

Spontaneous emulsification in the system water/benzene/ethanol: Phase equilibria and emulsification mechanism

Abeer Al-Bawab^{a,b,*}, Ayat Bozeya^{a,b}, Stig E. Friberg^c, Lingling Ge^d, Rong Guo^d

^a Hamdi Mango Center for Scientific Research (HMCSR), The University of Jordan, Amman, Jordan

^b Chemistry Department, Faculty of Science, The University of Jordan, Amman, Jordan

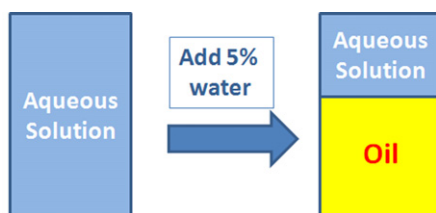
^c Ugelstad Laboratory, NTNU, Trondheim, Norway

^d School of Chemistry and Chemical Engineering, Yangzhou University, Yangzhou, People's Republic of China

HIGHLIGHTS

- Investigation of the spontaneous emulsification along the de-mixing line.
- The system was water/benzene/ethanol when contacted with water.
- Clarification for the effect of the composition of the solution versus the plait point.
- At the initial contact between the solution and the water, emulsion was formed.
- Direct relationship of spontaneous emulsification mechanism with the phase diagram.

GRAPHICAL ABSTRACT



The System: Water/Benzene/Ethanol

ARTICLE INFO

Article history:

Received 6 September 2012

Received in revised form 5 November 2012

Accepted 6 November 2012

Available online 15 November 2012

Keywords:

Spontaneous emulsification

Phase diagram

Interfacial phenomena

Diffusion

Emulsions

ABSTRACT

Solutions (Or), along the de-mixing line in the system water/benzene/ethanol were contacted with water (W) and the spontaneous emulsification followed by a camera at 40 pictures/s. The emulsions formed predominantly in the solution layer for both the aqueous and organic branch of the de-mixing line.

These results were projected on the phase diagram of the system and a direct relationship between diagram features and the mechanism of spontaneous emulsification showing a significantly more powerful reaction for solutions of a composition close to the plait point of the system.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

Spontaneous emulsification was early introduced into emulsion science by Gad [1], discovering the action at the interface between solutions of a carboxylic acid in oil and sodium hydroxide in water. The effect was evidently due to the chemical reaction, the neutralization at the interface and interfacial instability became the focus of subsequent investigations [2] though

Abbreviations: aqueous, Aq; benzene, B; close aqueous composition, CPP; dilution line, DL; ethanol, E; oil, Oi; original solution, Or; oil in water emulsion, O/W; plait point, PP; water, W.

* Corresponding author at: Chemistry Department, Faculty of Science, and HMCSR, the University of Jordan, Amman, Jordan, P.O. Box 13536, Amman 11942, Jordan. Tel.: +962 796661601; fax: +962 6 5300253/962 6 5300238.

E-mail addresses: drabeer@ju.edu.jo, abeerbawab@yahoo.com (A. Al-Bawab).