Z-COTE® Simple
for convenient, non-nano ZnO formulations

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Organic UV filters squeezed in the US, opens door for ZnO

FDA Tentative Final Monograph (issued 2/19)

- ZnO (non-nano and nano GRASE)
- All organic UV filters categorized as Category III (insufficient data to label as Category I (safe and effective) or Category II (not safe or not effective))

Hawaii bans Oxybenzone and Octinoxate (Uvinul MC 80) (takes effect 1/21)

- Key West adopted similar legislation taking effect 1/21. State of Florida considering legislation taking effect 7/1/19. Other areas are considering adopting similar legislation.
- 65% of all SPF formulations affected*

Source: *Happi June 2018, FDA.gov
Consumer market drivers – increase use of ZnO

- ZnO interest growing due to consumer need for natural and mild products
  - ZnO has a natural perception
  - ZnO has a skin protectant perception

765 new skin care product launches with ZnO in the last 5 years, 713 (93%) were in sun care.

553 launches with OMC. Its use is expected to decline. (161 (29%) used in sun care.)

Source: Mintel 2-19
## BASF ZnO Filters
### Broadspectrum (UVA/UVB)

<table>
<thead>
<tr>
<th>Product</th>
<th>INCI name</th>
<th>Form</th>
<th>Chemical (Crystalline) Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-COTE® HP1</td>
<td>Zinc Oxide, Triethoxycaprylsilane (nano)</td>
<td>Powder</td>
<td>&gt; 96% wurtzite crystalline structure</td>
</tr>
<tr>
<td>Z-COTE®</td>
<td>Zinc Oxide (nano)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z-COTE® LSA</td>
<td>Zinc Oxide (and) Triethoxycaprylsilane (non-nano)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z-COTE® LSA-UC</td>
<td>Zinc Oxide (non-nano)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z-COTE® Simple</td>
<td>Zinc Oxide (and) Caprylic/Capric Triglyceride (and) Triethoxycaprylsilane, Polyhydroxystearic Acid (non-nano)</td>
<td>Pourable dispersion</td>
<td></td>
</tr>
</tbody>
</table>

- Compatible with organic UV filters
- Available for water (uncoated) and oil (coated) phase of the formulations

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*H. Morkoç, Ü. Özgür, Zinc Oxide: Fundamentals, Materials and Device Technology, 2009 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim*
New! Z-COTE® Simple
Broad-spectrum, non-nano Zinc Oxide dispersion for convenient sun care formulation

Z-COTE® Simple is an inorganic, broad-spectrum UV filter with excellent photo-stability. Its physical characteristics support elegant, low-whitening and mild formulations, and it is applicable for baby care. Its long extension into UVA makes it ideal for long wavelength protection. As a pourable, dispersed version of ZnO, it affords formulation ease and may help to reduce manufacturing time.

- Broad-spectrum inorganic UV filter
- Non-nano (>100 nm) yet low whitening on all skin types
- High active content dispersion (70%)
- Critical Wavelength of 375 nm
- Highly photo-stable
- Applicable for baby care sunscreens
- Synergistic with non-organic and organic UV filters
- Convenient, quick and easy to use - pourable
- Provides excellent sensorial benefits
- **Why use a dispersion?**
  - Dispersion version is easy to use, may reduce manufacturing time and is optimized for performance. Pre-dispersed version may provide consistent, higher performance than dispersion made in-situ during manufacturing.*

*Source: Industry expert

25 ul each product, applied in a 4cm x 4cm square, rubbed in with 25 circles using a finger cot and allowed to dry for 5 minutes
Z-COTE® Simple process differentiators while being environmentally friendly

- Clean production process, with less than 2% waste product
- No water consumed in production of the product
- Achieve tight control of particle size
- Made under cGMP in a FDA registered production facility
- Proprietary dispersion method enables high solids pourable dispersion
Technical Info

- INCI designation
  - Zinc Oxide (and) Caprylic/Capric Triglyceride (and) Polyhydroxystearic Acid (and) Triethoxycaprylylsilane

- Appearance
  - Off-white pourable liquid

- Application areas
  - Sun Care
  - Skin care / face care / body care
  - Baby care
  - Color cosmetics

Condensed Specifications
- Wt. % ZnO actives: 69/- 3%*
- Transmittance > 25%
- Viscosity (@25 C): ≤ 30000 cP
- Density: 2.3 ± 0.3 g/cc
- Uncoated ZnO Feed: Meets USP tests
- Particle size: > 100 Microns

* Comparable to industry benchmarks
Formulation performance comparison to industry benchmarks

UVA absorbance via FDA 2011 method (in formulation)*:

Incorporation in formulation
Color was similar to Benchmark A and better than Benchmark B

Stability in formulation is excellent. Note Benchmark B showed separation after 1 day stability testing and added yellowness to the formulation.

Application in
Z-COTE® Simple was esthetically the best to apply and with good application time.**

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*SPF 50 Formulation
**In-house expert opinion
Protect-n-Go Sunscreen Lotion SPF 30* (UV-US-18-35513-29) and 50* (UV-US-18-35513-54)

Protect-n-Go Sunscreen is an emollient, non-greasy broad-spectrum (UVA/UVB) sunscreen that applies and dries quickly on the skin. This formulation features Z-COTE® Simple zinc oxide dispersion which has low whitening properties and is virtually transparent on all skin types. It can be used for the beach or daily wear products.

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>INCI (USAN)</th>
<th>SPF 50 % W/W</th>
<th>SPF 30 % W/W</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dehymuls™ PGPH</td>
<td>Polyglyceryl-2 Dipolyhydroxystearate</td>
<td>5.00</td>
<td>3.50</td>
<td>Emulsifier (W/O)</td>
</tr>
<tr>
<td>Lameform® TGI</td>
<td>Polyglyceryl-3 Disostearate</td>
<td>3.00</td>
<td>2.00</td>
<td>Emulsifier (W/O)</td>
</tr>
<tr>
<td>Z-COTE® Simple</td>
<td>Zinc Oxide (and) Caprylic/Capric Triglyceride (and) Polyhydroxystearic Acid (and) Triethoxycaprylylsilane</td>
<td>14.50</td>
<td>14.50</td>
<td>Broad spectrum UV filter</td>
</tr>
<tr>
<td>UV Cut TiO2-60-VL</td>
<td>Titanium Dioxide (and) Coconut Alkanes (and) Stearic Acid (and) Polyhydroxystearic Acid (and) Alumina (and) Coco-Caprylate/Caprate</td>
<td>3.34</td>
<td>8.34</td>
<td>Broad spectrum UV filter</td>
</tr>
<tr>
<td>Neo Heliopan HMS</td>
<td>Homosalate</td>
<td>10.00</td>
<td></td>
<td>UV-B filter</td>
</tr>
<tr>
<td>Neo Heliopan OS</td>
<td>Ethylhexyl Salicylate (Octisalate)</td>
<td>5.00</td>
<td></td>
<td>UV-B filter</td>
</tr>
<tr>
<td>Cetiol® Ultimate</td>
<td>Undecane (and) Tridecane</td>
<td>7.00</td>
<td></td>
<td>Emollient</td>
</tr>
<tr>
<td>Lanete® 18</td>
<td>Stearyl Alcohol</td>
<td>1.00</td>
<td></td>
<td>Consistency agent</td>
</tr>
<tr>
<td>Myritol® 331</td>
<td>Cocoglycerides</td>
<td>17.77</td>
<td></td>
<td>Emollient</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water, demineralized</td>
<td>Water</td>
<td>45.28</td>
<td>47.99</td>
<td></td>
</tr>
<tr>
<td>Glycerin</td>
<td>Glycerin</td>
<td>3.00</td>
<td>3.00</td>
<td>Humectant</td>
</tr>
<tr>
<td>Sodium Chloride</td>
<td>Sodium Chloride</td>
<td>0.50</td>
<td>0.50</td>
<td>Stabilizer</td>
</tr>
<tr>
<td>Magnesium Sulfate</td>
<td>Magnesium Sulfate</td>
<td>0.40</td>
<td>0.40</td>
<td>Stabilizer</td>
</tr>
<tr>
<td>Euxyl PE 9010</td>
<td>Phenoxyethanol, Ethylhexylglycerin</td>
<td>1.00</td>
<td>1.00</td>
<td>Preservative</td>
</tr>
<tr>
<td>Sensiva PA 40</td>
<td>Phenylpropanol (and) Propanediol (and) Caprylyl Glycol (and) Tocopherol</td>
<td>1.00</td>
<td>1.00</td>
<td>Auxiliary preservative</td>
</tr>
</tbody>
</table>

*Theoretical value
Smooth-Smack Lip Balm (SPF 15*) (UV-US-18-35513-39)

Smooth-Smack lip balm is an elegant lip sunscreen that promotes smooth application and leaves a non-heavy coating. This formulation features Z-COTE Simple zinc oxide dispersion which has low whitening properties and is virtually transparent on all skin types. Smooth-smack lip balm helps keep lips feeling emollient yet has broad-spectrum UV protection.

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>INCI (USAN)</th>
<th>% W/W</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Z-COTE® Simple</td>
<td>Zinc Oxide (and) Caprylic/Capric Triglyceride (and) Polyhydroxystearic Acid (and) Triethoxycaprylylsilane Homosalate</td>
<td>7.15</td>
<td>Broad-spectrum UV filter</td>
</tr>
<tr>
<td>Neo Heliopan HMS (Symrise)</td>
<td>Homosalate</td>
<td>10.00</td>
<td>UVB filter</td>
</tr>
<tr>
<td>Myritol® 331</td>
<td>Cocoglycerides</td>
<td>40.25</td>
<td>Emollient</td>
</tr>
<tr>
<td>Lameform® TGI</td>
<td>Polyglyceryl-3 Diisostearate</td>
<td>6.00</td>
<td>Emollient</td>
</tr>
<tr>
<td>Cetiol® CC</td>
<td>Dicapryl Carbonate</td>
<td>3.00</td>
<td>Emollient</td>
</tr>
<tr>
<td>Cosmedia® DC</td>
<td>Hydrogenated Dimer Dilinoleyl/Dimethylcarbonate Copolymer</td>
<td>1.35</td>
<td>Film former</td>
</tr>
<tr>
<td>Cosmedia® Gel CC</td>
<td>Dicapryl Carbonate (and) Stearalkonium Hecotriet (and) Propylene Carbonate (and) Ethylhexylglycerin (and) Tocopheryl Acetate</td>
<td>3.00</td>
<td>Forming agent</td>
</tr>
<tr>
<td>Sensiva SC 50 (Schülke)</td>
<td>Ethylhexylglycerin</td>
<td>0.25</td>
<td>Auxiliary</td>
</tr>
<tr>
<td>Vitamin E-Acetate Care</td>
<td>Tocopherol Acetate</td>
<td>1.00</td>
<td>Antioxidant</td>
</tr>
<tr>
<td>MSS-500 (Kobo)</td>
<td>Silica</td>
<td>1.00</td>
<td>Skin feel modifier</td>
</tr>
<tr>
<td>B Cutina® PES (Kobo)</td>
<td>Pentaerythrityl Distearate</td>
<td>6.00</td>
<td>Skin feel modifier</td>
</tr>
<tr>
<td>Cetiol® SB 45</td>
<td>Butyrospermum Parkii (Shea) Butter</td>
<td>4.00</td>
<td>Emollient</td>
</tr>
<tr>
<td>Ozokerite Wax White SP 273P (Strahl &amp; Pitsch)</td>
<td>Ozokerite</td>
<td>5.00</td>
<td>Structurant</td>
</tr>
<tr>
<td>Cegesoft(TM) HF 62</td>
<td>Hydrogenated Vegetable Oil</td>
<td>6.00</td>
<td>Consistency agent</td>
</tr>
<tr>
<td>Candelilla Wax</td>
<td>Euphorbia Cerifera (Candelilla) Wax</td>
<td>6.00</td>
<td>Structurant</td>
</tr>
</tbody>
</table>

*Theoretical value
Formulation guidelines

- Can be added to oil phase of the preparation
- Should be kept at pH>7
- Should not be used with cationic ingredients
- Should not be used with acrylates
- Approved up to 25% in most countries including the US, check with your local regulatory authorities
Summary

- Consumer, regulatory, and formulation dynamics are changing in the US where organic UV filters are being squeezed and interest is increasing in Zinc Oxide.

- BASF has a new offering, Z-COTE® Simple.
  - an excellent choice for your UV filter needs.
  - It has many features/benefits including broad-spectrum protection into the longer UVA region.

- Z-COTE® Simple offers convenience, good efficacy, and may be used in a variety of applications.
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