

**Polyhydroxy surfactants for the formulation of lipid nanoparticles (SLN and NLC):
effects on size, physical stability and particle matrix structure**

ABSTRACT

The two polyhydroxy surfactants polyglycerol 6-distearate (Plurol®Stearique WL1009 ó (PS)) and caprylyl/capryl glucoside (Plantacare® 810 ó (PL)) are a class of PEG-free stabilizers, made from renewable resources. They were investigated for stabilization of aqueous solid lipid nanoparticle (SLN) and nanostructured lipid carrier (NLC) dispersions. Production was performed by high pressure homogenization, analysis by photon correlation spectroscopy (PCS), laser diffraction (LD), zeta potential measurements and differential scanning calorimetry (DSC). Particles were made from Cutina CP as solid lipid only (SLN) and its blends with Miglyol 812 (NLC, the blends containing increasing amounts of oil from 20% to 60%). The obtained particle sizes were identical for both surfactants, about 200 nm with polydispersity indices below 0.20 (PCS), and unimodal size distribution (LD). All dispersions with both surfactants were physically stable for 3 months at room temperature, but Plantacare (PL) showing a superior stability. The melting behaviour and crystallinity of bulk lipids/lipid blends were compared to the nanoparticles. Both were lower for the nanoparticles. The crystallinity of dispersions stabilized with PS was higher, the zeta potential decreased with storage time associated with this higher crystallinity, and leading to a few, but negligible larger particles. The lower crystallinity particles stabilized with PL remained unchanged in zeta potential (about 50 mV) and in size. These data show that surfactants have a distinct influence on the particle matrix structure (and related stability and drug loading), to which too little attention was given by now. Despite being from the same surfactant class, the differences on the structure are pronounced. They are attributed to the hydrophobicólipophilic tail structure with one-point anchoring in the interface (PL), and the loop conformation of PS with two hydrophobic anchor points, i.e. their molecular structure and its interaction with the matrix surface and matrix bulk. Analysis of the effects of the surfactants on the particle matrix structure could potentially be used to further optimization of stability, drug loading and may be drug release.

Keyword: Polyhydroxy surfactants; Solid lipid nanoparticles; SLN; Nanostructured lipid carriers; NLC; Physical stability; Crystallinity