Use of harmless NADES for modulating luminescent properties of N-doped graphene quantum dots

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Solvents are capable to control the dehydration and carbonization of organic molecules in solvothermal processes. They also determine the size of sp2-conjugated domains related to the emission range of fluorescence for carbon-based quantum dots and are involved in the addition of doping agents as nitrogen in graphitic positions responsible of an increase of Photoluminescence Quantum Yield (PLQY) [1]. Modulating luminescence is required for several applications of Quantum Dots (QDs). Current strategies for red shifting are associated to the use of complex precursors, reducing solvents like dimethylformamide (DMF) or concentrated sulfuric acid solutions [2]. However, these approaches limit their applicability for large scale applications in synthesis of functional materials due to their toxicity and effect in environment. Deep eutectic solvents (DES) achieved a large interest recently due to their high ionic charge, their high polarity, and their supramolecular structure [3]. Moreover, natural sourced eutectic solvents (NADES) have been studied due to their low toxicity, low production cost and high chemical stability that makes them promising candidate to be employed in different processes as catalysts o even reactor medium [4]. For example, some studies have reported their use as solvents or precursors for carbonized nanostructures with desired electronic properties [5]. In this work, different proportions of NADES have been employed as reaction medium to modify the emission wavelength of solvothermal synthesized luminescent graphene quantum dots. According to the results obtained, the use of different compounds like *choline and polyols*, as well as their mixture proportions are capable to tune the reductive character of solvothermal medium. Thus, an inhibition of oxidized moieties and an increase of conjugated domains and nitrogen doped in graphitic positions are observed compared to water-based assays. This allowed to obtain highly luminescent materials with tuned emission properties for several applications (as cell labelling, led lighting, etc) avoiding the use of harmful reactants at the same time.

References

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Figures

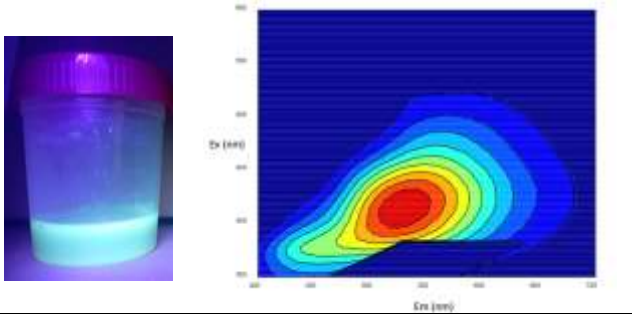

Figure 1: Synthesized graphene quantum dots in NADES (left picture) and excitation-emission spectroscopy wavelength profiles of synthesized quantum dots (right picture).