Journal of Clinical and Experimental Toxicology
ISSN 2630-4570
2020
Vol.4 No.4

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

Marta Ruano Aldea[1], Donald Kelemen[2], Mike Bedford[3], Natasha Whenham[3], Valerie A. Ferro[1], Alexander B. Mullen[1]

[1]Strathclyde Institute of Pharmaceutical and Biomedical Sciences, University of Strathclyde, Glasgow, UK.
[2] Abitec Corp. (Columbus).
[3]AB Vista, 3 Woodstock Court, Blenheim Road, Marlborough SN8 4AN.

Abstract

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 compounds1-3. 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: ultrasonication5, homogenisation6, and microfluidics7. 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 37ºC. 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. Acknowledgments: These findings are part of the Knowledge Transfer Partnership (KTP) project developed between AB Vista, Abitec and the University of Strathclyde. The authors would like to express their gratitude to Neofluidics for support in conducting this research.

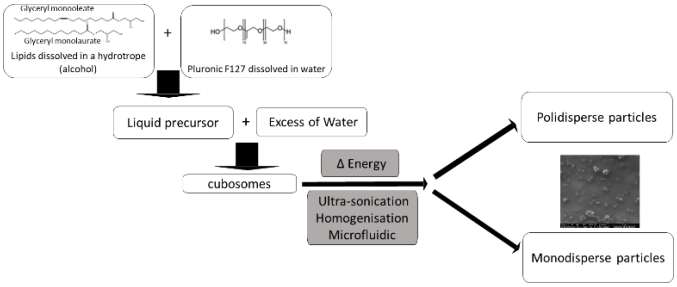

Figure 1. Approach developed by Spicer. In this approach, the hydrotrope helps to dissolve the lipid creating the liquid precursor. The excess of water with the liquid precursor forms spontaneous cubosomes[4]

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.

Speaker 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.
3. Shah, J. C., Sadhale, Y., & Chilukuri, D. M. (2001). Cubic phase gels as drug delivery systems. Advanced drug delivery reviews, 47(2-3), 229-250.
4. Spicer, P. T., Hayden, K. L., Lynch, M. L., Ofori-Boateng, A., & Burns, J. L. (2001). Novel process for producing cubic liquid crystalline nanoparticles (cubosomes). Langmuir, 17(19), 5748- 5756.
5. Thadanki, M., Kumari, P. S., & Prabha, K. S. (2011). Overview of cubosomes: a nano particle. Int J Res Pharm Chem, 1(3), 535- 541.
6. Siekmann, B., Bunjes, H., Koch, M. H., & Westesen, K. (2002). Preparation and structural investigations of colloidal dispersions prepared from cubic monoglyceride–water phases. International journal of pharmaceutics, 244(1-2), 33- 43.
7. Ghazal, A., Gontsarik, M., Kutter, J. P., Lafleur, J. P., Labrador, A., Mortensen, K., & Yaghmur, A. (2016). Direct monitoring of calcium-triggered phase transitions in cubosomes using small- angle X-ray scattering combined with microfluidics. Journal of Applied Crystallography, 49(6), 2005-2014.

21st International Conference and Exhibition on Pharmaceutics & Novel Drug Delivery Systems; Rome, Italy- March 11-12, 2020.

Abstract Citation:

Marta Ruano Aldea, Comparison of the physical characteristics of cubosomes prepared using different manufacturing methods, Pharmaceutica 2020, 21st International Conference and Exhibition on Pharmaceutics & Novel Drug Delivery System; Rome, Italy- March 11-12, 2020. (https://novel-drugdelivery-systems.pharmaceuticalconferences.com/abstract/2020/comparison-of-the-physical-characteristics-of-cubosomes-prepared-using-different-manufacturing-methods)