

# Classification of Ester oils using C<sub>10</sub>E<sub>4</sub>/Oil/Water Systems

C. Pierlot<sup>1,\*</sup>, J. F. Ontiveros<sup>1,2</sup>, H. Takahashi<sup>1,3</sup>, M. Catté<sup>1</sup>,  
V. Molinier<sup>1</sup>, J.-L. Salager<sup>2</sup>, J.-M. Aubry<sup>1</sup>

<sup>1</sup> Université Lille Nord de France, Université Lille 1, ENSCL, EA 4478, Chimie Moléculaire et Formulation, F-59650 Villeneuve d'Ascq Cedex, France.

<sup>2</sup> Laboratorio FIRP, Ingeniería Química, Universidad de Los Andes, Mérida 5101, Venezuela

<sup>3</sup> Nagoya Institute of Technology, Nagoya 466-8555, Japan.

Esters oil are frequently used in the cosmetic industry as isopropyl myristate and isopropyl palmitate. The aim of the present work is characterize several esters (Figure 1) by determination of the equivalent alcane (EACN) which would have the same oil comportment when emulsified.

The physicochemical formulation plays a major role in the phase behavior of surfactant/oil/water systems and therefore on the properties of emulsions. Salager introduced the concept of hydrophilic lipophilic deviation HLD a dimensionless expression of the variation of chemical potential required to transfer a surfactant molecule of the oil phase to the aqueous phase. For non ionic surfactant, at the optimum formulation the HLD law becomes simplified (Eq. 1)

$$0 = \alpha - k \cdot \text{ACN} + c_T(T^* - T_{\text{ref}}) \quad (1)$$

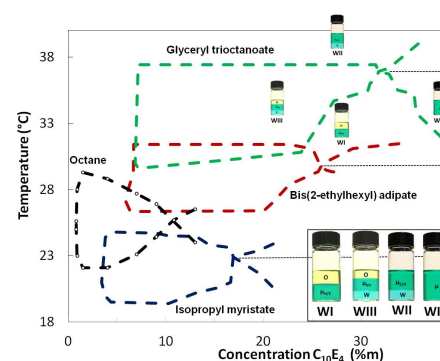
Where  $\alpha$ ,  $k$ , and  $c_T$  are characteristic parameters of the surfactant, “ACN” is the number of carbon atoms for the n-alkane, and  $T_{\text{ref}}$  is the difference between the temperature of the system and the reference temperature (25°C).  $T^*$  can be determined on the Fish diagram at the intersection of Winsor I, II, II and IV areas.

Using C<sub>10</sub>E<sub>4</sub> surfactant, we have determined the fish diagram for several esters and determined the Equivalent Alkane Carbon Number (EACN) using calibration curve. The effect of number of ester's groups, the position of the functional group and the number of carbon atoms in the “alcohol” and “acid” chain is rationalized. Conductivity and rheological experiments will be investigated to see the correlation between  $T^*$  and the phase inversion temperature.

## Reference :

Classification of ester oils according to their Equivalent Alkane Carbon Number (EACN) and asymmetry of fish diagrams of C<sub>10</sub>E<sub>4</sub>/ester oil/water systems.

J.F. Ontiveros, C. Pierlot, M. Catte, V. Molinier, A. Pizzino, J.L. Salager, J.M. Aubry, *J. Colloid Interf Sci* (2013), 403, 67-76.



**Fig. 1.** Fish diagrams for isopropyl myristate, bis(2 ethylhexyl) adipate and glyceryl trioctanoate C<sub>10</sub>E<sub>4</sub>/Octane/Water system.