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Supplementary Information

Solar-driven interfacial evaporation for Water Treatment: Advanced Research Progress and Challenges

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Table S1. Acid and alkali resistance of SDIE

	Composition	Acidic/ Alkaline solution/pH	Purification effect	Method	RE ($kg\ m^{-2}\ h^{-1}$)	EE (%)	Ref.
1	NiCoxSy-PANI@GF	HCl/pH=1; NaOH/pH=14	Structural stability without any corrosion.	Continuous immersion	1.3	78.7	1
2	Carbonized pencil shaving wastes (CPS)	1mol/L H_2SO_4/pH=1; 1mol/L NaOH/ pH=14	No decompose or deform	Immersion and evaporation	1.2	82.2	2
3	Copper-zinc-tin-selenide (CZTSe) nanocarambolas	5×10^{-4} M H_2SO_4/pH=1,3; 5×10^{-2} M NaOH/pH=11,14	H^+ and OH^- concentrations decreases to 10^{-3} and 10^{-1} M	Immersion and evaporation	1.528	86.4	3
4	Ag-PDA@wood	H_2SO_4/pH~1, NaOH/pH~14	The evaporated water exhibits a pH close to 7	Evaporation	1.58	88.6	4
5	Polypyrrole-wax gourd	HCl/pH=1, NaOH/pH=13	Still kept the high and steady evaporation rates	Evaporation	1.57	77.3	5
6	Carbon cloth nanocomposite with biomimetic pelargonium hortorum-petal-like surface(CC-BPHPLS)	pH~1, pH~14	The evaporated water exhibits a pH close to 7	Evaporation	1.42	93	6
7	Hydrophobic and porous carbon nanofiber(HPCNF) membrane	PH=3, PH=12	Evaporation rate is stable	Immersion and evaporation	1.43 1.42~1.43 (acid & alkaline)	87.5	7
8	Sulfuric acid hydrothermal carbonized sugarcane (SHCSC)	1 M H_2SO_4, 1 M NaOH	The evaporation rates is stable.	Immersion and evaporation	2.32 (pure) 2.30 (acid) 2.27 (alkali)		8
9	Chitosan/gelatin-based IPN sponge incorporated with melanin-coated titania hollow nanospheres (CG@MPT-h)	HCl/pH=2~7, NaOH/pH=7~11	Evaporation rate is stable	Evaporation	1.13	78.9	9
10	Pt_3Ni–S-deposited Teflon (PTFE) Membrane	HCl/pH=1.2; NaOH/pH=12	Evaporation rate is stable	Immersion and evaporation	1.27 (pure) 0.93~1.04 (acid & alkaline)	80	10
11	Aligned attapulgite-based aerogel	pH=1 and 13	The pH of the condensed water is ca. 7	Immersion and evaporation	1.41	87.6	11
12	The Janus PDMS/PDA/PU evaporator	pH=3~12	Evaporation rate is stable	Immersion and evaporation	1.2	90.67	12

Table S1(contiued)

	Composition	Acidic/ Alkaline solution/pH	Purification effect	Method	RE (kg m^{-2} h^{-1})	EE (%)	Ref.
13	Multi-walled carbon nanotube (MWCNT) bucky paper	1 mol/L H_2SO_4	No damage. Evaporation rate is stable	Immersion	0.79	56	13
14	A-MU/PAN-3# textile	HCl/pH=1; NaOH/pH=14	Stable structure	Immersion	1.4	89.2	14
15	Multifunctional blacksand aggregate	0.5M H_2SO_4	Stable structure	Immersion (1 y)	1.43	94.96	15
16	GO/Mxene aerogel	H_2SO_4,NaOH pH=1~14	The pH of condensate is ca. 7	Evaporation	1.27	90.7	16
17	Carbonized loofah sponge	1mol/L H_2SO_4/pH =1, 1 mol/L NaOH/ pH =14	The pH of condensate is ca. 7	solar distillation	1.36	83.7	17
18	Ethanol-treated-carrot biochar,(ECB)	12 M HCl, 10 M NaOH	Evaporation rate is stable	Evaporation	2.04	127.8	18
19	PVA hydrogel-based 3D evaporator	HCl/pH=1, NaOH/pH=12.5	The pH of the purified brine was close to neutral	Evaporation	2.22(3.5 wt%NaCl)		19
20	$KMnO_4$ oxidized wood (K-wood)	pH=2,12	The structure and evaporation rate are stable	Evaporation	1.22	81.4	20
21	Superhydrophobic silicone sponge with multi-walled carbon nanotubes (MWCNTs)	2 M H_2SO_4, 2 M NaOH	The pH of aqueous solutions has a negligible effect on the evaporation rate.	Immersion (30 d) and evaporation	1.72	92.4	21
22	Porous foam based on cross-linked aromatic polymer (PDVB-PS)	0.1 M HCl, 0.1 M NaOH	The pH was close to neutral after desalination.	Evaporation	1.3986	87.6	22
23	Wood-TA-Fe^{3+}	HCl/pH=2, NaOH/pH =12	The light absorbing layer can keep black	Immersion (1 d) and evaporation	1.85	90	23
24	Lotus-Inspired Janus biomimetic evaporator (MBE)	0.1 mol/L H_2SO_4, 0.1 mol/L KOH	The purified water meets the standards of drinking water	Evaporation	1.597	74.2	24
25	Solar evaporator constructed by poly(vinyl alcohol) and sodium lignosulfonate (SLS)	1 mol/L HCl, 1 mol/L NaOH	The pH of is ca. 7	Evaporation	2.09	80.4	25
26	KGM / Fe-MOF / PVA network	pH =2~14	Effect evaporation stability	Evaporation	3.2	90	26
27	Calcinated poly-melamine-formaldehyde sponge (MS)in air (AMS)	0.1 mol/L HCl pH~1, 0.1 mol/L NaOH pH~14	The pH of the purified brine was close to neutral	Evaporation	1.98	92	27

Table S1(contiued)

	Composition	Acidic/ Alkaline solution/pH	Purification effect	Method	RE (kg m^{-2} h^{-1})	EE (%)	Ref.
28	SHPP membrane	1wt% CH_3COOH pH=2.8, 1wt% Na_2CO_3 pH=11.7	Structural stability	Immersion	1.68	97.3	28
29	M-PPy sponge	0.1 M HCl, 0.1 M NaOH	The evaporation rate and energy efficiency are almost unchanged	Immersion and evaporation	1.447	84.72	29
30	MXene/LSC hydrogels (MLH)	1mol/L HCl pH=1, 1 mol/L NaOH pH =14	The pH of the collected water was close to neutral	Immersion and evaporation	2.73	92.3	30
31	PDA/PEI/PPy@PI-MS Photothermal Aerogel	HCl/pH=1, NaOH/pH=13	Stable evaporation efficiency	Immersion and evaporation	1.38	93.04	31
32	Modified melamine foam	0.5 M H_2SO_4/pH =1, 1 M NaOH/pH= 14	The purified water is close to neutral (pH=7).	Evaporation	1.38	86.9	32
33	Black PVA sponge soaked in nitric acid	0.5 M H_2SO_4, 1M NaOH	The pH of evaporated water is ca. 7	Evaporation	2.72		33

Table S2. Bacteriostasis and algal inhibition of SDIE

Num.	Material	Bacteria species	Antibacterial effect	Method	RE (kg m^{-2} h^{-1})	EE (%)	Ref.
1	Cu@CuO/CG-aero Janus membrane	E.coli	No bacteria were found in the solar steamed water	Evaporation decontamination	1.32	88	34
2	Carbonized sorghum stalk	Colonies cultured from seawater samples on tryptone agar plate	No bacterial colony was observed in the treated seawater		3.173		35
3	rGO/PTFE composite membrane		Chemical sterilization indicator color from light yellow to black, sterilization success	Sterilizing with high temperature		84	36
4	Activated carbon-juncus effusus (AC-JE)	Colonies cultured in petri dishes with original water samples	No obvious impurities were detected in purified lake water		2.23		37
5	MXene/cellulose photothermal membrane	E.coli S. aureus	After 24 hours, the inhibition rates of E.coli and S. aureus were 99.99 % and 99.98 %, respectively	Physical damage to bacterial membranes	1.44	90	38
6	HHNDL membrane	E.coli S. aureus	10^6 ultra-high quantities of bacteria can be completely intercepted	Evaporation interception	1.657	86.6	39
7	Copper-zinc-tin-selenide (CZTSe) nanocarambolas	S. aureus	CZTSe membrane had no biological pollution	Evaporation interception	1.528	86.4	3
8	Ag-PDA@wood	E.coli	24 h later, bacteria almost completely killed	Sterilization effect of Ag$^+$	1.58	88.6	4
9	Localized interfacial electrical-heating (LIEH) evaporation	E. coli	All E. coli bacterial cells were killed	Sterilizing with high temperature	14.53	90	40
10	Double-layered GO–chitosan/ZnO scaffold (GCZ scaffold)	S. aureus E. coli	72 h later, the number of bacterial cells decreased	Antibacterial effect of ROS	13.5（10 sun）	90.8（10 sun）	41
11	FTCS-PDA/BNC membrane	E.coli	No living bacteria were found after exposure for 10 min	Local temperature rise sterilization	1.0	68	42
12	Vertically oriented graphene nanosheets and graphene aerogel（VG/GA）		Bioindicator color from yellow to purple, sterilization success	Sterilizing with high temperature	12.32（10 sun）	89.4（10 sun）	43

Table S2(continued)

Num.	Material	Bacteria species	Antibacterial effect	Method	RE (kg m^{-2} h^{-1})	EE (%)	Ref.
13	PU/CNT/ZCB fabrics	E. coli S. aureus	S. aureus decreased by 86.5 %, E. coli decreased by 96.2 %		2.2	93.5	44
14	W-cotton cloth-NCC	E. coli	Retention rate of E. coli can reach more than 99.9 % under 10^6 bacteria	Evaporation interception	1.88	89.9	45
15	CPHs based on METAC and PPy	E. coli S. aureus	Almost all S. aureus and E. coli were killed	Mechanism of cationic fixation	1.592		46
16	Ag_3PO_4-rGO nanocomposite-coated textiles	E. coli S. aureus	Antibacterial rates against E. coli and S. aureus were higher than 99 %	Sterilization of Ag^+ and ROS	1.31	86.8	47
17	SA/PVA/HACC hydrogel foam		After 15 days, bacterial coverage on gel surface was lowest	Mechanism of cationic fixation	2.12		48
18	GO/Mxene aerogel	E. coli	No colonies were found after treatment	Sterilizing with high temperature	1.27	90.7	16
19	Hierarchically porous radiation-absorbing hydrogel (hp-RAH)	S. aureus E. coli		Bactericidal effect of Ag nanoparticles	1.983	95	49
20	Ag@MXene/PAN	E. coli	Antibacterial efficiency at 12 h, 18 h and 24 h reached 85.4 %, 98.8 % and 99.9 %, respectively	Sterilization effect of Ag^+	2.08	92.4	50
21	MoS_2@PEI/MCE membrane	Artificial colonies	The agar plate method showed good antibacterial activity	Photothermal synergistic antibacterial effect		92（3.7 sun）	51
22	PPy origami	Bacteria in Colorado River Water	Bacteria removed from the Colorado River		2.12	91.5	52

Table S2(continued)

Num.	Material	Bacteria species	Antibacterial effect	Method	RE (kg m^{-2} h^{-1})	EE (%)	Ref.
23	Carbon and Ag$^+$ loaded on pumice (P-C-Ag$^+$)	E. coli	Almost all E. coli were killed	Sterilization effect of Ag $^+$	1.395	88.8	53
24	All-fiber porous cylinder-like foam (AFPCF)	S. aureus; MRSA; S. epidermidis; E. coli	within 10 min of irradiation,99.86% E. coli, 99.91% S. epidermidis, 99.96% S. aureus, and 99.98% MRSA were killed	Sterilization effect of ROS	3.6		54
25	Ti-Ag-O nanoporous powders	E. coli S. aureus	Ti-Ag-O significantly inhibited the reproduction of E. coli and S. aureus	Sterilization effect of Ag $^+$	2.27	72	55
26	Interfacial-heating-based solar steam sterilization device	Bacillus subtilis (B.S); CC09; Bacillus cereus (B.C.); Bacillus stearothermophilus (B.St.)	For all kinds of bacterial spores, it achieved over 8 LRE	Sterilizing with high temperature	1.21	80	56
27	MnCDs@PPy	Gram-positive (Escherichia coli, Bacillus subtilis); Gram-negative (Staphylococcus aureus, Staphylococcus aureus)	After purification,negligible colonies were seen on the surface plate	Antibacterial activity of oxidative stress	1.68	96.4	57
28	KGM / Fe-MOF / PVA network	E. coli Coliform	E. coli and Coliform reduced to below US drinking water kit levels		3.2	90	26
29	Carbonized corncobs (C-corncobs)	Multiple colonies incubated in actual seawater	No colonies formed on agar plates after seawater purification		1.358	86.7	58
30	Interfacial evaporator within a solar vacuum tube	E. coli G. stearothermophilus biological	After cultured at 56 °C for 24 h, the sterilization was successful	Sterilizing with high temperature		49	59

Table S3. Removal heavy metals of SDIE

	Composition	Species of ions	Removal effect	Removal method	RE ($kg\ m^{-2}\ h^{-1}$)	EE (%)	Ref.
1	GO/MXene aerogel	The initial concentration ($\mu g\ L^{-1}$): $Mn^{6+}=8\times10^{6}$, $Cd^{2+}=8\times10^{5}$, $Pb^{2+}=7\times10^{5}$, $Cu^{2+}=2\times10^{5}$, $Ni^{2+}=9\times10^{4}$, $Zn^{2+}=2\times10^{5}$, $Fe^{2+}=2\times10^{5}$	Ion rejection rate was 99. 9 % after purification	Solar driven water purification	1.27	90.7	16
2	3D-structured carbonized sunflower heads	Cu^{2+}, Ni^{2+} and Pb^{2+}	Concentrations of heavy metal ions decreased by 4 ~ 6 orders of magnitude	Solar driven water purification	1.51	100.4	60
3	rGO-Ag/SA@PU	Pb^{2+}, Cu^{2+}, Cd^{2+} (1500 mg/L)	Concentrations of all heavy metal ions were less than 0.1 mg / L	Solar driven water purification	2.02	91	61
4	Meat and bonemeal biochar (MBB)	Pb^{2+} (1mg/L), Cu^{2+} (2mg/L), Zn^{2+} (5mg/L) and Cd^{2+} (0.1mg/L)	Concentrations of the four ions decreased by about 3 orders of magnitude	Solar driven water purification	1.48	131.2	62
5	Poly(N-isopropyl acrylamide) hydrogel	Pb^{2+}=25ppm	After the first treatment, the Pb^{2+} concentration was 3.7 ppm and 0.012 ppm after the second cycle	Absorbing pure water while removing harmful impurities			63
6	Carbonized loofah sponge	Pb^{2+}, Cu^{2+}, Cr^{3+} (5000 mg/L)	All three ions reduced by 4 orders of magnitude	Solar driven water purification	1.36	83.7	17
7	KGM / Fe-MOF / PVA network	Cd^{2+}, Cr^{3+}, Cr^{6+}, Cu^{2+}, Ni^{2+}, Ag^{+}, Zn^{2+}, Pb^{2+}, Se^{2+}, As^{5+}, Hg^{2+} (>10^{4}ppb)	Total concentration of heavy metal ions decreased by 6 ~ 9 orders of magnitude	Adsorption and solar distillation	3.2	90	26

Table S3(continued)

	Composition	Species of ions	Removal effect	Removal method	RE (kg m^{-2} h^{-1})	EE (%)	Ref.
8	STA-EGaIn/lignin-CNC aerogel (SLC aerogel)	Zn^{2+}, Ni^{2+}, Cu^{2+}, Fe^{3+}	The ion removal rate was 99 % after treatment	Solar distillation	1.29	94	64
9	Chemically-treated carbonized wood	Cu^{2+} , Pb^{2+} , Cd^{2+}, Zn^{2+} , Ni^{2+}(0.1mol L^{-1})	The adsorption capacity of carbonized wood for various metal ions was $Cu^{2+} > Pb^{2+} > Cd^{2+} > Zn^{2+} > Ni^{2+}$	Adsorption	1.85		65
10	Gold nanostructure with the shape of a trepang (nano-trepang)	Hg^{2+}, Cd^{2+},Ag^{+}	The concentration of heavy metal ions drop to 0.01 mg L^{-1} after purification	Solar distillation	2.7	79.3	66
11	PDA/CB@PP non-woven fabrics	Cu^{2+}, Fe^{3+} Sr^{2+}, Zn^{2+}	The rejection rate of ions exceeds 99.9 %	Solar distillation	1.68	91.5	67
12	Carbon nanofiber decorated carbonized loofah (CL-CNF)	Ba^{2+}, Cu^{2+}, Mn^{2+}, and Ni^{2+} (100 mg L^{-1})	Removal rates of ions were higher than 99.8 %	Solar distillation	1.72	92.5	68
13	Cellulose nanofibril/polylactic acid/polyaniline (CNF/PLA/PANI) aerogel	The waste steel treatment solution (pH≈ 0.19) with an Fe^{3+} concentration of up to 97600 mg/L	The concentration of Fe^{3+} in the collected steam water (pH≈ 7) was reduced to 9.8 mg/L	Solar distillation	1.58	90	69
14	Wood/Fe_2O_3/CNT	Cr^{3+}, Pb^{2+}, Zn^{2+}, and Cu^{2+}	The retention rates of four ions were all above 99 %	Solar distillation	1.42	87.2	70
15	Ti_3C_2/MoS_2 nanocomposite	The Cu^{2+}, Cr^{3+}(mg/L), Cd^{2+}(109 mg/L), Zn^{2+}(82.6 mg/L), and Pb^{2+}(153 mg/L)	After purification, the concentrations of Cr^{3+}, Cd^{2+}, Zn^{2+} and Pb^{2+} were 0.06, 0.061, 0.11 and 8.3 mg / L, respectively	Solar distillation	1.36	87.2	71

Table S3(continued)

	Composition	Species of ions	Removal effect	Removal method	RE (kg m^{-2} h^{-1})	EE (%)	Ref.
16	Carbon nanotubes aerogel-coated wood (CACW)	Cr^{2+}, Ni^{2+}, Cu^{2+}, Zn^{2+}（1000mg/L）	The concentration of heavy metal ions decreased significantly after treatment	Solar distillation	2.22	93.2	72
17	Ultrablack carbon aerogels (CAs)	Cr^{3+}, Cu^{2+}, Ni^{2+}, Zn^{2+} and Pb^{2+}	The concentrations of heavy metal ions were below 0.25 mg L^{-1}	Solar distillation	1.37	87.51	73
18	vapor generator(cotton core, polystyrene foam, black nonwoven cotton film）	Cu^{2+}, Cr^{3+}, Pb^{2+}	After purification, the concentration of Cu^{2+} was 0.066 mg / L, the concentration of Cr^{3+} and Pb^{2+} was < 0.01 mg / L	Evaporation purification effect	1.62		74
19	Composite functional layer of polyetherimide modified CER and PEDOT-based conductive ink	Pb^{2+}(24000 mg/L), Cu^{2+}(31750 mg/L) and Cd^{2+}（41250 mg/L）	Three kinds of ion concentration were less than 0.1 ppm, the removal rates were more than 99.9 %	Solar distillation	1.42	82	75
20	MXene/PVA modified PC (MPCF)	Cr^{3+}, Cu^{2+}, Pb^{2+}, Zn^{2+}	All the heavy metal ion concentrations were lower than WHO requirement	Solar distillation	3.38	132.9	76
21	CNT/starch hybrid biohydrogel	Fe^{3+}, Cu^{2+}, Ni^{2+}, Cr^{6+}, Cd^{2+} ,Zn^{2+}	The ion concentration decreased by 5-6 orders of magnitude	Solar distillation	2.77	88	77
22	Pt$_3$Ni–S-deposited Teflon (PTFE) membrane	Cu^{2+}, Cd^{2+}, Cr^{3+}, Ba^{2+} , Pb^{2+}(100mg/L)	After purification, the concentrations of Cu^{2+}, Cd^{2+}, Cr^{3+}, Ba^{2+}, Pb^{2+} were 0.018, 0.023, 0.036, 0.038, 0.051 mg / L, respectively	Solar distillation	1.27	80	10

Table S3(continued)

	Composition	Species of ions	Removal effect	Removal method	RE (kg m^{-2} h^{-1})	EE (%)	Ref.
23	Carbonized aerogel	Cu^{2+}, Zn^{2+}, Pb^{2+}, Cd^{2+}(5g/L)	After purification, the ion concentrations of Cu^{2+}, Zn^{2+}, Pb^{2+} and Cd^{2+} were 0.5, 2, 0.01 and 0.1 mg / L, respectively	Solar distillation	2.1		78
24	HHNDL membrane	Fe^{3+}, Cu^{2+}, Cr^{6+}	Ion rejection rate is close to 100 %	Solar distillation	1.657	86.6	39
25	Graphene assembled porous fiber-based Janus membrane	Cu^{2+}, Mn^{2+}, Cd^{2+}	The ion concentration decreased to less than 10 mg / L, and the ion retention rate was about 99.9 %	Solar distillation	1.4	87.9	79
26	Carbon cloth nanocomposite with a biomimetic pelargonium hortorum-petal-like surface (CC-BPHPLS)	Cr^{3+}, Cd^{2+}, Ni^{2+}, Ag^{+}, Pb^{2+}, Cu^{2+} Pd^{2+}(1000ppm)	Ion rejection rate of ion solution is close to 100 %	Solar distillation	1.42	93	6
27	PPy-compounded air-laid paper (PPy-AP)	Na^{+}, Cu^{2+}, Pb^{2+} and Cd^{2+}	The ion rejection of metal ions can reach 99.99%	Solar distillation	2.0	93.5	80
28	Solar evaporator constructed by poly(vinyl alcohol) and sodium lignosulfonate (SLS)	Co^{2+}, Ni^{2+},Cu^{2+} and Zn^{2+}（1000mg/L）	Retention rates of four ions were above 99.9 %	Solar distillation	2.09	80.4	25
29	Graphene/MoO_{3-x} coated porous Nickel (Ni-G-MoO_{3-x})	Pb^{2+}(116mg/L),Cu^{2+}(112mg/L), Cd^{2+}(102mg/L), Cr^{3+}(104mg/L) and Zn^{2+}(106mg/L)	After purification, the ion concentrations of Pb^{2+}, Cu^{2+}, Cd^{2+}, Cr^{3+}, Zn^{2+} were 0.001, 0.0002, 0.0008, 0.002, 0.014mg / L, respectively	Solar distillation	1.5	95	81

Table S3(continued)

	Composition	Species of ions	Removal effect	Removal method	RE (kg m^{-2} h^{-1})	EE (%)	Ref.
30	PVA hydrogel-based 3D evaporator	Na$^+$, K$^+$, Li$^+$, Cu^{2+}, Mg^{2+}	After desalination, the above ion concentration decreased by 3 orders of magnitude	Solar distillation	2.22 (3.5 wt % NaCl)		19
31	Situ-polymerized nickel foam (IPNF)	Cu^{2+}, Pb^{2+}, Cd^{2+} and Cr^{3+}(1000mg/L)	After purification, the concentrations of Cu^{2+}, Pb^{2+}, Cd^{2+}, Cr^{3+} were 0.0085, 0.0063, 0.0042, 0.0033mg / L, respectively	Solar distillation	1.74	90	82
32	Corn straw-based microcrystalline	Cu^{2+}, Cr^{6+}, Zn^{2+}(400 mg/L)	Three metal concentrations were reduced by 95 %, 88 % and 90 %, respectively	Adsorption	1.44	88	83
	Oxidized microcrystalline cellulose	Cu^{2+}, Cr^{6+}, Zn^{2+}(400 mg/L)	After purification, the ion concentrations decreased by 99 %, 89 % and 92 %, respectively	Adsorption	1.36	84	
33	Carbon nanotube/polyvinyl alcohol porous composite evaporator	Cu^{2+}(6.47 mg/L), Ni^{2+}(6.9 mg/L), Cr^{6+}(7.28 mg/L) , and Zn^{2+}(7.97 mg/L)	The removal rate of Cr^{6+} was more than 99.86 %, and the removal rate of other ions was more than 96.81 %	Solar distillation	1.34	85.71	84
34	Hydrophobic soot coated cloth / hydrophilic cloth double layer on PE coated cellulose aerogel	Ni^{2+}, Cu^{2+}, Zn^{2+}, and Pb^{2+} (1000 mg/L)	Concentrations of metal ions after evaporation were lower than China standard limits	Solar distillation	1.308	91.2	85

Table S3(continued)

	Composition	Species of ions	Removal effect	Removal method	RE ($kg\ m^{-2}\ h^{-1}$)	EE (%)	Ref.
35	Copper-zinc-tin-selenide (CZTSe) nanocarambolas	Cu^{+}, Zn^{2+}, Sn^{4+} and Se^{2-}	After evaporation,there was no presence of Cu or Se element	Solar distillation	1.528	86.4	3
36	Cu-CAT/Wood	Cu^{2+} and Cd^{2+}(100 mg/L)	Concentrations of Cu^{2+} and Cd^{2+} were lower than 1 mg /L	Solar distillation	1.8		86
37	Carbon hybrid aerogel (CHA)	Fe^{3+}, Cu^{2+}, Cd^{2+}, Pb^{2+}, Zn^{2+}, Ni^{2+}, Al^{3+}, Se^{2+}, Mn^{2+}, Sn^{3+}, V^{5+}, and Li^{+}	Concentrations of metal ions decreased by three orders of magnitude	Solar distillation	2.1		87
38	CuO@PDA/PB	Na^{+}, K^{+}, Ca^{2+}, Mg^{2+}, Cu^{2+} and Cr^{3+}	After distillation, the above ion concentrations decreased significantly and were lower than WHO standards	Solar distillation	1.39	87.1	88
39	Nanofibrous hydrogel-reduced graphene oxide (NHrG) membrane	Cd^{2+}, Cu^{2+}, Ni^{2+}, Pb^{2+}, Zn^{2+}(100 mg/L.)	The removal was consistently more than 99.5%	Solar distillation	1.85	95.4	89
40	3D interconnected porous carbon foam	Cu^{2+} , Ni^{2+}, Cd^{2+} , Zn^{2+}(5g/L)	After purification, the ion concentrations of Cu^{2+}, Ni^{2+}, Cd^{2+} and Zn^{2+} were 0.5, 1, 0.1 and 2 mg / L, respectively	Solar distillation	10.9 (natural convection)		90
41	PPY/BTA hydrogel	Wastewater containing Ag-NPs	Water collected by evaporation was free of pollutants	Solar distillation	1.9	89	91
42	N,S-GO/PPy foam	Fe^{3+}, Cu^{2+}, Cr^{6+}, Na^{+}, K^{+}	The concentration of main ions in wastewater decreased by 2 to 6 orders of magnitude	Solar distillation	1.32	90.5	92

Table S3(continued)

	Composition	**Species of ions**	**Removal effect**	**Removal method**	**REEe (kg m^{-2} h^{-1})**	**EE (%)**	**Ref.**
43	PSN-functionalized reduced graphene oxide (PSN-rGO) aerogel	Hg^{2+}(200 ppb),Cd^{2+}, Pb^{2+}, Ni^{2+},Cu^{2+} ,Zn^{2+}	Ion rejection rate close to 100 %, Hg^{2+} concentration below 1 ppb	Solar distillation	1.55	90.8	93
44	$Ti_3C_2T_x$ MXene/GO/polyaniline hybrids(MGP)	Cr^{3+}, Cu^{2+}, Pb^{2+}, Zn^{2+}	The rejection of metal ions was about 99.9 %	Solar distillation	3.94	135.6	94
45	MnCDs@PPy	Ca^{2+}, Pb^{2+}, Cr^{3+}, Mg^{2+}, Ti^{3+}, Hg^{2+}, Fe^{3+},Zn^{2+}	All above ions are excluded	Solar distillation	1.68	96.4	57
46	PPy@PEI@A-CNF aerogel	Mn^{2+}, Co^{2+},Cu^{2+} and Cr^{3+}(500mg/L)	After purification, the ion concentrations of Mn^{2+}, Co^{2+}, Cu^{2+} and Cr^{3+} were 0.42, 0.27, 0.58 and 0.39 mg / L, respectively	Solar distillation	1.66	94.62	95
47	MoS_2/SA@melamine foam	Pb^{2+}, Cu^{2+}, Fe^{3+} and Zn^{2+}(200mg/L)	After purification, the ion concentrations of Pb^{2+}, Cu^{2+}, Fe^{3+} and Zn^{2+} were 0.08, 66.9, 98.4 and 107 mg / L, respectively	Adsorption	1.92（3.5wt%NaCl）	90（3.5wt%NaCl）	96
48	Situ-polymerized MnO_2 nanowires/chitosan hydrogel(SPM-CH)	Ca^{2+}, Pb^{2+}, Cr^{3+}, Mg^{2+}	Ca^{2+} decreased obviously, Pb^{2+}, Cr^{3+}, Mg^{2+} were removed successfully	Solar distillation	1.78	90.6	97
49	All-fiber porous cylinder-like foam (AFPCF)	Na^+, Mg^{2+}, K^+, Ca^{2+}, and Pb^{2+} (10^3mg/L,simulated seawater)	Ion concentration decreased to 10-1 mg / L and removal efficiency reached 99.9 %	Solar distillation	3.6		54
50	SiO_2/MXene/HPTFE Janus membrane	Cu^{2+}, Mn^{2+}, Cd^{2+}	Ion rejection after purification was 99.9 %	Solar distillation	1.53	85.6	98

Table S3(continued)

	Composition	Species of ions	Removal effect	Removal method	RE (kg m^{-2} h^{-1})	EE (%)	Ref.
51	PDA-t@PU	Ni^{2+}, Cu^{2+}, Zn^{2+} and Pt^{2+}	Ion content decreased to about 10^{-2} mg / L after purification	Solar distillation	2.5–3.6		99
52	Cu@CuO/CG-aero Janus membrane	Cd^{2+},Pb^{2+},Cr^{2+}(20ppm)	About 99.999 % of metal ions were removed after solar evaporation	Solar distillation	1.32	88	34
53	MoS_2/C @ PU sponge	Ni^{2+}(271mg/L), Hg^{+}(200 ppb)	Ni^{2+} concentration decreased to 1 mg / L, and Hg^{2+} concentration decreased to 1 ppb	Solar distillation	1.95	88	100
54	MXene/LSC hydrogels (MLH)	Pb^{2+}, Cu^{2+}, Zn^{2+}(5000 mg/L)	Pb^{2+}, Cu^{2+}, Zn^{2+} concentrations decreased to 0.004, 0.138, 1.363 ppm, respectively	Solar distillation	2.73	92.3	30
55	SA/MNP@rGO aerogel	Mn^{2+}, Cu^{2+}, Ba^{2+}, Ni^{2+}(100 mg/L)	Concentrations of Mn^{2+}, Ba^{2+}, Cu^{2+}, Ni^{2+} decreased to 0.1389, 4.53, 0.0504, 0.0564μg / L, respectively	Solar distillation	2.64	93.9	101
56	Co−Sn alloy@PTFE	Mn^{2+}, Co^{2+}, Ni^{2+}, Cu^{2+}, Zn^{2+} and Cd^{2+}(100mg/L)	The ion retention rate was over 99.5 %	Solar distillation	1.28	89	102
57	Polyethyleneimine crosslinked carbon nanotubes/cellulose nanofibers (PEI@CNTs/CNFs)	Cu^{2+}, Zn^{2+}, Ni^{2+}, Co^{2+}(100mg/L)	Cu^{2+}, Zn^{2+}, Ni^{2+}, Co^{2+} concentrations decreased to 0.4ppb, 0.2ppb, 0.1ppb, 0.02ppb, respectively	Solar distillation	1.9	91.4	103

Table S3(continued)

	Composition	**Species of ions**	**Removal effect**	**Removal method**	**RE (kg m^{-2} h^{-1})**	**EE (%)**	**Ref.**
58	Foam-flamed-wood (F-F-wood)	Fe^{3+}, Cr^{3+}, Cu^{2+}	Removal of these ions was close to 100 %	Solar distillation	3.92		104
59	WO_3 decorated on nickel foam (WO_{3-x}/NF)	Cu^{2+}(10^6μg/L),Mn^{2+}(10^5μg/L),Cd^{2+} (10^4μg/L)	The concentrations of Cu^{2+}, Mn^{2+} and Cd^{2+} decreased to below 0.87, 1.47 and 0.08 mg / L, respectively	Solar distillation	1.50	88	105
60	a-CNTs-PPy-C	Zn^{2+}, Sr^{2+}, Cu^{2+},Fe^{3+}	The retention rate of ions exceeded 99.9 %	Solar distillation	1.61	91.2	106
61	Activated carbon-juncus effusus (AC-JE)	Cu^{2+}, Cd^{2+}, Pb^{2+}, and Zn^{2+}	The concentrations of Cu^{2+}, Cd^{2+}, Pb^{2+}, Zn^{2+} decreased to 0.020, 0.0060, 0.076, 0.060 mg / L, respectively	Solar distillation	2.23		37
62	Semi-coke/polydopamine@photothermal melamine sponge (SPMS)	Pb^{2+}, Cd^{2+}, Ag^{+}, Cu^{2+}, Zn^{2+}(1000mg/L)	Mixed heavy metal solution have almost disappeared	Solar distillation	1.41	90.56	107
63	PDA-modified biochar composite membrane	Cd^{2+}, Cu^{2+}, Ni^{2+}, Pb^{2+}, and Zn^{2+}	99.5 % of heavy metal ions can be removed	Solar distillation	1.65	90.5	108
64	Yolk-like non-stoichiometric nickel sulfide-based Janus hydrogel	Cd^{3+}, Co^{2+}, Cu^{2+}, Mn^{2+}, Ni^{2+}, and Zn^{2+}(100mg/L)	The removal rate of heavy metal ions was 99.9 %	Solar distillation	1.45	97	109

Table S3(continued)

	Composition	Species of ions	Removal effect	Removal method	RE (kg m^{-2} h^{-1})	EE (%)	Ref.
65	Superhydrophobic silicone sponge with multi-walled carbon nanotubes (MWCNTs)	Cu^{2+}(1280mg/L), Zn^{2+}（1300 mg/L）	The concentration of Cu^{2+} and Zn^{2+} decreased to 0.087 and 0.125 mg / L, and the ion removal rate was above 99.99 %	Solar distillation	1.72	92.4	21

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