COLD EMULSIFICATION: Energy saving and much more
Carme Fitó – Marketing Manager, Comercial Química Massó – January 2012

Benefits of cold emulsification

Emulsions are the main galenic form in the cosmetic industry. The choice of the emulsifier is therefore crucial in this sector, as it has many implications in the manufacturing process as well as in the texture of the final product.

Depending on the emulsifier, the emulsification process can be either a hot process – including heating and cooling steps, or a cold process – simply mixing all the ingredients in one vessel. Of course, in the second case, all the other formulation ingredients have to be liquid at room temperature.

Cold emulsification offers a series of benefits compared to hot emulsification:

- **ENERGY SAVING**: the most important benefit and the base for all the rest. By eliminating the heating step, the amount of energy used in production is dramatically reduced.
- **Cost saving**: energy is expensive; saving energy means saving money.
- **Easier process**: ingredients are easier to handle as they are liquid, and the whole procedure is simpler, a one step process!
- **Time saving**: the process is shorter as the heating and cooling steps have been eliminated. This means that the time needed to complete it is less that in hot processes.
- **Sustainable / environmental friendly**: less energy consumption means less CO₂ emissions. This reduces the impact of the process to the environment, and is in line with the “CO₂ footprint” trend.

COMERCIAL QUIMICA MASSO offers various cosmetic emulsifiers designed for cold emulsification. Those are:

<table>
<thead>
<tr>
<th>O/W Emulsions</th>
<th>PROTELAN Acyl Glutamates</th>
<th>Silky and moisturising emulsions</th>
</tr>
</thead>
<tbody>
<tr>
<td>OXYPON / MULSIFAN CAO 30 PEG Glycerides</td>
<td>Emollient and refatting emulsions</td>
<td></td>
</tr>
<tr>
<td>MASSOCARE MILK3 Concentrated base</td>
<td>The easiest solution for sprayables, lotions and creamy gels</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>W/O Emulsions</th>
<th>MASSOCARE PEG30 PHS L Liquid W/O polymeric emulsifier</th>
<th>W/O very glossy and non-greasy emulsions</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLANTEC Natural Emulsifier CP5</td>
<td>Ecocert emulsifier, olive oil derivative</td>
<td>Ecological emulsions, with high moisturising properties</td>
</tr>
</tbody>
</table>

That range offers a complete choice and permits to modulate the texture of the final product.
1. **O/W Emulsions**

1.1. **ACYL GLUTAMATES: Silkening moisturizing emulsifiers**

(PROTELAN AGL 95, Sodium Lauroyl Glutamate – PROTELAN AG 818G, Sodium Lauroyl Glutamate, ecocert certified - PROTELAN AGL 95/C, Sodium Cocoyl Glutamate. *Manufacturer: Zschimmer & Schwarz*)

That group of emulsifiers has the particularity to have an additional moisturizing effect. They can be used in rinse off applications as well as in leave on products.

Acyl glutamates have an excellent safety profile; they are not irritant at all. Moreover, they can split into fatty acid and glutamic acid that are ingredients of the skin’s Natural Moisturizing Factor. Their dermatological compatibility is excellent.

When using Acyl Glutamates, only a few requirements have to be kept in mind:

- Fat components have to be liquid at room temperature, and have to be compatible with the thickener. The polarity is not a problem as those emulsifiers are compatible with all types of oils.
- Thickener: polymeric thickeners with good stability in presence of anionic emulsifiers
- Additives have to be compatible with anionic groups and with the thickener.

In terms of applications, acyl glutamates are particularly suitable for sensitive skin and sensitive skin areas. Baby care is a very interesting application field for those emulsifiers. Other areas of application are: hypoallergenic products, products for dry skin, products for elderly people…

Formulations 1 and 2 are examples of final personal care products based on acyl glutamates.

### Formulation 1 – CREAMY-GEL BASE
Ref. E-01-230-01 – CQMASSO

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Phase</th>
<th>% w/w</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caprylic/Capric Triglyceride</td>
<td>A</td>
<td>7.50</td>
</tr>
<tr>
<td>Isohexadecane</td>
<td>A</td>
<td>7.50</td>
</tr>
<tr>
<td>Agua</td>
<td>B</td>
<td>up to 100.00</td>
</tr>
<tr>
<td>Betaine</td>
<td>B</td>
<td>2.00</td>
</tr>
<tr>
<td>Protelan AGL 95C - Sodium Cocoyl Glutamate</td>
<td>B</td>
<td>2.00</td>
</tr>
<tr>
<td>Sodium Polyacrylate</td>
<td>C</td>
<td>1.00</td>
</tr>
<tr>
<td>Conservante</td>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>

### Procedure

Mix the ingredients of phases A and B. Add A to B under moderate stirring (approx. 300 rpm). Homogenize AB for 1½ minutes (Silverson: 3.000 rpm). Add C and homogenize again 1½ minutes (Silverson: 3.000 rpm). Add D during homogenisation. Adjust final pH to 5.50-6.50 if needed. Stir for 20-30 minutes.
### Formula 2 – NATURAL CREAMY-GEL BASE
Ref. E-03-030-01 – CQMASSO

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Phase</th>
<th>% w/w</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protelan AG 818 G - Sodium Cocoyl Glutamate</td>
<td>A</td>
<td>5.00</td>
</tr>
<tr>
<td>Hydrogenated Ethyl Hexyl Olivate, Hydrogenated</td>
<td>A</td>
<td>5.00</td>
</tr>
<tr>
<td>Olive Oil Unsaponifiables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Squalane</td>
<td>A</td>
<td>5.00</td>
</tr>
<tr>
<td>Agua</td>
<td>B</td>
<td>up to 100.00</td>
</tr>
<tr>
<td>Glycerin</td>
<td>B</td>
<td>3.00</td>
</tr>
<tr>
<td>Dehydroxanthan Gum</td>
<td>B</td>
<td>0.75</td>
</tr>
<tr>
<td>Betaine</td>
<td>B</td>
<td>4.00</td>
</tr>
<tr>
<td>Preservative</td>
<td>C</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**Procedure**

Disperse Dehydroxanthan Gum in water for 40-45 minutes under moderate stirring (250-300 rpm). Add the rest of the ingredients of phase B. Add A to B under moderate stirring (250-300 rpm). Homogenize AB for 5 minutes (Silverson: 4.000 rpm). Add C to AB under moderate stirring. Adjust final pH to 5.50 - 6.00 if needed

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### 1.2. PEG Glycerides: Enriching emollient emulsifiers


The common benefit offered by that group of emulsifiers is their ability to impart emolliency and refatting properties; the consumer will notice an immediate as well as a long lasting silky skin feeling. Moreover, the OXYPON family exhibits oil solubilising capabilities.

Application wise, PEG Glycerides are used in both, leave-on and rinse off formulations. These are key components in the development of trendy clear microemulsion shower gels with oil content up to 3%.

Formulation 3 illustrates the use of PEG Glycerides as emulsifiers.

### Formulation 3 – CREAM FOR WINTER DRY SKIN
Ref. B60/157 – Zschimmer & Schwarz

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>% w/w</th>
</tr>
</thead>
<tbody>
<tr>
<td>OXYPON 288 - PEG-10 Olive glycerides</td>
<td>5.00</td>
</tr>
<tr>
<td>Lauryl Alcohol</td>
<td>2.50</td>
</tr>
<tr>
<td>Prumus Amuugdalus Dulcis (Sweet Almond) Oil</td>
<td>5.00</td>
</tr>
<tr>
<td>Simmondsia Chinensis (Jojoba) Seed Oil</td>
<td>2.00</td>
</tr>
<tr>
<td>Caprylic/Capric Triglyceride</td>
<td>3.00</td>
</tr>
<tr>
<td>Antioxidant</td>
<td>q.s.</td>
</tr>
<tr>
<td>Ammonium Acryloyldimethytaurate/vp Copolymer</td>
<td>1.00</td>
</tr>
<tr>
<td>Perfume</td>
<td>0.20</td>
</tr>
<tr>
<td>Preservative</td>
<td>q.s.</td>
</tr>
<tr>
<td>Water</td>
<td>Up to 100.00</td>
</tr>
</tbody>
</table>
Procedure

Mix OXYPON 288, Lauryl Alcohol, Sweet Almond Oil, Jojoba Oil, Caprylyl/Capric Triglyceride, Antioxidant And Ammonium Acryloyldimethyltaurate/VPCopolymer to a homogeneous dispersion. Add the other components in the indicated sequence and homogenize at the end. Adjust the pH value to approx. 5.5 and homogenize again.

1.3. MASOCARE MILK3: Emulsion concentrate

(MASOCARE MILK3, Caprylyl/capric Triglyceride & Triethylhexanoin & Glycerin & Polyperfluoroethoxymethoxy Difluoroethyl PEG Phosphate. Manufacturer: CQMasso)

Following a growing market demand, COMERCIAL QUIMICA MASSO has developed a series of concentrated products, ready to use, for the manufacture of sprayables, lotions and creamy-gels. MASOCARE MILKs are almost finished personal care products as they contain already the emollient and the emulsifying systems. The final formulations are prepared by simply adding water, the thickener (if needed) and the desired active principles, all that under moderate stirring.

<table>
<thead>
<tr>
<th>Sprayables / lotions</th>
<th>Milks, Creamy-gels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Dilution 1 concentrate : 2 water</td>
<td>Add thickener</td>
</tr>
</tbody>
</table>

The only requirement which has to be kept in mind is that cationic thickeners can't be used. COMERCIAL QUIMICA MASSO advises to use any of the following: MASOCARE TCK A1 (Sodium Polyacrylate, Paraffinum Liquidum, Trideceth-6), MASOCARE TCK A2 (Acrylamide/Sodium Acrylate Copolymer, Paraffinum Liquidum, Trideceth-6), MASOCARE TCK1 (Carbomer).

Personal care emulsions based on MASOCARE MILK3 show an excellent cosmetic feel and a superior emolliency. Moreover, they have skin moisturising and protective properties; they are film-forming and water-proof thanks to the use of a perfluoropolyether as emulsifier. Last, but not least, those are extremely flexible systems, compatible with a broad range of cosmetic ingredients.

Regarding the suggested applications, MASOCARE MILK3 is a very good choice for any type of skin care emulsion, no matter what type of viscosity is required.

A good example of the simplicity to formulate with Massocare Milks is shown on formulation number 4.
2. **W/O Emulsions**

2.1. **POLYMERIC LIQUID W/O EMULSIFIER: Brightening, non-greasy W/O emulsions**

(MASSOCARE PEG30 PHS L, PEG-30 Dipolyhydroxystearate & Isostearic Acid & Polyglyceryl-3-Diisostearate. Manufacturer: CQMasso)

PEG-30 Dipolyhydroxystearate is a well known and a very appreciated w/o non-ionic, polymeric emulsifier. It can be used in the formulation of creams, lotions or sprayable emulsions. It can be combined with any type of oils and allows the formulation of products with high water content. PEG-30 Dipolyhydroxystearate is also an emulsifier that forms very stable emulsions, especially regarding temperature. In terms of sensorial properties, w/o emulsions prepared with PEG-30 Dipolyhydroxystearate have an incredible light feel. They can be prepared by semi-cold processes, thus reducing manufacturing time and cost. The limitation to its use is related to its physical form: it is a waxy solid difficult to handle and to dose. To overcome that shortfall and also to work in real cold conditions, COMERCIAL QUIMICA MASSO have developed MASSOCARE PEG30 PHS L, which combines the already mentioned emulsifier with Polyglyceryl-3 Diisostearate, a liquid, w/o polymeric emulsifier and substantive emollient.

MASSOCARE PEG30 PHS L is a powerful w/o emulsifier, a ready to use liquid that permits cold emulsification.

Using MASSOCARE PEG30 PHS L, the cosmetic chemist can develop all types of W/O emulsions: facial care, body care, sun care...

Formulation 5 illustrates the use of MASSOCARE PEG30 PHS L
Formulation 5 – MOISTURISING W/O BASE CREAM
Ref. F-01/W-0133/02bis – CQMASSO

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Phase</th>
<th>% w/w</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massocare PEG30 PHS L - PEG-30</td>
<td>A</td>
<td>3.50</td>
</tr>
<tr>
<td>Dipolyhydroxystearate, Isostearic Acid, Polyglyceryl-3-Dioleostearate</td>
<td>A</td>
<td>5.00</td>
</tr>
<tr>
<td>Isohexadecane</td>
<td>A</td>
<td>7.00</td>
</tr>
<tr>
<td>Triethylhexanoin</td>
<td>A</td>
<td>2.00</td>
</tr>
<tr>
<td>Water</td>
<td>B</td>
<td>up to 100.00</td>
</tr>
<tr>
<td>Glycerin</td>
<td>B</td>
<td>3.00</td>
</tr>
<tr>
<td>Magnesium Sulfate</td>
<td>B</td>
<td>0.80</td>
</tr>
<tr>
<td>Perfume</td>
<td>C</td>
<td>1.00</td>
</tr>
<tr>
<td>Preservative</td>
<td>D</td>
<td>q.s</td>
</tr>
</tbody>
</table>

Procedure

Mix ingredients of phases A and B separately. Add B to A whilst stirring intensively (500 - 600 rpm). Add C and homogenise ABC for 2 minutes (Silverson: 4.000 rpm). Add phase D. Stir at 400-500 rpm during 30 minutes, minimum.

2.2. ECOCERT EMULSIFIER DERIVED FROM OLIVE OIL: Ecological formulation with strong hydrating properties

(PLANTEC Natural Emulsifier CP5, Glyceryl Oleate, Polyglyceryl-3-polyricinoleate, Olea Europaea (olive) Oil Unsaponifiables. Manufacturer: CRM International)

PLANTEC Natural Emulsifier CP5 is a non-ionic emulsifier, 100% from vegetable origin, based on an association of natural glycerides and olive unsaponifiables. That combination of actives provides, besides the emulsifying properties, exceptional moisturising capabilities. As emulsifier, it is a very versatile product: can be combined with a broad range of oils, with oil phase concentrations from 20% to 50%, and with a level of use between 3% and 5%. Its moisturising properties have been proven through the corneoeter test, in-vivo, with 10 volunteers; the results show that skin is hydrated both, immediately and at long term (8h). Moreover, emulsions based on PLANTEC Natural Emulsifier CP5 are quickly absorbed leaving the skin soft and flexible. Finally, it is worth to mention that it is Ecocert listed and therefore, can be used in the development of eco-certifiable formulations.

The potential personal care applications of PLANTEC Natural Emulsifier CP5 include practically all types of skin care products. It is specially indicated when hydration plays a key role.

Formulation 6 is a Natural Hydrating Cream Base based on that interesting emulsifier.
CONCLUSIONS

The current trends, both industrial and market wise, are in favor of the personal care products that besides their safety and their efficacy are “green”.

This concept goes behind the ingredients origin and includes everything related to the final product, from its conception until its sale, since it arrives to the consumer until it has been used. Issues like the packaging being recyclable or the manufacturing process being sustainable are good examples of some of the criteria tan consumers are including more often in their purchase decision processes. By using cold manufacturing processes, the personal care products’ producers show their commitment with the environment.

When the actual economic framework, cost reduction is a common strategy throughout the personal care industry. As shown, by eliminating the heating steps in the emulsions manufacturing processes has a direct impact on the corresponding costs, and therefore, this is something to bear in mind at any time.

The range of emulsifiers introduced in this article show that nowadays, cold processing is a realistic option, with no limitations at all in terms of sensorial properties and efficacy of the final products.

<table>
<thead>
<tr>
<th>Table1. “COLD” EMULSIFIERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROTELAN AGL 95</td>
</tr>
<tr>
<td>PROTELAN AG 81BG</td>
</tr>
<tr>
<td>PROTELAN AGL 95/C</td>
</tr>
<tr>
<td>OXYPON 288</td>
</tr>
<tr>
<td>OXYPON 328</td>
</tr>
<tr>
<td>OXYPON 365</td>
</tr>
<tr>
<td>OXYPON 401</td>
</tr>
<tr>
<td>MULSIFAN CAO 30</td>
</tr>
<tr>
<td>Product</td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>MASSOCARE MILK3</td>
</tr>
<tr>
<td>MASSOCARE PEG30 PHS L</td>
</tr>
<tr>
<td>PLANTEC Natural Emulsifier CP5 Ecocert</td>
</tr>
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