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Efficiency Boosting of Surfactants in Microemulsions with Novel Amphiphilic Poly(ethylene oxide)-poly(alkyl glycidyl ether) Polymers

By adding small amounts of amphiphilic diblock copolymers like poly(ethylene oxide)-co-poly(ethylene propylene) (PEO-PEP) to water – oil – non-ionic surfactant systems, Jakobs et al. showed that the efficiency of medium-chain surfactants to solubilize equal amounts of water and oil can be strongly increased (so-called efficiency boosting) [1]. In order to obtain a similar boosting while circumventing the drawback of a difficult large-scale synthesis, two new types of amphiphilic polymers were used in this work, namely poly(ethylene oxide)-poly(alkyl glycidyl ether)s (PEO-PAlkGE) and their carbonated poly(ethylene oxide)-poly(carbonate alkyl glycidyl ether) derivatives (PEO-PCO₂AlkGE) [2]. By studying their influence on the phase behavior of ternary non-ionic microemulsions containing different oils, ranging from the medium-chain *n*-decane (C₁₀H₂₂) to the long-chain *n*-octacosane (C₂₈H₅₈) to the technical-grade Sasolwax 5805 (equivalent alkane carbon number of 30.8), a significant increase in efficiency was found for both types of amphiphilic polymers [3]. This strong boosting effect was further observed for systems with technical-grade surfactants, which could be of interest for industrial applications where a reduction in surfactant needs is of substantial economic as well as ecological advantage. Endo et al. attributed this strong increase in efficiency to the adsorption of the amphiphilic copolymer molecules into the surfactant membrane, whereby the boosting was found to scale with the number density of copolymers in the membrane and the end-to-end distances of the hydrophilic and hydrophobic polymer blocks [4]. In this work, end-to-end distances of PEO and PAlkGE blocks were determined by small-angle neutron scattering or calculated from literature. For *n*-decane microemulsions, the boosting effect of the new PEO-PAlkGE's and the extensively investigated PEO-PEP's could be scaled on top of each other. A different scaling was found for *n*-octacosane microemulsions, which was attributed to the polymers behaving more like ideal chains at elevated temperatures.

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