

Title : Utilization of carbon nanodots for growth inhibition of bacteria and free radical scavenging

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## ABSTRACT

Carbon nanodots are a type of nanoparticles that have recently gained significant interest due to their outstanding properties such as biocompatibility, low toxicity, fluorescence, antibacterial and antioxidant activities. The objectives of this research are to characterize several parameters of carbon nanodots synthesized from sucrose, namely SCDs-PEI and SCDs-PEI+BZC, and to study the ability of these carbon nanodots as antibacterial and antioxidant agents. The characterization of both types of carbon nanodots using dynamic light scattering (DLS) revealed that SCDs-PEI+BZC had an average size of  $52.5 \pm 3.0$  nm and a polydispersity index (PI) of  $0.276 \pm 0.117$ , while the average particle size of SCDs-PEI particle was unable to be measured. The SCDs-PEI and SCDs-PEI+BZC particles exhibited zeta potential values of  $39.1 \pm 3.4$  and  $56.3 \pm 7.5$  mV, respectively. After testing the growth inhibition of *Escherichia coli* and *Staphylococcus aureus* using broth dilution technique, SCDs-PEI+BZC particles were capable of inhibiting both *E. coli* and *S. aureus* with the minimum inhibitory concentration (MIC) of  $30 \mu\text{g/mL}$  and  $1 \mu\text{g/mL}$ , respectively, while the SCDs-PEI particles could not inhibit the growth of two bacterial species tested. Agar disc diffusion technique revealed that SCDs-PEI+BZC was able to inhibit the growth of both *E. coli* and *S. aureus*, with the MICs of  $20 \mu\text{g/mL}$  and  $1 \mu\text{g/mL}$ , respectively. However, SCDs-PEI showed no inhibitory effect against either *E. coli* or *S. aureus*. The antioxidant activity of the carbon nanodots was assessed using DPPH and ABTS assays. The IC<sub>50</sub> values obtained from the DPPH and ABTS assays were  $107.13$  and  $93.07 \mu\text{g/mL}$  for SCDs-PEI, and  $275.30$  and  $321.84 \mu\text{g/mL}$  for SCDs-PEI+BZC, respectively. It is anticipated that the outcome from this research will become an initial platform for the development of new alternative nanoparticles to be applied as antimicrobial agents in disinfectants or as biomaterials for the treatment of diseases such as cancer.

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