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Application of a recombinant hybrid mussel adhesive protein as a functional cosmetic ingredient

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Marine mussels produce and secrete adhesive proteins that allow themselves to attach in rough marine environments. Currently, six mussel adhesive proteins (fp-1 through fp-6) have been identified from the adhesive plaques of mussels. Mussel adhesive proteins have been considered as a desirable source of water-resistant bioadhesives which can also be used as a useful ingredient in cosmetics. This study aimed to construct a recombinant hybrid mussel adhesive protein, fp-13151, in order to get convenient and economical production and enhance the adhesive capability of the mussel proteins, and evaluate its potential as a functional cosmetic ingredient. The hybrid gene was constructed to contain the parts of fp-1/fp-3/fp-1/fp-5/fp-1in a sequential order using recombinant DNA techniques. fp-13151 was purified from the corresponding overexpressed *E. coli cells* using affinity chromatography. fp-13151 did not exhibit cytotoxicity and irritability to the skin. fp-13151 at 50 µg/ml augmented the synthesis of collagen 1.63-fold over that of the non-treated control in HaCaT cells, implying its anti-wrinkle activity. On the contrary, fp-13151 diminished the levels of matrix metalloproteinase (MMP-1), also known as interstitial collagenase, in a concentration-dependent manner. It could marginally inhibit elastase activity in an in vitro experiment. fp-13151 was able to inhibit both monooxygenase and oxidase activities of mushroom tyrosinase in a concentration-dependent manner, suggesting its skin whitening activity. It was also found to contain an antioxidant activity, when an ABTS radical scavenging capacity assay was used. In a pilot-scale clinical trial, the essence containing fp-13151 significantly reduced the wrinkle parameters tested in the participants after both 4- and 8-week treatment, compared to the control group. Taken together, fp-13151 possesses skin beneficial properties, such as antioxidant, whitening and anti-wrinkle activities, in addition to its peculiar adhesive character. These findings suggest that fp-13151 has potential as an effective ingredient in the manufacture of functional cosmetics.

Biography

Ye-Eun Yoon received her MS degree from the Department of Chemical and Biomolecular Engineering, Yonsei University, Seoul, Korea. Her Master's thesis is entitled "Development of adhesive/multi-layered scaffolds for tissue adhesives and gene delivery vehicles". She has already published several peer-reviewed research papers in reputed journals and won an American Chemical Society (ACS) Editors' Choice Award in 2016. Currently, she works as a Research Scientist at Research & Development Center, Cosmocos Corporation, a branch of Korea Tomorrow and Global (KT&G), in Korea.

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