Carbon aerogels through organo-inorganic co-assembly and their application in water desalination by capacitive deionization

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Supporting Information S1

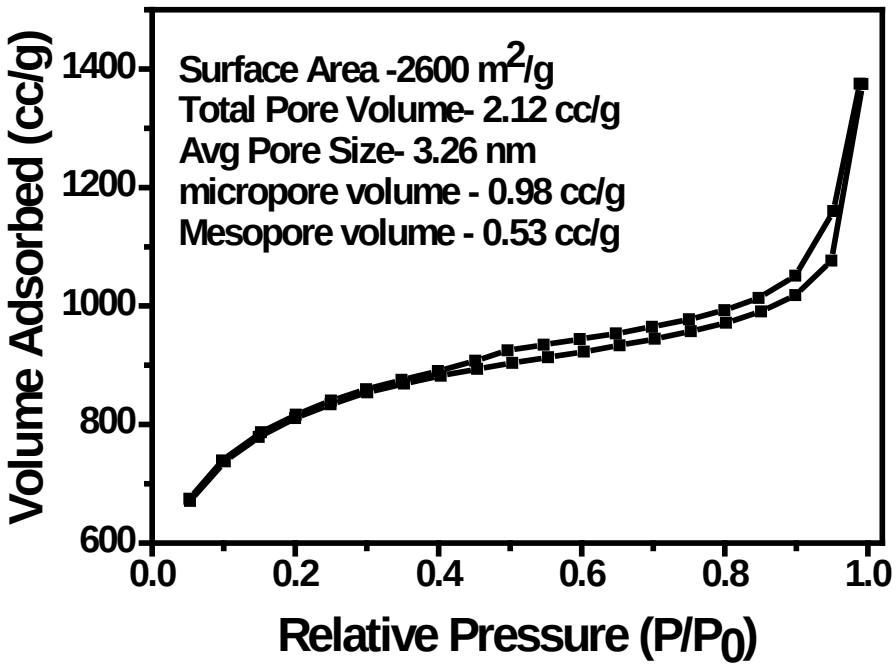

Fig. S1: N_2 adsorption–desorption isotherm and data of pore size distribution of CA.

Porosity measurement of CA sample shows that the total pore volume was 2.12 cc/g and average pore size was 3.26 nm. The pore size distribution (PSD) was obtained from the Barret-Joyner-Halenda (BJH) method.

The hysteresis in the curve at higher P/P_0 value shows the presence of large mesopores which arises due to the cross linking of smaller particles.

Supporting Information S2

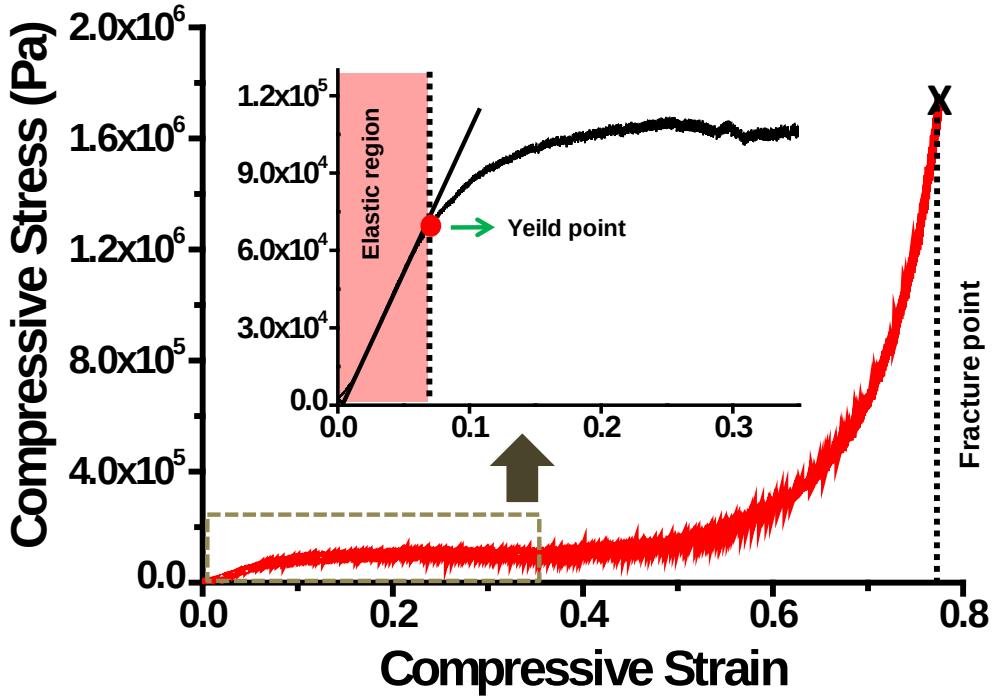

Fig. S2: Compressive stress-strain curve for carbon aerogel. The expanded region shows the elastic region and the yield point (marked). Fracture point is marked in the figure. The Young's modulus was calculated to be 1.12 MPa from the straight line (tangent) drawn in the elastic region.

Supporting Information S3

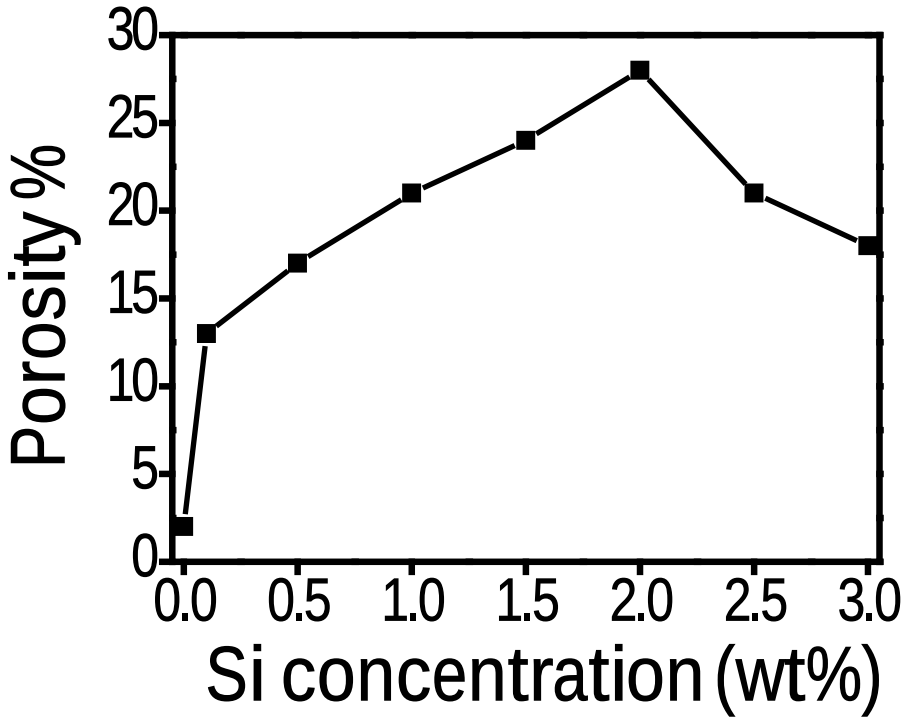

Fig. S3: Variation of porosity of CSA with the change in concentration of the SiO_2 precursor.

Supporting Information S4

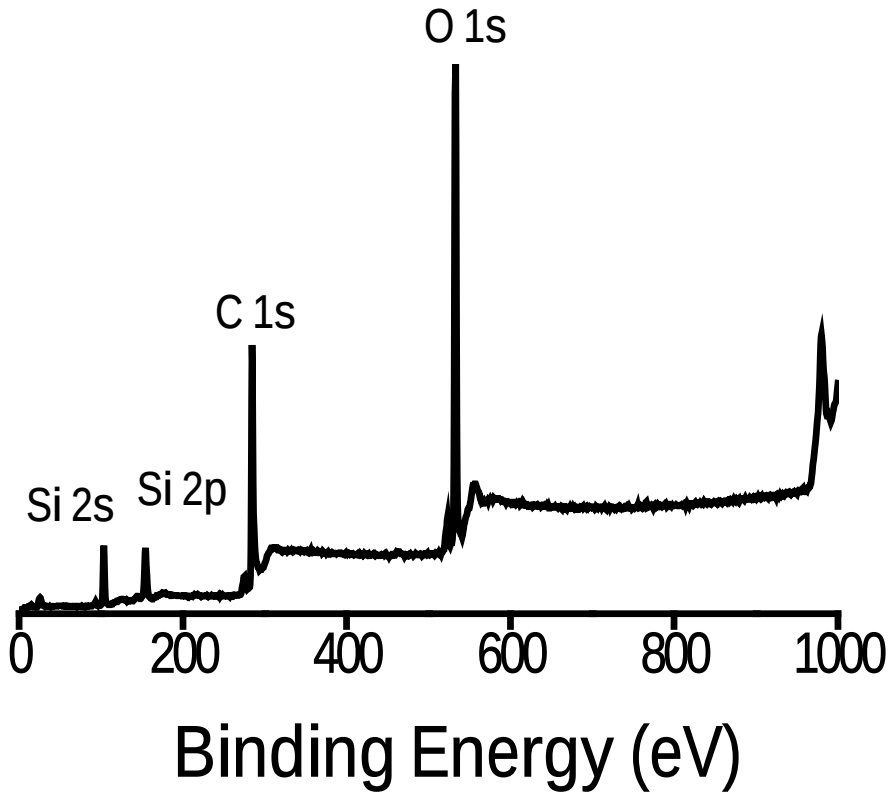

Fig. S4: XPS survey spectrum of CSA.

Supporting Information S5

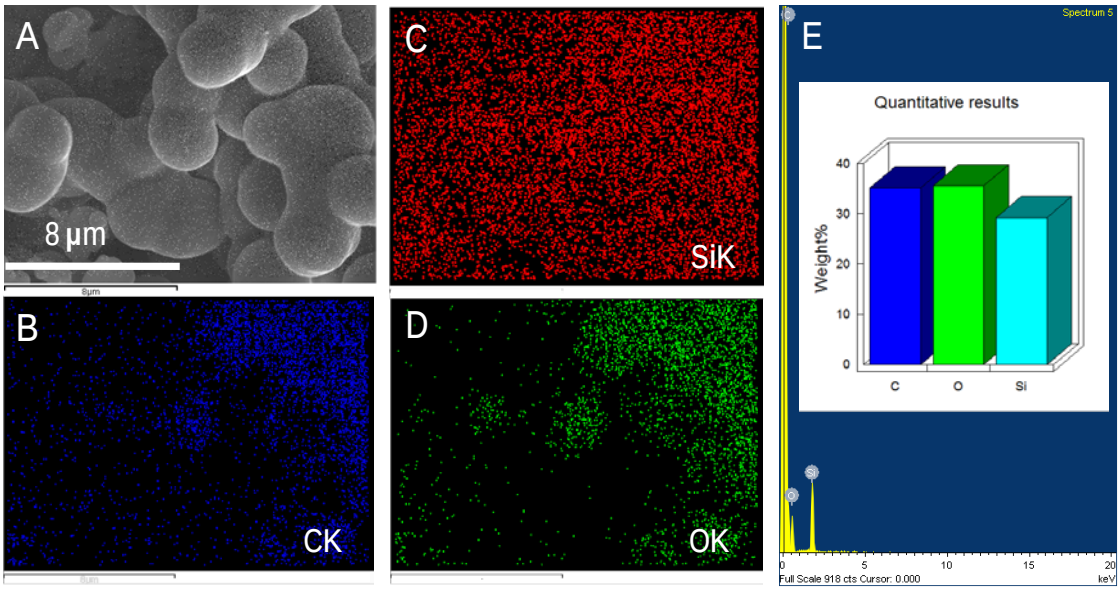

Fig. S5: A) SEM image of CSA B, C,D) EDS mapping of carbon, silica and oxygen and E)SEM-EDS with weight ratio of SiO_2 carbon aerogel.

Supporting Information S6

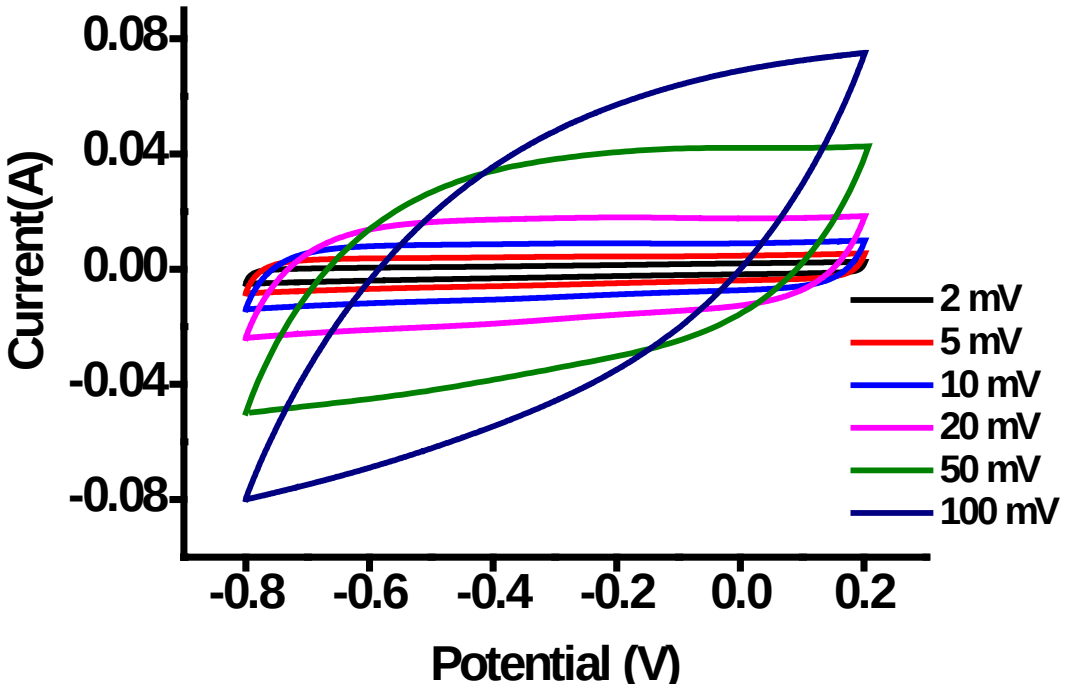

Fig. S6: CV curves of the carbon-silica aerogel at scan rates between 2 to100 mV/s.

Supporting Information S7

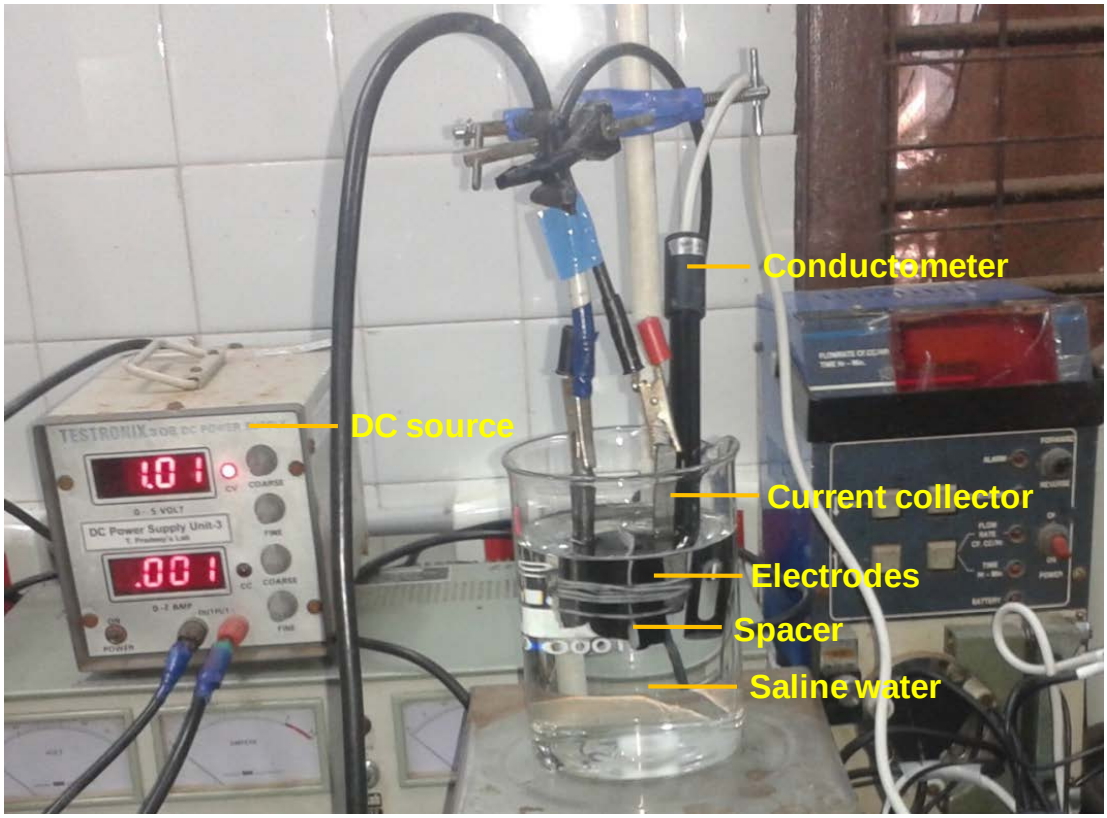

Fig. S7: Photograph of the CDI laboratory batch experimental set-up.

Supporting Information S8

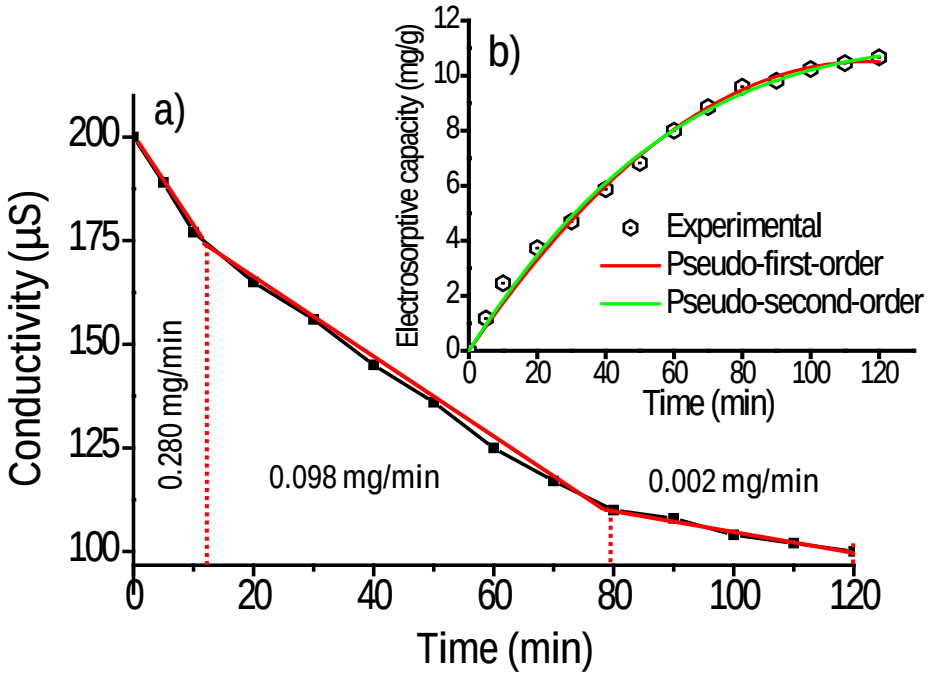

Fig. S8: a) Rate of adsorption for the CA material, having 200 ppm of NaCl solution. The kinetics shows a three step adsorption and b) represents the electrosorption kinetics for the CA electrodes and comparison with existing mathematical models.

The mathematical representations of the models are given below:

Pseudo-first-order equation: $$q_t = q_e\left(1-e^{-k_1 t}\right) \quad (1)$$

Pseudo- second-order equation: $$q_t = \frac{q_e^2 k_2 t}{1+q_e k_2 t} \quad (2)$$

Here, q_e and q_t (mg/g) denotes the amount of salt ion adsorbed at equilibrium and at time t (h), respectively. k_1 (1/h) and k_2 (g/mg h) are the first-order and second-order rate constants, respectively.

Supporting Information S9

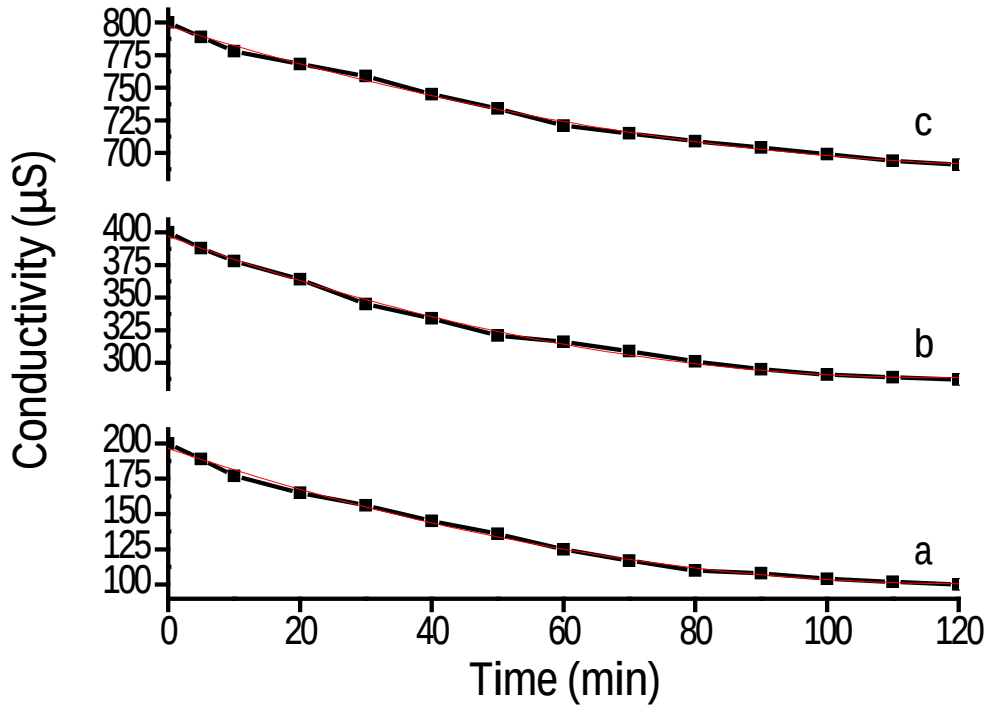

Fig. S9: CDI performance of CA with different initial concentrations of NaCl solution as electrolyte a) 200 ppm, b) 400 ppm and c) 800 ppm.

Supporting Information S10

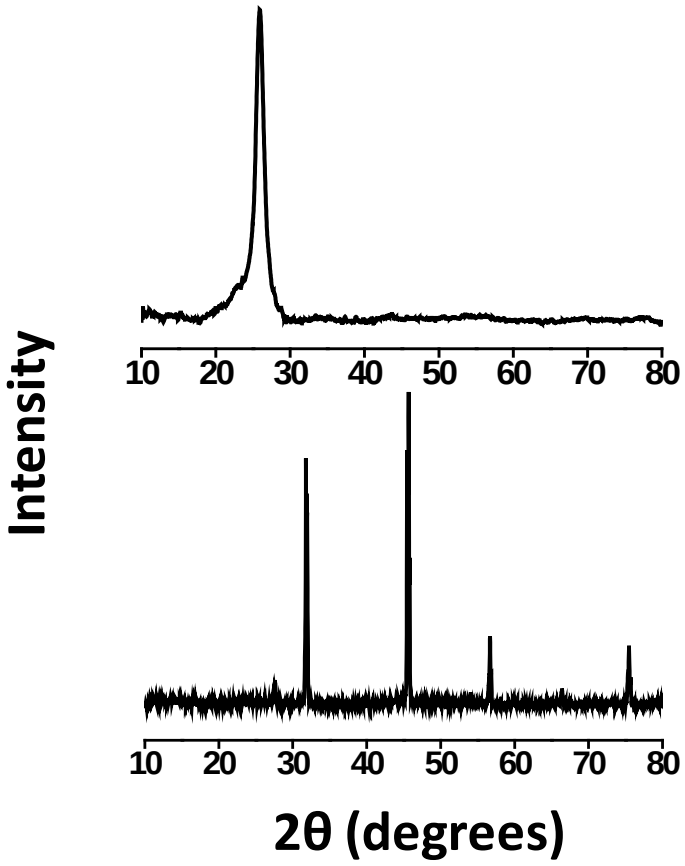

Fig. S10: XRD of CA A) before and B) after a single adsorption cycle.

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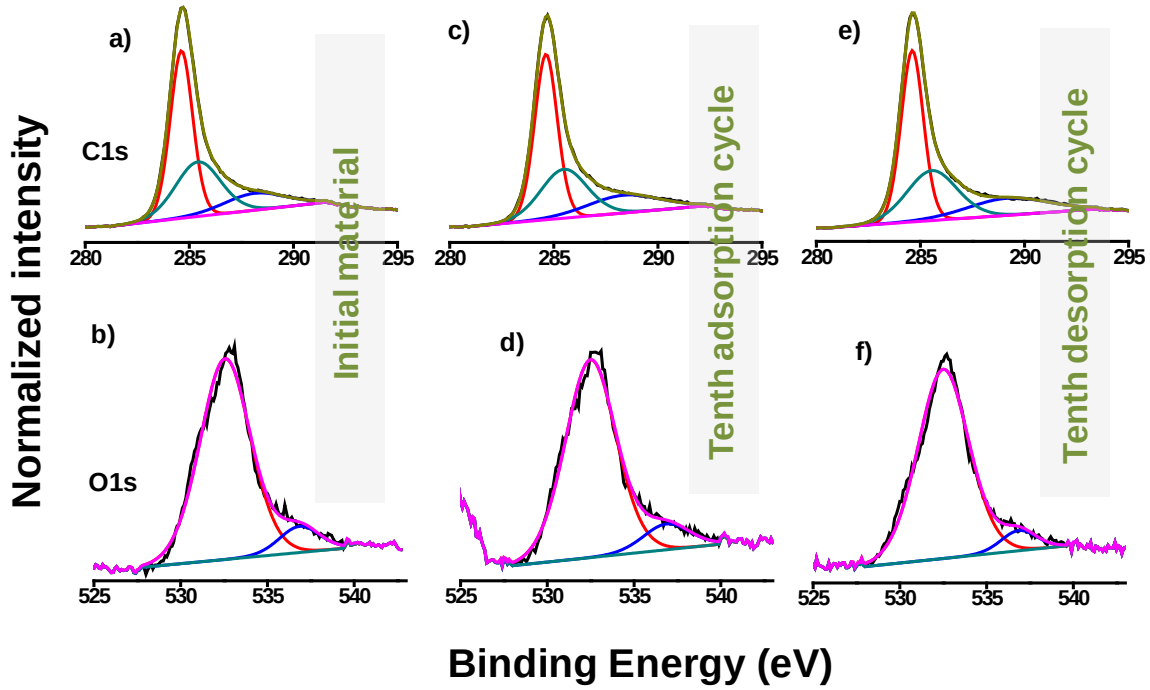

Fig. S11: Decovoluted XPS spectrum of C1s and O1s, a & b) of pristine CA, c & d) after tenth adsorption cycle and e & f) after tenth desorption cycle. The corresponding XPS survey spectrum is shown in Figure 6A in the manuscript.