Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting information

Tough, anti-drying and thermoplastic hydrogels consisting of biofriendly resources for wide linear range and fast response strain sensor

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Table S1. Compositions of PVA-CS-PA hydrogels.

Sample	PVA (g)	CS (g)	PA (mL)	H_2O (mL)
PVA-CS-2PA-3	1.40	0.28	2	3
PVA-CS-3PA-2	1.40	0.28	3	2
PVA-CS-4PA-1	1.40	0.28	4	1

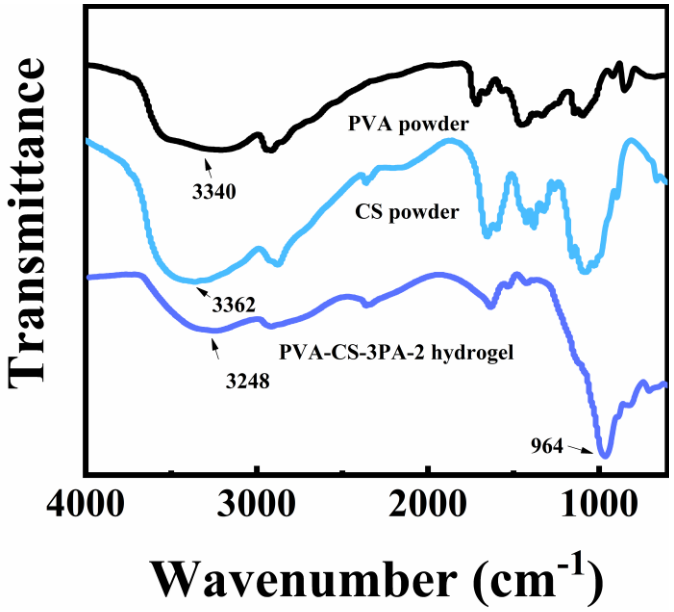

Fig. S1. FTIR spectra of the PVA powder, CS powder and PVA-CS-3PA-2 hydrogel.

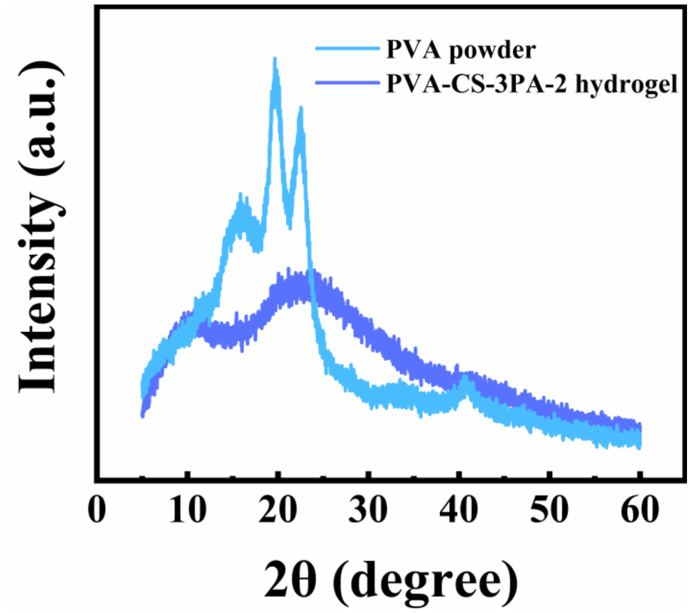

Fig. S2. XRD spectra of the PVA powder and the PVA-CS-3PA-2 hydrogel.

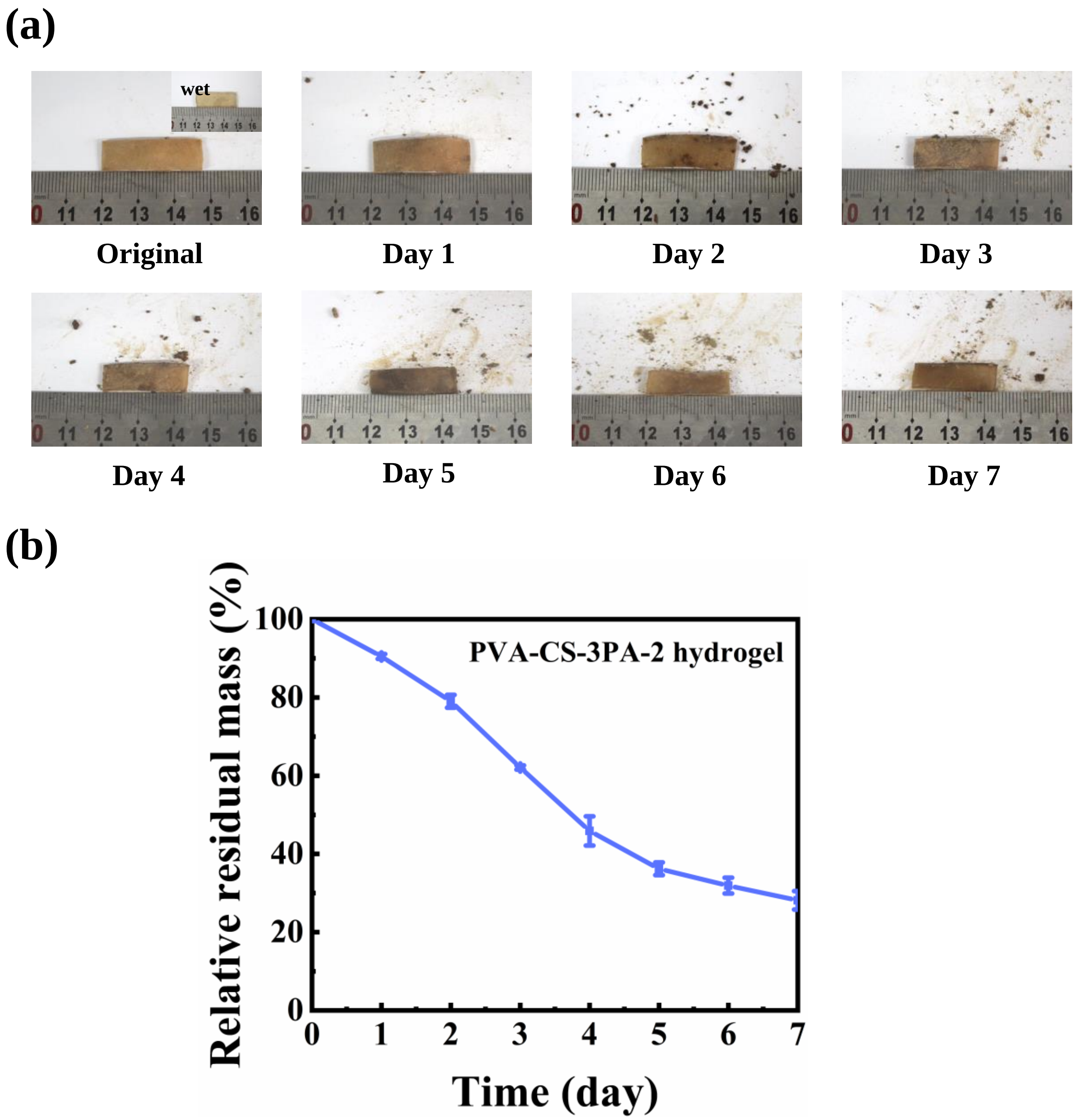

Fig. S3. (a) Biodegradation images of PVA-CS-3PA-2 hydrogels. (b) Degradation degree of the PVA-CS-3PA-2 hydrogel in soil.

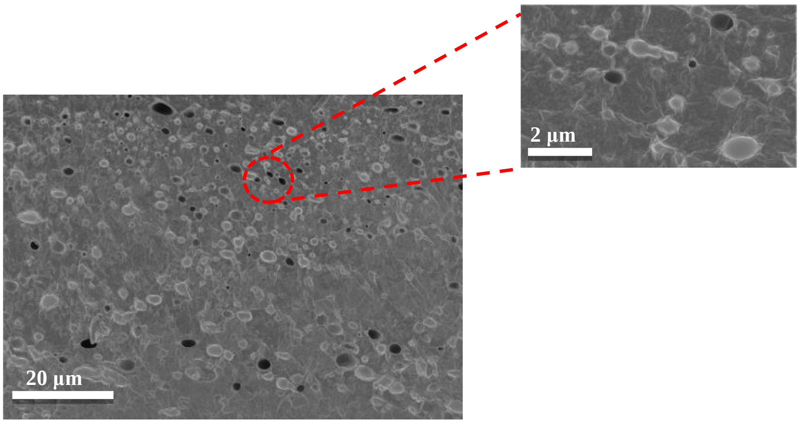

Fig. S4. SEM images of PVA-CS-3PA-2 hydrogel.

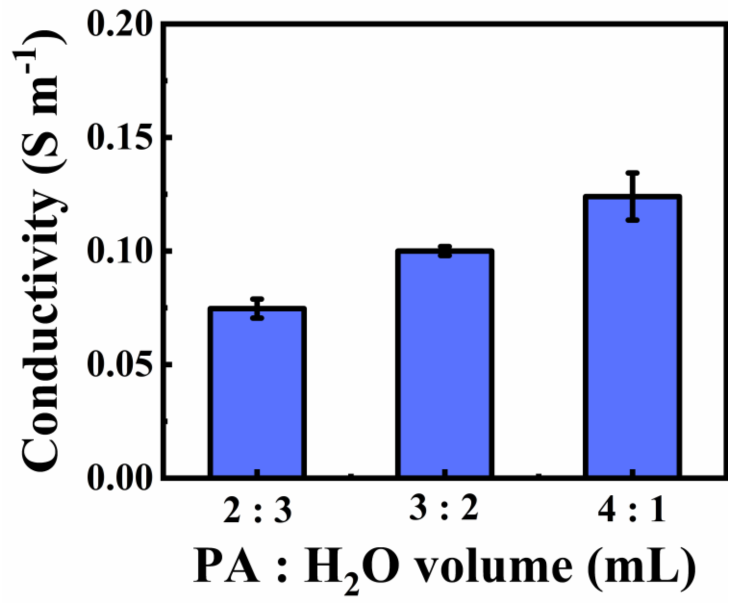

Fig. S5. The conductivity of PVA-CS-PA hydrogels with different volume ratios of PA: H_2O.

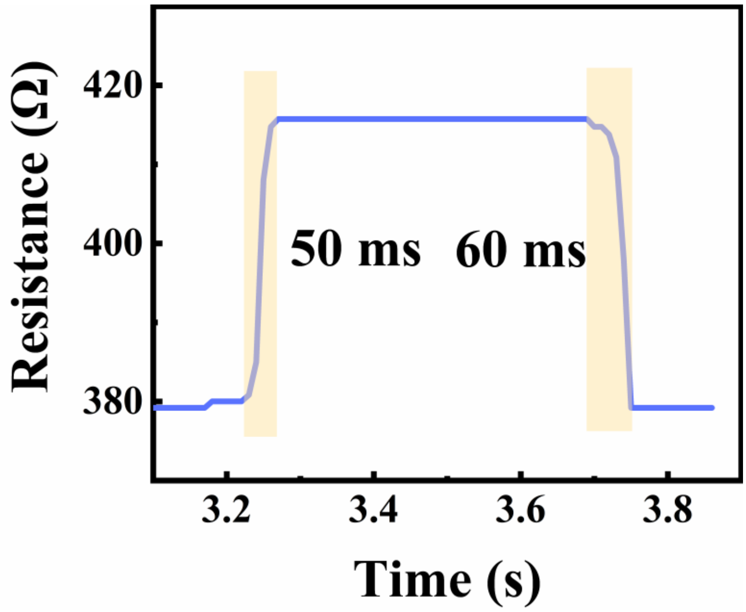

Fig. S6. The real resistance of PVA-CS-3PA-2 hydrogel sensor response time and recovery time at 10% strain.

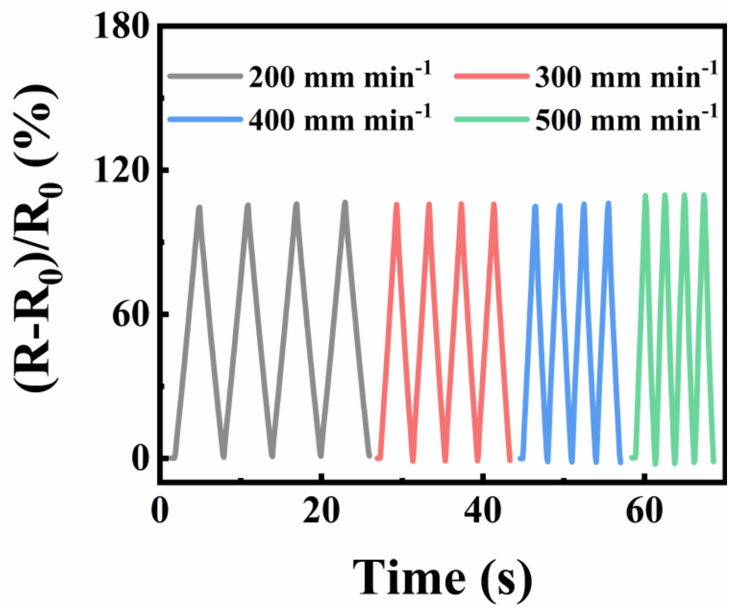

Fig. S7. Relative resistance changes of PVA-CS-3PA-2 hydrogel sensors under 100 % strain at various stretching rate.

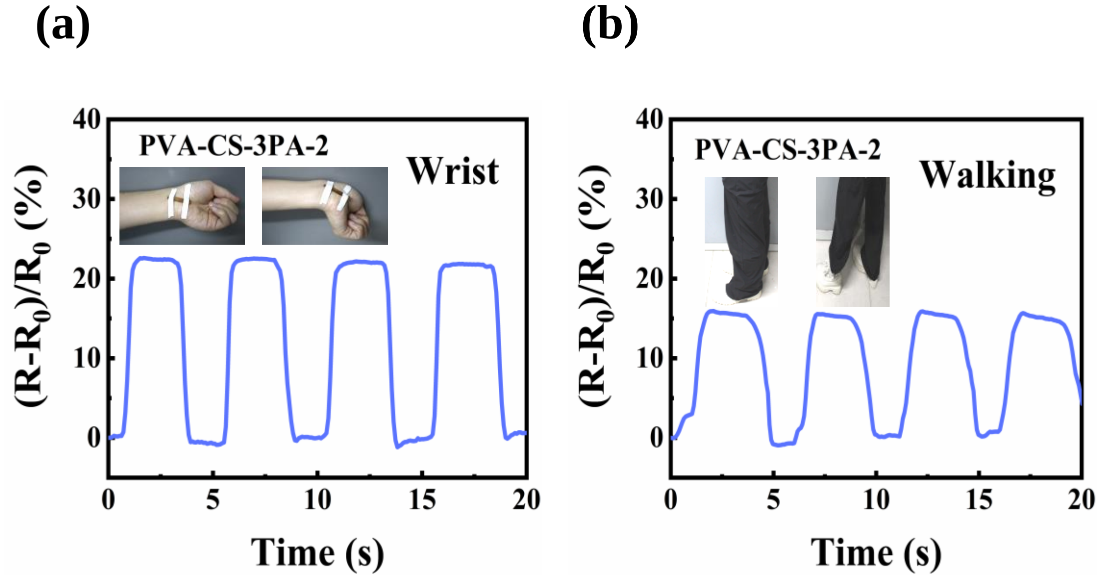

Fig. S8. Relative real-time resistance signals of the hydrogel sensor in response to human motions, including (a) wrist bending, and (b) slow walking.

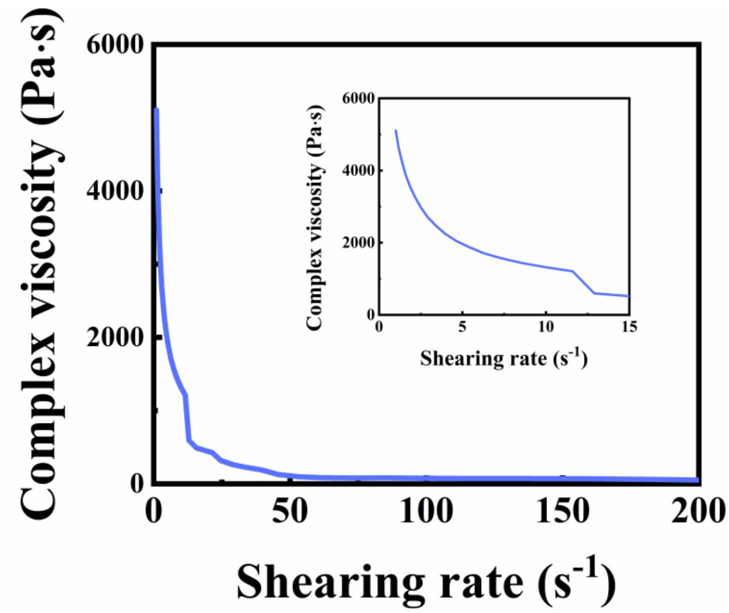

Fig. S9. Variation of viscosity of PVA-CS-3PA-2 hydrogel as a function of shear rate under a strain of 1.25% at 70 °C.

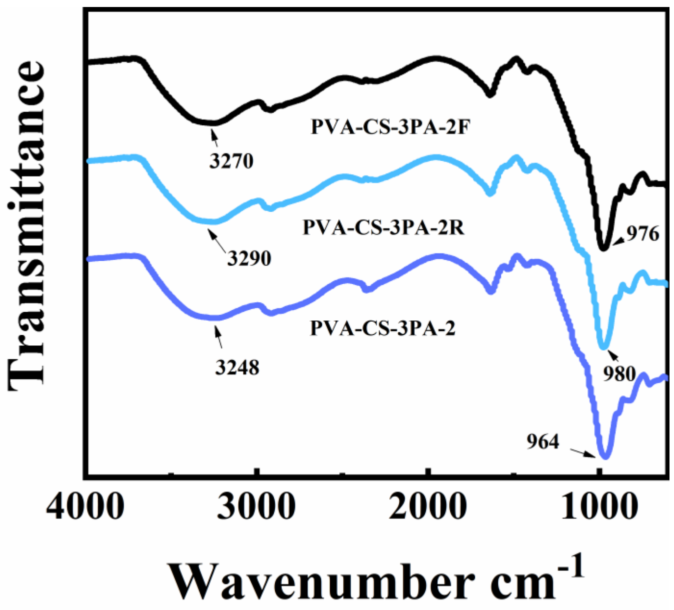

Fig. S10. FTIR spectra of the PVA-CS-3PA-2, PVA-CS-3PA-2R, and PVA-CS-3PA-2F hydrogels.

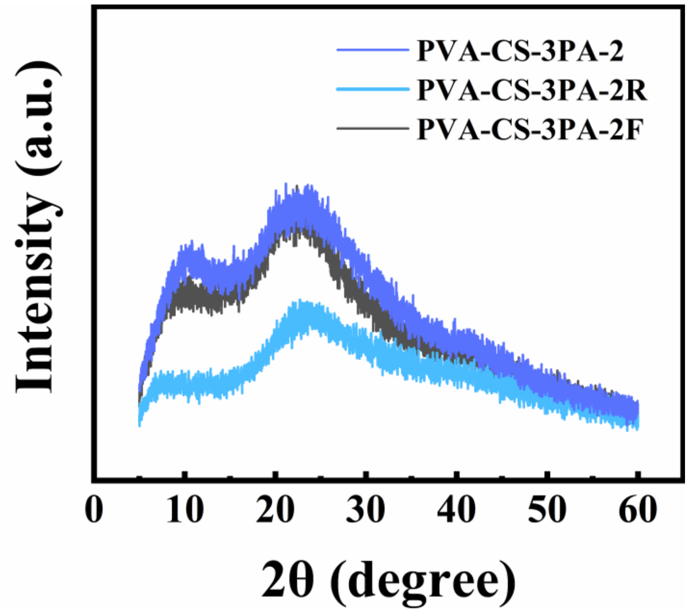

Fig. S11. XRD spectra of the PVA-CS-3PA-2, PVA-CS-3PA-2R, and PVA-CS-3PA-2F hydrogels.

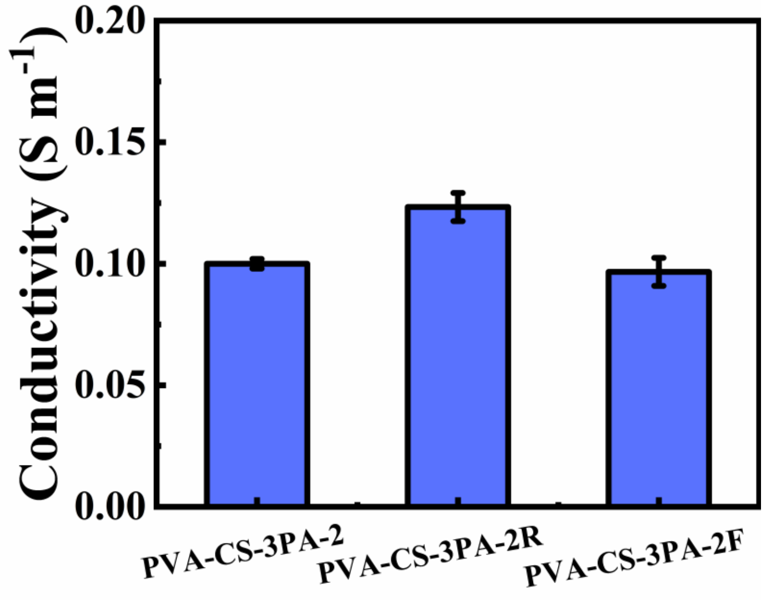

Fig. S12. The conductivity of the PVA-CS-3PA-2, PVA-CS-3PA-2R, and PVA-CS-3PA-2F hydrogels.

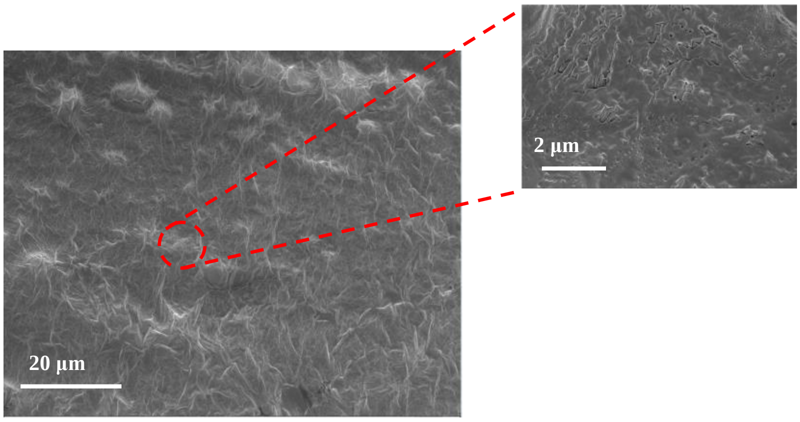

Fig. S13. SEM images of PVA-CS-3PA-2R hydrogel.

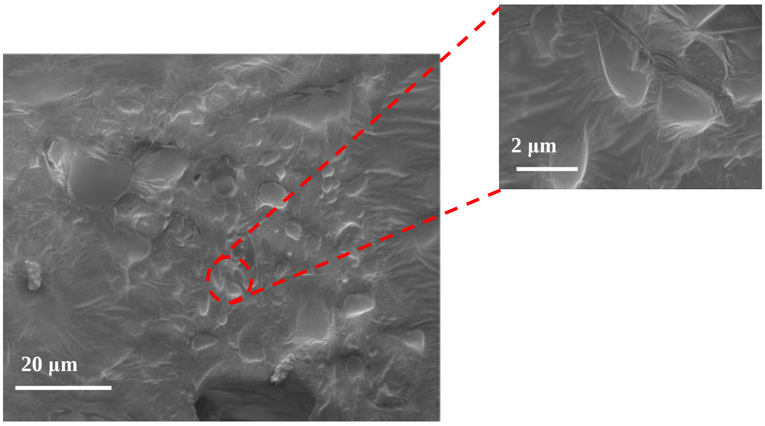

Fig. S14. SEM images of PVA-CS-3PA-2F hydrogel.

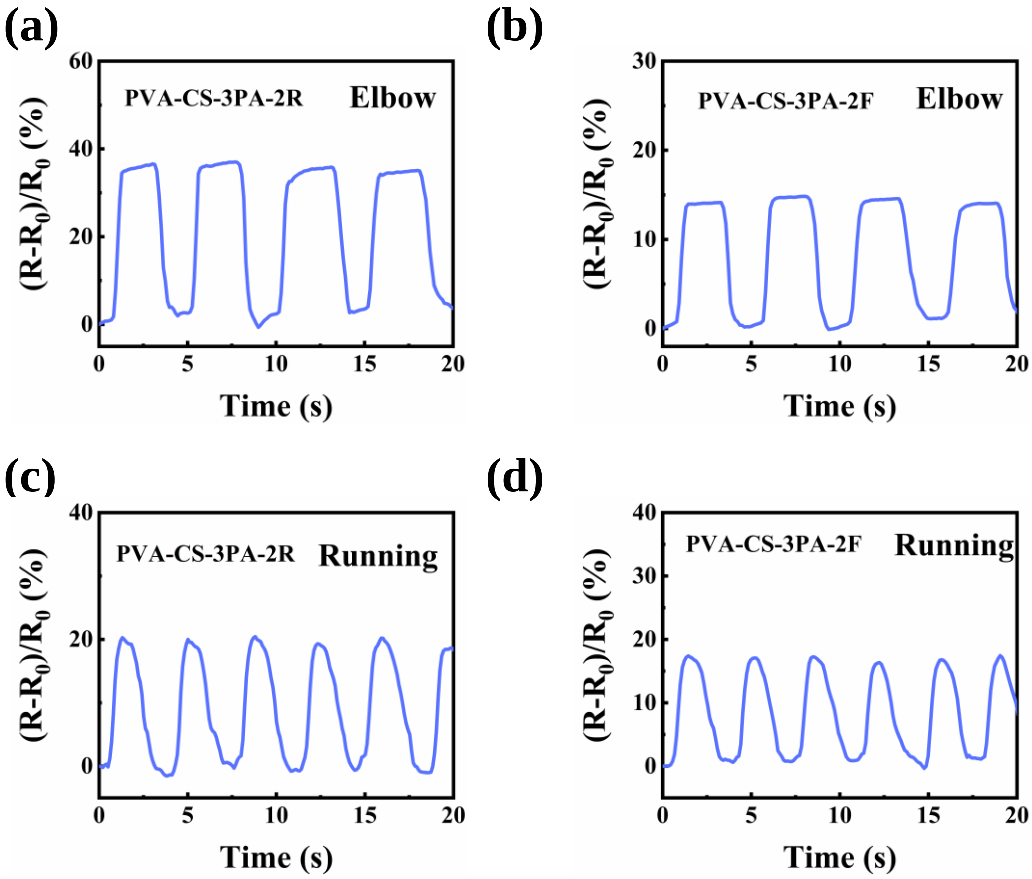

Fig. S15. Relative real-time resistance signals of PVA-CS-3PA-2R and PVA-CS-3PA-2F hydrogel-based strain sensors during (a-b) elbow bending and (c-d) running.

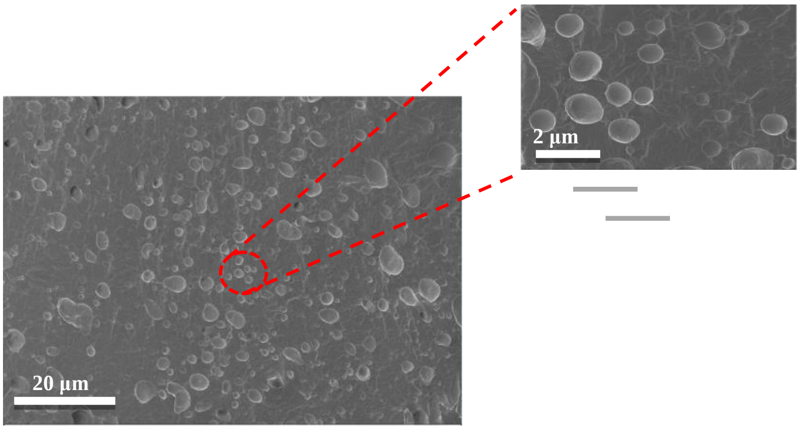

Fig. S16. SEM images of PVA-CS-3PA-2 hydrogel after being stored for 35 days.

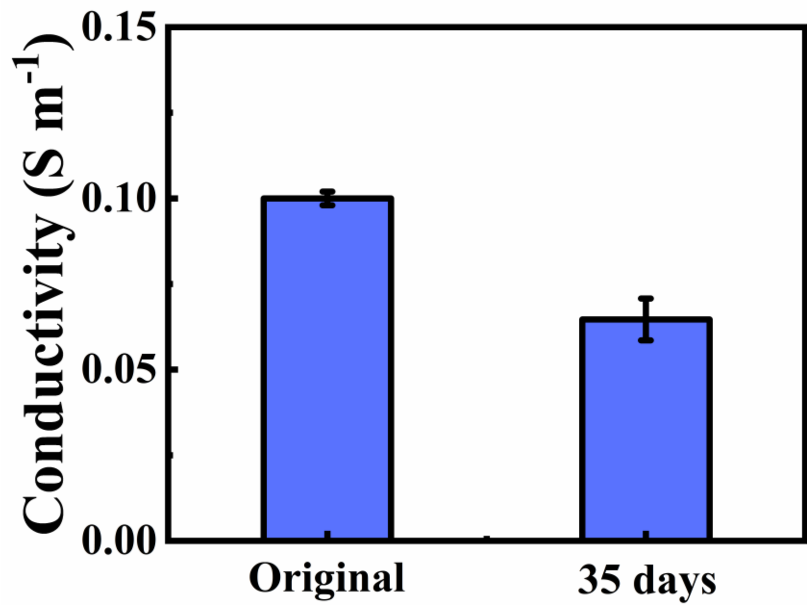

Fig. S17. The conductivity of PVA-CS-3PA-2 hydrogel before and after being stored for 35 days at 25 ℃.

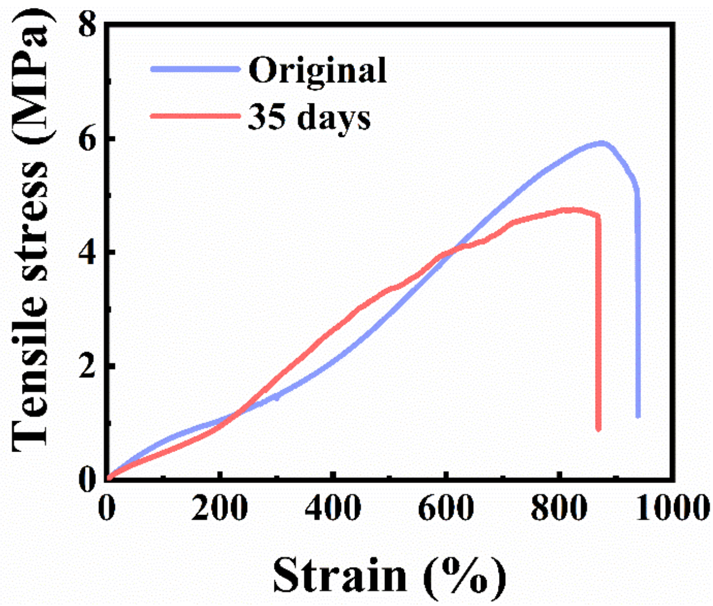

Fig. S18. The tensile stress-strain curves of PVA-CS-3PA-2 hydrogel before and after being stored for 35 days at 25 °C.

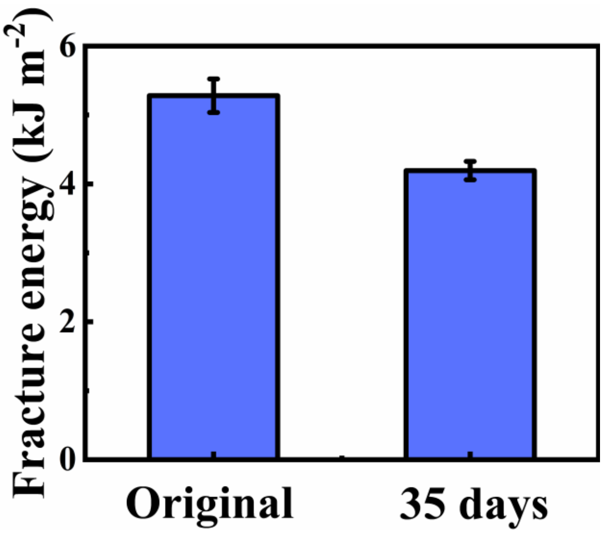

Fig. S19. The fracture energy of PVA-CS-3PA-2 hydrogel before and after being stored for 35 days at 25 ℃.

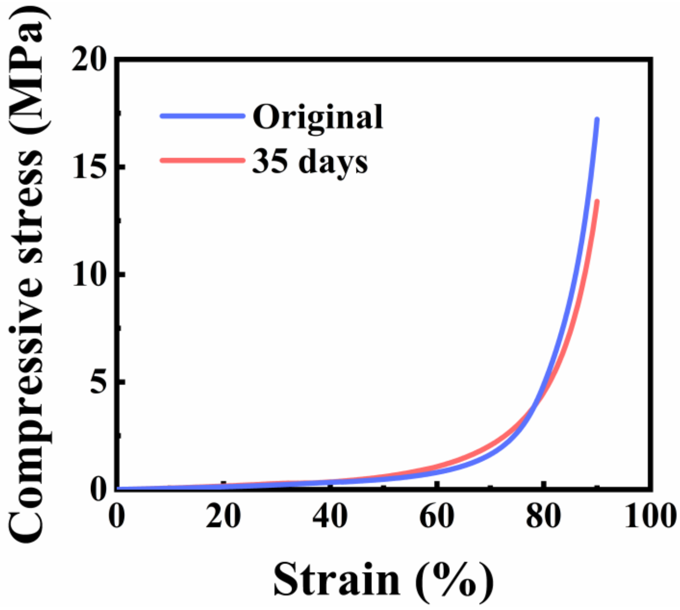

Fig. S20. The compressive stress-strain curves of PVA-CS-3PA-2 hydrogel before and after being stored for 35 days at 25 ℃.

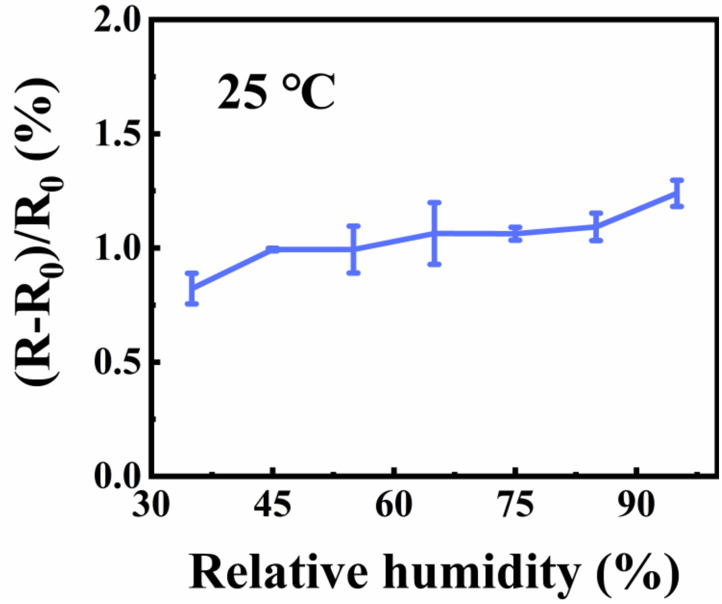

Fig. S21. Relative resistance changes of PVA-CS-3PA-2 hydrogel sensor under various relative humidity.

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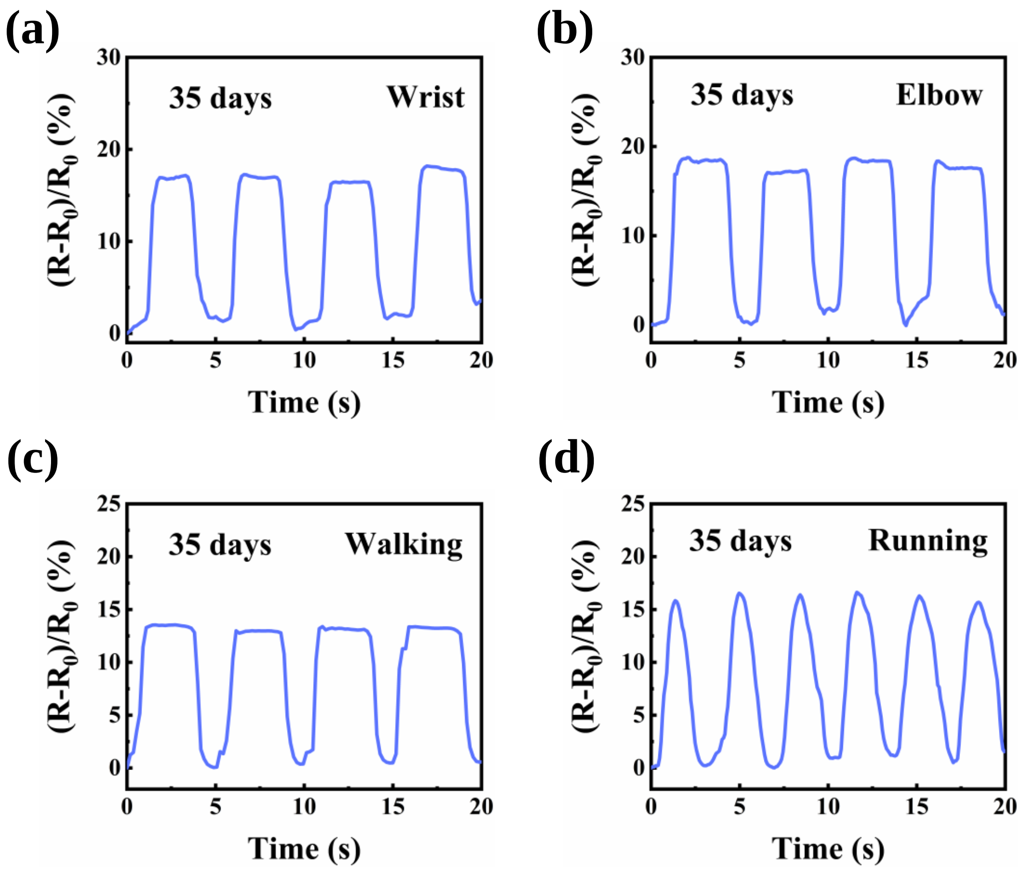

Fig. S22. Relative real-time resistance signals of the hydrogel sensor after 35 days storage in response to human motions, including (a) wrist bending, (b) elbow bending, (c) walking and (d) running.

Table S2. A comparison on the strain sensing range, gauge factor and response time of this work with other hydrogel-based strain sensors.

Materials	Strain sensing range (%)	Gauge factor	Response time (ms)/Strain (%)		Ref.
PGA hydrogel	0-100	2.14	NA		1
PVA/EMImAc/H_2O/Mg(II) hydrogel	0-60, 60-120	2.61 1.69	NA		2
VP/PP/ZP/Al^{3+} hydrogel	5-50, 50-300, 300-500, 500-700	1.27 1.73 2.46 3.07	NA		3
SSS-[BMIM]Cl hydrogel	0-200, 200-500, 500-800	1.07 1.28 1.76	NA		4
PGB-LCNF@GP hydrogel	0-500, 500-1000	1.17 3.24	NA		5
PVA/PA/NH_2-POSS hydrogel	0-125	3.44	220	NA	6
PVA-CNF organohydrogel	0-100， 100-300	0.96 1.57	130	NA	7
SICH hydrogel	0-300	1.1	80	200	8
PAAm-Ferritin hybrid hydrogel	0-30, 30-150, 150-300	0.55 1.94 2.06	470	NA	9
PNA/PVP/TA/F^{3+} hydrogel	0-300	3.61	265	NA	10
TA@HAP NWs-PVA(W/EG) hydrogel	0-350	2.84	51	50	11
PAC-Zn organohydrogel	0-200, 200-400 300-500	1.128 1.486 6.56	200	1	12
PCP-8 hydrogel	0-600	0.9	310	50	13
PGBC-B organohydrogel	0-700	2.07	250	1	14
CNC/PAA hydrogel	0-65, 65-470, 470-850	0.57 1.03 1.65	290	NA	15
PVA-CS-3PA-2 hydrogel	0-900	1.77 (2.6 after being remolded)	50	10	This work

*NA = not available

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