

Figure S1. XRD pattern of the different N-C/CeO₂ composites. N-C/CeO₂-1, N-C/CeO₂-2, N-C/CeO₂-3, N-C/CeO₂-4 and N-C/CeO₂-5 were synthesized by using melamine and Ce(NO₃)₃•6H₂O with the mass ratio of 6:1, 3:1, 2:1, 1:1 and 1:2, respectively.

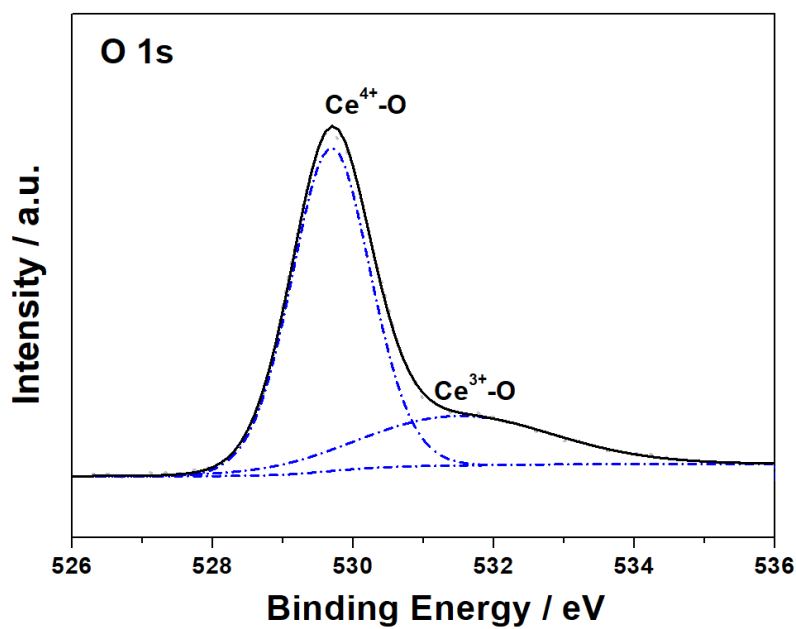


Figure S2. XPS pattern of N-C/CeO₂ composite O 1s.

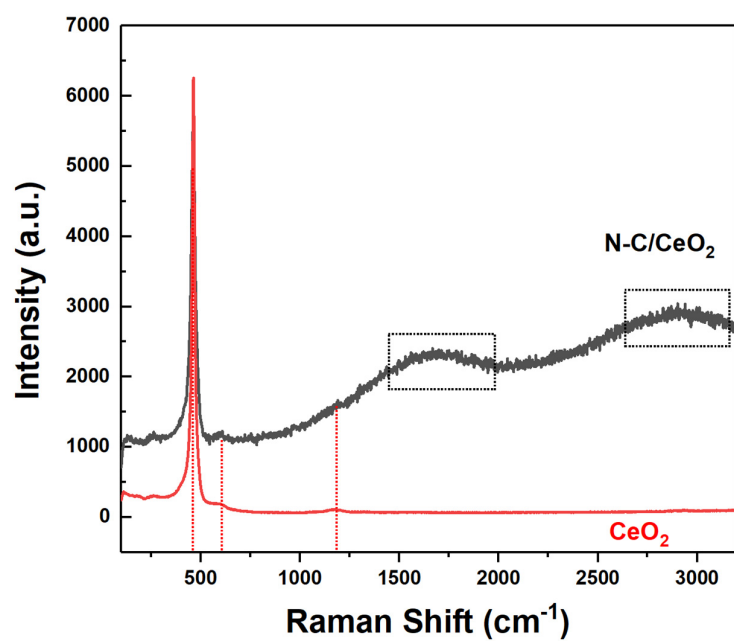


Figure S3. Raman spectra of CeO₂ and N-C/CeO₂ in the range 200~3200 cm⁻¹.

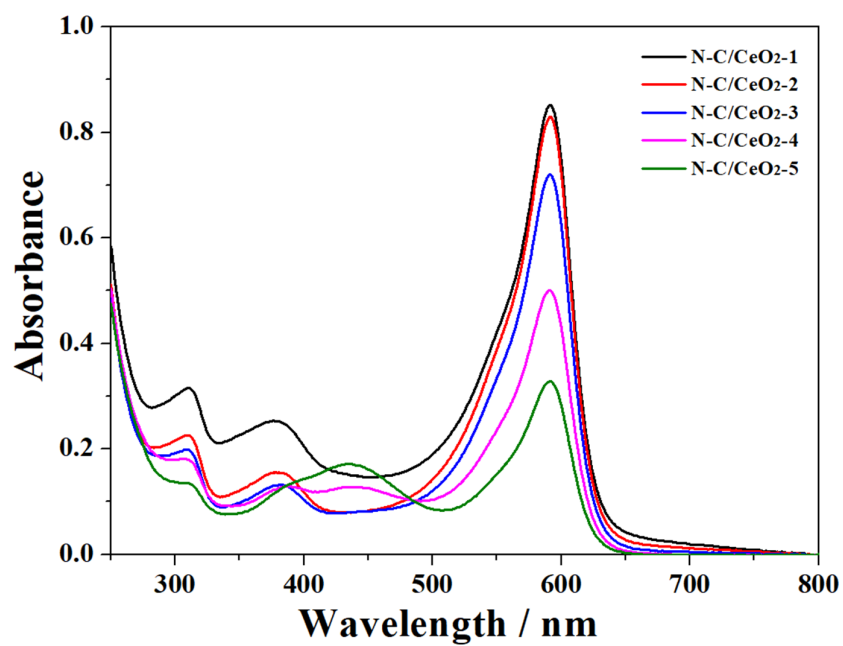


Figure S4. Absorbance spectra of reaction solutions catalyzed by the different N-C/CeO₂ composites.

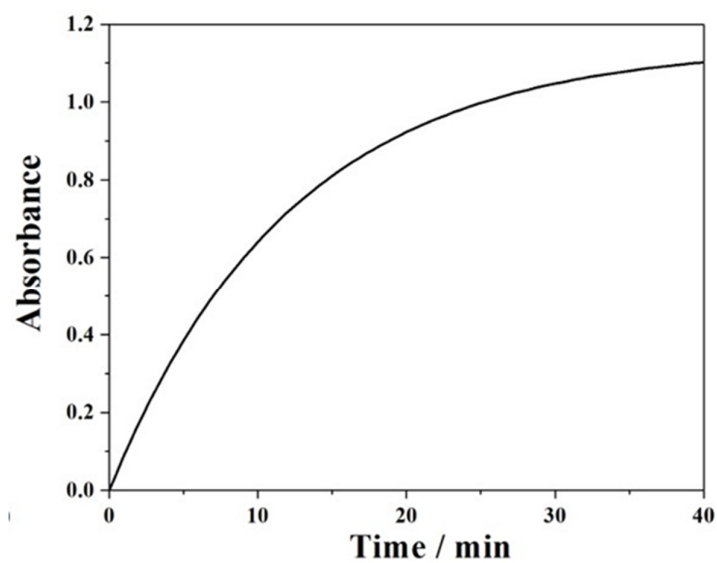


Figure S5. Time-dependent kinetics spectra showing the kinetics of the oxidative bromination of PR catalyzed by N-C/CeO₂ composite (40 min, 23–25 °C).

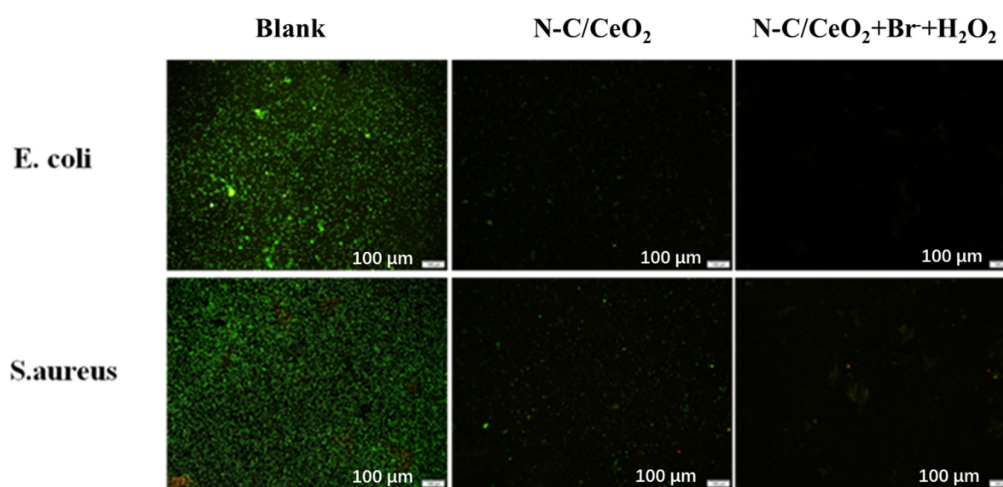


Figure S6. Live/dead staining images of *E. coli* and *S. aureus* treated with titanium plate in different systems: blank, N-C/CeO₂ and N-C/CeO₂ + Br⁻ + H₂O₂.

Table S1. The antibacterial of CeO₂ based materials.

Catalysts	Bacteria	Bacterial attachment (%)	Reference
CeO _{2-x} NRs	<i>E. coli</i>	~37	ACS Appl. Mater. Interfaces 2018, 10, 44722–44730
CeO _{2-x} nanorods with different aspect ratios	<i>E. coli</i>	~42%	ACS Sustainable Chemistry & Engineering 2020, 6744-6752
CeO ₂ @C	<i>E. coli</i>	~2.5%	Colloids and Surfaces A: Physicochemical and Engineering Aspects
N-C/CeO ₂	<i>E. coli</i>	~0.24%	This work

References

1. Hu, M.; Korschelt, K.; Viel, M.; Wiesmann, N.; Kappl, M.; Brieger, J.; Landfester, K.; Therien-Aubin, H.; Tremel, W., Nanozymes in nanofibrous mats with haloperoxidase-like activity to combat biofouling. *ACS Applied Materials & Interfaces* **2018**, 10, (51), 44722-44730.
2. He, X.; Tian, F.; Chang, J.; Bai, X.; Yuan, C.; Wang, C.; Neville, A., Haloperoxidase mimicry by CeO_{2-x} nanorods of different aspect ratios for antibacterial performance. *ACS Sustainable Chemistry & Engineering* **2020**, 8, (17), 6744-6752.
3. Wang, N.; Li, W.; Ren, Y.; Duan, J.; Zhai, X.; Guan, F.; Wang, L.; Hou, B., Investigating the properties of nano core-shell CeO₂@C as haloperoxidase mimicry catalyst for antifouling applications. *Colloids and Surfaces A: Physicochemical and Engineering Aspects* **2021**, 608, 125592.