|  |
| --- |
| **An exploration of selenium nanoparticle fabrication and antioxidant properties** |
| Lulwah Albassam; Gareth R. Williams; Steve Brocchini |
| UCL School of Pharmacy, 29-39 Brunswick Square, London, UK. |
| **Background:** The World Health Organization (WHO) estimates that approximately 2.2 billion people worldwide suffer from vision impairment, and that half of those cases could be prevented (1). Oxidative stress plays a critical role in the development of ocular conditions (2). Recently, the potential of selenium as a drug to treat such conditions has been proposed (2). Selenium is fundamentally important to human wellbeing as it is incorporated into 25 proteins including glutathione peroxidase (GPx), an antioxidant enzyme that protects lipids from peroxidation (3). We thus hypothesised that elemental selenium could be applied to supplement GPx levels and protect human lens cells from oxidative stress. |
| **Methods:** Selenium nanoparticles (SeNPs) were prepared by reduction of sodium selenite by ascorbic acid (vitamin C) in the presence of α-tocopheryl polyethylene glycol succinate (TPGS). The final colloidal solution was centrifuged to wash the nanoparticles (NPs) with de-ionized water. The NPs were characterised using dynamic light scattering (DLS), transmission electron microscopy (TEM), and inductive coupled plasma mass spectrometry (ICP-MS). Their functional performance was explored using 1,1-diphenyl-2-picrylhydrazyl (DPPH), human lens epithelial (HLE) cell viability, and glutathione peroxidase (GPx) quantification assays. |
| **Results:** DLS data shows the NPs to have a size of 40 ± 3 nm, with zeta potential of -14 ± 2 mV and PDI = 0.08 ± 0.01. TEM revealed that the SeNPs were spherical with a diameter of approximately 32 ± 6 nm. The size however increased to 86 ± 3 nm after 2 months storage at 1 – 4 °C. DPPH assays showed dose dependent antioxidant activity, and the NPs were found to be cytocompatible with IC50 of 2.2 µg/ml. A GPx assay revealed an increase in the concentration of the enzyme in SeNP-treated cells compared to controls and cells treated with organic Se (Se-methionine). |
| **Conclusions:** Selenium nanoparticles showed scavenging and antioxidant effects and can be further studied for topical applications to help delay the progression of cataracts. |

**References**

[1] World Health Organization. World report on vision 2019. Available from: <https://www.who.int/publications/i/item/9789241516570>.

[2] Ananth S, Miyauchi S, Thangaraju M, Jadeja RN, Bartoli M, Ganapathy V, Martin PM. Selenomethionine (Se-Met) Induces the Cystine/Glutamate Exchanger SLC7A11 in Cultured Human Retinal Pigment Epithelial (RPE) Cells: Implications for Antioxidant Therapy in Aging Retina. Antioxidants. 2021; 10(1):9. Available from: <https://doi.org/10.3390/antiox10010009>

[3] Steinbrenner H, Sies H. Protection against reactive oxygen species by selenoproteins. *Biochim Biophys Acta*. 2009; 1790(11):1478-1485. Available from : <https://doi.org/10.1016/j.bbagen.2009.02.014>