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Lysine- and threonine-based catanionic vesicles: structural characterization and biological activity

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Over the last two decades, several nanostructured vehicles that protect and deliver biomolecules effectively to target cells have been developed and optimized, from liposomes, polymers and dendrimers to nanotubes and nanoparticles. In this context, surfactants are a class of compounds widely used in the pharmaceutical industry due to their high surface activity and self-assembling versatility. Amphiphiles with low cytotoxicity are of special interest for the design of effective drug and gene delivery formulations. Cationic/anionic systems built from amino acid-based surfactants present higher levels of biocompatibility and biodegradability, with good interfacial performance and multifaceted self-assembly, from elongated micelles to vesicles, liquid crystalline nanoparticles and tubular structures.[1]

In this work, the vesicle-forming ability of different catanionic systems based on surfactants derived from two amino acids, threonine and lysine, were explored. The threonine derivatives have simple monomeric configuration and different alkyl chain length, and are designated by *n*ThrNa, where *n* is the number of carbon atoms in the hydrocarbon chain, ranging from 8 to 16. The lysine-derived surfactants are anionic and double-chained, with a variable degree of chain length mismatch, comprising compounds 8Lys*n* and *m*Lys8, and 10Lys*n* and *m*Lys10, with *n*, *m* = 12, 14 and 16, where numbers represent the number of C atoms in each alkyl chain.[2] Phase behavior studies and microstructural characterization of several aqueous mixtures based on 12ThrNa and *m*Lys8 as the anionic surfactant, and on gemini serine-based and gemini conventional surfactants as the cationic surfactants have been carried out. Detailed results from high-resolution light microscopy, cryo-SEM, DLS and zeta potential measurements are presented and discussed. The toxicological profile of the vesicles was evaluated in animal cell lines. Biomolecule encapsulation and release studies were performed, testing the effectiveness of the selected vesicle systems in conditions close to physiological ones.

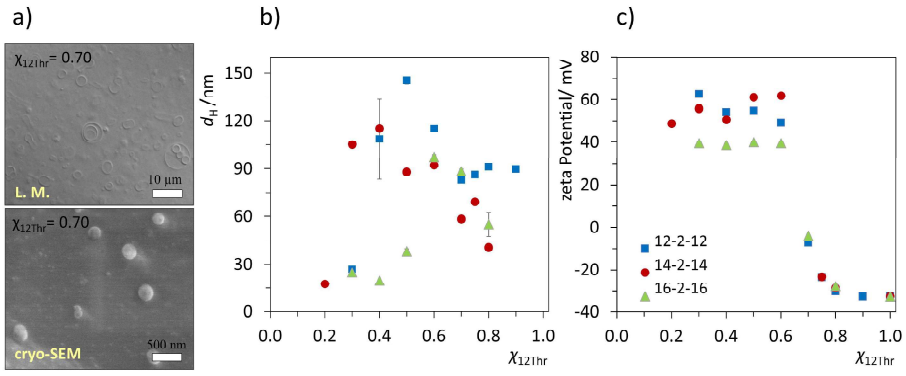

Figure 1: Light microscopy, a) top, and cryo-SEM, a) bottom, imaging of 12ThrNa:12-2-12 catanionic vesicles. Mean hydrodynamic diameter, b), and zeta potential, c), of 12ThrNa/gemini catanionic vesicles, for varying molar ratio of the amino acid surfactant, at 25 ºC.

Acknowledgements: We thank Fundação para a Ciência e Tecnologia and FEDER/COMPETE for financial support through grants UID/QUI/00081/2013, POCI-01-0145-FEDER-006980, NORTE-01-0145-FEDER-000028, and UID/QUI/50006/2013. I.S. Oliveira is also grateful to FCT for support through the PhD grant SFRH/BD/108629/2015.

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