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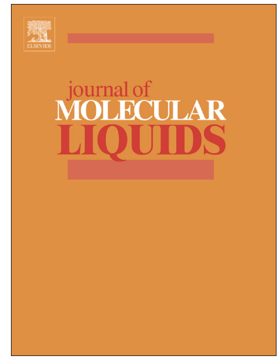

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Synthesis and properties of biodegradable cationic gemini surfactants with diester and flexible spacers

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Abstract

A series of cationic gemini surfactants with diester and flexible spacers, namely **C_{12}-PG-C_{12}**, **C_{14}-PG-C_{14}** and **C_{16}-PG-C_{16}**, were synthesized, purified and characterized. The surface properties and aggregation behavior of the gemini surfactants were investigated by surface tension, electrical conductivity, fluorescence and krafft point. These gemini surfactants possess higher surface activity than the traditional monomeric surfactants. The thermodynamic parameters exhibited that the micellization was a spontaneous and exothermic process in environment. The micellization process became less favorable with the decrease of alkyl chain length and the increase of temperature. Steady-state fluorescence measurements revealed that the micropolarity and aggregation number of micelles decreased with the increase of hydrocarbon chain length. The Krafft points were taken as less than 0℃, which indicated the synthesized gemini surfactants had good water solubility. The biodegradability of the gemini surfactants were evaluated in river water using Closed Bottle tested and showed their high biodegradation ratio in the open environment due to the diester bond inserting in the flexible spacer of surfactant molecules.

Keywords Gemini surfactants, Diester and fexible sacers, Surface properties, Biodegradability

1 Introduction

Gemini or dimeric surfactants, consisting of two single alkyl tails and two polar head groups covalently linked by a spacer group [1-3], have attracted more and more research attentions because of the lower critical micellar concentration (CMC), the better adsorption behavior, the superior aqueous solution, and the tendency to form micelles of different shapes and dimensions even at low concentration compared to the corresponding monomeric surfactants [4-7]. Among them, cationic gemini surfactants have been widely developed because their synthetic route from readily available starting materials is straight-forward. In recent years, cationic gemini surfactants show their great potential as a next generation surfactant for biomedical and industrial applications such as effective corrosion inhibitors [8,9], bactericidal agents [10-12], gene delivery agents [13,14], drug entrapment and release [15], and detergents, etc. However, the applicability of cationic gemini surfactants is usually hampered by certain environmental concerns and toxicity

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