

## Supporting Information

# Multifunctional nanocomposites mediated novel hydrogel for diabetic wound repair

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Zhangyou Yang<sup>a\*</sup> and Rong Li<sup>b\*</sup>*

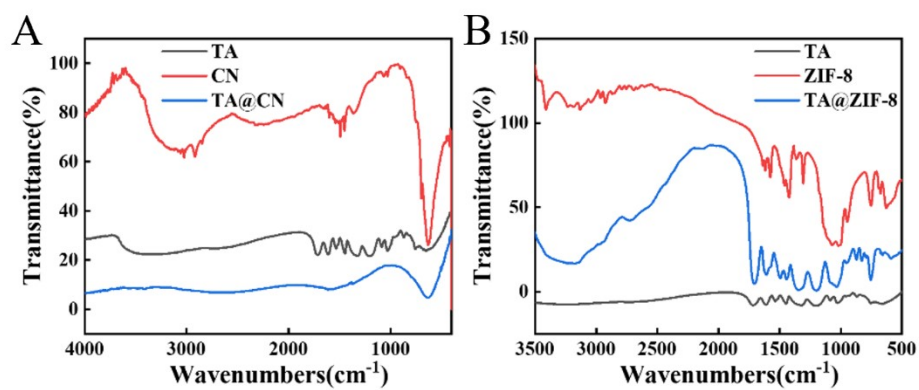
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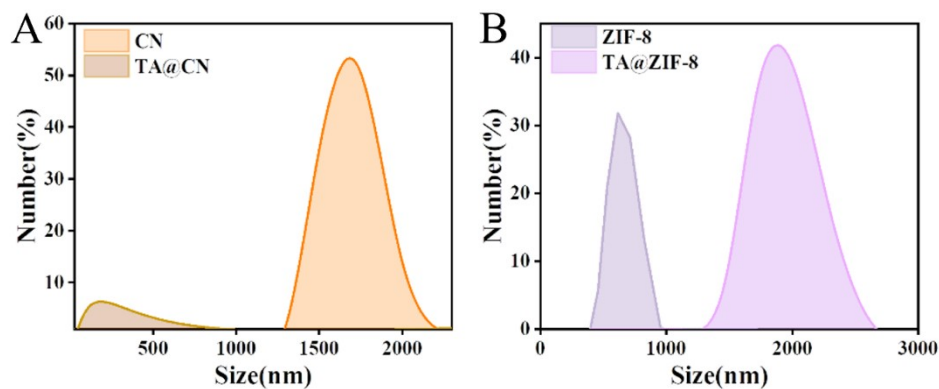
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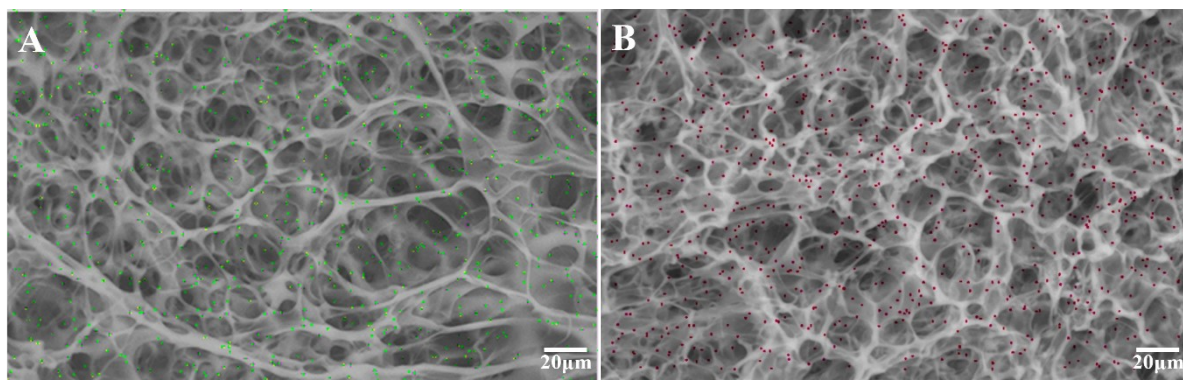
<sup>†</sup>These authors contributed equally to this work



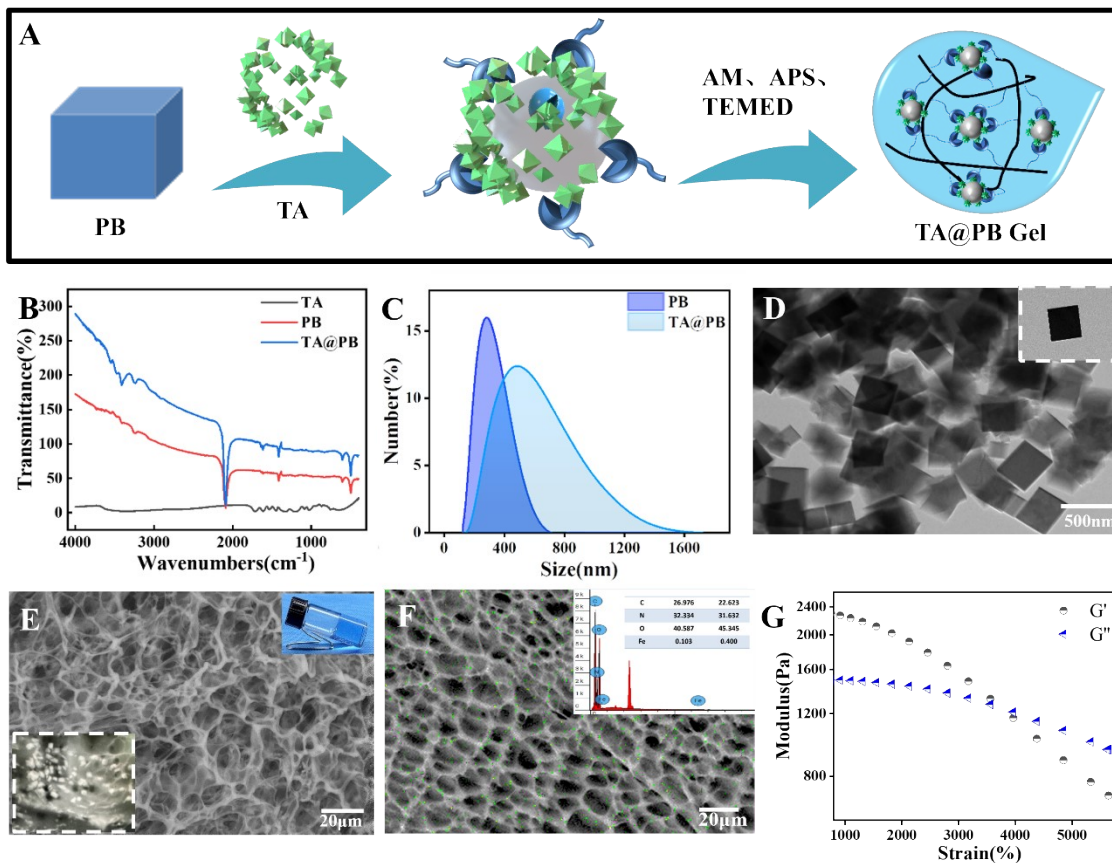
**Fig. S1.** Fourier infrared spectroscopy of different nanoparticles and tannic acid (TA). (A) CNPs; (B) ZIF-8.



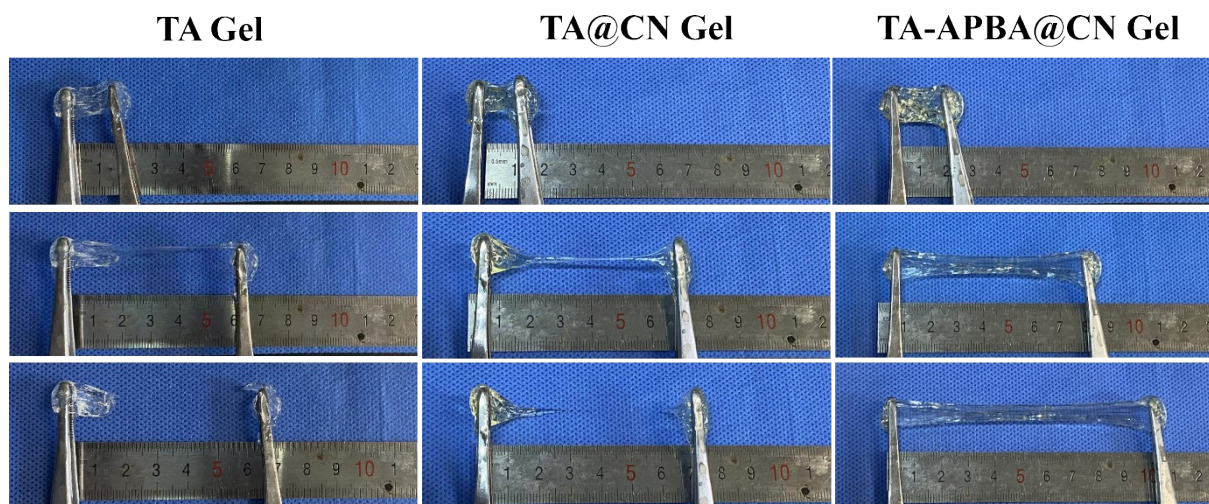
**Fig. S2.** DLS characterization of different nanoparticles before and after tannic acid (TA) modification. (A) CNPs; (B) ZIF-8.

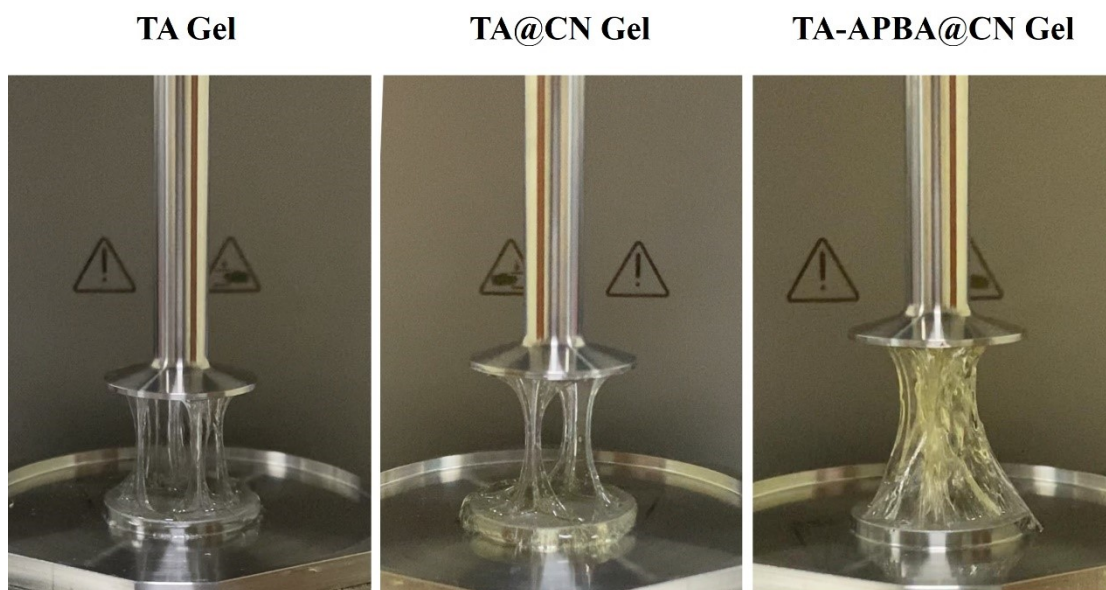


**Fig. S3.** (A) SEM elemental scanning of TA@CN Gel; (B) TA@ZMG Gel.

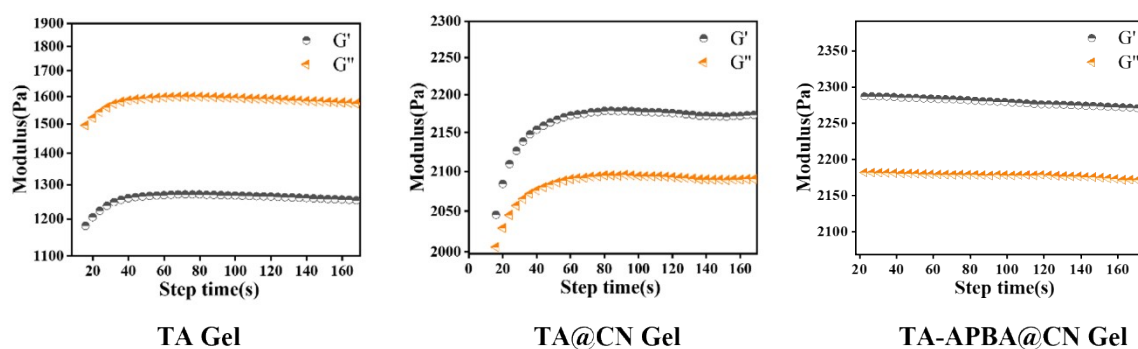


**Fig. S4.** Schematic of Prussian blue nanoparticle-mediated hydrogel synthesis and its characterization





**Fig. S5.** Effect of nanoparticles and borate ester bonds on the mechanical properties of hydrogels.



**Fig. S6.** Effect of nanoparticles and borate ester bond on rheological properties of hydrogels.

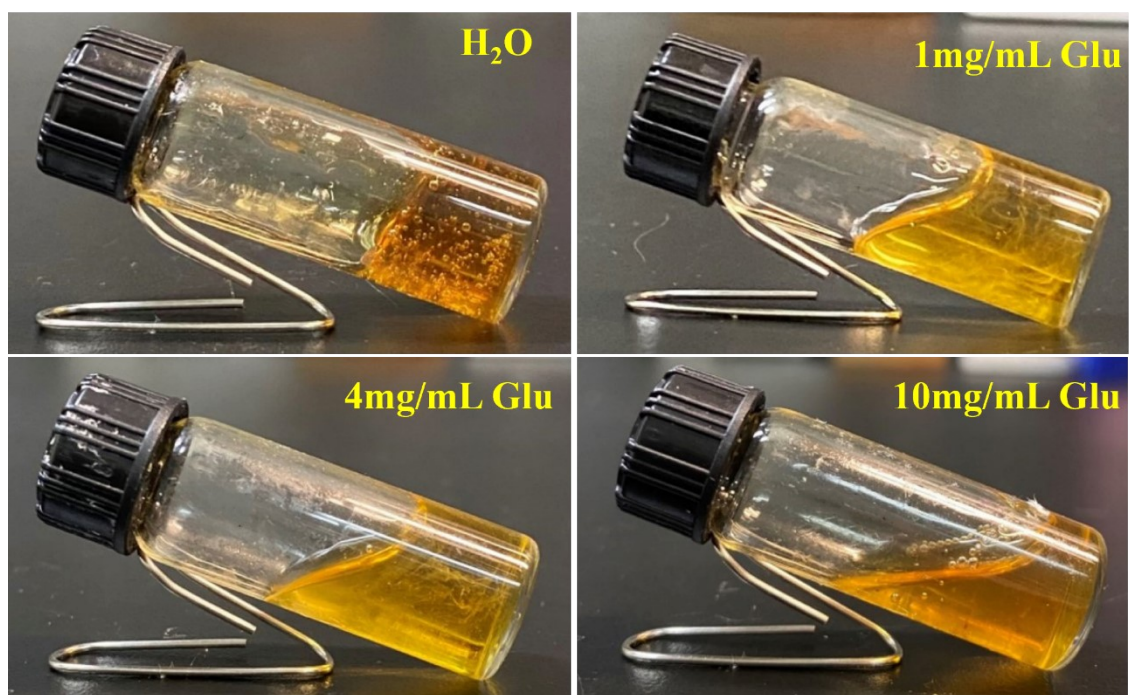
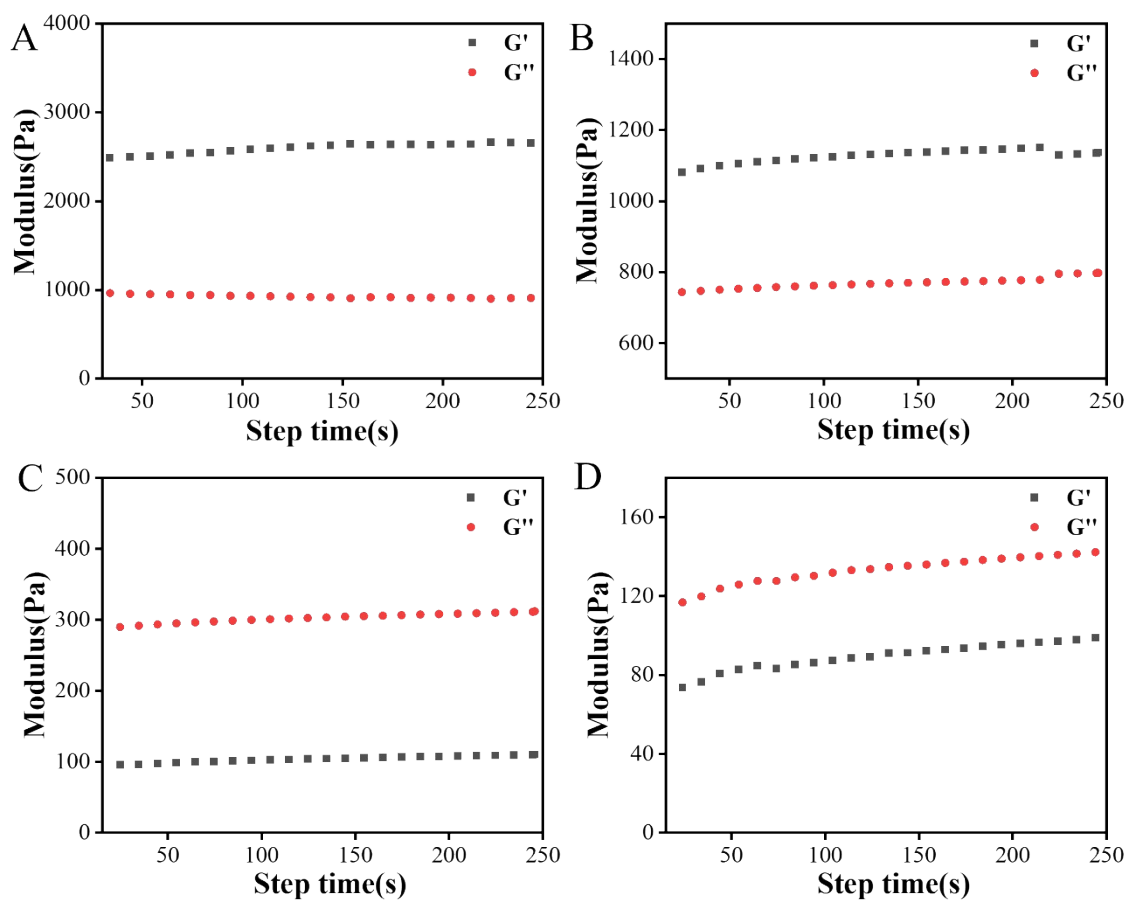
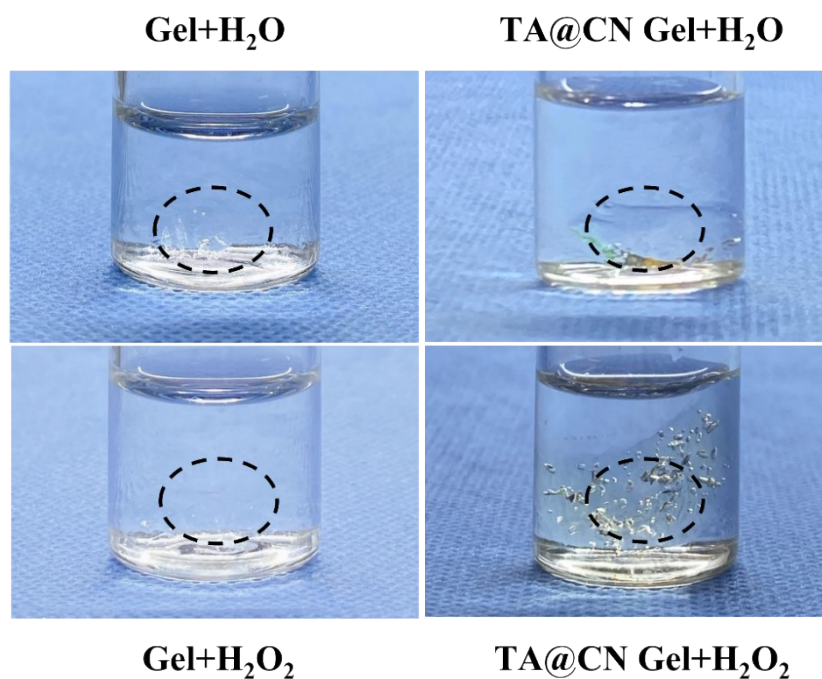


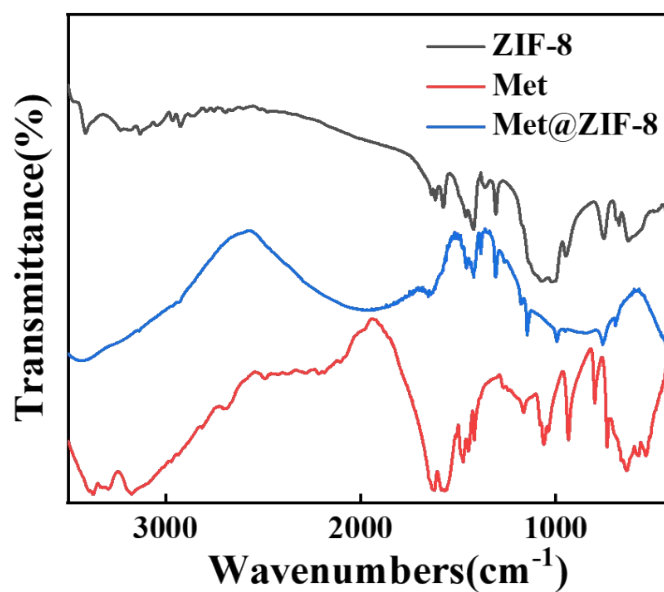
Fig. S7. Degradation of hydrogels in different concentrations of glucose.



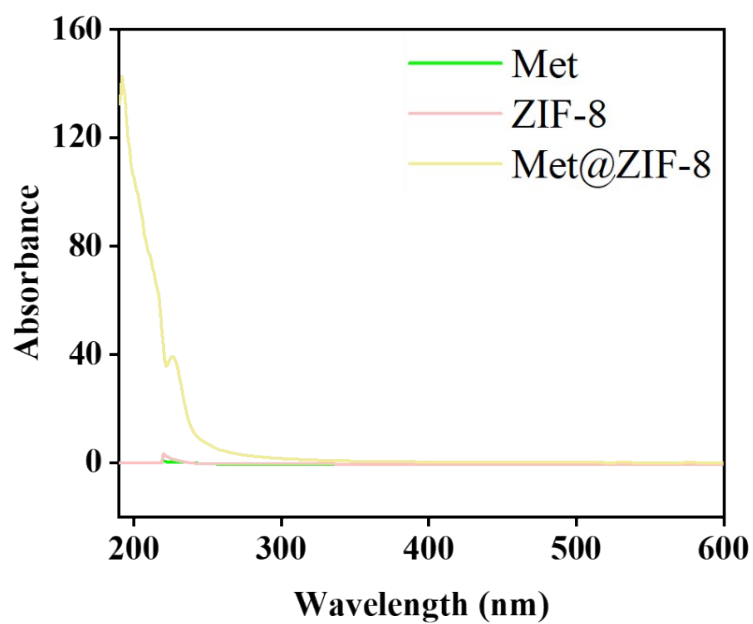
**Fig. S8.** Storage moduli( $G'$ ) and loss moduli( $G''$ ) of hydrogel after degradation in different concentrations of glucose solutions.(A) $H_2O$ ;(B)  $1\text{ mg mL}^{-1}$  glucose solution;(C)  $4\text{ mg mL}^{-1}$  glucose solution;(D)  $10\text{ mg mL}^{-1}$  glucose solution.



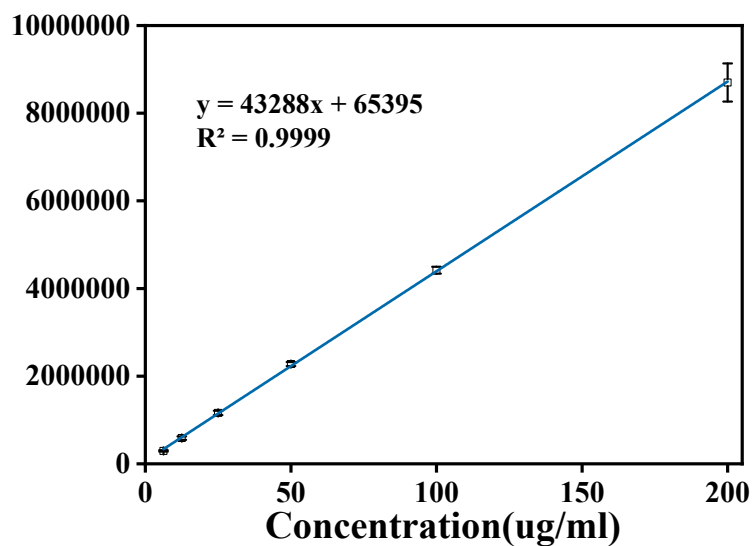
**Fig. S9.** Pictures of oxygen production by adding  $H_2O$  and  $H_2O_2$  to different materials.



**Fig. S10.** The FIRT results showed a characteristic absorption peak of guanidine group at 1168 nm confirming the successful loading of metformin.



**Fig. S11.**Uv absorption of ZIF-8 nanoparticles, metformin and ZIF-8 loaded with metformin. The absorption peak showed that metformin was successfully loaded.



**Fig. S12.** Standard curve of metformin hydrochloride by HPLC.

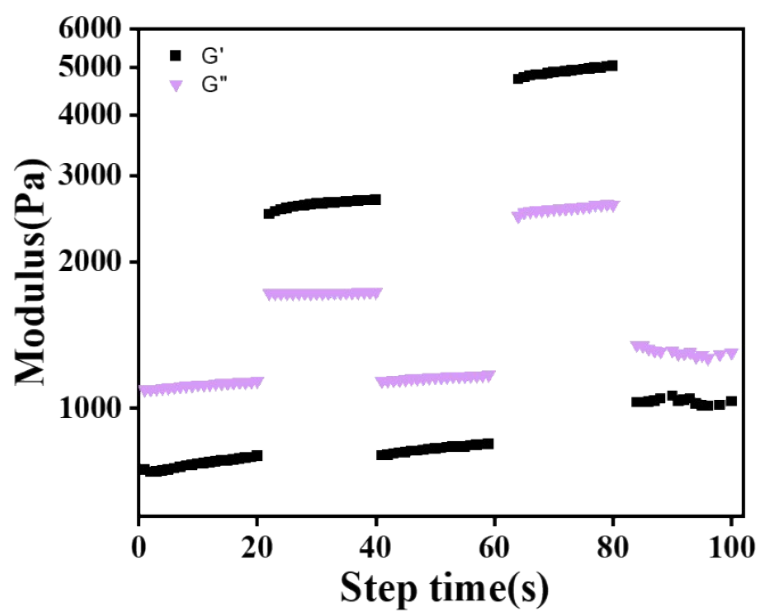


Fig. S13. Self-healing properties of TA@ZMG Gel.

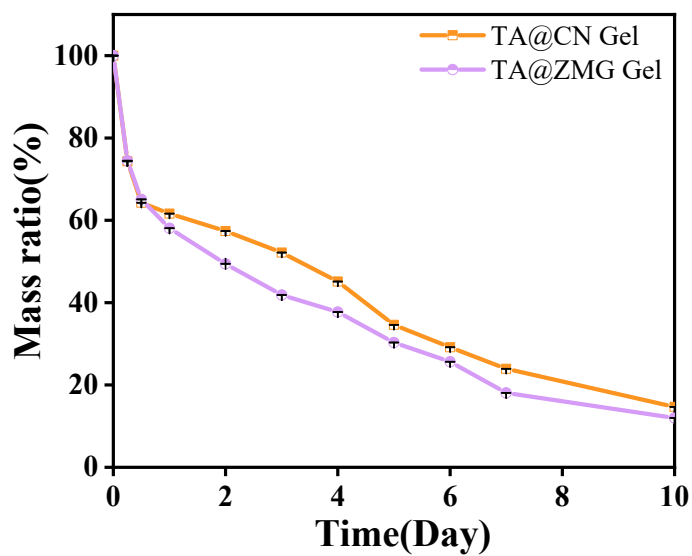
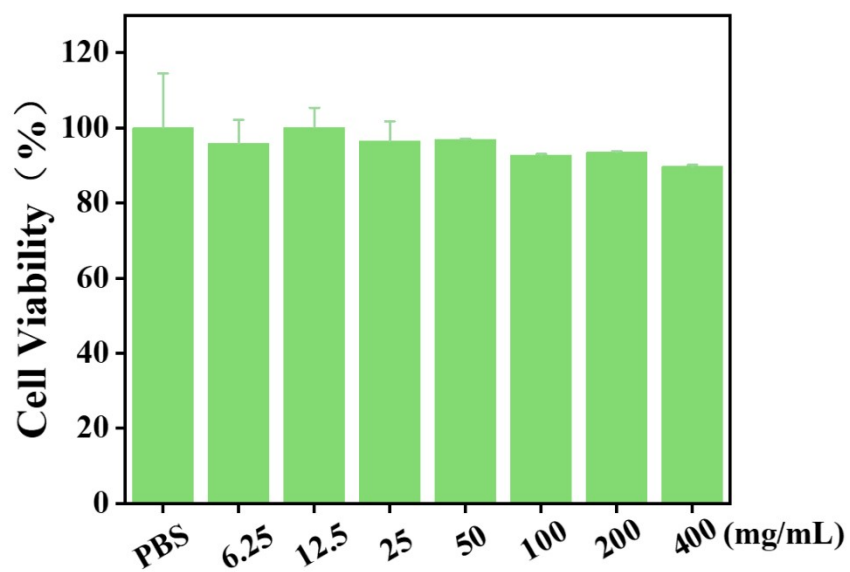
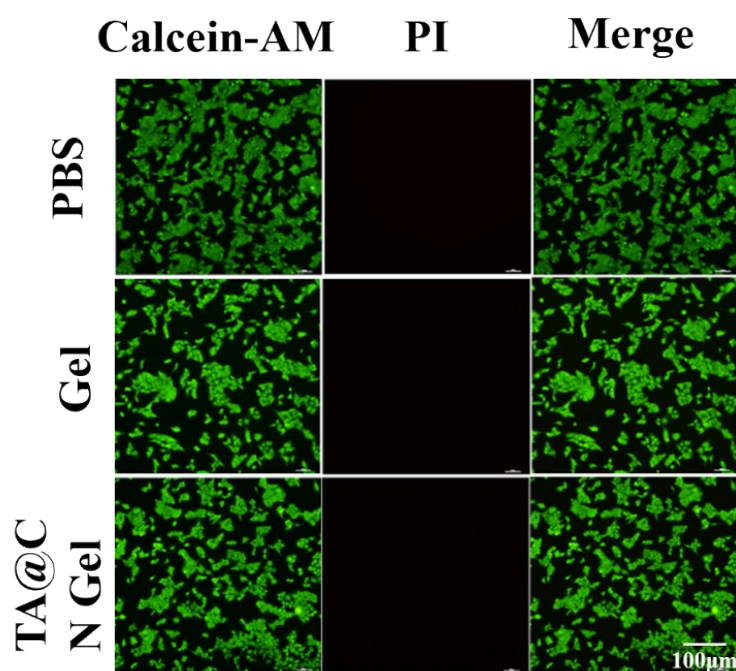


Fig. S14. Degradation of TA@CN Gel and TA@ZMG Gel.

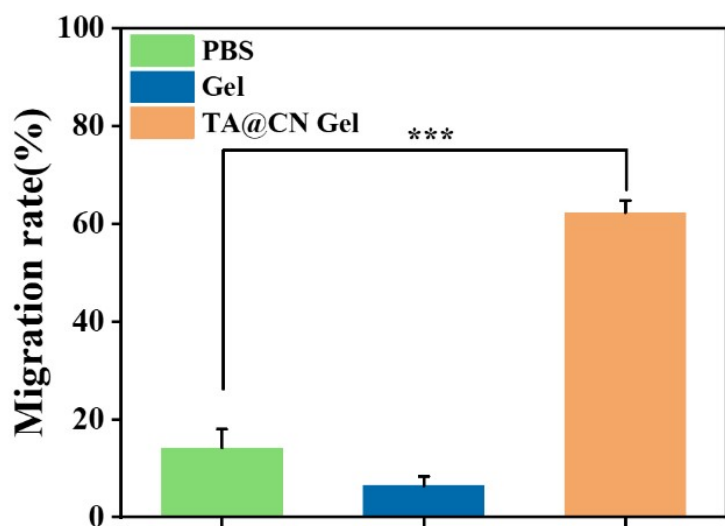
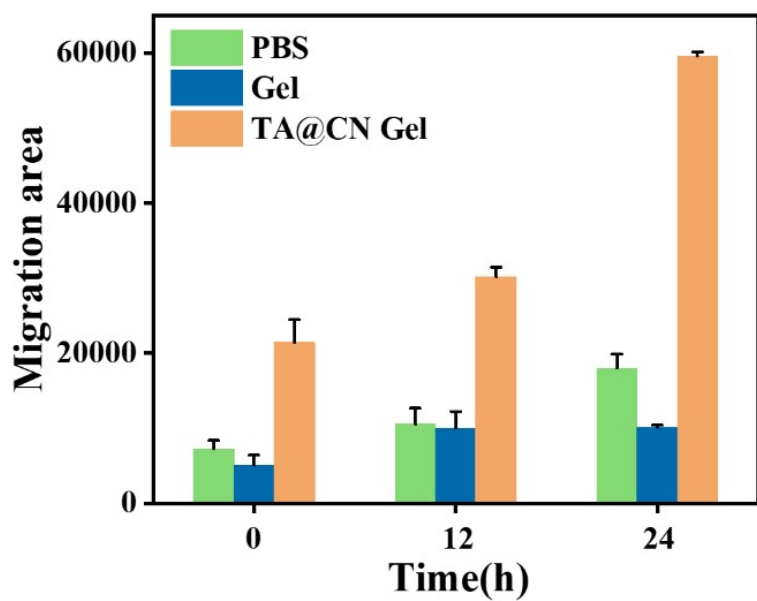




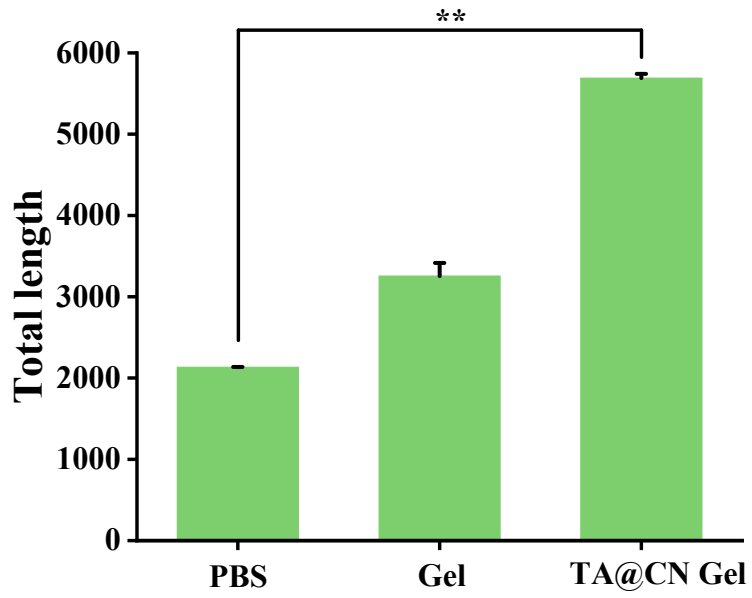
**Fig. S15.** Cell viability after 24 h treatment with different concentrations of TA@CN Gel.



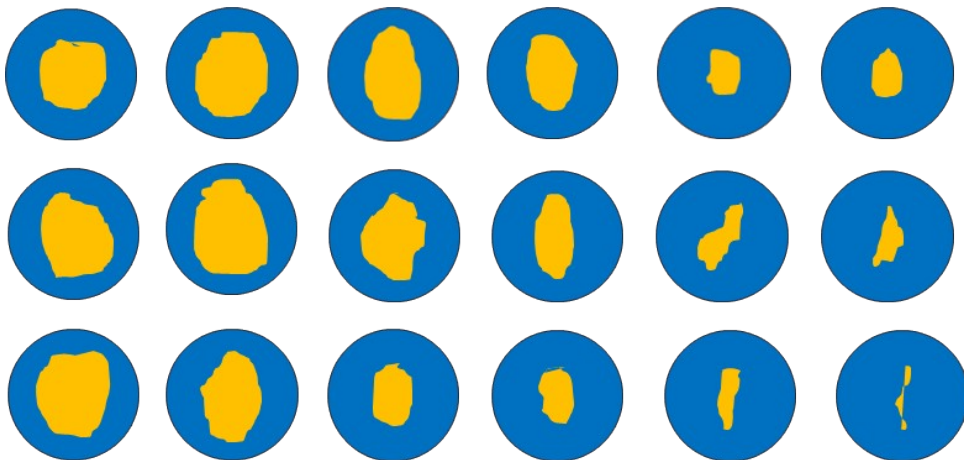
**Fig. S16.** Calcein -AM/PI cell staining in different treatment groups.



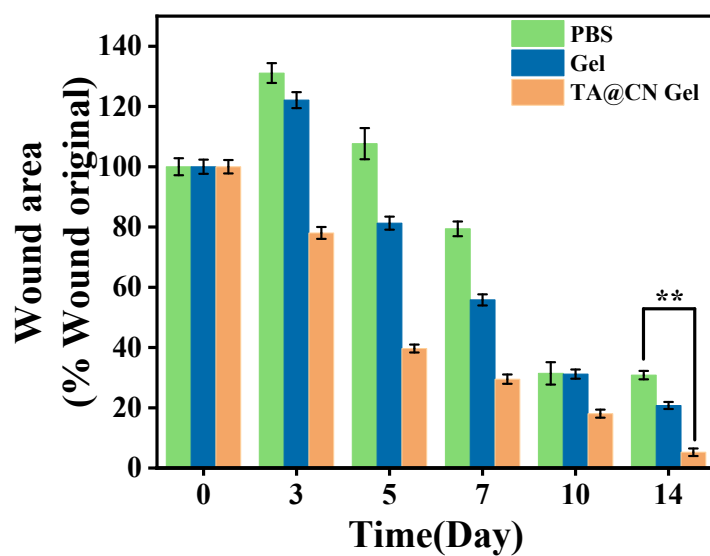
**Fig. S17.** Quantification of cell migration area and cell migration rate of different treatment groups.



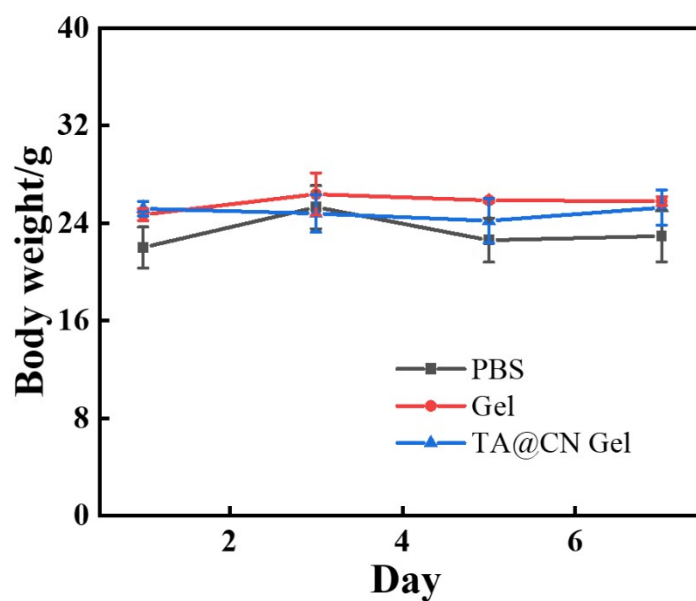
**Fig. S18.** Quantification of vessel length.



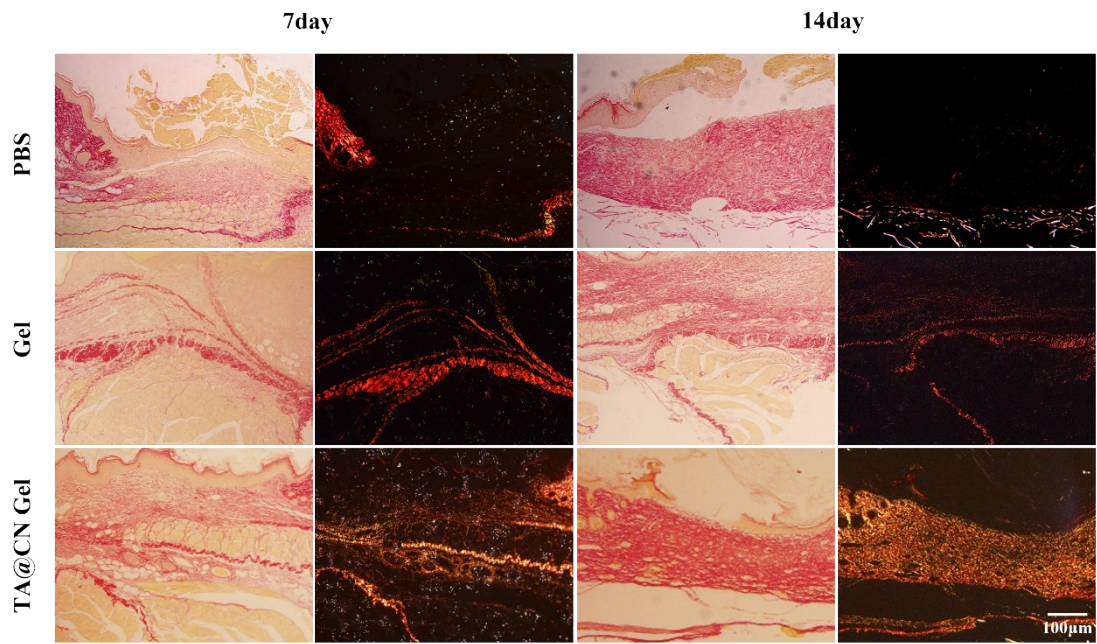
**Fig. S19.** Image J simulation analysis of wound size.



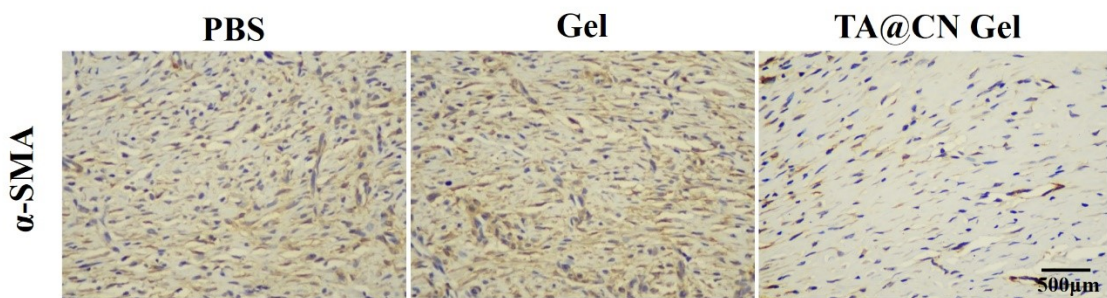
**Fig. S20.** Quantification of wound area at 3, 5, 7, 10 and 14 days for different treatments.



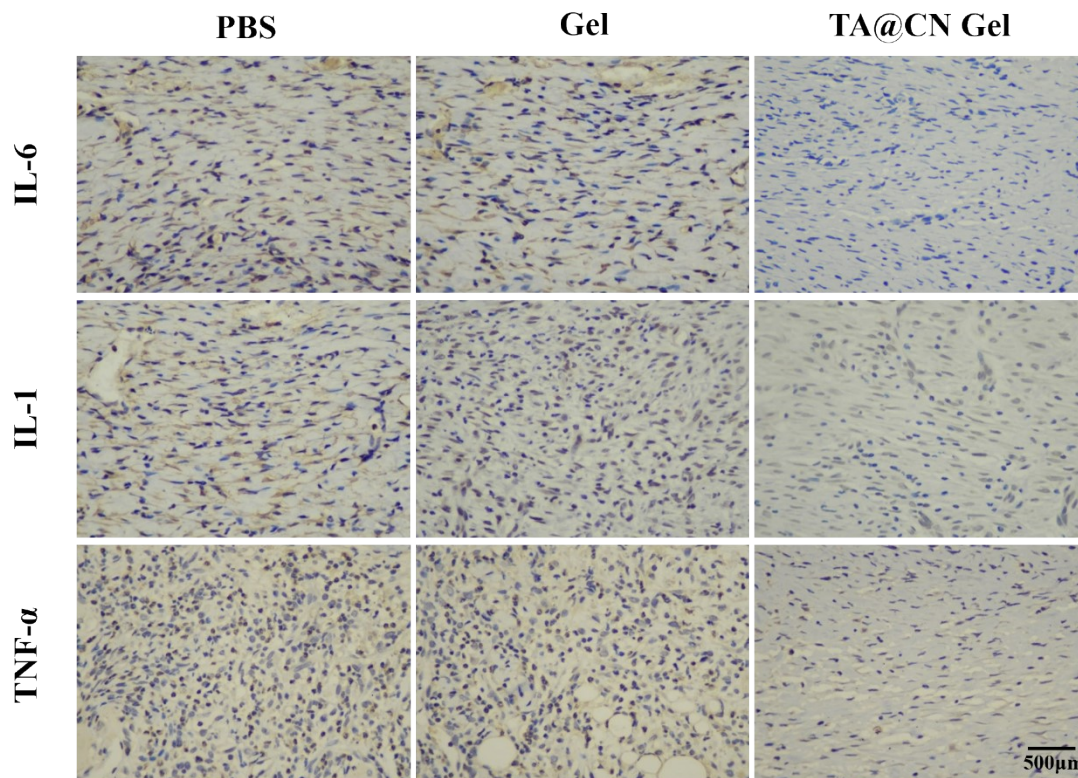
**Fig. S21.** Weight changes of mice in different groups during treatment.



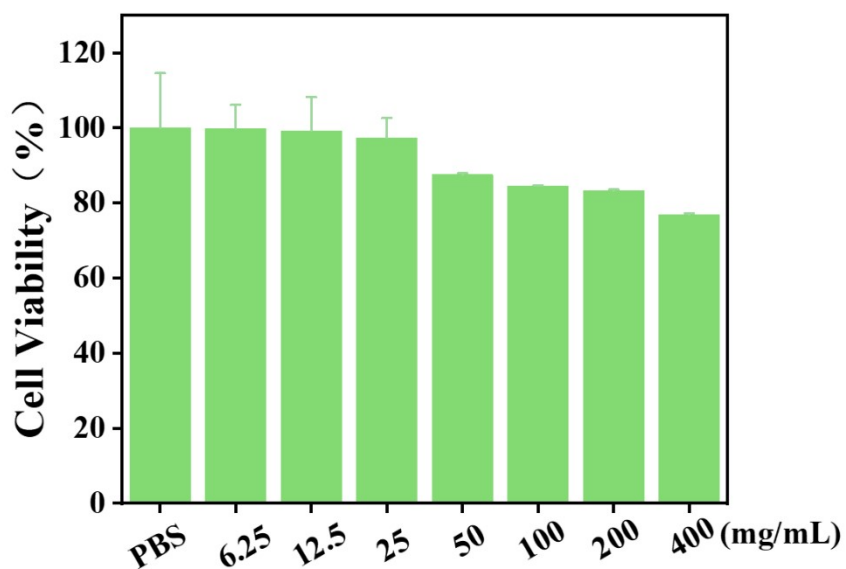
**Fig. S22.** Polarized optical microscope images of birefringent collagen at 7,14 days.



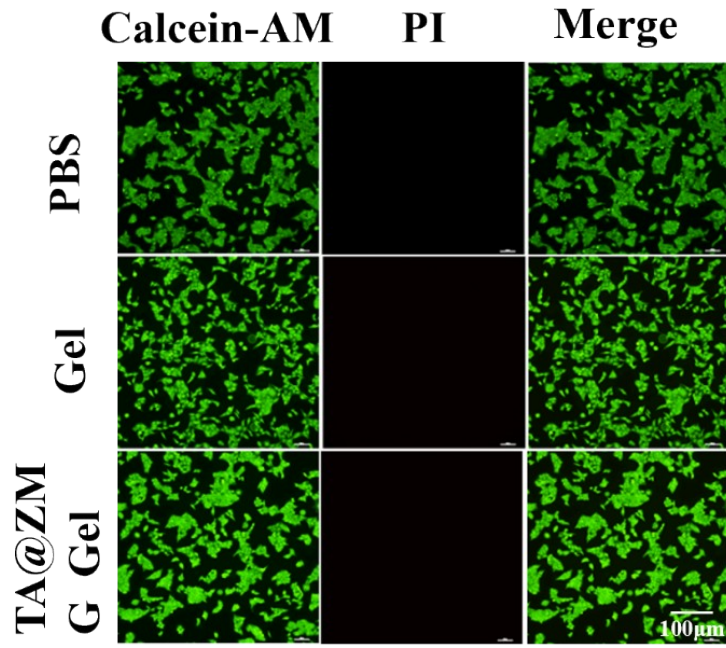
**Fig. S23.**  $\alpha$ -SMA histochemical staining of the wound on day 14.



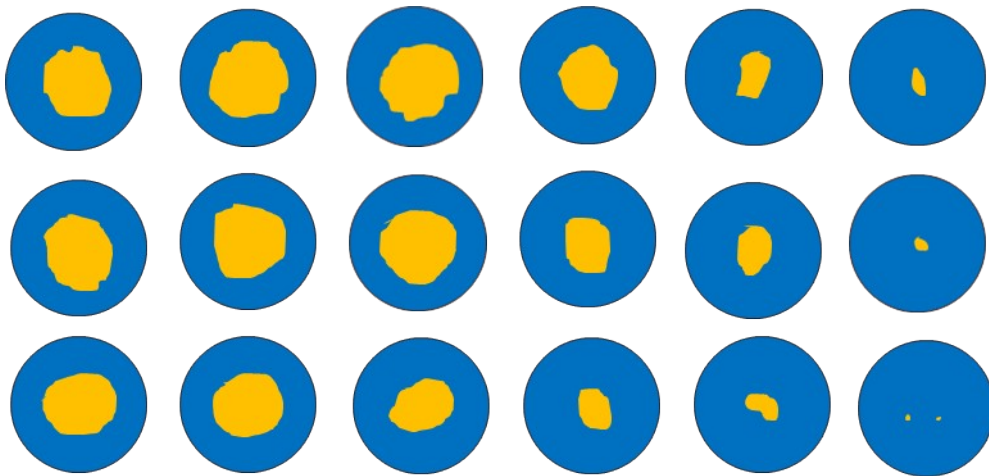
**Fig. S24.** Immunohistochemical staining of IL-6 $\beta$ , IL-1 and TNF- $\alpha$  expressed in wounds at 14 day.



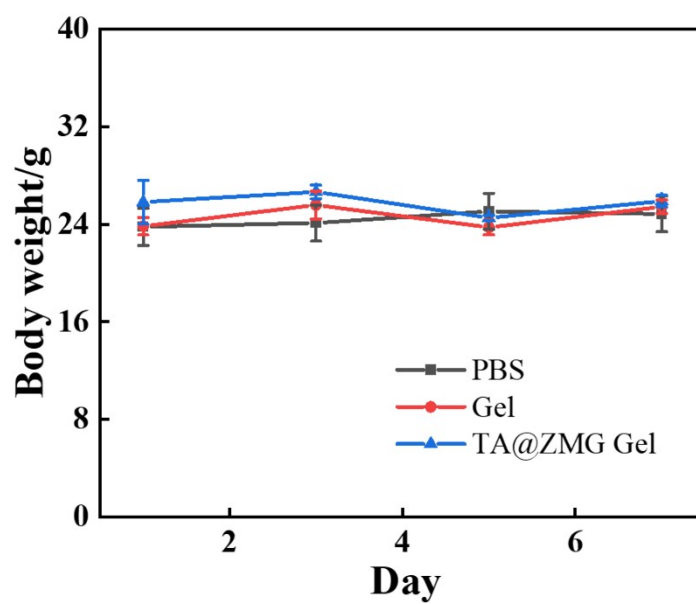
**Fig. S25.** Cell viability after 24 h treatment with different concentrations of TA@ZMG Gel.



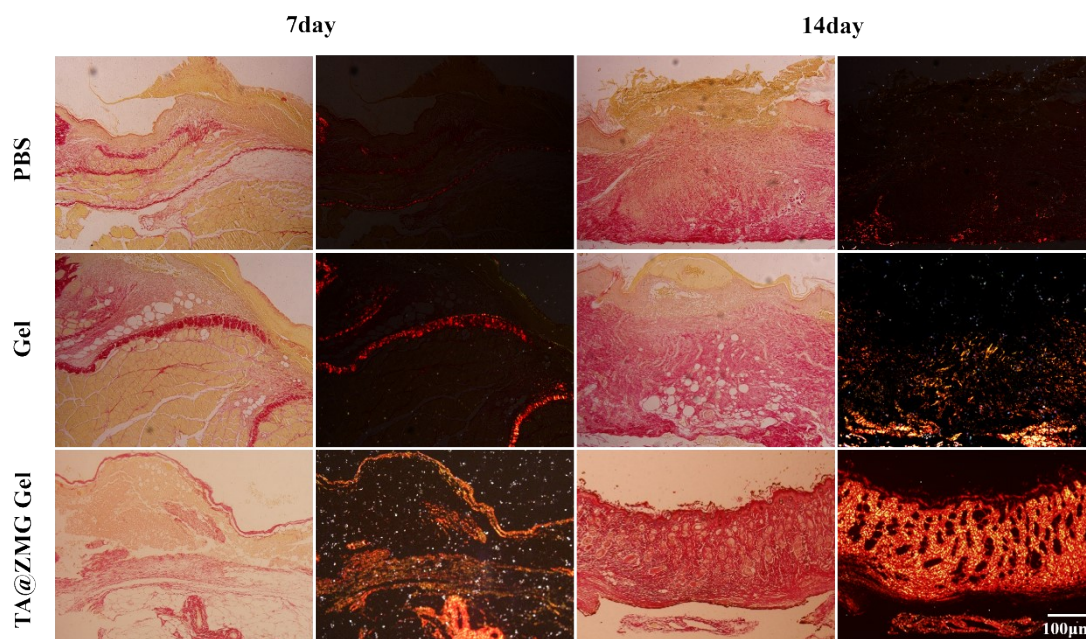
**Fig. S26.** Calcein -AM/PI cell staining in different treatment groups.



**Fig. S27.** Image J simulation analysis of wound size.

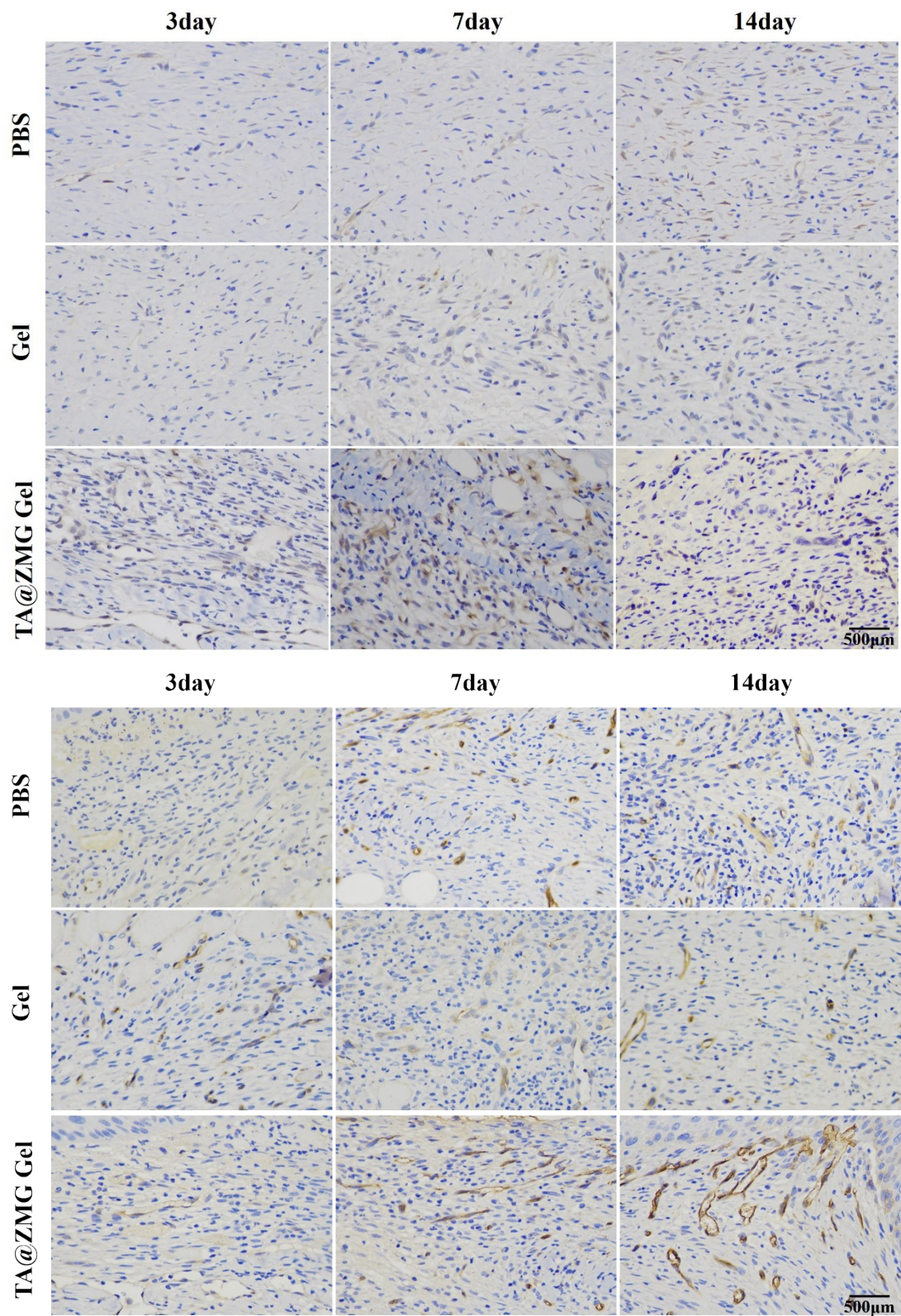


**Fig. S28.** Changes of body weight in PBS, Gel and TA@ZMG Gel groups during treatment.

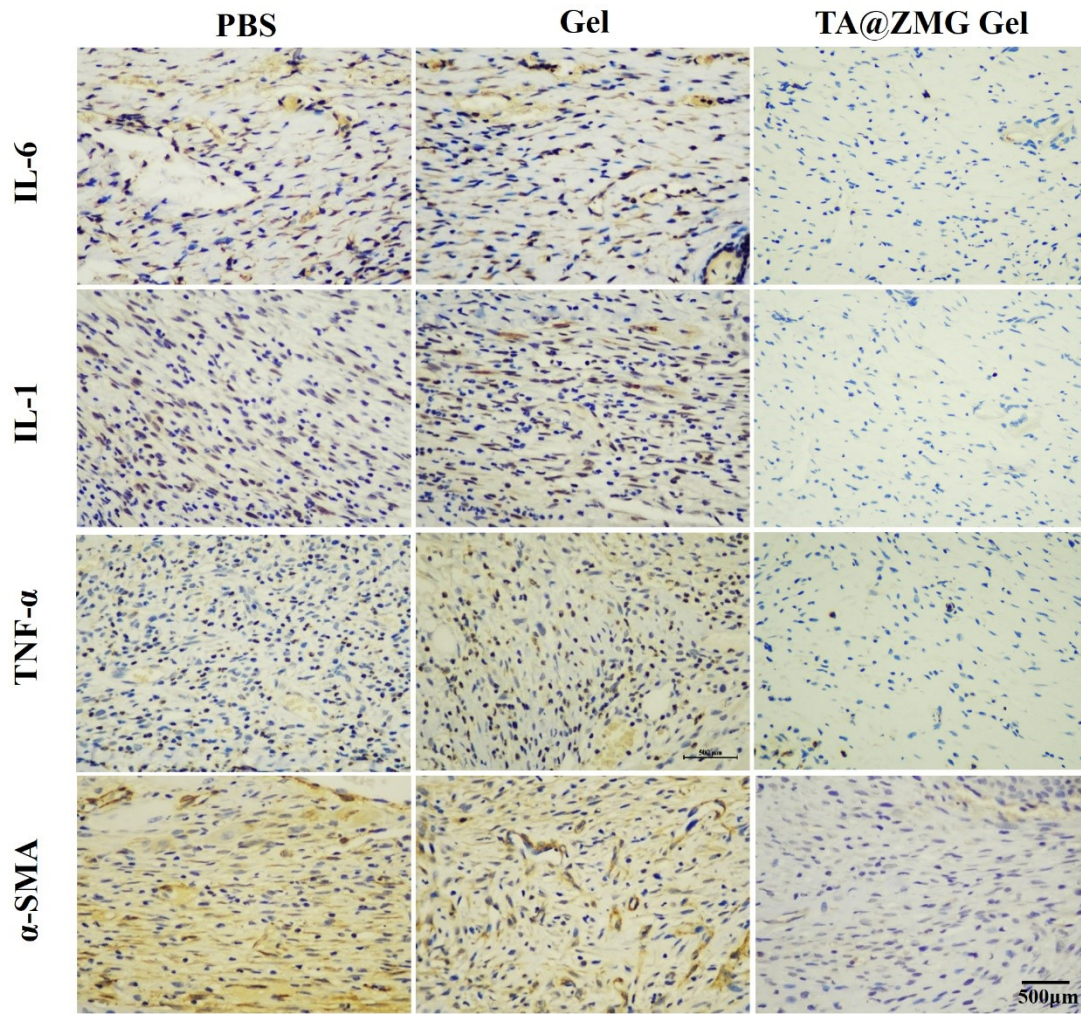


**Fig. S29.** Diabetic wound tissues were stained with bitter red collagen on different days (7,14 days).

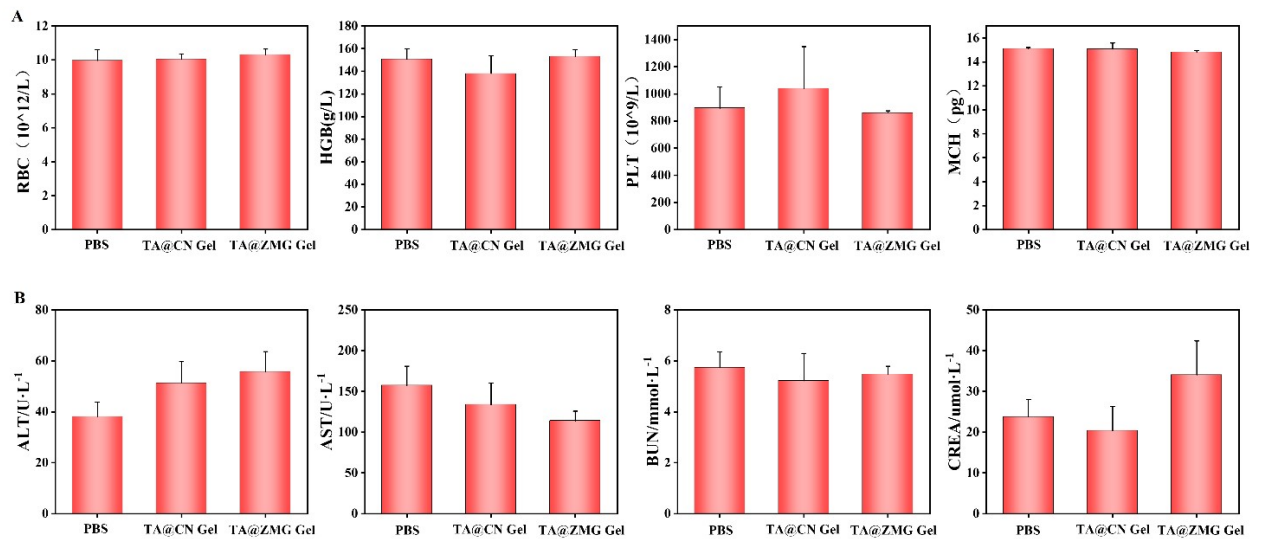




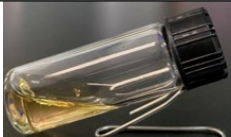


**Fig. S30.** VEGF and CD31 histochemical staining.



**Fig. S31.** Immunohistochemical staining of IL-6 $\beta$ , IL-1,  $\alpha$ -SMA and TNF- $\alpha$  expressed in wounds at 14 day.



**Fig. S32.** *In vivo* safety assessment. (A) Results of routine blood analysis: red blood cells (RBC), hemoglobin (HGB), platelets (PLT) and mean corpuscular hemoglobin (MCH). (B) Serum levels of typical lipid markers. ALT, alanine aminotransferase; AST, aspartate aminotransferase; BUN, blood urea nitrogen; CRE, blood creatinine.

AM	2M	5M	7M
TA : APBA	1 : 10	1 : 10	1 : 10
APS:TEMED	10 : 1	10 : 1	10 : 1
Hydrogel Properties			

**Table S1.** Experiments on the conditions of hydrogel formation in different ratios.