

Environmentally Friendly Synthesis of Carbon Dots for Cancer Therapy

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Carbon dots, also known as carbon quantum dots or fluorescent carbon nanoparticles, are small-sized, spherical nanomaterials (below 10 nm) presenting amorphous carbon cores (mixed of sp²/sp³) with nanocrystalline regions of graphitic structure (sp² carbon)¹. They show unique properties such as higher aqueous solubility, robust chemical inertness, non-toxicity, and relatively low-cost manufacturing². However, the efficient resistance to photobleaching and outstanding fluorescence are the most remarkable features compared to more conventional luminescent materials³.

Here, we present a low-cost and environmentally friendly synthesis of carbon dots using natural resources like coffee grounds. The proposed synthetic route eliminates the use of highly toxic heavy metals and high energy-consuming reaction times, improving biocompatibility and benefiting the environment. These carbon dots were fully characterized by different techniques, showing small-size nanoparticles with tunable fluorescence. Biocompatibility studies on CAL-51 and SKOV-3 cell lines were also conducted showing good viability in both cellular lines. Furthermore, their surface functionalization makes them suitable for a wide range of applications in nanomedicine⁴ such as drug delivery shuttles, biosensors, or bioimaging⁵.

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Sofia Dominguez Gil completed her degree in Chemistry at the University of Valladolid (Spain). Afterwards, she carried out her Ph.D. and first postdoctoral research at the University of Montpellier under the supervision of Dr. Frédérique Cunin working on different types of nanoparticles for Rhabdomyosarcoma theranostic. Currently, she holds an Enterprise Partnership Postdoctoral Fellowship from the Irish Research Council to work at Dublin City University under the supervision of Prof. Silvia Giordani on the CAROTENE project. Her research project aims to develop new smart carbon-based nanomaterials capable of improving chemotherapeutic drug delivery.