ideas, injecting new vitality into the textile and fashion industries.

CONCLUSIONS

Eco-oriented textile design represents not only a crucial direction for sustainable development in the current textile industry but also serves as a key pathway to meet consumers' growing demands for health and environmental protection. Research indicates that achieving eco-oriented textiles requires comprehensive implementation throughout the entire product lifecycle, from material selection and manufacturing processes to post-consumer waste management. This approach emphasizes three fundamental principles: eco-friendly production processes (minimizing chemical pollution), safe usage (eliminating hazardous substances), and environmentally sound end-of-life disposal (preventing secondary pollution). Furthermore, the application of natural plant-based dyeing techniques has significantly expanded the design value dimensions of eco-textiles.

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СУЧАСНА ЦІННІСТЬ ТРАДИЦІЙНОЇ КИТАЙСЬКОЇ РОСЛИННОЇ ТЕХНІКИ ФАРБУВАННЯ В ЕКОЛОГІЧНОМУ ТЕКСТИЛЬНОМУ ДИЗАЙНІ

Китайські традиційні рослинні методи фарбування демонструють значну цінність застосування. Дослідження показують, що це екологічно чисте ремесло виникло понад 4000 років тому, еволюціонувавши під час династій Тан і Сун у пріоритетний напрям торгівлі Шовкового шляху шляхом інтеграції з текстильною майстерністю. Сучасні екологічні проблеми, пов'язані з хімічними барвниками, спричинили глобальне відродження технологій природного фарбування. Дослідження розглядає шляхи впровадження рослинного фарбування в екологічному текстильному дизайні, пропонуючи три основні принципи: екологізація виробничих процесів (зменшення хімічного забруднення), забезпечення безпеки використання (усунення небезпечних речовин) і досягнення екологічної сумісності після утилізації (запобігання вторинному забрудненню). Це дослідження далі досліджує екологічні цінності та наслідки дизайну текстилю, орієнтованого на стійкість.

Ключові слова: *техніка фарбування рослин; екологічно чистий; текстильний дизайн; сучасний дизайн, дизайн одягу, текстильні техніки, екологічно орієнтований текстильний дизайн.*