MODULATORY EFFECT OF HUMAN PLASMA ON NANOSTRUCTURAL AND MORPHOLOGICAL FEATURES OF LIQUID CRYSTALLINE NANOCARRIERS

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Abstract

Cubosomes and hexosomes enveloping well-defined internal nanostructures are promising nanocarriers for entrapment of anticancer drugs intended for the intravenous delivery. Limited information is available on the influence of plasma components on nanostructural and morphological features of cubosome and hexosome dispersions, which may modulate their stability in the blood and their overall biological performance. Here, we have addressed the structural events occurring after prolonged incubation of an anticancer drug cisplatin-free and cisplatin-loaded dispersions based on phytantriol (PHYT) with human plasma. Through an integrated approach involving synchrotron small angle X-ray scattering (SAXS), cryo-TEM, and Nanoparticle Tracking Analysis (NTA), we have studied the time-dependent effect of human plasma (and the plasma complement system) on the integrity of the internal nanostructure, morphology and fluctuation in size distribution of these nanostructured aqueous dispersions. The results indicate that in the presence of plasma, the internal nanostructure of cisplatin-free nanoparticles undergoes transition from a biphasic feature (a bicontinuous cubic phase of the symmetry Pn3m co-existing with an inverted type hexagonal (H2) phase) to a neat hexagonal (H2) phase, which decreases the median particle size. These observations were independent of a direct effect by serum albumin and dispersion-mediated complement activation. The solubilization of cisplatin significantly affects the internal nanostructure of these nanoparticles. This study provides a basic understanding of the effect of biological milieu on nanoparticulate cubosomal and hexosomal formulations. However, thorough investigation is needed in the future in order to establish a link between the interaction of cubosomes and hexosomes with plasma components and their performance after administration.

Keywords: Cubosomes, hexosomes, anticancer drug, human plasma

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