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Multifunctional graphene quantum dot-concanavalin A@Fe_3O_4 nanocomposites for targeted drug delivery and cancer cells detection

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Multifunctional nanocomposites containing intrinsic property for serving as the sensing elements as well as targeted nano conjugates are highly preferred in various therapeutic applications. In this work, nanocomposites of graphene quantum dots (GQDs) and Fe_3O_4 with conjugation of lectin protein, concanavalin A, to form GQD-ConA@Fe_3O_4 nanocomposites are developed for both detection of cancer cell and release of drugs to HeLa cells. The GQD-ConA@Fe_3O_4 nanocomposites deposited on Pt electrode can specifically detect cancerous HeLa cells over normal endothelial cells with a dynamic linear range of 5×10^2 to 1×10^5 cells mL^{-1}. The GQD-ConA@Fe_3O_4 also can serve as nanocarriers for loading and delivering doxorubicin (Dox). The *in vitro* cell images show that the Dox concentration in HeLa cells is enhanced more than double in the presence of external magnetic field due to the incorporation of Fe_3O_4 in the nano carrier. The cytotoxicity assay indicates that the susceptibility of cancerous HeLa cells to Dox is 13% higher than that of normal cells, confirming the selective role of concanavalin A (ConA) in nanocarriers. Results clearly indicate the GQD-ConA@Fe_3O_4 nanocomposites as a promising material for cancer cell detection and targeted Dox release toward HeLa cells which can serve as the multifunctional platform for novel cancer cell diagnostic and therapeutic applications.

Biography

Ruey-an Doong is a Chair Professor in the Institute of Environmental Engineering, National Chiao Tung University Taiwan. His current research interest includes the fabrication of nanomaterials with novel optical and electrochemical properties for biosensing of analytes, drug delivery system, environmentally benign nanotechnology for treatment of contaminants, and porous materials for energy storage and conversion. He has published over 170 papers with 6500+ citations and h-index of 46.

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