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PROCEEDINGS ABSTRACT

# Development and physicochemical characterization of selenium nanoparticles stabilized and functionalized by hyaluronic and gallic acid

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The discovery of targeted, biocompatible nanocarriers represents a substantial transformation in the field of cancer therapeutics by addressing critical limitations of conventional chemotherapy (including nonspecific toxicity, unfavourable pharmacokinetics, and the emergence of multidrug resistance). Nanotechnology-based drug delivery systems have emerged as effective methods of addressing these limitations. Selenium (Se) nanoparticles (SeNPs), in particular, have garnered considerable interest due to their unique physicochemical and biological characteristics, including low toxicity, biocompatibility, antioxidant activity, and prospective medicinal utility. The surface modification and functionalization of SeNPs with biocompatible compounds can enhance their stability, targeting efficacy, and overall performance as nanocarriers. This study has focused on varying hyaluronic acid (HA) to Se and gallic acid (GA) to Se mass ratios in order to identify the optimal formulation for generating SeNPs with desirable particle size distribution, high homogeneity, and adequate colloidal stability for nanodrug delivery applications. We have effectively produced and physiochemically characterized SeNPs that are stabilized and functionalized with HA and GA (HA/GA-SeNPs). HA was chosen for its superior biocompatibility and its capacity to improve nanoparticle stability and cellular targeting, while GA was used as a natural polyphenolic stabilizer and functionalizing agent. The nanoparticles were produced using sodium selenite (as the Se precursor) and ascorbic acid (as the reducing agent) under regulated conditions in the presence of HA and GA. HA solutions (5 mg/mL) were subsequently added in varying concentrations in order to produce several formulations with HA to Se ratios of 5:1, 7.5:1, 10:1, and 12.5:1. The reaction mixture's obvious colour change from colourless to reddish-orange was the first indication that the nanoparticles had been formed, while the produced HA/GA-SeNPs were characterized by a variety of techniques, including dynamic light scattering and zeta potential assessment. Our results indicate that alterations in the HA to Se and the GA to Se ratios can greatly influence nanoparticle size, surface charge, and dispersity. The examined HA-SeNPs, with HA to Se ratios of 5:1, 7.5:1, 10:1, and 12.5:1, have yielded nanoparticles exhibiting Z-average diameters between 123.6 and 130.8 nm, with polydispersity index (PDI) values ranging from 0.085 to 0.182. Zeta potential tests varied from -12.8 to -24.8 mV, thereby signifying adequate colloidal stability. The HA to Se ratio of 7.5:1 exhibited optimal particle homogeneity, as evidenced by a PDI value of 0.085. Further optimization was conducted by integrating GA at various GA to Se ratios (0:1, 2.5:1, and 5:1). Our findings indicate that the formulation created at HA to Se and GA to Se ratios of 5:1 bears the most ad-

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vantageous physicochemical characteristics, featuring a Z-average diameter of 98.91 nm, a low PDI value of 0.065, and a zeta potential of -16.7 mV. The results demonstrate the effective synthesis of highly uniform and stable HA/GA-SeNPs of suitable nanoscale dimensions, that could exert enhanced permeability and retention-mediated tumour targeting. In conclusion, the HA/GA-SeNPs synthesized in our study constitute a viable nanoscale platform with excellent physicochemical characteristics and a promising potential as an efficient and selective nanodrug delivery system for anticancer applications.

**Keywords**

gallic acid; hyaluronic acid; selectivity; selenium; targetability

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**Conflicts of interest statement**

None to declare.

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