PhD Seminar Talk-II

Fabrication of Fluorescent Carbon Dots Functionalized with AURKA-targeting Peptides as a Nano platform for Targeted Cancer Theranostics

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ABSTRACT

Carbon dots (CDs) are a novel class of carbon-based fluorescent nanomaterials with quasi-spherical particle sizes ranging from 1 to 10 nm. They possess distinctive features such as tunable photoluminescence, high water solubility, low toxicity, and excellent biocompatibility. These properties have driven their widespread exploration in biomedical applications, especially in drug delivery and disease diagnosis. Conventional physical and chemical synthesis methods often involve toxic reagents, longer reaction times, and higher energy requirements, raising environmental concerns. In this study, we report a green, microwave-assisted synthesis of CDs using *Cucumis maderaspatanus* (CM) leaves as a natural carbon source. This eco-friendly method offers advantages such as simplicity, reduced reaction time, and lower energy consumption. Characterization techniques including UV-visible spectroscopy, XRD, FTIR, SEM, HRTEM, DLS, and XPS were employed to confirm the structural integrity and optical properties of CM-derived CDs. The biogenic CDs exhibited excellent antioxidant activity. *In vitro* biocompatibility assessments further confirmed their safety for biological applications. Cellular uptake studies in oral cancer cells revealed effective internalization of the CDs, validating their potential as fluorescent probes for bioimaging. To develop a novel theranostic platform, the CM-derived CDs were functionalized with an AURKA inhibitory peptide and a tumor-homing peptide using EDC/NHS mediated bioconjugation. The CDs conjugated peptide were successfully characterized using UV-Visible spectroscopy, Fluorescence Spectroscopy, FTIR, and DLS. The integration of green-synthesized fluorescent CDs with inhibitory peptides establishes a biocompatible, multifunctional nanoplatform capable of simultaneous bioimaging and molecular targeting. Overall, the CD-peptide conjugates represent an effective strategy for cancer theranostics, offering significant potential for targeted diagnosis and therapeutic intervention.