Supplementary Material

A dual-mode wearable sensor with coupled ion and pressure sensing

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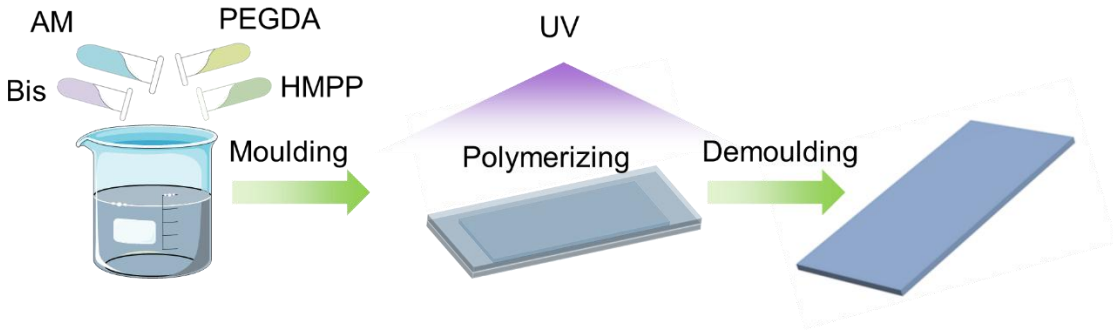
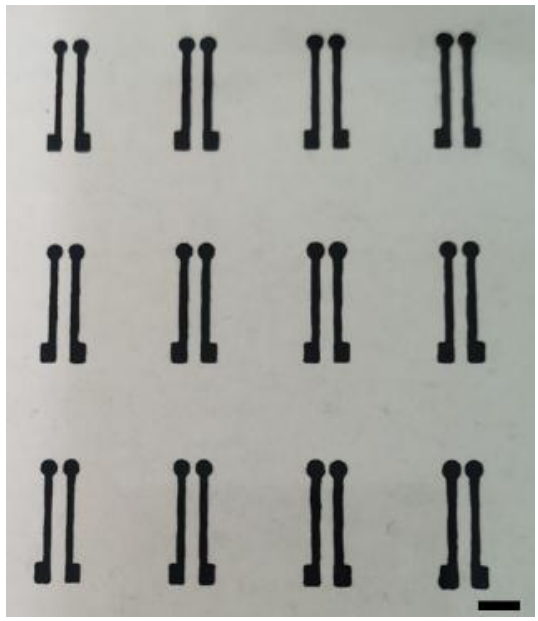
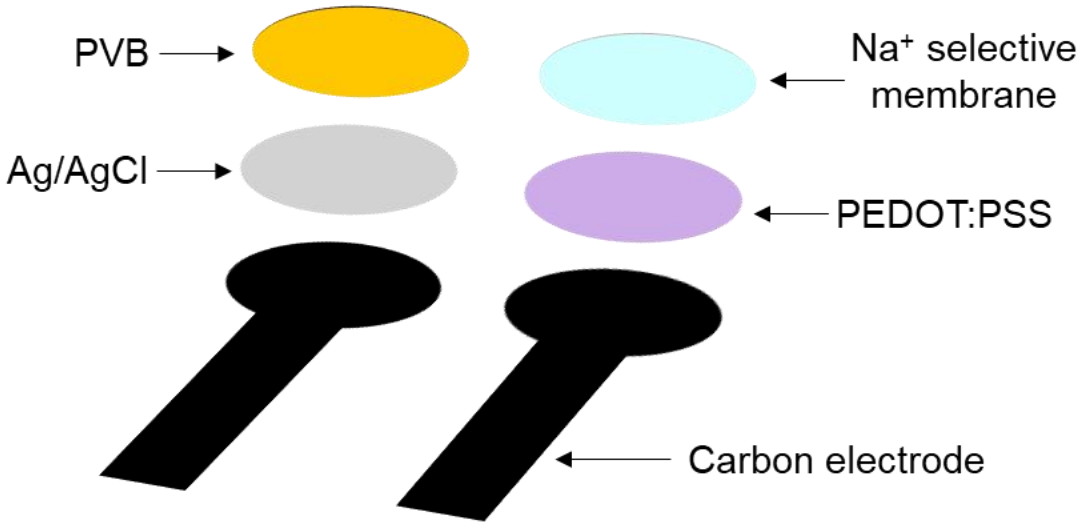


Supplementary Figure 1. Schematic illustration showing the synthesis process of the hydrogel.

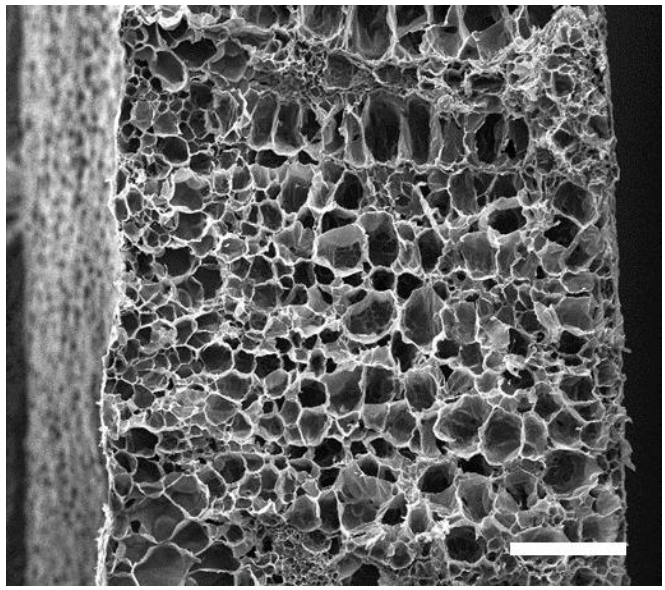


Supplementary Figure 2. Photograph of the screen-printed electrodes. Scale bar: 5 mm.

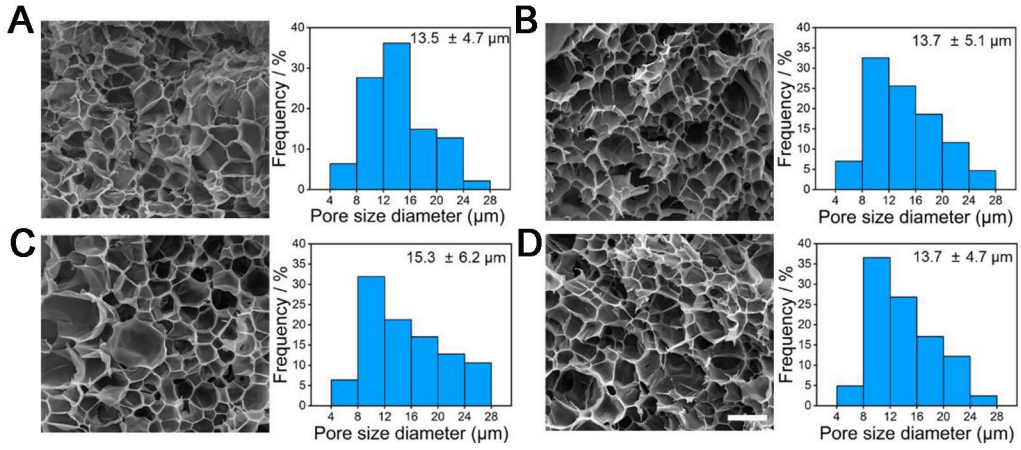


Supplementary Figure 3. Schematic diagram showing the structure and composition of the Na^+ selective electrode.

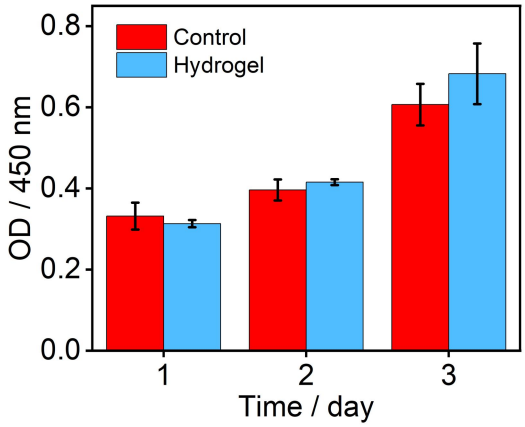
Supplementary Figure 4. Photograph of the sensor. Scale bar: 2 mm.



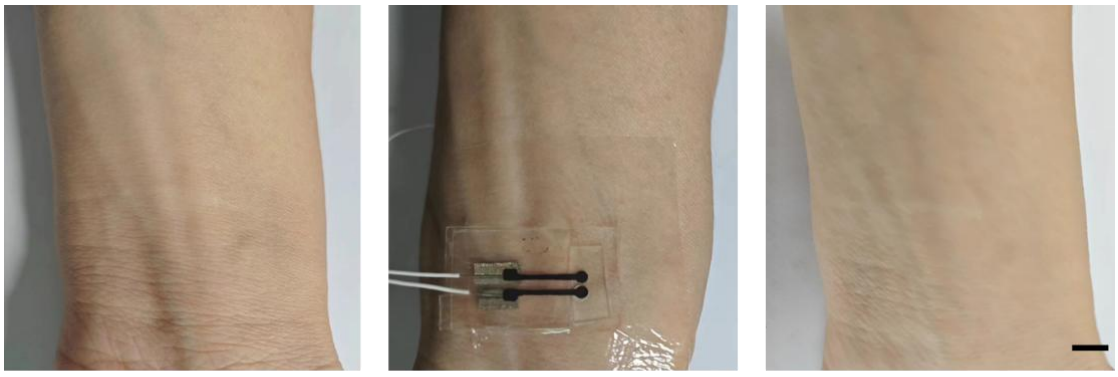
Supplementary Figure 5. SEM micrograph showing the cross-section structural morphology of the hydrogel in deionized water. Scale bar: 200 μm.



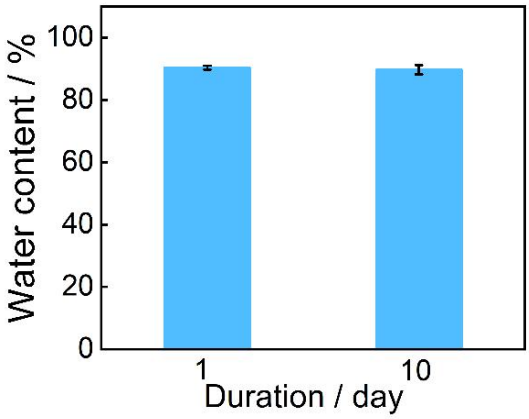
Supplementary Figure 6. SEM micrographs showing the cross-section of the hydrogels equilibrated in (A) deionized water, (B) 1 mM, (C) 5 mM, and (D) 10 mM NaCl solution, and the corresponding pore size distribution. Scale bar: 25 μm.



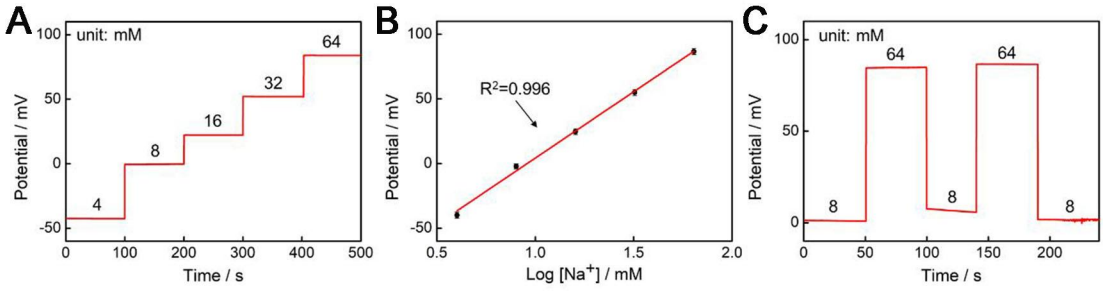
Supplementary Figure 7. Proliferation of MC3T3-E1 cells cultured with and without p(AM-co-PEGDA) hydrogel after day 1, day 2, and day 3. The cytocompatibility was assessed by employing the CCK8 assay with NIH 3T3 cells. These cells were cultured in a medium consisting of High Glucose Dulbecco's modified Eagle's medium (High Glucose DMEM) supplemented with 10% fetal bovine serum (FBS) and 1% streptomycin/penicillin. The hydrogels were trimmed to dimensions of 0.1 cm × 0.1 cm × 0.2 cm (length, width, height), subjected to three washes with sterilized phosphate-buffered saline (PBS), sterilized by exposure to ultraviolet radiation overnight, and then positioned in 96-well plates. Subsequently, 100 µL of a suspension of NIH 3T3 cells (2 × 104 cells mL^{-1}) was co-cultured with the hydrogels and incubated at 37 °C within a humidified 5% CO_2 environment. A control group was maintained without hydrogels. Cell proliferation was assessed after 1, 2, and 3 days of culture using Cell Counting Kit-8 (CCK-8, Beyotime Biotechnology, Shanghai). At each time point, the culture medium was replaced with 100 µL of medium containing a 10% CCK-8 working concentration, followed by a 2-hour incubation at 37 °C. Subsequently, the absorbance at 450 nm (n = 6) was measured using a microplate reader (SYNERGY HTX) to determine the optical density (OD) value.



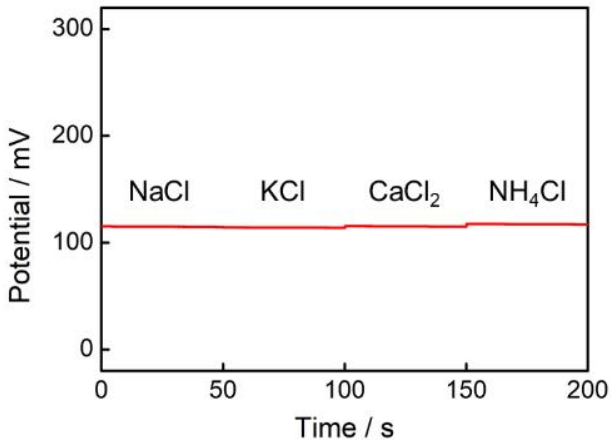
Supplementary Figure 8. Photographs showing the skin of the individual before and after wearing the dual-mode sensor for 2 h. Scale: 5 mm.



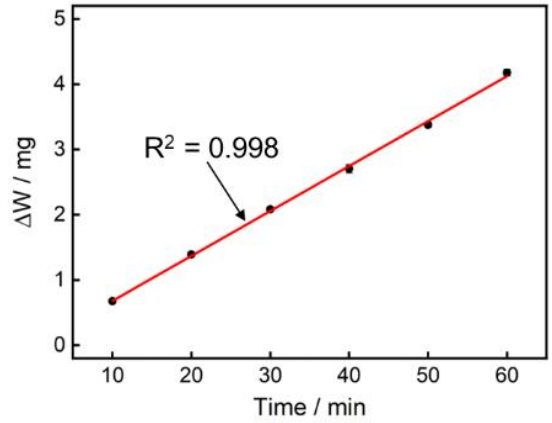
Supplementary Figure 9. Water contents of the hydrogel equilibrated in water for 1 day or 10 days.



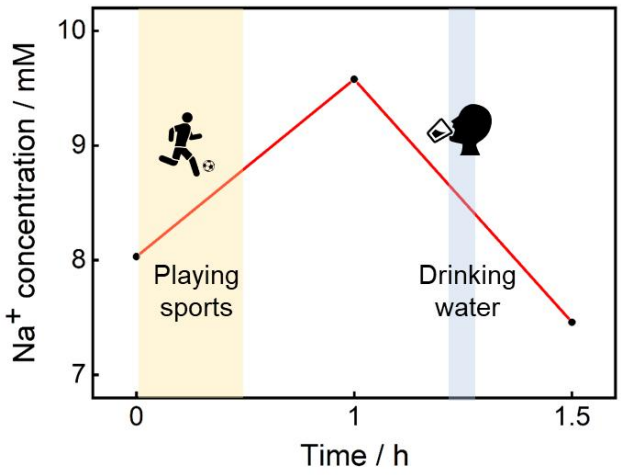
Supplementary Figure 10. Detection of the Na^+ in the solution using the Na^+ selective electrode. (A) Open-circuit potential in response to NaCl solutions with different concentrations; (B) Plots of the potential value as a function of the logarithm of the Na^+ concentration in the solution; (C) Repeatability test of the Na^+ detection.



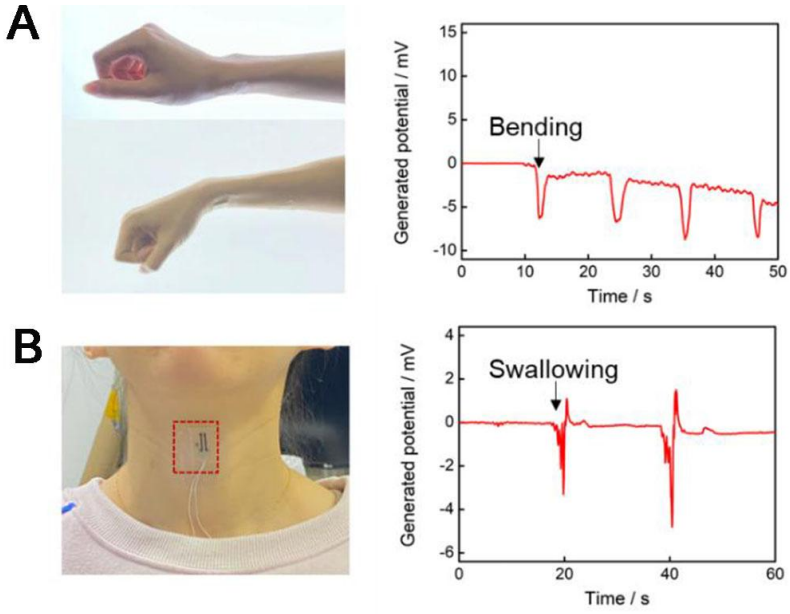
Supplementary Figure 11. Stability of the Na^+ selective electrode in solutions containing different cations.



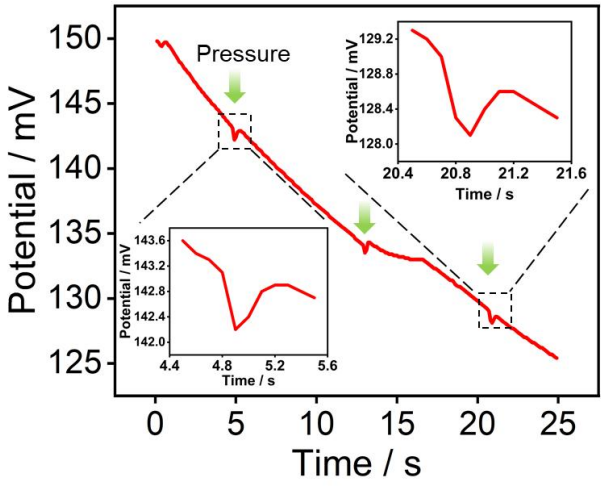
Supplementary Figure 12. Weight change of filter paper (0.5 cm × 1 cm) over time during sweat collection test. The weight increased linearly with time, suggesting that the sweat rate was constant. The sweat rate was calculated as ~ 0.137 $\mu L \cdot cm^{-2} \cdot min^{-1}$.



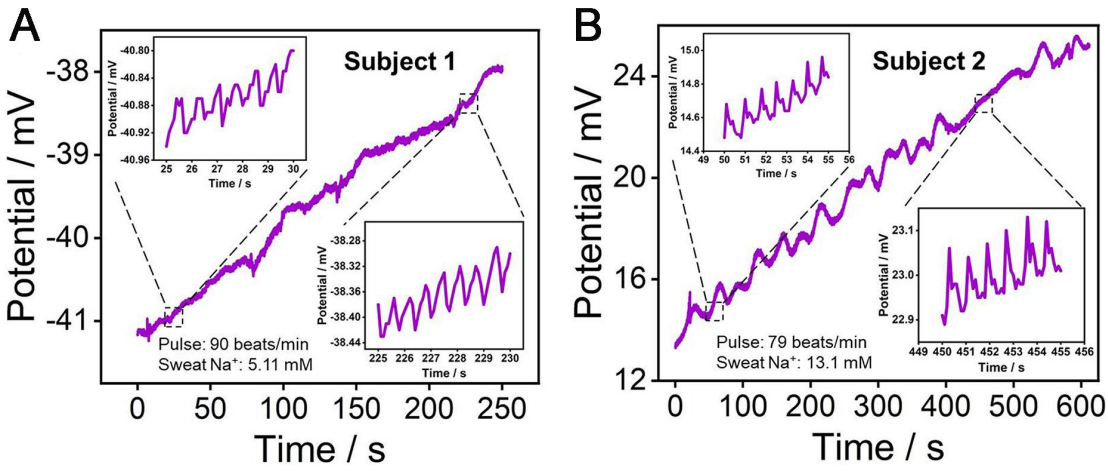
Supplementary Figure 13. Sweat Na^+ concentration change in the volunteers. An on-body sweat Na^+ detection test was carried out by attaching the sensor to the wrist of the volunteers for 5 min to collect ~0.35 μL sweat. We measured the volunteer's sweat Na^+ concentration undergoing different activities including exercise and drinking water.



Supplementary Figure 14. Generated potential of the sensor detecting (A) the joint bending and (B) swallowing.



Supplementary Figure 15. Piezoionic response of the hydrogel on the unmodified carbon electrode.



Supplementary Figure 16. Simultaneous detection of the sweat Na^+ and pulse for two volunteers: (A) Subject 1 and (B) Subject 2. Subject 1 is a female volunteer at the age of 34 and Subject 2 is a male volunteer at the age of 24.