Supporting Information

Antibacterial and Healing-Promoting collagen fibril constructed by the simultaneous strategy of fibril reconstitution and ε-polylysine anchoring for infected wound repair

by

Xiaoxia Zhang [a,b], Changkai Yang [a,b], Xin Guo [a,b], Chun Yang [a,b], Guoying Li [a,b] *

[a] *Key Laboratory of Leather Chemistry and Engineering (Ministry of Education), Sichuan University, Chengdu 610065, PR China;*

[b] *National Engineering Research Center of Clean Technology in Leather Industry, Sichuan University, Chengdu 610065, PR China;*

[*] *Corresponding Author: Guoying Li.*

Key Laboratory of Leather Chemistry and Engineering (Ministry of Education), Sichuan University, Chengdu 610065, PR China

Tel: +86-28-85462568

Fax: +86-28-85405237

E-mail address: liguoyings@163.com

Methods

1. Mechanical property characterization

Mechanical tensile stress-strain evaluation was performed using an electronic universal material tensile machine (UTM 6203, China) and investigated in line with the published procedure with a minor modification.[1] In brief, the lyophilized samples were cut into a rectangular shape (10 mm×20 mm). Digital calipers were used to measure the thickness of Col and CPTs. The tensile test was carried out at constant speed of 10 mm/min until the sample broken.

2. Water absorption test of the collagen fibrils

The water absorption capacity of the collagen fibrils was evaluated by immersing all the samples in PBS solution at 37℃.[2] At different time points, excess PBS presented on the surface of the samples was removed by gently tapping the surface with filter paper, and the weight of the swollen samples was measured. The water absorption capacity was determined through Eq.(1):

$$\text{Swelling ratio (\%)} = (W_i - W_0)/W_0 \times 100\% \quad (1)$$

where Wi is the final weight of swollen samples and W_0 is the initial weight of the lyophilised samples.

3. Biodegradation property of the collagen fibrils

The biodegradability of the collagen fibrils was investigated according to the method described by He et al. with a minor modification.[3] Briefly, the samples were incubated in PBS (pH=7.4) containing 1U/ml type I collagenase (≥125 U/mg, C0130, Sigma-Aldrich, Munich, USA) at 37 °C to simulate the degradation process under

physiological conditions. At different time points, incubated samples were placed in an ice bath immediately to terminate the enzymatic degradation and then were withdrawn from the solution, freeze-dried, and weighed. The fibrils' weight loss after degradation at each time point was calculated according to Eq. (2):

$$\text{Weight loss (\%)} = (W_n - W_0)/W_0 \times 100\% \qquad (2)$$

where W_0 corresponds to the initial weight of the lyophilised sample and W_n to the weight of the sample at different time points.

Results

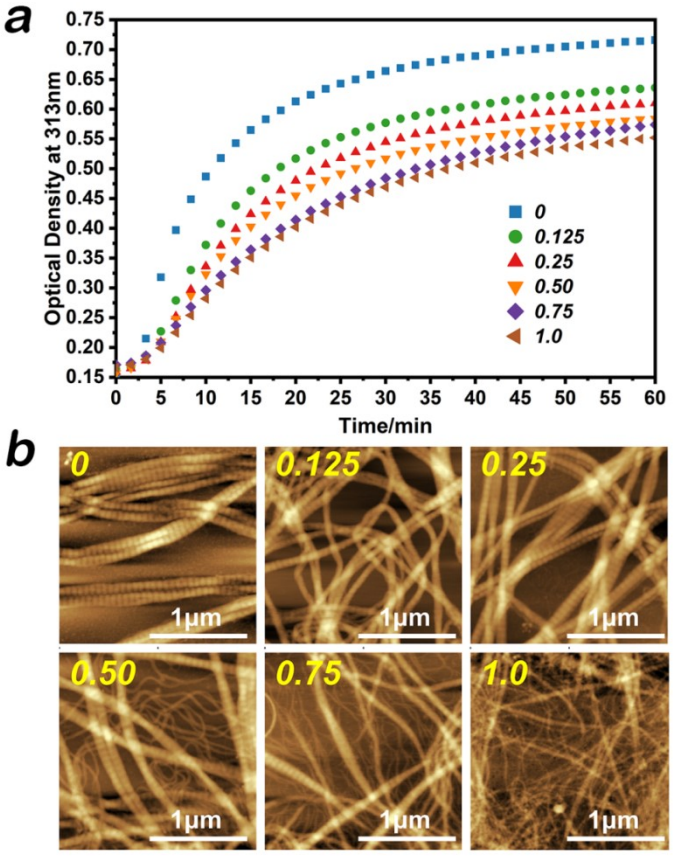

Fig. S1. The effect of various concentration (mg/ml) of ε-PL on (a) the fibrillogenesis process of collagen and (b) the formation of mature collagen fibril with D-periodicity (final collagen concentration was 1mg/ml in all tested systems).

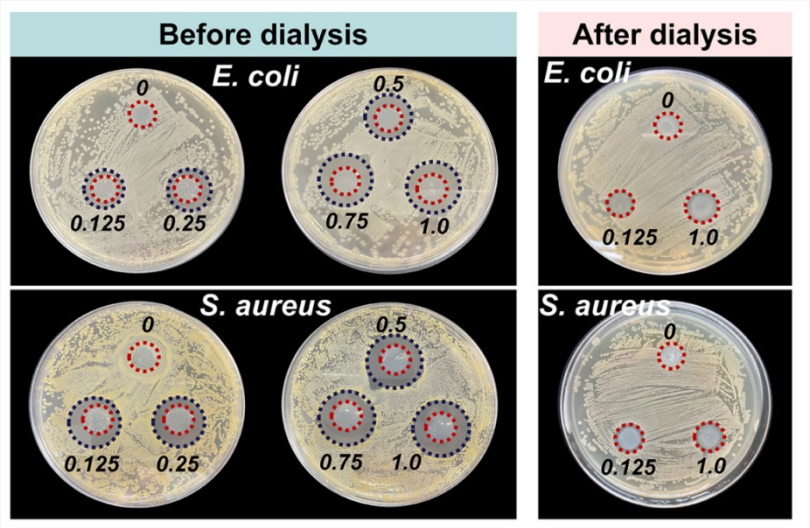

Fig. S2. Antibacterial zone of collagen/ε-PL co-assemblies with different concentration (mg/ml) of ε-PL against *S. aureus* and *E. coli* (a) before and (b) after dialysis.

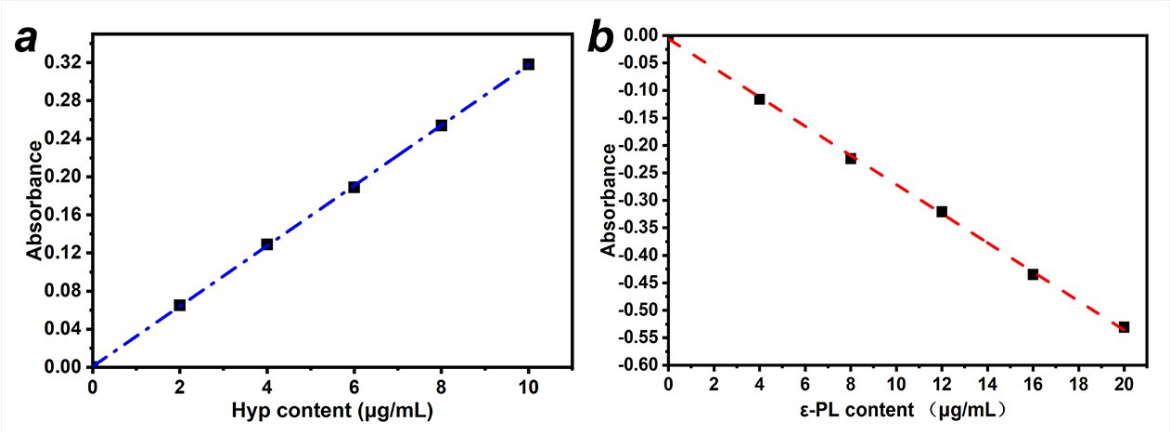

Fig. S3. The standard curves of (a) Hyp and (b) ε-PL.

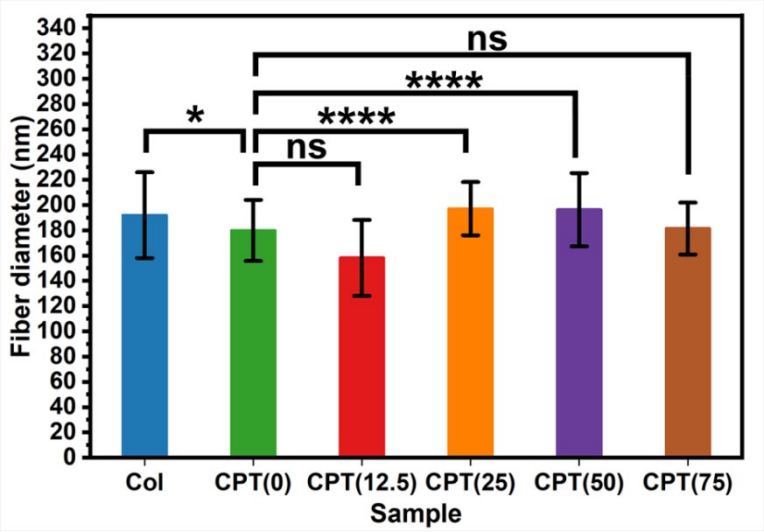

Fig. S4. Statistical analysis of fiber diameters of Col and CPTs.

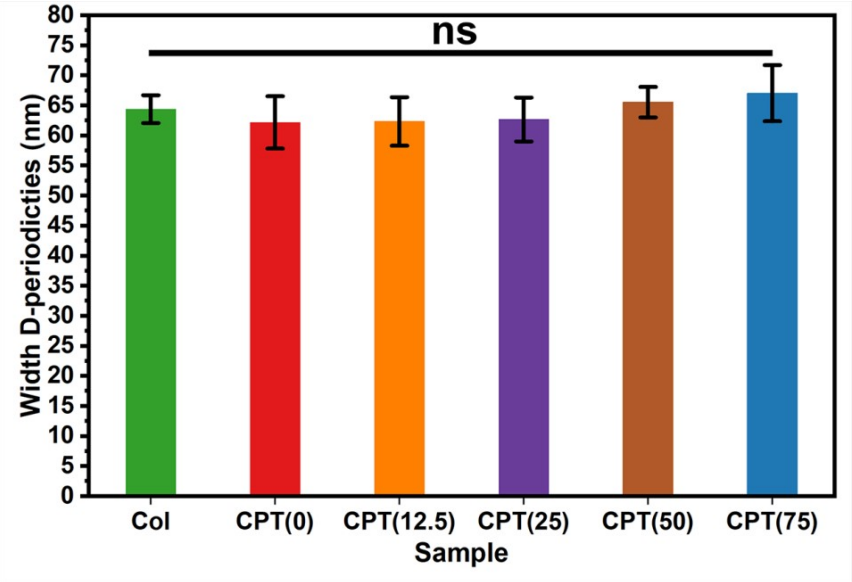

Fig. S5. Statistical analysis of Width D-periodicties of Col and CPTs.

Table S1. C1s analysis of Col and CPTs

Signal	Binding energies（eV）of various samples						Significance
	Col	CPT (0)	CPT (12.5)	CPT (25)	CPT (50)	CPT (75)	
C1s	284.81	284.84	284.80	284.81	284.72	284.72	C-C
	286.19	286.23	286.17	286.15	286.05	286.06	C-N
	287.97	288.00	287.94	287.93	287.83	287.81	O=C-N

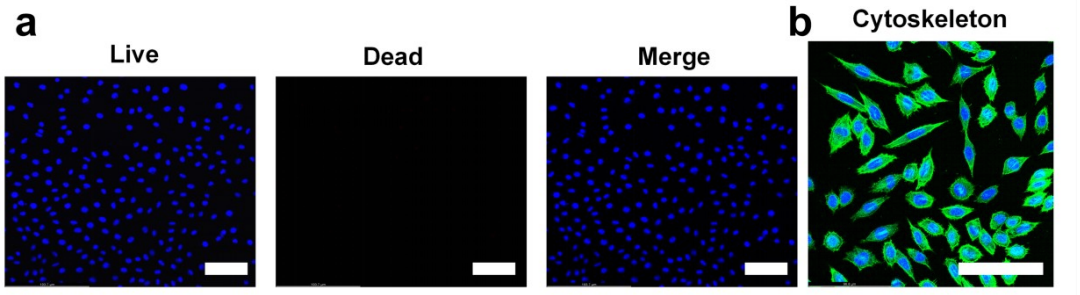

Fig. S6. (a) Live-Dead staining and (b) Cytoskeleton staining of blank control (Scale bar = 100 μm).

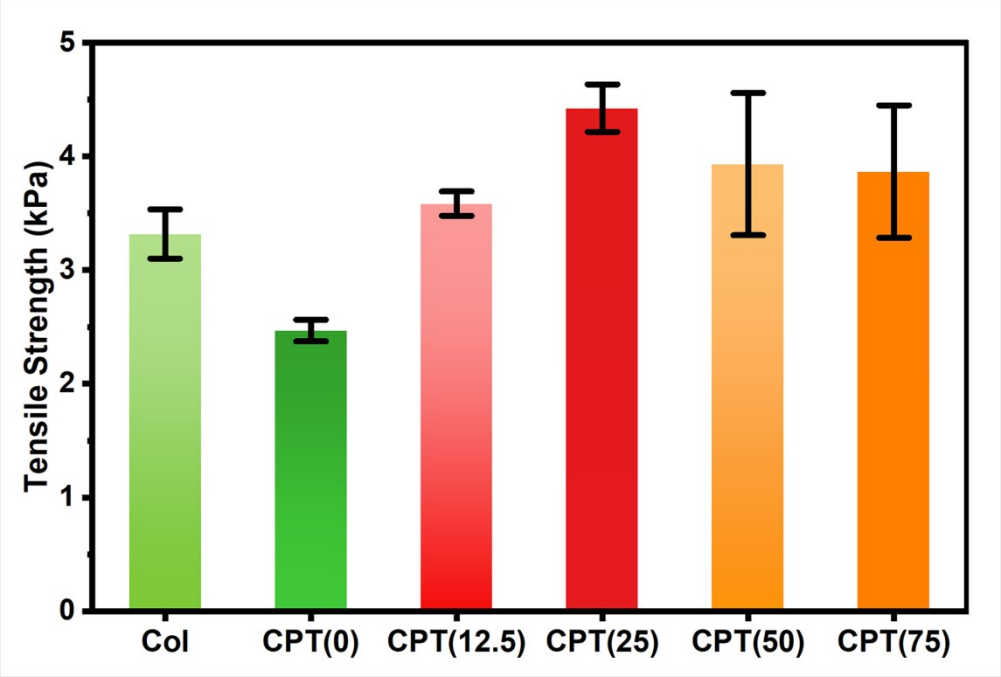

Fig. S7. Tensile strength of Col and CPTs.

References:

1. J. Zheng, K. Li, Y. Li and G. Jiang, *Materials Today Communications*, 2023, **35**, 105818.
2. W. Li, Z. Su, Y. Hu, L. Meng, F. Zhu, B. Xie, J. Wan and Q. Wu, *International Journal of Biological Macromolecules*, 2023, **241**, 124102.
3. J. He, G. Ye, H. Ma, S. Jia, J. Ma, J. Lv, D. Jia, Y. Song, F. Liu, P. Li, J. Wang, K. Gyal, K. Gou, M. La and R. Zeng, *International Journal of Biological Macromolecules*, 2023, **240**, 124487.