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Ficus microcarpa fruit derived iron oxide nanomaterials and its anti-bacterial, antioxidant and anticancer efficacy

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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 reducing and capping agent for nanoparticles' synthesis was examined by GC-MS/MS analysis. Then, the prepared nanoparticles were confirmed by various bio-physical techniques, including X-Ray Powder Diffraction (XRD), Fourier-Transform Infrared Spectroscopy (FTIR), UV-Vis Spectroscopy, 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 MTT test on MCF-7 cells. In antibacterial assay, lethal doses of the Fe_2O_3 NPs effectively inhibited the growth of gram-negative, gram-positive bacteria. The surface damage, ROS production, and protein leakage are the antibacterial mechanisms of Fe_2O_3 NPs. Concerning antioxidant activity, the fruit extracts of *F. microcarpa* had a strong antioxidant property, which was confirmed by DPPH, ABTS, FRAP, and SOD assays. In addition, the *F. microcarpa* derived iron oxide nanomaterials greatly reduced the cell viability on (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.