Streszczenie w języku angielskim

Vitamin C is an essential compound for a properly functioning organism. Knowledge of the processes responsible for the transport of this vitamin through the lipid bilayer allows the understanding of how local homeostasis is maintained. The influx of ascorbate is regulated by protein transporters (SVCT1, SVCT2 and GLUT) however, the mechanism of how ascorbate flows out to the extracellular matrix has not been explained yet. This is the motivation to study the possible interactions between vitamin C and lipid bilayer, including how these interactions could affect bilayer's physicochemical properties. The obtained results may relate to the transport of vitamin C through the lipid membrane and could underline the creation of a model which describes the bidirectional flux of this molecule in the cell. In the doctoral dissertation, the liposomal lipid bilayer model was used to carry out the research. The studies have been divided into three parts related to the research theses.

Firstly, to define the interactions between vitamin C and lipid bilayer, the isothermal titration calorimetry measurements were performed. The results confirmed the highly energetic interactions, depending on the lipid bilayer composition and the pH of the aqueous environment.

In the second part, the thermodynamic parameters from calorimetric data were used to quantitatively describe the transport of molecules through the lipid bilayer by passive diffusion. The obtained lipid bilayer/water partition coefficient of vitamin C indicates that this molecule has more affinity to lipid bilayer than to the aqueous environment, which has been shown for the first time and is opposite to the commonly referred octanol/water partition coefficient. The determined permeability coefficient is in good agreement with the literature data obtained with a different technique. That confirms that the created model, which was based on isothermal titration calorimetry data, could be used to determine this parameter.

In the last part, the influence of vitamin C on the physicochemical properties of lipid bilayer such as phase transition temperature, microviscosity and surface potential was verified. The obtained results demonstrated that this molecule changes the phase transition temperature and microviscosity of the lipid bilayer, which support the thesis of the possible interactions between vitamin C and lipid membrane.

The results of the research present that vitamin C interacts with the lipid bilayer and affects its physicochemical properties for the first time. The passive diffusion was not considered so far as the vital process of vitamin C efflux from the cell, due to the greater affinity of this molecule to the polar environment, as the octanol/water partition coefficient indicates. However, the determination of lipid bilayer/water partition coefficient along with the effect of vitamin C on features of lipid membrane implies that this mechanism of transport through the plasma membrane might be of great importance and could lead to the creation of a complete model of vitamin C homeostasis in the human body.

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