Optimization of preparation condition for glabridin nanoemulsion by collision-high pressure homogeni

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ABSTRACT

Nanoemulsion droplets size is in the range of 10-100 nm. Nanoemulsion was stable and easily absorbed through skin due to its miniaturized size. High pressure homogenization may be applicable to manufacture nanoemulsion products by providing great energy in a short time with a homogeneous flow to decrease particle size. In this study, the effects of oil (2-6%, w/w), surfactant (3-7%, w/w), and the homogenization pressure (70-130 MPa) on the particle size of emulsion were investigated using response surface methodology (RSM) with 3-factor-3-level Box-Behnken design. Based on the analysis of canonical, the effect of the number of passes of homogenization on particle size to obtain emulsion with low particle size and high stability was determined.Then, glabridin was added to the nanoemulsion as a functional ingredient, and effectiveness of the product was evaluated. Results showed that a good nanoemulsion was obtained by mixing oil 3.65% with emulsifier 5.3% and then homogenized at 129 MPa. The actual minimum particle size (58 nm) was closed to the predicted value (40.4 nm). Homogenization pressure was the key factor affecting particle size from the analysis of variance for joint test ($p < 0.005$). The particle size was proportionally reduced as the pressure increased. Moreover, the number of passes of homogenization could also affect the particle size, and stable particle size at about 28 nm was resulted after 3 passes of homogenization. Glabridin had a high DPPH radical scavenging activity (80%) of 1 mg/mL. Activity of tyrosinase was inhibited by 80% using 1 μg/mL of glabridin. The nanoemulsion containing glabridin retained tyrosinase inhibitory activity even after high pressure homogenization. The cumulative amount (0.086 g/mL) for the product was better than that that of non-high pressure homogenization (0.057 mg/mL) after transdermal diffusion for 24 hours. Furthermore, the glabridin nanoemulsion did not cause any irritation or allergy during the safety and stability test. In conclusion, this study showed that an optimal condition was developed for the preparation of a stable nanoemulsion, and glabridin is a highly valuable active ingredient for whitening the skin. Results also showed that the miniaturized particle of this product could be absorbed without irritation and allergy through skin while providing an effective high value skin care.

Keywords : Glabridin、Nanoemulsion、Collision-high pressure homogenization、Response surface methodology

Table of Contents

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