

Development of O/W mineral sunscreen with high UV protection ability using new zinc oxide suppressing zinc ion elution

(We were selected as Top 10 finalist for the Applied Research Award at the 33rd Barcelona congress.)

At the IFSCC Congress 2023 held from September 4th to 7th, 2023, Tayca Co., Ltd. made a podium presentation about development of oil-in-water (O/W) mineral sunscreen with high UV protection ability that makes full use of formulation technology and raw material design technology. The IFSCC Congress is the world's largest international conference held once every year, and is a cutting-edge conference where cosmetic engineers from around the world present their latest research. This year's conference was a great success, with 76 podium presentations and 373 poster presentations. We made a podium presentation on the above theme and was selected as Top 10 finalist for the Applied Research Award at the 33rd Barcelona congress.

1. **Presentation title**

Oil-in-water mineral sunscreen with strong UV protection designed using formulation technology and raw material development

2. **Background**

Recently, the demand for oil-in-water (O/W) sunscreens with high ultraviolet (UV) radiation protection has increased. Similarly, the use of safe and low-environment-impact inorganic UV protection agents, such as titanium dioxide and zinc oxide, has drawn much attention in recent years. However, the development of O/W mineral sunscreens with high UV protection has been impeded by challenges in designing the formulations. Specifically, the instability of the formulations owing to the elution of zinc ions from zinc oxide over time.

To overcome the challenge, we developed a new zinc oxide that suppresses the elution of zinc ions. Furthermore, using this novel raw material, we designed an ideal O/W mineral sunscreen with high UV protection ability and high stability over time.

3. **Research content**

We found that the higher the hydrophobicity of the powder, the lower the number of zinc ions eluting and developed LE-ZnO (Low Elution-ZnO) with high hydrophobicity. We selected triethoxycaprylsilane (OTS) as surface treatment agent of LE-ZnO. OTS bonds with the surface hydroxyl groups of zinc oxide through hydrolysis and condensation. Therefore, to increase the reaction points between them, we synthesized a zinc oxide base material to increase the surface hydroxyl groups using our original particle synthesis technology. (Fig.1) As a results, we confirmed that LE-ZnO using new zinc oxide base material, has higher hydrophobicity than conventional ZnO, and the number of zinc ions elution is reduced. Also, Formulation containing LE-ZnO had high stability over time because it did not change after two months at 50 degrees and had an in vivo SPF of 54, UVAPF of 21, having an extremely high UV

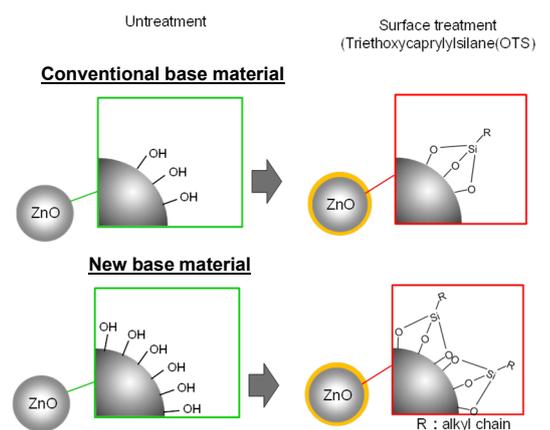


Fig. 1 Approach to increase hydrophobicity

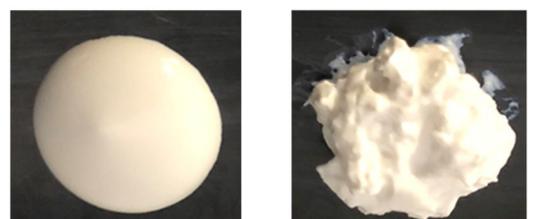


Fig. 2 External appearance of O/W formulation after 2 months at 50°C
(Left) Formulation containing 15% of LE-ZnO
(Right) Formulation containing 15% of Conventional ZnO

protection. The O/W mineral sunscreen we developed presents new possibilities for the cosmetic market /and contributes significantly to reduce the burden on human skin.

Presenter profile

Isao Shimizu



TAYCA CORPORATION

OKAYAMA Research laboratory 4th section

– Biography –

2015 Completed, Department of Applied Science, Graduate School of Engineering, Hiroshima University

Joined TAYCA corporation and was assigned to the 4th section of the Okayama Research laboratory.

Specializes in the development of base materials and surface treatments for inorganic UV scattering agents.

2 years from 2018 to 2020, he has been engaged in sunscreen formulation development at our Tokyo Creation Laboratory.