Supporting information:

3D Printing of Cell-Laden Electroconductive Bioink for Tissue Engineering Application

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1. Formulation of the bioink

Table S1 summarized the prepared formulation of MC/κCA/PEDOT:PSS inks in total 4 ml solution.

Table S1: Formulation of prepared MC/κCA/PEDOT:PSS inks in total 4 ml solution

Sample code	MC(mg)	κCA(mg)	PEDOT:PSS(μl)
MC-4/κCA-1	160	40	0
MC-6/κCA-1	240	40	0
MC-8/κCA-1	320	40	0
MC-4/κCA-1.5	160	60	0
MC-6/κCA-1.5	240	60	0
MC-8/κCA-1.5	320	60	0
MC-8/κCA-1/PEDOT:PSS-0.1	320	60	307
MC-8/κCA-1/PEDOT:PSS-0.3	320	60	923

2. Linear viscoelastic region of MC/κCA hydrogel

Figure S1 presents the evolution of the G' value over frequency range 0.01-100% to determine the linear viscoelastic regions. As seen, the G' value remain unchanged up to 1% strain followed by continuous fall. Accordingly, all oscillatory rheological experiments were conducted in 1 % stain.

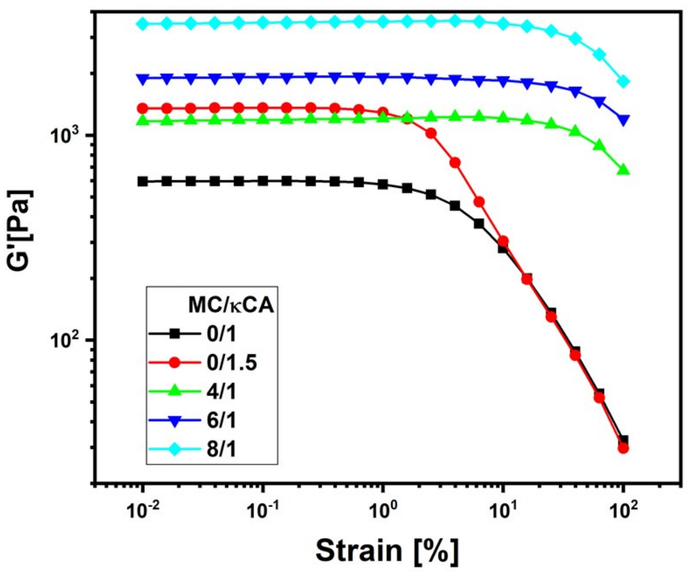

Figure S1: Change in the G' value over strain sweep from 0.01 % to 100 %

3. **Rheological measurements of MC/κCA-1.5 in extrusion stage**

Figure S2 provide the evolution of the G' and G'' over shear stress sweep and flow curve of MC/κCA with 1.5 wt.% κCA component. As seen, an increase in the MC concentration cause yield stress shift toward higher values. In addition, flow curves jump to higher values upon increase in the MC content.

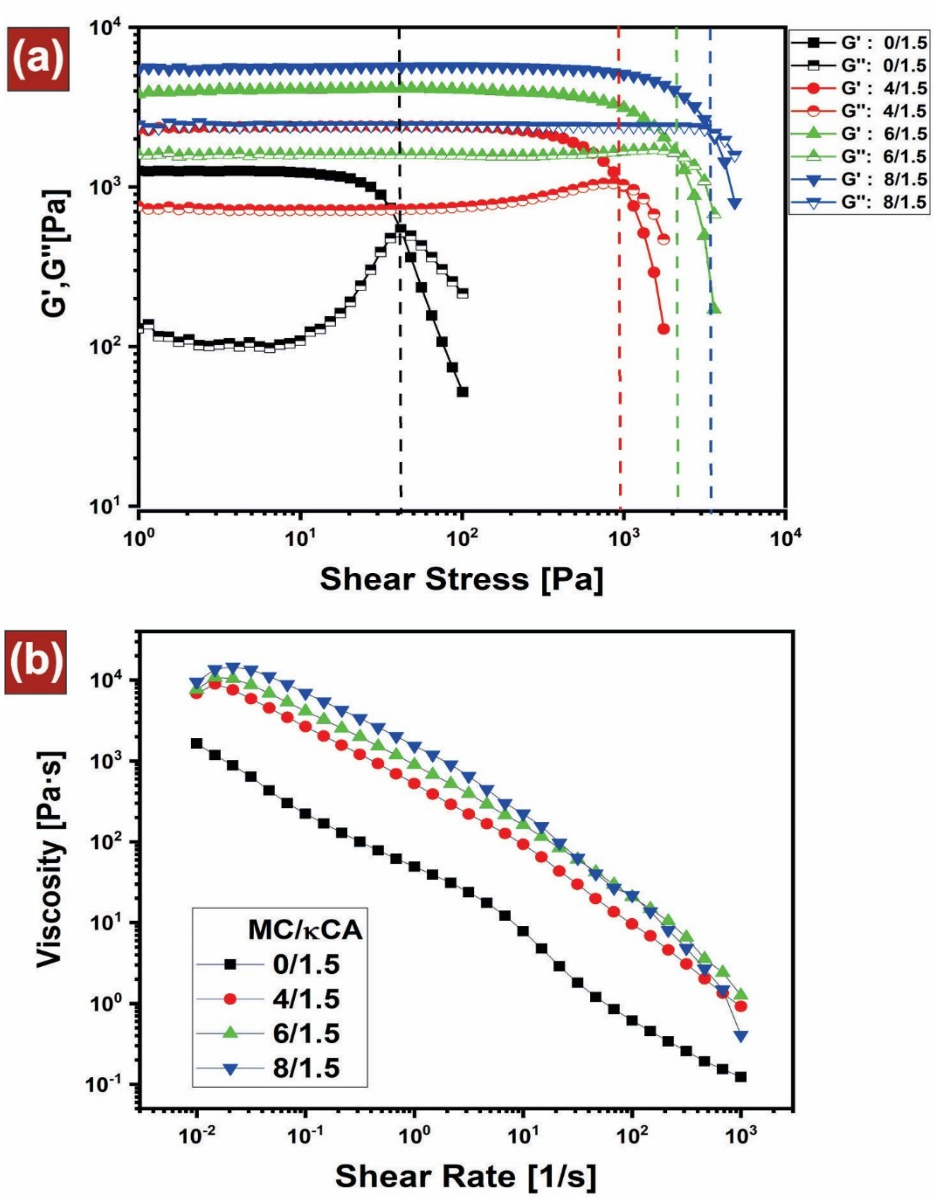

Figure S2. Rheological characterization of MC/κCA with 1.5 wt.% κCA in extrusion stage.

(a) yield stress determination (b) flow curve

4. **Rheological measurements of MC/κCA-1.5 in recovery stage**

Figure S3 provides the recoverability of MC/κCA hydrogel with 1.5 wt.% κCA component by applying alternating low and high strain and shear rate. As seen, almost full recovery occurs for all prepared MC/κCA-1.5 hydrogels after removing of high strain (**Figure S3 a**). In addition, viscosity of MC/κCA-1.5 hydrogels declined significantly immediately after application of high shear rate and then recovered in a short time (**Figure S3 b**).

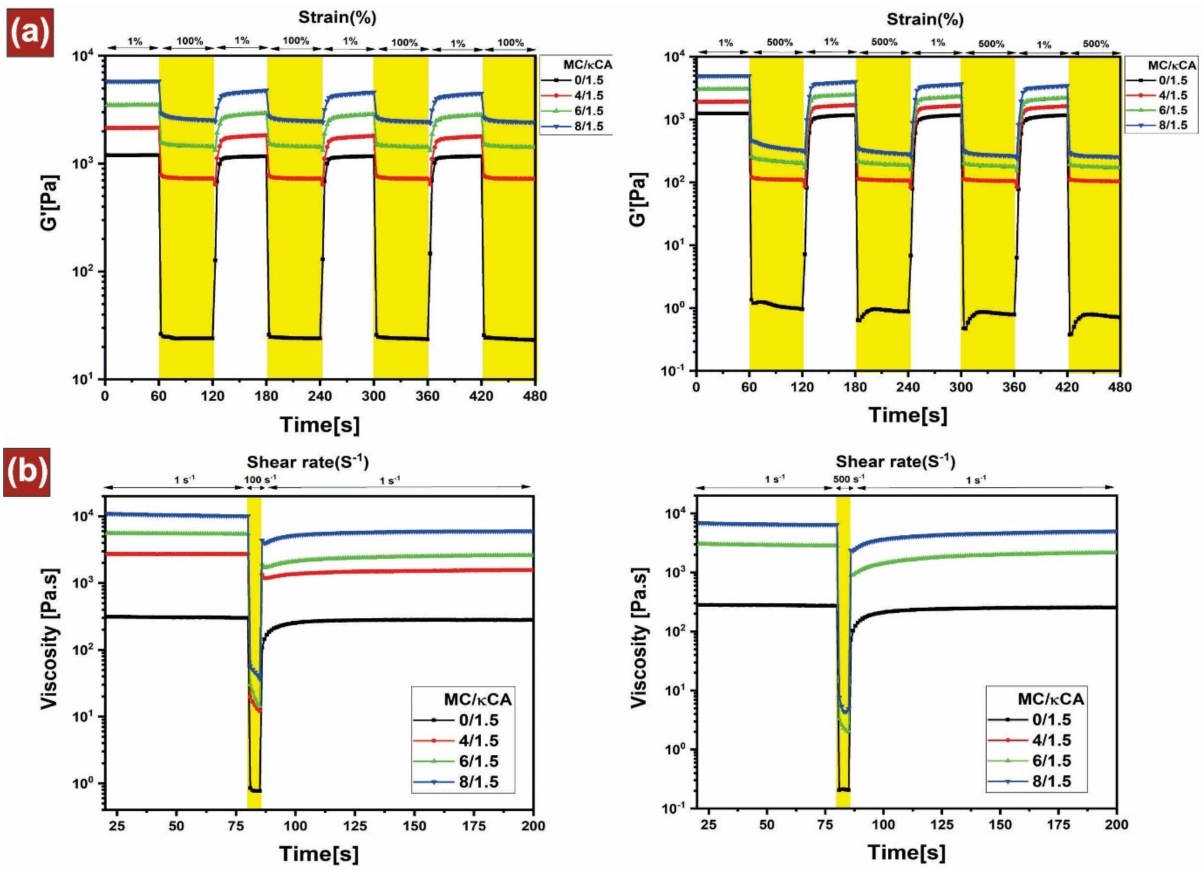

Figure S3. Rheological characterization of MC/κCA with 1.5 wt.% κCA in recovery stage. (a) change of G' upon applying repetetive low (1%) and high strains (100% left panel, 500 % right panel) and (b) Variation of visosity over low (1 s^{-1}) and high shear rate (100 s^{-1} left panel, 500 s^{-1} right panel)

5. **Rheological measurements of MC/κCA-1.5 in shape retention stage**

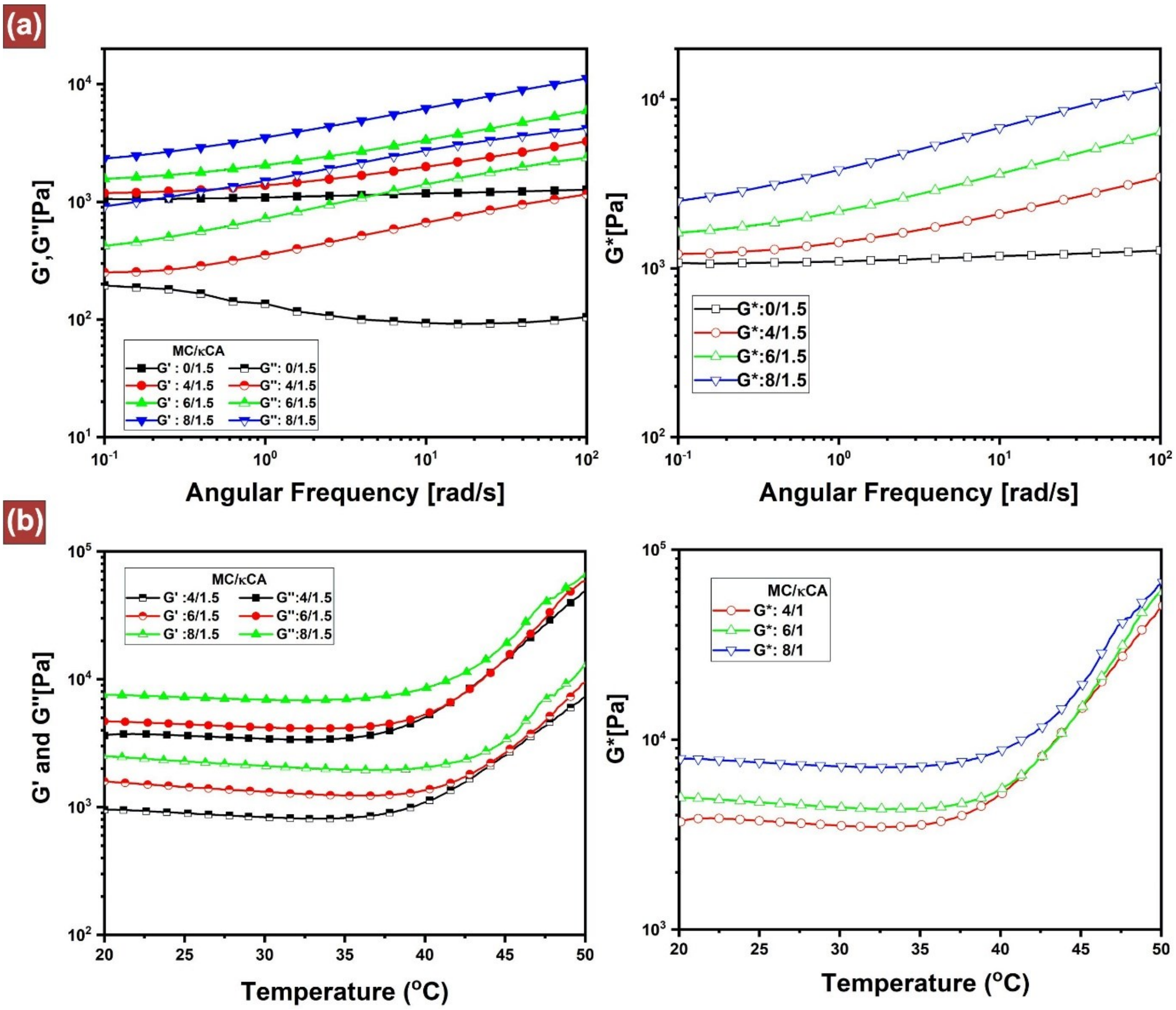

Figure S4. Rheological characterization of MC/κCA with 1.5 wt.% κCA in shape retention stage. Change of G',G'', and G* over (a) frequency sweep from 0.1 Hz to 100 Hz , and (b) tempeartuire ramp from 20 °C to 50 °C,

6. Electrical conductivity of the printed and bulk hydrogel

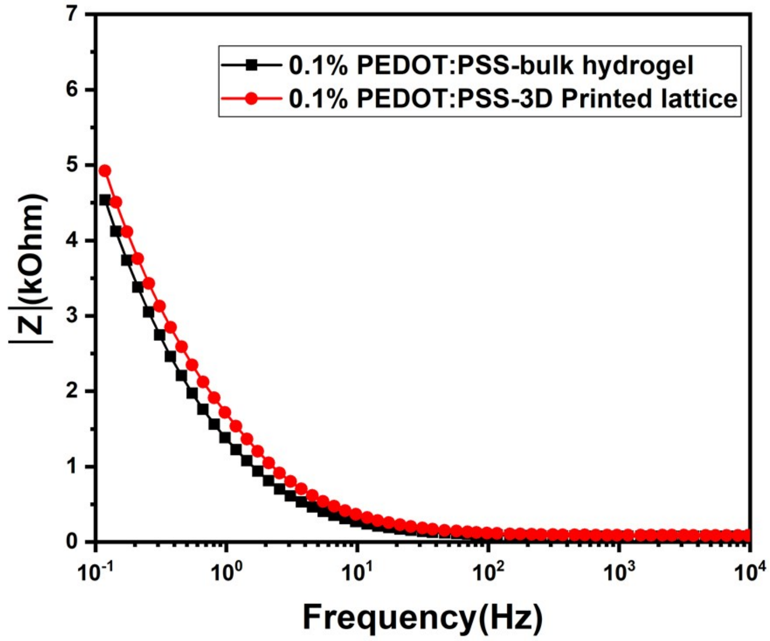

Figure S5: Electrical conductivity of the printed and bulk hydrogel containing 0.1 wt.% PEDOT:PSS conductive polymer

7. Collapse of 3D printed structurs by MC-8 hydrogel

Figure S6 presnts the hexagonal and circular shapes printed by MC-8 hysfogel. As seen, these strustures collapsed after few layer of deposition due to the low shape-retention behaviour.

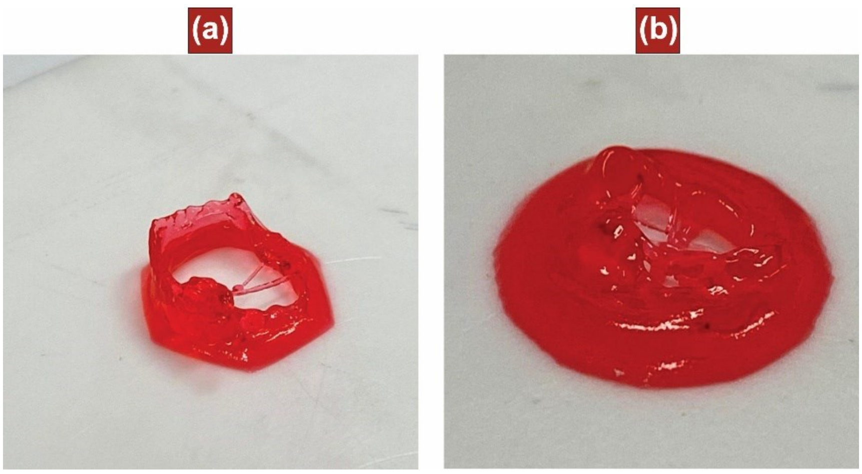

Figure S6. Pictures of 3D printed constructs with MC-8, which collapsed after few layers of deposition. (a) Hexagonal shape, (b) circular shape

8. Swelling of the 3D printed lattice construct

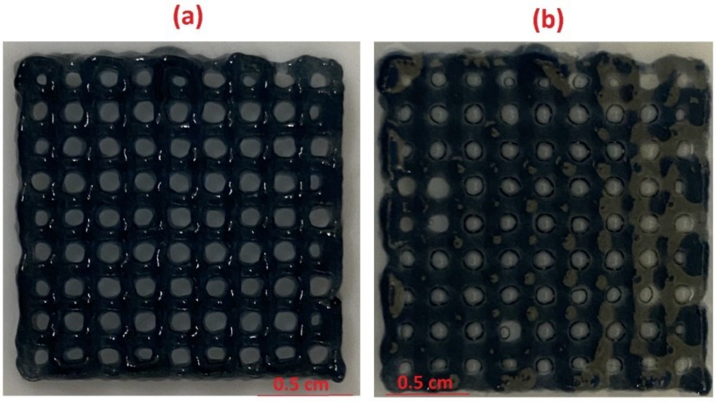

Figure S7: Pictures of 3D printed lattice construct by MC-8/κCA-1/PEDOT:PSS-0.1 ink (a) before and (b) after swelling