

ENCAPSULATING LIPIDS IN SELF-ASSEMBLED POLYMERIC AND INORGANIC MATRIX PARTICLES

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Liquid lipids are attractive as carriers, and encapsulation and delivery systems for poorly water soluble/lipophilic compounds, e.g. for application as functional foods, vitamin supplements and pharmaceuticals. However, such lipid carriers are challenging to formulate as solid material products and are generally manufactured as soft gelatin capsules. These capsules require specific engineering facilities for manufacture, and in many cases do not have optimal stability/shelf life and cannot control the bioactivity or delivery properties.

We have developed an alternative approach to encapsulate liquid lipids, i.e. by entrapment within a porous matrix structured microparticle, established through the assembly of inorganic or polymeric nanoparticles [1,2]. More specifically, these are prepared by drying (e.g. spray or freeze drying) a sub-micron lipid emulsion in the presence of inorganic (e.g. silica) or polymeric (e.g. PLGA) nanoparticles – see Fig. 1.

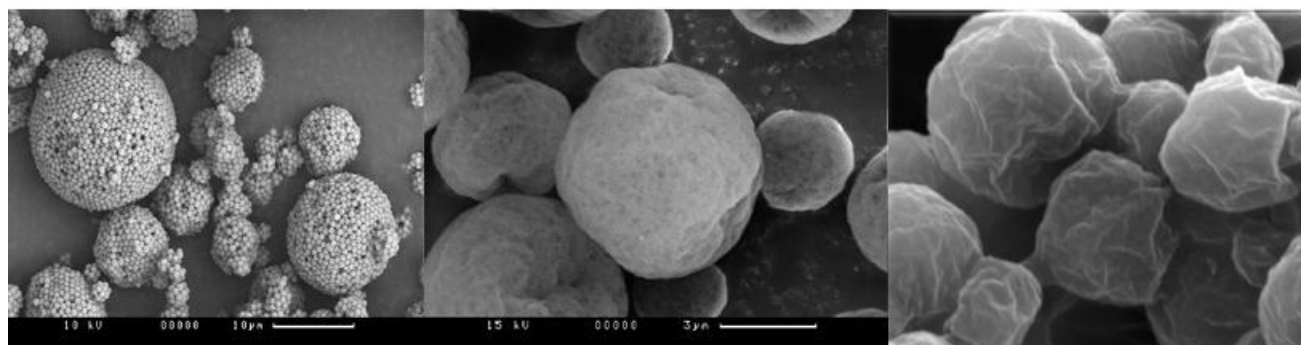


Figure 1 – Silica lipid hybrid (SLH) ((Stober silica (left) and fumed silica (centre)) and polymeric nanoparticle lipid hybrid (PLH) (right) particles as encapsulation and delivery systems for liquid lipids and lipophilic agents

We demonstrate that the porous nanostructure and surface chemistry of SLH and PLH particles controls their lipid/drug loading and biological activity, which in turn controls delivery performance. These encapsulation systems have potential for smart pharmaceutical delivery through various routes, e.g. oral, injectable and inhalation. Significantly, when considering oral delivery, improved bioavailability and other pharmacokinetic properties have been demonstrated for a number of poorly soluble drugs through in vivo studies on rodents, dogs and human clinical trials [3].

SLH and PLH particles are emerging as effective encapsulation systems for lipids and for enhancing the delivery of drugs via a smart interplay between the lipid-nanoparticle interaction and the action of lipid-digesting enzymes, which controls drug release, solubilization and absorption. Mechanistic understanding of the biological performance of these particles is enabling the effective engineering of optimized carrier particles for drugs, vitamins and functional foods and can accelerate their development for translation into commercial products.

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