Multi-Color Magneto-Fluorescent Nanoarchitectures for the Targeted Identification of Exosomes of Triple Negative Breast Cancer

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With rising mortality caused by breast cancer, it is necessary to develop early diagnostic techniques for rapid identification, prior to metastasis. Triple negative breast cancer (TNBC) makes up 10-15% of breast cancers and is characterized by its lack of estrogen, progesterone, and HER-2 receptors. This lack of receptors leads to an absence of targeted therapeutics and higher mortality rates, underscoring the need for early detection. Exosomes are extracellular vesicles found abundantly in the blood, containing biomarkers specific to the cell they originated from. If the presence of multiple exosomes of TNBC in the blood could be detected, then that would enable early detection as well as provide further insight into cancer behavior and prediction of optimal treatment options. In this study, we report the design of fruit-based magneto-fluorescent carbon dot nanoarchitectures for the identification of exosomes associated with TNBC. Yellow, green, and blue carbon dots were prepared using orange peel, yellow melon, and cantaloupe organic material. The carbon dots were coupled with amine functionalized Fe_2O_3 magnetic nanoparticles (MNPs) using the EDC/NHS coupling method. The MNP-carbon dot composites were conjugated with aptamers to form magneto-fluorescent nanoarchitectures. The nanoarchitectures were then employed in mixed exosome environments, displaying good specificity to the Tenascin C, ubiquitin carboxyl terminal hydrolase L1, and Programmed Cell Death Ligand-1 exosomes enabling multi-exosome detection of TNBC.

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