Biocompatibility assessment of selenium nanoparticles as novel biocidal nanomaterial

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Introduction

Selenium nanoparticles (SeNPs) represent promising candidates in nanomedicine due to their biocidal and antioxidant activity, biocompatibility, and biodegradability [1-3]. In this study different selenium nanoparticles (SeNPs) were designed using polyacrylic acid (PAA), polyvinylpyrrolidone (PVP) and poly-L-lysine (PLL) as surface modifiers. Physico-chemical characterization was performed regarding particle size, size distribution, and surface charge using dynamic light scattering. Visualization was carried out with transmission electron microscopy (TEM). Prior to *in vitro* testing, evaluation of SeNPs stability in cell-culture media was determined by means of agglomeration and dissolution behavior.

Materials and methods

Biocompatibility assessment of SeNPs was performed *in vitro* on human keratinocytes (HaCaT) and human buccal epithelial cells (TR146). Cell viability was tested using MTS assay and oxidative stress response was carried out with 2',7'-dichlorodihydrofluorescein diacetate (DCFH-DA) and rhodamine 123 staining.

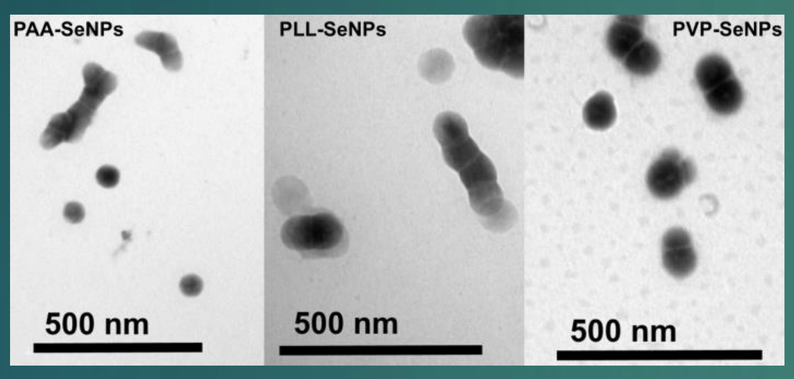

Figure 1: Transmission electron micrographs of SeNPs.

Results and conclusion

The results demonstrated a dose-dependend effect of SeNPs on cell viability and oxidative stress generation on both HaCaT and TR146 cells. Effects were dependent on the physico-chemical properties of SeNPs. PAA-coated SeNPs showed the most severe reduction in cell viability, whereas PLL-coated SeNPs induced the highest level of oxidative stress. Comparison with the inorganic form of selenium showed that SeNPs were less toxic, resulting in a higher biocompatibility than their ionic counter part. In conclusion, SeNPs can be considered as promising novel candidate for nanomedicine.

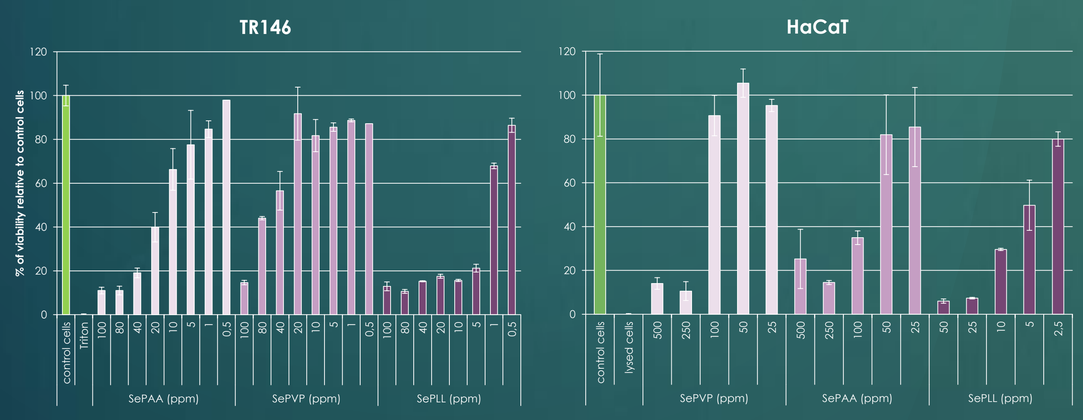

Figure 2: Cell viability of TR146 and HaCaT cells treated with SeNPs.

Figure 3: Oxidative stress induction measured by DCFH-DA of TR146 and HaCaT cells treated with SeNPs.

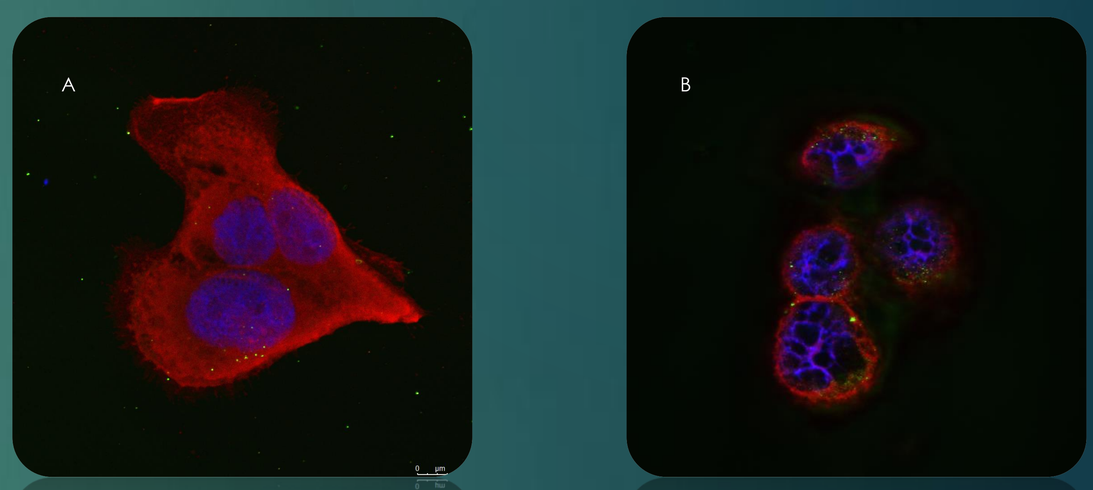

Figure 4: Opposite localisation of SePll NPs (green), the nucleus (blue) and actin fibres (red) in TR 146(A) and HaCaT cells(B)

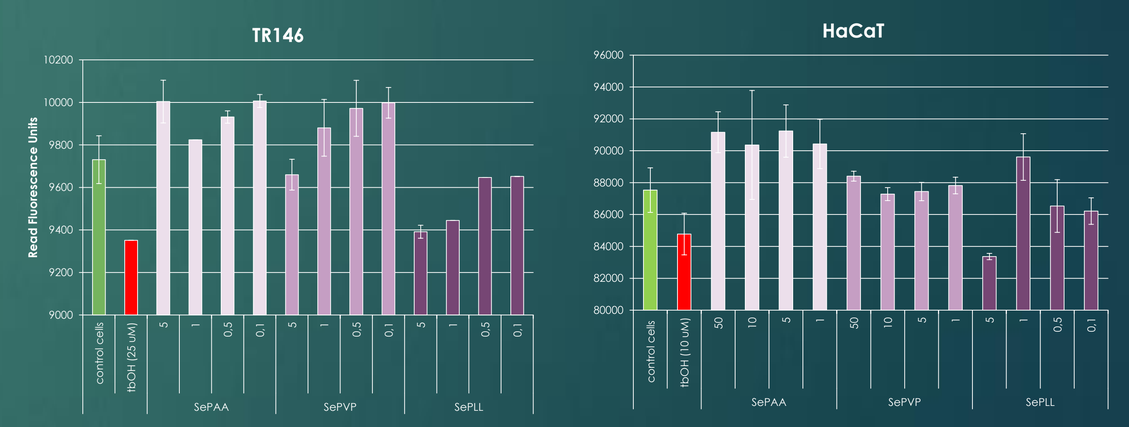

Figure 3: Effect of SeNPs on Rhodamine 123 fluorescence of TR146 and HaCaT cells

Conclusion

In conclusion, SeNPs can be considered as promising novel candidate for nanomedicine.

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