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Abstract

Evaluation of the Role of Different Bottom-Up Synthesis Procedures for Carbon Dots in Their Potential as Candidates as Drug Carriers †

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Abstract: Carbon Dots (CDs) application in biomedicine has been increasing, due to their properties of high photoluminescence, biosafety and low cost, which allow for possible applications in bioimaging and as drug carriers. However, their synthesis strategies are quite flexible, as tuning-reaction precursors and synthesis procedures can lead to an endless number of CDs with distinct properties and applications, which make their practical development difficult. In this work, we performed a systematic evaluation of the effect of three representative bottom-up strategies (hydrothermal, microwave-assisted and thermal heating) on the properties of CDs prepared from the same precursors (glucose and urea). In this way, the CDs were thoroughly evaluated in terms of structure, morphology and photoluminescent properties. To screen their potential as drug carriers, the biosafety of these CDs was tested against the normal breast cell line MCF-10A, as drug carriers need to be compatible with healthy cells to minimize harmful side-effects. The characterization results demonstrated a similar size range and composition for all the CDs. While hydrothermal synthesis generates CDs with lower fluorescence and synthesis yields, presenting also an emission more dependent on surface states, these CDs have the most promising viability profile in MCF-10A when compared with microwave-assisted and thermal-heating CDs, which present better fluorescence properties and. Our results suggest these CDs have the potential to proceed in further investigations in animal models as imaging candidates or biosensing tools, as well as drug carriers for future applications in medicine.

Keywords: carbon dots; MCF-10A cells; bottom-up synthesis; drug carriers

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