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

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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

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.

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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.

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...