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Photoreactive Carbon Dots Modified g-C3N4 for Effective Photooxidation of Bisphenol-A under Visible Light Irradiation

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Abstract
A series of carbon dots (CDs) modified g-C3N4 (xCDs/g-C3N4; x = 0.5, 1.0, and 1.5 mL CDs solution) was synthesized via the microwave-assisted hydrothermal synthesis method for the photooxidation of bisphenol-A (BPA) under visible light irradiation. The X-ray diffraction (XRD) analysis indicates that the CDs may have a turbostratic structure and the resulting photocatalysts have distorted crystal structure, as compared with pure g-C3N4. The high-resolution transmission electron microscope (HR-TEM) analysis revealed amorphous, mono-disperse, spherical CDs with an average particle size of 3.75 nm. The distribution of CDs within the matrix of g-C3N4 appear as small dark dot-like domains. The N2 adsorption-desorption analysis indicates that the nanocomposites are mesoporous with a density functional theory (DFT) estimate of the pore size distribution between 2–13 nm. The CDs quantum yield (QY) was determined to be 12% using the UV-vis spectral analysis, where the CDs/g-C3N4 has improved absorption in the visible region than g-C3N4. The higher BET surface area of CDs/g-C3N4 provided more adsorption sites and the ability to yield photogenerated e−/h+ pairs, which caused the 1.5 CDs/g-C3N4 to have better photocatalytic efficiency compared to the rest of the systems. The highest removal, 90%, was achieved at the following optimum conditions: BPA initial concentration = 20 mg L−1, catalyst dosage = 30 mg L−1, and pH = 10. The photooxidation process is mainly driven by photogenerated holes (h+) followed by •OH and O2•−. The synthesis of the 1.5 CDs/g-C3N4 system is simple and cost-effective, where this photocatalyst is highly stable and reusable versus other systems reported in the literature. © 2022 by the authors.

Author Keywords
bisphenol-A; carbon quantum dots; g-C3N4; photocatalysis; visible light irradiation

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