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Okra peel-derived nitrogen-doped carbon dots: Eco-friendly synthesis and multi-functional applications in heavy metal ion sensing, nitro compound detection and environmental remediation

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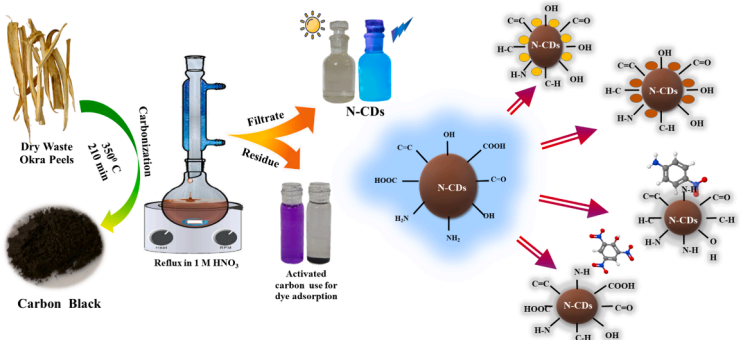
HIGHLIGHTS

- Kitchen waste okra peels derived synthesis of nitrogen doped carbon dots (N-CDs) as a fluorescent probe.
- N-CDs a fluorescent probe shows sensitivity towards Cr^{6+} and Mn^{7+} metal ions with instant decolourisation of Mn^{7+}.
- The developed fluorescent probe shows sensitivity and selectivity towards 4-nitroaniline (4-NA) and picric acid (PA).
- The developed method has good effectivity for real water sample with good recovery rate.
- The circular economy based reactivated carbon as an adsorbent for removal of model pollutant dyes.

GRAPHICAL ABSTRACT



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Nitrogen doped carbon dots (N-CDs)
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ABSTRACT

The present study explores the kitchen waste okra peels derived synthesis of nitrogen doped carbon dots (N-CDs) via simple carbonization followed by reflux method. The synthesized N-CDs was characterized using, TEM, XPS, FTIR, XRD, Raman, UV–Visible and Fluorescence Spectroscopy. The N-CDs emits bright blue emission at 420 nm with 12 % of quantum yield as well as it follows excitation dependent emission. Further, the N-CDs were employed as a fluorescence sensor for detection of hazardous metal ions and nitro compounds. Among various metal ions and nitro compounds, the N-CDs shows fluorescence quenching response towards Cr^{6+}, and Mn^{7+} metal ions as well as 4-nitroaniline (4-NA) and picric acid (PA) with significant hypsochromic and bathochromic shift for Mn^{7+}, 4-NA and PA respectively. The developed fluorescent probe shows relatively low limit of detection (LOD) of 1.46 μg/mL, 1.05 μg/mL, 2.1 μg/mL and 2.2 μg/mL for the above analytes respectively. The N-CDs did not show any significant interference with coexisting ions and successfully applied for real water sample analysis. In addition, circular economy approach was employed for adsorption of dyes by reactivating leftover waste carbon residue which was obtained after reflux. Thus, the kitchen waste valorization and circular economy

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