Natural Emulsun®
Low-Cost PEG-Free Emulsifier

www.floratech.com
is a low-cost, versatile, sunflower-derived o/w emulsifier.

Benefits:
- Low cost
- PEG-free
- HLB independent
- Preservative free
- Biodegradable
- Easy to handle particles
- Low odor and color
- Oxidatively stable
- Sensory appeal
- Liquid crystal structure

Formulating:

How to Use: Add Emulsun® to the oil phase. Heat both the oil and aqueous phases to 75-80°C. Combine the oil and aqueous phases with moderate to rapid mixing or homomixing. Reduce mixing speeds at temperatures below 60°C. When adding other ingredients (e.g. fragrance, preservatives, etc.) below 40°C, disperse briefly with slow to moderate mixing, as over mixing may cause a loss of viscosity.

Ease of Addition: Emulsun is an easy to handle spherical particle. The free-flowing particles improve dosing precision from bench-top formulations to large-scale production lines. The Emulsun particle form also offers an increased surface area compared to flakes or pellets. This allows Emulsun to be efficiently melted and blended. This increases throughput, lowers heating requirements, and creates a greener production process.

Compatibility: Emulsun is compatible with natural and synthetic oils, esters, silicones, ethanol, sunscreens and thickeners.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Tested Constraints</th>
<th>Emulsun Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triglyceride Oils, Esters, Mineral Oil, Silicons</td>
<td>15 - 40% / 2 - 20%</td>
<td>2 - 8%</td>
</tr>
<tr>
<td>Organic UV Filters</td>
<td>up to 20%</td>
<td>3 - 7%</td>
</tr>
<tr>
<td>TiO₂, ZnO</td>
<td>up to 15 - 20%</td>
<td>4 - 7%</td>
</tr>
<tr>
<td>Ethanol</td>
<td>up to 10%</td>
<td>---</td>
</tr>
<tr>
<td>pH</td>
<td>4 - 11</td>
<td>---</td>
</tr>
<tr>
<td>Synthetic Gelling Agents, Hydroxyethylcellulose, Xanthan Gum</td>
<td>0.1 - 0.5%</td>
<td>1 - 4%</td>
</tr>
<tr>
<td>Menthol</td>
<td>up to 7% / up to 10%</td>
<td>---</td>
</tr>
</tbody>
</table>

1. >1% electrolytes may disturb the Emulsun emulsion system. A thickener is suggested.
2. With the use of a thickener (e.g. xanthan gum).
**Origin:**

Emulsun is derived from sunflower (*Helianthus annuus*) oil, which has demonstrated a low irritation potential in personal care and cosmetics for centuries. Sunflower is also sustainable; it is grown with low water and fertilizer inputs, and is often rotated with other food crops to maintain soil fertility.

**Chemistry:**

Emulsun is composed of monoesters of sunflower oil, which contain high amounts of stearic and palmitic acid. The sunflower oil used to create Emulsun undergoes an innovative refining process to preserve the sunflower wax-ester and fatty alcohol components. Sunflower wax-esters have a unique botanical composition with carbon lengths C38-C50. The associated fatty alcohols are equally unique and range from C16-C30 in chain length. The monoesters form a liquid crystal structure which decreases surface tension and strongly promotes emulsification.

**Emulsun INCI**

- **Hydrogenated Sunflower Seed Oil Polyglycerol-3 Esters**
  - Provides emolliency + emulsification

- **Hydrogenated Sunflower Seed Oil Glycerol Esters**
  - Provides emolliency + secondary emulsification + stabilization

- **Cetearyl Alcohol**
  - Provides stabilization

- **Sodium Stearoyl Lactylate**
  - Provides emulsification

**HLB Independent:** Unlike PEG type emulsifiers that have limited HLBs, the unique ingredients of Emulsun are engineered to work together to emulsify a range of rHLBs making it suitable for a variety of applications.

**Chemistry Diagram:**

- **Hydrogenated Sunflower Seed Oil Polyglycerol-3 Esters**
  - Lipophilic

- **Hydrogenated Sunflower Seed Oil Glycerol Esters**
  - Lipophilic

- **Sodium Stearoyl Lactylate**
  - Hydrophilic
Liquid Crystal Structure:
The sunflower-derived monoglycerides and polyglyceride esters form a synergetic crystalline structure that can create microemulsions. The specific combination of the hydrophilic and hydrophobic structures in Emulsun generates a self-assembling hexagonal liquid crystal phase with oil in water formulations that can be witnessed during cooling.

Usage Range for Stable Emulsions:
Typical Usage Levels = 3-8%
Typical Oil Loading Levels = 15-40%

Unless otherwise stated, the oil phase in the lotions / creams included sunflower oil, macadamia oil, caprylic/capric triglyceride oil, ethyl macadamiate, jojoba esters, and isononyl isononanoate; and the water phase included 2% glycerin.

Emulsun can be used at reasonable loading levels, between a ratio of 2:1 and 5:1 (Oil:Emulsun), to build the viscosity of stable formulas with up to 40% oil (without the use of secondary emulsifiers or thickeners).

Emollient Compatibility

Viscosity vs. rHLB

Emulsun (6%) is compatible with a variety of emollients (20%) with a range of rHLBs from 4-9. Emulsun is also compatible with sunscreens and up to 10% ethanol. Use Emulsun to create stable formulas with a range of emollients.
The viscosity can be tailored by adjusting the Emulsun loading level (with 20% oil) or the oil loading level (with 6% Emulsun), without the use of thickeners. Emulsun is versatile and gives formulators a variety of rheology options for stable\(^1\) formulations.

**pH Compatibility**

**Sensory Appeal**

Emulsun can be used to create stable\(^2\) formulas from pH 4-11.

Adjusting the Emulsun loading level can also be used to modify product aesthetics. (*p<0.05*)
Although Emulsun does not require a thickener to create a stable formula like many other natural emulsifiers, it is compatible with natural and synthetic thickeners.

Formulators have the option of thickeners that are compatible with Emulsun which can be used to build viscosity and create stable formulas with low oil loading levels.

<table>
<thead>
<tr>
<th>Emulsifier (E)</th>
<th>% E</th>
<th>% Oil</th>
<th>Stable</th>
<th>Viscosity (cP)</th>
<th>% E</th>
<th>% Oil</th>
<th>Stable</th>
<th>Viscosity (cP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emulsun</td>
<td>6</td>
<td></td>
<td>pass</td>
<td>100250</td>
<td>8</td>
<td></td>
<td>pass</td>
<td>234125</td>
</tr>
<tr>
<td>Cetearyl Alcohol / Ceteareth-20</td>
<td>6</td>
<td>20</td>
<td>fail</td>
<td>---</td>
<td>8</td>
<td></td>
<td>fail</td>
<td>---</td>
</tr>
<tr>
<td>Cetearyl Olivate / Sorbitan Olivate</td>
<td>6</td>
<td></td>
<td>fail</td>
<td>---</td>
<td>15</td>
<td></td>
<td>pass$^4$</td>
<td>258125</td>
</tr>
<tr>
<td>Candelilla/Jojoba/Rice Bran Polyglyceryl-3 Esters / Glyceryl Stearate / Cetearyl Alcohol / Sodium Stearyl Lactylate</td>
<td>6</td>
<td></td>
<td>fail</td>
<td>---</td>
<td>8</td>
<td></td>
<td>fail</td>
<td>---</td>
</tr>
<tr>
<td>Glyceryl Stearate / PEG-100 Stearate</td>
<td>4</td>
<td></td>
<td>pass</td>
<td>68667</td>
<td>9$^3$</td>
<td></td>
<td>fail</td>
<td>---</td>
</tr>
</tbody>
</table>

Emulsun outperforms standard o/w emulsifiers by providing stable formulas with comparable viscosities.

$^1$ Stable for 12 weeks at 4°C, room temperature, and 43°C, in addition to 3 cycles of freeze / thaw.
$^2$ Stable for 2 weeks at 50°C and for 3 cycles for freeze / thaw.
$^3$ Carbopol, Natrosol, Keltrol, and Aristoflex are registered trademarks of The Lubrizol Corp., Ashland, Inc., CP Kelco, and Clariant Corp., respectively.
$^4$ Not freeze / thaw stable.
$^5$ Also included 3% cetearyl alcohol.
Dermatologic Efficacy

Increase Skin Hydration and Decrease TEWL

Emulsun outperforms standard o/w emulsifiers by:

- increasing skin hydration
- maintaining barrier function

Emulsun allowed for the creation of similar product aesthetics, with less greasiness and more perceived hydration, than other o/w emulsifiers. (*p<0.05)

Consumer Perception

Increase Sensory Appeal

Emulsun allowed for the creation of similar product aesthetics, with less greasiness and more perceived hydration, than other o/w emulsifiers. (*p<0.05)
A GREENER PROCESS

Standard industry production of emulsifiers often utilizes waste material of animal and vegetable oil processing. Emulsun's proprietary production process utilizes the inherent glyceride backbone of the sunflower triglyceride. This minimizes the processing steps and intermediate reactions, and produces fewer unwanted chemicals, which can disrupt an emulsion.

Floratech’s process is much greener and more energy efficient than common production processes. Emulsun is the superior, sustainable emulsifier and allowed for use in naturally certified products and is of 100% natural origin as defined under ISO 16128.