membranes

Supplementary Material

Fabrication of Mechanically Enhanced, Suturable, Fibrous Hydrogel Membranes

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S1. Materials and Methods

Chemical cross-linking

Since PVA is water-soluble, it is essential to cross-link the polymer molecules to prepare a water-insoluble, polymer gel system, which could eventually be implantable to the body. For this purpose, glutaraldehyde (GDA) was mixed into the PVA solutions as a cross-linker. An equal volume of 1 M GDA was added to 15 w/w% PVA solutions to achieve different crosslinking densities. Cross-linking density was calculated as follows:

$$Cross - linking\ Density = \frac{amount\ of\ crosslinks\ (mol)}{total\ polymer\ mass\ (mol)}$$

For example, 4 grams of 15 w/w% PVA solution contain 0.6 grams PVA,
which equals to 1,36 × 10^{-2} mol (calculated by the monomeric weight of PVA, 44 g/mol).
Thus, 4 g × 0.15 = 0.6 g then (0.6 g)/(44 g⁄mol) ≈ 0.0136 mol

In order to cross-link every 25th PVA molecule in the polymer chain:
(0.013 mol)/25=5.44 × 10^{-4} mol and 5.44 × 10^(-4) mol PVA should be in bond.

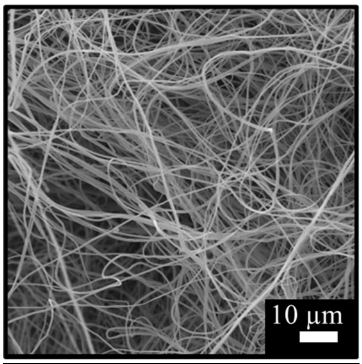
Since one molecule GDA can bind two PVA monomer molecules:
(5.44 × 10^{-4} mol)/2 = 2.72 × 10^{-4} mol

Thus, 2.72 × 10^{-4} mol GDA is needed.

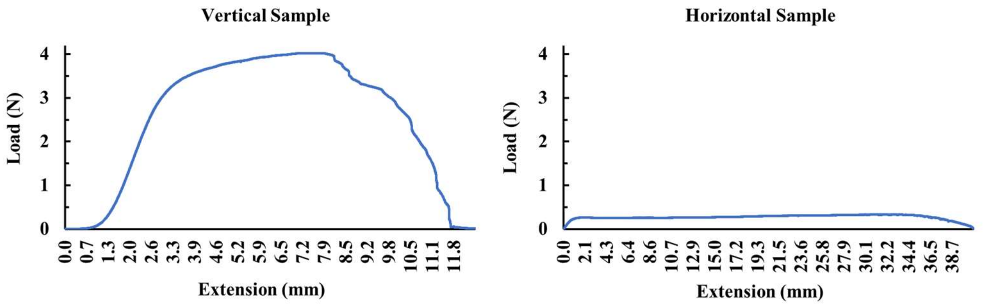
Post-electrospinning modifications

Supplementary Figure S1. Membranes directly after extraction from collector.

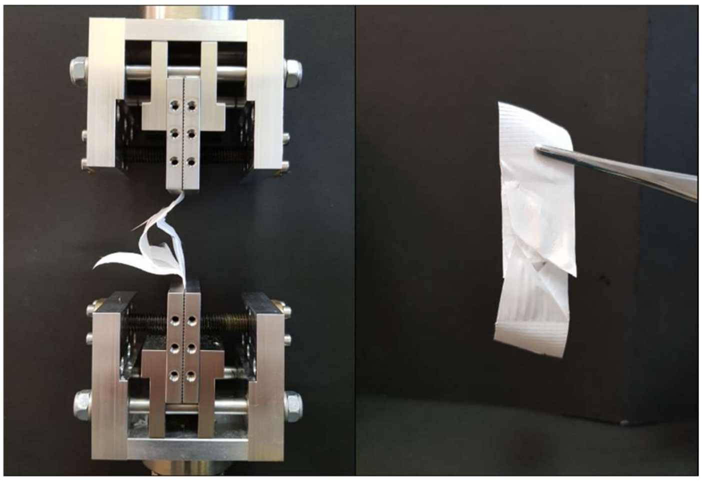
S2. Results



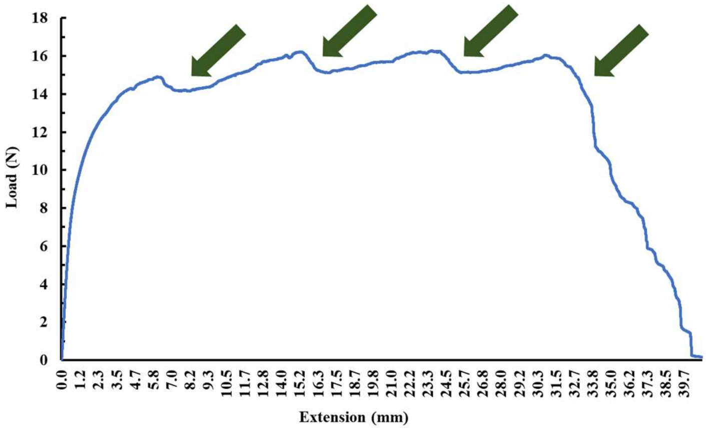
Supplementary Figure S2. Scanning electron microscopy of membranes fabricated with the static immobile flat collector.



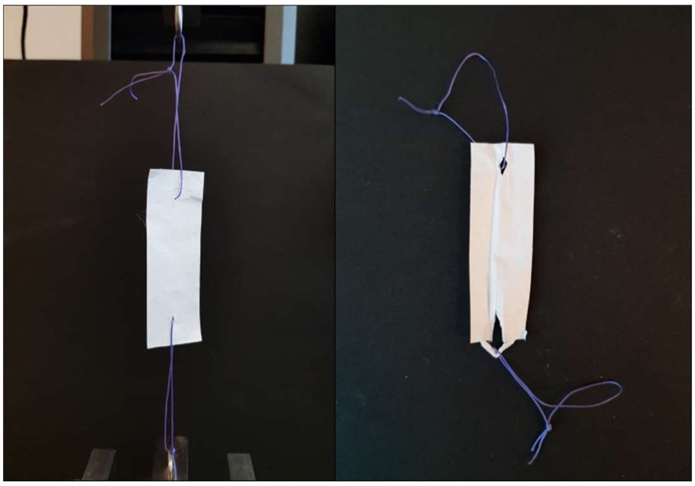
Supplementary Figure S3. A representative vertical (left) and horizontal (b) stress-strain curves of the monolayer PVA membrane.



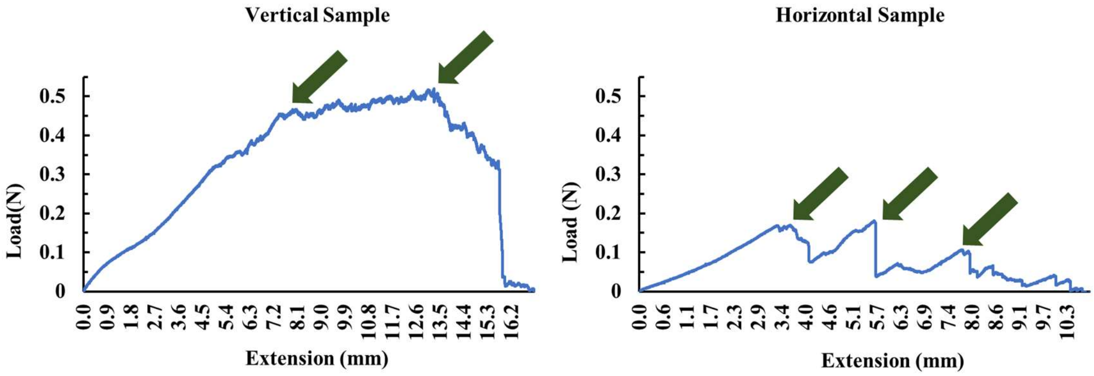
Supplementary Figure S4. Multi-layer membrane during mechanical assessment.



Supplementary Figure S5. A representative stress-strain curves of a multi-layer "C Arrangement" PVA membrane vertical sample (Green arrows: layer tearing).

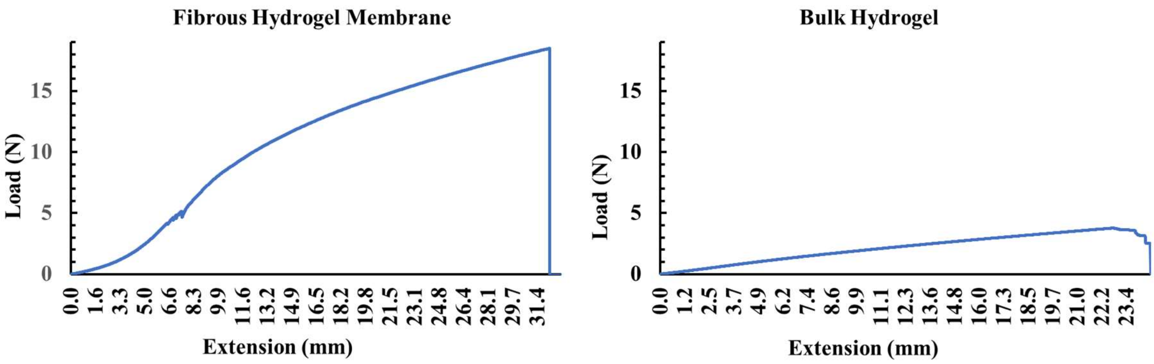


Supplementary Figure S6. Sutured Multi-layer membrane during mechanical assessment.

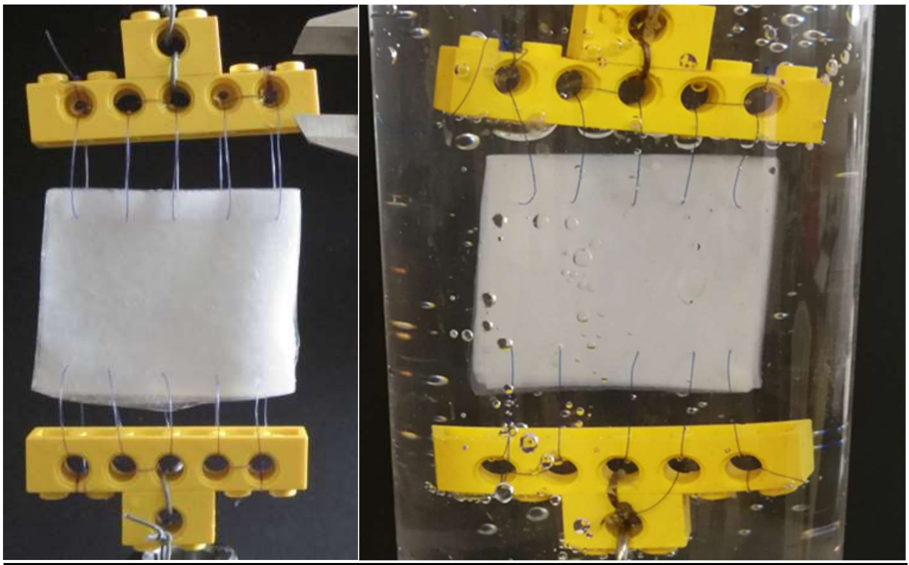


Supplementary Figure S7. A representative vertical (left) and horizontal (b) stress-strain curves of the sutured "C Arrangement" multi-layer PVA membranes (Green arrows: layer tearing).

Supplementary Figure S8. Hydrogel PVA membrane mechanical assessment.



Supplementary Figure S9. Stress-strain curves of an electrospun membrane (vertical sample) and a bulk hydrogel.

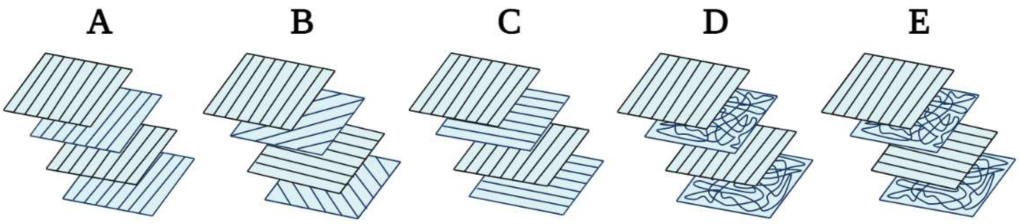


Supplementary Figure S10. Suturability of electropsun PVA membranes.

Staristical Analysis

Supplementary Table S1: Explanation of the significance levels calculated using unpaired t-test anaylsis.

Interpretation of significance levels		
significant	p < 0.0001	
	p < 0.0005	
	p < 0.001	
	p < 0.005	
	p < 0.05	
not significant	p > 0.05	



Supplementary Table S2: Analysis of the multilayered vertical samples.

Multilayered vertical samples					
	A	B	C	D	E
A					
B					
C					
D					
E					

Supplementary Table S3: Analysis of the multilayered horizontal samples.

Multilayered horizontal samples					
	A	B	C	D	E
A					
B					
C					
D					
E					

Supplementary Table S4: Analysis of the multilayered, sutured vertical samples.

Multilayered, sutured vertical samples					
	A	B	C	D	E
A					
B					
C					
D					
E					

Supplementary Table S5: Analysis of the multilayered, sutured horizontal samples.

Multilayered, sutured horizontal samples					
	A	B	C	D	E
A					
B					
C					
D					
E					