Electronic Supplementary Material (ESI) for Nanoscale.

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Electronic Supplementary Information

Sprayed copper peroxide nanodots for accelerating wound healing in a multidrug-resistant bacteria infected diabetic ulcer

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Supplementary information 1: TEM images of CuO_2 nanodots

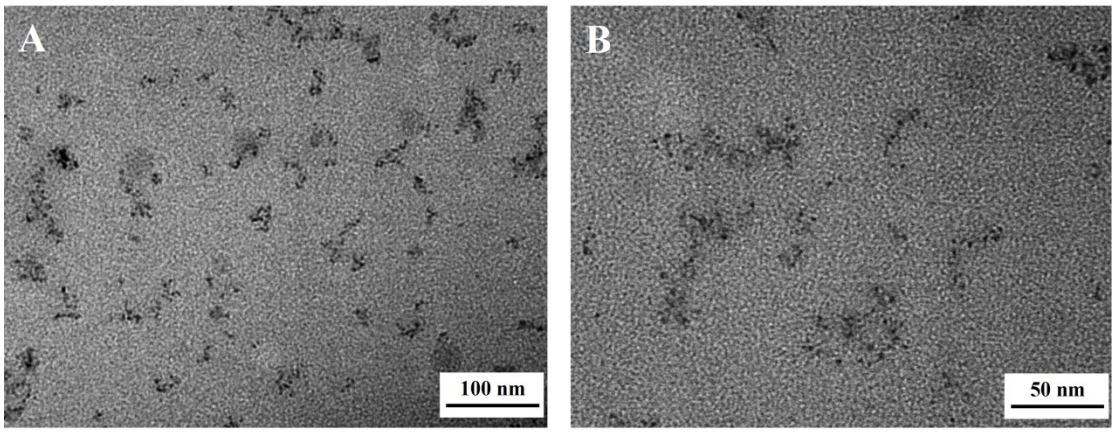

Figure S1. TEM images of CuO_2 nanodots at different magnifications.

Supplementary information 2: The X-ray photoelectron spectroscopy analysis

In the XPS spectra, two O 1s peaks at 531.3 and 532.5 eV were assigned to C=O and O−O, respectively, indicating the presence of PVP and peroxo groups. The Cu 2p spectrum displayed two main peaks at 933.7 and 953.5 eV accompanied by two satellite peaks at 942.1 and 961.9 eV, indicating the valence state of Cu in CuO_2 nanodots was +2. An obvious N 1s peak was observed in CuO_2 nanodots, demonstrating the existence of PVP coating.

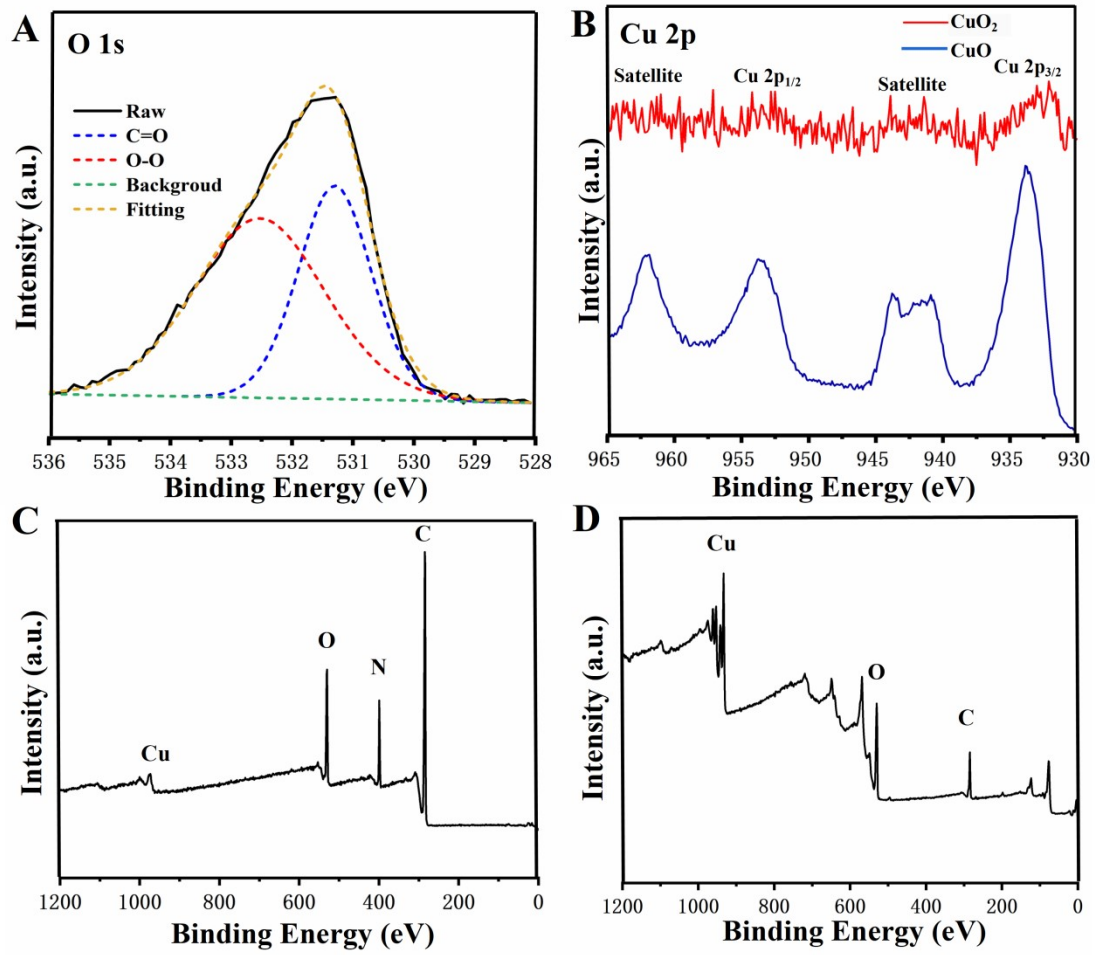

Figure S2. (A) High resolution O 1s, (B) Cu 2p, and (C) survey XPS spectra of CuO_2 nanodots. (D) Survey XPS spectra of CuO_2 synthesized in the absence of PVP.

Supplementary information 3: Measurement of H_2O_2 generation.

The generated H_2O_2 was determined by $KMnO_4$ titration. In a typical process, 2.5 mg of the CuO_2 nanodots was dispersed in 5 mL phosphate buffer solution (PBS) with different pH values (pH 5.5 and 7.4) and incubated at 37 °C under gently shaking. At indicated time points, the suspension was separated by ultrafiltration and 3 mL filtrate was withdrawn. The release buffer was then supplemented with 3 mL fresh PBS buffer and the CuO_2 nanodots were re-dispersed. The collected filtrate was used for further titration analysis. After adding 0.5 mL of sulfuric acid (0.3 M) solution, the filtrate was titrated with 1 mM $KMnO_4$. A pink color was observed at the end-point of titration.

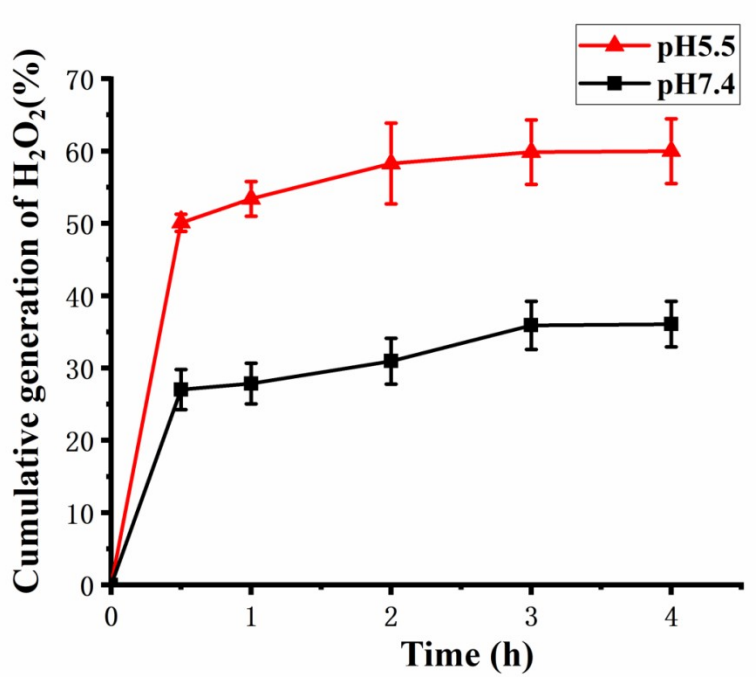

Figure S3.Cumulative generation of H_2O_2 from CuO_2 nanodots in different pH conditions, showing their acid-induced dissociation.

Supplementary information 4: Measurement of pH values during bacterial growth

E. coli, *S. aureus*, MRSA and *P. aeruginosa* were incubated in LB agar plates overnight at 37 °C. A single colony was then picked up from agar plate and cultured in LB medium (6 mL) at 37 °C, respectively. At different time intervals (0, 6, 12 and 24 h), the pH values of LB medium with culturing bacteria were detected with pH meter (Sartorius PB-10). The bare LB medium was used as control.

As shown in Figure S4, the initial pH values of all groups were approximately 7.4. When extending culture time to 6 h, the pH values of bacterial suspensions with *E. coli*, *S. aureus*, MRSA and *P. aeruginosa* obviously decreased to around 6.4, 6.4, 6.3 and 6.9, respectively. However, the pH value of bare LB medium remained unchanged (7.38). Prolonging to 24 h, the pH values continued to decrease slightly. This result indicated that bacteria proliferation would generate a weak acidic microenvironment. It should be pointed out that the pH change of *P. aeruginosa* was not as remarkable as the other three bacteria strains, probably because of the difference in metabolism, such as the ability of organic acid generation utilizing carbohydrates.

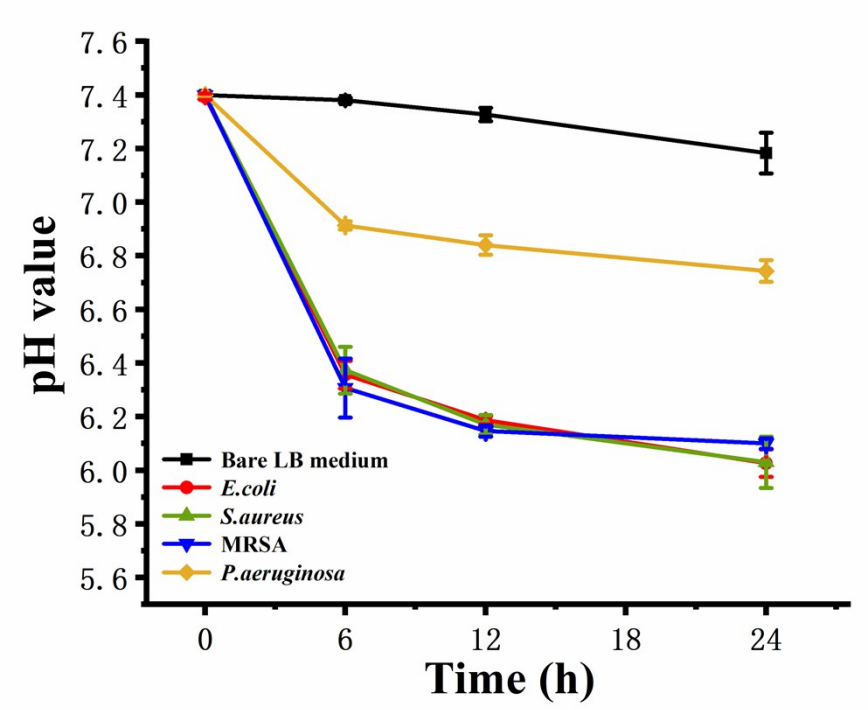

Figure S4. The pH changes of LB medium with culturing *E. coli*, *S. aureus*, MRSA and *P. aeruginosa* within 24 h.

Supplementary information 5: Blood glucose levels of diabetic mice in each group

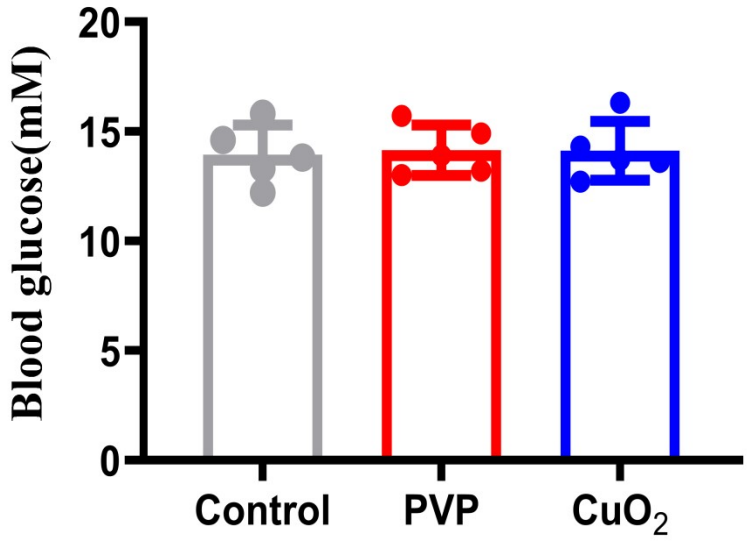

Figure S5. The initial blood glucose levels of STZ-induced diabetic mice for different wound healing treatment.