Supplementary Information

Micellar-Incorporated Hydrogels with Highly Tough, Mechanoresponsive, and Self-Recovery Properties for Strain-Induced Color Sensors

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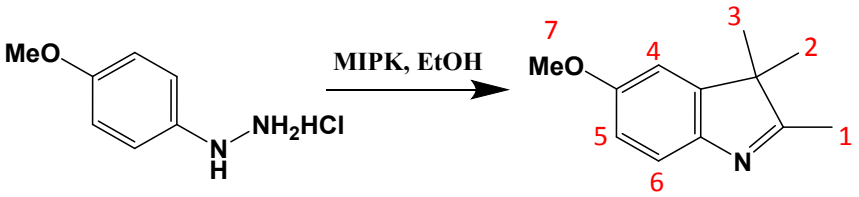
Table S1. Summary of the mechanical properties of poly(AM-*co*-MA/SP) hydrogels prepared at different conditions.

poly(AM-*co*-MA/SP)*	**Water content (wt%)**	**E (kPa)**	**σ_f (MPa)**	**ε_f (mm/mm)**	**W (MJ/m^3)**
MA_{10}-$SP_{0.2}$-AM_{40}	50	1.466	0.234	0.76	0.14
MA_{20}-$SP_{0.2}$-AM_{30}	50	0.710	0.373	3.55	0.87
MA_{25}-$SP_{0.2}$-AM_{25}	50	0.826	0.771	6.07	2.67
MA_{30}-$SP_{0.2}$-AM_{20}	50	0.692	0.859	5.97	2.70
MA_{40}-$SP_{0.2}$-AM_{10}	50	0.251	0.052	2.45	0.12
MA_{25}-$SP_{0.1}$-AM_{25}	50	0.556	0.271	5.88	1.12
MA_{25}-$SP_{0.2}$-AM_{25}	50	0.826	0.771	6.07	2.67
MA_{25}-$SP_{0.3}$-AM_{25}	50	1.074	1.083	6.01	3.46

* The poly(AM-*co*-MA/SP) hydrogel prepared at a MA:AM concentration ratio of 1:4 and 0.2 mol% SP is denoted as MA_{10}-$SP_{0.2}$-AM_{40} to identify the concentration of each component in the table.

Figure S1. ^{1}H NMR spectrum of Compound **1** ($CDCl_3$, 300 Hz)



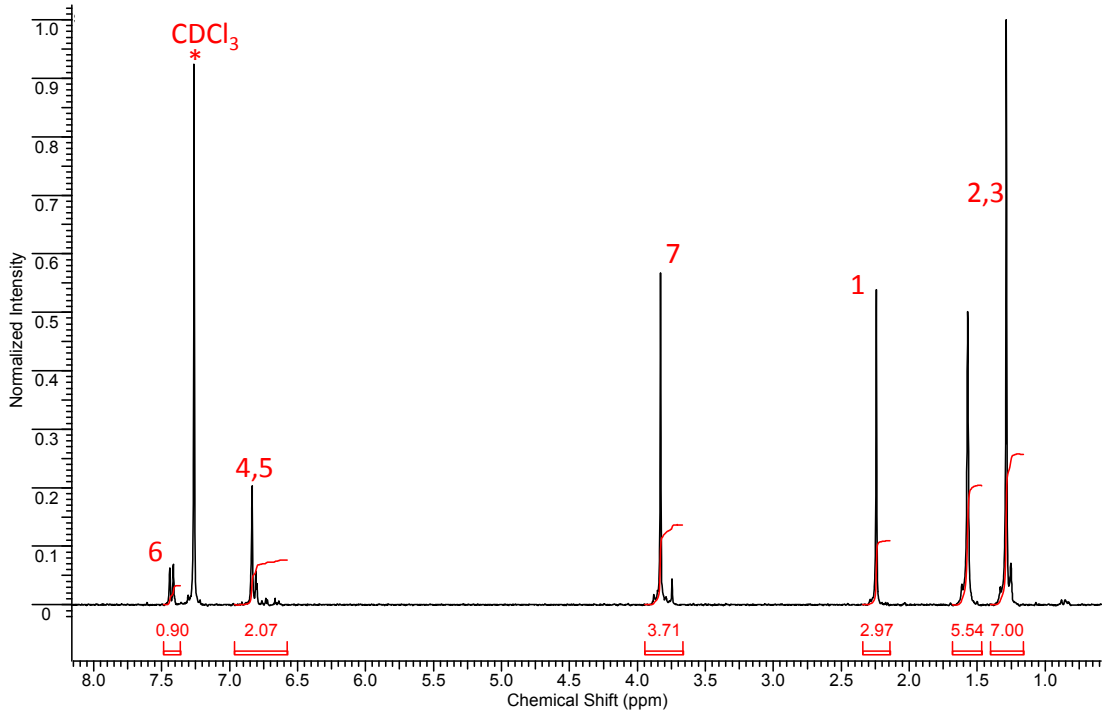
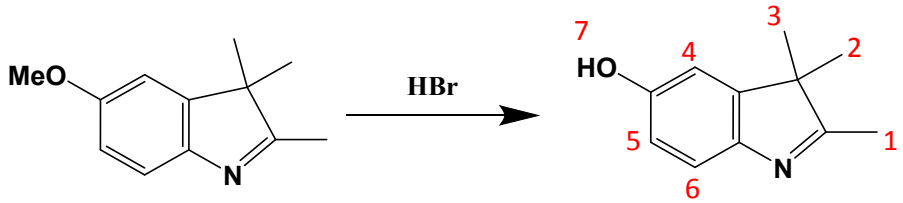


Figure S2. ^{1}H NMR spectrum of Compound **2** ($CDCl_3$, 300 Hz)



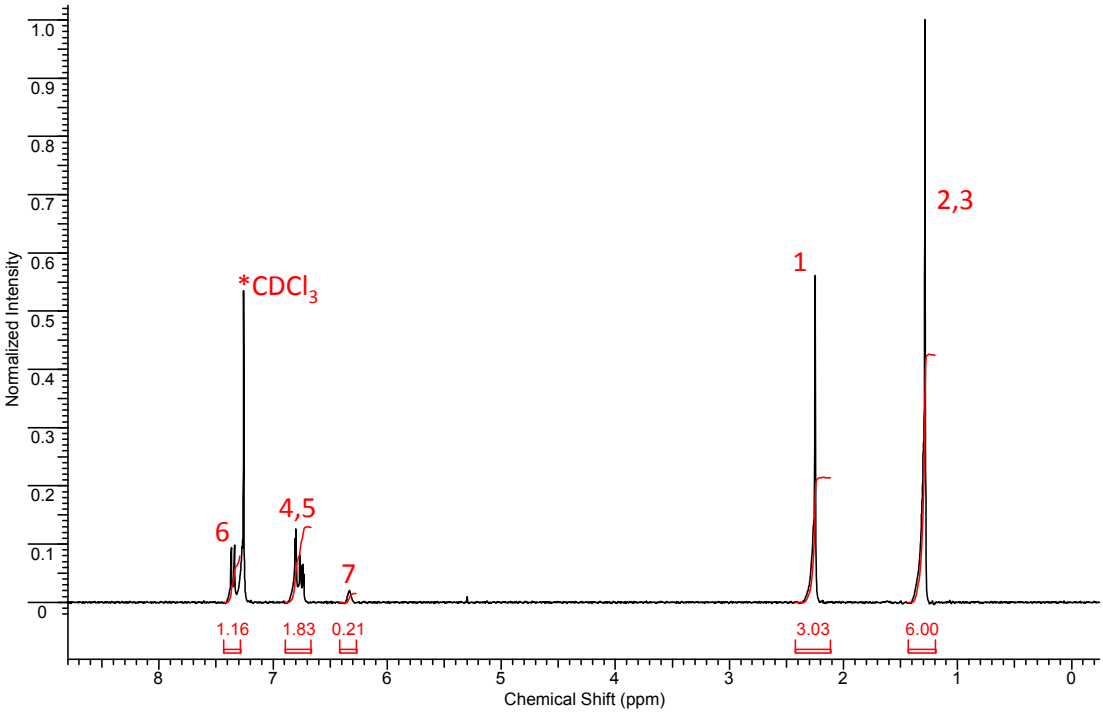
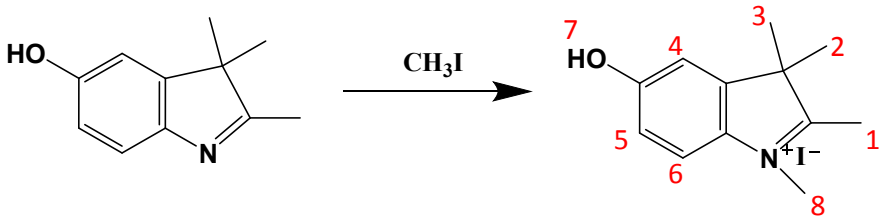


Figure S3. ^{1}H NMR spectrum of Compound **3** (DMSO-D_6, 300 Hz)



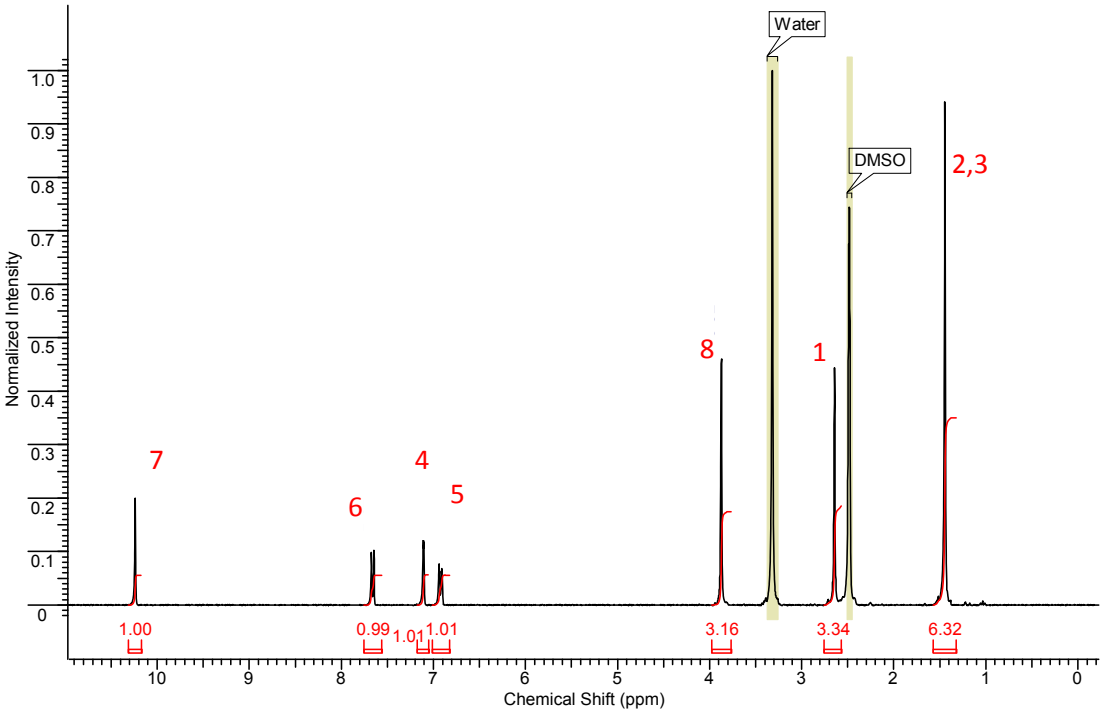
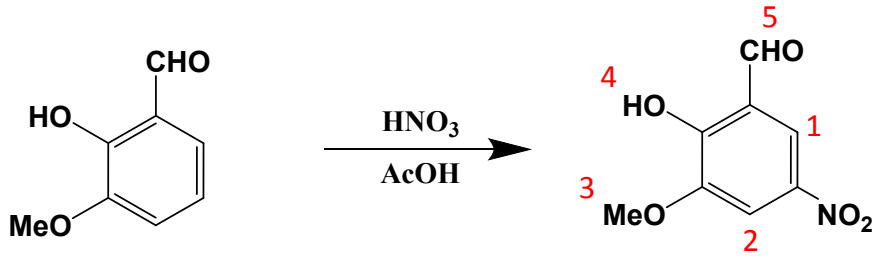


Figure S4. ^{1}H NMR spectrum of Compound **4** ($CDCl_3$, 300 Hz)



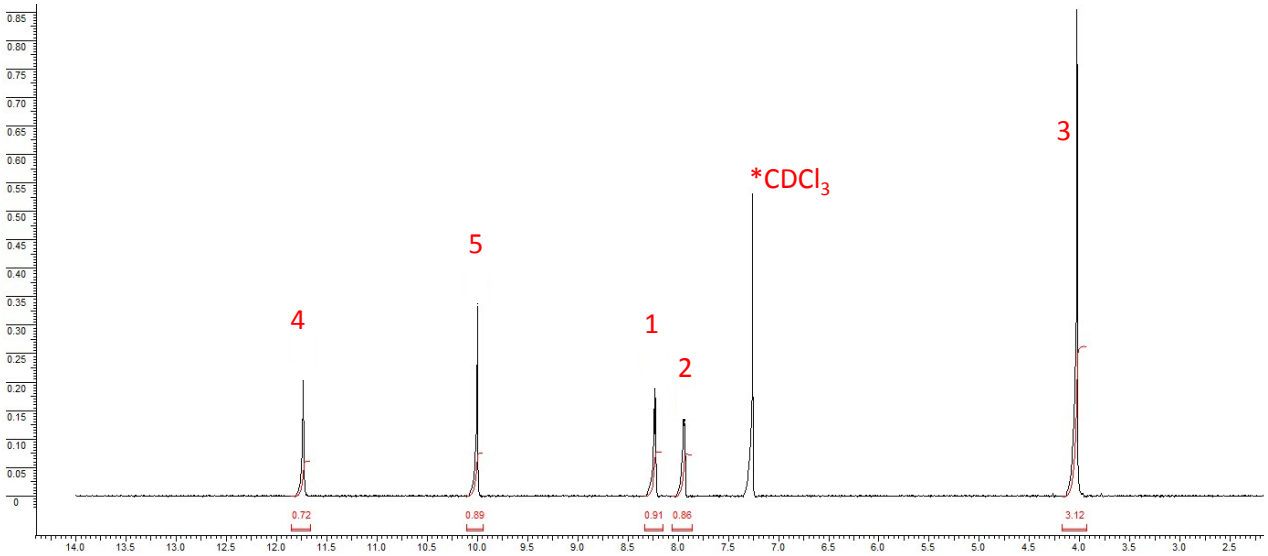
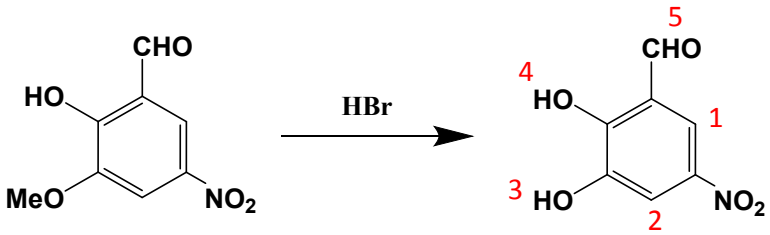


Figure S5. ^{1}H NMR spectrum of Compound **5** (Acetone-D_6, 300 Hz)



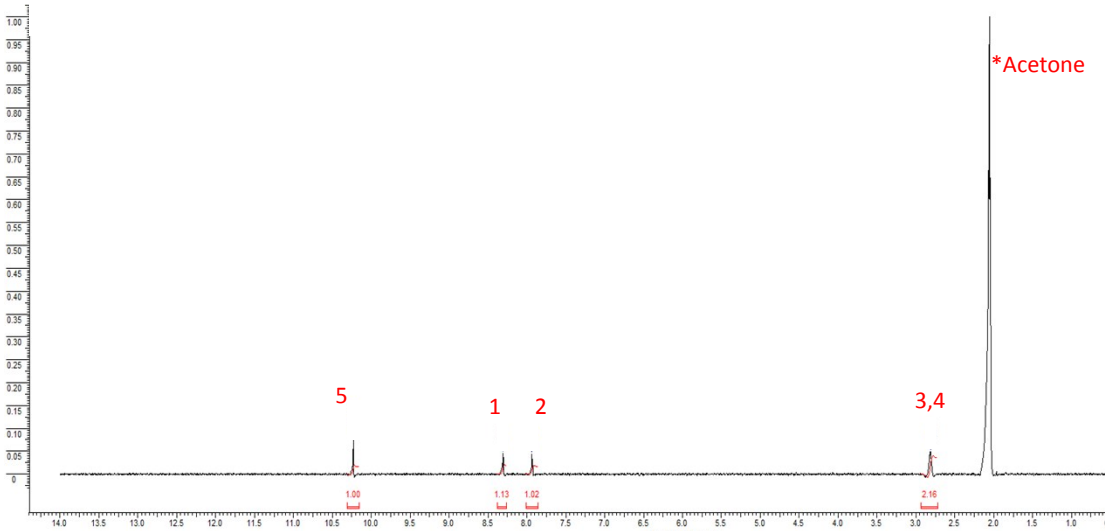


Figure S6. ^{1}H NMR spectrum of Compound **6,** SP crosslinker ($CDCl_3$, 300 Hz)

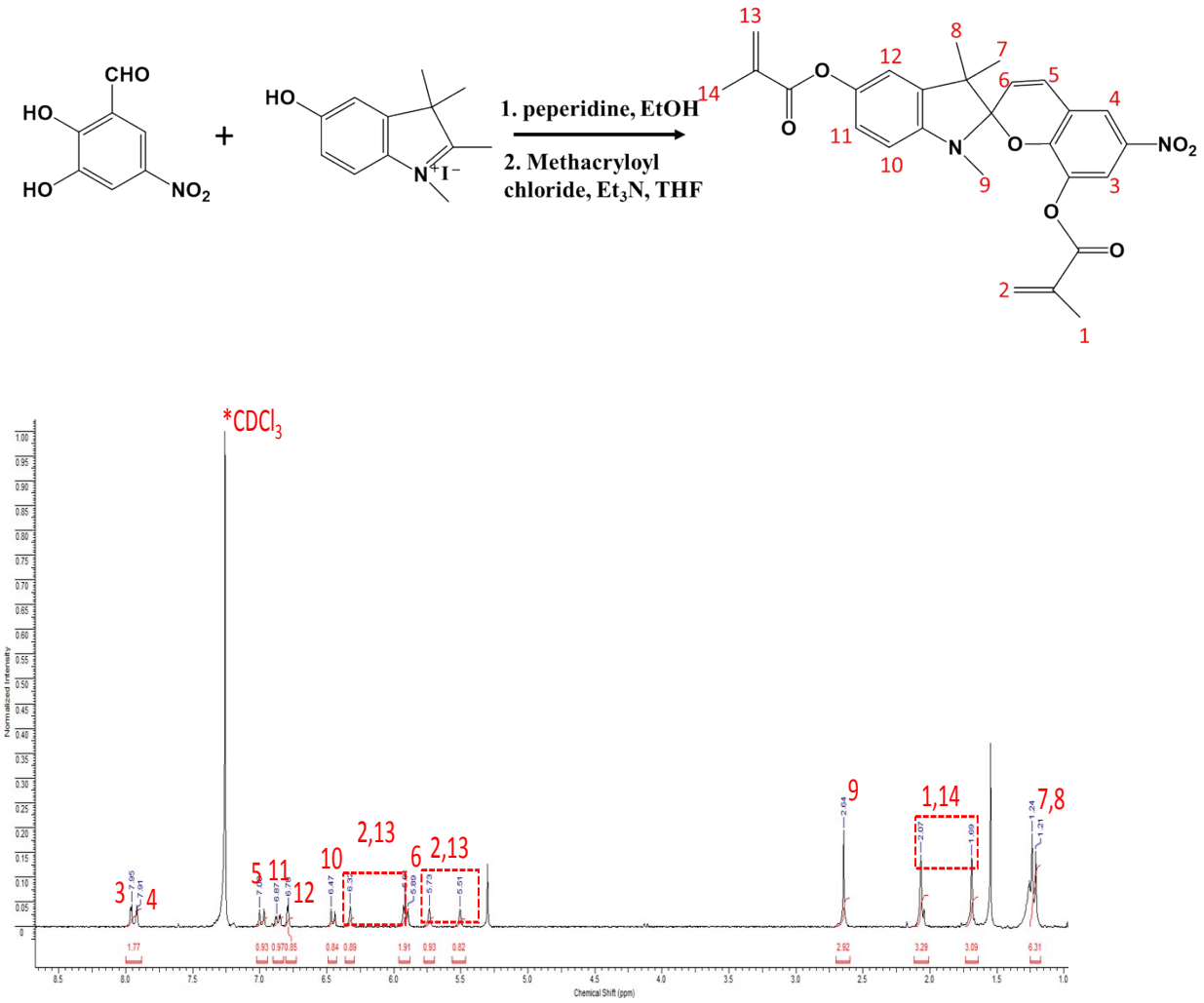


Figure S7. ^{13}C NMR spectrum of Compound **6**, SP crosslinker ($CDCl_3$, 300 Hz)

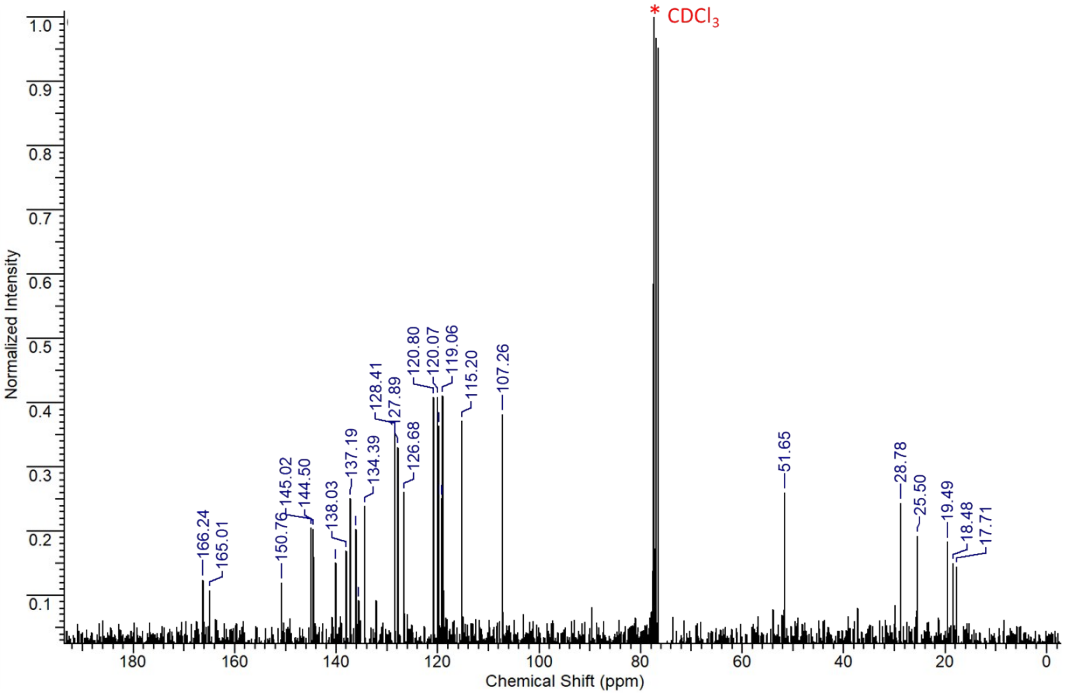


Figure S8. The HRMS spectrum of Compound **6**, SP crosslinker (MeOH, 0.01mg/mL)

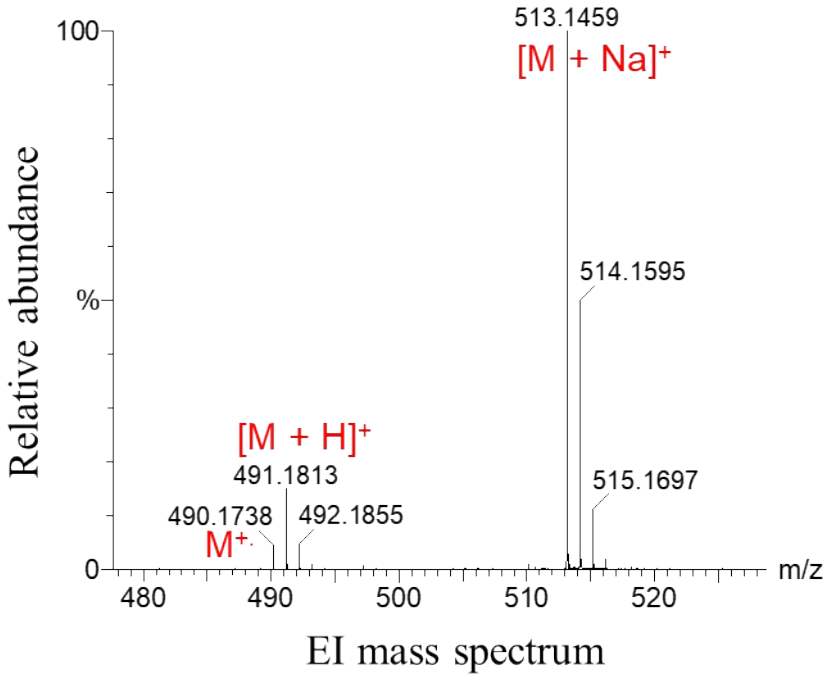


Figure S9. The stress-external force curves of poly(AM-co-MA/SP) hydrogels as a function of (a) MA:AM ratios and (b) SP concentrations.

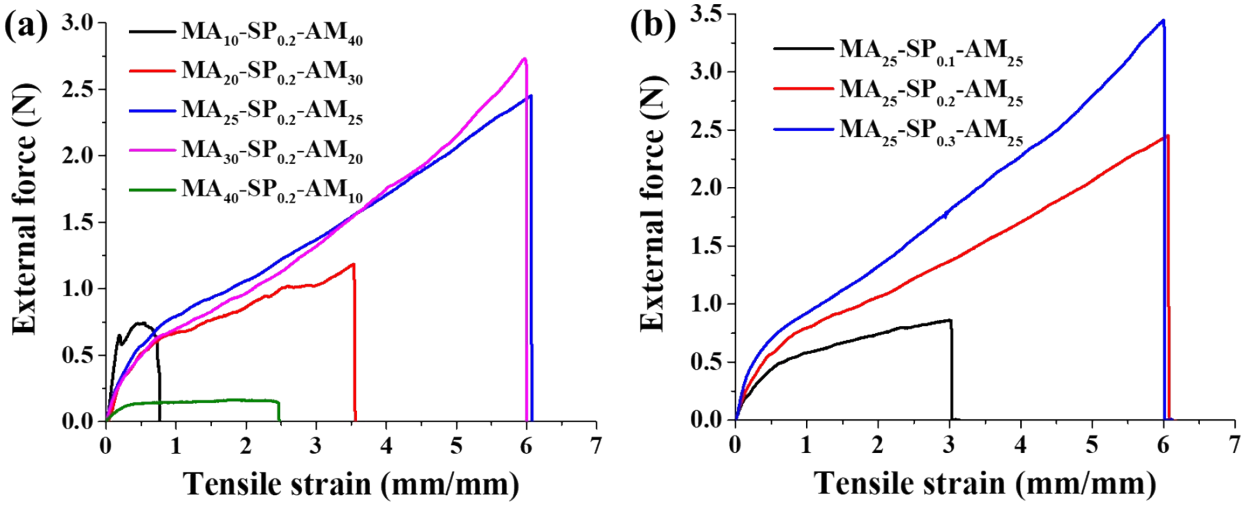


Figure S10. Color recovery of poly(AM-co-MA/SP) hydrogel as a function of recovery time (0, 2, 4, 6, 8, 10 min.) under white light.

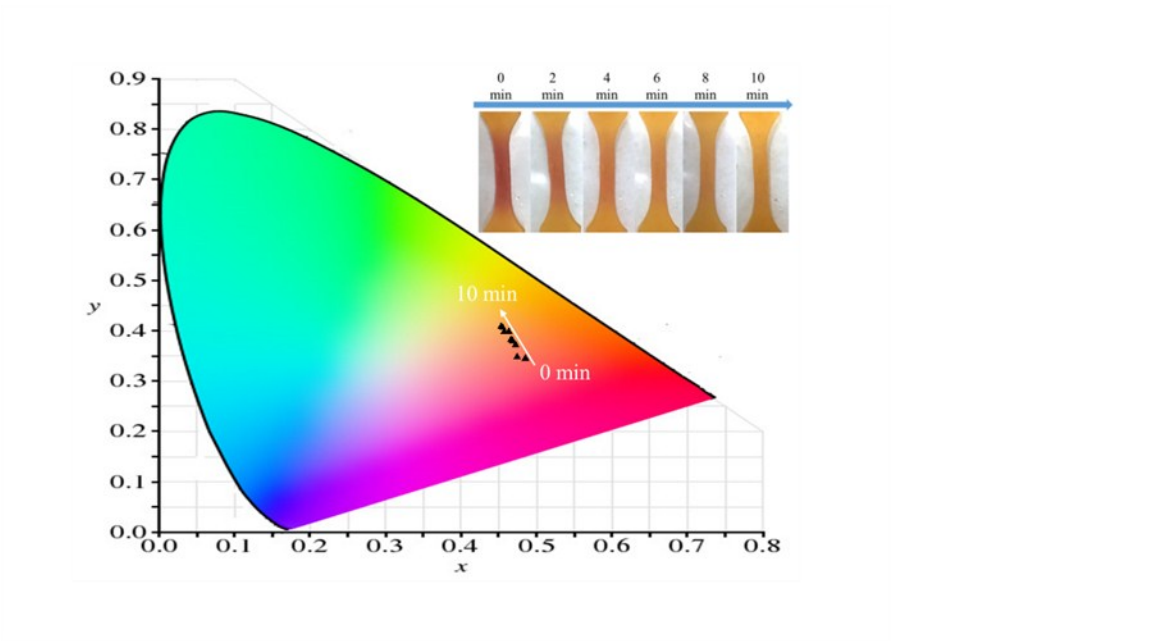


Figure S11. The potential application of poly(AM-co-MA/SP) hydrogel as wearable strain sensor for detecting the joint motion.