Supporting Information

Tough, Recyclable and Degradable Plastics with Multi-functions Based on Supramolecular Covalent Adaptive Networks

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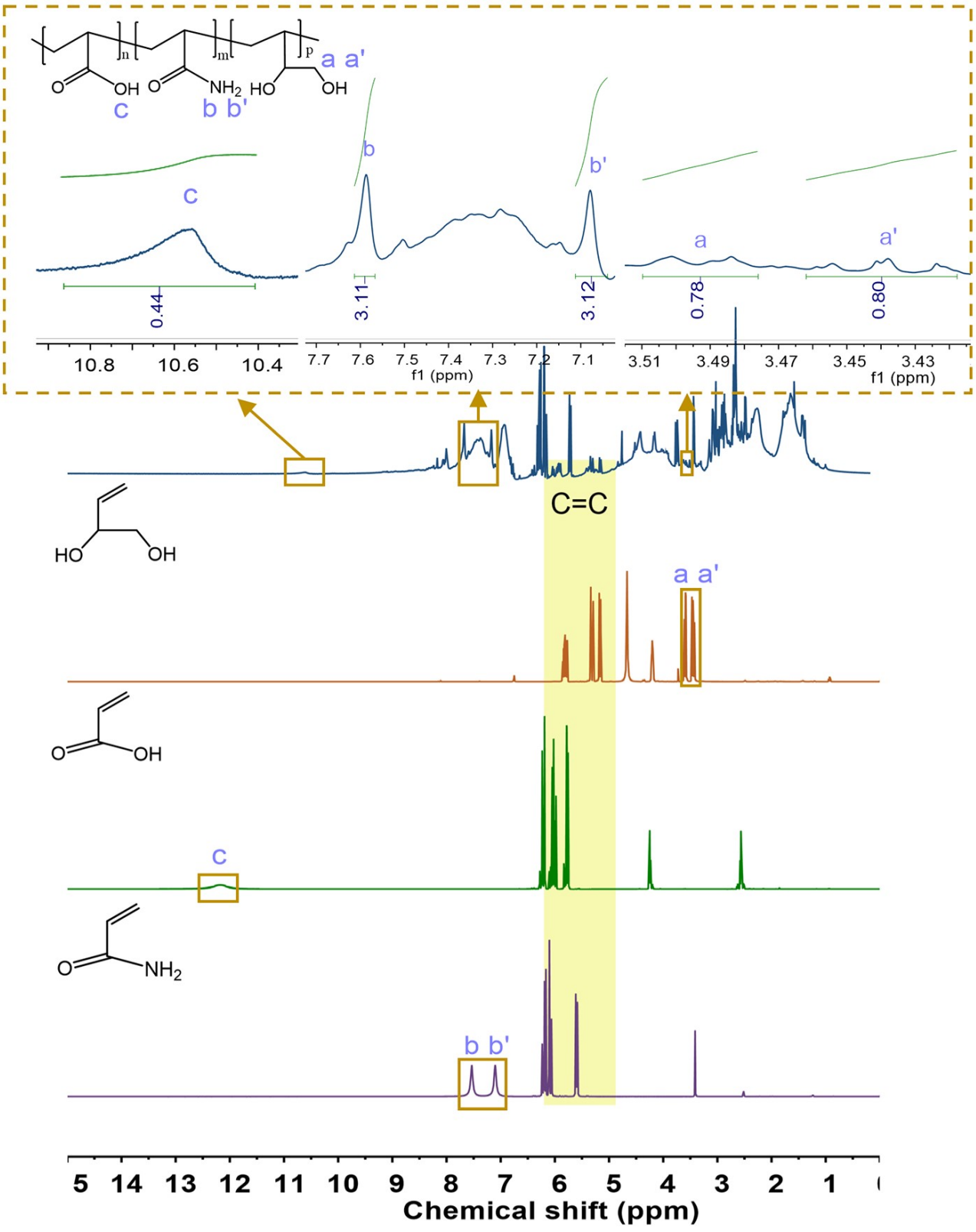

Figure S1. ^{1}H NMR (400 MHz, DMSO-d_6) spectrum of P (AA-co-AAm-co-6CI), AA, and AAm, and ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 6CI.

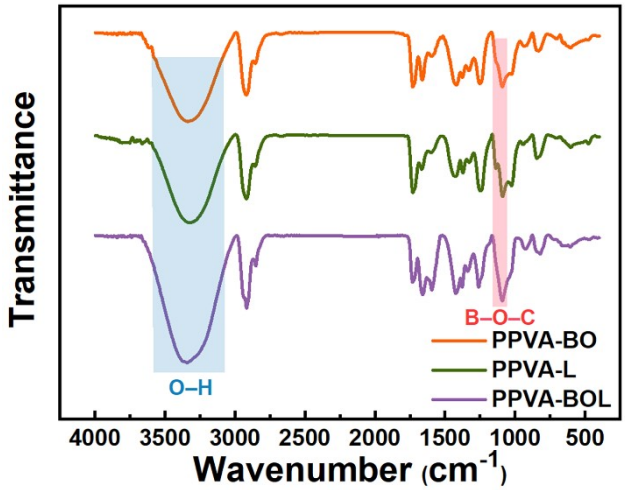

Figure S2. Fourier Transform infrared spectroscopy (FTIR) spectra of PPVA-BO, PPVA-L and PPVA-BOL.

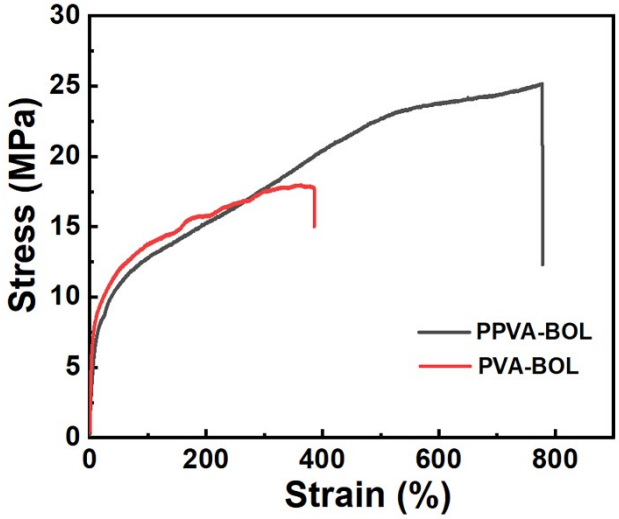

Figure S3. Typical cyclic stress-strain tests of the PPVA-BOL and PVA-BOL.

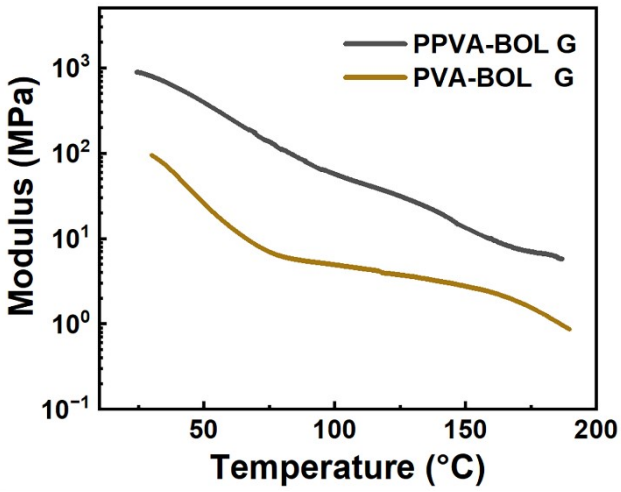

Figure S4. Storage modulus of PPVA-BOL and PVA-BOL by dynamic mechanical analysis.

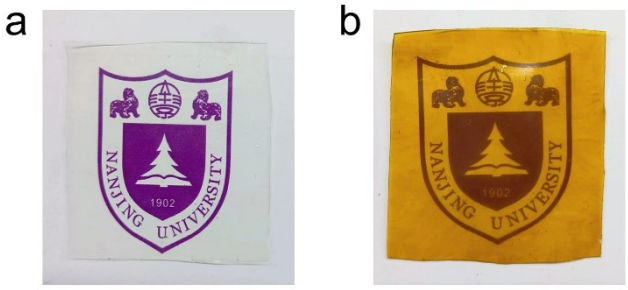

Figure S5. (a) The PPVA-BO plastic, (b) and the PPVA-BOL plastic were placed on the pattern of the Nanjing University logo, respectively.

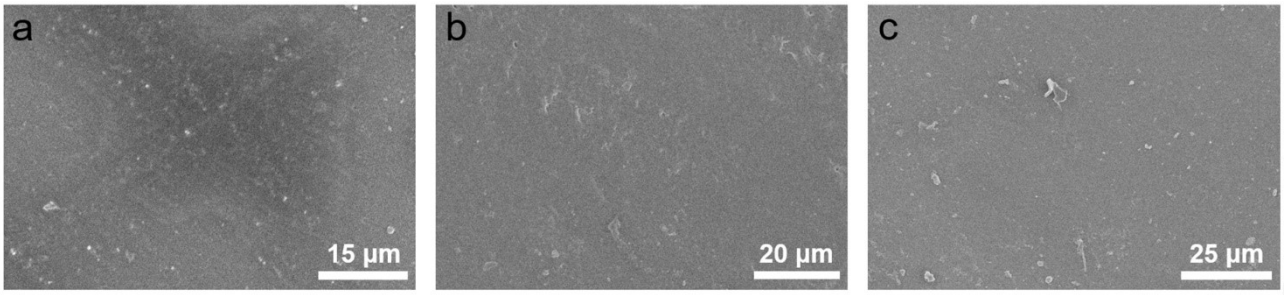

Figure S6. Scanning electron microscopy images of the PPVA-BOL plastic at different microscopic scales.

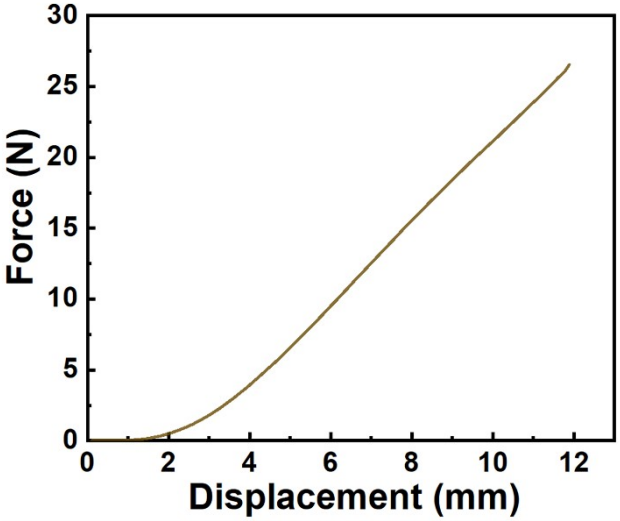

Figure S7. Puncture curve of the PPVA-BOL.

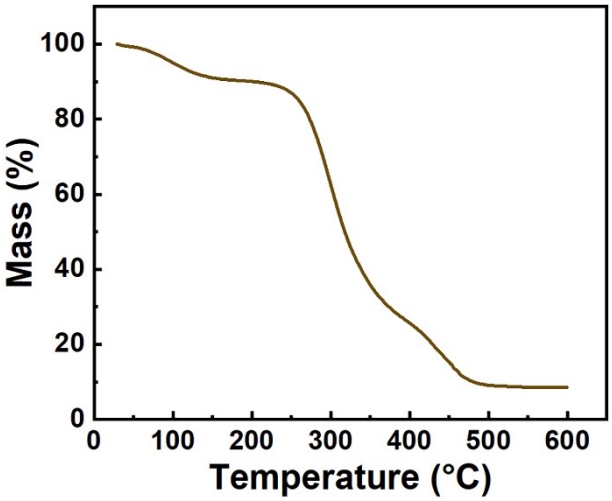

Figure S8. Thermal gravimetric analysis curve of the PPVA-BOL.

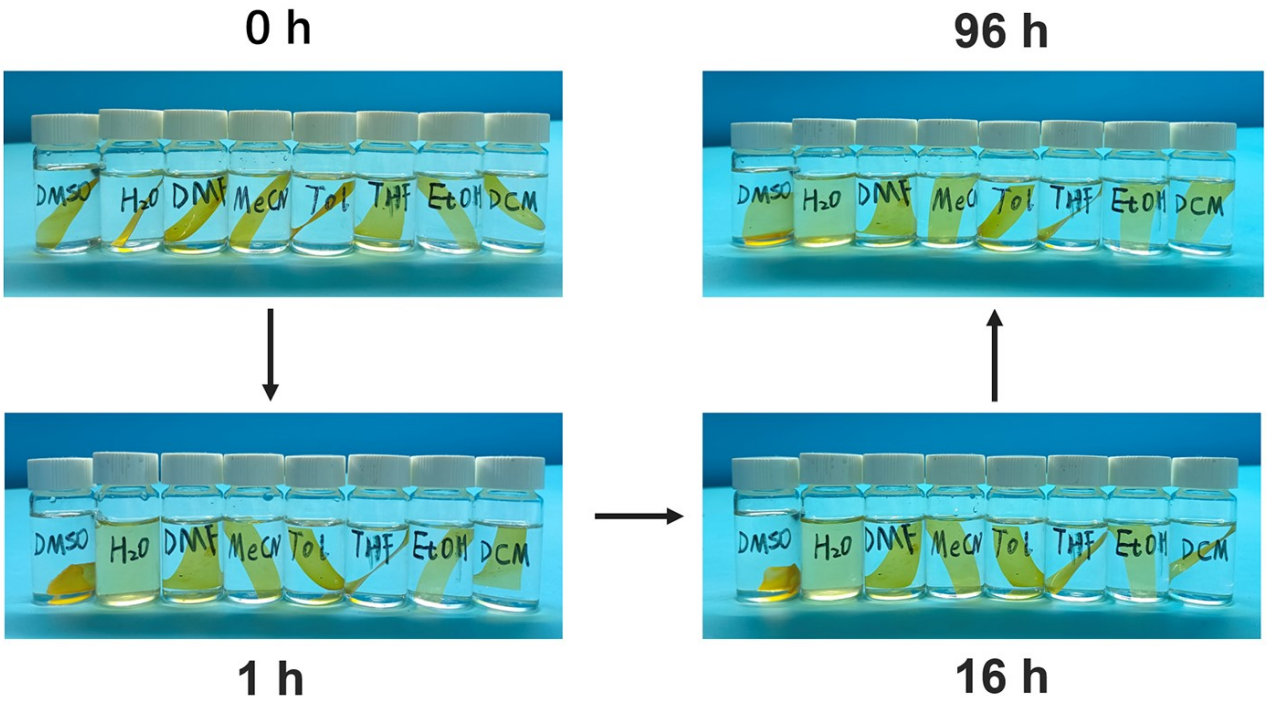

Figure S9. The PPVA-BOLs were immersed in water and different organic solvents for 0, 1, 16 and 96 h.

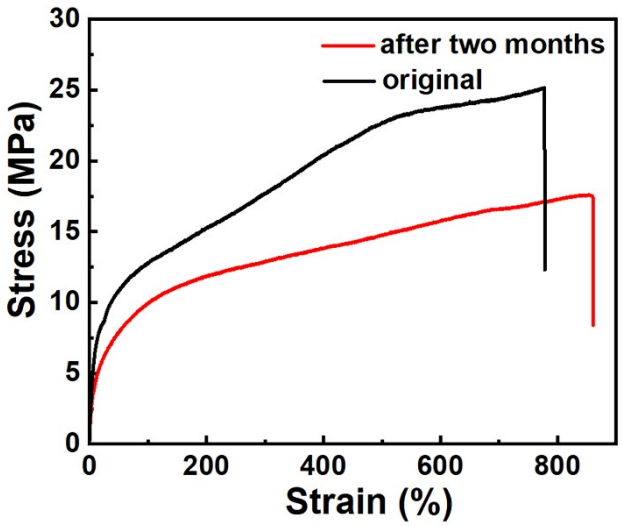

Figure S10. Stress-strain curves of the original sample with 10% water content and the sample placed in a constant humidity chamber at 60% humidity for two months.

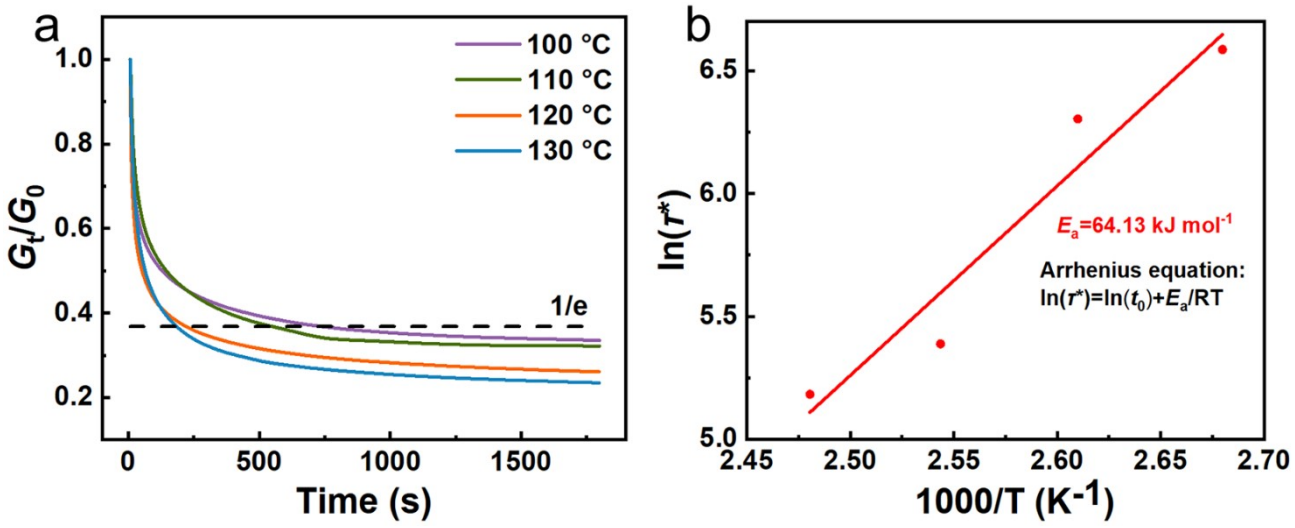

Figure S11. (a) The stress relaxation, (b) and calculated activation energy of PPVA-L.

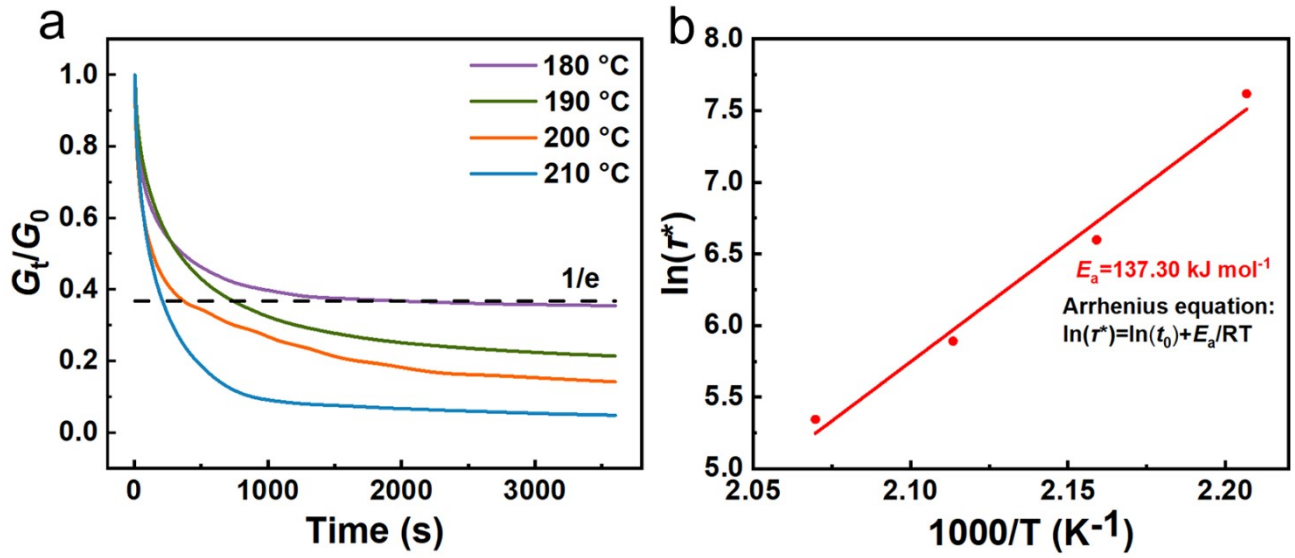

Figure S12. (a) The stress relaxation, (b) and calculated activation energy of PPVA-BO.

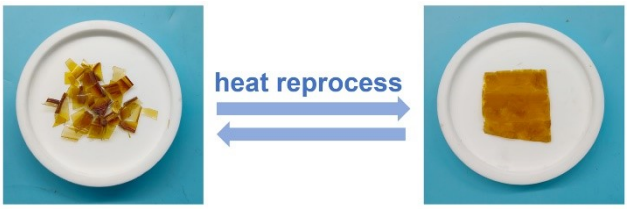

Figure S13. Heat-pressing of the completely dried PPVA-BOL.

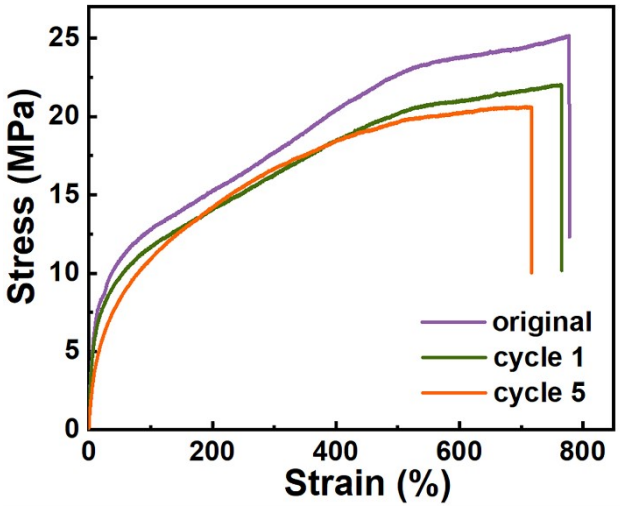

Figure S14. Stress-strain curves of the original sample and the sample after 1 and 5 times of hot press recycling.

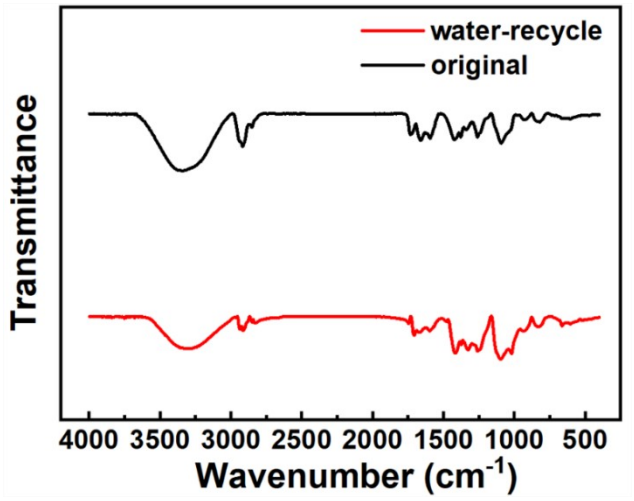

Figure S15. FTIR spectra of samples before and after water recycling.

Figure S16. Photographs of banknotes covered with the PPVA-BO film and the PPVA-BOL film with 365 nm UV irradiation.

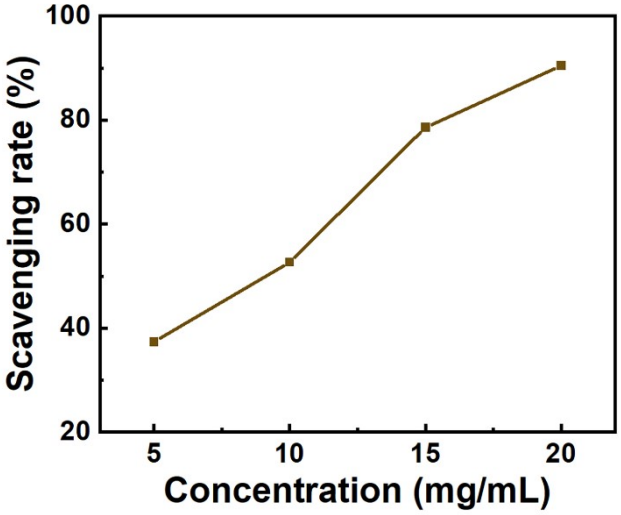

Figure S17. The radical scavenging rates after 3.5 h with different concentrations of PPVA-BOL aqueous solutions.

Table S1. Creep rates of the PPVA-BOL plastic in different temperatures.

Temperature (°C)	$\dot{\varepsilon}$ (% s^{-1})
60	1.5×10^{-5}
80	5.8×10^{-5}
100	2.9×10^{-4}

Table S2. Changes in mass, water absorption and water content of the PPVA-BOL plastic placed in a constant humidity chamber at 60% humidity for various days.

Time (day)	m (g)	Water absorption rate (g day^{-1})	Water content (%)

0	0.7873	0	0
1	0.8619	0.0746	8.61
2	0.8928	0.0309	11.82
4	0.9039	0.0056	12.90
15	0.9515	0.0043	17.26
60	1.1045	0.0034	28.72

Table S3. Dissolution time of PVAs in water with different molecular weights and hydrolysis degrees.

Molar mass (g/mol)	Hydrolysis (%)	Water dissolution time (min)
9500	80	28
27000	88	19
100000	99	slight swelling

Movie S1. The PPVA-BOL film dissolved quickly in hot water at 85 °C.

Movie S2. The PPVA-BOL film underwent multiple folding and bending without deformation.