

Abstract

Validation of Spent Coffee Grounds as Precursors for the Development of Sustainable Carbon Dot-Based for Fe³⁺ Optical Sensing †

Diana M.A. Crista *, Joaquim C.G. Esteves da Silva and Luís Pinto da Silva

Chemistry Research Unit (CIQUP), Faculty of Sciences of University of Porto, R. Campo Alegre 687, 4169-007 Porto, Portugal

* Correspondence: up200702319@fc.up.pt

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Carbon dots (CDs) are fluorescence carbon-based nanomaterials that possess several properties such as photoluminescence, biocompatibility and good water solubility.[1, 2] They can be fabricated from a large variety of precursors, however, most available organic molecules are still expensive and their use or synthesis can lead to significant challenges to the environment and human health. It has become desirable to use biomass waste as alternative precursors in the synthesis of CDs, given that biomass waste material is ubiquitous, nontoxic, cheap and renewable.

Spent coffee grounds (SCGs) are the residues of the treatment of coffee powder can be a potential carbon source to a more environmentally sustainable synthesis route.

In this work, we fabricated SCG-based CDs via one-pot and solvent-free carbonization of solid samples generating particles with sizes between 2.1 and 3.9 nm. These carbon nanoparticles exhibited blue fluorescence and excitation-dependent emission of carbon dots with moderate quantum yields (2.9-5.8%).[3]

More importantly, SCG-based CDs showed potential for being used as optical Fe³⁺ optical sensors, with Life Cycle Assessment (LCA) studies validating the SCGs as more sustainable precursors than classical precursors, both considering a weight- or function-based functional unit.

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