Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supporting information

Hydroxyl radical scavenging by cerium oxide nanoparticles improves *Arabidopsis* salinity tolerance by enhancing leaf mesophyll potassium retention

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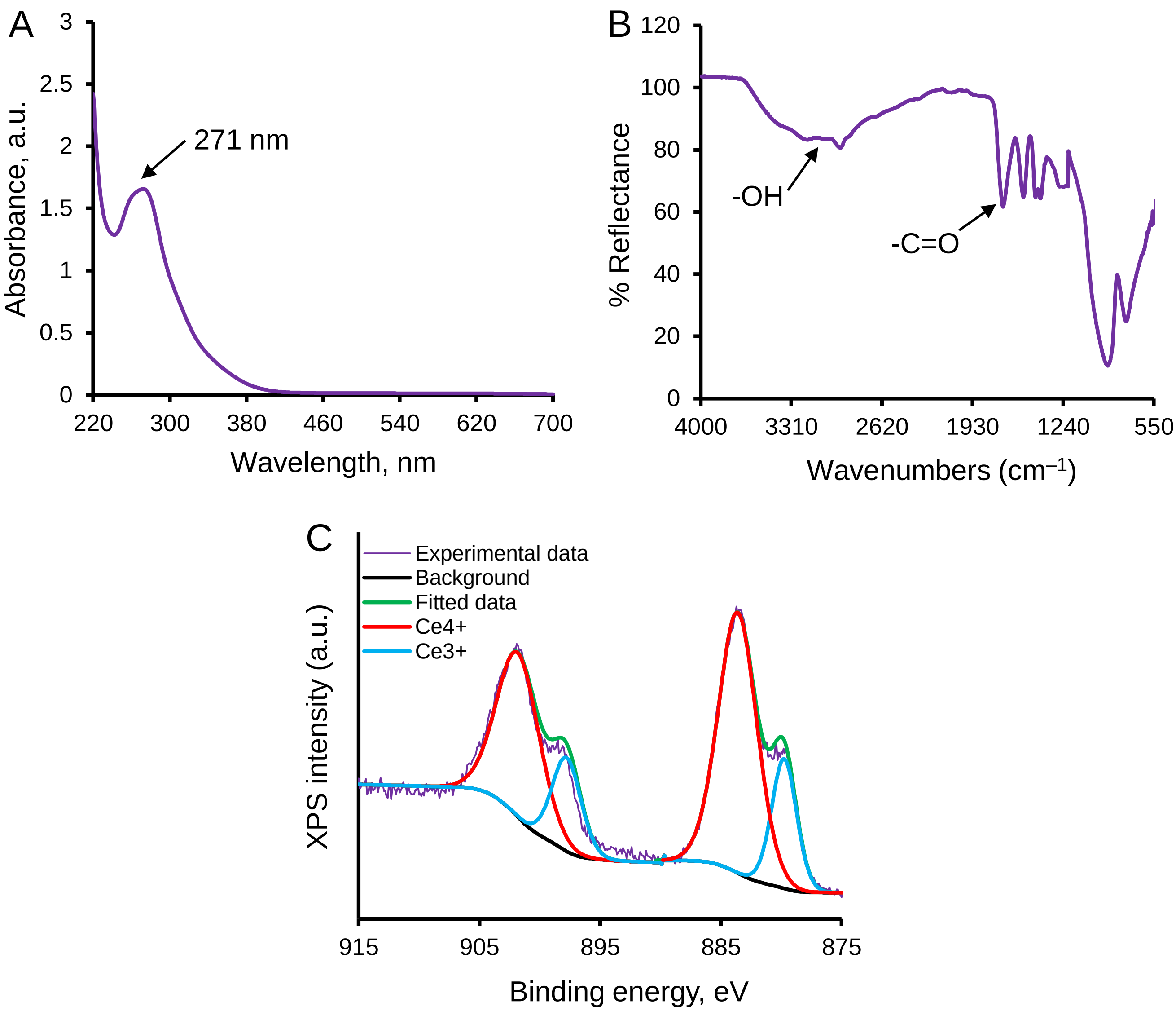

Fig. S1 PNC absorbance and Fourier Transform Infrared (FTIR) spectra, and X-ray photoelectron spectroscopy (XPS). (**A**) PNC has a peak of absorbance at 271 nm. (**B**) FTIR experiment confirmed the presence of –COOH group in PNC. (**C**) XPS analysis demonstrated the PNC has low Ce^{3+}/Ce^{4+} ratio ($35 \pm 2.2\%$).

Fig. S2

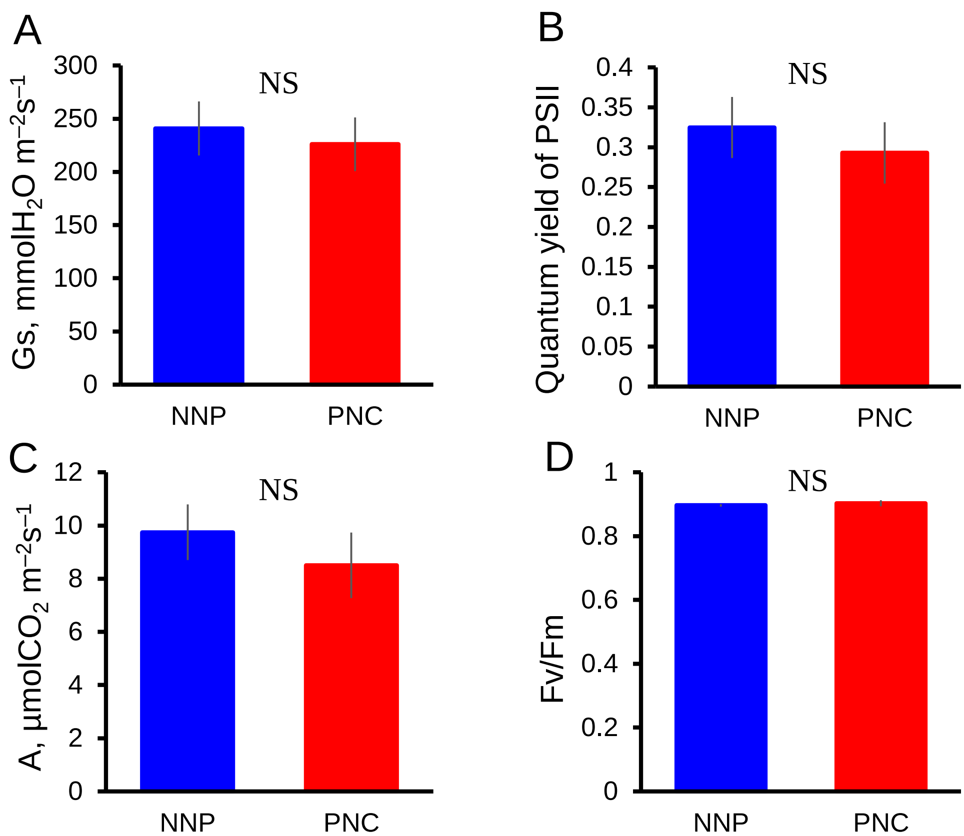

Fig. S2 Effect of nanoceria on leaf gas exchange and photosynthetic parameters. No significant differences were observed in stomatal conductance (Gs) (**A**), quantum yield (**B**), carbon assimilation rate (A) (**C**), and maximum PSII efficiency (Fv/Fm) (**D**) between NNP-leaves and PNC-leaves under control conditions. Mean ± SE (n = 8). NS, no significant difference.

Fig. S3

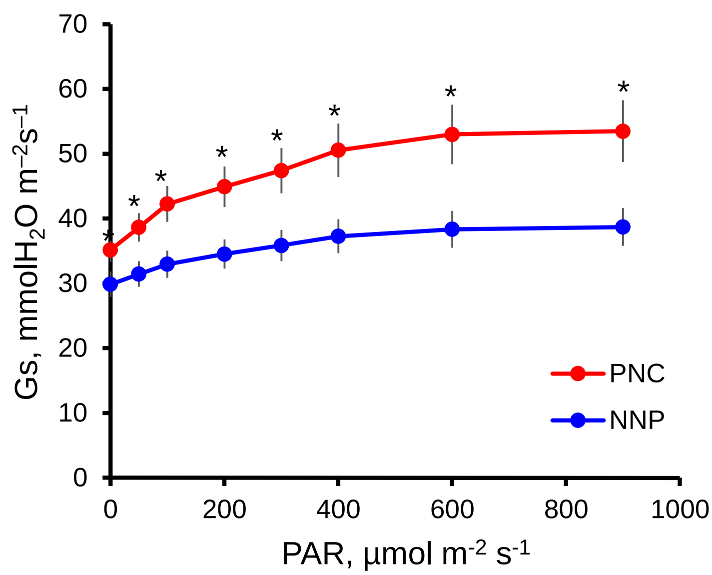

Fig. S3 Higher stomatal conductance in leaves infiltrated with nanoceria relative to controls in plants under salt stress (100 mM NaCl, 3 days). Stomatal conductance (Gs) was measured with a gas exchange analyzer (GFS-3000, Walz) in leaves infiltrated with PNC (PNC-Leaves) and buffer with no nanoparticles (NNP-Leaves) after 3 days of exposure to 100 mM NaCl. Mean ± SE (n = 15-16). *, $P < 0.05$.

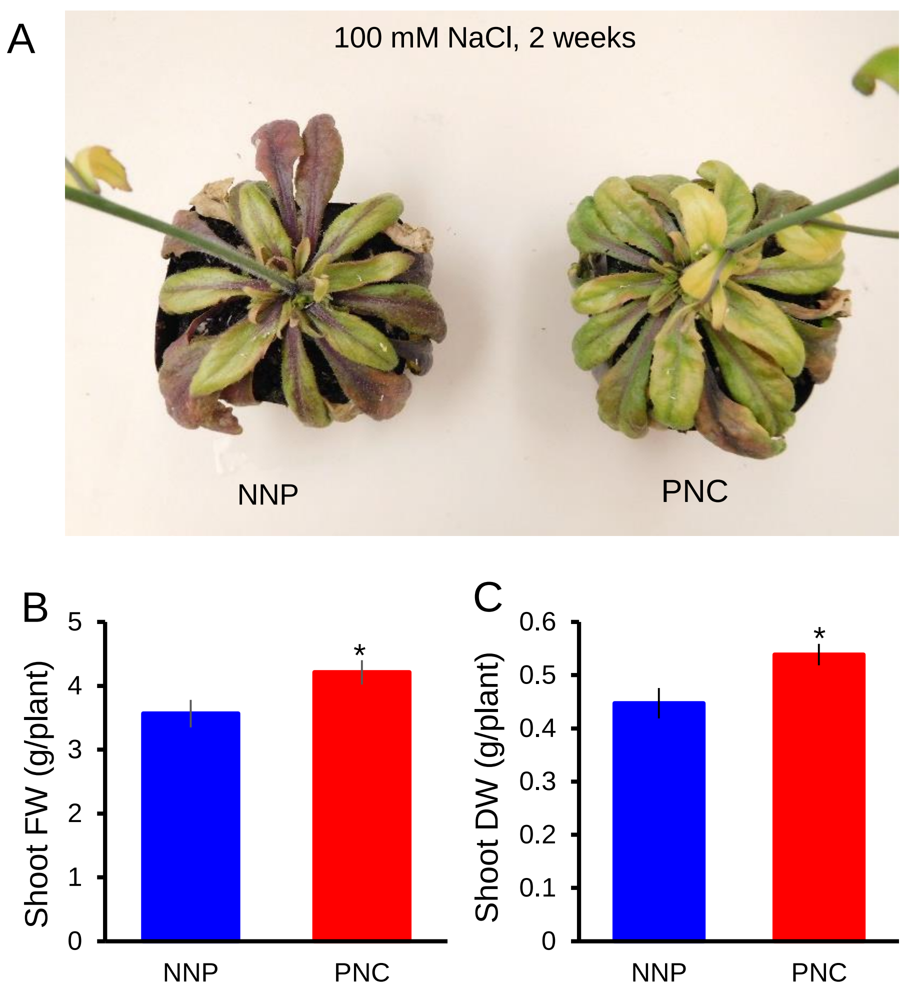

Fig. S4 Nanoceria improve Arabidopsis long term salt stress tolerance (100 mM NaCl, 2 weeks). (**A**) PNC-Leaves in comparison with NNP-Leaves under long term salt stress. (**B** and **C**) Plants infiltrated with PNC have significantly higher shoot fresh weight (FW) and dry weight (DW) than those infiltrated with buffer without nanoparticles. Mean ± SE (n = 8). *, $P < 0.05$.

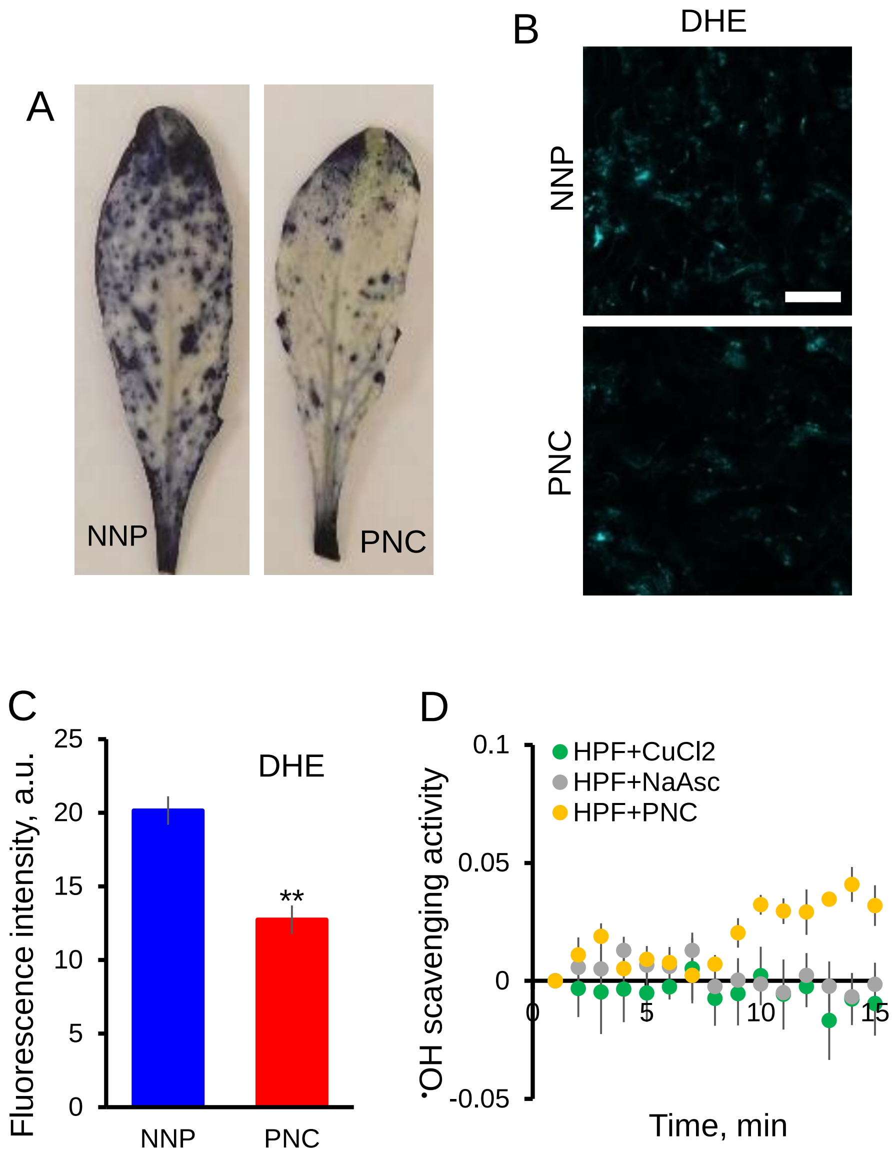

Fig. S5 Catalytic scavenging of ROS by nanoceria in *Arabidopsis* leaf mesophyll cells under salinity stress (100 mM NaCl, 3 days). (**A**) Histochemical staining with NBT (superoxide anion, blue spots) of leaves infiltrated with PNC (PNC-Leaves) and buffer with no nanoparticles (NNP-Leaves) under salt stress. (**B**) Confocal images of leaf spongy mesophyll cells showing the intensity of superoxide anion (DHE). (**C**) Comparison of DHE dye intensity between PNC-Leaves and NNP-Leaves under salt stress. Mean ± SE (n = 3). Scar bar represents 40 µm. **, $P < 0.01$. (**D**) The background signal of HPF dye in the presence of PNC, CuCl2, and NaAsc separately. Mean ± SE (n = 3-6).

Table S1 Primers used.

Target genes	Primer sequences
At-Gork	F: 5'-TTGCGTGAATTACAAGAGGA-3'
	R: 5'-TGCTTTCTACTACGCTCTTC-3'
At-HAK5	F: 5'-AAGAGGAACCAAATGCTGAGACA-3'
	R: 5'-GCCCCGATGAAGGGACAT-3'
At-NHX1	F: 5'-CAGCACAGTGGTGTTTGGTATGCTG-3'
	R: 5'-GTATGGATTTTGGGGTGTTGTCATCA-3'
At-Aha1	F: 5'-GACATTTTGAAGTTTGCCATTCGGTAT-3'
	R: 5'-CTTTCTCCAATACCGTAATCTTTCTTGGTT-3'
At-Avp1	F: 5'-GGAAACACCACTGCTGCTATTGGAA-3'
	R: 5'-GGGTCAAAACATCTACGGTGTGGAT-3'
At-GAPDH-A	F: 5'-TGGTTGATCTCGTTGTGCAGGTCTC-3'
	R: 5'-GTCAGCCAAGTCAACAACTCTCTG-3'
At-Actin2	F: 5'-ACCTTGCTGGACGTGACCTTACTGAT-3'
	R: 5'-GTTGTCTCGTGGATTCCAGCAGCTT-3'