Rapid Elimination Hindering Exosome-Assisted Carbon Dot Delivery

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Abstract

Biocompatible carbon dot nanoparticles have emerged as versatile tools in biomedical applications, particularly for imaging purposes. However, in their native form, these nanoparticles tend to enter cells through passive pathways and exhibit rapid elimination. Exosomes, as promising carriers for targeted delivery, offer potential solutions, especially for accessing difficult-to-reach tumors. Among different types of cell-derived exosomes, macrophage exosomes have demonstrated a notable affinity for cancer cells.

In this study, we explored the roles of both macrophage-derived exosomes and MDA-MB-231-derived exosomes in facilitating the transport of carbon dots derived from ethylene amide (E-CNDs) to the MDA-MB-231 triple-negative breast cancer cell line. E-CNDs were encapsulated within both types of exosomes, and subsequent attempts were made to remove any unloaded E-CNDs using an Amicon filter after a two-hour incubation period. Following this, the loaded exosomes were incubated with MDA-MB-231 cells. However, our findings revealed that the rapid elimination of carbon dots led to the unintentional unloading of exosomes during the segregation process, resulting in a diminished signal observed in the treated cells.

Our findings underscore the ongoing challenge of achieving efficient encapsulation of carbon dots within exosomes. Furthermore, we observed that the rapid elimination of carbon dots significantly hampers their encapsulation inside exosomes. Consequently, the use of exosomes did not effectively address this issue.

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