ESTER Quaternary for Fabric Softener
Ester Quaternary for Fabric Softener

5 EQ from Palm Oil
   TE90 series: Premium EQ
   TEQ90 series: Economy EQ

7 Cold-Processable EQ
   CEQ series:
   Low Melting Point
   Pump-able at Room Temp.

8 EQ from Cotton Seed
   CTN series: Non edible source

9 EQ for High Viscosity
   PEQ90HV:
   Can make High Viscosity Fabric Softener without Thickener

FORMULA BOOK

12 Formula Stability Check Criteria
20 Regular Type
26 Concentrated Type
29 Other Surfactants
Technology Overview

Palm Oil → Fatty Acid Makers → Fatty Acids → Other EQ makers

SUNJIN → EQ

Cost competitive
Environmental Friendly
More sustainable
# EQ Table

<table>
<thead>
<tr>
<th>Grade</th>
<th>Solid(%)</th>
<th>Solvent</th>
<th>Melting Point</th>
<th>Alkyl Group</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>SUNQAT-TE90</td>
<td>90±1</td>
<td>IPA</td>
<td>32 °C</td>
<td>Palm</td>
<td>Premium Palm EQ</td>
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<tr>
<td></td>
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<td>Palm EQ</td>
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<tr>
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<td>90±1</td>
<td>IPA</td>
<td>33 °C</td>
<td>Palm</td>
<td>Economy Palm EQ</td>
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<td></td>
<td>Palm EQ</td>
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<td>SUNQAT-CEQ90</td>
<td>90±1</td>
<td>IPA</td>
<td>18 °C</td>
<td>Oleic</td>
<td>Low Melting Point Pump-able at room temp. Dispersible in cold water</td>
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<tr>
<td>SUNQAT-CTN90</td>
<td>90±1</td>
<td>EtOH</td>
<td>14 °C</td>
<td>Cotton</td>
<td>Cotton seed Non edible oil source</td>
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<tr>
<td>SUNQAT-PEQ90HV</td>
<td>89±1</td>
<td>EtOH</td>
<td>35 °C</td>
<td>Palm</td>
<td>High Viscosity Fabric Softener without Thickener</td>
</tr>
</tbody>
</table>
EQ Price Structure

- This is to give a ball park figure of prices of EQs from SUNJIN as of Sep. 2014.
- However, the exact prices can be changeable based on the fluctuation of raw material costs.
Cold Possible CEQ90

- Not pumpable at RT

- Heating @Hot Box
  - 60 °C

- Pumping

- Cold Possible CEQ90

- Pumpable at RT

- Cold process

- Good cold water dispersibility, making fabric softener by cold process

- No need to heat to pump, no need to heat to make fabric softener → reduction of manufacturing cost, reduction of CO2 emission
Cotton Seed EQ, CTN90

- Non edible oil source
- Melting point 14°C

Orangutans and oil palm plantations
“…Of approximately 11 million hectares of oil palm plantations globally, about 6 million hectares are found in Indonesia (in 2006) - and counting. But in many places, these plantations are taking over rainforests, the natural habitat of endangered species such as orangutans. Habitat conversion from natural forests to oil palm plantations has been shown to have a devastating impact on tropical forests, along with plants and animals that depend on them.

For example, there are nearly 80 mammal species in Malaysia’s primary forests, just over 30 in disturbed forests, and only 11 or 12 in oil palm plantations. A similar loss in diversity occurs for insects, birds, reptiles, and most important of all, for soil microorganisms….”

WWF Global
PEQ90HV

High Viscosity Fabric Softener
Without thickening agent
Only 6% PEQ90HV for 1,000cps possible!
## DDAC vs EQ vs PEQ90HV

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DDAC*</th>
<th>Conventional EQ</th>
<th>PEQ90HV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Softening power</td>
<td>++++++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Formula viscosity</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Biodegradability</td>
<td>Not allowed in EU</td>
<td>++++ ECO friendly</td>
<td>++++ ECO friendly</td>
</tr>
<tr>
<td>Formula stability</td>
<td>High</td>
<td>OK</td>
<td>High</td>
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<tr>
<td>Sweat Absorption</td>
<td>+</td>
<td>++++</td>
<td>++++</td>
</tr>
<tr>
<td>Concentrated Formula</td>
<td>+</td>
<td>++++</td>
<td>++++</td>
</tr>
<tr>
<td>Fragrance boosting</td>
<td>+++</td>
<td>++++</td>
<td>++++</td>
</tr>
<tr>
<td>Anti-Static</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Non-Yellowing</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Price</td>
<td>Expensive</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

**DDAC**: Dimethyldioctadecylammonium chloride, or distearyl dimethyl ammonium chloride, is a quaternary ammonium salt consisting of a nitrogen atom substituted with two methyl groups and two octadecyl groups.

DDAC is not allowed in EU and more expensive than EQ but DDAC still captures the major market share because it can provide High Formula stability and High Formula viscosity that matter a lot in SEA.
Formula Book
Formula stability Check

2 Year Shelf Life at Room Temperature should be examined...But it’s too long!

Something faster test methods needed…

**Acceleration Test** at Higher Temp

- $60{^\circ}\text{C} \times 8 \text{ weeks} = 25{^\circ}\text{C} \times 2 \text{ year}$
- $45{^\circ}\text{C} \times 16 \text{ weeks} = 25{^\circ}\text{C} \times 2 \text{ year}$
How to judge whether formula is stable or not?

SUNJIN suggests 5 criteria for the stability of Fabric Softener formulation:

1. Phase separation
2. Sedimentation
3. White Scum (= Halo effect)
4. Severe change of viscosity of formula
5. Severe change of color of formula

If you see any of these, the formula is no good.
How to judge whether formula is stable or not?

SUNJIN suggests 5 criteria for the stability of Fabric Softener formulation

1. Phase separation
2. Sedimentation
3. White Scum(=Halo effect)
4. Severe change of viscosity of formula
5. Severe change of color of formula

<Example>
Phase separation noticed: No Good
How to judge whether formula is stable or not?

SUNJIN suggests 5 criteria for the stability of Fabric Softener formulation

1. Phase separation
2. Sedimentation
3. White Scum (=Halo effect)
4. Severe change of viscosity of formula
5. Severe change of color of formula

<Example>
Sedimentation at the bottom noticed: No Good
How to judge whether formula is stable or not?

SUNJIN suggests 5 criteria for the stability of Fabric Softener formulation:

1. Phase separation
2. Sedimentation
3. White Scum (Halo effect)
4. Severe change of viscosity of formula
5. Severe change of color of formula

<Example>
White scum on the surface noticed: No Good
How to judge whether formula is stable or not?

SUNJIN suggests 5 criteria for the stability of Fabric Softener formulation

1. Phase separation
2. Sedimentation
3. White Scum (= Halo effect)
4. Severe change of viscosity of formula
5. Severe change of color of formula

<Example>
Viscosity increased significantly noticed : No Good
How to judge whether formula is stable or not?

SUNJIN suggests 5 criteria for the stability of Fabric Softener formulation

1. Phase separation
2. Sedimentation
3. White Scum (= Halo effect)
4. Severe change of viscosity of formula
5. Severe change of color of formula

<Example>
Color paled significantly noticed: No Good
Regular Type Fabric Softener Formula
Thickeners Used:

**ACUSOL882 : Nonionic Thickener**

A hydrophobically modified, nonionic polyol (HEURs) thickener and stabilizer used in detergent formulations for household and industrial applications, providing outstanding rheology and excellent chemical compatibility.

**Fiosoft 222 : Polymer Thickener**

Cationic acrylamide-based polymer used as a thickening agent for acidic aqueous compositions, and particularly in domestic detergents and laundry softeners.

White creamy water-in-oil emulsion typically used at a concentration range between 0.1% and 5.0% in fabric softener compositions.
## Regular 100cps ver 1.0

<table>
<thead>
<tr>
<th>Step</th>
<th>Trade Name</th>
<th>REMARK</th>
<th>TE90</th>
<th>TEQ90</th>
<th>CEQ90</th>
<th>CTN90</th>
<th>PEQ90HV</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>D.I-Water</td>
<td>Aqua</td>
<td>93.27</td>
<td>94.27</td>
<td>94.27</td>
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<tr>
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<tr>
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<tr>
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<td>Thickener</td>
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<tr>
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16 weeks@45 ℃, 7 weeks@60 ℃ stability tests passed
### Regular 300cps ver1.0

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<th>TE90</th>
<th>TEQ90</th>
<th>CEQ90</th>
<th>CTN90</th>
<th>PEQ90HV</th>
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<td>0.03</td>
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16 weeks@45 ℃, 7 weeks@60 ℃ stability tests passed
## Regular 500cps ver1.0

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<th>Step</th>
<th>Trade Name</th>
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<th>TE90</th>
<th>TEQ90</th>
<th>CEQ90</th>
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<td>Aqua</td>
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<td>Ester Quat.</td>
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<td>FS-222</td>
<td>Thickener</td>
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16 weeks@45℃, 7 weeks@60℃ stability tests passed
### Regular 1000cps ver1.0

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<th>Trade Name</th>
<th>REMARK</th>
<th>TE90</th>
<th>TEQ90</th>
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</table>

16 weeks@45 °C, 7 weeks@60 °C stability tests passed
Concentrated Type Formula
Calcium Chloride : Reduction of surface tension

\[ \text{CaCl}_2 \]

The presence of calcium chloride reduce the surface activity to a greater extent above the critical micelle concentration region of cationic surfactant. Ageing effects due to the salts affected the surface tension, probably by reason of the tendency of a solution to take in water by osmosis.
### Concentrated 200cps ver1.0

<table>
<thead>
<tr>
<th>Step</th>
<th>Trade Name</th>
<th>REMARK</th>
<th>TE90</th>
<th>TEQ90</th>
<th>CEQ90</th>
<th>CTN90</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>Aqua</td>
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<td>DB-110A</td>
<td>Anti foam</td>
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<td>0.05</td>
<td>0.05</td>
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<tr>
<td></td>
<td>LA-9N</td>
<td>Emulsifier</td>
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<td></td>
<td>CaCl2</td>
<td>Viscosity</td>
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8 weeks@45°C, 4 weeks@60°C stability tests passed
## Concentrated 3500cps ver1.0

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<td>0.05</td>
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<td></td>
<td>LA-9N</td>
<td>Emulsifier</td>
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<td>CaCl2</td>
<td>Viscosity</td>
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<td>0.03</td>
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<tr>
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<td>Kathone CG</td>
<td>Preservative</td>
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<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
</tr>
</tbody>
</table>

8 weeks @ 45°C, 4 weeks @ 60°C stability tests passed
Other Surfactants
CETRIMONIUM CHLORIDE for hair care products

Conditioning agent for hair care

Prevent the buildup of static electricity

Inhibiting the growth of microorganism

<table>
<thead>
<tr>
<th>Grade</th>
<th>Active (%)</th>
<th>Solvent</th>
<th>Free amine (%)</th>
<th>pH</th>
<th>Color (APHA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUNQAT-CM27</td>
<td>27%</td>
<td>Water</td>
<td>1.0 max</td>
<td>7.0 ± 1.0</td>
<td>40 max</td>
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<tr>
<td>SUNQAT-CM29</td>
<td>29%</td>
<td>Water</td>
<td>1.0 max</td>
<td>5.0 ± 1.0</td>
<td>40 max</td>
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<tr>
<td>SUNQAT-CM50</td>
<td>50%</td>
<td>Mixed Alcohol</td>
<td>1.0 max</td>
<td>7.0 ± 1.0</td>
<td>30 max</td>
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</tbody>
</table>

Best recommend for

- Hair conditioner
- Hair pack
- Hair dye

INCI name
: Cetrimonium chloride

CAS No.
: 112-02-7

Custom Tariff No.
: 3402.12-0000

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Guideline formula for **SUNQAT-CM**

### Hair pack

<table>
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<tr>
<th>Ingredients</th>
<th>%</th>
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<tr>
<td>Glycerin</td>
<td>3.0</td>
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<tr>
<td>Methyl Paraben</td>
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<td>Hydroxy ethyl cellulose</td>
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<td>Cetyl alcohol</td>
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<td>Propyl Paraben</td>
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<tr>
<td>Vitamin E Acetate</td>
<td>0.1</td>
</tr>
<tr>
<td>Polyquaternium-7</td>
<td>1.0</td>
</tr>
<tr>
<td>Silicone Emulsion</td>
<td>3.0</td>
</tr>
<tr>
<td>Fragrance</td>
<td>0.3</td>
</tr>
<tr>
<td>D.I. Water</td>
<td>up to 100</td>
</tr>
</tbody>
</table>

### Hair rinse

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUNQAT-CM29</td>
<td>5.0</td>
</tr>
<tr>
<td>Polyquaternium-7</td>
<td>1.0</td>
</tr>
<tr>
<td>Hydroxy ethyl cellulose</td>
<td>0.2</td>
</tr>
<tr>
<td>Cetyl alcohol</td>
<td>5.0</td>
</tr>
<tr>
<td>Glyceryl Stearate/PEG100 Stearate</td>
<td>1.5</td>
</tr>
<tr>
<td>LP</td>
<td>2.0</td>
</tr>
<tr>
<td>Cyclomethicone</td>
<td>3.0</td>
</tr>
<tr>
<td>Silicone Emulsion</td>
<td>1.0</td>
</tr>
<tr>
<td>Preservative</td>
<td>0.05</td>
</tr>
<tr>
<td>Extracts</td>
<td>0.1</td>
</tr>
<tr>
<td>Fragrance</td>
<td>0.15</td>
</tr>
<tr>
<td>D.I. Water</td>
<td>up to 100</td>
</tr>
</tbody>
</table>
## IMIDAZOLINE Ester QUANTERNARY for Fabric Softener

**Best recommend for**
- Fabric softener
- Textile treatment

<table>
<thead>
<tr>
<th>Grade</th>
<th>Solid (%)</th>
<th>Solvent</th>
<th>Liquid point (°C)</th>
<th>Paste point (°C)</th>
<th>Alkyl Group</th>
<th>Color (Gardener)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUNQAT-OM90</td>
<td>90±1</td>
<td>EtOH</td>
<td>5~10</td>
<td>0 ~5</td>
<td>Oleic</td>
<td>3.0 max</td>
</tr>
</tbody>
</table>

**INCI name**
:Methyl-1-oleylamido ethyl-2-oleyl imidazolinium methyl sulfate

**CAS No.**
:86088-85-9

**Custom Tariff No.**
:3402.12-0000
DISODIUM COCOAMPHODIACETATE for baby & sensitive skin

Very mild foaming agent

Very low skin irritation (Not defatting to the skin)

Good compatibility with other surfactants

<table>
<thead>
<tr>
<th>Grade</th>
<th>Dry residue (%)</th>
<th>Solvent</th>
<th>Cl as NaCl (%)</th>
<th>Color (Gardener)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUNBET-C2M</td>
<td>49.0 min</td>
<td>Water</td>
<td>13± 2</td>
<td>4.0 max</td>
</tr>
</tbody>
</table>

Best recommend for
- Hair & body wash for baby
- Facial cleanser

Comparative skin irritancy

Sodium lauryl sulfate
Sodium laureth sulfate
Cocamidopropyl betaine
Decyl polyglucoside
Disodium cocoamphodiacetate

INCI name: Disodium cocoamphodiacetate
CAS No.: 68650-39-5
Custom Tariff No.: 3402.11-0000
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Global Representatives

CHINA
China Headquarter / TIANJIN XIANGGUANG CHEMICAL
Jinyu Road, Xiditou Beichen District, Tianjin
Tel : +86-22-8684-5637
E-mail : psf7337@xianguang-chem.com
Mobile: +86-1370-213-6240
Contact : Sheng-Fan Piao

South China / GUANGZHOU HUATU COSMETICS TECHNOLOGY CO., LTD
F305, Park Office Zone Baiyun District, Guangzhou, Guangdong, China
Tel: +86-20-3630 9891
Email: gjhx@huatuchem.com
Contact : Deng Jianming

East China / SHANGHAI YIXIN CHEMICAL CO., LTD
Room 6002, NO. 588 Yindu Road, Minhang District, Shanghai, China
Tel: +86-21-54290047
Email: dizlwz4587@aliyun.com
Contact : Zhang Li Zhi

South East Asia
Shantou china / Shantou Mitutoyo Chemical Co., Ltd
NO. 60, 4 lane, Guiyuan Yangfenling, Xiashan town, Chaonan district, Shantou city, Guangdong, China
Tel: 86-13553377719

ASIA & Pacific
Japan / LINDEN CO., LTD.
2-2-14 Nakamaru Fujimino City, Saitama 356-0016, Japan
Tel : (+81) 49-293-3345
E-mail : koc.li.pd@linden.jp
Contact : Kazuyuki Miyadera

Australia / New Zealand
RPL Trading.
159-161 Allingham Street, Golden Square, VIC 3555, Australia
Tel : +61-3-9375-4100
E-mail : rpltrading2@bigpond.com
Contact : Russell McNab

Thailand / GOWELL CO. LTD
8/9 Moo 7, Bangna - Trad Road KM.9, Bangkao, Bangplee, Samutprakarn 10540, Thailand
Tel : +66-2-315-9189
E-mail : tommy@wwrc.com.tw
Contact : Rodjana Onnom

Taiwan / WWRC
5F-A, No. 30, Chung Cheng 2nd Road, Kaohsiung 802, Taiwan, R.O.C.
Tel : +868-7-223-9188
Email : tommy@wwrc.com.tw
Contact : Tommy Hu

Malaysia / DCM Personal Care
Address : No. 5, Jalan U1/21 Seksyen U1, Hicom-Glenmarie Industrial park , 40150. Shah Alam, Selangor/Darul Ehsan, Malaysia
Tel : +603-7804 9606
Kokleong@drexchem.com.my
Contact : Kok Leong, KHOO

Indonesia / PT. MEGASETIA AGUNG
KIMIA
Jl. Paradise Timur Raya F21/58, Sunter Agung Podomoro, Jakarta 14350
Tel : +62-21-645-1037
abigail@megasetia.com
Contact : Abagail

EUROPE
France / IMPAG France SAS
6, Boulevard du 21eme Regiment d’Aviation 54000 NANCY France
Tel : +33 (0)3 83 48 98 05
Email : dominique.cormary@impag.fr
Contact : Dominique Cormary

Germany / IMPAG GmbH
Fritz-Reynr-str.25,63071 offenbach
Tel: +49-69-8500-0830
Fax: +49-69-8500-0880
E-mail: dominique.cormary@impag.de
Contact : Karin Flach-Zlierer

Switzerland / IMPAG AG
Feldeggstrasse 26, Postfach, CH-8008 Zurich
Tel: +41 43 499 25 20
E-mail: peter.alarter@impag.ch
Contact: Peter Alder

Italy / Caldic Italia Srl
Via Saronmino, 5 21040 Origgio (VAERESE) Italy
Tel : +39 (02) 96390216
Email : marcello.baggi@caldic.it
Contact: Marcello Baggi

UK / ASTON CHEMICALS
1 Aylesbury Industrial Center
Bicester Road, Aylesbury, HP19 8AL
Tel: +44 (0) 1296 678224
E-mail: louism@aston-chemicals.com
Contact: Louis Moulin

Poland
ASTON CHEMICALS
Oddział w Polsce, ul. Mińska 63 03-828 Warszawa
Tel: +48 22 33-08-450
E-mail: MariuszS@astonchemicals.pl
Contact: Mariusz Siwiński

Spain & Portugal
COSMETALIA
Monlau 28 2nd floor 08027 Barcelona, SPAIN
Tel : +34 630 12 66 76
Email : info@cossmetalia.com
Contact : Laura Mas

Turkey / HD ULULSLARARASI TIC. VE AMBALAJ SAN. LTD STI.
Dilovasi Organize Sanayi Bolgesi 5.Kisim D-5007 Sokak No:2 Ofis No: 11 (Jokey Plastik Fabrikasi ici) TR-41455 Dilovasi-Kocaeli Turkey
Tel : +90 262 754 01 62
E-mail: ozturk@hd.biz.tr
Contact : Oktay OZTURK

MIDDLE EAST
Jordan & Syria
RIMA AL.SHURAFA & PARTNERS
149 Amman 11118 Jordan
8th Circle, Al.Bayader, Randa Complex Building, 2nd Floor, Office, 206
Tel: 09962589976
Mobile: 0096279659025
E-mail : Firas@Jadarahchemicals.com
Contact : Firas Shurafa

AMERICA
USA
Lipo Chemicals
207 19th Ave.
Paterson, NJ 07504
Cell 908-797-8592
cdres@lipochemicals.com
Contact : Caren Dres-Hajeski

SUNJIN AMERICA INC.
2125 Center Ave. (Suite 502) Fort Lee, NJ 07024
Tel : +1-201-585-2801
Mobile : 201-936-3860
E-mail : plee@sunjinamerica.com
Contact : Phil Lee

Brazil / Lipo chemicals Inc.
Travessa Claudio Armando, 171 São Bernardo do Campo São Paulo Brazil
Tel : +55 11 2124-5311 or 5312
E-mail : v.sales@lipobr.com.br
Contact : Victor Sales

Mexico / Lipo chemicals Inc.
Tenayuca No.72-A, Col. Centro Ind.
Tlalnepantla Estado de Mexico 54030
Tel : +52 (55) 5090-9658
E-mail : victor@lipochemicals.com
Contact : Yasset Gomez Mayoral