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Effects of Protein Hydrophobicity on Protein Corona Formation Modes on Soluplus® Nanomicelles

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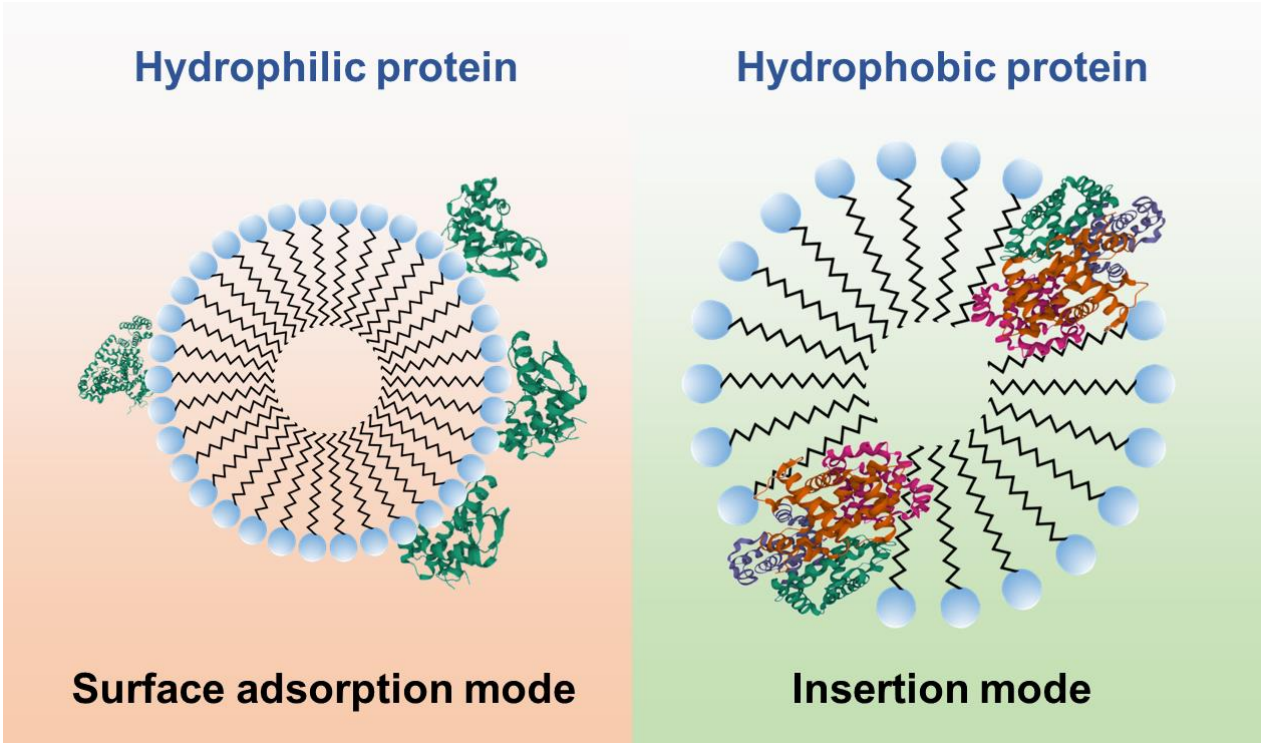
Graphical Abstract



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Abstract:

Soluplus® nanomicelles have been rising as excellent drug carriers for their great drug loading capacity. Nevertheless, the protein corona would be formed when subjected to biological fluids, but few efforts have been made in elucidating that. Here, the effects of protein hydrophilicity on the protein corona formation modes were investigated based on three model proteins, Bovine serum albumin (BSA, hydrophilic), Lysozyme (Lyso, hydrophilic) and Bovine hemoglobin (BHb, more hydrophobic). Protein corona formation was proved by the size and zeta potential measurements, while the size increments of BHb group were the most significant. We hypothesized that the hydrophilic protein might be dominated by the surface adsorption mode, where the proteins were cross-linked by the out-layer PEG chains. However, the hydrophobic protein may show insertion mode, where the nonpolar part was inserted into the hydrophobic core of nanomicelles and the polar part distributed on the surface. To justify this hypothesis, the microenvironment polarity of hydrophobic tryptophan (Trp) acid amino residue was analyzed. The most obvious peak wavelength changes and the minute absorbance change were exhibited in ultraviolet-visible spectra of the BHb group, indicating the hydrophobic Trp was distributed in the nonpolarity core of nanomicelles. This conclusion was further proved by the similar results in fluorescence emission wavelength. In addition, the circular dichroism results confirmed the obvious arresting conformational change induced by insertion mode protein corona formation. In summary, the hydrophilic proteins follow the surface adsorption mode while the hydrophobic proteins follow the insertion mode in the protein corona formation of Soluplus® nanomicelles.

Keywords: Soluplus®; Nanomicelles; Protein corona; Polarity microenvironment; Spectroscopy

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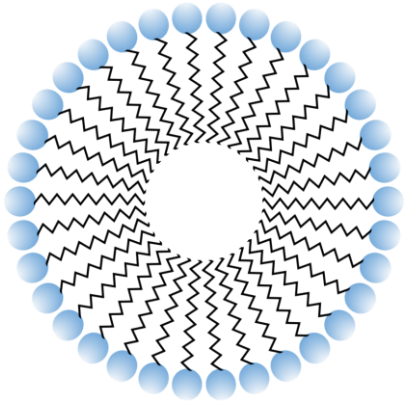
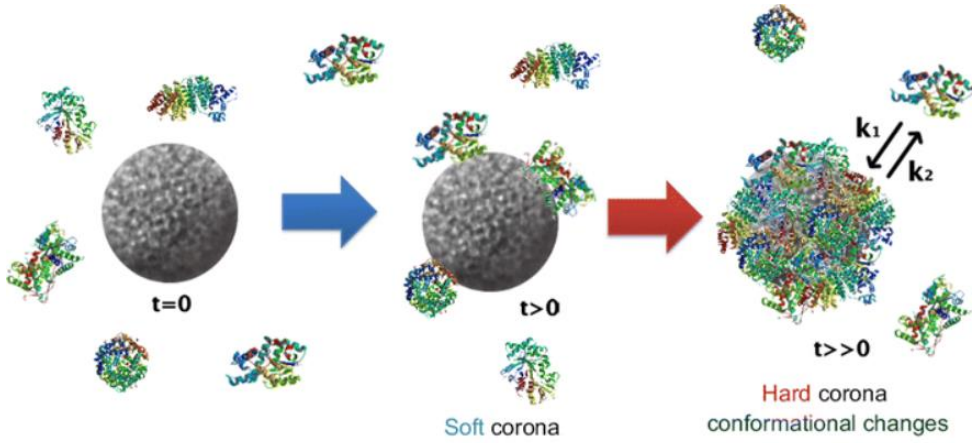
Introduction

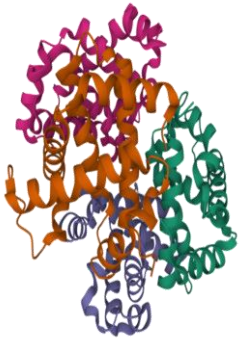
Soluplus® Nanomicelles



Administrated *in vivo*

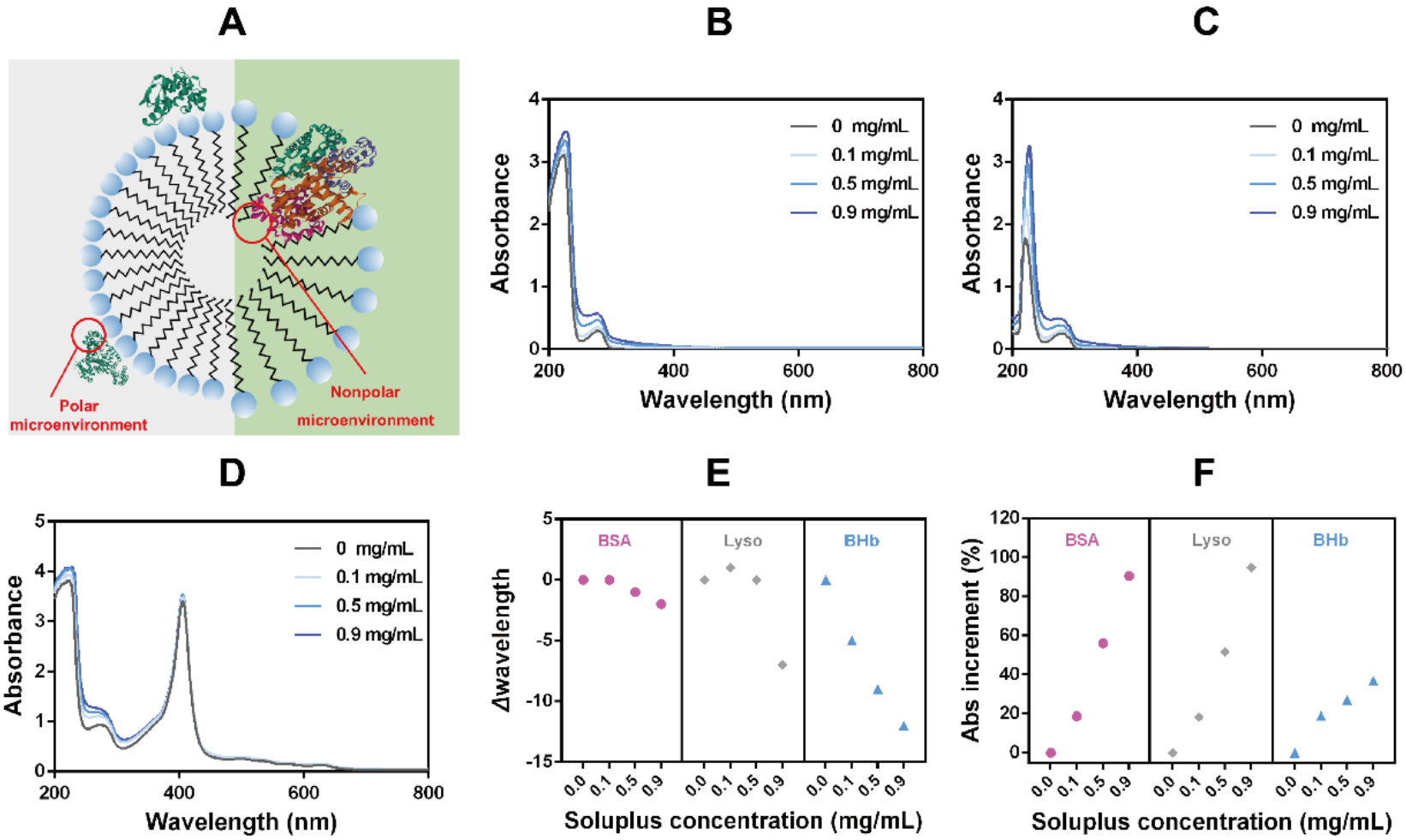
Protein corona formation



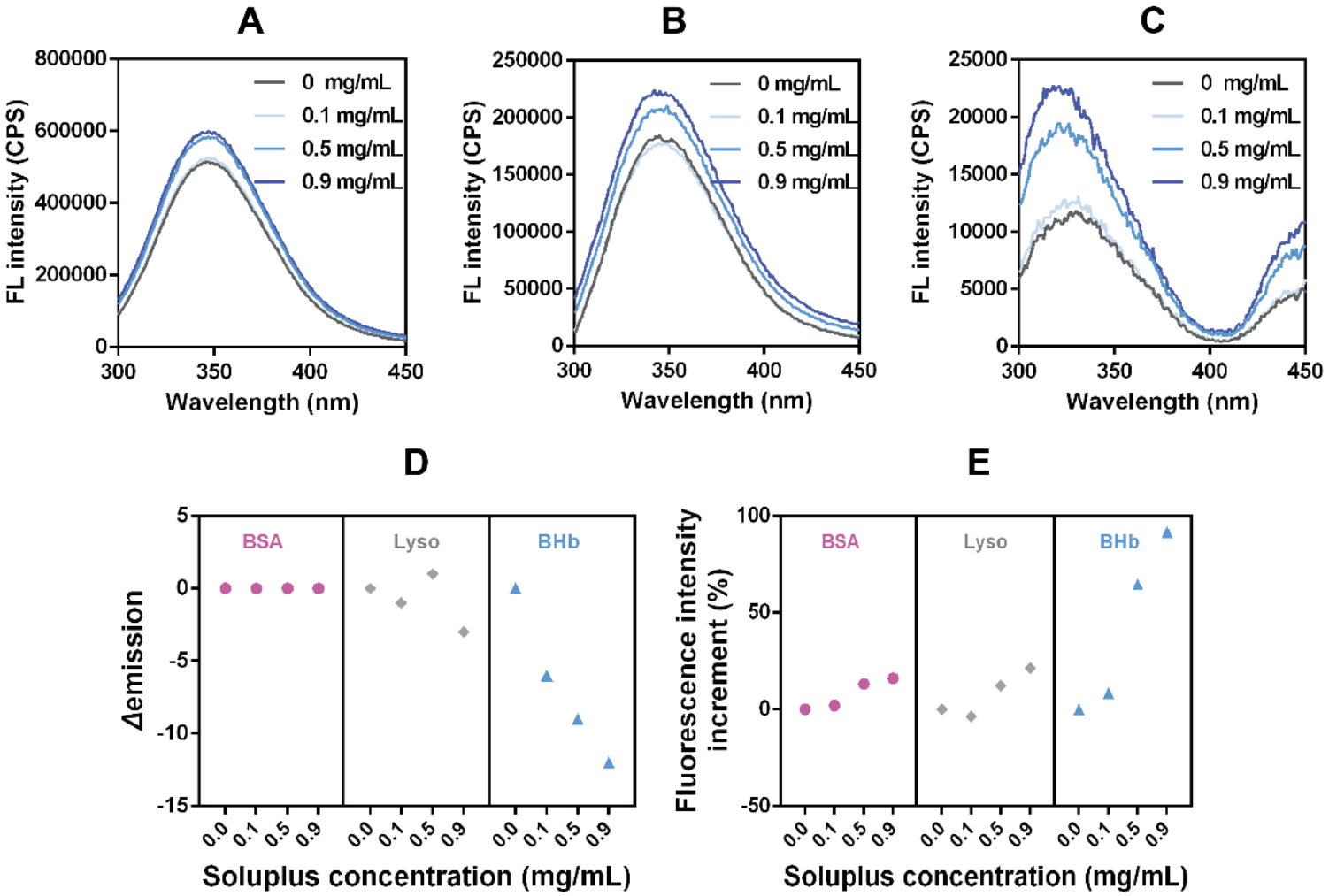


How the protein hydrophobicity influence the protein corona formation?

Results and discussion



Results and discussion



Conclusions

- There are two different protein corona formation modes in Soluplus® nanomicelles
- Protein hydrophilicity determined the adsorption pattern
- Hydrophilic proteins follow the surface adsorption mode
- Hydrophobic proteins follow the insertion mode

Acknowledgments

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