Supporting information

Autoregenerative redox nanoparticles as antioxidant and glycation inhibitor for palliation of diabetic cataract

Yurui Zhou,[#a] Lu Li,[#a] Shenghui Li,[b] Shufei Li,[c] Miao Zhao,[c] Qinghong Zhou,[c] Xiaoqun Gong,*[a] Jin Yang,*[d] and Jin Chang*[a]

[a] School of Life Sciences, Tianjin University, Tianjin Engineering Research Center for Micro-Nano Biomaterials and Detection-Treatment Technology, Tianjin 300072, China

[b] Key Laboratory of Post-Neurotrauma Neurorepair and Regeneration in Central Nervous System Ministry of Education in China and Tianjin, Tianjin Neurological Institute, Department of Neurosurgery, Tianjin Medical University General Hospital, Tianjin, 300052, China

[c] Department of Toxicology, Tianjin Center for Disease Control and Prevention, Tianjin 300011, China

[d] Department of Ophthalmology, Eye and ENT Hospital, Fudan University Myopia Key Laboratory of Health PR China, Shanghai, 200031, China

[#] The authors contribute equally to this work.

*Corresponding Author: Jin Chang, E-mail: jinchang@tju.edu.cn

Jin Yang, E-mail: jin_er76@hotmail.com

Xiaoqun Gong, E-mail: gongxiaoqun@tju.edu.cn

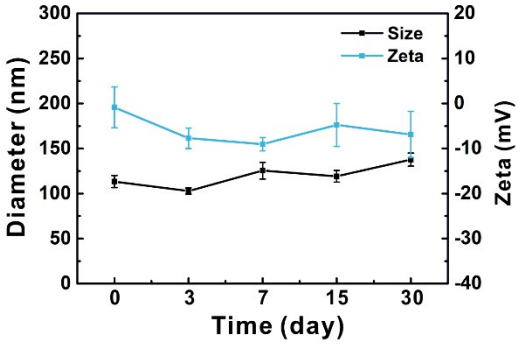

Figure S1. The diameter and Zeta potential of PCNPs over 30 days in PBS. The PCNPs without obvious change in diameter and Zeta potential after being kept in PBS over 30 days. Mean ± SD, n = 3.

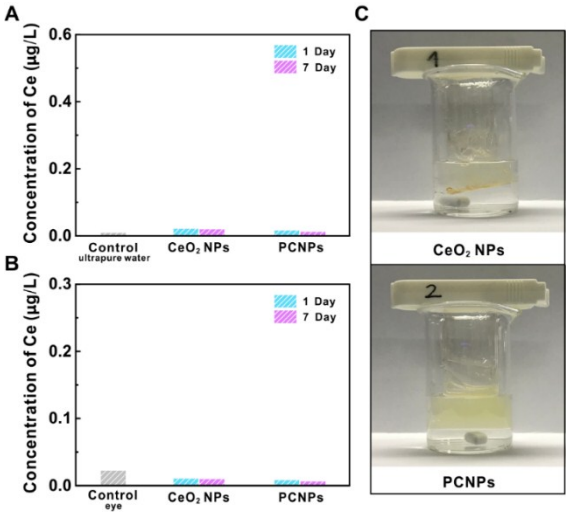

Figure S2. CeO_2 NPs and PCNPs reacted with H_2O_2 (100 mM) respectively, then 1 mL reaction solution was taken into the dialysis bag on the 1st and 7th days. (A) The concentration of Ce (from the solution outside the dialysis bag) was quantified by ICP-MS after dialysis for 24 hours. (B) The concentration of Ce released by nanoparticles in A was converted into the concentration of Ce released by nanoparticles with eye injection amount, and control group was no treatment eye. (C) Dialysis device of CeO_2 NPs and PCNPs.

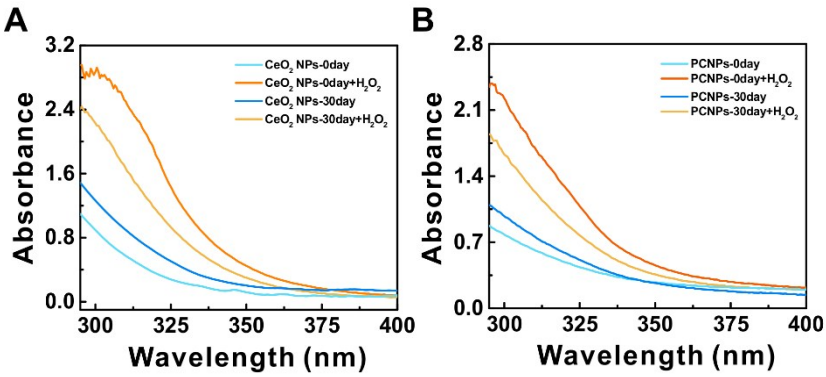

Figure S3. (A-B) UV-vis spectra of CeO_2 NPs and PCNPs on addition of H_2O_2 (100 mM) at different time intervals. The corresponding UV absorption changed after adding H_2O_2.

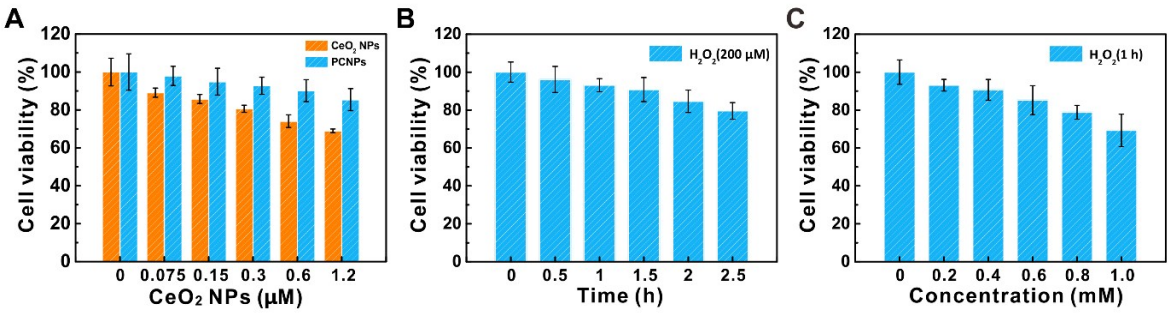

Figure S4. Quantitative assessments of in vitro HLE-B3 cell viability (MTT) assay. (A) The viability of HLE-B3 cells after 24h incubation with CeO_2 nanoparticles and PCNPs at various concentrations. The PCNPs were not found to be cytotoxic to HLE-B3 cells more than 90% at the concentration of 0~1 mg/mL, and when the concentration of the CeO_2 NPs increased to 1 mg/mL, the survival percentage of cells was only 74.1%, which confirmed PCNPs had less cytotoxicity than CeO_2 NPs. (B) The viability of HLE-B3 cells incubated with 200 μm hydrogen peroxide at different time. (C) The viability of HLE-B3 cells after 1h incubation with different concentrations of hydrogen peroxide. The cytotoxicity increases under the induction of 200 μM H_2O_2 as time went on or gradually increasing concentration of H_2O_2 for 1h. Mean ± SD, n=3.

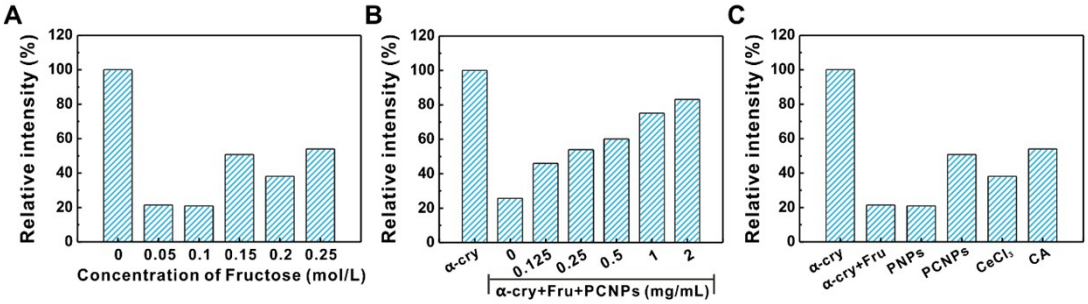

Figure S5. Quantitative assessments of SDS-PAGE (Figure 4E-G) by computing representative gray value. (A) α-crystallin (α-cry) was incubated with different concentration of fructose. (B) α-crystallin (α-cry) was incubated with 200 mM fructose (Fru) and PCNPs (0-2 mg/mL). (D) α-crystallin (α-cry) was incubated with 200 mM fructose (Fru) and different samples.

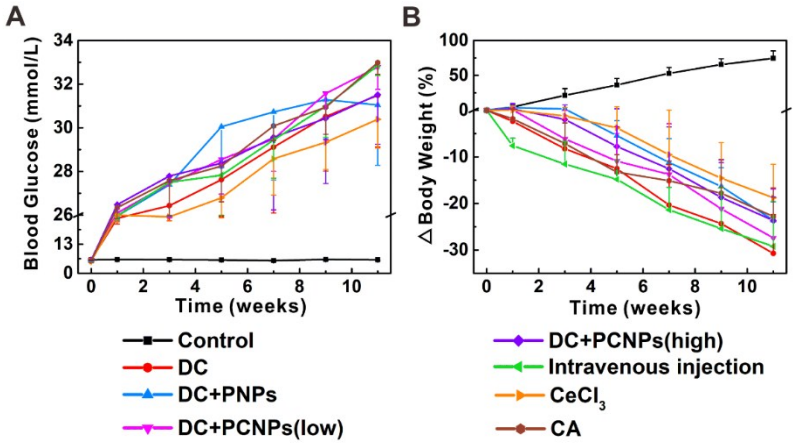

Figure S6. (A) Blood glucose and (B) body weight change of each group at several time points (week 0, 1, 3, 5, 7, 9, 11). The body weight of diabetic rats was strikingly decreased in comparison with control group, conversely, the blood glucose of diabetic rats was significantly increased. Mean ± SD, 8 rats per group.

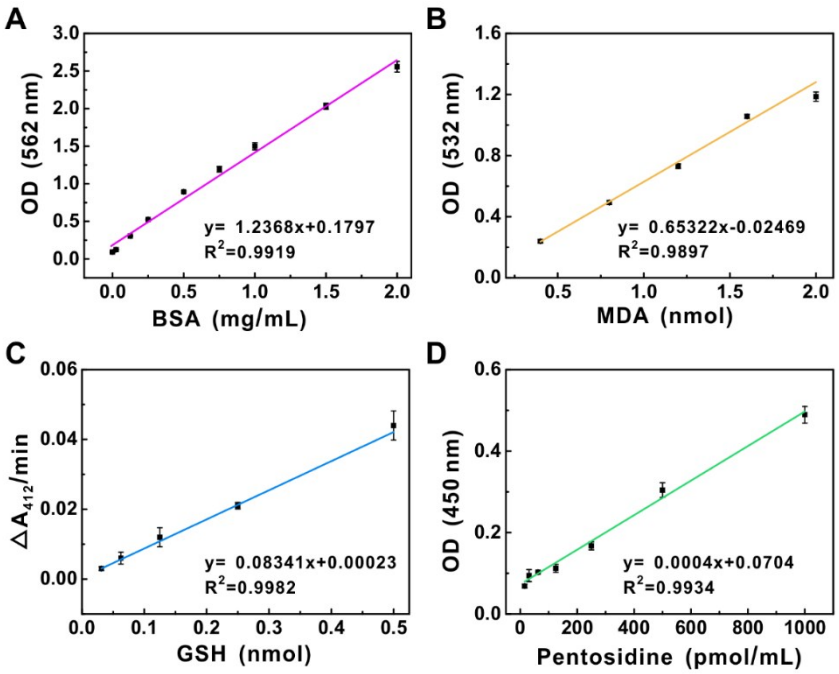

Figure S7. Calibration curve of (A) BSA, (B) malondialdehyde (MDA), (C) glutathione (GSH) and (D) pentosidine. Error bars are standard deviation across three repetitive experiments. Mean ± SD, n = 3.

Calculate the concentration of CeO_2 NPs:

$$N_{Ce} = \frac{n \times V_1}{V_2}$$ Equation 1

N_{Ce} is the number of Ce in one CeO_2 NPs; n is the number of Ce atom in one CeO_2 cell; V_1 is the volume of CeO_2 NPs; V_2 is the volume of CeO_2 cell.

$$C = \frac{C_1}{N_{Ce} \times M_{Ce}}$$ Equation 2

C (μM) is the concentration of CeO_2 NPs; C_1 (μg/L) is the mass concentration of Ce atom which measured by the ICP-MS; M_{Ce} is the relative atomic mass of Ce atom.