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Abstract

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

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Abstract: Soluplus® nanomicelles are increasingly recognized as excellent drug carriers due to their great drug loading capacity. Nevertheless, the protein corona would form when it was subjected to biological fluids, but a few efforts have been made to elucidate this. Here, the effects of protein hydrophilicity on protein corona formation modes were investigated based on three model proteins, bovine serum albumin (BSA, which is hydrophilic), lysozyme (Lyso, which is hydrophilic) and bovine hemoglobin (BHb, which is more hydrophobic). Protein corona formation was proved by the size and zeta potential measurements, while the size increments of the BHb group were the most significant ones. We hypothesized that the hydrophilic protein might be dominated by the surface adsorption mode, where the proteins were cross-linked by the outer layer polyethylene glycol (PEG) chains. However, the hydrophobic protein may show an insertion mode, where the nonpolar part is inserted into the hydrophobic core of nanomicelles and the polar part is 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 changed, and the minute absorbance changes were exhibited in ultraviolet-visible spectra of the BHb group, indicating that the hydrophobic Trp was distributed in the nonpolarity core of nanomicelles. This conclusion was further proved by similar results in the fluorescence emission wavelength. In addition, the circular dichroism results confirm the obvious arresting conformational changes induced by the 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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