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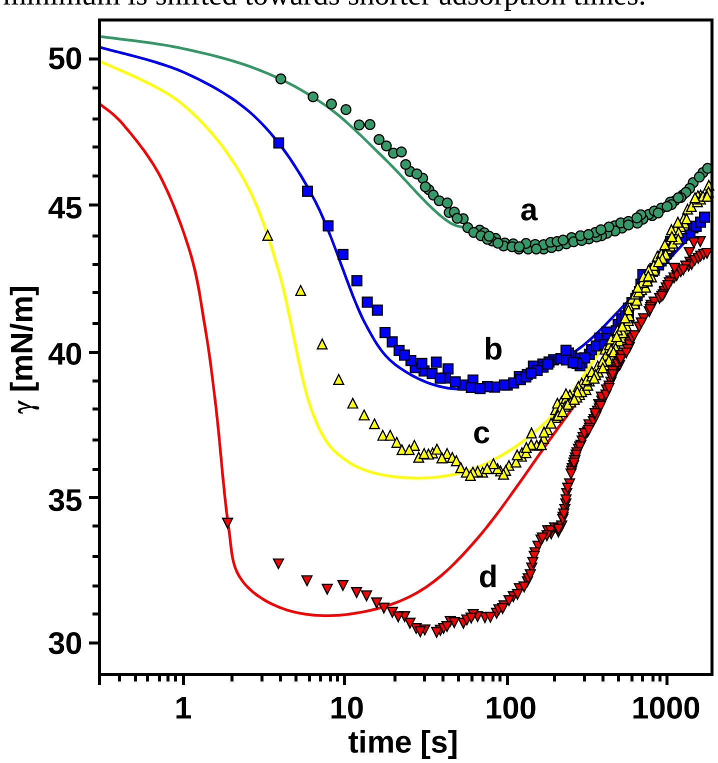
Dynamic Interfacial Tensions Obtained by the Drop and Bubble Shape Tensiometer PAT-1

Using the PAT-1 instrument, dynamic interfacial tensions can be obtained. During the experiments either the drop volume or the drop surface area can be kept constant. Experimental data obtained with constant surface area are advantageous for a quantitative data analysis. The method works at liquid-liquid interfaces without modifications, however, a new calibration is required due to changed properties of the liquid media.

The principle type of data obtained from PAT-1 with the format “*.fit” are given in a text format and can be imported into any graphic tool. Typically, only the adsorption time and the interfacial tension are needed.

A suitable software to display the results graphically is MS EXCEL. The data can be easily imported into an EXCEL worksheet. The following graphics shows the time dependence of four different concentrations of a model surfactant (C_{13}DMPO – alkyl dimethyl phosphine oxide) studied at the water-hexane interface. The typical minimum is obtained when the surfactant solved in the water drop is soluble also in the oil phase (here hexane). For increasing concentrations the surface tension decrease starts earlier and is faster, and the minimum is shifted towards shorter adsorption times.



Dynamic interfacial tension during the adsorption and transfer of C_{13}DMPO at the water/hexane interface; the hexane phase is initially free from surfactant; water/hexane volume ratio is 10^{-3} (single water drop in a hexane environment); initial concentrations in water: $C_0=1 \cdot 10^{-8}$(a), $2 \cdot 10^{-8}$ (b), $3 \cdot 10^{-8}$ (c), $5 \cdot 10^{-8}$ mol/cm³(d); *according to M. Ferrari at al., J. Colloid Interface Sci., 186(1997)40*

Using a theoretical model, the adsorption mechanism of the studied surfactant can be analysed. Algorithms and procedures for such an analysis have been described in a book recently published (*Surfactants – Chemistry, Interfacial Properties and Application, Studies in Interface Science, V.B. Fainerman, D. Möbius and R. Miller (Eds.), Vol. 13, Elsevier, 2001*). The model includes the partitioning coefficient of the surfactant between the two liquid phases and the transport in both liquids by diffusion. The solid lines in the graph have been calculated using a diffusion model (for the description of the model see *Liggieri et al., J. Colloid Interface Sci., 186(1997)46*).

If the studied surfactant is soluble only in one phase, for example the water phase, then the dynamic interfacial tensions show the typical S-shape when plotted versus logarithm of time. For experiments at shorter adsorption times, the module DPA-1 as additional equipment for PAT-1 is available, providing data in a much short time range (*A. Javadi et al., Colloids & Surfaces A, 365 (2010) 62–69*).

Our service:

- selection of the right experimental technique for a given surfactant
- measurement of dynamic interfacial tensions over a respective adsorption time
- data analysis and graphical representation
- analysis of the adsorption mechanism
- proposal of other complementary techniques if needed
- compare with standard surfactants
- reference to literature data
- literature analysis to the subject