Highly flexible fabric-based hydrovoltaic generator with core-sheath structure for wearable applications

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Characterizations

The microstructures of the samples were characterized using field emission scanning electron microscopy (Gemini SEM500, Heidenheimer, Germany) and transmission electron microscopy (Hitachi H7650, HITACHI, Japan). The field emission scanning electron microscope was equipped with an energy-dispersive X-ray spectrometer (Octane Super, Mahwah, NJ, USA) operating at an accelerating voltage of 5 kV. The transmission electron microscope operated at an accelerating voltage of 120 kV with a resolution of 0.204 nm. The phase composition of the samples was analyzed by X-ray diffraction (XRD, D8 Discover, Bruker, Karlsruhe, Germany). The hydrophilic properties of the samples were evaluated using an optical contact angle meter (OCA20), with a 5 μL water droplet applied for each measurement. The chemical and elemental compositions of the samples were characterized by X-ray photoelectron spectroscopy (XPS, ESCALAB250Xi, Massachusetts, USA). The open-circuit voltage and short-circuit current of the prepared samples were measured and recorded using an electrometer (34465A, Keysight, USA). Cyclic voltammetry measurements were conducted in a 3.5 wt% NaCl solution using an electrochemical workstation (CHI 660D), with a Fe-BiVO4-modified electrode as the working electrode, a platinum electrode as the counter electrode, and an Ag/AgCl electrode as the reference electrode.

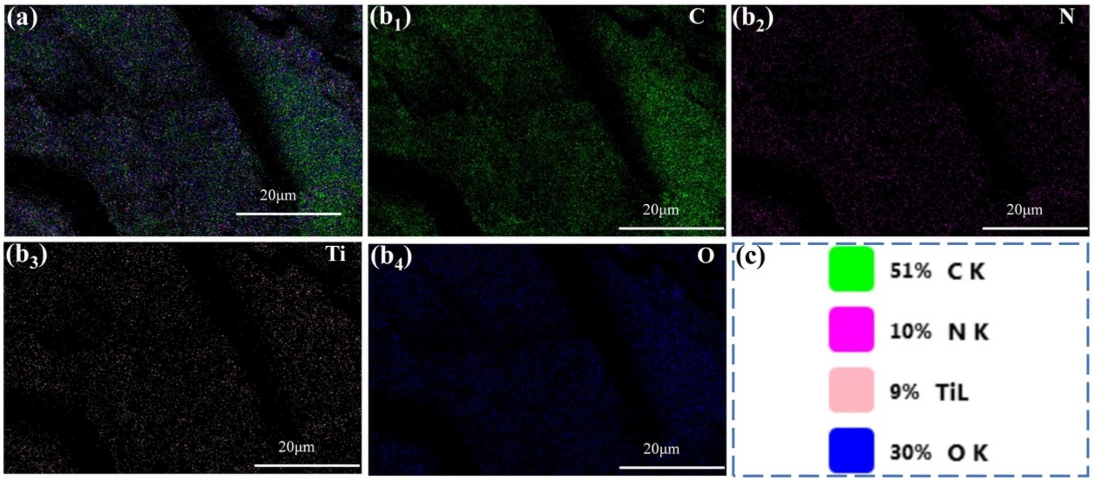

Fig. S1 (a-b) EDS mapping of C, N, Ti, and O elements in PGCMG, and (c) the corresponding elemental composition percentages.

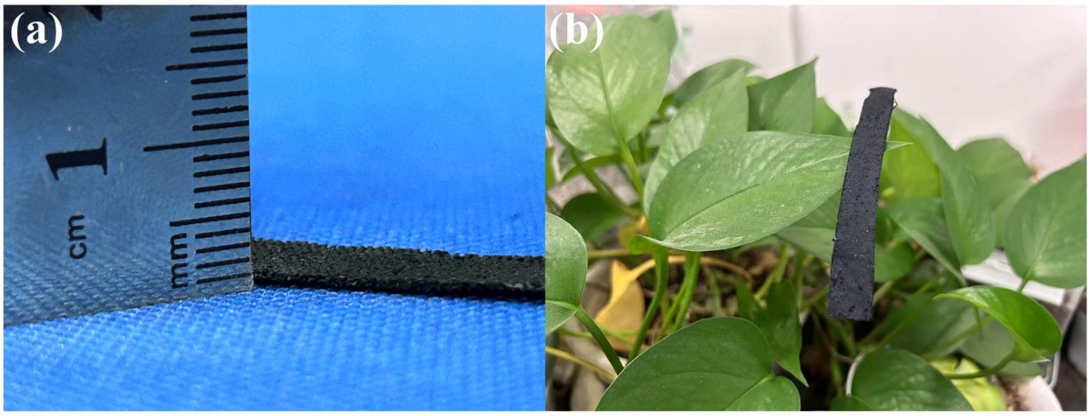

Fig. S2 (a) Thickness of the PGCMG sample. (b) One leaf can carry one PGCMG sample.

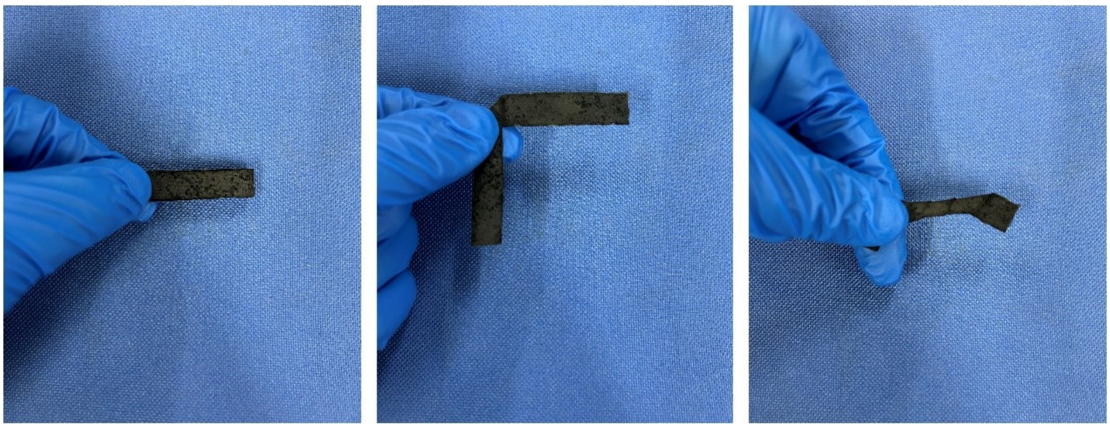

Fig. S3 Demonstration of PGCMG sample flexibility.

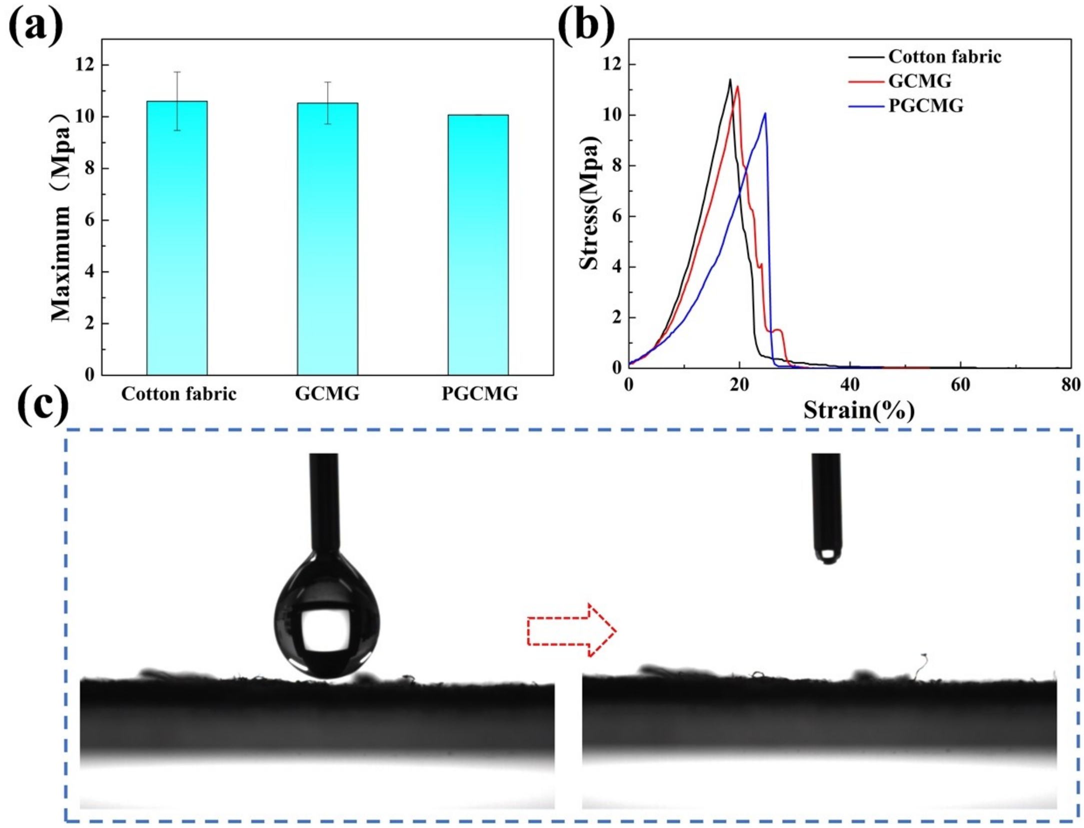

Fig. S4 (a) Tensile strength and (b) stress strain of the samples. (c) Hydrophilicity of PGCMG.

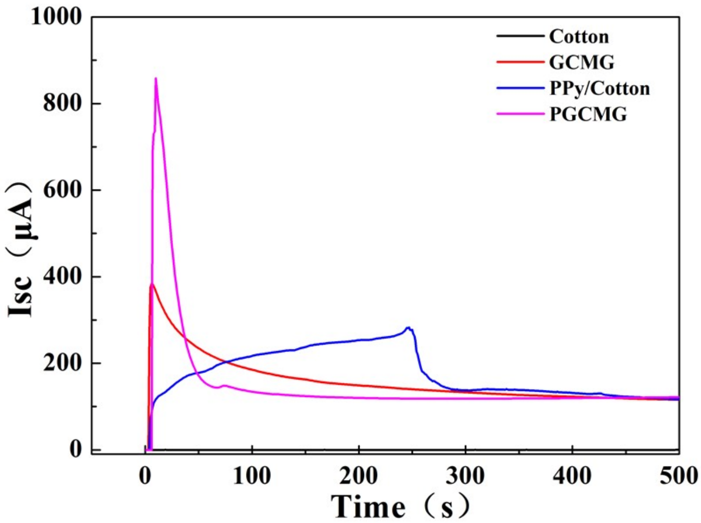

Fig. S5 Controlled hydrovoltaic experiments on Cotton fabric, GCMG, PPy/Cotton and PGCMG

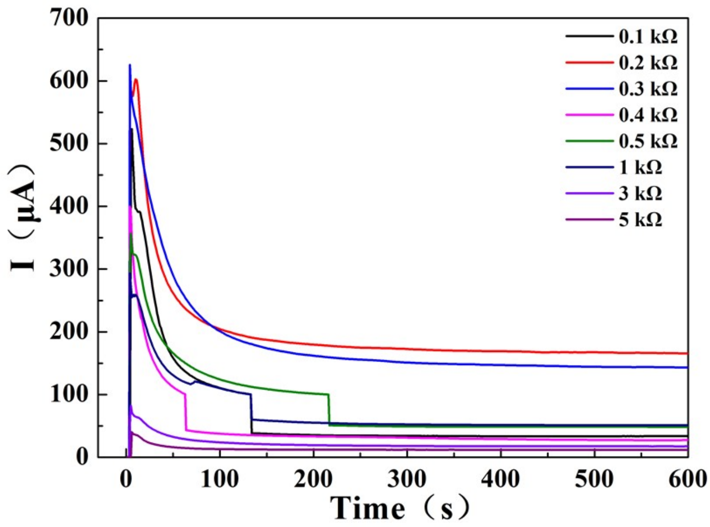

Fig. S6 Output current of PGCMG with different loads of applied resistance.

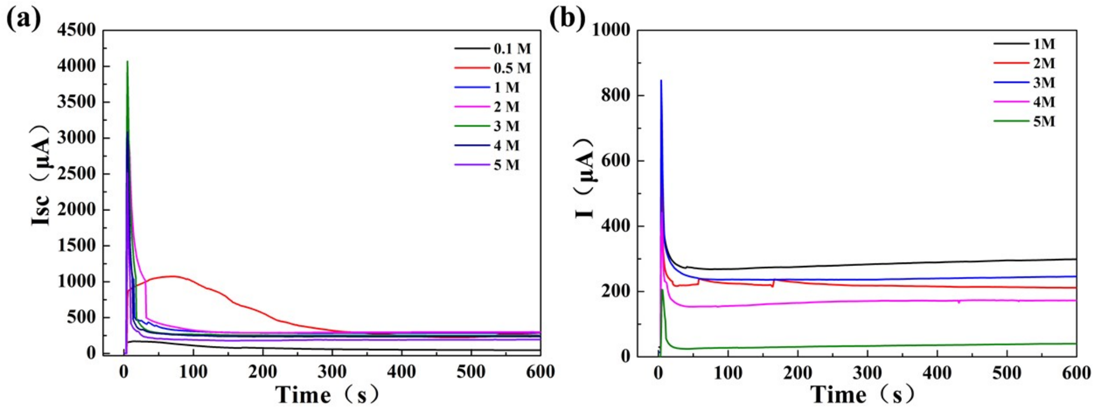

Fig. S7 Short-circuit current and actual output current of PGCMG in different concentrations of NaCl solution.

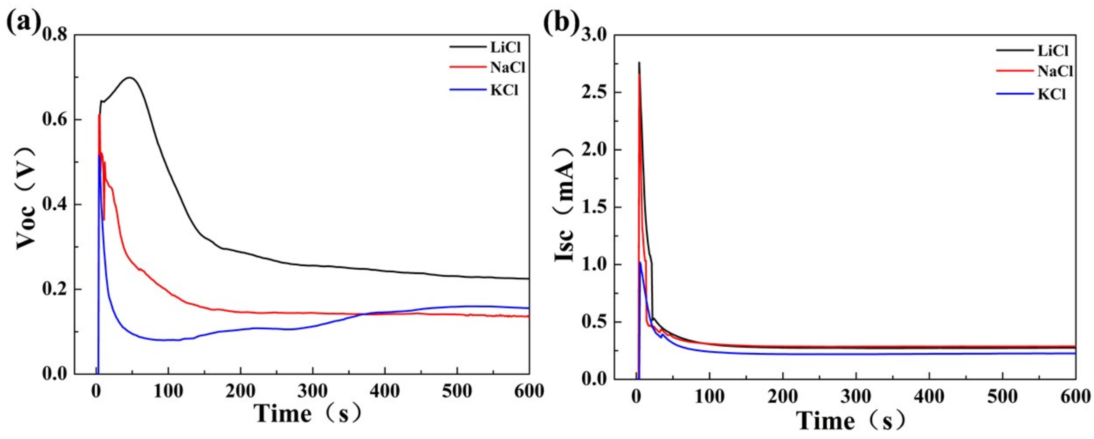

Fig.S8 The Voc and Isc of PGCMG in 1M different ionic solutions.

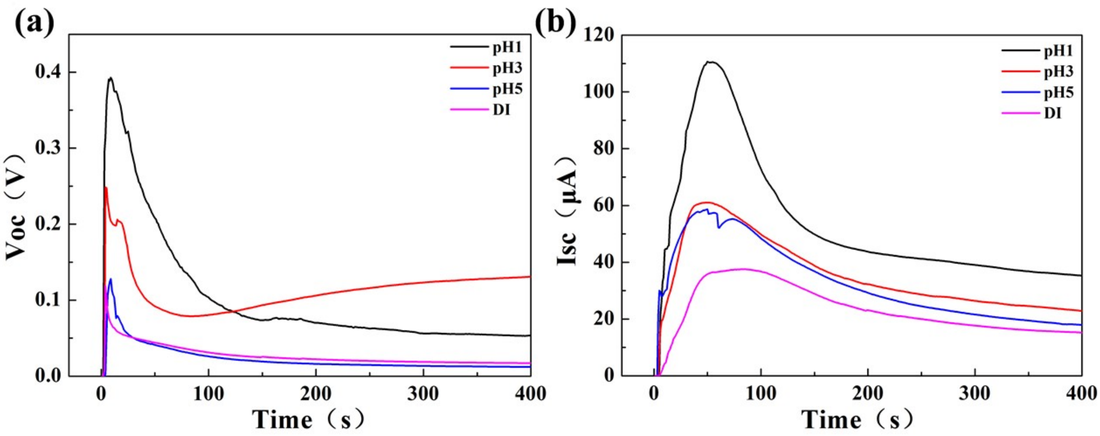

Fig.S9 Power generation performance of PGCMG in different pH solutions.

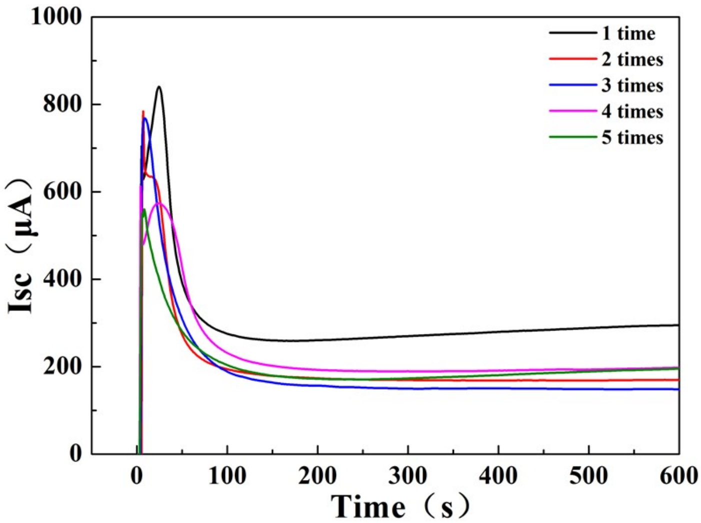

Fig. S10 Power generation performance of PGCMG after five cycles of wetting-drying

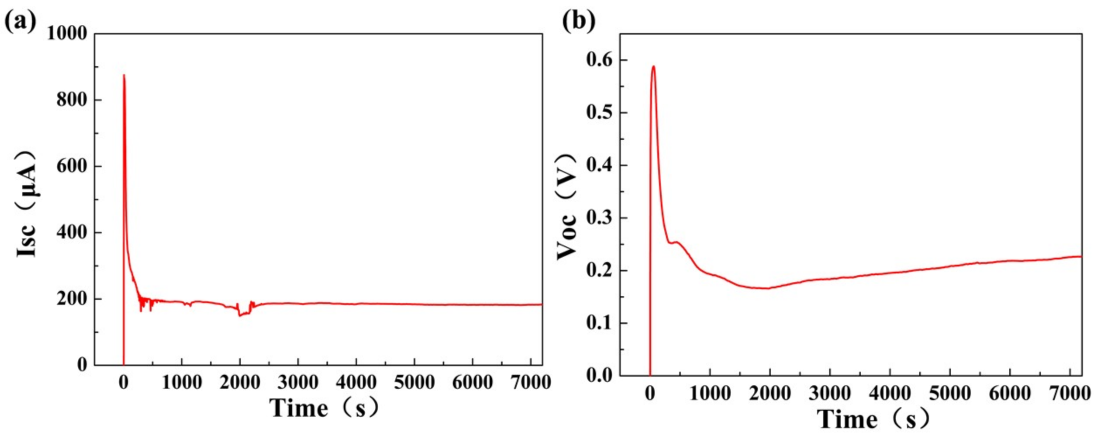

Fig. S11 PGCMG two-hour power generation performance test.

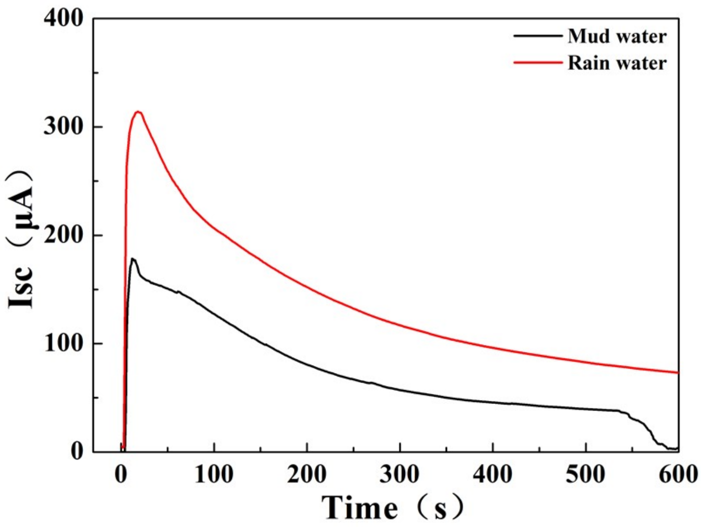

Fig.S12 Power generation performance of PGCMG in rainwater and muddy water solutions.

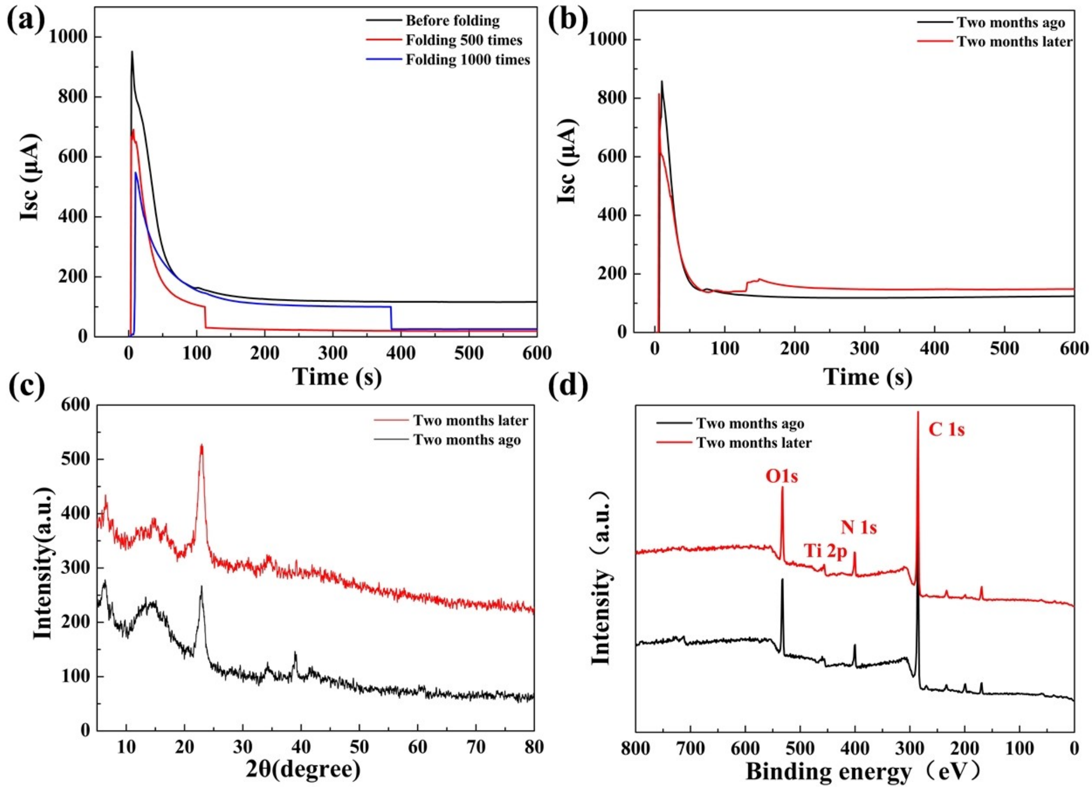

Fig. S13 (a) Power generation performance of PGCMG samples after 500 and 1000 folds. (b) Power generation performance of PGCMG after two months of storage. (c) XRD and (d) XPS spectra of PGCMG before and after two months of storage.

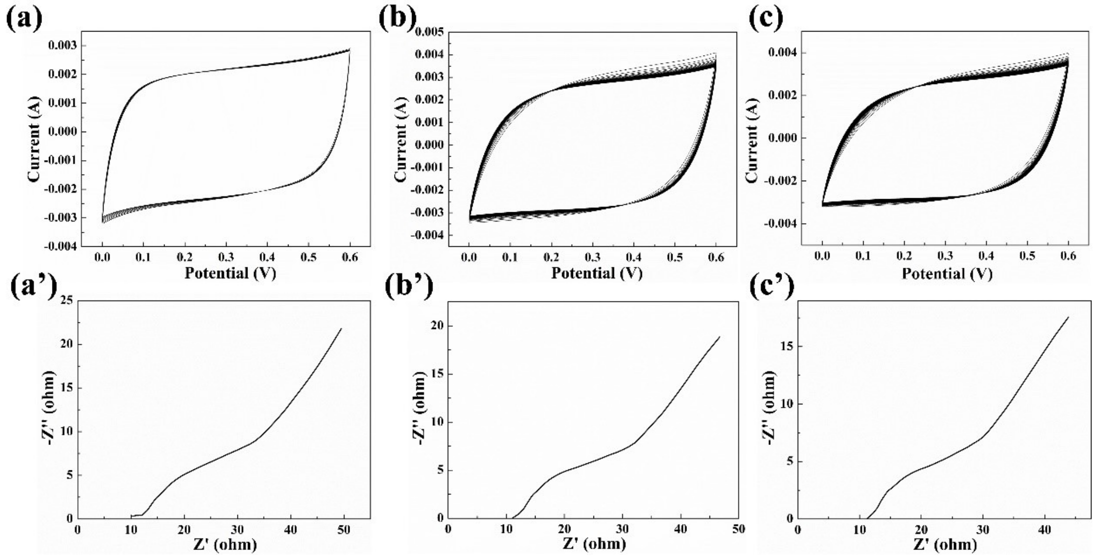

Fig. S14 CV curves and corresponding Nyquist curves of PGCMG samples after different cycles of 10 (a-a'), 30 (b-b') and 50 (c-c').

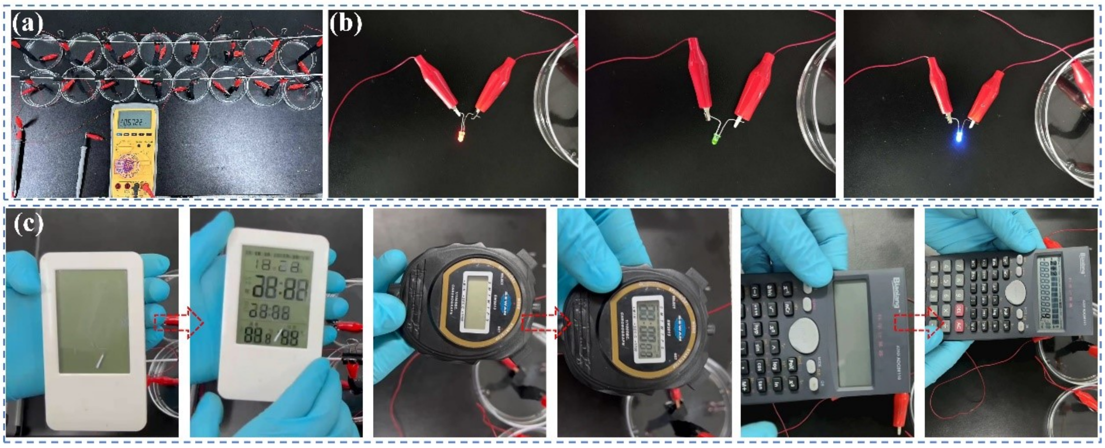

Fig. S15 Serial connection of 16 PGCMG samples with (a) output power and driving (b) small light bulbs of different colors, (c) temperature and humidity device, electronic watch and electronic calculator.

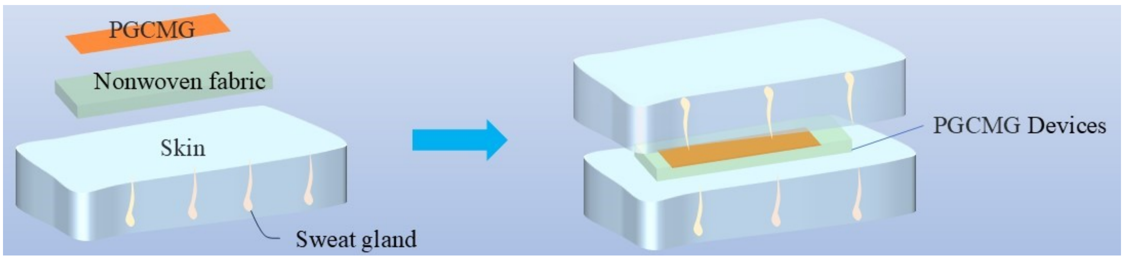

Fig. S16 Schematic diagram of the PGCMG assembly device.

Table.S1 Comparison of energy harvesting for different hydrovoltaic power generation

Materials	Power density	Ref.
GO/PAAS	**0.07 μW/cm^2**	**1**
PAANa/N-CNP/Si	**0.71 μW/cm^2**	**2**
GO membrane	**0.1 μW/cm^2**	**3**

PAN/SDBS、PAN/DTAB	**0.15 μW/cm^2**	**4**
PANI/PVA/$Ti_3C_2T_X$	**0.18 μW/cm^2**	**5**
P(MEDSAHco-AA)	**0.6 μW/cm^2**	**6**
VO/$Ni(OH)_2$	**1.06 μW/cm^2**	**7**
CNT/AAO/In-Ga	**1.3 μW/cm^2**	**8**
CNT/$Ti_3C_2T_X$	**1.56 μW/cm^2**	**9**
PVA/OCB/AP film	**2.45 μW/cm^2**	**10**
Alg/MWCNT	**3.23 μW/cm^2**	**11**
TiO_2 nanowire	**4 μW/cm^2**	**12**
LiCl/Carbon ink	**5.65 μW/cm^2**	**13**
PPy/GO/CNT/ $Ti_3C_2T_X$	**21.5 μW/cm^2**	**This work**

Supplementary References

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