Exploring Bio-Nano Interactions with Poly(ethylene glycol) Particles

Jiwei Cui,[1,*] *Yi Ju*,[2] *Frank Caruso*[2]

[1] Key Laboratory of Colloid and Interface Chemistry of the Ministry of Education, School of Chemistry and Chemical Engineering, Shandong University, Jinan, Shandong 250100, China
[2] ARC Centre of Excellence in Convergent Bio-Nano Science and Technology, and the Department of Chemical Engineering, The University of Melbourne, Parkville, Victoria 3010, Australia

jwcui@sdu.edu.cn

Successful accumulation of drugs specifically at diseased sites is mainly limited by biological barriers to drug transport, especially the nonspecific uptake of drug carriers in mononuclear phagocyte system (MPS).[1] Hence, it is critical to develop drug delivery systems that can specifically bind to diseased cells, while avoiding interactions with normal, healthy cells.[2] This presentation will demonstrate the engineering of polymer particles composed with poly(ethylene glycol) (PEG) itself, and will show the cell association and biodistribution of these particles, PEG particle deformation in a microcapillary model, as well as cell targeting of PEG particles modified with targeting molecules.

PEG particles composed with large molecular weight of PEG and prepared from smaller templates result in longer circulation time and can avoid non-specific accumulation of PEG particles in spleen and liver.[3] In addition, the deformability behavior of PEG particles can be tuned to be similar to that of human red blood cells via varying the particle cross-linking density, which could avoid the filtration effect in vivo and therefore increase the circulation time of PEG particles.[4] Surface modification of PEG particles with targeting molecules (e.g., antibody) can improve the specific cell targeting while retaining the stealth property of PEG particles.[5] The optimization of PEG particle engineering to overcome the MPS biological barrier and show promising tumor targeting in mouse studies is examined by tuning PEG molecular weight, particle size, particle stiffness, and targeting molecule density, which highlights the influence of unique aspects of polymer particles on biological interactions. The reported PEG particles represent a new class of polymer carriers with potential biomedical applications.

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