Green Transformation of Biomass-Derived Indian Gooseberry into Fluorescent Intrinsic Nitrogen-Functionalized Carbon Quantum Dots for Real-Time Detection of Vitamin B2 in Nanomolar Range

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Abstract:

Riboflavin (RF) detection is essential for controlling nutritional health due to its increasing significance in the food products, biological, and pharmaceutical industries. Regular daily intake of RF (vitamin B2) is important because it is not synthesized and stored in human body in appreciable amounts. 1.1 mg for men and 1.3 mg for women is suggested on daily basis. So efficient and biocompatible nanosensor with good selectivity and sensitivity is required for RF detection. CQDs derived from biomass have recently attracted interest in environmental science due to their simple, cost-effective methods of synthesis, as well as their sustainability advantages and practical implications. Herein, we demonstrate the utility of ratiometric fluorescence-based carbon quantum dots (CQDs) nanosensor from biomass precursor (Indian Gooseberry) using microwave-assisted pyrolysis method for detection of RF in its isolated, pure form in aqueous and HEPES medium as well as in pharmaceutical tablets in the nanomolar range, governed predominantly by FRET. The synthesis protocol was very fast, simple, green, and biocompatible with no externally-added reagent. This present work opens a new vision for development of innovative and sensitive approach of green fluorescent nanosensor for detection of RF which may find potential applications in the biological and food industries.

Keywords:

Biomass, Indian Gooseberry, N-CQDs, Green nanosensor, Riboflavin (vitamin B2 detection), FRET, Real sample analysis.