ABSTRACT

Nitrogen-doped Carbon Quantum Dots (N-CQDs) are carbon-based nanomaterials with attractive optical properties and promising potential for fluorescence-based glucose biosensing applications. This study aimed to synthesize, characterize, and analyze the optical properties and particle size distribution of N-CQDs synthesized from Tridax procumbens extract via a hydrothermal method using monoethanolamine (MEA) as a nitrogen source at concentrations of 0%, 0.2%, 0.5%, and 0.7%. Characterization was conducted using UV–Visible spectroscopy and Particle Size Analyzer (PSA). The results showed that N-CQDs were successfully synthesized at all dopant concentrations, indicated by the formation of a yellowish-brown solution. The UV–Vis spectra exhibited two main absorption peaks at 285–287 nm corresponding to $\pi \rightarrow \pi^*$ transitions of C=C bonds and 374–378 nm corresponding to $n \rightarrow \pi^*$ transitions associated with C=O and N–H surface functional groups. The calculated band gap values ranged from 3.65 to 3.77 eV. PSA analysis revealed an increase in Z-Average particle size from 18.41 nm to 32.24 nm with increasing dopant concentration. The particle size distribution was multimodal, consisting of nanoparticle fractions in the range of 7.095–8.965 nm and larger aggregates in the micrometer range (approximately 2.4–3.0 µm). All samples exhibited polydispersity index (PDI) values above 0.4, with the lowest value observed for the 0.7% doped sample (0.4159). The presence of active surface functional groups and nanoparticle fractions below 10 nm indicates that the synthesized N-CQDs have potential as candidate materials for glucose biosensors. However, further optimization of the synthesis process is required to improve particle size homogeneity and enhance biosensor performance.

Keywords: *N-CQDs, Tridax procumbens, monoethanolamine, glucose biosensor, optical properties, particle size distribution.*