338f Novel Surfactants with Biodegradable Tails for the C02-Water Interface

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Abstract

Compressed carbon dioxide is an environmentally benign, nonflammable, and inexpensive solvent. It has a high mass transfer coefficient, low surface tension and adjustable solvent power. Compressed CO2-based systems have been suggested as potential alternatives in processes including extraction, fractionation, materials processing and chemical reactions. However, with a low dielectric constant, and low polarizability per unit volume CO2 is unable to dissolve hydrophilic substances and large molecular weight solutes. One particular approach to tackle this problem is to employ suitable surfactants that produce stable water in CO2 emulsions and microemulsions, which contain polar domains where nonvolatile hydrophilic substances can be dissolved. Such aqueous dispersions in CO2 have attracted much attention and have possible applications in areas including dry cleaning, nanoparticle synthesis, enzymatic catalysis and chemical reactions.

In this study, a new class of amphiphiles with biodegradable CO2-philic groups has been synthesized. Their interfacial activity was measured at the CO2-water interface using a high-pressure pendant drop tensiometer. We will present the interfacial tension results at varying hydrophilic-CO2 philic balance (HCB) at sub and supercritical conditions, and pressures up to 35 MPa. The results indicate that these amphiphiles can reduce the interfacial tension of the binary CO2-water interface down to values where microemulsion formation has been observed for other surfactant systems.

Keywords: compressed carbon dioxide, emulsions and microemulsions, amphiphiles, biodegradable, interfacial tension.