CO_2-expanded solvents for the preparation of high-quality nanovesicles for biomedical applications

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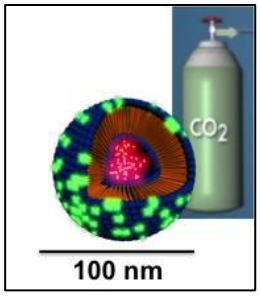
Vesicles, such as liposomes, are undoubtedly one of the most promising molecular colloidal assemblies for nanomedicine due to their great versatility respect to size, composition, surface characteristics and capacity for integrating active ingredients, such as therapeutic or sensing molecules. Besides, they are well recognized as pharmaceutical carriers because of their biocompatibility, biodegradability and low toxicity. They constitute one of the most successfully translated delivery systems that are currently in clinical use for a variety of indications against cancer, inflammatory, dermatological diseases and in various types of vaccines.

Despite their versatility, a high degree of structural homogeneity is crucial for an optimal performance of vesicles in drug-delivery and diagnosis. Thus, the formation stage of these supramolecular entities must be tightly controlled in order to achieve a homogeneous assembling of the lipids and other components constituting the vesicular nanostructure. In this sense, compressed fluids (CFs) like compressed CO_2 have a great deal of promise as solvent media for material processing, since their unique characteristics between those of liquid and gases, allow the achievement of materials presenting highly homogeneous structure.



On the last decade, we have been focused on the research and development of processes using CO_2-expanded solvents for the precise engineering of nanovesicles for medical applications [1]. By using CO_2-expanded solvents, we have synthesized new vesicular structures, named Quatsomes, thermodynamically stable [2]. These non-liposomal nanovesicles with a medium size smaller than 100 nm and positive charged surfaces can be precisely decorated at their surfaces with multiple biotargeting groups and functions. The colloidal stability of these nanovesicular architectures, the high vesicle to vesicle homogeneity in size, lamellarity and chemical composition, their stability upon dilution, their low toxicity, their good recovery after liophilization and the availability in pharmaceutical grade of their components, make them ideal colloidal nanoparticles for the preparation of new formulations to improve disease treatment and diagnosis [3].

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