Colloids and Surfaces A: Physicochem. Eng. Aspects 414 (2012) 320–326

Contents lists available at SciVerse ScienceDirect

Colloids and Surfaces A: Physicochemical and Engineering Aspects

journal homepage: www.elsevier.com/locate/colsurfa

A new fluorinated inositol-based surfactant

Nils Bongartz[a], Sandeep R. Patil[b], Cosima Stubenrauch[b,c], Dirk Blunk[a,*]

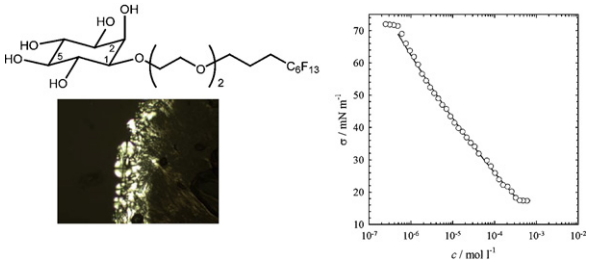
[a] Universität zu Köln, Institut für Organische Chemie, Greinstr. 4, 50939 Köln, Germany
[b] School of Chemical and Bioprocess Engineering, University College Dublin, Belfield, Dublin 4, Ireland
[c] Universität Stuttgart, Institut für Physikalische Chemie, Pfaffenwaldring 55, 70569 Stuttgart, Germany

HIGHLIGHTS

- Synthesis of fluorinated inositol-based surfactant $C_{6F}C_{3H}E_2I_1$.
- Properties are dominated by fluorinated chain.
- Recipe to tailor-make fluorinated surfactants with hybrid head groups.

GRAPHICAL ABSTRACT

Molecular structure, lyotropic lamellar phase and surface tension of the partly fluorinated, new inositol-based surfactant $C_{6F}C_{3H}E_2I_1$.



ARTICLE INFO

Article history:
Received 24 February 2012
Received in revised form 23 August 2012
Accepted 25 August 2012
Available online 31 August 2012

Keywords:
Inositol-based fluorinated surfactant
Thermotropic and lyotropic liquid crystals
Surface properties
Design of new surfactants

ABSTRACT

Carbohydrates are versatile materials of natural origin and thus they are interesting hydrophilic head groups for surfactants. Especially *myo*-inositol derivatives have advantages over pyranosidic or furanosidic sugar derivatives, namely a higher thermal and chemical stability. The main disadvantage turned out to be the poor water solubility of *myo*-inositol surfactants, which, however, can be overcome by introducing an oligoethylene oxide group between the inositol head group and the apolar chain. Our goal was to combine the favourable properties of surfactants based on *myo*-inositol with those of fluorinated surfactants, which are becoming increasingly important as CO_2 solvation mediators or stabilizers for reverse water-in-fluorocarbon microemulsions. Thus we synthesized a new surfactant which combines the three units of interest, namely an inositol head group, an oligoethylene oxide linker to provide sufficient solubility and a fluorinated chain. We studied the thermotropic and lyotropic liquid crystalline behaviour as well as the surface tension and compared these results with those of a fully protonated surfactant which has a similar structure.

1. Introduction

Inositol-based surfactants are increasingly attracting attention mainly due to their enhanced properties compared to other carbohydrate surfactants such as pyranosidic or furanosidic sugar derivatives. For example, inositol-based surfactants have a higher chemical and temperature resistance and they arehydrolysis-stable at low pH values. Inositols (cyclohexane-1,2,3,4,5,6-hexols) belong to the group of cyclitols and to the family of carbohydrates since they have the same molecular formula as hexoses ($C_6H_{12}O_6$) but a different constitution. In fact, they can be considered as homocyclic carbon analogues of pyranoses. The inositol family consists of nine stereoisomers, with one of them, namely *myo*-inositol, being commercially available at reasonable price as it is industrially obtained by the cleavage of phytic acid, which appears as a side product from many biomaterial converting processes [1]. The disadvantage of *myo*-inositol monoalkylethers and monoalkyesters, however, is their comparably low water solubility [2,3]. As was

* Corresponding author. Tel.: +49 221 4705213; fax: +49 221 4703064.
E-mail address: d.blunk@uni-koeln.de (D. Blunk).

0927-7757/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.colsurfa.2012.08.053