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Eco-Friendly Synthesis of Carbon Quantum Dots as an Effective Adsorbent

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Abstract : Fluorescent carbon quantum dots (CQDs) were prepared by an economical, green, and single-step procedure based on microwave heating of urea with sugarcane bagasse (SCB), cellulose (C), or carboxymethyl cellulose (CMC). The prepared CQDs were characterized using a series of spectroscopic techniques, and they had small size, strong absorption in the UV, and excitation wavelength-dependent fluorescence. The prepared CQDs were used for Pb(II) adsorption from an aqueous solution. The removal efficiency percentages (R %) were 99.16, 96.36, and 98.48 for QCMC, QC, and QSCB. The findings validated the efficiency of CQDs synthesized from CMC, cellulose, and SCB as excellent materials for further utilization in the environmental fields of wastewater pollution detection, adsorption, and chemical sensing applications. The kinetics and isotherms studied found that all CQD isotherms fit well with the Langmuir model than Freundlich and Temkin models. According to R^2, the pseudo-second-order fits the adsorption of QCMC, while the first-order one fits with QC and QSCB.

Keywords : carbon quantum dots, graphene quantum dots, fluorescence, quantum yield, water treatment, agricultural wastes
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