Streszczenie w języku angielskim

In recent years, there has been a growing interest of liposomes applications, such as targeted drug systems in pharmacy, medical diagnostics, cosmetology and food for special medical purpose design or biosensors for environmental monitoring. The mechanical properties of liposomes directly affect their stability, size as well as the amount and time of the substance transport. Additionally, liposomes mechanics affects the efficiency of cellular uptake of liposomes carrying therapeutic substances and the efficiency of their accumulation in target tissues. The presented results suggest that liposome stiffness is a critical parameter for the new liposomal formulations design efficient. Nevertheless, the study of the lipid bilayer mechanics mainly focus on liposomes with a diameter greater than 1 micrometer, which are not applicable in industry. Sub-micron-sized liposomes, commonly used in many technologies, are rarely tested for mechanical properties. This is because there are a limited number of experimental methods available for quantifying the mechanical properties of submicron liposomes, and the available techniques require the use of complex models and expensive equipment. The lipid bilayer mechanics in the microscale is studied mainly using micromanipulation technique or flicker-noise spectroscopy method. Studies using microliposomes provide useful data for understanding biological systems, but it has not been proven whether the parameters obtained with such an experimental model can be translated into the nanoscale.

This work is an article thesis. It is collection of four publication. The first one analyzed the liposomes industrial applications and the potential of lipid nanoparticles to improve the quality of life in society. In the second article, methods of the lipid nanoparticles mechanical properties determination were collected and attention was drawn to the inconsistencies between the results obtained using various techniques. Another publication developed a new technique for measuring the liposomes mechanical properties on a submicron scale. In the last article, the development of the new measuring technique was continued. Additionally, the effect of the mechanical properties of liposomes on biological processes such as endocytosis and stability under mechanical stress was studied.

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