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## Formation, physicochemical and interfacial study of carbamate surfactants

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### Abstract

Carbon dioxide is commonly used as pH regulator in switchable surfactant systems and in the formation of alkyl ammonium-alkyl carbamate ion-pair. Its use to form a meta-stable anionic surfactant has been less explored and can impart a cleavable character to the amphiphile.

The reaction between CO<sub>2</sub> and an alkylamine, N,N-di(propylamino)dodecylamine (Y12-amine), under alkaline pH conditions, produced a stable anionic carbamate-based surfactant (Y12-carbamate). By heating and exposure to N<sub>2</sub>, anionic Y12-carbamate could slowly be reverted into Y12-amine. The surface activity of Y12-amine and Y12-carbamate was investigated by surface tension measurements. To study the behavior of Y12-amine at the gas-water interface during CO<sub>2</sub> exposure, we used the pendant drop technique with a sealed chamber where the gas composition could be controlled.

The Y12-carbamate had a higher CMC than Y12-amine at pH 12, and was also less surface active. The ion pair Y12-ammonium – Y12-carbamate, obtained at neutral pH, exhibited the lowest CMC and the highest surface activity. The interfacial formation of anionic Y12-carbamate induced an increase in surface tension. When CO<sub>2</sub> was exchanged to N<sub>2</sub>, the migration from the bulk to the interface of Y12-amine induced a decrease in surface tension. The rate was dependent on the concentration of Y12-amine.

### Keywords

Surfactant, anionic carbamate, amine, carbon dioxide, surface tension, interface, ion pair.

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