Development of CdSe/ZnS-QD protein/peptide coronas from pleural fluids for targeted biomedical use

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Protein/peptide corona formation on nanoparticles has gained significant attention in nanotheranostics, particularly for personalized medicine applications [1,2]. This study presents a strategic approach to utilize proteins and peptides derived from pleural fluids (PFs) of non-cancer and adenocarcinoma patients to develop CdSe/ZnS quantum dot (QD)-based protein/peptide corona nanostructures for affinity-based cell targeting. PFs samples from non-cancer and adenocarcinoma patients were pooled separately and divided into four groups: raw PF, albumin-depleted PF, and peptide/protein fractions obtained via ethanol precipitation. The Defensin 1β, Angiogenin, LL-37, and RNase-7 content of PFs was quantified using ELISA. These fractions were subsequently conjugated with QDs to create corona-like nanostructures, which were characterized using SEM, DLS, and fluorescence spectroscopy. Additionally, peptides/proteins bound to the QD surface were further identified by mass spectrometry. The affinity of these nanostructures was evaluated against two lung cell lines: A549 (lung cancer) and BEAS-2B (normal lung cells). Cell viability (MTT assay) and uptake studies (fluorescence microscopy) revealed enhanced specificity of the corona nanostructures toward A549 cells compared to BEAS-2B cells, with IC50 values indicating preferential targeting. Nanostructures derived from adenocarcinoma PF demonstrated superior efficacy compared to those from non-cancer PF, with peptide-enriched fractions showing the most significant effects. This innovative approach highlights the potential of PF-derived protein/peptide coronas for diverse biomedical applications, including drug delivery, theranostics, and the development of advanced personalized medicine strategies.

References

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