

# **Nitrogen-doped core-shell mesoporous carbonaceous nanospheres for effective removal of fluorine in capacitive deionization**

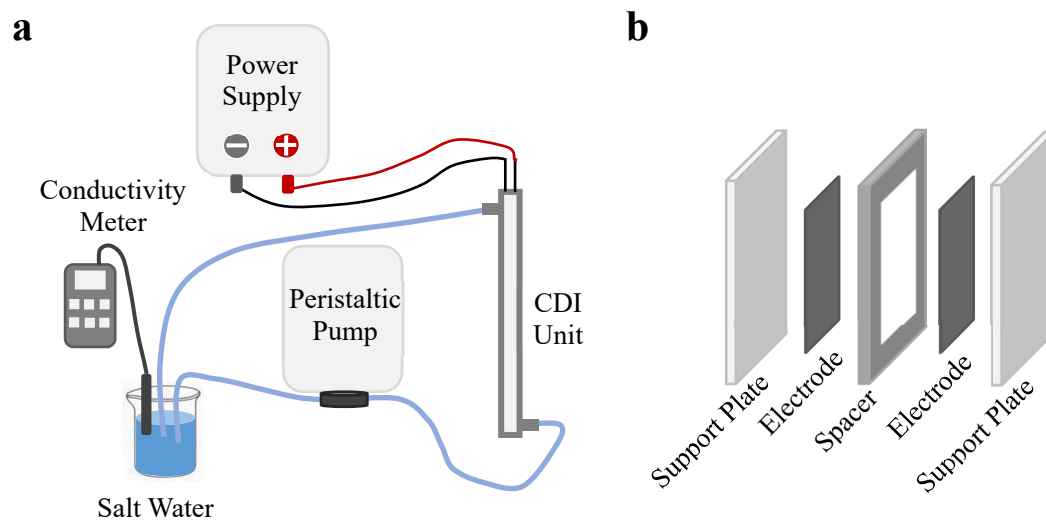
**Yubo Zhao <sup>1</sup>, Kexun Li <sup>2</sup>, Bangsong Sheng <sup>3</sup>, Feiyong Chen<sup>1,\*</sup> and Yang song <sup>1,\*</sup>**

<sup>1</sup> Resources and Environment Innovation Institute, Shandong Jianzhu University, Jinan 250101, Shandong, China

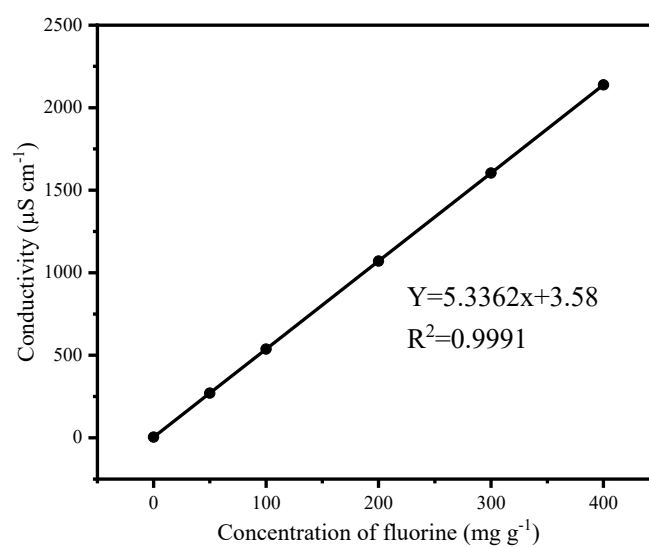
<sup>2</sup> College of Environmental Science and Engineering, Nankai University, Tianjin 300071, China

<sup>3</sup> The Second Construction Limited Company of China Construction Eighth Engineering Division, Jinan 250011, Shandong, China

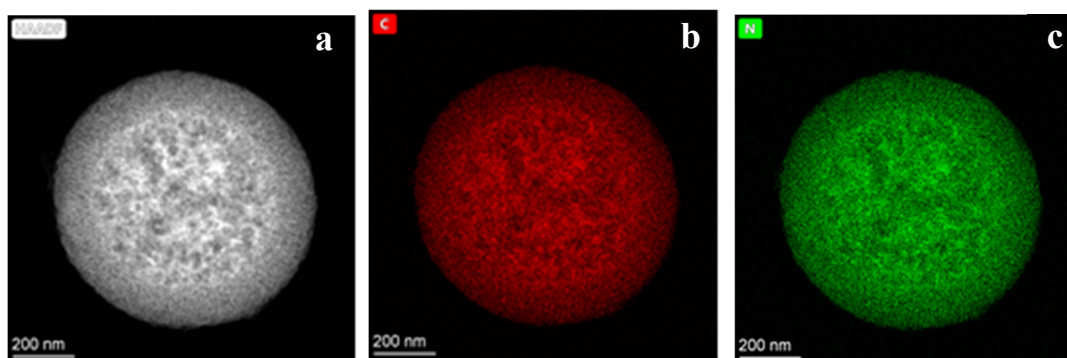
\* Correspondence: ctokyo@hotmail.com (Feiyong Chen); songyang20@sdjzu.edu.cn (Yang Song)



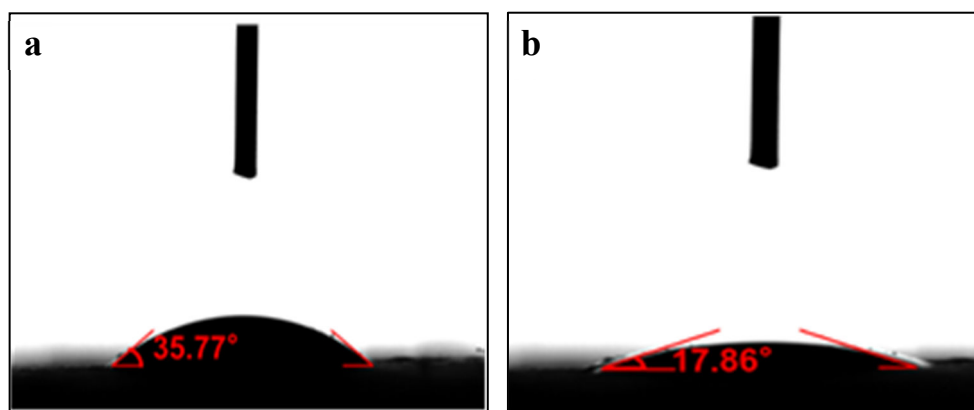
**Figure S1.** Schematic diagram of the defluorination system (a) and the CDI unit (b).



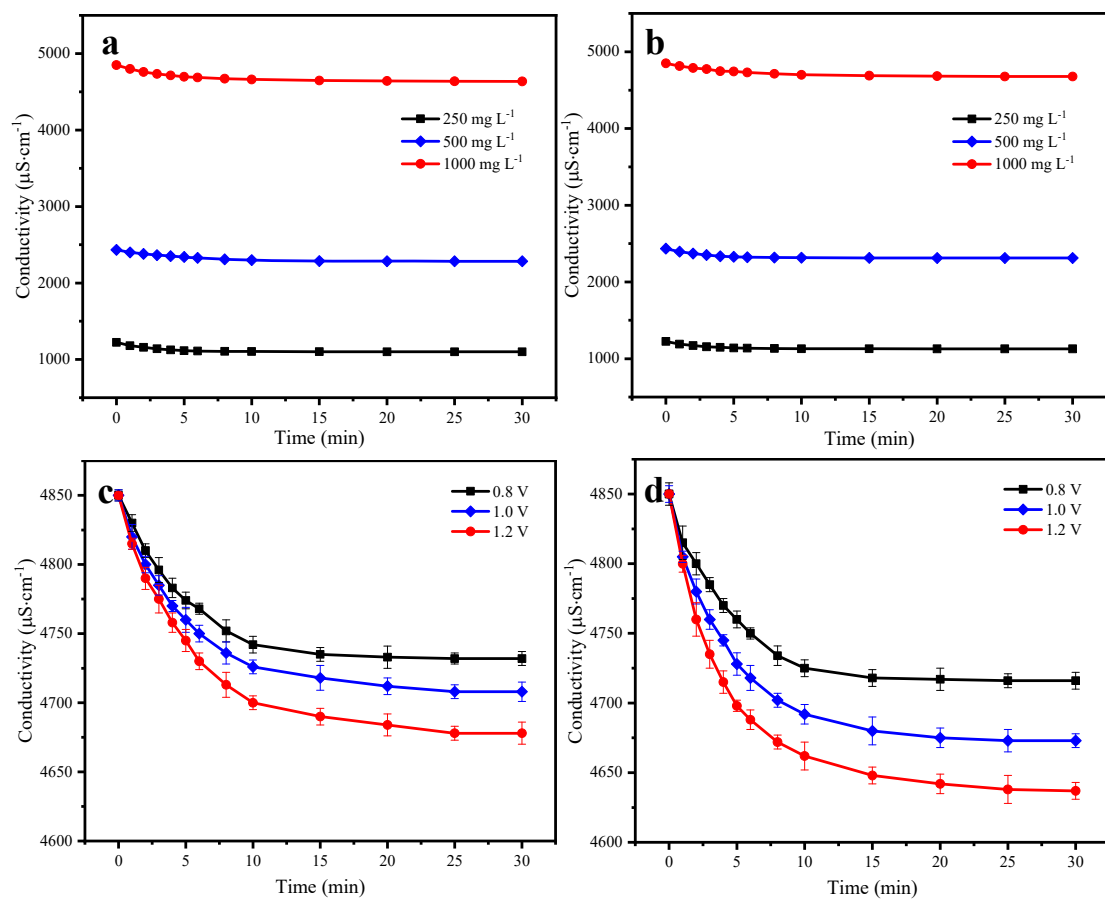
**Figure S2.** Standard curve of conductivity and fluorine concentration.



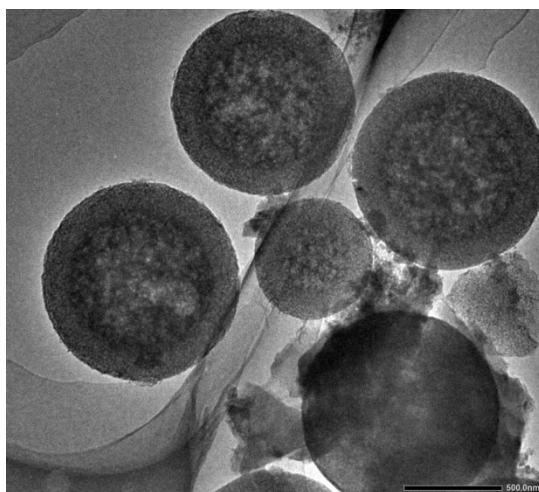
**Figure S3.** EDS elemental mapping images equipped with TEM of NMCS.



**Figure S4.** The water contact angle of MCS(a) and NMCS (b).



**Figure S5.** Conductivity change of circulating solution of MCS (a) and NMCS (b) with different initial fluorine concentrations; Conductivity change of circulating solution of MCS (c) and NMCS (d) with different voltages.



**Figure S6.** TEM image of NMCS after 10 adsorption-regeneration cycles.

**Table S1. Comparison of defluorination capacity and time between NMCS and reported materials in literature.**

| Material                              | Defluorination performances       |               | Experimental conditions |  | Ref.      |
|---------------------------------------|-----------------------------------|---------------|-------------------------|--|-----------|
|                                       | Capacity<br>(mg g <sup>-1</sup> ) | Time<br>(min) | Voltage<br>(V)          | Concentration<br>(mg g <sup>-1</sup> ) |           |
| Activated carbon                      | 5.44                              | /             | 1.2                     | 215.5                                  | [16]      |
| Commercial<br>activated carbon        | 3.22                              | 120           | 1.2                     | 100                                    | [14]      |
| Tea waste<br>biomass                  | 2.49                              | 130           | 1.2                     | 100                                    | [17]      |
| activated carbon                      |                                   |               |                         |  |           |
| Limonia<br>acidissima hell            | 2.7554                            | 130           | 1.2                     | 100                                    | [45]      |
| activated carbon                      |                                   |               |                         |  |           |
| TiO <sub>2</sub> -activated<br>carbon | 3.3                               | 60            | 1.5                     | 70                                     | [26]      |
| NMCS                                  | 8.37                              | 30            | 1.2                     | 250                                    | This work |
| NMCS                                  | 11.07                             | 30            | 1.2                     | 500                                    | This work |
| NMCS                                  | 13.34                             | 30            | 1.2                     | 1000                                   | This work |