MICROFLUIDIC PRODUCTION, STABILITY AND LOADING OF SYNTHETIC GIANT UNILAMELLAR VESICLES

Mart Ernits[1], Olavi Reinsalu[1], Naresh Yandrapalli[2], Sergei Kopanchuk[3], Ehsan Moradpur-Tari[1], Immanuel Sanka[4], Ott Scheler[4], Ago Rinken[3], Reet Kurg[1], Andreas Kyritsakis[1], Veikko Linko[1,5], and Veronika Zadin[1],

1 Institute of Technology, University of Tartu, Nooruse 1, 50411 Tartu, Estonia

2 Max Planck Institute of Colloids and Interfaces, Department of Colloid Chemistry, Am Mühlenberg 1, 14476 Potsdam, Germany

3 Institute of Chemistry, University of Tartu, Ravila 14a, 50411 Tartu, Estonia

4 Department of Chemistry and Biotechnology, Tallinn University of Technology (TalTech), Akadeemia tee 15, 12618 Tallinn, Estonia

5 Biohybrid Materials, Department of Bioproducts and Biosystems, Aalto University School of Chemical Engineering, Kemistintie 1, 02150 Espoo, Finland

e-mail of presenting author: mart.ernits@ut.ee

In advanced drug delivery, versatile liposomal formulations are commonly employed for safer and more accurate therapies. Here we report a method that allows a straightforward production of synthetic monodisperse (~100 μm) giant unilamellar vesicles (GUVs) using a microfluidic system. The stability analysis based on the microscopy imaging showed that at ambient conditions the produced GUVs had a half-life of 61 ± 2 h. However, it was observed that ~90% of the calcein dye that was loaded into GUVs was transported into a surrounding medium in 24 h, thus indicating that the GUVs may release these small dye molecules without distinguishable membrane disruption. We further demonstrated the feasibility of our method by loading GUVs with larger and very different cargo objects; small soluble fluorescent proteins and larger magnetic microparticles in a suspension. Compared to previously reported microfluidics-based production techniques, the obtained results indicate that our simplified method could be equally harnessed in creating GUVs with less cost, effort and time, which could further benefit studying closed membrane systems.