The ultimate solution for an ideal non-chemical sunscreen: "A novel spherical zinc oxide renders unsurpassed transparency and texture"

Poster ID: 365

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Introduction

Many organic materials are used as UV filters in the sunscreen products currently on the market, but there are concerns about the safety of such materials in the human body[1] and their adverse effects on the marine environment[2]. Hence, the demand for inorganic materials such as zinc oxide and titanium dioxide has been increasing in recent years. However, non-chemical sunscreens that use only inorganic materials as UV filters have issues with unsatisfactory transparency and texture[3], and one cannot say that they are fully satisfying consumers. To solve these problems and to achieve an ideal non-chemical sunscreen, we developed spherical zinc oxide "S-ZnO" with super-dispersibility.

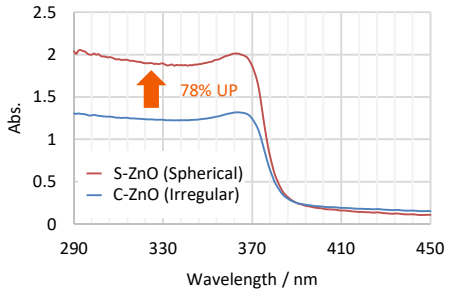
Conclusions

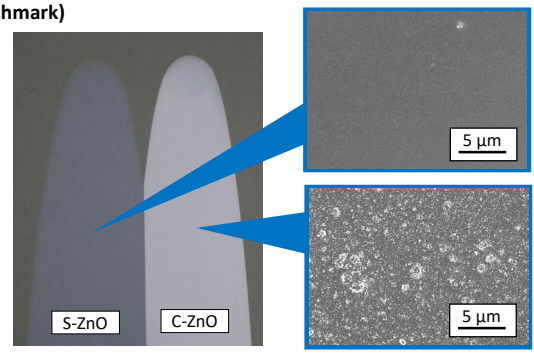
➢S-ZnO improves excellent dispersibility in oil, solves the issues of transparency and texture, and achieves an ideal non-chemical sunscreen.

➢S-ZnO can be dispersed in any dispersion equipment, and even a short dispersion time provides a high UV-protection effect; therefore, it is an eco-friendly raw material that can reduce energy costs. In addition, S-ZnO provides the highest transparency and naturalness for all skin tones, and will enable new possibilities for the development of higher-quality cosmetics, as well as contribute to the achievement of many SDGs.

Results & Discussion

Evaluation of W/O emulsion of S-ZnO and C-ZnO (Benchmark)

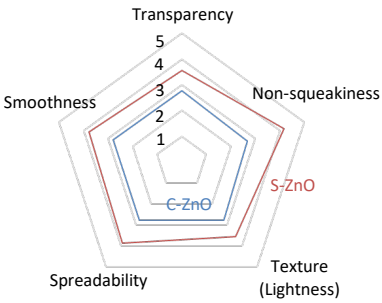


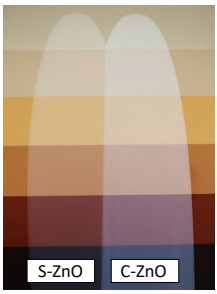


The absorbance curves show that in the UVB-UVA region, the absorbance of the S-ZnO W/O emulsion was better by up to 78% compared to that of C-ZnO, confirming a high UV-protection effect. The transparency of the W/O emulsion with S-ZnO was much higher than that with C-ZnO because of both the smaller aggregated particle size[4] of S-ZnO and the higher smoothness of the coating film.

Evaluation of W/O formulation of S-ZnO achieving global regulation (SPF > 50, UVAPF > 16, CW > 370)

Ingredients		S-ZnO W/O [%]	C-ZnO W/O [%]
S-ZnO		**20**	-
C-ZnO		-	**25**
Titanium dioxide treated with Aluminum Hydroxide and Stearic Acid		5	5
Others		75	70
in vitro	SPF	> 50	> 50
	UVAPF	> 16	> 16
	CW [nm]	> 370	> 370



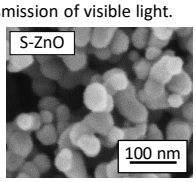


The amount of inorganic material required to achive global regulation for S-ZnO was 25.0%, whereas 30.0% was required for C-ZnO. In other words, the amount of inorganic material blended with S-ZnO was successfully reduced by 16.7% compared with that for C-ZnO. As a result of usability evaluation, the S-ZnO W/O emulsion was found to be superior to the C-ZnO emulsion in all the items due to the lower amount of inorganic ingredients used. Furthermore, it is apparent that the C-ZnO emulsions look conspicuously white on any skin tones, the S-ZnO counterparts blend in naturally regardless of the skin tone.

Materials & Methods

The primary particle size of S-ZnO was adjusted to 40 nm to protect from a wide range of wavelengths, from UVB to UVA, and to allow excellent transmission of visible light.

Triethoxycaprylylsilane was selected as the lipophilic treatment agent to achieve high dispersion in any oil used in cosmetics. Conventional zinc oxide (C-ZnO; irregular shape) with a primary particle size of 35 nm was selected as a benchmark product and prepared using the same treatment agent and process.



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