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The Photo-Thermal Effect of Green-Synthesized Gold Nanoparticles on Human Breast Cancer Cells

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Breast cancer continues to be one of the main causes of cancer-related deaths among women globally, highlighting the need for new, targeted, and less harmful treatment options. Gold nanoparticles (AuNPs) have been identified as potential tools in nanomedicine due to their compatibility with biological systems, customizable surface chemistry, and distinctive optical characteristics. Nevertheless, traditional synthesis methods often utilize toxic reducing agents, which limits their use in medicine. This study investigates an environmentally friendly method for synthesizing AuNPs using an extract from the Kniphofia porphyrantha plant and assesses their effectiveness in treating breast cancer. The AuNPs were synthesized through a green chemistry approach, utilizing aqueous plant extracts both as reducing and stabilizing agents. The spectrophotometric analysis was performed to confirm the optical properties of AuNPs. At the same time, the phototoxic effects of synthesized AuNPs on MCF-7 breast cancer cells were evaluated by assessing morphological changes, cellular viability, and cytotoxicity rates 24 hours post-irradiation using a 525 nm laser with a fluency of 10 J/cm². Results showed a dose-dependent response to the treatment, demonstrated by significant morphological changes, increased cytotoxicity, and decreased cell viability compared to untreated cells, indicating the anticancer properties of green AuNPs. This highlights the dual advantages of green AuNPs: sustainable production and potential use in cancer therapy. These results encourage further exploration of the optical properties and biological activity of plant-synthesized AuNPs as promising candidates for cancer nanomedicine.

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