Dissecting the role of hyperbranched polymers in liposomal advanced Drug Delivery nanoSystems as drug carriers

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Over the last years, a class of advanced Drug Delivery nanoSystems (aDDnSs) has emerged, resulting from the combination of liposomes and dendritic polymers showing positive results in terms of increased encapsulation efficiency and modification of drug release as compared to conventional systems. Previous thermodynamic studies [1] indicated that the dendrimer-liposome interactions are mostly of entropic nature triggering a phase separation within the lipid bilayer, that implies the displacement of dendrimer-drug complex to the inner core of the liposome and eventually stabilize the liposome wall.

In this study, these principles were exploited replacing the high cost dendrimers with a low cost class of dendritic polymers, named hyperbranched polymers (HBPs) [2], that are characterized by multiple terminal functional units, high degree of branching and a three dimensional architecture able to trigger phase separation and so to mimic the dendrimer action. In particular, three different pseudo-generation hyperbranched polymers belonging to the class of aliphatic polyesters have been incorporated in liposomes consisted of 1,2-distearoyl-sn-glycero-3-phosphocholine (DSPC) and 1,2-dipalmitoyl-sn-glycero-3-phospho-(1'-rac-glycerol) (sodium salt) (DPPG) at a 9:1 molar ratio. The anticancer drug doxorubicin was loaded into these aDDnSs using the pH gradient method.

Micro-DSC investigations on these systems and complementary spectroscopic data confirmed the thermodynamic scenario, dissecting the contributions to the overall system stability, including the liposome osmotic pressure and the internal and external mediums composition, and highlighting the criteria for a successful design of new low cost aDDnS.

Bibliography

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