Application of DSC and Imaging Techniques on the Development of Innovative Chimeric/Mixed Nanosystems

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Keywords: Chimeric nanosystems, differential scanning calorimetry, imaging techniques

The aim of this study was to rationally design, develop and investigate chimeric/mixed liposomes, comprising the lipid L-a-phosphatidylcholine, hydrogenated (Soy) (HSPC) and two pH-sensitive amphiphilic diblock copolymers poly(2-(dimethylamino)ethyl methacrylate)-b-poly(lauryl methacrylate) (PDMAEMA-b-PLMA), at various molar ratios to be proposed as new drug nanocarriers[1].

Initially, chimeric bilayers of phospholipid and polymer were prepared and characterized by differential scanning calorimetry (DSC) in order to assess the thermotropic behavior in physiological and acidic environment. Based on the results, chimeric liposomes were developed by thin-film hydration and their physicochemical properties, as well as colloidal physical stability, were investigated with dynamic, electrophoretic and static light scattering (DLS, ELS and SLS). In addition, their size and morphology were evaluated through atomic force microscopy (AFM) and cryogenic transmission electron microscopy (cryo-TEM). An *in vitro* screening confirmed the low toxicity of these bioinspired and biocompatible nanosystems, which are composed of non-toxic biomaterials as building blocks. Finally, based on the above set of results, the most promising for *in vivo* applications chimeric liposomes were optimized.

Classic and micro-DSC techniques were employed to highlight the thermodynamic phenomena that drive the self-assembly of these mixed nanosystems and that contribute to the membrane properties (transition cooperativity, fluidity, phase separation, etc.), also quantifying the pH-responsive character of these nanosystems. Complementary information as regard the morphological aspects emerged by imaging techniques and the influence of the concentration and hydrophilic-to-hydrophobic balance of the copolymer was assessed.

Drug molecule entrapment/incorporation and release studies will be the next step of this work and require a multidisciplinary approach. In this integrated frame, the calorimetric methods[2] are of great relevance as regards both the characterization and the design of these nanosystems.

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