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Synthesis of tea catechin incorporated carbon based nanocomposites and *in vitro* analysis of their antimicrobial properties

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Background: Tea Catechins (TC) which are polyphenolic compounds present mainly in green tea extract, possess numerous health benefits. As their usage in the native form is limited, researchers are interested in developing nanocomposites to enhance their therapeutic usage.
Objective: Synthesis of TC/Carbon nanocomposites and assessment of their antimicrobial activity against some selected bacteria and fungi causing superficial skin infections.

Methods & Materials: Nanocomposites were synthesized via the adsorption method. Graphene Oxide(GO), Reduced Graphene Oxide(RGO), Expanded Graphite(EG), Activated Carbon(AC) and Graphite(G) were selected to synthesize the nanocomposite. 5 mg from each carbon-based material was mixed well with a tea catechin solution of a known concentration. Adsorption capacities were determined by measuring the remaining concentration of TC in the supernatant using UV-Visible Spectroscopy. Composites were characterized with X-Ray Diffraction (XRD) and Fourier Transform Infra-Red (FTIR) spectrometry. Antimicrobial activity was assessed using agar well diffusion method against *Staphylococcus aureus* (ATCC 25923), *Escherichia coli* (ATCC 25922) and clinically isolated *Candida albicans.* After incubation at 37^{o}C for 24 hours, inhibition zone diameters were measured.
Results: Adsorption capacities of the nanocomposites of GO, RGO, EG, AC and G) were 250, 240, 158, 218 and 136 mg/g respectively. Successful incorporation of TC was validated by XRD peak around 20º-24º and O-H stretching at 3400cm^{-1} in FTIR. In diluted DMSO, all composites showed inhibitory activity against *S. aureus* and *E. coli* giving 20.0$\pm$0.1 mm and 19.0$\pm$0.1 mm for TC. No zones were observed for the negative control. AC showed the highest antibacterial activity against *S. aureus* and both AC and GO showed the highest activity against *E. coli.* Composites were not active against the *Candida* species. Slow and sustained release of TC from composites was confirmed by the larger inhibition zones exhibited by TC than its composites.
Conclusion: The synthesized bio-nanocomposites possess antibacterial activity against *S. aureus* and *E.coli*. Slow and sustained release of TC from the composites indicates their potential applications in the pharmaceutical industry.