Development of a novel “all-in-one” anti-aging ascorbic acid polypeptide ingredients and their promising application in cosmetics

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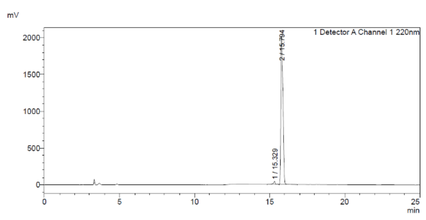
Introduction:

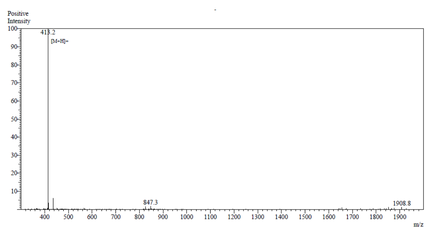
External environmental factors such as UV and particulate matter gradually caused skin aging. Wrinkle formation and abnormal pigmentation are major clinical alterations associated with skin aging as extracellular matrix destruction, melanin accumulation and cell activity reduction among major cell types at epidermal layers. Therefore, modulation of melanogenesis, collagen synthesis as well as cell regenerative activity is an important objective in the development of cosmetic active ingredients.
L-ascorbic acid (vitamin C), a water-soluble antioxidant s a widely accepted anti-aging ingredient in these cosmetic products. However, the ultra-unstable structure has limited its application in the cosmetic industry.
To address this problem, we have developed an efficient and stable multifunctional ascorbic acid polypeptide derivative: 3-O-ethyl ascorbic acid-carnosine. In terms of structure, we have retained the highly reducing C=C double bond, at the same time, we have added dipeptide (carnosine). This novel ascorbic acid polypeptide reveals not only stable characters but also significant improvement of anti-aging effects comparing to ascorbic acid & carnosine respectively in terms of extracellular matrix boosting, anti-oxidation and melamin inhibition etc.

Materials & Methods:

1. HPLC



2. MS



3. 3-O-ethyl ascorbic acid-carnosine

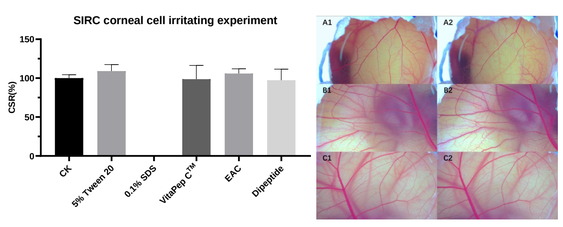
3-O-ethyl ascorbic acid-carnosine was synthesed from Carnosine (beta-alanyl-L-histidine) by coupling with ascorbic acid derivative.
The HPLC detection result is shown in Figure 1, and the purity of the compound can reach 98.271%. In addition, the MS detection result is shown in Figure 2. The chemical structure of the target compound is $C_{17}H_{24}N_4O_8$, the molecular weight is 413.2, and MS shows that the molecular weight meets the requirements.

Conclusions:

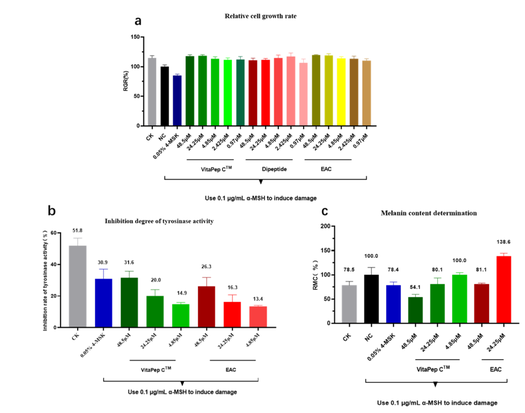
VitaPep C retains the active structures of carnosine and EAC, imidazole-based structure and alkene glycol structure, respectively, and is a brand-new whitening, anti-oxidation and photo-aging material. Tested in vitro, it can effectively inhibit the activity of tyrosinase and reduce the synthesis of melanin. At the same time, it can repair the existing melanin and reduce the deposition of melanin; Through the biological activity of imidazole base and C=C structure, reduce the production of ROS, promote the expression of HYP, and achieve the increase of collagen; It can repair a certain limit of in vitro oxidative damage; Protect cells from UVA-induced photoaging damage; the recommended minimum effective concentration of this material is 24.25μM, which is 10ppm.

Results & Discussion:

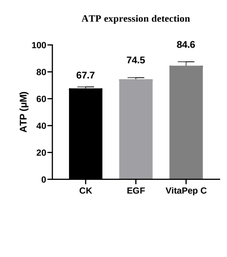
1. Safety



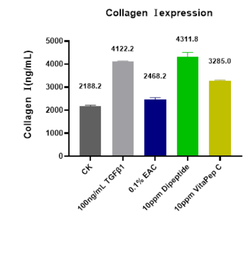
2. Whitening efficacy test



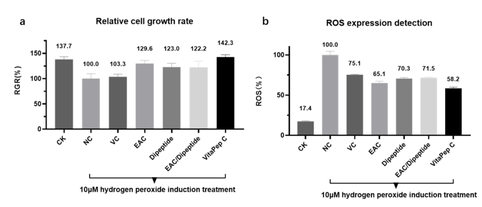
3. ATP



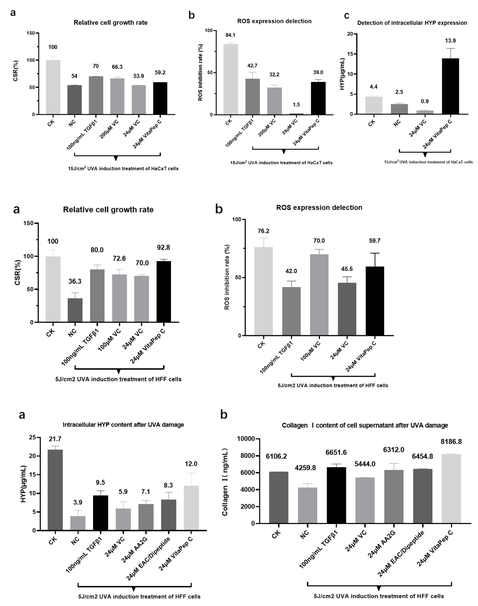
4. Collagen Ⅰ



5. Oxidative damage repair



6. Protection of cells under UVA photoaging stress



Sample name	HYP up-regulation rate	Collagen Ⅰ up-regulation rate
24 μM（10 ppm）VitaPep C	207.7%	92.2%
24 μM EAC/ 24 μM Dipeptide	112.8%	51.5%
24 μM AA2G	82.1%	48.2%
24 μM VC	51.3%	27.8%
100ng/mL TGFβ1	143.6%	56.1%
CK	456.4%	43.3%
NC	0%	0%

The stability of ascorbic acid has always received extensive attention, and high-concentration products are prone to oxidation and yellowing, thereby losing biological activity. Therefore, the research workers related to ascorbic acid derivatives in the early stage focused on modifying the C=C adjacent -OH structure of ascorbic acid in order to protect C=C from oxidation. The fat solubility of ascorbic acid has also been improved by modifying the structure, and the fat solubility directly affects the penetration rate and absorption rate.
Comprehensive stability and fat solubility, Roche launched Stay-C (APPS) in 1991, which combines the fat-soluble modification of A6Pal and the stability modification of MAP to solve the stability and transdermal problems, but the effect of equal concentration is not Inferior to ascorbic acid; in 2008, the 3-O-Ethyl-L-ascorbic acid (EAC) developed by Shu Jin et al. only modified the -OH at position 3 on the ascorbic acid ring and added an ethyl ether structure to prevent C=C It is oxidized, and at the same time, EAC has a small change in molecular weight and has good fat solubility. After testing, it can surpass ascorbic acid in actual efficacy.
Based on the structure of EAC, we modified the functional structure of carnosine and successfully prepared an ascorbic acid peptide, named VitaPep C, to make it possess the biological activities of ascorbic acid and carnosine at the same time.

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