USING SMALL-ANGLE NEUTRON SCATTERING TO CHARACTERIZE THE STRUCTURE OF LIPOSOMAL AND MICELLAR SAMPLES: STIMULI-RESPONSIVE AND DRUG EFFECTS

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Researchers investigated various mesoscopic objects for years like e.g. micelles and liposomes. Some of these objects can undergo structural modifications when submitted to an external stimulus (like pH or temperature). Few techniques are able to analyse in detail these internal modifications. One of them is Small Angle Neutron Scattering. We studied three kinds of samples: a micellar pH-sensitive system, liposomes in presence of an increasing concentration of a selected drug and a micellar sample able to lead to gel formation when metallic cations are added.

First, we studied micellar nanocarriers made of biocompatibles copolymers. The hydrophobic polycaprolactone (PCL) core is intended to incorporate a drug. The corona of hydrophilic polyethylene oxide (PEO) stabilizes the nanocarriers. We incorporated a pH-sensitive sequence of poly(2-vinylpyridine) (P2VP). These nanocarriers could be used in therapeutic applications to fight cancer[1].

Our second sample is a liposomal solution with or without cholesterol in the presence of an increasing concentration of a randomly methylated cyclodextrin. This system constitutes a model of the interactions between cyclodextrins and the cell membrane[2].

Third, we investigated a solution of micelles composed of diblock polystyrene (PS, core) – b - poly(tert-butyl acrylate) (PtBA, corona) chains. The PtBA chains are terminated by bis-pyridine ligands that can coordinate metal ions[3]. In this case, the formation of a gel[3] is observed.

We measured the neutron scattering cross sections for these different mesoscopic systems and we developed tailored models for their analysis. The models provide the aggregation number, the global size of the nanoobjects and the dimensions of their internal structures. In addition we obtain information about the size distribution of the objects that we compare with more traditional techniques like dynamic light scattering.

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