Comparison of the physical characteristics of cubosomes prepared using different manufacturing methods

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Abstract

Background: Cubosomes are cubic lyotropic Liquid Crystalline structures consisting of polar lipids, such as glycerol monooleate (GMO) or glycerol monolaurate (GML) that provide the capability of carrying both hydrophilic and lipophilic compounds[1-3]. The most straightforward method of producing cubic phase particles is the agitation of both phases (oil and water) with a magnetic stirrer resulting in a coarse dispersion. This produces a polydisperse and unstable solution. Further post-manufacture modifications are required to control dispersity and size: ultrasonication[5], homogenisation[6], and microfluidics[7].

Aims: The aim of the present study was to formulate cubosomes (see Figure 1)[4] in the presence of ethanol (hydrotrope) prepared comparing the three post-manufacture methods.

Methods: Three samples were prepared using GMO and GML dissolved in ethanol (oil phase) and the surfactant (F127) dissolved in water (water phase). One sample was sonicated for 5 minutes using 30-40% of the maximum power. The second sample was homogenised for 10 minutes at 8000 rpm. The third sample was prepared using a Neonano device from Neofluidics for 1 minute. The samples were examined by Scanning Electron Microscopy to determine if cubosomes had been formed, and evaluated by Dynamic Light Scattering (DLS) for measurement of particle size and Zeta potential using a Zetasizer Nano ZS90 system to provide a comparison of average droplet size and polydispersity index between all the samples and the measurements of zeta potential showed which method provides better colloidal stability during storage for three months at 4, 25 and 37°C.

Results: The dispersions examined under Scanning Electronic Microscope showed non-aggregated particles confirming the nanoparticle formation for all three methods. The sample produced by microfluidics showed low polydispersity with no variation of the zeta potential over three months.

Conclusion: Microfluidics avoids the heat gradient and it reduces the manufacture time with high reproducibility.

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Image

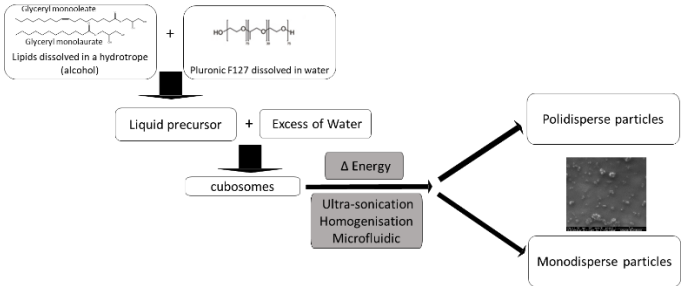


Figure 1. Approach developed by Spicer. In this approach, the hydrotrope helps to dissolve the lipid creating the liquid precursor. The excess of water with the liquid precursor forms spontaneous cubosomes[4].

Recent Publications

1. Chang, C. M., & Bodmeier, R. (1997). Swelling of and drug release from monoglyceride-based drug delivery systems. Journal of pharmaceutical sciences, 86(6), 747-752.

2. Drummond, C. J., & Fong, C. (1999). Surfactant self-assembly objects as novel drug delivery vehicles. Current opinion in colloid & interface science, 4(6), 449-456.

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Biography

Marta Ruano is a Chemical Engineer who obtained a PhD from the Physical-Chemistry Department of University Complutense of Madrid with the thesis entitled Fabrication of liposomes and polymeric microcapsules. She has 5 years expertise in drug delivery systems for food, cosmetics, and nutraceuticals: liposomes, polymeric micro and nano microparticles with different actives after years dedicated to this research in a R&D technology center. In 2018, she started the KTP project in Glasgow where AB Vista and the University of Strathclyde are involved. The aim of this project is the development of novel nano-delivery systems incorporating bioactive lipids and peptides in animal food formulation with effective antimicrobial stewardship to reduce antibiotic resistance in the food chain.

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Notes/Comments