# Green Biosynthesis of Gold Nanoparticles Using Pomegranate Peel and Their Potential Application in Photothermal Therapy for Cancer Treatment

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This study aimed to develop an environmentally friendly process to biosynthesize gold nanoparticles (AuNPs) using pomegranate peels, an agro-waste. AuNPs were formed by reducing gold ions with hydroxyl-containing compounds in pomegranate peel extract (PPE). The particle surface absorbed these compounds, creating a coating layer to stabilize the formed AuNPs, preventing aggregation, and acting as a capping agent. Effects of reaction conditions, including temperature (room temperature [RT], 40 C and 80 C), HAuCl4 concentrations (ranging from 0.1 to 1 mM), and PPE/HAuCl4 ratio on the synthesis of AuNPs were investigated. The biosynthesized AuNPs were monitored based on the characteristic red or purple color of the solution and were validated by UV-Vis spectroscopy. Zeta potential analyzer and transmission electron microscope (TEM) were employed to characterize the size and polydispersity of the biosynthesized AuNPs. The results showed that the AuNPs were mostly spherical in shape and had moderate to broad size distribution. Data indicated that AuNP size ranging from 15 to 105 mm could be controlled by adjusting the process conditions, with HAuCl4 concentrations having the greatest influence, followed by temperature and PPE:HAuCl4 ratio. Additionally, the biosynthesized AuNPs remained stable for at least six months without exhibiting any aggregation. The potential of biosynthesized AuNPs in photothermal therapy for cancer treatment was studied using HeLa cells. A downward trend in cell viability was observed for AuNPs synthesized as PPE amount increased compared to AuNPs groups with lower PPE content and the control group, suggesting a favorable outcome.

**Awards Won:**