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Graphene Quantum Dots for Drug Delivery

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ABSTRACT

Graphene Quantum Dots (GQD), the next generation of carbon based nanomaterials, due to their outstanding physical, chemical and biological properties and their strong size-dependent photoluminescence have shown potential in revolutionizing the future of nanomedicine and biotechnology. The presence of more active groups on the GQD surface allows their multimodal conjugation with drugs, targeting ligand and biopolymers, making them ideal systems for the diagnosis and therapy of cancer as well as new antiviral agents with a good pharmacological profile.

Biocompatible and cell traceable drug delivery systems GQD based, were reported for the targeted delivery of anticancer agents to cancer cells. GQD conjugated with anticancer drugs and targeting modules able to efficiently recognize receptors over-expressed on cancer cells, showed high water dispersibility, great biocompatibility and enhanced anticancer activity with respect to the anticancer drugs alone, thus opening new possibilities in the use of anticancer drugs poorly soluble in water and endowed with low cell uptake, systemic toxicity and undesirable side effects.

GQD conjugated with reverse transcriptase inhibitors (RTI), have been also investigated as nanodrugs for anti-HIV therapy. Biological tests performed on the GQD-RTI systems reported a similar mechanism of action to that exerted by reverse transcriptase inhibitors alone. The reported results represent a significant starting point for future research on the use of graphene based materials for HIV therapy, allowing the administration of poorly water-soluble and highly permeable RT inhibitors and leading to the development of new anti-HIV agents with an ideal pharmacological profile.

Keywords: Graphene quantum dots, Drug delivery systems, Targeted therapy, Anticancer agents, HIV therapy

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