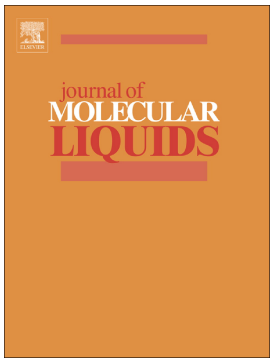

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Hongyan Cai, Yancheng Zheng, Hongzhuang Wang, Yi Zhang, Lu Lai, Qian Xie, Luwei Fang

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Synthesis and physiochemical properties of poly(ethylene glycol)-octanolsulfosuccinates

Hongyan Cai[a], Yancheng Zheng[b*], Hongzhuang Wang[a], Yi Zhang[a], Lu Lai[b], Qian Xie[b], Luwei Fang[b]

a State Key Laboratory of Enhanced Oil Recovery, Research Institute of Petroleum Exploration and Development, PetroChina, Beijing 100083, China. b College of Chemistry and Environmental Engineering, Yangtze University, Jingzhou434023,China

*Corresponding author. E-mail address: zhengycg@163.com

Abstract: A series of sulfonated maleic diesters with ethylene oxide groups were synthesized by the reactions of esterification and sulfonation. Maleic diesters were prepared by esterification of maleic anhydride with any one kind of poly(ethylene glycol) with different molecular weights from 200 to 1000 and isooctanol, and then sulfonated by sodium bisulfite to get poly(ethylene glycol)-octanol sulfosuccinates. Reaction temperature and time of esterification of monoester and diester, using toluene sulfonic acid as catalyst and toluene as solvent, were investigated. The surfactants synthesized are identified by FTIR and ^{1}HNMR. Thermal analysis results identify that the investigated surfactants have a good thermal stability. The surface activity of the surfactants in aqueous solution was determined at 298K. It was found that the critical micelle concentrations (CMC) decrease with increase of the molecular weights and the number of ethylene oxide units of the investigated products, surface tension values at the CMC (γ_{CMC}) are upward trend in general. The maximum surface excess concentration (Γ_{max}) decreases mildly with the increasing of molecular weight of poly(ethylene glycol), and area per molecule (A_{min}) increases with the increasing of ethoxy chain unit. Hydrodynamic diameter of investigated surfactants increases with increasing the concentration, and decreases in general trend with increase of molecular weight of poly(ethylene glycol). Addition of salt to the aqueous solution of surfactants sharply decrease values of CMC and γ_{CMC} compared with corresponded surfactants in distilled water.

Keywords: Sulfonated succinate; Polyethylene glycol; Thermal analysis; Surface activity; Micellization; Inorganic salt

1 Introduction

Wettability is the most important factor which affects the rate and amount of spontaneous imbibition of water and changes the efficiency of oil displacement [1,2]. Especially in water-wet fractured reservoirs, oil recovery depends on spontaneous imbibition of water to drive oil from the matrix into the fracture system. The water-wet rock helps to enhance oil recovery compared to the oil-wet rock because capillary force of water-wet rock is the power of the water-flood recoveries which improves the spontaneous imbibition rate. As a matter of fact, most matrix blocks of reservoirs are oil-wet or mixed-wet. Chemical treatment for wettability alteration has become one of the techniques to recover oil from such reservoir. Electrolyte, solvent and surfactant have been used to alter the wettability of originally oil-wet rocks. Surfactants including anionic, cationic, nonionic and betaine surfactants are commonly used as materials to change wettability [3~7].

R.Gupta et al.[8] have treated oil-wet chips with the brine solution of polyethyleneglycol type