

Amphiphilic nanostructures in aqueous solutions of triethyleneglycol monododecyl ether

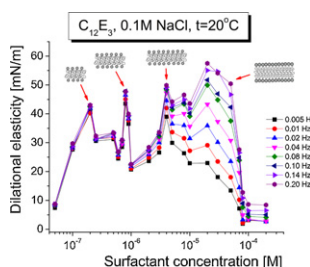
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HIGHLIGHTS

- ▶ In aqueous solutions of $C_{12}E_3$ pre-micelles cause onset of two plateaus and one kink of surface tension isotherm.
- ▶ In aqueous solutions of $C_{12}E_3$ pre-micelles cause onset of maxima in surface dilational elasticities.
- ▶ In aqueous solutions of $C_{12}E_3$ pre-micelles cause onset of unstable black patterns (dots) in foam films.

GRAPHICAL ABSTRACT



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ABSTRACT

The aim of the present study is to relate the surfactant adsorption layer properties at air/solution interface to the drainage parameters of microscopic foam films in the case of aqueous solutions of the non-ionic amphiphile triethyleneglycol monododecyl ether ($C_{12}E_3$). The scope of the research covers adsorption dynamics, construction of equilibrium surface tension isotherm, studies on dilational rheology of the interfacial layers and foam film drainage kinetics. It is established that in the pre-micellar concentration domain (for surfactant concentrations higher than the range where the Henry's law is operative but one–two orders of magnitude lower than the conventional CMC-values) there are considerable irregularities of the adsorption layer properties: two plateau regions and a kink are registered in the experimental surface tension isotherm, unusual changes of the surface rheological characteristics. The systematic investigations of the microscopic foam films reveal that the courses of basic kinetic parameters against the amphiphile concentration run in synchrony with the changes in the adsorption layer anomalies. This fact is related to the presence of pre-micellar surfactant aggregates. The results are juxtaposed to previously obtained characteristics of aqueous solutions of the non-ionic amphiphile tetraethyleneglycol monododecyl ether under similar experimental conditions (Colloids & Surfaces A, 392 (2011) 233–241).

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1. Introduction

Nonionic surfactants from the group of oligoethylene glycol mono-n-alkyl ethers C_nE_m have been a topic of intensive research (e.g. [1]). Most of these compounds are relatively water soluble and biodegradable and they find applications in the production of

pharmaceuticals, cosmetics, dyes, etc. The key factor in the design and fine-tuning of the surfactant formulations based on C_nE_m is the possibility to regulate the hydrophilic–lipophilic balance (HLB) in aqueous solutions by varying the lengths of the hydrophilic and the hydrophobic chains. It is well-known that in aqueous solutions and above a certain threshold quantity – the critical micellar concentration (CMC) – the amphiphilic molecules organize into a range of self-assemblies. The nanostructures may be identified by sharp changes in various bulk and interfacial properties (e.g. electrical conductivity, surface tension isotherms at solution air/interface, etc.). Analogous effects have also been detected when the surfactant concentrations are within the intermediate (pre-micellar)

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