Bio-Inspired 3D-Printed TPU/LiCl Hierarchical Porous Cones for High-Performance Harvesting of Atmospheric Water

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Content

Table S1. Comparison of the water sorption performance for the HPCs in this work and previous publications.

| No.	Materials	Hygroscopic salts loading weight (wt%)	Temperature (°C)	Relative humidity (%)	Water uptake (g g^{-1})	Ref.
1	MOF-801	N/A	25	30	0.25	[1]
2	CACS	N/A	23~26	35	0.3	[2]
3	SGB/LiCl	36	20	70	0.5	[3]
4	MOF nanoporous carbon	N/A	25	20	0.13	[4]
		N/A	25	30	0.19	
		N/A	25	30	0.22	
		N/A	25	50	0.23	
5	Loofah grafted calcium alginate sorbent with ink	70	25	30	0.5	[5]
		70	25	60	1.2	
		70	25	90	1.5	
6	Zeolite 13X/LiCl/CaCl$_2$	20	25	80	1.1	[6]
7	AA/LiCl	14.7	20	80	0.41	[7]
8	LiCl@MIL-101(Cr)	51	30	30	0.77	[8]
9	Cellulose fabric	N/A	25	60	0.31	[9]
10	Nanostructured biopolymer hygroscopic aerogel	N/A	24	18	0.55	[10]
		N/A	24	33	0.8	
		N/A	24	42	0.92	
11	CNF/LiCl-CNF/CNT	213	25	11	0.33	[11]
		213	25	57	1.15	
		213	25	95	1.59	
12	PHRSP-Li	N/A	25	30	0.5	[12]
		N/A	25	90	1.29	
13	CNTs-coated HPC	50	20	30	0.6162	This work
		50	20	55	1.1316	
		50	20	80	2.654	

Table S2. Detailed information of the sorption and desorption process of HPC arrays in the outdoor experiments.

| Sample	Dry weight of the array (g)	Weight of the array after absorbing water vapor for 12 h (g)	Water uptake (g g^{-1})	Weight of the array after water release (g)	Weight of the released water (g)	Evaporation efficiency (%)
HPC arrays	4.9164	14.2256	1.8935	6.77824	7.4474	80%

Table S3. Comparison of the AWH performance between this work and previous publications.

No.	Materials	Water uptake (g g^{-1})	Water sorption rate (g g^{-1} h^{-1})	Water release rate (g g^{-1} h^{-1})	Daily water production (g g^{-1} day^{-1})	Recyclability	Scalability	Ref.
1	PHRSP-Li	1.29 (level 3)	0.45 (level 1)	1.54 (level 5)	0.56 (level 1)	14 (level 2)	level 3	12
2	LiCl@MIL-101(Cr)	0.77 (level 2)	0.19 (level 5)	0.34 (level 4)	0.45 (level 2)	20 (level 4)	Powder (level 1)	8
3	TUN/SA	0.22 (level 1)	0.11 (level 3)	0.13 (level 3)	0.58 (level 2)	Continuous (level 5)	Monolith (level 2)	13
4	CACS	0.3 (level 1)	0.09 (level 2)	0.22 (level 4)	0.26 (level 1)	10 (level 3)	Monolith (level 2)	2
5	CNF/LiCl-CNF/CNT	1.29 (level 3)	0.11 (level 3)	0.31 (level 4)	0.63 (level 2)	10 (level 3)	Compactness (level 4)	11
6	CNTs-coated HPC	2.65 (level 5)	0.132 (level 4)	0.154 (level 3)	2.48 (level 5)	20 (level 4)	level 5	This work

Note: The six grades of "water uptake", "water sorption rate", "water release rate", "daily water production" , "recyclability" and "portability" in brackets are determined according to the value, and the higher the value, the higher the grade. As far as the levels in the portability column are concerned, they are determined by sample state. According to the grade of these data, the radar map is drawn.
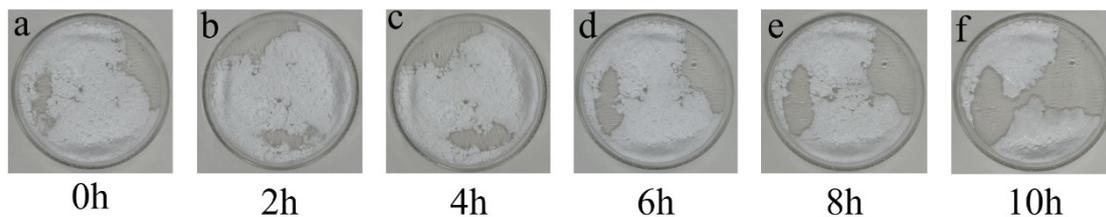
Figure S1.LiCl water absorption. Photographs of LiCl powders during the water sorption process within 10h with humidity of about 50% in an open system.
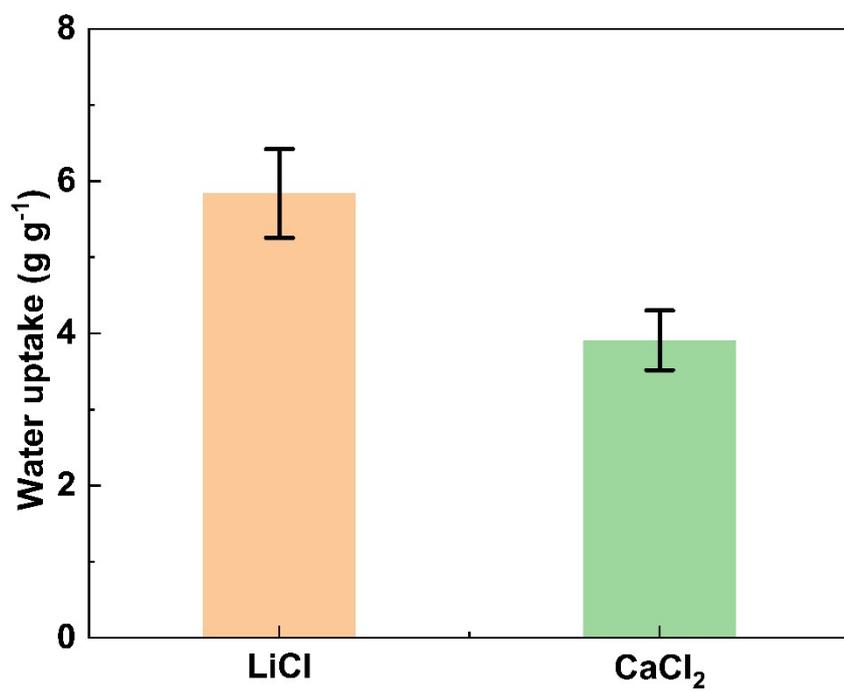
Figure S2. Performance comparison of materials. Comparison of water-harvesting performance between LiCl and CaCl$_2$ under identical conditions.

Figure S3. Preparation equipment. Selective Laser Sintering (SLS) 3D printing machine.
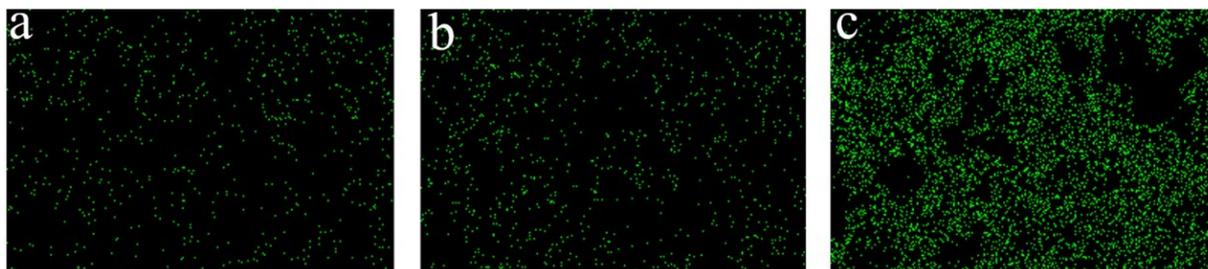
Figure S4. The EDX images of composite powders at TPU/LiCl weight ratios of 7:3 (a), 6:4 (b), and 5:5 (c).
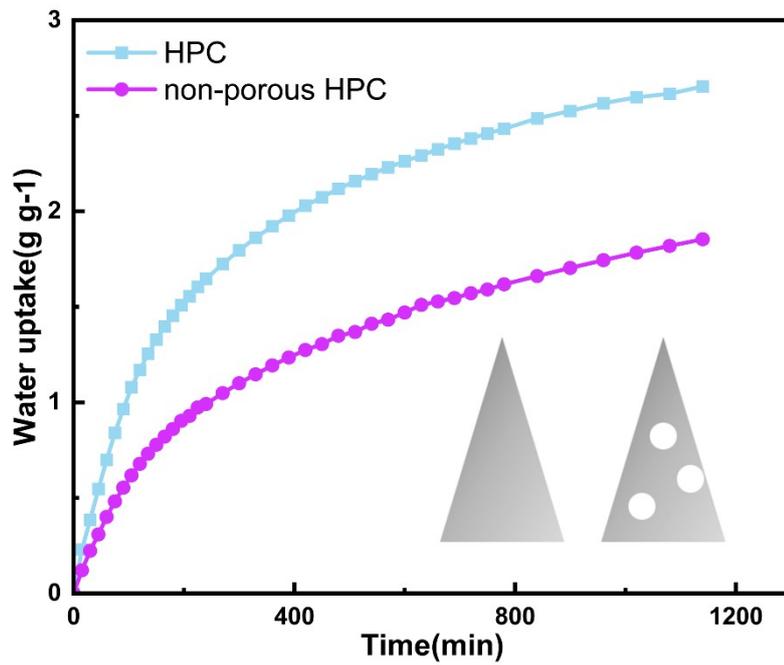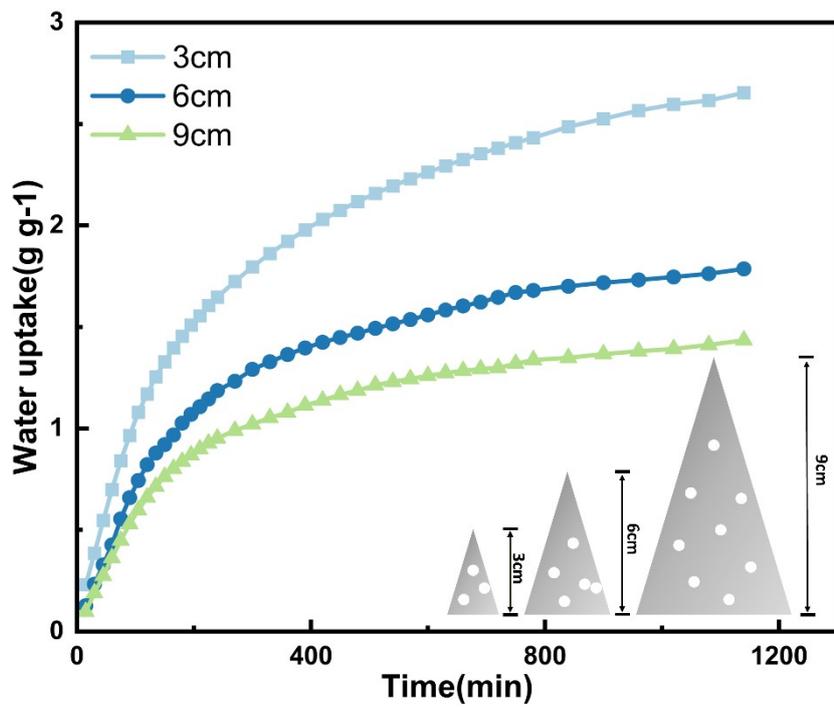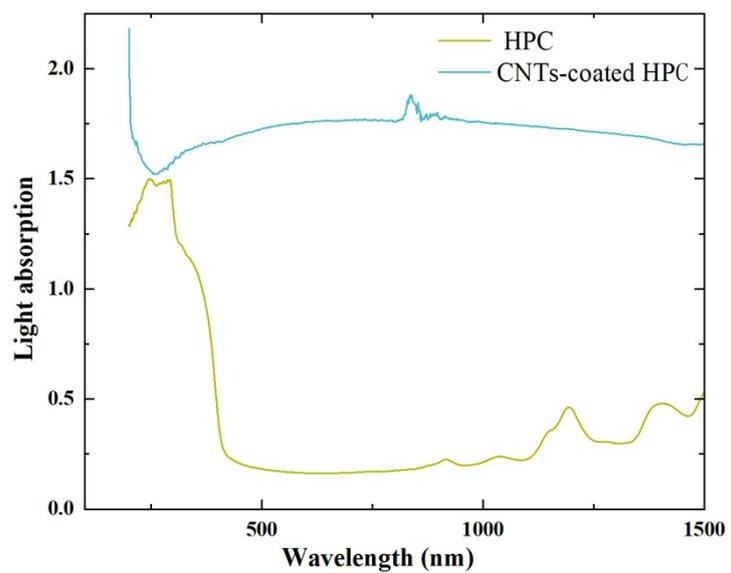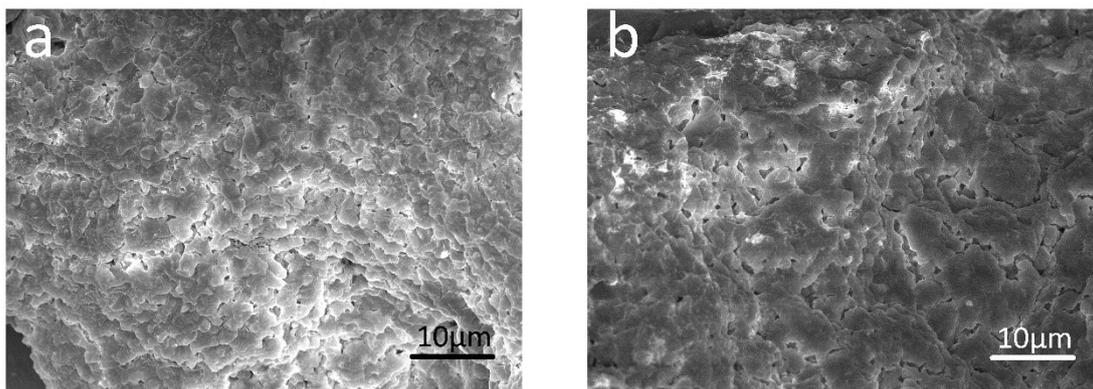
Figure S5. The water absorption performance of HPCs and non-porous TPU/LiCl cone.
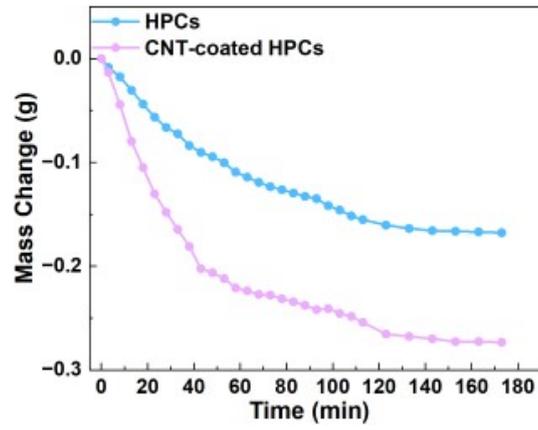
Figure S6. The water absorption performance of HPCs with different bottom diameters.
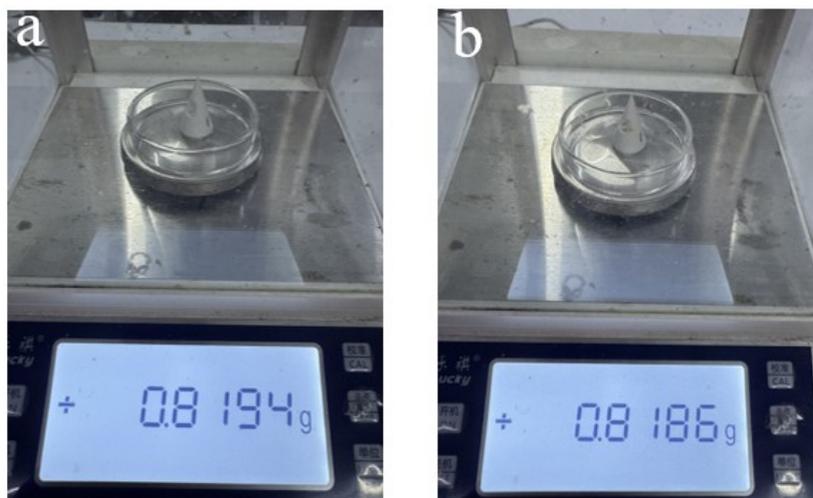
Figure S7. Light absorbance spectra within the wavelength range from 100 to 1500 nm for HPC and CNTs-coated HPC.
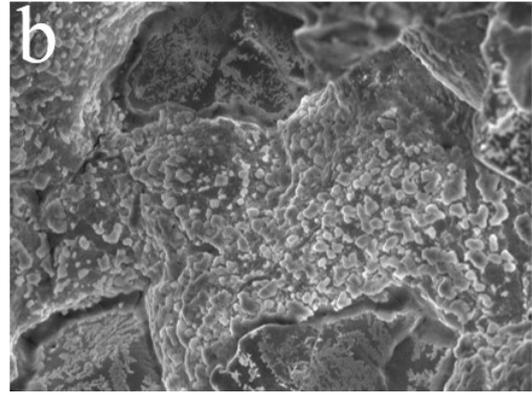
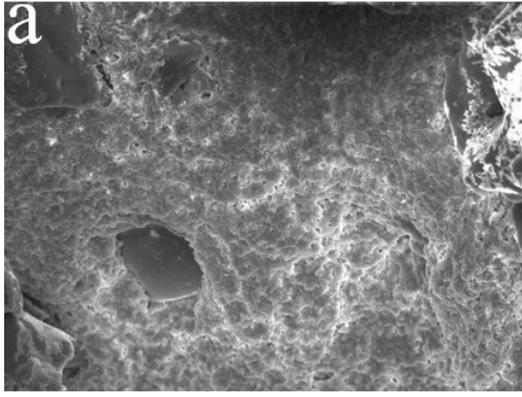**Figure S8. Surface friction test.** (a) SEM before friction test.(b) SEM after 500 friction tests.
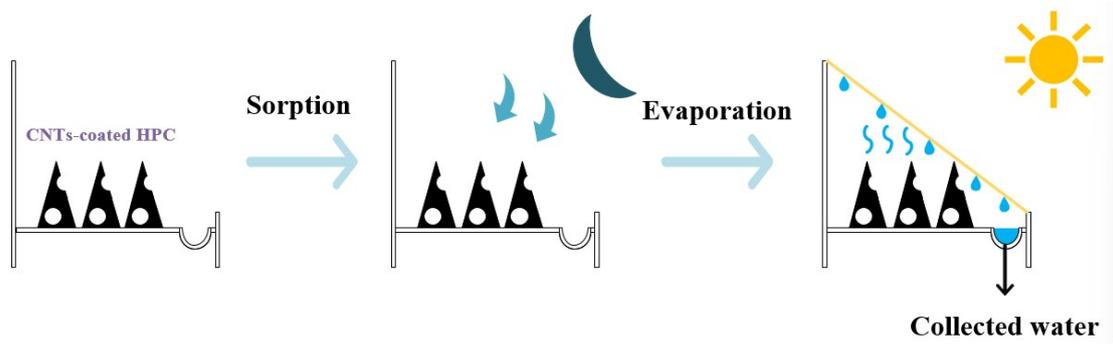
Figure S9. The weight change over time of HPCs and CNTs-coated HPCs under sunlight.

Figure S10. Weight before absorption (a) and after desorption (b) of HPC.

Figure S11. SEM image of HPC before absorption(a) and after desorption(b).

Figure S12. Schematic illustrating the apparatus for water evaporation test.

$$V = \Pi R_1 m \sqrt{R_1^2 + H_1^2} - n\Pi m R_2^2$$

$$S = 2\Pi R_1 \sqrt{R_1^2 + H_1^2} + 2\Pi m R_1 \frac{\sqrt{R_1^2 + H_1^2}}{H_1} + 2nm\Pi R_2 - 2n\Pi R_2^2$$

$$y = \frac{S}{\rho V} = \frac{2}{\rho} [\frac{1}{m} + \frac{1}{H} + (1 + \frac{R_2}{H}) \frac{nR_2}{R_1 \sqrt{R_1^2 + H^2} - nR_2^2}]$$

Equation S1. Derivation of the specific surface area formula for HPC. where ρ is the density of the water-collecting spine, m is the wall thickness, n is the number of openings, R_1 is the bottom diameter, R_2 is the pore diameter, and H is the height of the spine.

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