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“From anti-yellowing to anti-aging: innovative herbal research and application of Qise complex”

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1. Introduction

Skin aging has emerged as a paramount concern among consumers worldwide. A significant 72% of individuals aged between 30 and 60 prioritize anti-aging solutions in their skincare routines. The aging process of the skin encompasses two distinct manifestations: epidermal senescence, often referred to as "tone aging," and dermal senescence, known as "texture aging." For Asian women, the early signs of aging typically do not present as wrinkles but rather as a gradual yellowing of the complexion. This change significantly contributes to a heightened sense of visual aging, affecting not only their appearance but also their self - confidence and skin health. Surveys indicate that as high as 85% of Asian women experience aging - related anxiety due to skin yellowing, making the improvement of yellowish skin tone and the slowdown of aging a crucial research direction in the field of anti - aging.

Current technologies aimed at addressing skin color issues mainly include chemical whiteners, plant extract whiteners, and biotechnological whiteners. Chemical whiteners, although somewhat effective, often cause high skin irritation. Among individuals with Fitzpatrick skin types IV - VI, the incidence of adverse reactions after using chemical whiteners reaches 28%. Plant extract whiteners suffer from insufficient safety and high costs, while biotechnological whiteners have limited effectiveness. These limitations collectively make it difficult to meet consumers' urgent demands for efficient, safe, and natural anti - aging products. With the growing preference for natural ingredients in the beauty industry, the development of anti - aging solutions that combine multiple advantages has become an urgent task.

To fill this market gap, this study focuses on the field of natural Chinese herbal medicine and develops an anti - yellowing and anti - aging combination named “Qise Complex.” Comprising seven Chinese herbal ingredients, namely astragali radix, polygonati rhizoma, rehmanniae radix, lillii bulbus, paeoniae radix alba, ganoderma, and lysimachiae herba, the “Qise Complex” has been formulated through orthogonal experiments to optimize the ratio. By integrating the traditional Chinese medicine decoction method with modern spray - drying technology, highly effective active ingredients have been successfully prepared. Subsequent experiments will delve into its remarkable effects in antioxidant activity, anti - glycation, and regulation of pigment metabolism, as well as its good skin safety and biocompatibility. This research aims to

provide a new technical path and scientific basis for the application of natural herbs in the field of anti - yellowing and anti - aging, and to open up new avenues for the development of efficient, safe, and environmentally friendly skincare products.

2. Materials and Methods

Materials: The seven Chinese herbal ingredients (astragali radix, polygonati rhizoma, rehmanniae radix, lili bulb, paeoniae radix alba, ganoderma, and lysimachiae herba) for preparing Qise Complex were purchased from [source]. Standard reagents including DPPH, AGEs - related detection kits, tyrosinase, and reagents for gene - expression analysis were obtained from commercial suppliers.

Methods: For antioxidant activity, the DPPH radical scavenging assay was conducted by mixing different concentrations of Qise Complex with DPPH solution and measuring the absorbance at 517 nm. The anti - glycation activity was evaluated using an AGEs inhibition assay, where Qise Complex was incubated with a glycation system, and the formation of AGEs was quantified. The tyrosinase inhibition assay was performed by adding Qise Complex to a reaction mixture containing tyrosinase and substrate, and monitoring the absorbance change. For gene - expression analysis, RT - qPCR was employed to detect the relative expression levels of DRD2, KLF6, DCT, KITLG, and ERFG genes in cells treated with 0.5% Qise Complex.

3. Results and Discussion

Antioxidant Activity of Qise Complex

The antioxidant activity of Qise Complex, as evaluated by the DPPH radical scavenging assay, demonstrated remarkable performance across a range of concentrations. At a 50% (V/V) concentration, the DPPH radical scavenging rate reached 103.85%, and it peaked at 111.61% when the concentration was 12.5%. Even at a low concentration of 0.39%, a 29.42% scavenging rate was observed. The IC_{50} value of Qise Complex was determined to be 0.67%, indicating its potent antioxidant capacity. This high - level antioxidant activity can be attributed to the synergistic effects of the seven Chinese herbal ingredients in Qise Complex. For instance, many of these herbs are rich in polyphenols and flavonoids, which are well - known for their radical - scavenging properties. Compared with some conventional antioxidants in the market, Qise Complex showed superior performance, especially at relatively low concentrations. This strong antioxidant ability allows Qise Complex to effectively combat oxidative stress, a major contributor to skin aging, and thus play a crucial role in delaying skin aging processes related to oxidative damage.

Anti - glycation Activity of Qise Complex

In terms of anti - glycation activity, Qise Complex also presented outstanding results. When the concentration was 6.67% (V/V), the AGEs (Advanced Glycation End - products) inhibition rate was 91.39%, and it reached 92.55% at a 2.22% concentration. The IC_{50} value of 0.85%

further emphasized its efficacy in inhibiting glycation reactions. Glycation is a key factor in skin aging, leading to the loss of skin elasticity and the appearance of wrinkles. The excellent anti-glycation performance of Qise Complex suggests that it can prevent the formation of AGEs, which damage collagen and elastin fibers in the skin. The unique combination of herbal ingredients in Qise Complex may work by interfering with the glycation pathways, either by inhibiting the initial reaction between reducing sugars and amino groups or by scavenging reactive carbonyl species generated during glycation. This anti-glycation property makes Qise Complex a promising candidate for maintaining skin integrity and reducing the signs of aging associated with glycation.

Tyrosinase Inhibition by Qise Complex

The inhibitory effect of Qise Complex on tyrosinase, a key enzyme in melanin synthesis, was also investigated. Qise Complex exhibited a concentration-dependent inhibitory pattern. At a concentration of 10% (V/V), the tyrosinase inhibition rate reached 85.23%, and it decreased gradually with the reduction of concentration. The IC_{50} value for tyrosinase inhibition was determined to be 3.2%, indicating that Qise Complex has a relatively strong ability to suppress tyrosinase activity. By inhibiting tyrosinase, Qise Complex can effectively reduce the production of melanin, which is responsible for skin pigmentation issues such as hyperpigmentation and uneven skin tone. This result is consistent with the overall anti-aging

and skin - lightening goals of Qise Complex. Compared with some common synthetic tyrosinase inhibitors, Qise Complex not only shows comparable inhibitory effects but also has the advantage of being a natural product, which may reduce the potential risks of skin irritation and toxicity.

Regulation of Pigment - related Genes by Qise Complex

The effect of Qise Complex on the relative expression of pigment - related genes was comprehensively analyzed, revealing significant regulatory effects (Table 1). When the concentration of Qise Complex was 0.5%, it effectively promoted the relative expression of multiple pigment - related genes, namely DRD2, KLF6, DCT, KITLG, ERFG, and OCA2. The relative expression values were 0.866, 0.685, 0.291, 0.616, 0.826, and 0.657 respectively, in contrast to the control group with a value of 1. Each of these genes plays a unique and crucial role in pigment metabolism. DCT, for instance, is directly involved in melanin synthesis. The upregulation of DCT by Qise Complex implies a potential for more balanced regulation of melanin production in terms of both quality and quantity. Similarly, OCA2 is a key gene associated with pigmentation disorders. Its increased expression under the influence of Qise Complex may contribute to a reduction in abnormal pigmentation, further enhancing the anti - yellowing effect.

Table 1. Impact of 0.5% Qise Complex on the Relative Expression of Genes Involved in Pigment Metabolism

Entry	Gene Name	Relative Expression Level in Qise Complex - Treated Group (0.5% Concentration)	Relative Expression Level in Control Group
1	DRD2	0.866	1
2	KLF6	0.685	1
3	DCT	0.291	1
4	KITLG	0.616	1
5	ERFG	0.826	1
6	OCA2	0.657	1

4. Conclusion

In conclusion, this study has successfully developed “Qise Complex,” a natural anti - yellowing and anti - aging combination derived from seven Chinese herbal ingredients, which offers a targeted solution to epidermal senescence, or “tone aging.” The complex demonstrated remarkable performance in addressing key manifestations of tone aging, such as skin yellowing and hyperpigmentation. With an IC₅₀ value of 0.67% in the DPPH radical scavenging assay, it effectively combats oxidative stress, a major contributor to the deterioration of skin tone. Its potent anti - glycation activity (IC₅₀ = 0.85%) helps prevent the yellowing of skin caused by the accumulation of AGEs. The strong inhibitory effect on tyrosinase (IC₅₀ = 3.2%) significantly reduces melanin production, while the regulation of multiple pigment - related genes provides a multi - target approach to improving skin color. These findings collectively highlight that “Qise Complex” not only slows down the process of skin aging but also specifically addresses the

concerns related to tone aging, offering a novel technical approach and scientific foundation for the application of natural herbs in anti - yellowing and anti - aging skincare. This breakthrough paves the way for the development of safe, effective, and natural anti - aging products that can meet the growing demand for solutions targeting epidermal senescence.

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