Catechol functionalized polyguluronate enriched sodium alginate wetspun fibers with immobilized platelet lysate for diabetic wound healing

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Platelet lysate preparation:

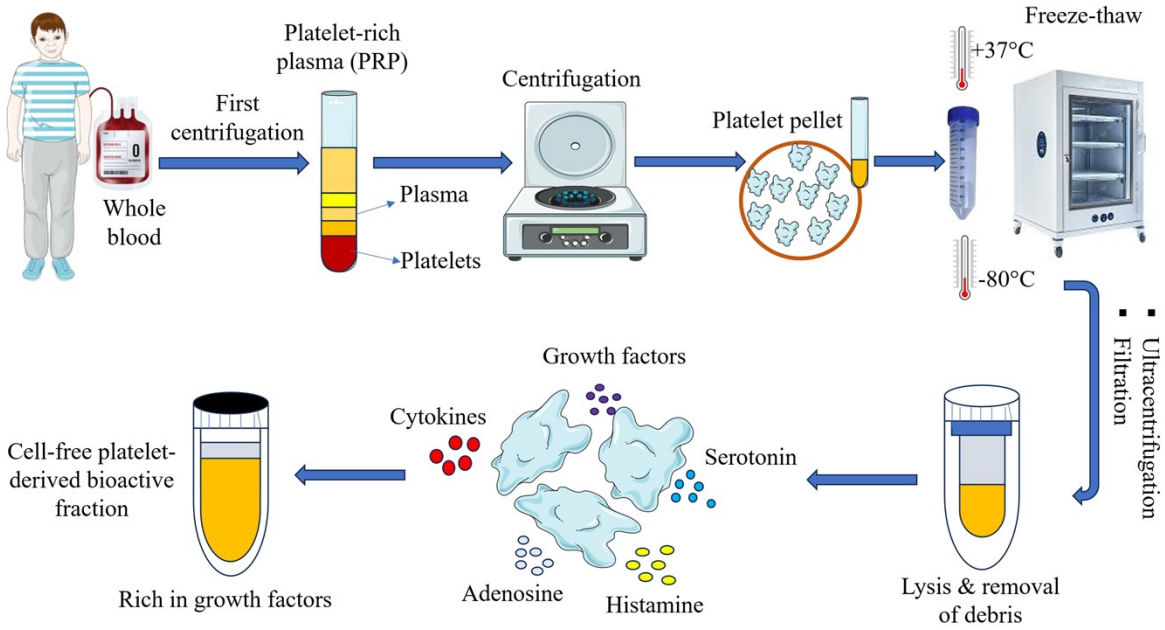
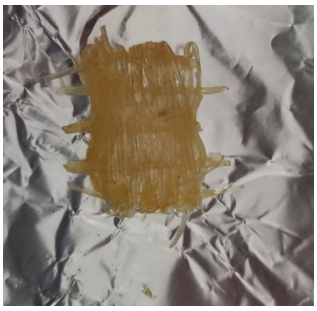


Fig. S1: Schematic illustration of platelet lysate preparation. Platelet-rich plasma (PRP) was obtained from pooled human donors. Following centrifugation, platelets were subjected to repeated freeze-thaw cycles to release bioactive contents including growth factors, cytokines, serotonin, adenosine, and histamine. After lysis and debris removal, the final platelet lysate rich in growth factors was collected, sterile filtered, aliquoted, and stored at -80°C until use.

Modified (SA-PEG-D-PL) and Unmodified (SA-PEG-PL) fibers, indicating successful surface modification:

SA-PEG-D-PL:

SA-PEG-PL:



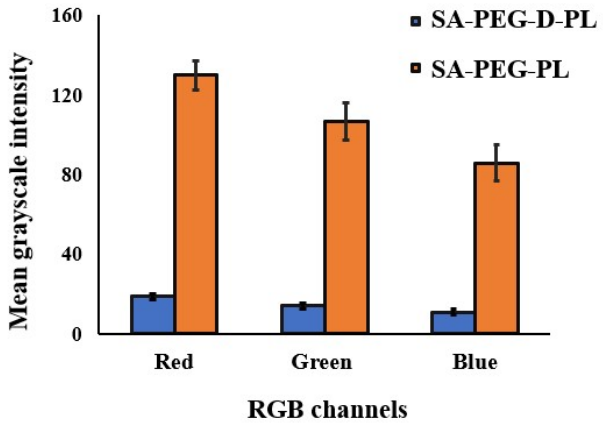


Fig. S2: Comparison of unmodified and PDA-modified SA-PEG fibers showing color change after dopamine immobilization (black indicates successful PDA coating). Also performed digital image analysis using ImageJ. By splitting the images into RGB channels and measuring the grayscale intensity distribution across the surface

Tensile testing:

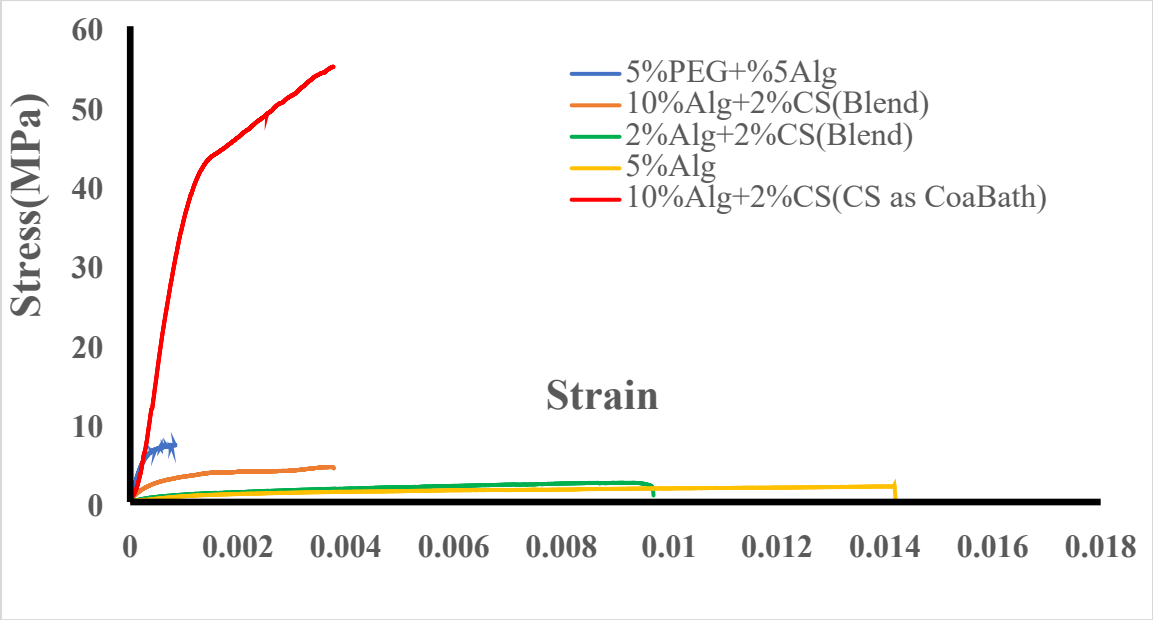
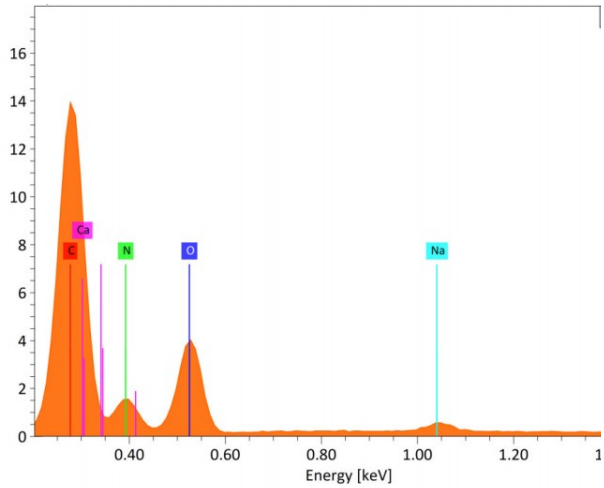


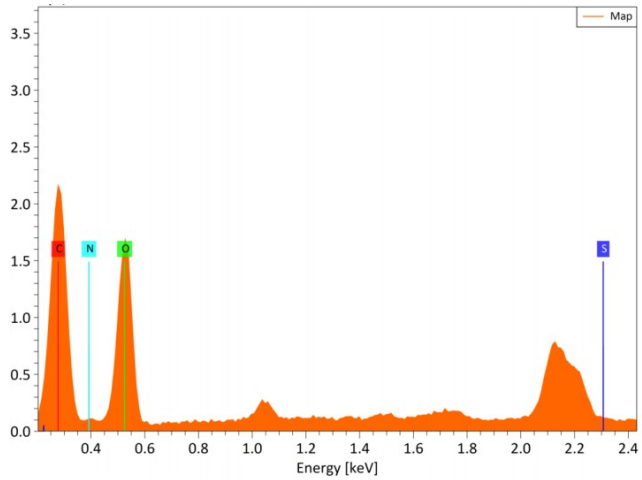
Fig. S3: Stress-strain behavior of different fiber formulations: 5%PEG + 5%Alg, 5%Alg, 10%Alg + 2%CS (blend), 2%Alg + 2%CS (blend), and 10%Alg + 2%CS with CS used as coagulation bath. The results show significant enhancement in mechanical strength when CS is used as a coagulation medium, indicating improved interfacial interactions and fiber integrity compared to blended systems.

EDS analysis:

SA-PEG-D-PL



SA-PEG-PL

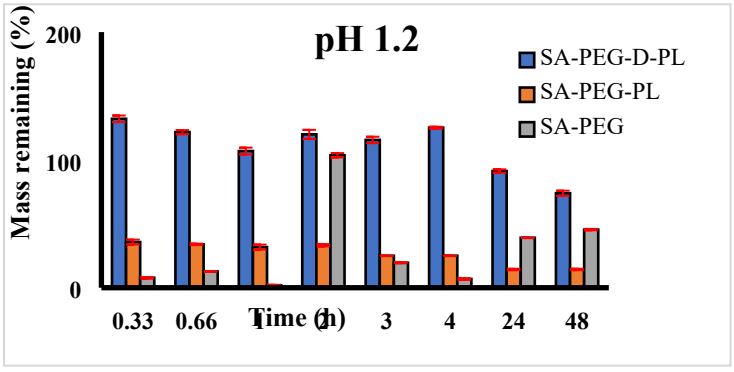


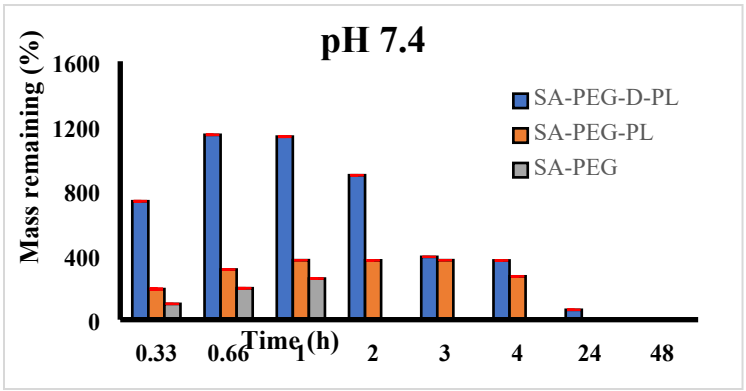
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (3 sigma)
C	6	72826	56.12	56.12	63.33	4.83
N	7	5527	12.92	12.92	12.51	1.70
O	8	19905	26.19	26.19	22.18	2.80
Na	11	1912	1.47	1.47	0.86	0.33
Ca	20	549	3.31	3.31	1.12	1.09
		Sum	**100.00**	**100.00**	**100.00**	

Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (3 sigma)
C	6	11918	48.77	48.77	56.54	4.71
O	8	8335	44.35	44.35	38.60	4.54
N	7	334	3.34	3.34	3.32	0.86
S	16	534	3.55	3.55	1.54	1.07
		Sum	**100.00**	**100.00**	**100.00**	

Fig. S4: EDS spectra of SA-PEG-D-PL and SA-PEG-PL fibers; increased nitrogen content confirms successful surface modification. EDS analysis revealed a distinct increase in nitrogen content in the dopamine-modified sample (SA-PEG-D-PL) compared to the SA-PEG-PL. Specifically, SA-PEG-D-PL exhibited 12.92 wt% (12.51 at%) nitrogen, whereas SA-PEG-PL showed only 3.34 wt% (3.32 at%) nitrogen. Since SA-PEG does not intrinsically contain nitrogen, the substantial increase in N content after dopamine treatment confirms successful surface functionalization via polydopamine deposition.

Swelling & degradation:





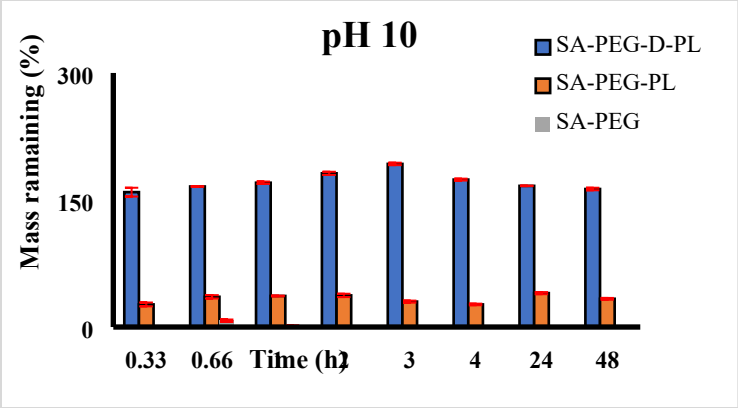


Fig. S5: Swelling and degradation behavior of the fabricated fibers at different pH environments (pH 1.2, 7.4, and 10), simulating acidic, physiological, and basic conditions, respectively. The measurements were conducted to evaluate the pH responsiveness and structural stability of the samples under various physiological and pathological conditions.

Standard curve for *in vitro* PL release:

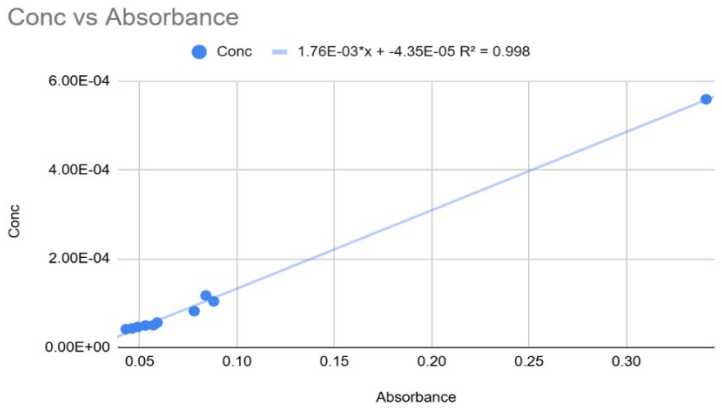


Fig. S6: Concentration vs absorbance standard curve for cumulative PL release

Vessel density:

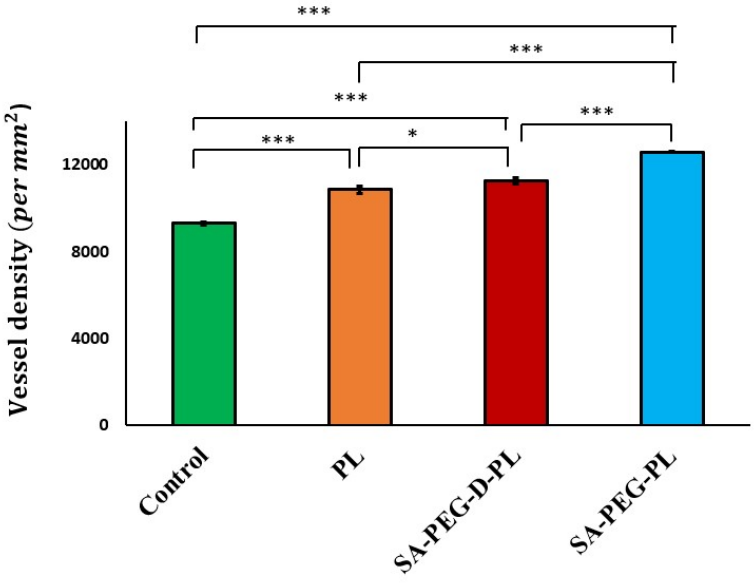


Fig. S7: Quantitative analysis of vessel density (vessels/mm²) in the wound region at day 14. The SA-PEG-PL group exhibited the highest vessel density compared to Control, PL, and SA-PEG-D-PL groups. Statistical significance was analyzed using one-way ANOVA, followed by $p < 0.05$, $p < 0.001$. A significant difference was observed between SA-PEG-D-PL and PL ($p = 0.034$), while comparisons involving SA-PEG-PL showed $p < 0.001$.