“Sensory, Rheology and Microstructure: Designing Winning Products”

Maria Pedreca – Sr. Researcher for Personal Care
Nov. 2014
Agenda

- Oxiteno’s Introduction
- Emollients Introduction
- Oxismooth Line
- Applications
- Suggested Formulations
- Conclusions
Oxiteno’s Introduction
Oxiteno

- Brazilian multinational part of the Ultra Group
- Leading producer of surfactants in Latin America
- Integration of the main raw materials (Ethylene Oxide and Natural Fatty Alcohols)
- Continuous Innovation (R&D Facilities in Brazil, Mexico, Uruguay, USA and Venezuela)
  10% of the total employees.
Oxiteno around the world

GLOBAL SERVICE OUT OF:

12 Industrial Units

5 R&D Facilities

COMMERCIAL PRESENCE

9 commercial offices worldwide

Oxiteno
around the world

USA

MEXICO

Guadalajara
San Juan Del Rio
Coatzacoalcos
Pasadena

VENEZUELA

Santa Rita
Caracas

BRAZIL

Camaçari
Tremembé

URUGUAY

Montevideo
Triunfo

PERSONAL CARE

HOME CARE AND I&I
Oxiteno: an Ultrapar Company

BOVESPA (UGPA3)

NET REVENUE
(US$ - billion)

2010  1,2

2011  1,4

2012  1,5

2013  1,5

2010  24.1

2011  29.1

2012  27.6

NYSE (UGP)
R&D Capabilities

Our Team & Goals

- PhDs and Masters with over 20 years of experience in formulation
- Fully focused on generating sustainable, high performing solutions
- Driven by consumer experience and claims generation and support
- Unique expertise in surfactants & solvents

Our Core Capabilities

- Formulation and Application
- Organic Synthesis
- Colloids & Surfactants Chemistry and Performance
- Data Handling & Modeling
HPC Innovation Platforms

INNOVATION PLATFORMS

Sensory & Rheology
- Fragrance release (blooming & long lasting)
- Rheology manipulation
- Effective delivery (systems that help your formulation)

Superior Performance
- Superior cleansing
- Mildness
- Dirt & stain removal
- Surfactant/enzyme balance

Smart Formulation
- Formats conversion
- Ease of use
- Anti-bacterial
- Surfactant/polymer interaction

Sustainability
- Concentrated
- Fast rinsing solutions
- Less usage of water
- Free of...
Emollients
Emollients

- From Latin *emolliere* = “to soften“
- To soften the skin
- To entrap the natural moisture into the skin
- To solubilize UV filters in case of sun care formulations
- To conditionate the hair
- To improve the texture of the final product

*Source: Euromonitor*
Emollients - Highlights

- Growth in natural ingredients
- Going green
- Petroleum based ingredients dominate the market
- Moisturizing for all
- More than just the basic
- To improve the texture of the final product

Source: Euromonitor
Oxismooth Line
### Oxismooth Line

<table>
<thead>
<tr>
<th>Emollient</th>
<th>Characteristics</th>
</tr>
</thead>
</table>
| **OXISMOOTHP CP** (Isoamyl Caprate-Caprylate) | ✓ Isoamyl alcohol (AIP – isopentyl alcohol) is a sugar cane derivative → alternative to isopropyl alcohol (a petrochemical derivative)  
✓ 100% from renewable sources  
✓ Branched alkyl chain → promote spreadability  
✓ Different fatty acids → different skin feel in use. |
| **OXISMOOTHC CO** (Isoamyl Cocoate)            |                                                                               |
| **OXISMOOTHC ST** (Isoamyl Stearate)          |                                                                               |

Oleochemical fatty acids + Isoamyl alcohol

A sugar cane derivative
Value chain involved in the natural emollients production

Sugar cane → Alcohol production → Fusel oil → Distillation → Isoamyl alcohol → Oxismooth™ → Personal care formulations

Vegetable oils → Oil chemical → Vegetable fatty acids
Skin Care Applications
Skin Care Formulations

Formulation: Processing & Ingredients
(Emollients, rheology modifiers, etc)

Structure of the Emulsion

- Stability
- Sensory & Rheological Properties
Skin Care Formulations

- Products using (OXISMOOTH line)
- Products using important market players worldwide (commercial products)
- Rheological measurements
- Sensory panel
Skin Care Formulations

Rheological data → Correlation → Sensory panel

Herschel-Bulkley model.

\[ \sigma = \sigma_0 + k\gamma^n \]

Where \( \sigma_0 \) is the yield stress, \( k \) is the consistency index and \( n \) is the flow index.
### Skin Care Formulations

<table>
<thead>
<tr>
<th>Samples</th>
<th>Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product 1 – Oxiteno</td>
<td>Oxismooth CO</td>
</tr>
<tr>
<td>Product 2 – Oxiteno</td>
<td>Oxismooth CO and CP</td>
</tr>
<tr>
<td>Product 3</td>
<td>Liquid Parafin</td>
</tr>
<tr>
<td>Product 4</td>
<td>Cyclopentasiloxane and Dimethicone</td>
</tr>
</tbody>
</table>

Analysis for Sensory and rheology to evaluate the attributes of spreadability, oil free and tacky free were made by comparing our Oxismooth line versus products known in the market.
The results show that for good spreadability sensory the product has to have low levels of consistency. In the case of flow index, the differences are not as noticeable for the sensory analysis. As we can see the Oxismooth line had a good performance.

The spreadability is given by the size of the circle. Larger bubbles, improved spreadability.
The results show that for the tacky free feel, the product must have low levels of consistency. In the case of flow index, the differences are not noticeable for the sensory analysis. As we can see the Oxismooth line had a good performance.

Tacky feel is given by the size of the circle. Smaller the bubbles, smaller the tacky feeling.
Rheological Results - oil feel

The feel oil free is given by the size of the circle. Smaller the bubbles, the smaller the oil free feeling.

The product must have low levels of consistency to delivery low free oil feel. In the case of flow index the differences are not noticeable for the sensory analysis. As we can see the Oxismooth line had a good performance.
Sun Care Applications
## UV Filters Solubilization

<table>
<thead>
<tr>
<th>UV Sunscreen/Emollient</th>
<th>Octocrylene (EU max. 10%)</th>
<th>Butyl Methoxydibenzoylmethane (EU max. 5%)</th>
<th>Homosalate (EU max. 10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral Oil</td>
<td>1</td>
<td>1</td>
<td>S</td>
</tr>
<tr>
<td>OXISMOOTHT ST</td>
<td>9</td>
<td>7</td>
<td>S</td>
</tr>
<tr>
<td>OXISMOOTHT CO</td>
<td>10</td>
<td>9</td>
<td>S</td>
</tr>
<tr>
<td>OXISMOOTHT CP</td>
<td>15</td>
<td>14</td>
<td>S</td>
</tr>
<tr>
<td>Isopropyl Palmitate</td>
<td>10</td>
<td>9</td>
<td>S</td>
</tr>
<tr>
<td>Isopropyl Myristate</td>
<td>10</td>
<td>10</td>
<td>S</td>
</tr>
<tr>
<td>C12:15 Alkyl Benzoate</td>
<td>14</td>
<td>12</td>
<td>S</td>
</tr>
</tbody>
</table>

Notes: Solubility expressed in % w/w; S = Soluble; I = Insoluble
UV Filters Solubilization

<table>
<thead>
<tr>
<th>Phase A</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Octocrylene (NH 303)</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Butyl Methoxydibenzoylmethane (NH 357)</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Diethylhexyl 2.6 Naphthalate (Corapan TQ)</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Homosalate (NH HMS)</td>
<td>9.5</td>
<td>9.5</td>
<td>9.5</td>
<td>9.5</td>
<td>9.5</td>
<td>9.5</td>
</tr>
<tr>
<td>Alkonat 1698</td>
<td>2.6</td>
<td>2.6</td>
<td>2.6</td>
<td>2.6</td>
<td>2.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Oxismooth CP</td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxismooth CO</td>
<td></td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxismooth ST</td>
<td></td>
<td></td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C12-C15 Alkyl Benzoate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase B</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>4.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenylbenzimidazole Sulfonic Acid (NH Hydro)</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Disodium Phenyl Dibenzimidazole Tetrasulfonate (NH AP)</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Sodium Hydroxide (50%)</td>
<td>1.9</td>
<td>1.9</td>
<td>1.9</td>
<td>1.9</td>
<td>1.9</td>
<td>1.9</td>
</tr>
<tr>
<td>Water</td>
<td>58.7</td>
<td>58.7</td>
<td>58.7</td>
<td>58.7</td>
<td>58.7</td>
<td>58.7</td>
</tr>
<tr>
<td>Glycerin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Carbomer</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Disodium EDTA</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase C</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DMDM Hydantoin</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Alkont EL 3645</td>
<td>2.8</td>
<td>2.8</td>
<td>2.8</td>
<td>2.8</td>
<td>2.8</td>
<td>2.8</td>
</tr>
<tr>
<td>Sodium Hydroxide (50%)</td>
<td>qs</td>
<td>qs</td>
<td>qs</td>
<td>qs</td>
<td>qs</td>
<td>qs</td>
</tr>
</tbody>
</table>

Expected SPF: 30. with 1/3 of UVA PF
UV Sunscreen Supplier: Symrise
UV Filters Solubilization

Spreadability ¹

1 = low spreadability; 5 = very high spreadability

Oily feel ²

1 = low oily feel; 5 = high oily feel

Tacky feel ³

1 = low tacky feel; 5 = high tacky feel
Suggested Formulations

- Body cream
- Sun care
- Body lotion
- Hair conditioner
- Liquid hand wash
- After shave balm
- Bath body oil
- Baby diaper rash cream
- Lip balm.
Conclusions

• The line was developed based on the Greenformance concept of Oxiteno, which associates the use of renewable resources, environmental care, health and wellness.

• Different chain sizes associated to their branch chain, offers a wide range of sensory feel (dry to oily) and spreadability.

• It is compatible to the cold and hot formulations.

• The line is indicated to Silicon replacement, sun filter solubilizer, Mineral Oil replacement, leaving the skin feeling smooth, soft and no-greasy touch.
Another option in our portfolio is........

Alkont EL 3645

**INCI name**: Sorbeth-450 Tristearate (and) Water (and) PEG-9 Cocoate (and) PEG-32 Distearate (and) PEG-175 Distearate.

- Multifunctional ingredient for Personal Care segment, made from two renewable resources: corn sugar and fatty acids;
- Indicated for the thickening of Personal Care formulations.;
- Differentiated attributes : sensory and moisturizing action;
- Preservative Free;
- Compatible with skin;
- Suitable for cold formulations.
Thank you

Maria Pedreca
Oxiteno - Global Innovation & Application
Senior Researcher for PC

maria.pedreca@oxiteno.com