Nanoparticle core guides the choice of cell membrane coating method

Moataz B. Zewail, Yilong Fan, Guangze Yang, Chun-Xia Zhao, Yun Liu**

School of Chemical Engineering, Faculty of Sciences, Engineering and Technology, The University of Adelaide, Adelaide, South Australia 5005, Australia

Presenting author
E-mail: *moataz.zewail@adelaide.edu.au*

*Corresponding author
E-mail: *chunxia.zhao@adelaide.edu.au; yun.liu01@adelaide.edu.au*

Cell membrane-coated nanoparticles (NPs) have emerged as a promising platform for drug delivery, offering enhanced cellular uptake and improved therapeutic efficacy.[1] Among the methods used to fuse cell membranes with NP cores, extrusion and sonication are the most widely employed.[2] However, a clear guide for selecting between these two techniques based on NP type remains lacking, leading to inefficiencies in therapeutic outcomes and the need for extensive experimental optimization. In this study, we explored the influence of material type and drug loading on the fusion of cancer cell membranes (4T1) with NP cores using extrusion and sonication. Lipid nanoparticles and polymeric nanoparticles with varying drug-loading levels,[3,4] along with silica nanocapsules with different mechanical stiffness,[5] were used as core materials to investigate cell membrane coating efficiency. Our results indicate that increasing drug loading enhances mechanical stiffness and alters surface hydrophobicity. The interplay between NP stiffness and surface hydrophobicity is crucial in determining the appropriate cell membrane coating method. Extrusion is better suited for coating softer, more hydrophobic NPs, while sonication is preferable for NPs with lower hydrophobicity and greater mechanical stiffness. The efficiency of cell membrane coating was assessed based on stability, coating degree, and biological performance. These findings provide critical insights into selecting the appropriate cell membrane coating method to optimize therapeutic outcomes, advancing the potential of cell membrane-coated NPs in drug delivery applications.

References:

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