

Kinetics of evaporation from interfacial adsorption layers of volatile surface-active amphiphiles

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O1:17. Kinetics of evaporation from interfacial adsorption layers of volatile surface-active amphiphiles

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We investigate the changes in the tensile properties of air/ water interfaces in presence of a volatile surfactant, so that continuous evaporation is taking place simultaneously with the adsorption or desorption. The study is focused on substances whose characteristic features are (i) appreciable water solubility, (ii) relatively high vapor pressure, and (iii) significant surface activity – we use linalool, benzyl acetate, and citronellol, as volatile amphiphiles (VA).

The adsorption is quantified by measuring the kinetics of surface tension, $\sigma(t)$, in experimental arrangements which ensure reproducible evaporation. Drop shape analysis was carried out, with sessile and pendant drops – the surface tension is found to increase (see Fig. 1). The latter dependence is explained in the frames of a proposed theoretical model, taking into account the balance of fluxes at the interface, including the mass transport through the boundary layer at the gas side. Then, local equilibrium at the A/W interface suggests that the adsorbed amount of VA [$\Gamma(t)$], the surface tension [$\sigma(t)$], and the sub-surface concentration [$c_s(t)$] are connected by an isotherm – it is determined in absence of evaporation, by measurements of dynamic surface tension at different bulk concentrations using the Maximum Bubble Pressure Method. The data are fitted with the van der Waals equation of state. The obtained $\sigma(c_s)$ dependence is combined with the mass transport kinetics, to yield a prediction for $\sigma(t)$.

Following the above procedures, we achieve very good agreement between theory and experiment (Fig. 1). As an adjustable parameter, one material constant is determined – the mass transfer coefficient of VA across the A/W boundary. Results for different VA are presented.

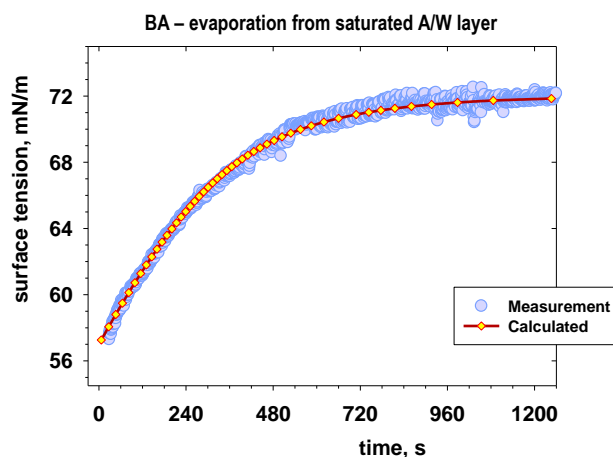


Figure 1. Comparison between experimental and theoretical increase of surface tension, $\sigma(t)$, when benzyl acetate (BA) is left to evaporate from a pendant drop whose surface has been preliminarily equilibrated in saturated vapors of pure liquid BA.

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THE END

Thank you for your attention!



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