ABSTRACT

Fluorescent carbon dots (CDs) have gained remarkable attention for chemical and biomedical sensing owing to their unique optical properties, stability, and biocompatibility. In this work, spinach was employed as a natural carbon precursor to synthesize CDs via a simple hydrothermal route at 120 °C, 140 °C, and 160 °C for 7 h. The UV–Vis spectra exhibited two characteristic absorption peaks at 290 nm (π⟶π transition of C=C) and 330 nm (n⟶π* transition of C=O). Photoluminescence (PL) analysis revealed that increasing the synthesis temperature enhanced the fluorescence intensity from 122 a.u (120 °C) to 167 a.u (140 °C), reaching 258 a.u at 160 °C, with maximum emission around 465 nm. The enhancement was attributed to the formation of more ordered aromatic conjugated domains at higher temperatures. The as-prepared CDs also showed excellent sensitivity toward the antibiotic ciprofloxacin (CIP), where the addition of 688 ppm CIP led to a 260% increase in fluorescence intensity. CIP was selected due to its widespread use and frequent detection as a residue in hospital wastewater and aquatic systems. These findings demonstrate that spinach-derived CDs are promising, eco-friendly fluorescent probes for rapid and sensitive detection of CIP in environmental and biomedical samples.*

Keywords : *Carbon dots, spinach leaves, hydrothermal, antibiotic sensing*