

Structural and thermodynamic studies of drug delivery nanoparticles

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It has been studied the structure and stability to temperature and environmental conditions of calcium containing DPPC and DPPA liposomes, as well as calcium containing PLGA nanoparticles, prepared by our technology. The obtained data allow them to be used for treatment of calcium-deficient diseases, such as osteoporosis, osteopenia or bone fractures. The effectiveness of calcium nanoparticles will be increased if they are delivered specifically to calcium-deficient areas, thereby eliminating negative effects on the body. The studies considered delivering calcium nanoparticles to their destination in the shortest possible way - through the skin. The human and pig skin have many similarities, our experiments were conducted only using pig skin. For this reason, we created a device that determines the penetrating of nanoparticles the skin. The experiments showed that it was not so easy for nanoparticles to penetrate through the skin. In such way we used the alternative approaches to achieve our goals.

Through the experiments, we determined that the easiest and most effective way to transport calcium into the body through the skin was to prepare calcium-containing nanoparticles from eggshell. They contain a large amount of calcium (95% in the form of CaCO_3), which we prepared in the form of small diameter (100 nm) nanoparticles (suspension or gel). The suspension or gel of such eggshell nanoparticles makes it possible to deliver calcium through the dermis of the skin in calcium-deficient areas.

The above studies allowed us to determine what conditions are required to prepare such a structure of calcium-containing DPPC and DPPA liposomes, as well as calcium-containing PLGA nanoparticles for delivery calcium into the body through the skin.

Also, using our technology, we incorporated the anti-tumor drug doxorubicin (Adriamycin) into the liposomes and studied the structure of such complexes. We are confident that such liposomal drug should be more effective than the treatment produced by the existing drug (chemotherapy), the direct delivery of which into the body, along with the treatment, has more negative side effects on patients - weakness, hair loss, negative emotions, etc. Our liposomal delivery systems eliminate these effects. Research on these complex nanoparticles has not yet been completed and is currently ongoing.