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Abstract

Fluorescent Carbon Nanodots as Sensors of Toxic Metal Ions and Pesticides †

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Abstract: Carbon nanodots (CDs) are a new class of fluorescent carbon-based nanomaterials characterized by a plethora of morphologies and sizes. Among these, we can include two different types of CDs, namely, graphitic and diamond-like. This wide range of structures opens up the possibility to design different CDs, with tunable optical properties accordingly to the synthesis method and precursors used. We prepared two different CDs following a bottom-up approach by thermally induced decomposition of organic precursors (namely, citric acid and urea in different molar ratios), and using purification by Size Exclusion Chromatography (SEC). Obtained CDs were characterized by Raman, absorption and fluorescence (PL) spectroscopies to understand structural and optical properties, and by atomic force microscopy (AFM) to elucidate morphology. They feature graphitic and diamond-like carbon structures with highly efficient visible emissions. Their sensing towards Cd and Hg heavy metals has been tested by PL experiments. We found a PL quenching in the presence of concentrations of metal salts starting from 0.5 μM and a selectivity towards the interacting ions, depending on the CDs structure, enabling using them for sensing. Furthermore, preliminary experiments suggest that these dots can also be used in principle as sensors of common pesticides. Considering the advantages of carbon dots with respect to other nanomaterials, such as non-toxicity, low cost and ease of synthesis, we consider these results to be very promising in view of exploiting the optical response of carbon dots to fabricate in the near future a variety of pollutant-sensing devices.

Keywords: carbon dots; quenching; fluorescence; pollutants

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