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Biodiversity and Cosmetics: Reaching Sustainable Technology

Solid sunscreens: challenges for development and production

Mirela Seixas, PhD; Ada Mota, MSc; Ingrid Alexandrino; Matheus Soares, MD, MSc; Felipe Soares, MD, MSc; Vitor Seixas, PhD. * ADCOS group. Brazil

INTRODUCTION

The use of solid cosmetics has been a trend in the market due to its practical application, portability and environmental benefits. However, the development of sunscreens in solid form is still a challenge for the formulator who needs to stabilize a combination of solid, hydrophilic and lipophilic active ingredients in wax bases, in a homogeneous way to ensure the correct protection. A rigorous evaluation of the physicochemical characteristics of this type of cosmetic must be carried out not only during product development, but also throughout the manufacturing process, since scale-up also presents a challenge in the development of solid sunscreens.

OBJECTIVE

The objective of this study was to develop solid sunscreens and standardize the manufacturing process to ensure product quality.

METHODS

Four different solid sunscreens with different SPF, with and without FeO_2 pigment, and with different vehicles based on candelilla wax, microcrystalline wax and silicone were developed (Image 1). Physicochemical characterizations were performed to identify the characteristics of the mixtures and evaluate the dispersion of the active ingredients and photostability. Photoprotection was evaluated following international standards for SPF (ISO 24444:2019 Cosmetics - Sun Protection Test Methods - In Vivo Determination of The Sun Protection Factor), FP-UVA (ISO 24443:2012 Determination of Sunscreen UVA Photoprotection In Vitro), water resistance (COLIPA - Guidelines for Evaluating Sun Product Water Resistance, Dec 2005) and visible light. Sensory perception studies were also performed to understand the benefits of using sunscreens in stick format. The main parameters evaluated are listed in Table I.

Image 1. Illustrative image of a solid sunscreen vehicle

Parameters Evaluated
Wax
Pigments (FeO_2)
Melting Point
Dispersion of Active Ingredients
Photostability
SPF
UVA
Visible Light
Water Resistence
Sensory Perception

Table I. Parameters evaluated in the development of photoprotectors in solid vehicles.

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RESULTS

The solid sunscreens developed with the different waxes presented distinct physical and chemical characteristics, but all allowed the homogeneous distribution of the sunscreens, which also provided a homogeneous distribution under the skin, resulting in more uniform and effective sun protection. Solid vehicles release the active ingredient into the skin through pressure on them and not through skin temperature, since the melting point obtained is above 50 degrees Celsius. High concentrations of FeO_2 pigment were included, maintaining the stability of the formulas.

The different vehicles allowed different filter combinations, which resulted in high SPF values, UVA greater than 1/3 of the SPF and high-water resistance (Table II).

SPF	FP-UVA	Water Resistence
85	38	high resistance
70	29	high resistance
59	21	resistence
55	19	high resistance

Table II. FPS, FP-UVA and water resistance results of the 4 products developed.

The formulas developed were stable and photostable. In the development of the manufacturing process, the parameters to be monitored include melting point, rheology, filling and cooling temperature, filling and packaging speed.

Studies on the perception of effectiveness have demonstrated different benefits of sunscreens in solid form, highlighting easy application, portability, does not run into the eyes, high water resistance, very high coverage of imperfections, sensorially suitable for different skin types.

DISCUSSIONS

This study presents the benefits of using sunscreen in solid vehicles based on candelilla wax, microcrystalline wax and silicone, with interesting values of protection against UVB, UVA and visible light, being able to adapt to different skin types and with adequate sensory. In tinted sunscreens containing FeO_2 pigments, the technologies developed have allowed the inclusion of high pigment concentrations, which provide high protection against visible light and high coverage of imperfections. In addition, this study demonstrates the importance of physical-chemical monitoring of solid sunscreens during all manufacturing stages.

CONCLUSIONS

The results provided important information on the use of sunscreens in solid form and can be used to prove the benefits of applying this pharmaceutical form in cosmetics.

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