The influence of the potential on the arrangement and lateral diffusion of DOPC on gold

Hana Hoffmannová[1], Martin Hof[1, 2] and Petr Krtil[1]
[1]J. Heyrovský Institute of Physical Chemistry, Academy of Sciences of the Czech Republic, [2]Centre for Complex Molecular Systems and Biomolecules, Dolejskova 3, CZ 18223, Prague, Czech Republic

The phospholipid bi-layers supported on solid substrates were developed as a model of biological membranes. The preparation of such layers is possible using Langmuir-Blodgett method and by spontaneous vesicle fusion. Due to its experimental simplicity the spontaneous fusion of vesicles is more often used and caused the development of methods studying the adsorbed phospholipid layer characteristics.

The vesicle fusion on conductive substrates could be studied in more systematic way than that on nonconductive substrates, since one can use an external electrical field to control some important factors of the process, like surface charge of the substrate. This paper demonstrates the influence of electric field on the arrangement and mobility of the adsorbed 1,2-dioleoyl-*sn*-glycero-3-phosphocholine (DOPC) on gold.

As follows from quartz crystal microbalance (QCM) data, a contact of unilamellar DOPC vesicles with polarized gold results in DOPC adsorption (see Fig. 1). The total frequency change caused by adsorption is affected by the potential of the gold electrode (see Fig. 2). The analysis of the QCM data indicates that bi-layer like systems are formed on positively or negatively charged substrates. In the case of adsorption at potentials close to potential of zero charge (*pzc*) an adsorption of intact vesicles may be possible.

The lateral mobility of the DOPC molecules in the adsorbed layers expressed in terms of diffusion coefficient shows complex dependence on the electrode potential (see Fig. 3). The highest mobility of DOPC in the adsorbed films was found for films deposited at *pzc*. The lateral mobility of DOPC molecules decreases as the potential departs from *pzc* and the surface charge density of the gold increases. It needs to be mentioned that observed diffusion coefficients of DOPC molecules on polarized or chemically modified gold surface is 4 – 5 orders smaller than those on mica or in solution.

Acknowledgement: This work was supported by the Grant Agency of the Czech Republic under contract No. B4040305 and by Ministry of Education, Youth and Sports of the Czech Republic via contract LN 00A032.

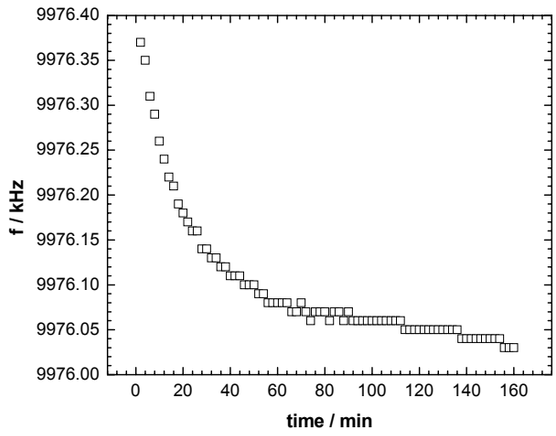

Fig. 1. Characteristic frequency change vs. time curve during adsorption of DOPC on bare gold. Applied potential was 50 mV.

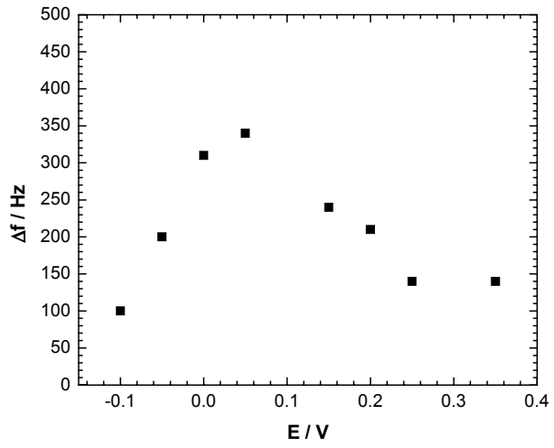

Fig. 2. The total frequency change at different potentials. Data were extracted from QCM experiment on bare gold.

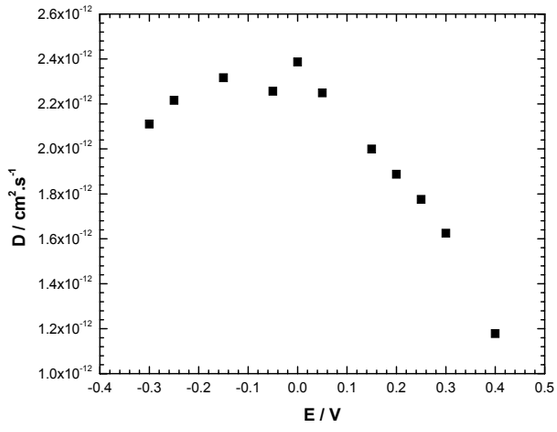

Fig. 3. Diffusion coefficients of DOPC molecules in the adsorbed film at different potentials. Data were extracted from FRAP experiments.