Supporting Information

Multi-stimuli-responsive Degradable Boronic Ester-crosslinked E-spun Nanofiber Wound Dressings

Sofia Nieves Casillas-Popova,[1] Nishadi Dilkushi Lokuge,[1] Prerna Singh,[1] Arianna Cirillo,[1] Anna Thinphang-Nga,[1] Cameron D. Skinner,[1] Brandon Findlay,[1,2] Dajana Vuckovic,[1] Jung Kwon Oh[1]*

1. Department of Chemistry and Biochemistry, Concordia University, Montreal, Quebec, Canada H4B 1R6

2. Department of Biology, Concordia University, Montreal, Quebec, Canada H4B 1R6

Emails:john.oh@concordia.ca

Figure S1. Digital image of a home-made electrospinning set-up.

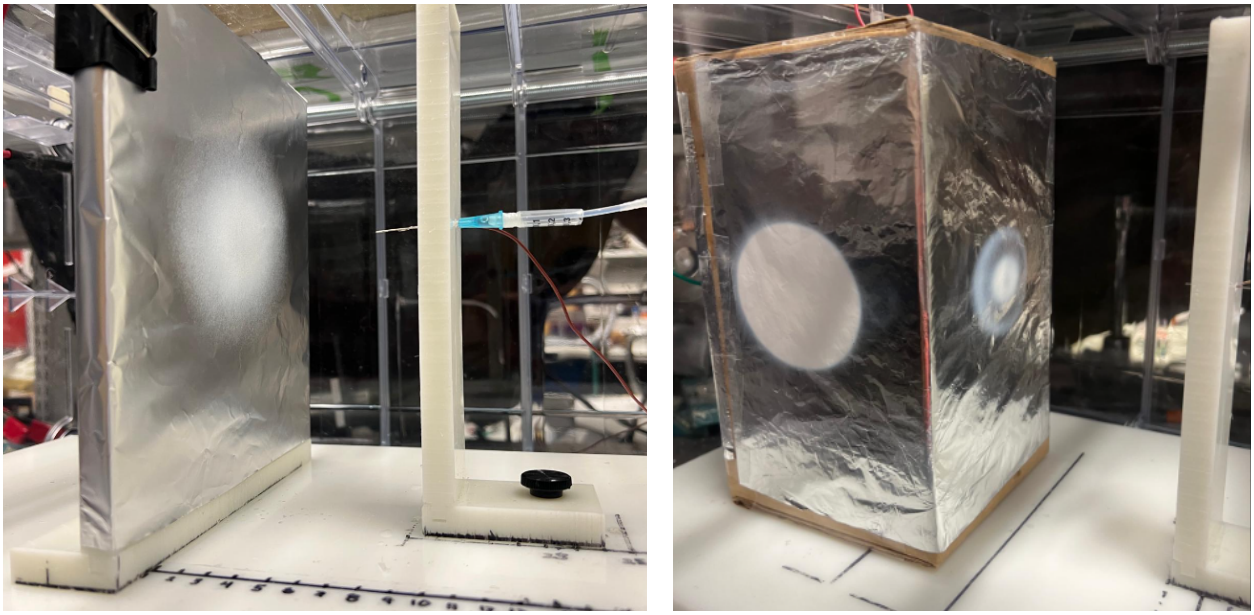


Figure S2. ^{13}C NMR of DBA-E in DMSO-d_6.

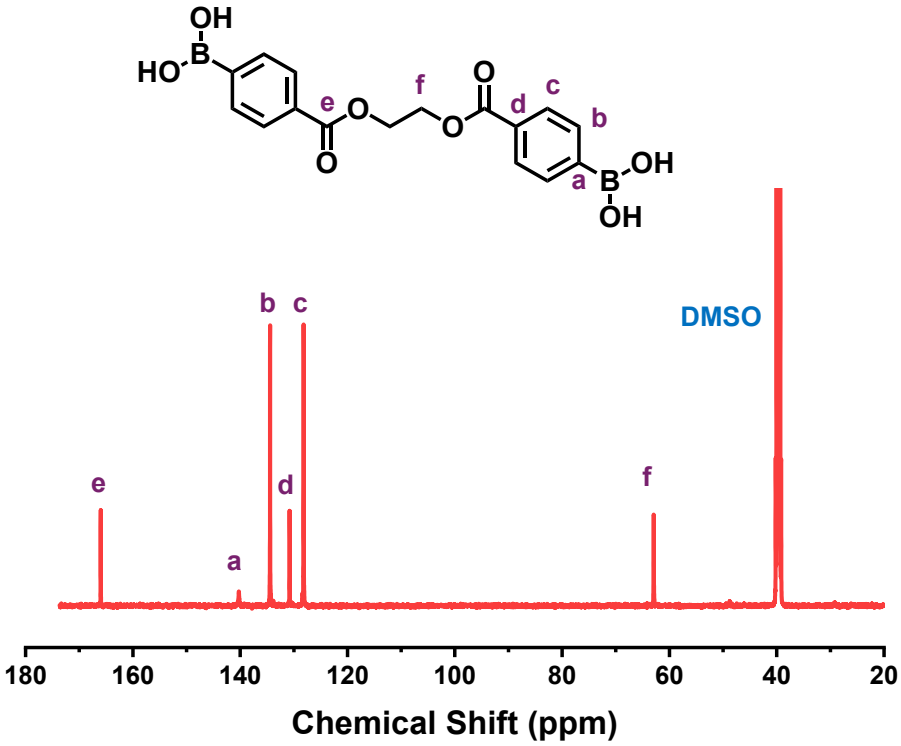


Figure S3. Overlaid UV-Vis spectra of DBA-E at pH = 5.5-9.5.

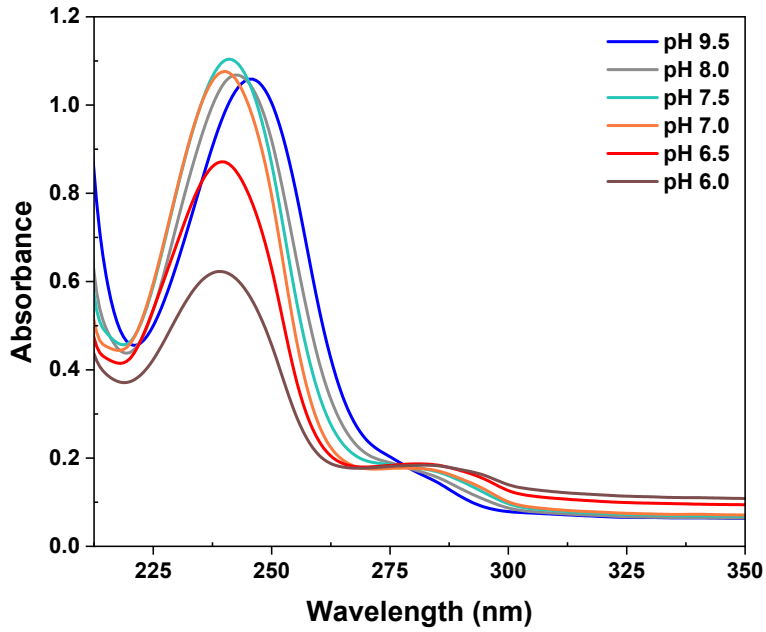


Figure S4. Overlaid UV-Vis spectra of CPBA at pH = 5.0-10.0.

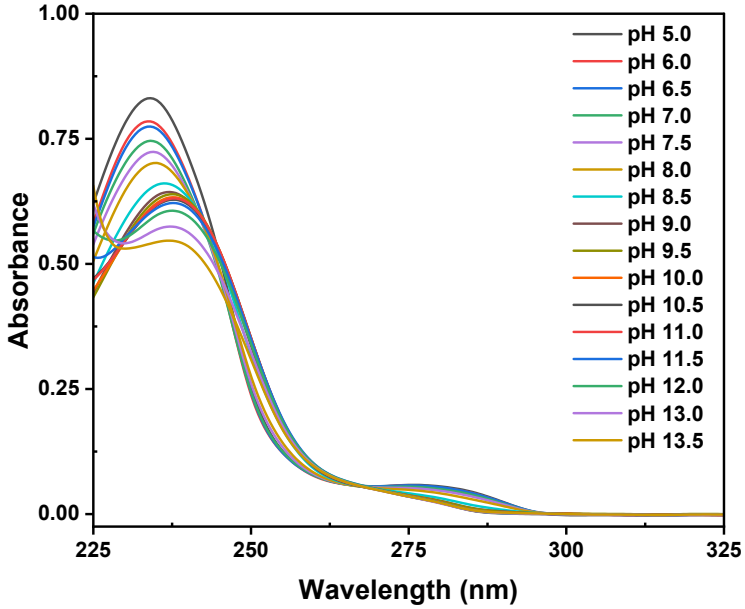


Figure S5. For CPBA, spectroscopic titration curve of normalized absorbance at λ = 285 nm at pH = 5.0-13.5.

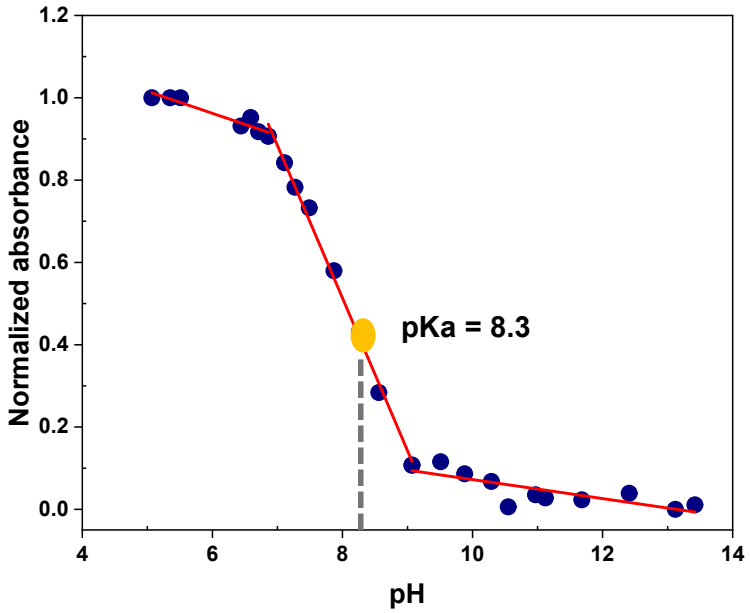
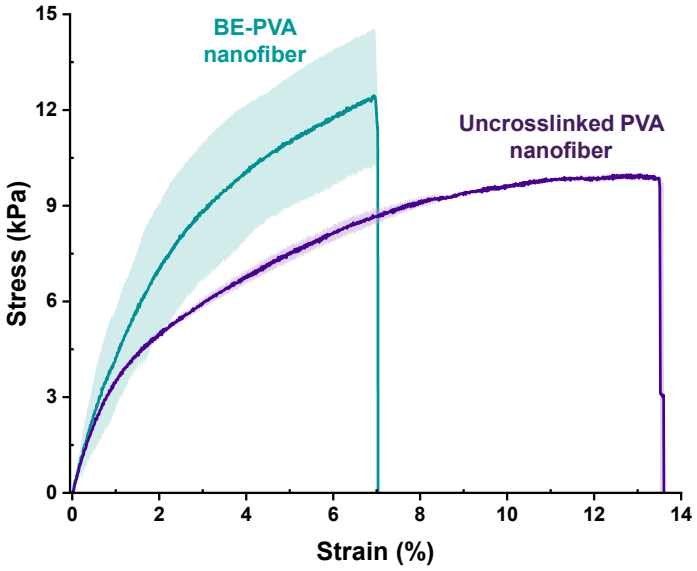


Figure S6. Stress-strain curves of BE-PVA mats (crosslinked) and uncrosslinked mats for comparison.



Specimens	Young's modulus (kPa)	Tensile strength (kPa)	Elongation (%)
BE-PVA nanofiber	5.2 ± 0.1	12.5 ± 2.1	6.9 ± 2.4
Uncrosslinked nanofiber	4.2 ± 0.1	9.8 ± 0.1	13.5 ± 0.1

Figure S7. For DBA-EP, synthesis by the esterification of DBA-E with pinacol (a), ^{1}H NMR spectrum in DMSO-d_6 (b), and ^{13}C NMR spectrum in mixture of DMSO-d_6 with THF (c).

Figure S8. Schematic illustration of acid-responsive degradation through acid-catalyzed hydrolysis of DBA-EP (a) and overlaid ^{1}H NMR spectra DBA-EP incubated with HCl in DMSO-d_6 over time (b).

Figure S9. Schematic illustration of base-responsive degradation through base-catalyzed hydrolysis of DBA-EP (a) and overlaid ^{1}H NMR spectra DBA-EP incubated with NaOH in DMSO-d_6 over time (b).

Note: When incubated with NaOH, ^{1}H NMR spectra of DBA_E show multiple peaks related to pinacol ester and its degraded products at 0.9-1.5 ppm including the peak (d′) corresponding to pinacol generated upon the cleavage of BE bonds. Different from other stimuli, %degradation was determined by the integral ratio of the peak (d′) to the sum of all the peaks. Figure below is overlaid 1H NMR spectra of DBA_E and its degraded products over incubation time, for better view.

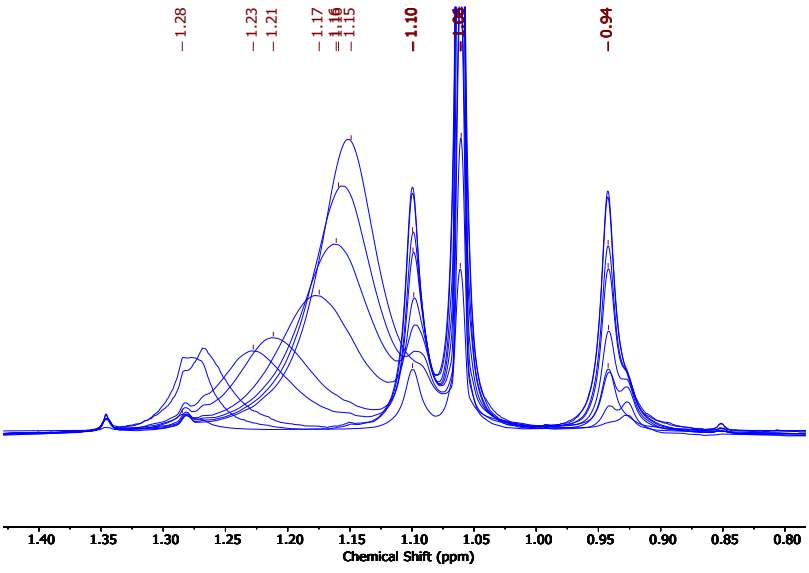
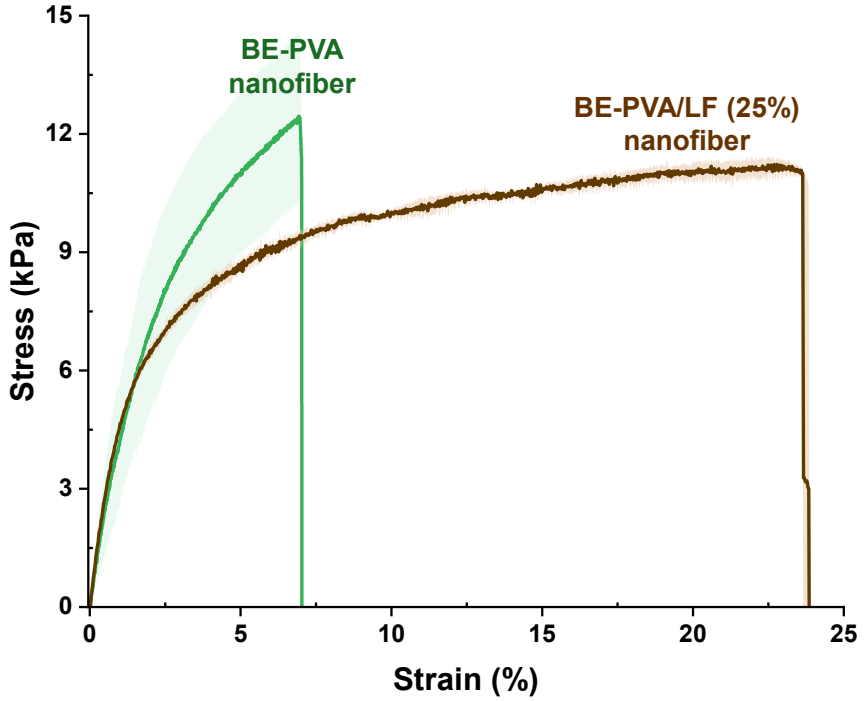


Figure S10. Schematic illustration of degradation of DBA-EP in response to H_2O_2 (a) and overlaid ^1H NMR spectra of DBA-EP incubated with H_2O_2 at BE/H_2O_2 = 1/1 in DMSO-d_6 (b).

Figure S11. Schematic illustration of degradation of DBA-EP in the presence of glucose through transesterification reaction (a) and overlaid ^1H NMR spectra of DBA-EP incubated with Glu at BE/Glu = 1/1 mol equivalent ratio in DMSO-d_6 (b).

Figure S12. Schematic illustration of degradation of DBA-EP in the presence of glucose through base-catalyzed transesterification reaction (a) and overlaid ^{1}H NMR spectra of DBA-EP incubated with Glu at BE/Glu = 1/1 mol equivalent ratio and NaOH in DMSO-d_6 (b).

Figure S13. Stress-strain curves of BE-PVA mats with and without loaded with LF (25%).



Specimens	Young's modulus (kPa)	Tensile strength (kPa)	Elongation (%)
BE-PVA nanofiber	5.2 ± 0.1	12.5 ± 2.1	6.9 ± 2.4
BE-PVA/LF (25%) nanofiber	5.5 ± 0.1	11.1 ± 0.2	23.4 ± 0.3

Figure S14. Overlaid spectra of LF and correlation curves in McIlvaine buffer at pH = 5.4 (a), 7.4 (b), and 8.4 (c); in 126 mg/dL aqueous Glu solution without (d) and with NaOH (e).

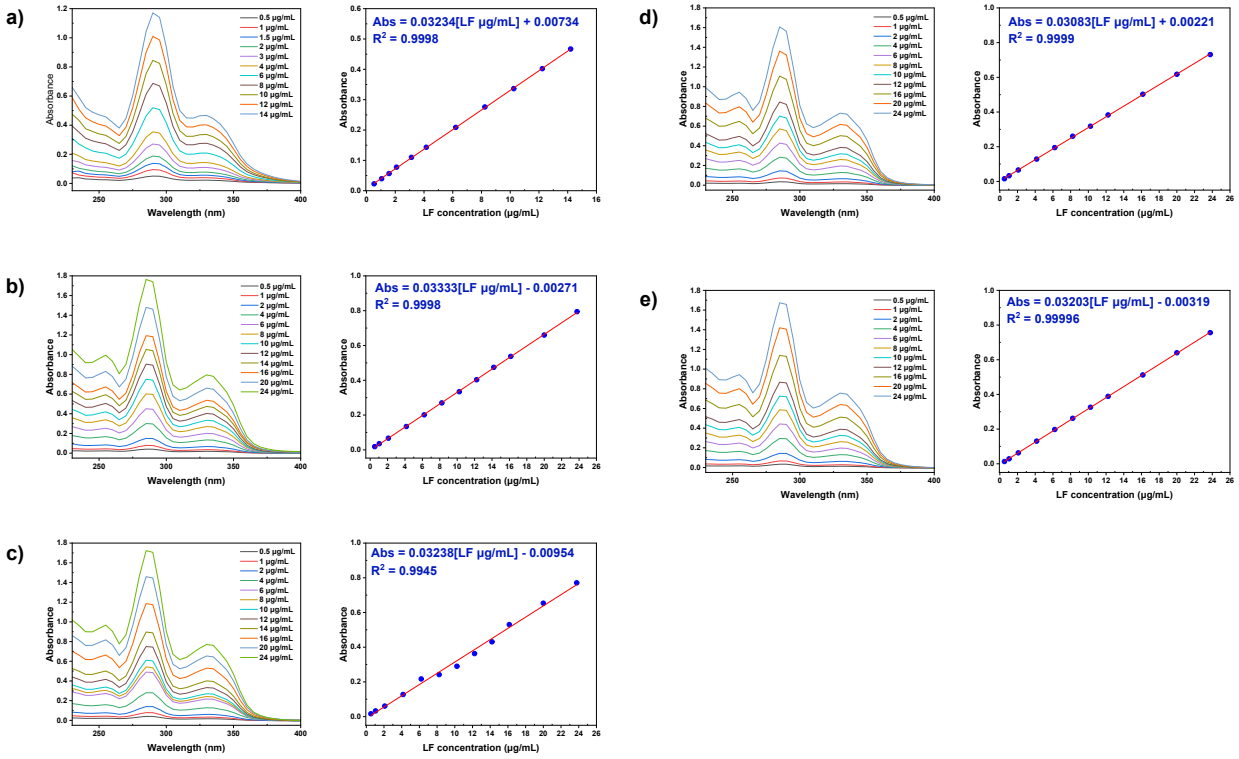


Figure S15. Overlaid UV-Vis spectra of H_2O_2-induced LF degradation over incubation time in 1mM H_2O_2 solution.

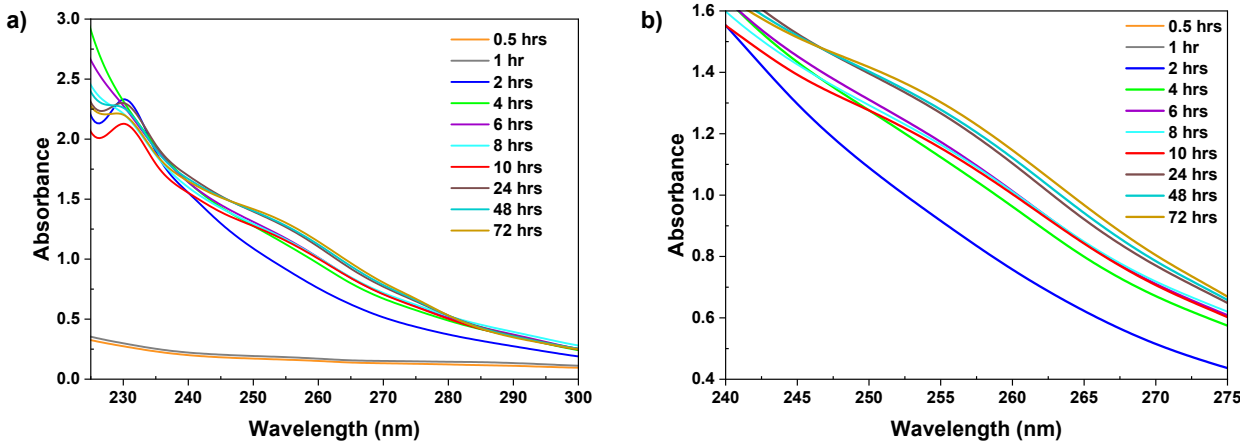


Figure S16. Digital images of MHB agar gels at pH = 5.4, 7.4, and 8.4.

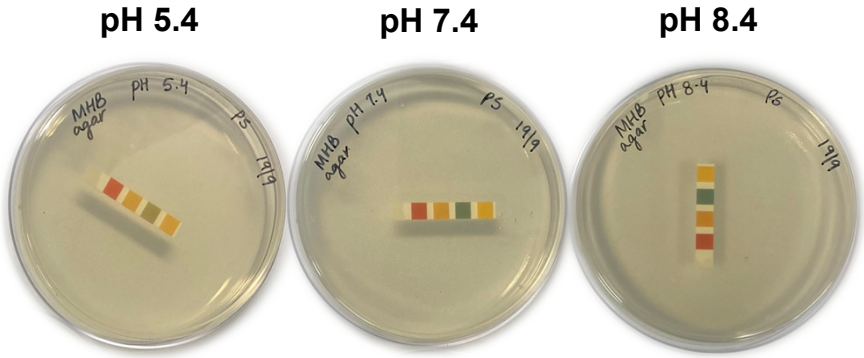


Figure S17. DOI of *E. coli* (ATCC 25922 (a), *S. aureus* (ATCC 29213) (b), and MRSA (c) by Kirby-Bauer disk diffusion method.

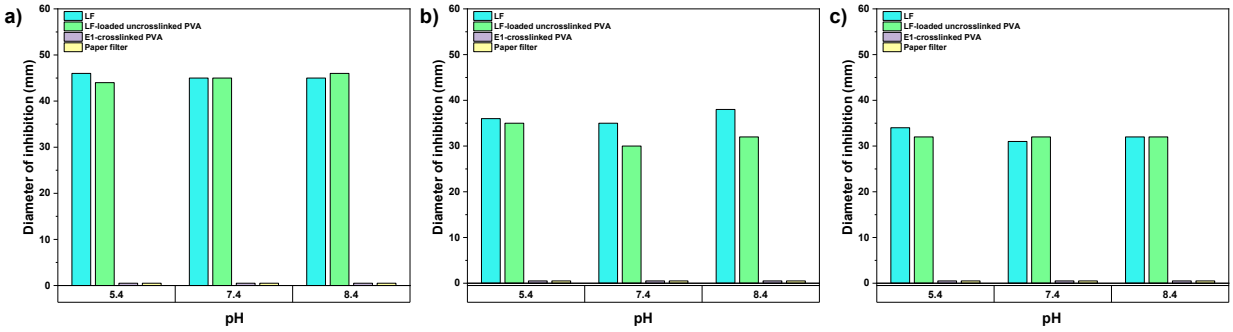


Figure S18. Kirby-Bauer disk diffusion method in MHB culture media at pH = 7.4 containing phenol red as indicator of BE-crosslinked and uncrosslinked nanofibers with and without LF in *E. coli* (a) and *S. aureus* (b).

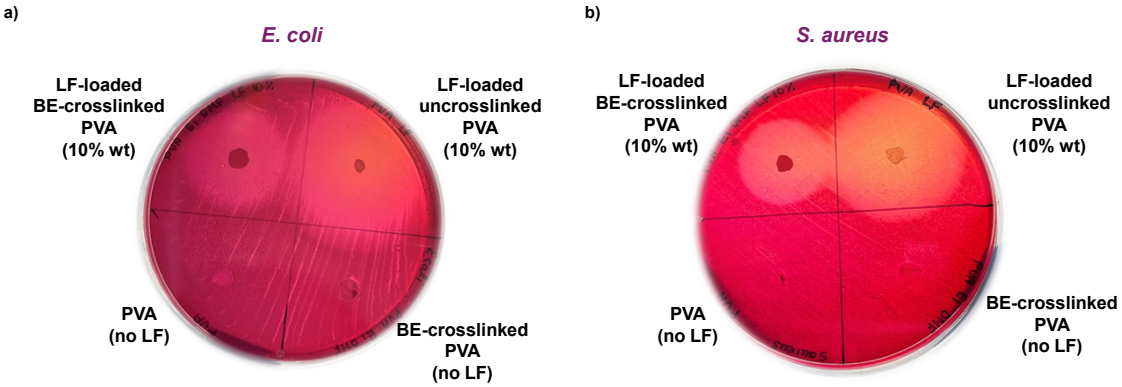
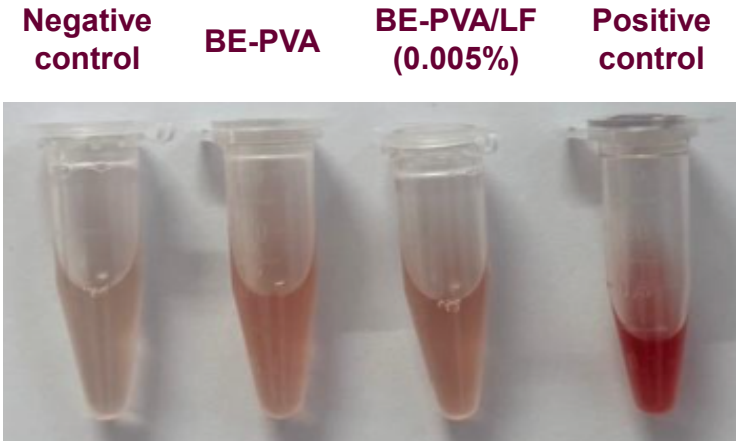


Figure S19. Evaluation of hemocompatibility of BE-PVA mats loaded with and without 0.005% LF mats.



Sample	Hemolysis (%)
BE-PVA	1.2 ± 0.3
BE-PVA/LF (0.005%)	1.3 ± 0.4

Figure S20. Viability of HFF-1 and HEK293 cells incubated with BE-PVA mats loaded with and without LF (0.005%) for 24, 48, and 72 hrs, determined using a resazurin reduction assay.

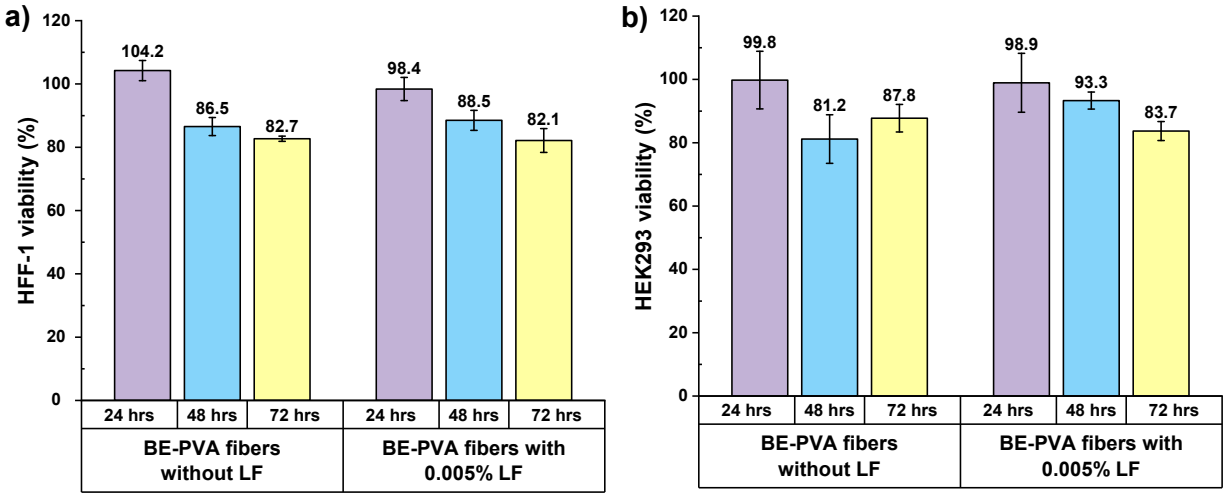


Table S1. Comparison of characteristics and properties for BE-PVA mats crosslinked with DBA-E in THF and DMF at BA/2OH = 1/1 mole equivalent ratio.

Solvent	δ [a] ($MPa^{1/2}$) [b]	Efficiency of DBA-E %	OH reacted %	Gel content %
THF	18.6	0.7 ± 0.1	2.8 ± 0.4	50.7 ± 1.0
DMF	21.7	1.5 ± 0.3	6.0 ± 1.3	89.2 ± 1.0

a) Hildebrand solubility parameter δ for PVA = 22 - 25 $MPa^{1/2}$; b) Calculated at 25 °C.

Table S2. MIC values at various pHs for *E. coli* and *S. aureus*.

	MIC (mg/L)		
pH	***E. coli***	***S. aureus***	**MRSA**
5.4	0.25	0.25	-
7.4	0.0625	0.25	32
8.4	0.0625	0.5	32