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Supporting information

for

Enhanced desalination performance in flow electrode capacitive deionization with nitrogen doped porous carbon

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Table. S1. Parameters index of activated carbon.

Item	YEC-8A
Surface area (m^2/g)	＞1800
Ash (%)	0.26
Moisture	＜5
Iron salt (%)	＜0.005
Particle size	～10 μm

Table. S2. Parameters index of ion exchange membrane

Membrane type	anion exchange membrane Grion 0011 (28S)	cation exchange membrane Grion 1201 (3)
thickness (hygrometric state) (mm)	0.28 ± 0.03	0.26 ± 0.02
Dry and wet dilatancy (%)	5~12	4~6
Water content (%)	35（wet）	35（wet）
Bursting strength (Kg/cm^2)	6	9
Exchange capacity (meq/g)	2.1	1.9
Selective transmittance (%)	98	≥98
The membrane surface resistance ($\Omega \cdot cm^2$)	3	2.4
Current density ($mA \cdot cm^2$)	＜150	＜100
Temperature resistance (℃)	＜80℃	＜60℃

Table. S3. Composition of the flow electrode.

Sample	Active material (g)	Deionized water (mL)	Carbon black (g)
1 wt% AC	0.8 AC	79.0	0.2
2 wt% AC	1.6 AC	78.2	0.2
3 wt% AC	2.4 AC	77.4	0.2
1 wt% NPC	0.8 NPC	79.0	0.2
2 wt% NPC	1.6 NPC	78.2	0.2
3 wt% NPC	2.4 NPC	77.4	0.2

Table. S4. Porosity parameters and heteroatom content of the NPC

Sample	S_{BET} ($m^2 \cdot g^{-1}$)	Carbon content (at%)	Nitrogen content (at%)	Oxygen content (at%)
AC	2,143.8	92.48	1.02	6.50
NPC-700	787.4	86.34	8.64	5.02
NPC-800	1168.4	93.77	3.12	3.11
NPC-900	1079.1	94.89	2.54	2.57

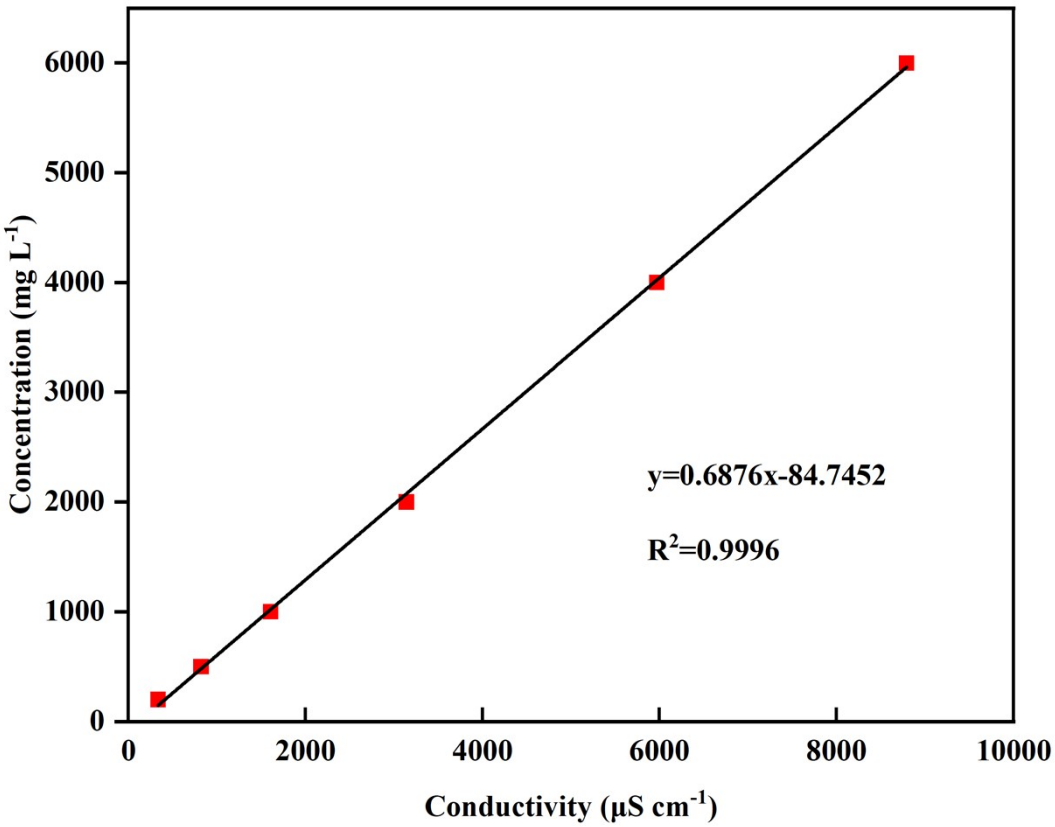

Fig. S1. Calibration curve of conductivity to NaCl concentration.

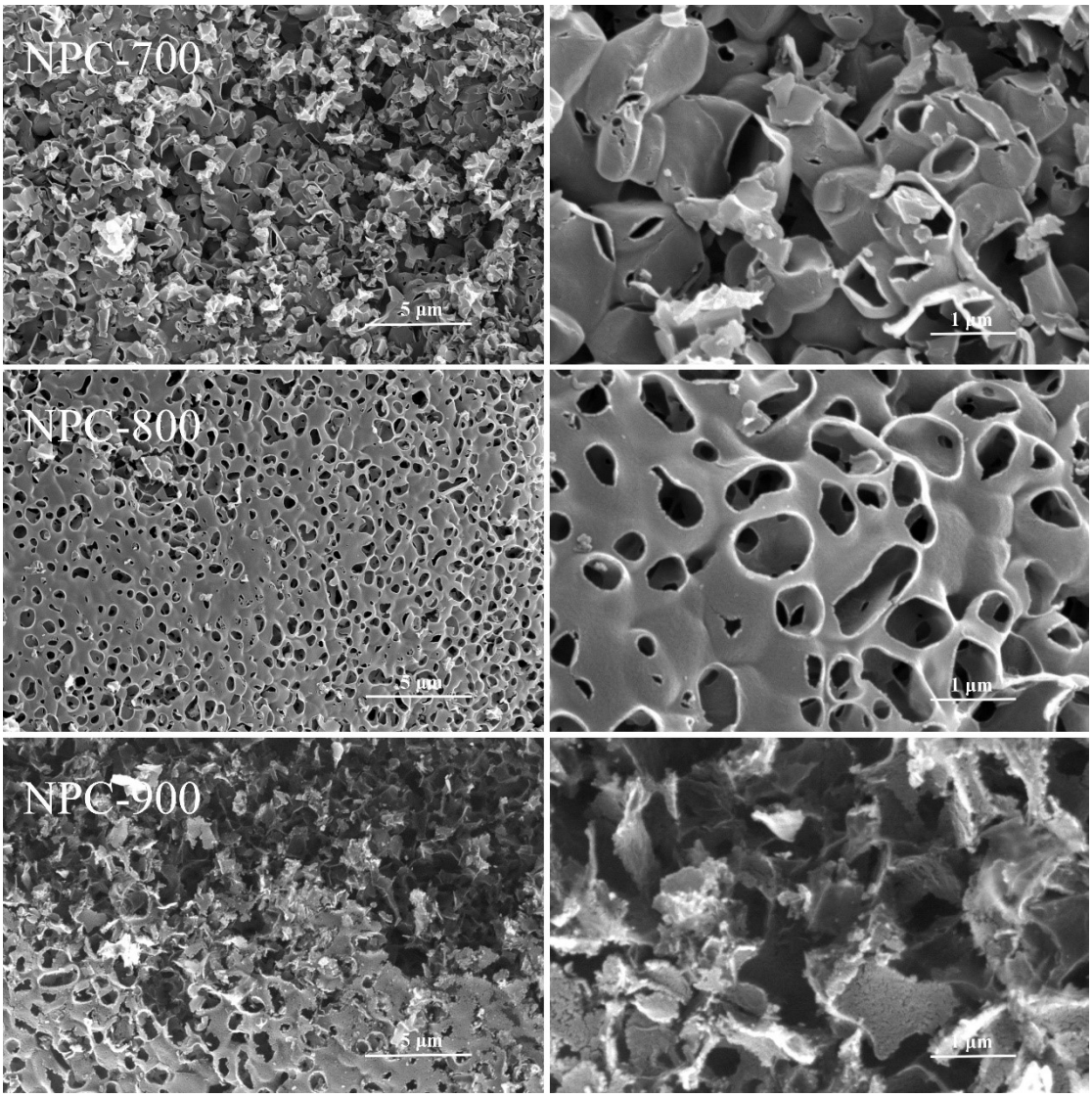

Fig. S2. Morphology of NPC prepared at different pyrolysis temperatures illustrated by SEM.

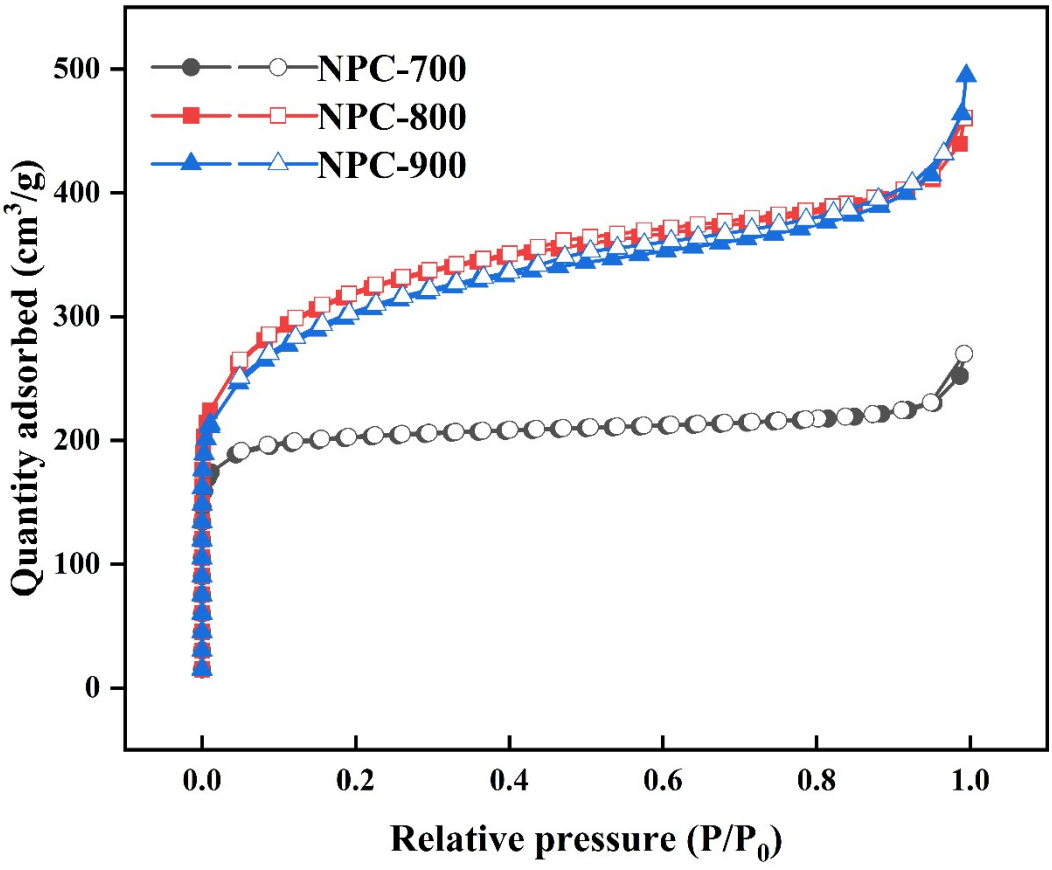

Fig. S3. Nitrogen adsorption/desorption isotherms of NPC prepared from different pyrolysis temperature.

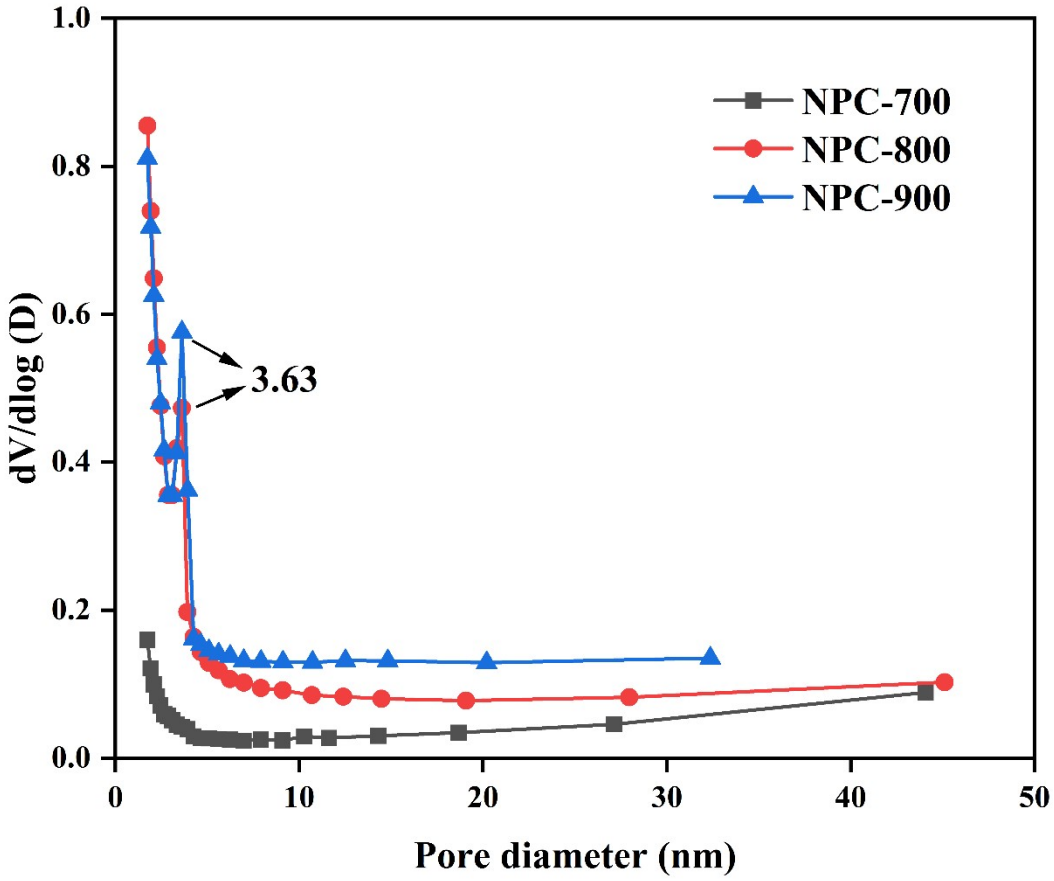

Fig. S4. BJH pore size distribution plots for the NPC prepared from different pyrolysis temperature.

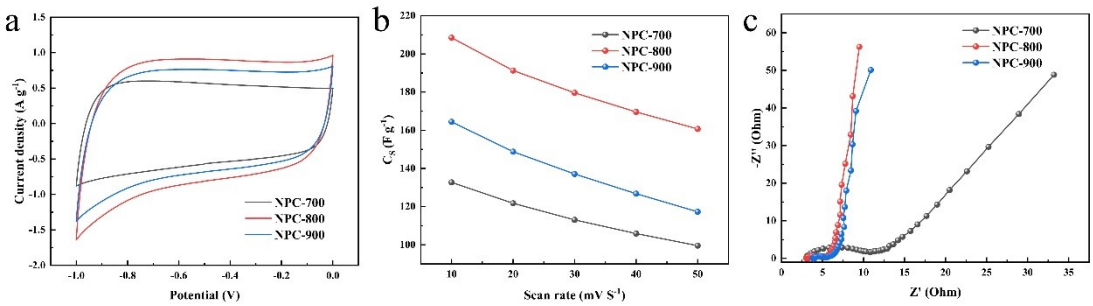

Fig. S5. Electrochemical performance tests of the NPC electrodes at different pyrolysis temperature in a 1M NaCl aqueous solution. (a) The CV curves were scanned at a rate of 10 mV s^{-1}; (b) The specific capacitance at different scan rates; (c) EIS spectra of the NPC.

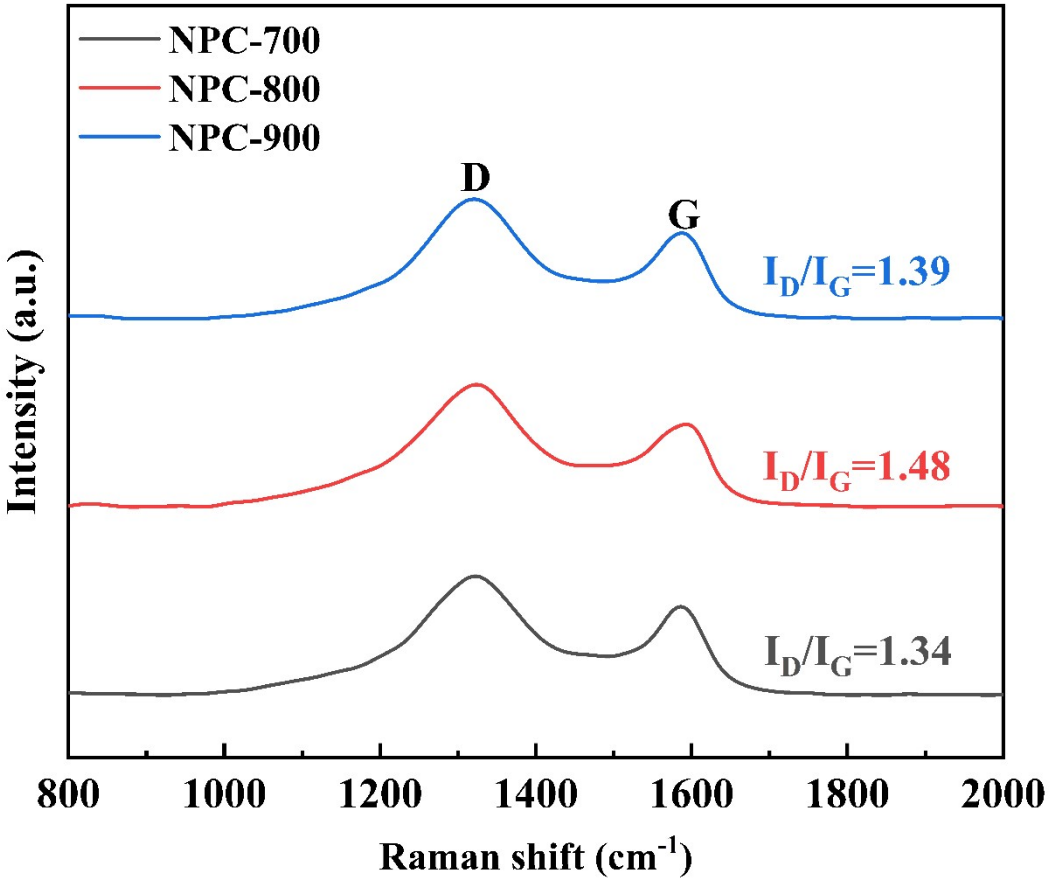

Fig. S6. The Raman spectroscopy of NPC at different pyrolysis temperature

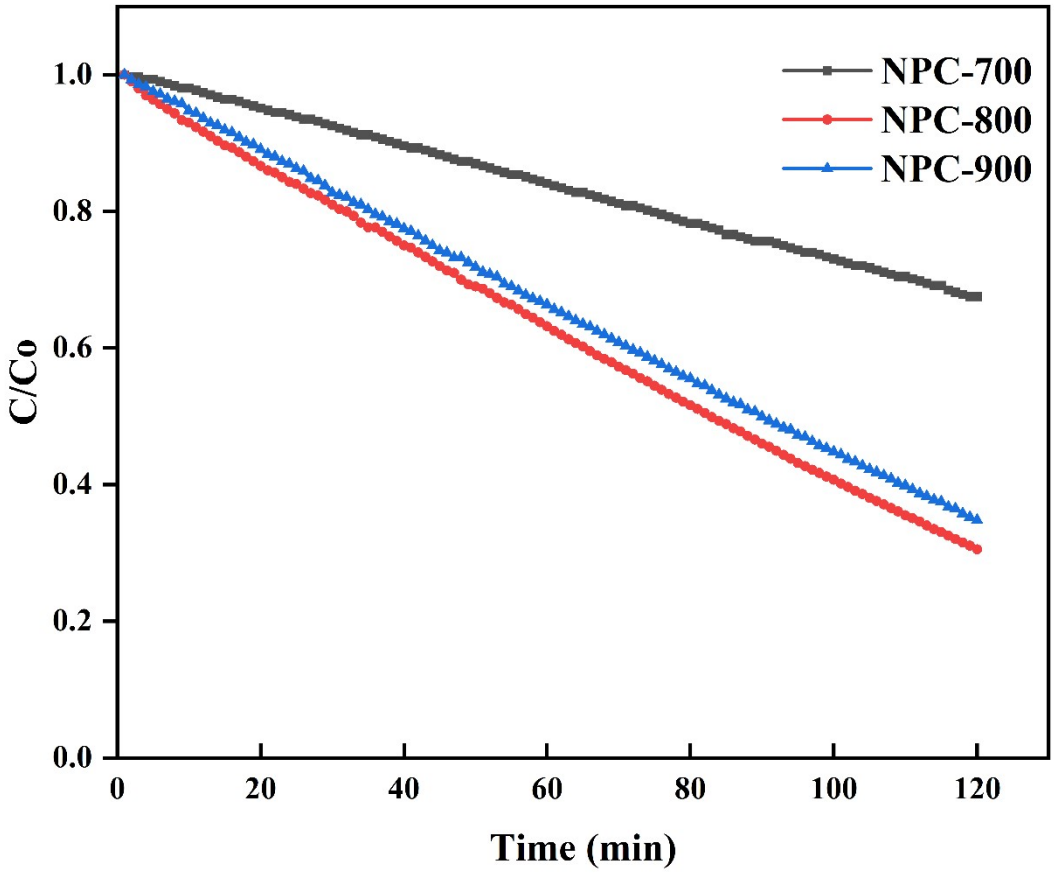

Fig. S7. The C/C_0 of three NPC prepared at different pyrolysis temperature (1.2 V applied voltage, 1 wt% carbon content, 2000 mg L^{-1} initial concentration of NaCl).

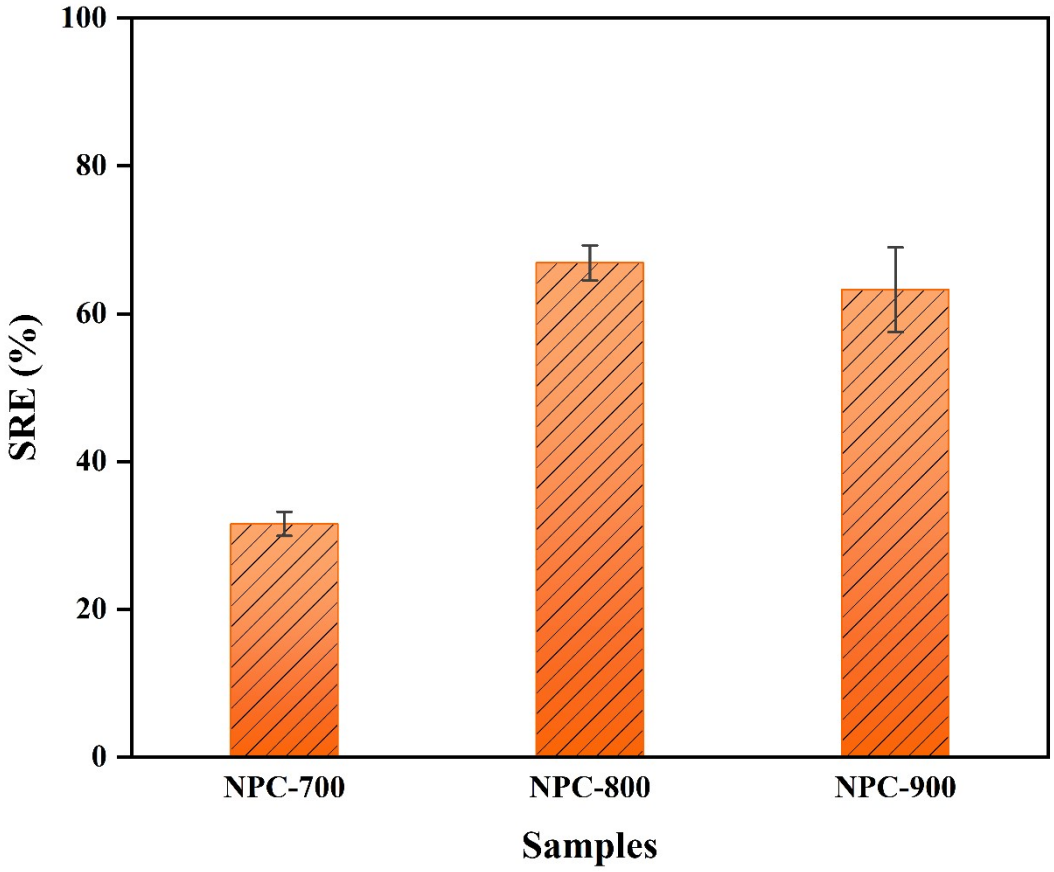

Fig. S8. The SRE of the three NPC samples. (1.2 V applied voltage, 1 wt% carbon content, 2000 mg L^{-1} initial concentration of NaCl).

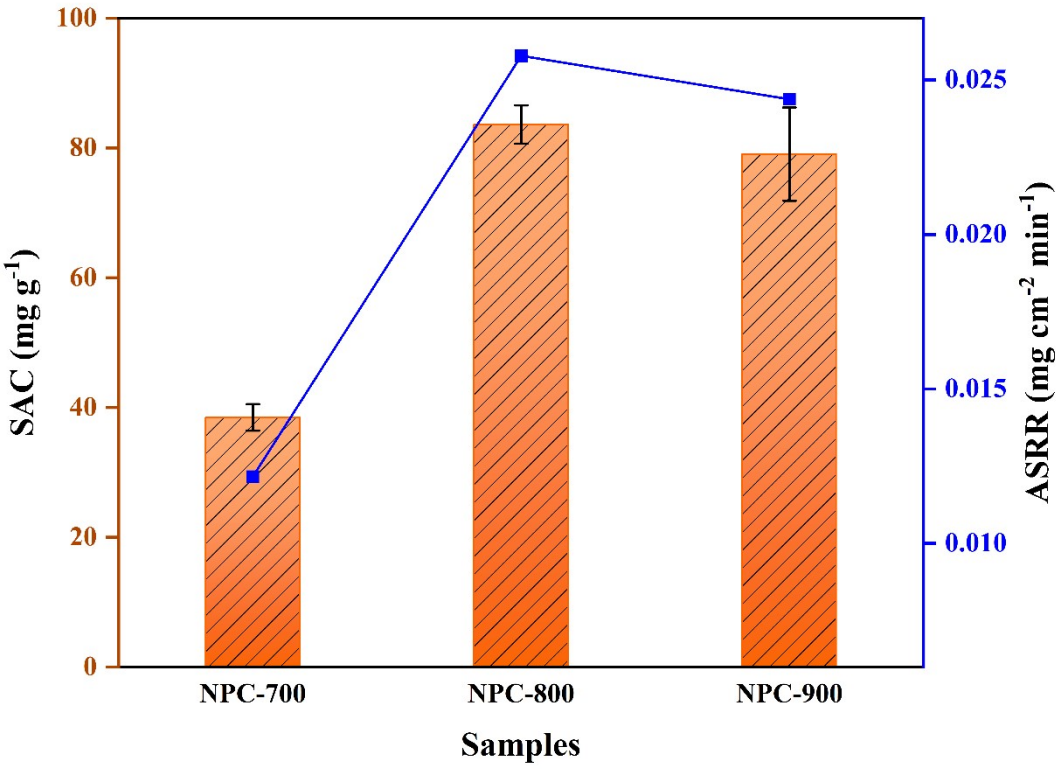

Fig. S9. The SAC and ASRR of the three NPC samples. (1.2 V applied voltage, 1 wt% carbon content, 2000 mg L^{-1} initial concentration of NaCl).

The Desalination performances of the three samples prepared at different temperatures were studied. As shown in Fig. S7, the NPC-800 showed lowest C/C0 than the other samples, the salt adsorption capacity (SAC), average salt removal rate (ASRR) and the salt removal efficiency (SRE) for NPC-800 were higher than that of NPC-700 and NPC-900 (Fig. S8, Fig. S9). The reason for this was that the NPC-800 had a higher specific surface area and pore volume, suitable nitrogen and oxygen doping, it presented the best desalination performance among the three NPC samples. As for NPC-700, it did not form a mesoporous structure (Fig. S4) and had a small specific surface area at lower temperatures. As for NPC-900, when the temperature was too high, the pore structure was destroyed and the surface collapsed (Fig. S2), resulting in a reduction of the specific surface area.

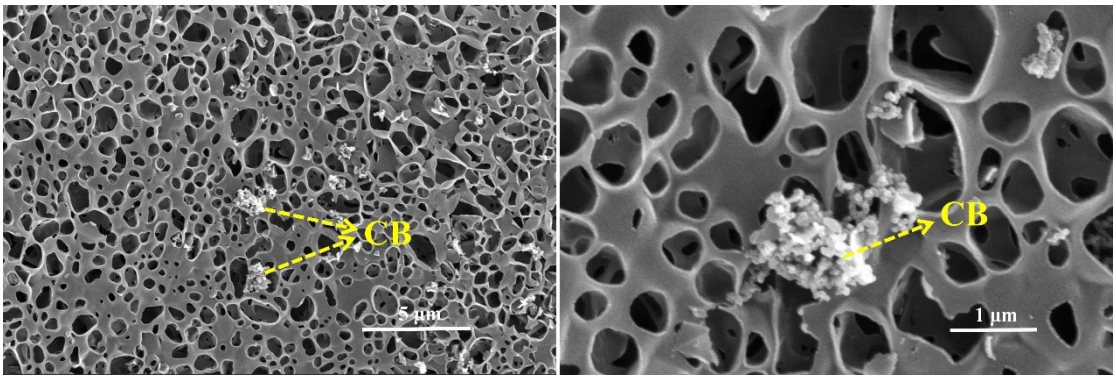

Fig. S10. The SEM of NPC with CB after desalination experimen