Supplementary Information for

High-strength anisotropic hydrogels as adhesive strain sensors for dual-environment applications

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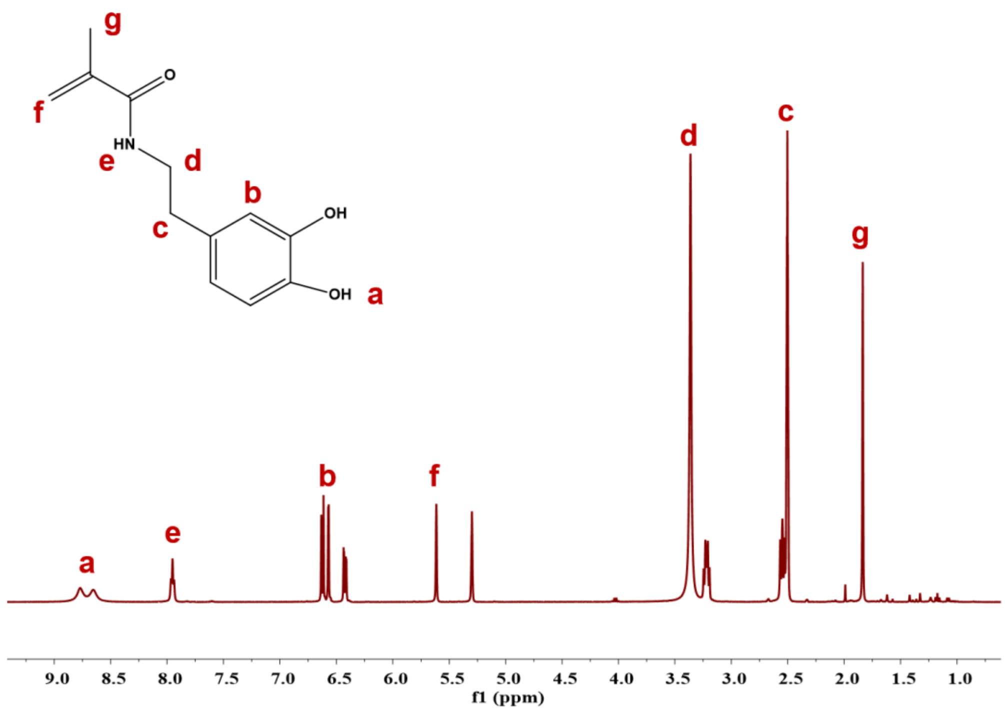

Fig. S1 ^{1}H NMR Spectrum of DMA. δ 8.71 (d, J = 46.6 Hz, 2H), 7.95 (t, J = 5.7 Hz, 1H), 6.62 (d, J = 8.0 Hz, 1H), 6.57 (d, J = 2.1 Hz, 1H), 6.42 (dd, J = 8.0, 2.1 Hz, 1H), 5.61 (s, 1H), 5.30 (t, J = 1.7 Hz, 1H), 3.25 - 3.18 (m, 2H), 2.55 (dd, J = 8.8, 6.6 Hz, 2H), 1.84 (s, 3H).

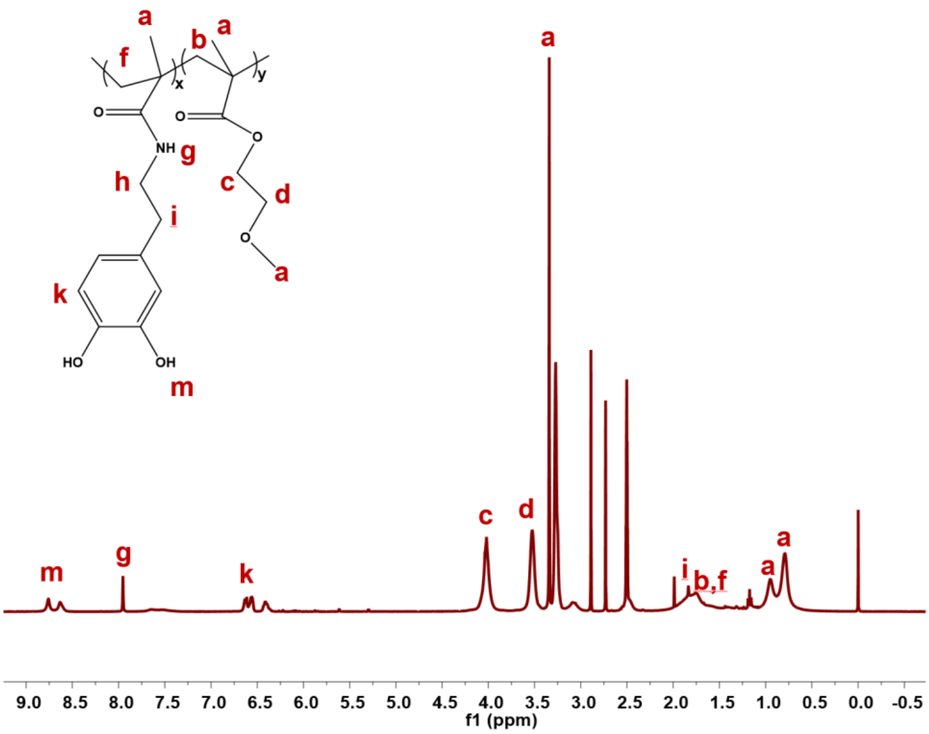

Fig. S2 ^{1}H NMR Spectrum of P(DMA-MEMA).

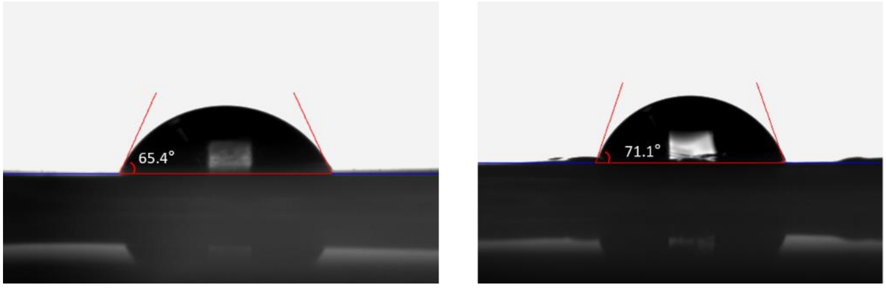

Fig. S3 The contact angle on surface of P(AAm-AAc/Fe^{3+}) hydrogel (left) and adhesive hydrogel surface (right).

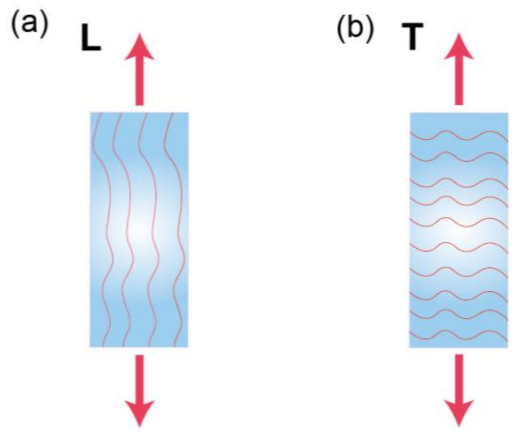

Fig. S4 Diagram of anisotropic hydrogel stretching in different directions.

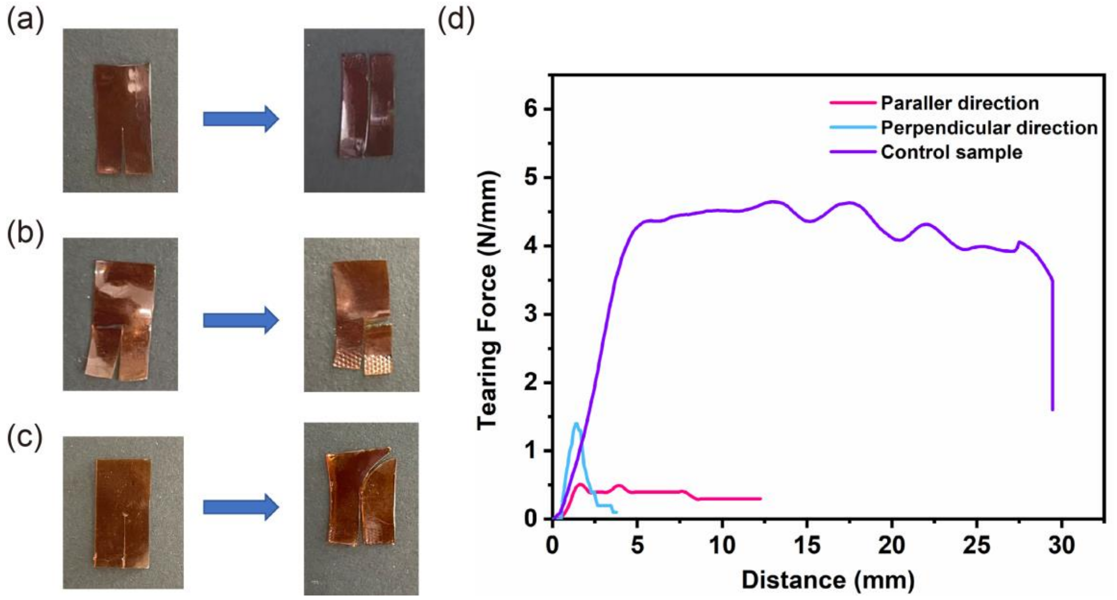

Fig. S5 Tearing measurement along (a) the parallel and (b) perpendicular direction of anisotropic hydrogel and (c) random direction of isotropic hydrogel. (d) The force-distance curves from tearing test of the three samples.

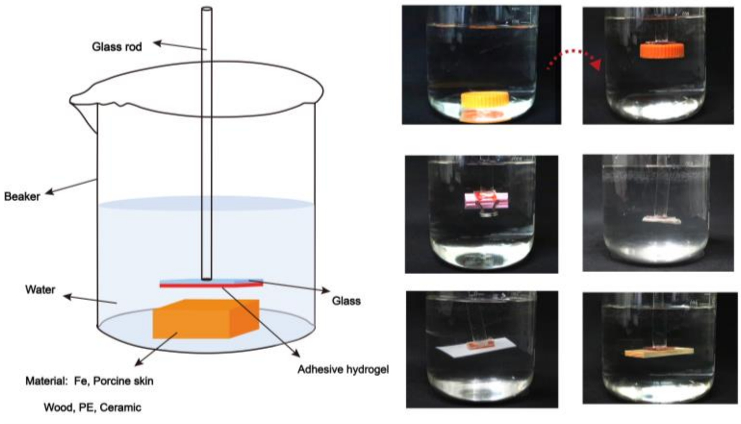

Fig. S6 The diagram and photos with adhesive hydrogels that adhered to a variety of substrates underwater.

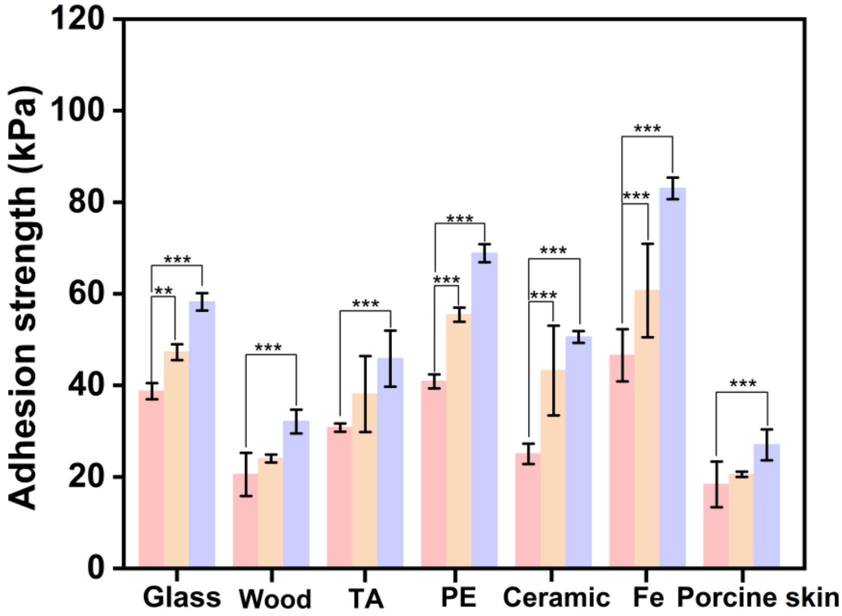

Fig. S7 The adhesion strength of hydrogel under water is determined by applying different preloading forces (1 N, 2 N, 3 N) on different substrates.

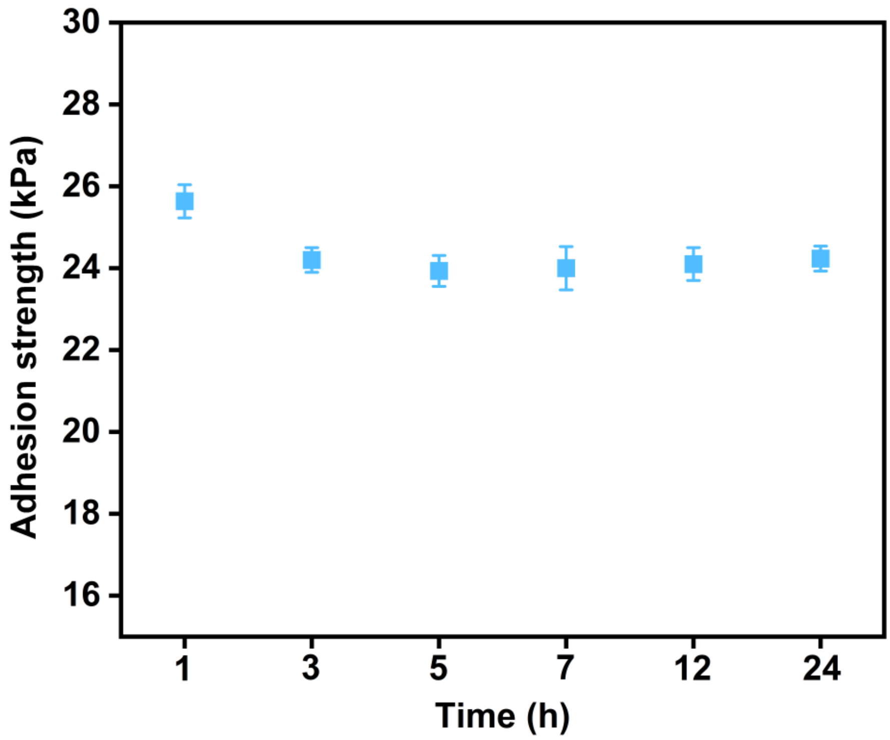

Fig. S8 The adhesion strength of the adhesive hydrogel attached to pig skin under water for different time.

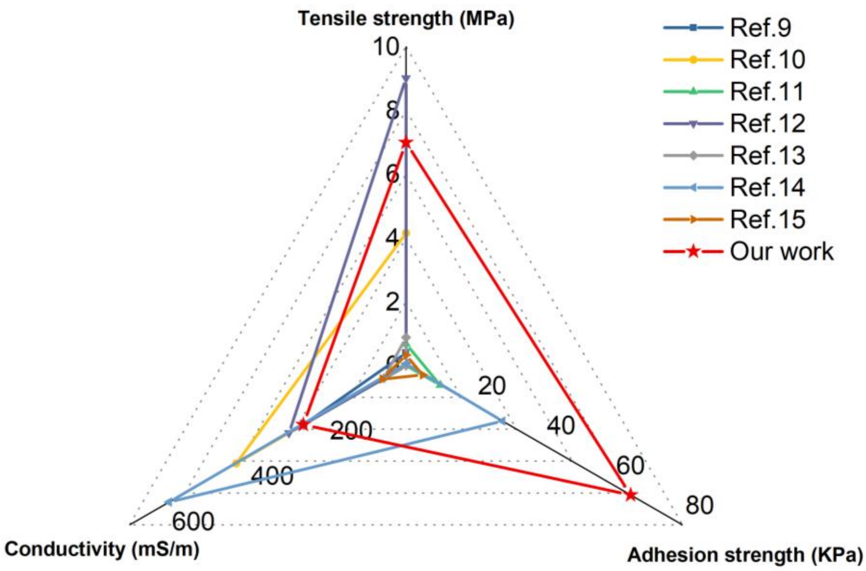

Fig. S9 Comparison of the tensile strength, adhesion performance and electrical conductivity of hydrogels with those reported in other literatures. [9-15]

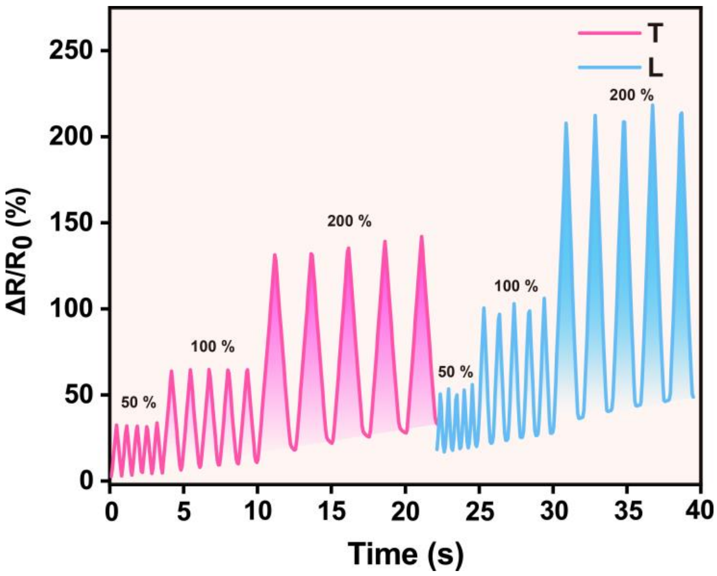

Fig. S10 Relative resistance changes in cyclic stretching-releasing process under different tensile strains: 50 %, 100 %, and 200 %.

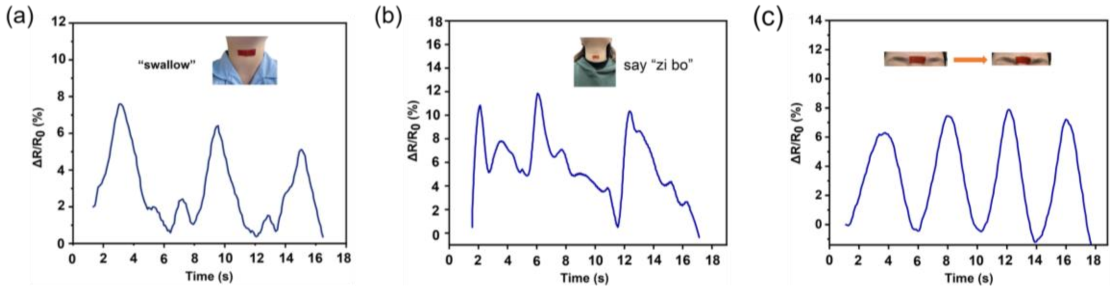

Fig. S11 The relative resistance changes of anisotropic adhesive hydrogel strain sensors in monitoring swallowing, vocalization and frowning.

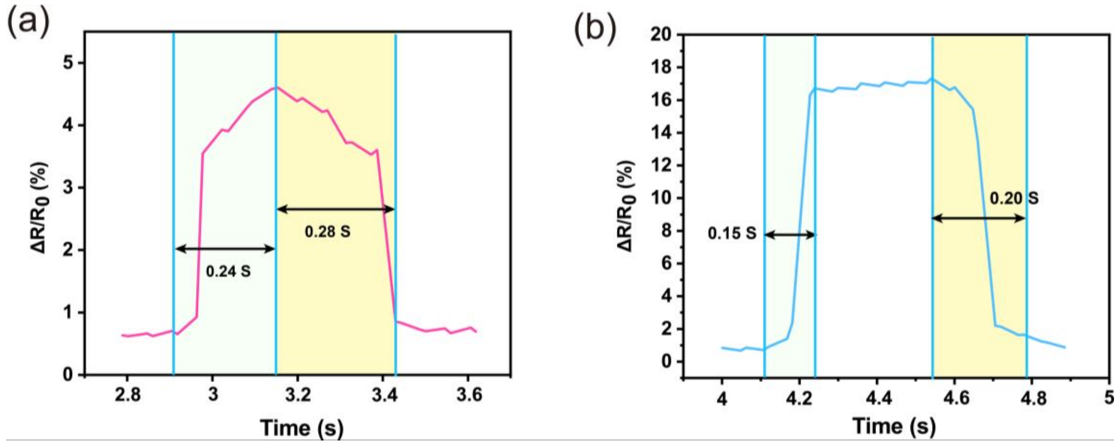

Fig. S12 Response time of anisotropic adhesive hydrogel in T (a) and L (b) directions in air.

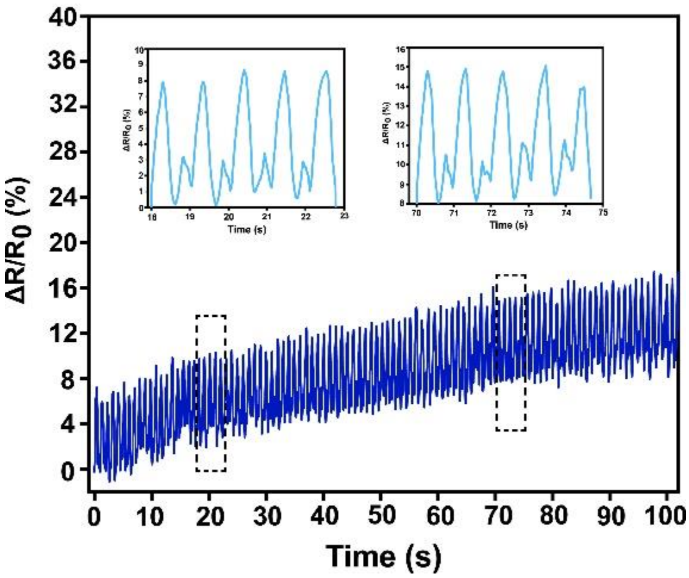

Fig. S13 Relative resistance changes ($\Delta R/R_0$) of the hydrogel for finger bending test for 100 cycles underwater.

Table S1. A comparison table of tensile strength, adhesion performance and electrical conductivity of hydrogels with those reported in the literature. [1-15]

Materials	Tensile strength (MPa)	Adhesion strength (KPa)	Conductivity (mS/m)	Ref.
PAAm-AABT/CMCS	0.25	50.78	370	[1]
MXene/PHMP	0.11	19	16	[2]
PAA-PAM/Fe^{3+}	1.97	42.93	-	[3]
PAA-Fe^{3+}-IL	0.49	-	1480	[4]
P(AM-APBA)/starch	0.0046	0.3	0.758	[5]
PAM/TOChN-PDA/Fe^{3+}	0.089	62.56	7660	[6]
MWCNT-80/HA/LM	0.484	15.3	780	[7]
Poly (AM-co-MA-co-BA)	11	-	124	[8]
ohPEI/PAA	0.39	0.25	258	[9]
GluP(HEA-co-AA)-Fe/LiCl	4.15	-	430	[10]
AA/LMA/SBMA	0.67	10	-	[11]
CS/PAM-AA/$Al_2(SO_4)_3$	9.01	-	296.3	[12]
Ti_3AlC_2/PVA/ $ZnSO_4$	0.875	-	56	[13]
PDA/ PFeCNT	0.055	28	600	[14]
DA-PPy/PVA	0.325	4.9	60	[15]
P (AAm-AAc/Fe^{3+})	**6.99**	**65**	**260**	**This work**

Note: [1-8] are the working literatures of isotropic hydrogels, [9-15] are the working literatures of anisotropic hydrogels.

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