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A method for measuring pressure-area isotherms of insoluble surfactant monolayers

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Abstract

A simple method for measuring pressure-area isotherms of insoluble surfactant monolayers is proposed. It can be seen as a variant of the ADSA-PD/CSD (Axisymmetric Drop Shape Analysis-Pendant Drop/Constrained Sessile Drop) film balance technique, where both the surface pressure and area per surfactant molecule are measured in the course of the experiment. In the proposed method, the measurement of this latter quantity is substituted by a straightforward fitting of an equation of state to the surface pressure values. In this way, one eliminates the main source of error of the ADSA-PD/CSD technique: the accurate determination of the small amount of surfactant deposited on the interface. The comparison between previous experimental results and those obtained with this approach shows remarkable agreement (the relative deviations in the area per surfactant molecule are of the order of 1%).

Key words: insoluble surfactants, pressure-area isotherms, surface pressure
PACS: 42.30.-d, 47.35.Pq, 47.55.nk

*Introduction.*The use of surfactants possesses a number of applications in diverse technological fields. More specifically, insoluble monolayers play an important role in biology and molecular electronics, are used to mimic and analyse biomembranes, constitute the main component of lung surfactants, are present in the protection of eyes and ears, and allow one to construct electronic devices such as sensors and capacitors, among many other applications. Insoluble surfactants have also demonstrated their usefulness in water pollutants recovery treatments [1]. The presence of an insoluble monomolecular film alters fundamentally the dynamical response of capillary systems [2], especially when the action of surface tension is maximized due to the very small size of the system. The Marangoni convection produced by the surfactant concentration variation has a stabilizing effect, increasing the limiting length of stretching liquid bridges or causing extra-damping of linear oscillations.

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