

Title: Green synthesis of highly fluorescent carbon quantum dots from almond resin for advanced theranostics in biomedical applications

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Abstract: Fluorescent Carbon Quantum Dots (CQDs) are being used in medical applications, particularly in theranostics. These Carbon Quantum Dots have been gaining more attention lately due to their potential as an effective replacement for hazardous synthetic organic dyes in a variety of biomedical applications, including live cell imaging and diagnostics. In this study, highly fluorescent Carbon Quantum Dots by one pot microwave based green route with a size of less than 10 nm, was prepared from commercially available almond resin, *Prunus dulcis* and conjugated with honey as additional reagent for surface functionalization. They exhibit a deep blue emission on excitation at 350 nm with an elevated quantum yield at 61%. They possess atomic nature and basic features such as high photo-stability, varying fluorescence, greater biocompatibility, and better water solubility. These fluorescent labels exhibit faster cellular invagination without disturbing the cell stability. The CQDs present cell imaging capacity with multi-coloration for visualizing the fine architecture of the nucleus naming, the nuclear membrane and nucleolus, which is linked with their varied, surface structures such as amphiphilic property and higher positive charges. These characteristics with minimal invasion have made carbon quantum dots to become the spotlight in theranostics. They can be used as alternatives to synthetic dyes for fluorescence- related cell-imaging. The intriguing fact about this approach is that it opens the possibility of combining therapy and diagnostics into one unit, which can alter how some diseases are handled and, in turn, transform the field of healthcare.

Keywords: Carbon Quantum Dots (CQDs), Fluorescence, Theranostics, Green synthesis, *Prunus dulcis* (almond resin), Honey conjugation, Biocompatibility, FluorescenceBio-imaging, Antioxidant, Angiogenesis

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