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Ficus Microcarpa Fruit Derived Iron Oxide Nanomaterials and Its Anti-bacterial, Antioxidant and Anticancer Efficacy

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Abstract : Microbial infections-based diseases are a significant public health issue around the world, mainly when antibiotic-resistant bacterium types evolve. In this research, we explored the anti-bacterial and anti-cancer potency of iron-oxide (Fe_2O_3) nanoparticles prepared from F. macrocarpa fruit extract. The chemical composition of F. macrocarpa fruit extract was used as a reducing and capping agent for nanoparticles' synthesis was examined by GC-MS/MS analysis. Then, the prepared nanoparticles were confirmed by various biophysical techniques, including X-ray powder diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), UV-Vis Spectroscopy, and Transmission Electron Microscopy (TEM) and Energy Dispersive Spectroscopy (EDAX), and Dynamic Light Scattering (DLS). Also, the antioxidant capacity of fruit extract was determined through 2,2-diphenyl-1-picrylhydrazyl (DPPH), 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid (ABTS), Fluorescence Recovery After Photobleaching (FRAP), Superoxide Dismutase (SOD) assays. Furthermore, the cytotoxicity activities of Fe_2O_3 NPs were determined using the (3-(4, 5-dimethylthiazolyl-2)-2, 5-diphenyltetrazolium bromide) (MTT) test on MCF-7 cells. In the antibacterial assay, lethal doses of the Fe_2O_3NPs effectively inhibited the growth of gram-negative and gram-positive bacteria. The surface damage, ROS production, and protein leakage are the antibacterial mechanisms of Fe_2O_3NPs. Concerning antioxidant activity, the fruit extracts of F. macrocarpa had strong antioxidant properties, which were confirmed by DPPH, ABTS, FRAP, and SOD assays. In addition, the F. microcarpa-derived iron oxide nanomaterials greatly reduced the cell viability of (MCF-7). The GC-MS/MS analysis revealed the presence of 25 main bioactive compounds in the F. microcarpa extract. Overall, the finding of this research revealed that F. microcarpa-derived Fe_2O_3 nanoparticles could be employed as an alternative therapeutic agent to cure microbial infection and breast cancer in humans.

Keywords : ficus microcarpa, iron oxide, antibacterial activity, cytotoxicity
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