

UNIVERSITI TEKNOLOGI MARA

**COLLOIDAL GOLD
NANOPARTICLES SYNTHESIZED
BY ELECTROSPRAY ASSISTED
CHEMICAL REDUCTION METHOD**

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ABSTRACT

The Electrospray technology was employed for continuous synthesis of polymeric stabilizer protected gold nanoparticles (GNPs) in aqueous region via chemical reduction method. GNPs in the range of 2–30 nm were chemically synthesized using HAuCl₄ as precursor solution, L-ascorbic acid as reducing agent and polyvinyl pyrrolidone (PVP) as stabilizer. Physical properties of colloidal GNPs such as particle size, morphology, and polydispersity index were optimized by manipulating electrospray precursor stream and droplets governing factors such as flow rate, precursor concentration, and working distance. Correlation between particle size, morphology, and particle size distribution of GNPs in final product and electrospray parameters were analysed. Quantitative and qualitative measurements of final GNPs were characterized using ICP – AES, DLS, UV-Vis, TEM, and FTIR techniques. Results reveal that the mean diameter of GNPs decreased from ~ 9 to 4 nm with increasing electrospray flowrate, electrospray droplet size current passing through the electrospray jet and decreasing working distance. Besides, it was found out that spherical and monodispersed GNPs with 0.04 PDI value in relatively high flowrate (2ml/h) and moderated concentration of precursor solution (2mM) of this study. In addition, favourable chemical environment conditions such as pH of reaction bath, molar ratio of reactants and presence of stabilizer (PVP) for synthesizing engineered GNPs in electrospray incorporated system was investigated. The smallest size with best homogeneity of particles were yield where the high pH value (10.5) of reducing agent, ascorbic acid to gold (III) chloride molar ratio; 20:1 and in presence of PVP conditions. Eventually, it has been proved that the size, morphology and homogeneity of GNPs can be tuned by manipulating the electrospray parameters and engineered GNPs with desire properties can be synthesized using electrospray incorporated chemical reduction system. Hence, it is expected that this study full fill the necessity of the proper reactor system for synthesis GNPs with optimum properties with minimum protocols

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