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Short communication

Investigation of sensory characteristics of cosmetic emulgels containing different vitamin C derivatives

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Introduction

Topical vitamin C (L-ascorbic acid) is an useful part of the dermatologist's armamentarium, regarding to its diverse cutaneous benefits. It is an important ingredient widely used in cosmetic and dermatological products thanks to its favourable effects which include collagen synthesis promotion, photoprotection from ultraviolet A and B lightening hyperpigmentation, improvement of cohesion in the dermalepidermal junction and of a variety of inflammatory dermatoses, also (Farris, 2005; Telang, 2013). The biggest challenge in the utilization of this versatile molecule is to maintain the stability. Vitamin C's instability resulted in the development of more stable derivatives with different chemical properties and some carrier systems in order to overcome these limitations (Carita et al., 2020). Nowadays, emulgels are affordable and efficient as the new possibilities of delivery and improvement of stability (Tadić et al., 2021). The aim of our study was to examine the sensory characteristics of oil-in-water emulgels containing hydroxyethylcellulose, biodegradable sugar emulsifiers and vitamin C derivatives of different polarities: ascorbyl palmitate and magnesium ascorbyl phosphate, at a concentration of 0.5% w/w.

Materials and methods

Materials

For preparation of the emulgels, following reagents were used: Myritol® 318 (INCI: caprylic/capric triglycerides) was purchased from Henkel (Germany), isopropyl myristate (INCI: isopropyl myristate) from Centrohem (Serbia), while Paryol 165 OL/R (INCI: olive oil) and Euxyl PE 9010 (INCI: phenoxyethanol (and) ethylhexylglycerin) were from Comcen (Serbia). Montanov™82 (INCI: cetearyl alcohol (and) coco-glucoside) and Montanov™14 (INCI: myristyl alcohol (and) myristyl glucoside) were bought from Seppic (France) while Propylene glycol (INCI: propylene glycol) from Fagron (Netherlands). Thickener hydroxyethylcellulose and vitamin C derivatives, ascorbyl palmitate and magnesium ascorbyl phosphate were purchased from AvenaLab Cosmetics (Serbia), while purified water was obtained from Faculty of Medicine (University of Niš, Serbia).

Emulgel preparation method

The preparation of two emulgels included separate emulsion and gel formation (Ajazuddin, 2013). The oil and water phases are heated to 70-80 °C and then combined with constant stirring until they cool to room temperature. The gel phase of the emulgel is prepared by dispersing hydroxyethyl cellulose (HEC) in water earlier and leaving it in overnight. When both the emulsion and gel components are prepared, the emulgel is prepared by combining the emulsion with the gel with gentle stirring. Ascorbyl palmitate and magnesium ascorbyl phosphate were dissolved separately in isopropyl myristate and propylene glycol, respectively at a concentration of 0.5% w/w, and added into the system when the temperature reached 40 °C.

The sensory analysis

Over the last few years, the sensory analysis has extensively been developed and used to describe and quantify texture characteristics of cosmetic products. The sensory analysis is a helpful tool for researches and development area of companies which aims to obtain cosmetic products of good consumer acceptance. The data obtained by sensory characterization could be used in the formulation of a cosmetic product of predefined sensory

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characteristics or in the process of reformulation (Gilbert et al., 2013). In the study, 20 participants of both genders (15 women and 5 men), were involved. The healthy volunteers, had no past or present history of skin diseases, nor had they used systemic or topical drugs within two weeks prior to the study. Half of them applied an emulgel containing hydrosoluble vitamin C, twice a day, on the inside of the forearm. The other half, applied emulgel containing lipophilic vitamin C, in the same way. The volunteers had to fulfill a questionnaire on product attributes before, during and after application on the skin, also. All of them were informed about the study protocol, and signed the written informed consent form. The research was conducted in accordance with the Helsinki Declaration, and permitted by the Ethics Committee of the Medical Faculty in Niš (Serbia), protocol code 12-6316-2/8 from 16 June 2016. The entire study was carried out in consonance with the guidelines and published recommendations. During this long-term *in vivo* study that lasted for 30 days, electrical capacitance of the stratum corneum, trans-epidermal water loss (TEWL), and skin pH, were also measured parameters.

Results and discussion

Today's biggest challenge lies with developing a stable formulation and finding the most efficient transepidermal delivery method for the esterified forms of vitamin C. The stability of ascorbyl palmitate was somewhat lower than that of phosphate ester (Segall and Moyano, 2008). So, magnesium ascorbyl phosphate is shown to be convenient as an active ingredient in topical preparations (Spiclin et al., 2001). The efficiency of both derivatives depends on their concentration, but also on the application properties and type of carrier system for dermal application (Jurkovič et al., 2004). Emulgels were described by panelists as preparations with better sensory properties. The tested emulgels were described as semi-solid, slightly dense and easy-to-spread by the majority. The consistency, firmness and stickiness of the emulgels were similarly assessed by volunteers as mild ones. All respondents agreed that emulgels are moderately absorbed and that the skin is not sticky or shiny after application. Regarding that, the hydro-lipophilic properties of vitamin C derivatives did not affect the sensory characteristics of the tested emulgel.

Conclusion

The sensory properties of the emulgel containing hydrophilic sodium ascorbyl phosphate were compared to that containing lipophilic ascorbyl palmitate at the same concentrations. The results reported demonstrate that phosphate ester of vitamin C emulgel and ascorbyl palmitate emulgel have similar sensory characteristics. Therefore, more different carrier systems for dermal application and different concentration of vitamin C derivatives in formulations should be subjects of novel studies in order to achieve appropriate textural and sensorial characteristics of dermocosmetic products.

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