EMPICOL® C Surfactants: Formulating For Mildness

The EMPICOL® C surfactants are a high quality versatile range of Alkyl ether carboxylates and their salts. These products display a variety of desirable properties for the personal care formulator:

- Excellent mildness
- Tolerant to hard water
- No nitrosamines
- No colour
- Good clearing
- Lime soap dispersion
- Good skin compatibility

The EMPICOL® C range is offered in the form of low active sodium salts and high active carboxylic acids.

The Chemistry

EMPICOL® C can be tailored to achieve the desired surfactant characteristics (foam level, mildness, solubility etc.) by altering either the degree of ethoxylation (m) or the carbon chain distribution as illustrated above.

This publication will particularly focus on the Laureth Carboxylates in the Huntsman range, providing an overview of their key properties and benefits.

Benefits of Laureth Carboxylates

Foam Properties

- Graph C demonstrates that Laureth carboxylates have excellent high foam characteristics and show:
  - Good tolerance to hard water
  - High foam stability, even in the presence of soap
- Increasing the level of ethylene oxide (EO) in the product leads to an increase in foam stability
- Laureth carboxylates can significantly improve the foaming characteristics of formulated products (Graph D)

Lime soap dispersing power (LSDP)

Lime soap dispersion power is a measure of how much surfactant is required to disperse the insoluble soap, calcium oleate. The EMPICOL® C range displays good lime soap dispersion properties required by formulators working with shampoos, shower and bath foams and hard water.

- EMPICOL® CED 5 surfactant (SLE5C) gives outstanding performance
- Significant improvement over sodium cocoyl isethionate (SCI), which is traditionally used in synthetic soap for this reason

Mildness in formulations

- Laureth Carboxylates are characterised by outstanding mildness and good skin compatibility
- Graph A below depicts results from Human Patch Test and demonstrates the low irritancy of Sodium Laureth-4 Carboxylate (SLE4C) and Sodium Laureth-5 Carboxylate (SLE5C)
  - Low irritancy is further supported by Eyetex Draize equivalent test; the measured Zein Number is << 200
- Substituting SLES with Laureth Carboxylates has been shown to progressively reduce the potential to cause eye irritation (Graph B)
  - Mildness can be optimised by changing the degree of ethoxylation as shown in the comparison between Sodium Laureth-4 Carboxylate (SLE4C) and Sodium Laureth-7 Carboxylate (SLE7C).
Sensory Perception

Compared to soap, formulations containing Laureth Carboxylates demonstrate superior:

- Soap-like lather and skin feel
- Excellent rinsing from skin

Neutralization properties of EMPICOL® CED 5

EMPICOL® CED 5 surfactant is an alkyl ether carboxylate in the acid form. Alkyl ether carboxylates are weak acids. When EMPICOL® CED 5 surfactant is included in formulations it can be neutralised with a variety of bases to any chosen pH target. Each base will have a different neutralization equivalent.

The Neutralization Curve

The Neutralization Equivalent

- Complete neutralisation of EMPICOL® CED5 occurs at pH 9.16

Product Range

<table>
<thead>
<tr>
<th>EMPICOL®</th>
<th>INCI Name</th>
<th>Huntsman Name</th>
<th>Viscosity</th>
<th>Active Matter %</th>
<th>pH</th>
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<td>Sodium Laureth-4 Carboxylate</td>
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<td>Laureth-11 Carboxylic Acid</td>
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