Modification of the surface of pH-responsive liposomes with polyanions as the key to formation of effective nanocontainers with tunable adhesion to the cell surfaces.

Jian Tang[1,2], Darya Stepanova[1], Vasily Migulin[3], Andrey Sybachin[1,], Alexander Yaroslavov[1]*

[1]Department of Chemistry, Lomonosov Moscow State University, Leninskie gory 1-3, 119991 Moscow, Russian Federation
[2]Department of Chemistry, Tsinghua University, Shuangqing road 30, HaiDian district, Beijing, People's Republic of China
[3]Zelinsky Institute of Organic Chemistry, Russian Academy of Sciences, 119991, Moscow, Russian Federation

Liposomes are widely used in medicine as nanocontainers for the delivery of bioactive substances. Hydrophilic drugs could be incorporated in inner cavity of the liposomes. To ensure the controlled release of the bioactive molecules the modification of lipid membranes with stimuli-responsive molecules is applied. Incorporation of capable to change its conformation after protonation trans-4,5-didodecylaxycarbonyl-2-morpholinocyclohexanol (TACH) in electroneutral liposomes allows one to create nanocontainers with pH-responsive release in areas with low pH values like areas of inflammation. To increase the efficiency of the drug release or to alter the adhesion to the cell membranes the modification of the liposomal nanocontainers with polymers could be applied. The impact of the interaction between strong and weak polyacids with liposomes composed of electroneutral dioleoylphosphatidylcholine and TACH on the integrity of the lipid membrane (i.e. release properties) at different pH values was studied by dynamic light-scattering, electrophoretic mobility and conductivity measurements. It was found that polyanions are capable to interact with liposomes even with electoneutral surface charge. For the strong polystyrenesulphonic acid the pH range of the interaction was found to be wider than for the weak polyacrylic acid. The complexation affected the release rate of the TACH-modified liposomes and the total surface charge of the complexes at different pH. The latter allowed one to control the release process either in intracellular space or on the cell membrane after adsorption of the liposomes.

Acknowledgements This work was supported by Russian Foundation for Basic Research (project № 18-29-02080).

*Corresponding author: sybatchin@mail.ru