HOW SYNERGISTIC PROPERTIES OF COSMETIC EMOLLIENTS IMPROVE SPF AND TEXTURE IN SUNCARE PRODUCTS

“Sensory and functional performance for truly pleasurable suncare products”

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Esters are ideal ingredients for reaching the current trend for multitasking products. Due to their great versatility, they can be used to solubilize UV sunscreens and organic pigments, disperse pigments, adjust spreading properties, provide various functional benefits and give the products unique and sophisticated sensory properties.

We have investigated the properties of these esters in order to anticipate their functional efficiency, optimize their use by formulators and demonstrate their added-value in cosmetic applications.

An illustration with a suncare application is given.

Introduction

Like an “addictive” elixir, the use of a sun cream becomes an integral part of a polysensory experience.

The galenic development of the ideal suncare product is based on a formulation that includes an oil phase optimized by a selection of emollient esters. These esters:
– Improve the product’s sensory properties and spreadability, resulting in a more even distribution of sunscreens on the skin,
– Improve the solubilization of the sunscreens, which in turn improves absorbance of the UV radiations, while meeting all regulatory requirements.

The spreadability of a cosmetic ingredient is defined by the speed at which it can cover a given surface of skin¹².

For this first formulation approach, we will choose the emollients that produce the best results in terms of spreadability as well as a dry and light, sensorial finish.

For this study, we will focus on the technical aspects of how esters behave in interaction with sunscreens, given that their spreadability and sensory properties have already been characterized⁴.

Nowadays’ sunscreens are increasingly effective against the harmful effects of sunlight. Although most of the dangerous solar radiations are blocked by the Earth’s atmosphere, some of them do reach the surface of the skin. The wavelengths of these rays are measured in nanometers (nm). UV-B rays are the shortest, with wavelengths between 280 and 315 nm, while UV-A rays range from 315 to 400 nm.

Consequently, the choice of the oil phase for a suncare formulation requires the optimized solubilization of sunscreens that are specific to each type of solar radiation, coupled with spectrophotometric measurements of absorbance.

A study was led on a selection of chemical UV filters solubilized by various emollients in order to compare their solubilizing ability, to measure their absorbance and to quantify the SPFs of the resulting cosmetic suncare formulations using UV spectrophotometry.

All of these factors were used to determine the best solubilizing agent, in terms of absorbance and in term of SPF booster effect.

¹ Zeidler
² Savary2013
³ “Sensorial Esters” IFSCC 2014
⁴ Patent, DUB SYNERSOL (FR 1.263.406)
Equipment & Methods

Solubilization of UV filters by emollients

- A total of 21 cosmetic emollients were selected and characterized:

Method:
- Selection of 4 UV filters available on the market (Avobenzone, Octyltriazone, Bemotrizinol, Oxybenzone).
- Selection of 21 emollients known for their solubilizing and emollient effect.

Protocol:
A UV filter is solubilized with a given emollient: 1% filter mixed with the emollient at 90°C, then stored at 4°C for 24 hours.
- If recrystallization is observed, the maximum incorporation of that filter into the emollient has been reached.
- If there is no recrystallization, an additional 1% of the filter is mixed at 90°C, and the sample is stored at 4°C. This process is repeated until crystallization is observed.

Equipment:
- Magnetic stirrer
- Heating plate
- Spectrophotometer

Solubilization of UV filters and absorbance

- The 4 best solubilizing agents from the previous protocol are combined with UV filters in order to measure their absorbance. Correlation between good solubilizing power and good absorbance.

Protocol:
Solubilization of 1% of each UV filter (Avobenzone, Octyltriazone, Bemotrizinol, Oxybenzone).
Each resulting solution is measured by spectrophotometry.

Tests on a cosmetic formulation with in vitro SPF measurement:

- Combination of the 4 best solubilizing agents in formulation vs. emollients known to the formulator.

Protocol:
- A medium SPF formulation is produced with and without a blend of the 4 selected emollients and its SPF is measured by spectrophotometry.
- Test of photostability with Avobenzone and the 4 best solubilizers and the blend obtained. Test done by a SUNTEST ATLAS CPS + Irradiation 65 w/m² with Xenon Lamp of 300 to 700 nm.
Tests made at wavelengths range 400 to 290 nm.

Results

Solubilization

- 4 UV Filters tested with 21 different solubilizers (Esters and benchmark molecules).
- 4 esters are the best solubilizers : DUB DIS – DUB DIPA - DUB ZENOAT - DUB B1215

Absorbance

Absorbance curve obtained with a given UV filter and results for each of the 4 best solubilizers.

Ester ranking

<table>
<thead>
<tr>
<th>Ester</th>
<th>Absorbance (UA)</th>
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<tbody>
<tr>
<td>DUB B12-15</td>
<td>OXYBENZONE</td>
</tr>
<tr>
<td>DUB B12-15</td>
<td>OCTYLTRIAZONE</td>
</tr>
<tr>
<td>DUB B12-15</td>
<td>BEMOTRIZINOL</td>
</tr>
<tr>
<td>DUB B12-15</td>
<td>AVOBENZONE</td>
</tr>
</tbody>
</table>

Wavelength (nm)

Absorbance (UA)
Our ester blend is especially well-suited for formulations that provide solar protection, offering both effectiveness and sensory quality. In combination with other esters, it makes it possible to increase the SPF without increasing the concentration of UV filters.

**Photostability**

Photostability of Avobenzone increase by the use of the blend of our 4 esters especially DUB DIPA.

**Conclusion**

The technical quality of a cosmetic texture is a key factor for success on today’s market. All suncare formulators strive to achieve an ideal combination of pleasurable sensations in application, proven effectiveness and a totally natural feel on the skin. Our blend of emollient esters presented in this study meets this challenge by offering a multifunctional solution adapted to the current trends in formulation.

This study enables the characterization of emollients as solubilizing agents for UV filters.

Esters stand out as the best solubilizers for UV filters due to their multifunctional characteristics and excellent absorbance combined with UV Filters. In a cosmetic formulation, they deliver a combination of sensory qualities plus effectiveness as solubilizing agents and SPF booster effect.

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**Why should esters be used in Suncare Formulation**

**The precise characterization of esters**

Due to their *multifunctional nature* (emollience, sensory, properties, texture, etc.), emollients are key ingredients in cosmetic formulations.

Thus it very important to match the properties of the emollient(s) with characteristics of the final formula.

To this end, a strong knowledge of the emollients’ properties and behavior in formulation is a must.

This knowledge must be based on physicochemical characterization and sensory analysis.

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**Expert in the precise characterization of esters**

Our studies have revealed the relationship between the esters’ chemical and structural characteristics and their physicochemical properties, results corroborated by bibliographic data, making it possible to:

- Offer emollient blends that enable new sensory properties based on synergies or cascade effects,
- Envision combinations with other cosmetic ingredients, and especially Suncare Combination

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*A visionary partner: multifunctional esters, optimized formulation*

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**A scientific coaching...**