Supplementary file

2D-WAXS correlation calculation of CN+HAMA hydrogels:

Two types of orientation factors, π: the degree of orientation, f: the Herman's order parameter. The Herman's order parameter are calculated from the azimuthal intensity distribution profiles according to Equations (1-4)[1, 2]. π was calculated by the Equations (1). FWHM: the full width at half maximum for the azimuthal peak. The distribution of intensity (I) with respect to (ϕ) along the 360° circle, defined by 2θ=21.0-22.3°

π: the degree of orientation

f: Herman's order parameter

FWHM: full width at half maximum

f=1: maximum orientation of CN+HAMA

f=0: random orientation of CN+HAMA

$$\pi = \frac{180 - FWHM}{180} \quad (1)$$

$$f = \frac{3\langle \cos^2 \gamma \rangle - 1}{2} \quad (2)$$

where,

$$\langle \cos^2 \gamma \rangle = 1 - 2\langle \cos^2 \theta \rangle \quad (3)$$

and

$$\langle \cos^2 \theta \rangle = \frac{\int I(\phi) \cos^2 \phi \ \sin \phi \ d\phi}{\int I(\phi) \sin \phi \ d\phi} \quad (4)$$

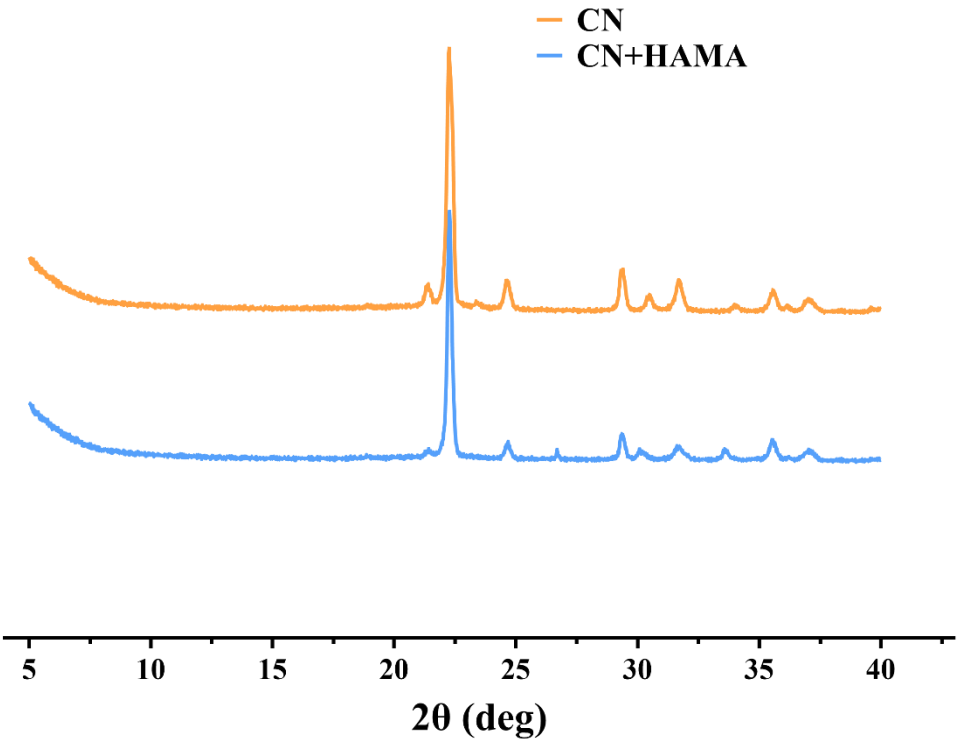

Figure S1. XRD pattern of CN, CN+HAMA hydrogels were scanned in 2θ range of 5–40◦. From the obtained diffraction pattern of the high intensity peak was noticed at 2θ = 22.8°

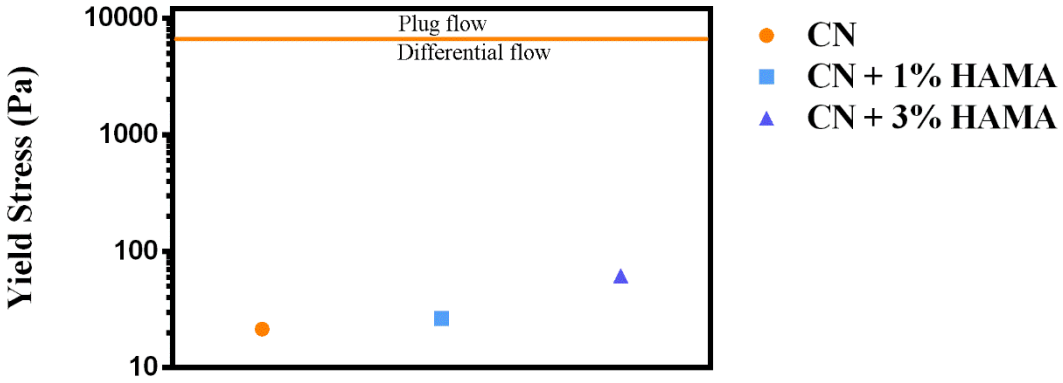

Figure S2. Yield stress of the hydrogels (CN, CN+1%HAMA and CN+3%HAMA), while the orange line (6460Pa) represents the maxium stress applied on the nozzle.

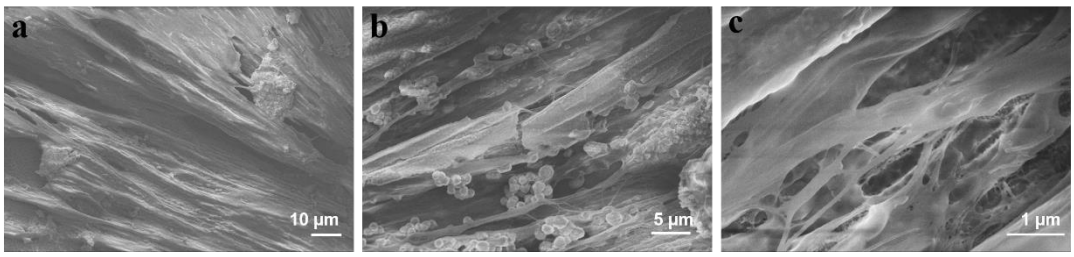

Figure S3. SEM images of (a) surface of CN+1%HAMA hydrogels, (b, c) the inner structures of CN+1%HAMA hydrogels.

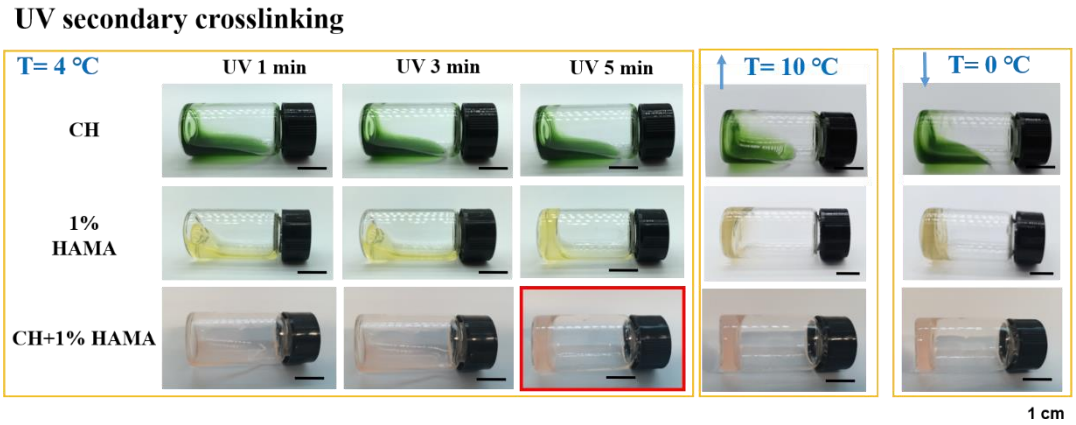

Figure S4. Image of the state of the hydrogel after being irradiated with UV light and changing the ambient temperature.

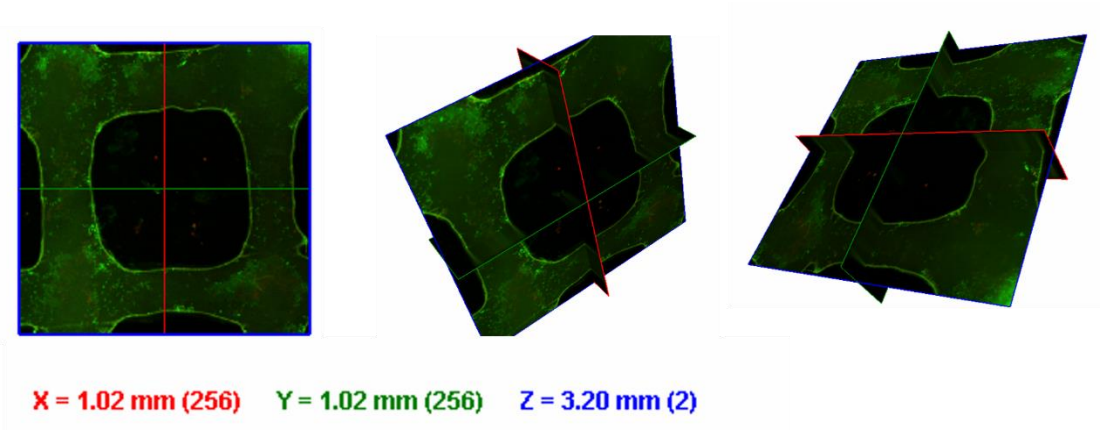

Figure S5. Sectional view of fluorescence image of printed scaffold seeded with L929 cells with live/dead stain.

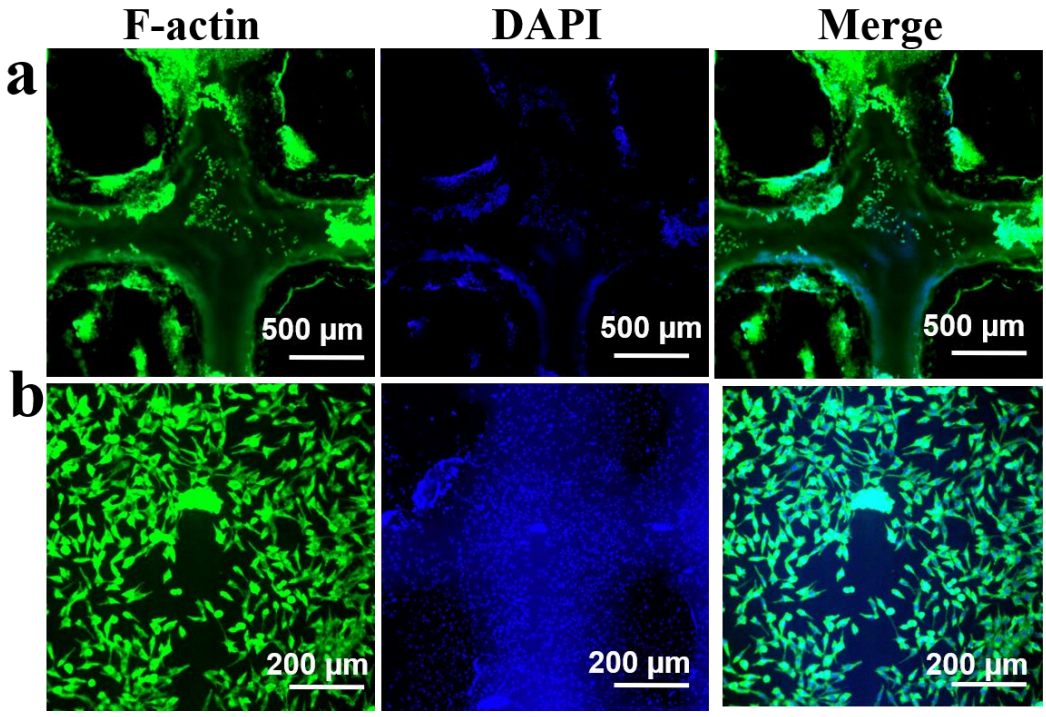

Figure S6. Fluorescence images of hydrogel seeded with L929 cells with F-actin and nuclei.

References

[1] Bordel D, Putaux JL, Heux L. Orientation of native cellulose in an electric field. Langmuir : the ACS journal of surfaces and colloids. 2006;22:4899-901.

[2] Fourmann O, Hausmann MK, Neels A, Schubert M, Nystrom G, Zimmermann T, et al. 3D printing of shape-morphing and antibacterial anisotropic nanocellulose hydrogels. Carbohydrate polymers. 2021;259:117716.