Probing nanoliposomes using single particle analytical techniques: effect of excipients, solvents, phase transition and zeta potential

ABSTRACT

There has been a steady increase in the interest towards employing nanoliposomes as colloidal drug delivery systems, particularly in the last few years. Their biocompatibility nature along with the possibility of encapsulation of lipidsoluble, water-soluble and amphipathic molecules and compounds are among the advantages of employing these lipidic nanocarriers. A challenge in the successful formulation of nanoliposomal systems is to control the critical physicochemical properties, which impact their in vivo performance, and validating analytical techniques that can adequately characterize these nanostructures. Of particular interest are the chemical composition of nanoliposomes, their phase transition temperature, state of the encapsulated material, encapsulation efficiency, particle size distribution, morphology, internal structure, lamellarity, surface charge, and drug release pattern. These attributes are highly important in revealing the supramolecular arrangement of nanoliposomes and incorporated drugs and ensuring the stability of the formulation as well as consistent drug delivery to target tissues. In this article, we present characterization of nanoliposomal formulations as an example to illustrate identification of key in vitro characteristics of a typical nanotherapeutic agent. Corresponding analytical techniques are discussed within the context of nanoliposome assessment, single particle analysis and ensuring uniform manufacture of therapeutic formulations with batch-to-batch consistency.