Purification and application of silk protein and the preparation of its nanoemulsion

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ABSTRACT

Silk protein is a water-soluble poly peptide. A various molecular weight of silk proteins were obtained with different sample preparation. As indicated in the literature, silk protein was ability of inhibiting free radical, antioxidation, blocky ultraviolet sunlight that prevent the erosion of the skin; if also was the role of inhibition of tyrosinase activity and inhibition of the formation of melanin. However, the detail experimental evidences were rarely seen in the literature. The aim of this study was to develop a sample preparation protocol for extraction of silk protein, and to study the feasibility of its inhibition of free radical and melanin formation and Preparation of nanoemulsion. The different molecular weight of silk protein were studied at various concentrations for its DPPH (2,2-Diphenyl-1-picryl-hydrazyl) scavenging activity, ABTS (Agreement of Basic Telecommunications Services) cation scavenging activity, reducing power, ferrous ion chelating activity and anti-peroxidation of linoleic acid. In addition, inhibition of tyrosinase were also studied by using silk protein in at various concentration,pH and temperature. It was shown that all silk protein of different molecular weight after fractionation by ultrafiltration displayed DPPH scavenging activity, ABTS cation scavenging activity, reducing power, ferrous ion chelating activity and anti-peroxidation of linoleic acid and inhibition tyrosinase activity. However, silk protein of 100 kDa showed the best activity, when it was at 100 mg/mL, the scavenging activity of DPPH free radical and ABTS cation free radical was 95.37% and 94.01%, respectively when it was at concentration of 50 mg/mL, the reductive ability was 1.2079, the chelating efficiency with Fe2+ was 96.57% and the inhibition of tyrosinase capacity was 94.72%, respectively. The results also shown that, when mixed with jojoba oil, silk protein of different molecular weight formed nano-emulsion that displayed excellent activity and stability, the smallest particle size could be obtained when 5 kDa molecular weight of silk protein was used; when it was at concentration of 50 mg/mL, the particle size was 83.7 nm and the nano-emulsifying capacity was 99.4% at pH 5.5; the particle size was 80.4 nm and the nano-emulsifying capacity was 99.8% at pH 7.5. The size of nanoemulsion, formed by using 5 kDa silk protein mixed with jojoba oil at 50 mg/mL and pH 5.5, varied with number of treatment by high pressure homogenization, the minimum diameter of 28.1 nm was obtained after 3 treatments. This study has demonstrated that silk protein has high anti-oxidation ability and the ability of inhibiting tyrosinase. When mixing with jojoba oil, nano-emulsion was formed, which might lead to be easily absorbed through the skin. Therefore, the active component of silk protein has potential to be used for the production an ingredient of whitening cosmetics that have high activity and easily absorbed ability.

Keywords : Silk protein、Antioxidation、Inhibition of tyrosinase、Nanoemulsion

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