Vitamin C and UV filter in color cosmetics: When the protector becomes the villain

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Almeida, Claudia*[1]; Giglio, Danielle[1]; Padilha, Milene[1]; Cruz, Janny[1]; Luce, Leonardo[1]; Sasson, Clarice[1]; Urio, Camila[1]; Lorencini, Márcio[1]
[1]Grupo Boticário, São José dos Pinhais, Paraná, Brazil

Introduction:

The interest for multipurpose or hybrid make-up has grown in the last few years. Consumers seek the practicality of using only one product to obtain several benefits such as protection, skin care and makeup. Vitamins are one of the most popular skin care ingredients and it is also associated with health and immunity, a topic that grew in consumer's interest since the pandemic of Covid-19 [1]. Vitamin C, for example, are commonly used as skin lightening ingredients and it has an antioxidant effect that can be used for the treatment of skin photoaging [2].

Despite the practicality, the development of multipurpose products requires special care to ensure all the expected benefits. Liquid foundations are constituted of a multitude ingredients, a very complex system, fascinating and challenging at the same time. Photoprotection is another important attribute for color cosmetic foundations and widely used by the cosmetic industry. Its combination with vitamin C, adds a challenge in product development, due its instability.

Ethyl Ascorbic Acid (3-O-ethyl-l-ascorbic acid) is an l-ascorbic acid derivative, commonly known as Vitamin C. Different from pure vitamin C which is easily degraded, Ethyl Ascorbic Acid (3OAA) is a modified molecule that increase the molecule's stability and enhance its transport through skin. In additional, 3OAA retains the benefits of Vitamin C, such as antioxidant activity [3].

Although more stable, the evaluation of the stability of 3OAA in the product is essential to ensure its benefits. Therefore, this work aims to evaluated the influence of physical and chemical UV filters on the stability of ethyl ascorbic acid on a multipurpose foundation.

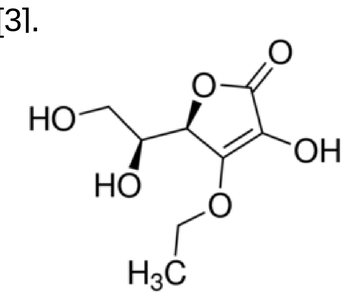


Figure 1. Ethyl Ascorbic Acid

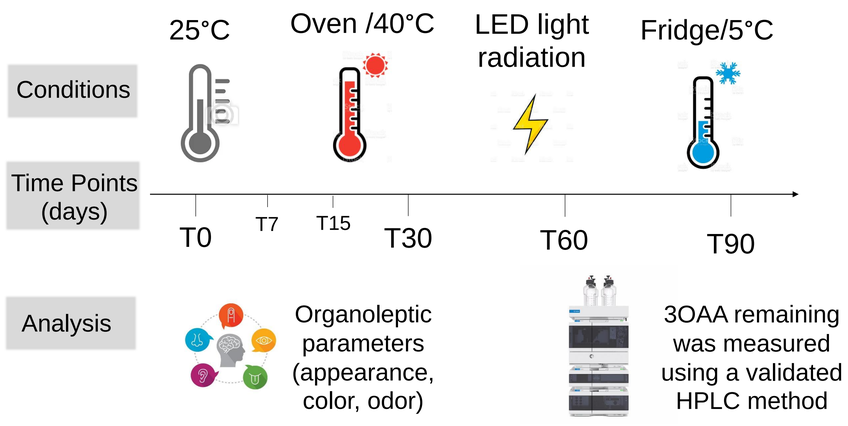
Materials & Methods:

A fluid color cosmetic foundation composition (water-in-silicone emulsion) was developed. Table 1 describes formulations F1 to F5 built from possible combinations of the UV filters and antioxidant systems evaluated. Figure 2 shows analysis, conditions and time pontis during the stability study [4].

Table 1. Quantitative composition of formulations (%)

Components	F1	F2	F3	F4	F5
Zinc oxide (ZnO)	-	6.0	6.0	-	-
Titanium dioxide (TiO_2)	-	-	-	-	5.0
Octyl Methoxycinnamate (Metox) and Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine (Triazine)	-	-	-	5.0: 2.5	-
Tocopheryl Acetate	0.5	0.5	-	-	-
Tocopheryl Acetate, Tocopherol, Vitis Vinifera (grape) Seed oil and Sodium Metabisulfite	-	-	1.7	1.7	1.7

Figure 2: Stability study analysis: organoleptic parameters and 3OAA content analysis



Results & Discussion:

Organoleptics parameters

Oil phase separation was observed in formulations F2, F3 and F4, returning to initial appearance after shaking, something expected for liquid foundations. No change in color and odor was observed in all formulas.

Storage stability of Ethyl Ascorbic Acid at different conditions

Differences between the conditions and formulations was observed (figure 3). Samples stored at 5°C showed better retention for all formulations. On the other hand, samples stored in 40 °C had the worst retention, also previously observed with ascorbic acid [5]. Comparing differents formulations, F3 (with ZnO) showed the greatest degradation in all evaluated conditions. F4 (Methox and Triazine) and F5 (TiO2) showed similar behavior. Such difference may be related to the small solubility of ZnO and consequent variation of pH [6]. The antioxidation system of F3, F4 e F5 was more effective in stabilizing the active when compared to the antioxidant system composed only by Tocopheryl Acetate (F2). F3 was 16x more effective in retention rate in fridge/5°C, 8x more effective in ambient/25°C and light conditions and 2x more effective in oven/40°C.

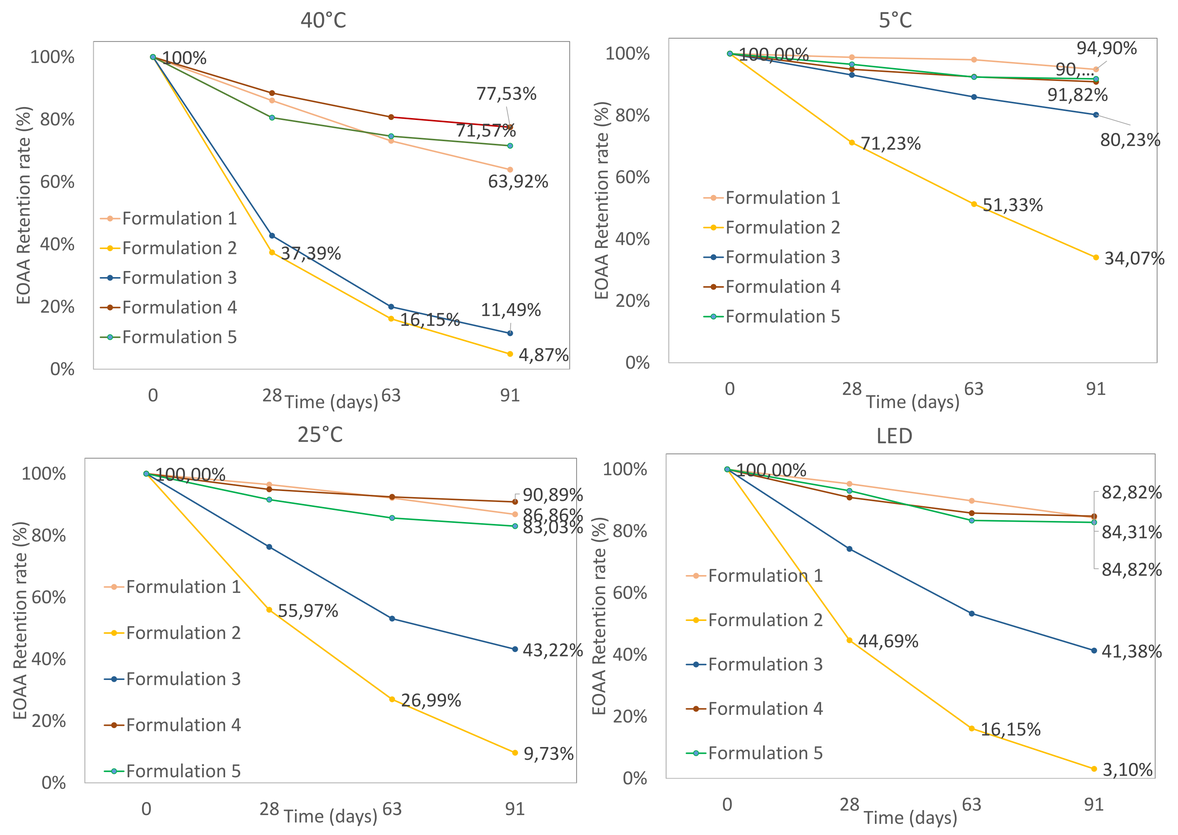


Figure 3: Retention rate (%) Ethyl Ascorbic Acid in formulations during the accelerated stability study stored at Fridge/5°C, Room temperature/25°C, Oven /40 °C and LED light radiation.

Conclusions:

- Effect of UV filters on the stability of multifunctional makeup with vitamin C was presented for the first time.
- Results shows that the presence of ZnO significantly impacts the stability of vitamin C. TiO2 or Methox/Triazine showed better results compare to ZnO.
- It's observed that, despite being more stable, 3OAA is also subject to instability due to factors such as temperature and chemical interactions of formulation components. Furthermore, we also concluded that antioxidants systems can be an important ally in stabilization of 3OAA in cosmetic products.
- These results reinforce the importance of product development for creating more stable, safety and effective products to the consumers.

Aknowledgments:

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