EMULSION SCIENCE AND TECHNOLOGY

November 12–13, 2012
Malmö – Sweden

The Öresund bridge, Malmö–Copenhagen

CALMIA
EDUCATION CENTER

EMULSION SCIENCE AND TECHNOLOGY

Emulsion formation
Selection of emulsifiers
Emulsion stability

November 12–13, 2012
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This course is held for the 19th time.

Course outline

Introduction
The definition and classification of emulsions. The general description of emulsion break down processes. Industrial applications of emulsions.

Physical chemistry of emulsion systems
The interface and the Gibbs dividing surface. Definition of interfacial tension and effect of curvature. Thermodynamics of emulsion formation and breakdown. Role of the stabilizer (emulsifier).

Interaction energies between emulsion droplets and their combinations
Van der Waals attraction. Double layer repulsion. Steric repulsion. Combination of van der Waals attraction and double layer repulsion. Combination of van der Waals attraction and steric Repulsion.

Adsorption of surfactants at the liquid/liquid interface
The Gibbs Adsorption Isotherm. Measurement of interfacial tension.

Mechanism of emulsification
Energy required for expansion of the interface and the role of the Laplace pressure. Representation of the processes occurring during emulsion formation. Methods of emulsification: Mixers and high pressure homogenisers. Laminar and turbulent regimes.

Role of surfactants in emulsion formation
Surfactant adsorption and droplet size. The role of the interfacial dilational modulus. Interfacial tension gradients and droplet formation. The Gibbs-Marangoni effect.

Selection of emulsifiers
The Hydrophilic Lipophilic Balance (HLB). Calculation of the HLB number from surfactant composition.

Davies approach of group numbers to calculate the HLB number. Correlation of HLB number with cloud point. The Phase Inversion Temperature (PIT) concept. Correlation of PIT with emulsion coalescence.

The Cohesive Energy Ratio (CER) concept and Critical Packing Parameter (CPP) concepts for emulsifier selection
The Winsor R_{∞} concept. Calculation of interaction parameters from Hildebrand solubility parameter and Hansen hydrogen bonding concept. Calculation of the Critical Packaging Parameter (CPP) from surfactant geometry. The CPP for spherical, rod-shaped and lamellar micelles and its relation for the type of emulsion formed.

Creaming or sedimentation of emulsions
The driving force for creaming or sedimentation. Calculation of creaming or sedimentation rates and the effect of the oil volume fraction. Prevention of creaming or sedimentation.

Flocculation of emulsions
Balance of attractive and repulsive forces. Flocculation of electrostatically stabilised emulsions. Slow and fast flocculation rates and the stability ratio. Flocculation of sterically stabilised emulsions. General rules for reducing or eliminating flocculation.

Ostwald ripening. Emulsion coalescence and phase inversion
Driving force for Ostwald ripening. Methods for reduction of Ostwald ripening. The mechanism of emulsion coalescence. The concept of disjoining pressure for reduction of coalescence. Reduction or elimination of coalescence. Rate of coalescence. Phase inversion. Transitional and catastrophic inversion and factors that affect the processes.

Experimental methods for assessment of emulsion stability
Assessment of creaming or sedimentation. Assessment of flocculation, Ostwald ripening, coalescence and phase inversion.

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Course description

The formation of emulsions (liquid/liquid dispersions), selection of emulsifiers, the stabilisation of emulsions and the control of their properties on application represent a challenge to most industries. It is essential to understand the physical chemistry of emulsions and the adsorption of surfactants and the liquid/liquid interface. It is also important to understand the process of emulsification and the role of the emulsifier in order to be able to prepare emulsions that are suitable for applications and with a desirable shelf life. This course addresses the above processes at a fundamental level.

This is followed by various lectures on emulsion stability and instability: Creaming or sedimentation, flocculation, Ostwald ripening and phase inversion. The methods that can be applied to reduce or eliminate these instabilities are described. It is also important to describe the various experimental techniques that may be applied to assess the stability of emulsions.

The above course will be valuable for chemists and chemical engineers involved in the formulation of emulsions and assessment of their stability. It will also be valuable for researchers involved in fundamental studies on emulsions.

Course lecturer

Prof. Tharwat Tadros

was formerly a Senior Research Associate at the Zeneca Agrochemicals, Jealott's Hill Research Station (The ICI Group), Bracknell, UK. He is a Visiting Professor at The Bristol University and also works as a consultant and lecturer worldwide.

Prof. Tadros has published over 250 papers in the fields of rheology and dispersions and has edited four books on polymer adsorption and stability, solid/liquid dispersion, surfactants and polymers in disperse systems. Furthermore he is the author of a book on Surfactants in Agrochemicals. And he has written a book on Applied Surfactants (2005).

He also carried out extensive research in the fields of suspensions and emulsions and their rheology. Prof. Tadros is the editor of Colloids and Surfaces Journal, Advances in Colloid and Interface Science and is a past President of the International Association of Colloid Scientists.

Due to his distinguished research Prof. Tadros was awarded two medals from the Royal Society of Chemistry in the UK.

Course Fee and Payment

EUR 1580 (Discounted fee* EUR 1480)

**Discounted Course fee is valid for two or more enrolments from the same company, at the same time, for the same course. And for enrolments from Universities and Government Institutes.*

The course fee includes: Tuition, copies of all Power Point presentations, certificate and meals. Two Lunches, beverages at breaks and course Dinner the first day.

All registrations will be confirmed with a course schedule and some practical information.

We will send an ***Invoice*** to the amount of the Course Fee.

Accommodation is not included in the course fee.

VAT (Moms) will be added for applicants domicile in Sweden.

Course Location and Hotel

The course is held at

Radisson BLU Hotel, Malmö–Sweden

November 12–13, 2012

To obtain the reduced price for accommodation, reservations must be made through Calmia.

Weekday nights
SEK 1575 (about **EUR 157**) for a single or double room per night incl. breakfast and VAT.
Nights between Saturday/Sunday/Monday
SEK 950 (about **EUR 95**) for a single or double room per night incl. breakfast and VAT.

Radisson BLU Hotel
Östergatan 10
211 25 Malmö, Sweden
Tel. +46-40-698 4000
www.radissonblu.com/hotel-malmo

Transport Information

Copenhagen Airport, Kastrup, is the nearest international airport. There are trains running several times each hour (20 min. journey) from Copenhagen Airport to Malmö Central Station. The course location is only 5–10 min. away from the station in Malmö. The airport bus from Malmö Airport, Sturup, stops outside the station in Malmö.

Course Time Table

Registration on Monday at 08:30–8:45
The course ends on Tuesday about 16:00

How to register

- **On-Line registration**
  www.calmia.se
- **Fax or Mail**
  A Registration Form can be printed from each PDF-file

Registration must be made before October 12, 2012

Substitutions are allowed at any time from the same company or institute.

Cancellation

No refunds will be made for those who do not attend the scheduled course and/or cancel after October 12, 2012.

Questions

For General questions please contact:
Mrs G Tånge-Henderson
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tel/fax: +46-(0)46-211 00 20

For Scientific questions please contact:
Prof. Tharwat Tadros
Tharwat@Tadros.fsnet.co.uk

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Registration Form

Registration before October 12, 2012

Please print!

The number of participants is limited.

I wish to attend the course:

EMULSION SCIENCE AND TECHNOLOGY
November 12–13, 2012
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Reserve on my behalf accommodation at the Radisson BLU Hotel in Malmö

From (date) _____ To (date) _____ Number of nights: _____

☐ Single room ☐ Double room ☐ Late arrival (after 18:00)

The hotel bill should be paid directly to Radisson BLU Hotel on the day of departure

Surname _____

Given Name _____

Job Title _____ ☐ Ms ☐ Mr

Company/Institute _____

Address _____

Country _____

Tel/fax _____ E-mail _____

Purchase Order number _____ (If required by your company)

Invoice address if different from the one above:

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