

Experimental evidence of residual micellar structures in lipid nanocapsules suspensions.

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Nanoemulsions are metastable emulsions in the nanometric range which can be obtained using robust low energy processes. Their use as nanometric drug delivery systems (NDDS) for encapsulated lipophilic drugs has been extensively studied during the past 20 years¹. 10 years ago, it was demonstrated on a model oil/surfactant system that, depending on the formulation path, a non-negligible amount of residual surfactant micelles may coexist with the oil nanodroplets^{2,3}. Those micelles were called “wasted” micelles as they did not participate in the formation of the nanoemulsion. For the NDDS field, the existence of “wasted” micelles raises a series of important questions not addressed in current literature. This includes e.g., how such micelles affect the encapsulation and distribution of drugs in nanoemulsions, and ultimately the *in vivo* fate of drugs administered in this type of NDDS. It also elicits the need to limit their presence e.g., by purification methods or by modifying the formulation process.

Here, we present an extensive characterization of a type of nanoemulsion called lipid nanocapsules (LNCs). LNCs are composed of a medium chain triglyceride (MCT) mixed with a pegylated surfactant and are obtained by a process that combines both a phase inversion in temperature and a phase inversion in composition^{4,5}. Using various experimental techniques (NMR, DLS, FRAP, NTA...), we showed that up to 40 wt% of the surfactant was not involved in the LNC formation. Those residual micellar structures also contained a small quantity of MCT (2% of the initial amount) and encapsulated around 40 wt% of a Dil dye originally dispersed in the MCT phase.

References

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