

# Zemea® Propanediol in Sunscreen Applications



**Performance is in our nature.**

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# Zemea® Propanediol in Broad Spectrum Protection Daily Facial Moisturizers

# Introduction

- Further need than just occasional sunburn protection product
- Every day, broad spectrum UV protection keeps skin youthful and healthy
- Growing concerns regarding effectiveness, safety, and aesthetics of active ingredients used in sunscreen applications
- Evaluation of underutilized Category 1 actives

# Actives

| Active                            | Type  | Performance   | Other   |
|-----------------------------------|---|---|---|
| Ensulizole                        | Organic,<br>water-soluble<br>UVB filter                     | Crystalline solid and<br>loses effectiveness if too<br>much solvent is lost | Mode of action is<br>absorption   |
| Sulisobenzone<br>(Benzophenone-4) | Organic,<br>water-soluble<br>UVB and UVA<br>(UVA-II) filter | Crystalline solid and<br>loses effectiveness if too<br>much solvent is lost | Needs combination<br>of UVA absorber to<br>attain broad<br>spectrum<br>protection |

# Zemea® Propanediol an Effective Solvent

- Ensulizole and sulisobenzone are utilized globally, but concerns exist around their effectiveness as they return to their crystalline state as they fall out of solution
- Multiple studies simulating an aqueous phase were completed:
  1. An aqueous phase of 4% ensulizole and Zemea® propanediol at 10% showed that solubility can be maintained when 75% of the water in the aqueous phase has evaporated
  2. An aqueous phase of 10% sulisobenzone and 10% Zemea® propanediol showed that solubility can be maintained when 75% of the water in the aqueous phase has evaporated
- Zemea® propanediol is an essential ingredient for these actives successfully keeping them in solution leading to greater efficacy for both

# O/W Broad Spectrum Daily Facial Moisturizer

| Phase | Ingredient          | INCI Name  | Supplier                        | Function          | Wt.%    |
|-------|---------------------|--|---------------------------------|-------------------|---------|
| A     | Water               | Water  | -                               | -                 | 45.00%  |
|       | Zemea® propanediol  | Propanediol  | DuPont Tate & Lyle Bio Products | Sunscreen Solvent | 10.00%  |
|       | NaOH (10% solution) | Sodium Hydroxide   | -                               | -                 | 5.00%   |
|       | Eusolex® 232        | Ensulizole   | EMD                             | Active            | 4.00%   |
|       | KerrPoly GA         | Acacia Senegal Gum   | Kerry                           | Thickener         | 1.50%   |
| B     | Solaveil™ AT-300    | Caprylic/Capric Triglyceride (and) Titanium Dioxide (and) Polyhydroxystearic Acid (and) Stearic Acid (and) Alumina | Croda                           | Active            | 15.00%  |
|       | KerrSoft AVG        | Acetylated Hydrogenated Vegetable Glyceride  | Kerry                           | Emollient         | 10.00%  |
|       | KerrEmul GSSL       | Glyceryl Stearate (and) Sodium Stearoyl Lactylate  | Kerry                           | Emulsifier        | 5.00%   |
|       | CosmoSurf® CE-140   | Stearyl/Octyldodecyl Citrate Crosspolymer  | SurfaTech                       | Emollient         | 2.00%   |
| C     | Structure® ZEA      | Hydroxypropyl Starch Phosphate   | AkzoNobel                       | Thickener         | 2.00%   |
|       | Phenonip™           | Phenoxyethanol (and) Methylparaben (and) Ethylparaben (and) Butylparaben (and) Propylparaben (and) Isobutylparaben | Clariant                        | Preservative      | 0.50%   |
| Total |                     |  |                                 |                   | 100.00% |

## Procedure:

- Mix phase A and heat to 70°C
- Mix phase B and heat to 70°C.
- Add phase B to phase A with propeller stirring.
- Homogenize at 40°C.
- Add phase C with propeller mixing when below 40°C.

# W/O Broad Spectrum Daily Facial Moisturizer

| Phase | Ingredient         | INCI Name  | Supplier                        | Function          | Wt.%    |
|-------|--------------------|--|---------------------------------|-------------------|---------|
| A     | Water              | Water  | -                               | -                 | 39.80%  |
|       | Zemea® propanediol | Propanediol  | DuPont Tate & Lyle Bio Products | Sunscreen Solvent | 10.00%  |
|       | Benzophenone-4 USP | Sulisobenzone (Benzophenone-4)                                       | SandreamImpact                  | Active            | 10.00%  |
| B     | SF 1202            | Cyclopentasiloxane   | Momentive                       | Emollient         | 15.00%  |
|       | Crodamol™ AB       | C12-15 Benzoate  | Croda                           | Emollient         | 10.00%  |
|       | Zano® 10 Plus      | Zinc Oxide (and) Triethoxycaprylylsilane                             | Ultra/Umicore                   | Active            | 10.00%  |
|       | Silube® 316        | Lauryl, bis-hydroxymethyl butyl propyl ether, dimethicone (proposed) | Siltech                         | Emulsifier        | 5.00%   |
| C     | Cab-O-Sil® TS-610  | Silica Dimethyl Silylate   | Cabot                           | Thickener         | 0.20%   |
| Total |                    |  |                                 |                   | 100.00% |

## Procedure:

1. Mix phase A until clear and uniform.
2. Mix phase B with propeller stirring until uniform.
3. Slowly add phase A to phase B with fast propeller stirring.
4. Add phase C with propeller stirring.
5. Homogenize until glossy.

# Protection

- Combining organic and inorganic sunscreens yield SPF's that are higher
- O/W formulation containing ensulizole and titanium dioxide had an in-vitro SPF of just above 15 and critical wavelength of 373nm
- W/O formulation containing sulisobenzone and zinc oxide was heavily biased toward UVA protection, with an in-vitro SPF of around 15 and a critical wavelength of 377nm





# Resistance

- When formulating with water-soluble organic actives, there is a concern they will wash off the skin becoming ineffective
- O/W formulation uses Cosmosurf® CE-140, a Zemea® propanediol-based, water-resistance agent to protect against wash off
- W/O emulsions have inherent water resistance; however, the W/O formulation uses a PEG-free emulsifier and modified silica to further enhance the water resistance, build thickness of the film on the skin, and provide a powdery dry feeling when applied

# Aesthetics

- Customers searching for products that look, feel, and keep skin moisturized
- Inorganic actives can make the skin look pasty
- Addition of water-soluble organic actives that have a larger particle size in the emollient phase can yield products that have lower whitening for a given SPF
- Zemea® propanediol in both formulations help build moisturization and provide additional benefits including lack of skin irritation and excellent sensory characteristic.

# Conclusion

| Zemea® Propanediol  | Confirmed  |
|---|--|
| <p>Zemea® is a high performing solvent keeping ensulizole and sulisobenzone in solution through evaporation boosting their efficacy</p>                               |   |
| <p>Zemea® improves aesthetics of formulation, specifically daily facial moisturizer (non-irritating, increased moisturization, excellent sensory characteristics)</p> |  |