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Development of multifunctional gold nanoparticles for selective induction of apoptosis in target cells

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evelopment and progression of chronic diseases such as obesity and cancer, is dependent on angiogenesis for nutrients and oxygen supply to diseased cells. As such, pharmacological inhibition of angiogenesis is therefore a sensible strategy for treatment of these diseases. The aim of this study was to develop targeted anti-angiogenic gold nanoparticles (AuNPs) that can be delivered selectively to the target cells and trigger the apoptotic cell death. The AuNPs were bi-functionalized with a targeting peptide and a proapoptotic peptide. The targeting peptide (Adipose Homing Peptide, AHP) used in the study binds to a protein that is overexpressed by endothelial cells in the White Adipose Tissue (WAT) vasculature of obese subjects. We previously evaluated the bio-distribution of nanomaterials functionalised with the AHP and demonstrated that these nanoparticles accumulated in the WAT of animal models of obesity. In the current study, the bi-functionalized AuNPs were synthesized then characterised by UV-Vis, Zeta potential and TEM. The selective targeting and toxicity of the targeted-AuNPs was investigated on three human cancer cell lines (Caco-2, MCF7 and HT29), of which Caco-2 cells express the cell surface receptor for AHP. The AuNP toxicity on cells was evaluated using the WST-1 and the APO Percentage assays, while the AuNP uptake was confirmed by ICP-OES analysis. The AuNP cytotoxicity was more pronounced in the cells expressing the receptor for AHP, the Caco-2 cells. The uptake of the bi-functionalized AuNPs was higher on target cells, the bifunctionalized AuNPs showed receptor mediated targeting and targeted destruction of Caco-2 cells following apoptosis pathway. The bi-functionalized AuNPs demonstrates potential for the development of targeted anti-angiogenic strategy for the treatment of obesity and possibly also colon cancer. The therapeutic efficacy and specificity of bi-functionalized AuNPs in animal models of obesity and cancer is underway.

Biography

Nicole R S Sibuyi obtained her PhD degree in Biotechnology from University of the Western Cape (South Africa) where she is currently enrolled as a Postdoctoral Research Fellow under DST/Mintek Nanotechnology Innovation Centre (Biolabels Unit). Her research interests range from biomarker discovery, proteomics, targeted nano-based therapy and drug delivery. Her research is mainly focused in identifying biomarkers for chronic diseases such as cancer, diabetes and obesity. These disease-associated biomarkers will be used for the development of diagnostics as well as personalized therapy using Nanotechnology. Her research interests had advanced into Green Nanotechnology after she had received 3 months training in the application of green nanotechnology for synthesis of biocompatible metallic nanoparticles using indigenous medicinal plants.

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