Gold Nanoparticles Supported on Nanoparticulate Ceria as a Powerful Agent against Intracellular Oxidative Stress

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Abstract

Ceria-supported gold nanoparticles are prepared exhibiting peroxidase activity and acting as radical traps. Au/CeO_2 shows a remarkable biocompatibility as demonstrated by measuring cellular viability, proliferation, and lack of apoptosis for two human cell lines (Hep3B and HeLa). The antioxidant activity of Au/CeO_2 against reactive oxygen species (ROS) is demonstrated by studying the cellular behavior of Hep3B and HeLa in a model of cellular oxidative stress. It is determined that Au/CeO_2 exhibits higher antioxidant activity than glutathione, the main cytosolic antioxidant compound, and its CeO_2 carrier. Overall the result presented here shows the potential of implementing well-established nanoparticulated gold catalysts with remarkable biocompatibility in cellular biology.

References

[1] Menchón C, Martín R, Apostolova N, Victor VM, Alvaro M, Herance JR, García H., Small, 8 (2012) 1895.

Figures

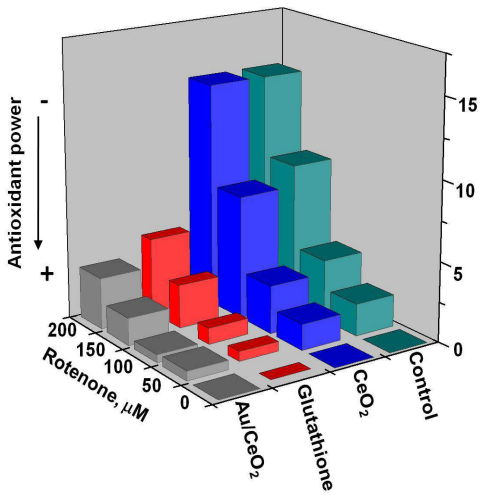


Fig 1. Effect of Au/CeO_2 (20 µg/ml), CeO_2 (20 µg/ml) and glutathione (100 µM) on Rotenone-induced ROS production. Bar charts showing DCFH fluorescence in Hep3B cells.

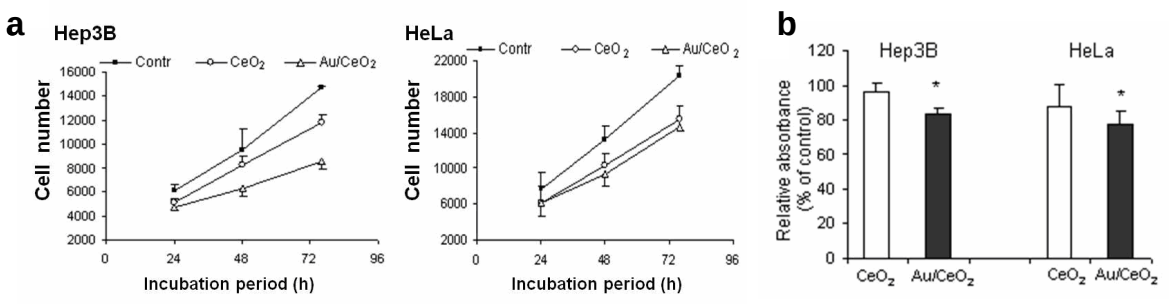
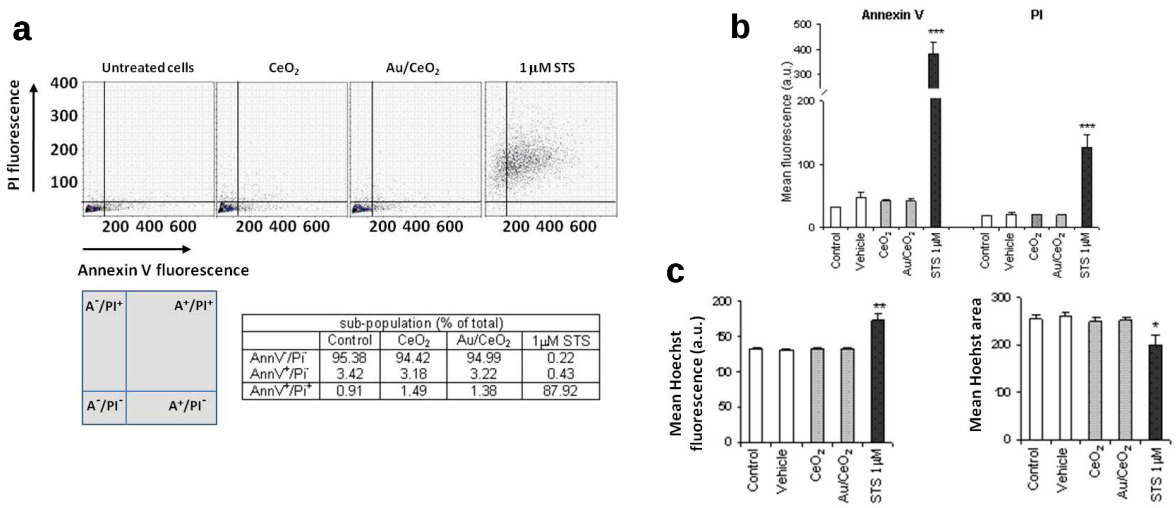


Fig 2. Effect of Au/CeO_2 and the carrier CeO_2 on cellular proliferation and viability in Hep3B and HeLa cells (a). Cell count over 3 days by static cytometry (data represented as mean ± S.E.M, n= 3). (b) MTT assay of exponentially growing cells after 24 h of culture (data represented as mean ± S.E.M, n= 5-6) were analyzed by Student´s t-test, significance vs control * $p<0.05$.



sub-population (% of total)				
	Control	CeO_2	Au/CeO_2	1µM STS
AnnV-/PI-	95.38	94.42	94.99	0.22
AnnV+/PI-	3.42	3.18	3.22	0.43
AnnV+/PI+	0.91	1.49	1.38	87.92

Fig 3. Assessment of apoptosis in He3B cells after 24 h incubation with the nanoparticles or the positive apoptotic control, staurosporine (STS). (a) Representative histograms (Bivariate Annexin V/PI analysis) of untreated control, the carrier CeO_2 and 1µM STS-treated cells. The table shows the % of each sub-population for all the conditions studied. (b) Summary histogram of AnnexinV and PI fluorescence data and (c) nuclear morphology changes (mean Hoechst fluorescence and nuclear area). Data (mean ± S.E.M, n=4) was analyzed by Student´s t-test significance vs control * $p<0.05$ and *** $p<0.001$.