Supplementary Data

Adsorption-Desorption of CO_2 on Zeolite-Y Templated Carbon at Various Temperature

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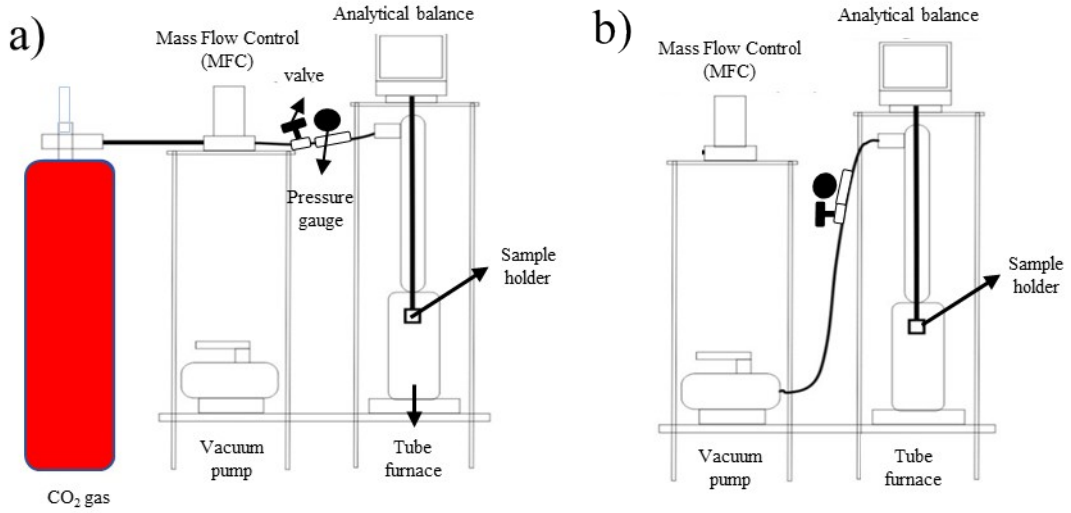

Fig S1 Schematic diagram of a) adsorption system, and b) desorption system

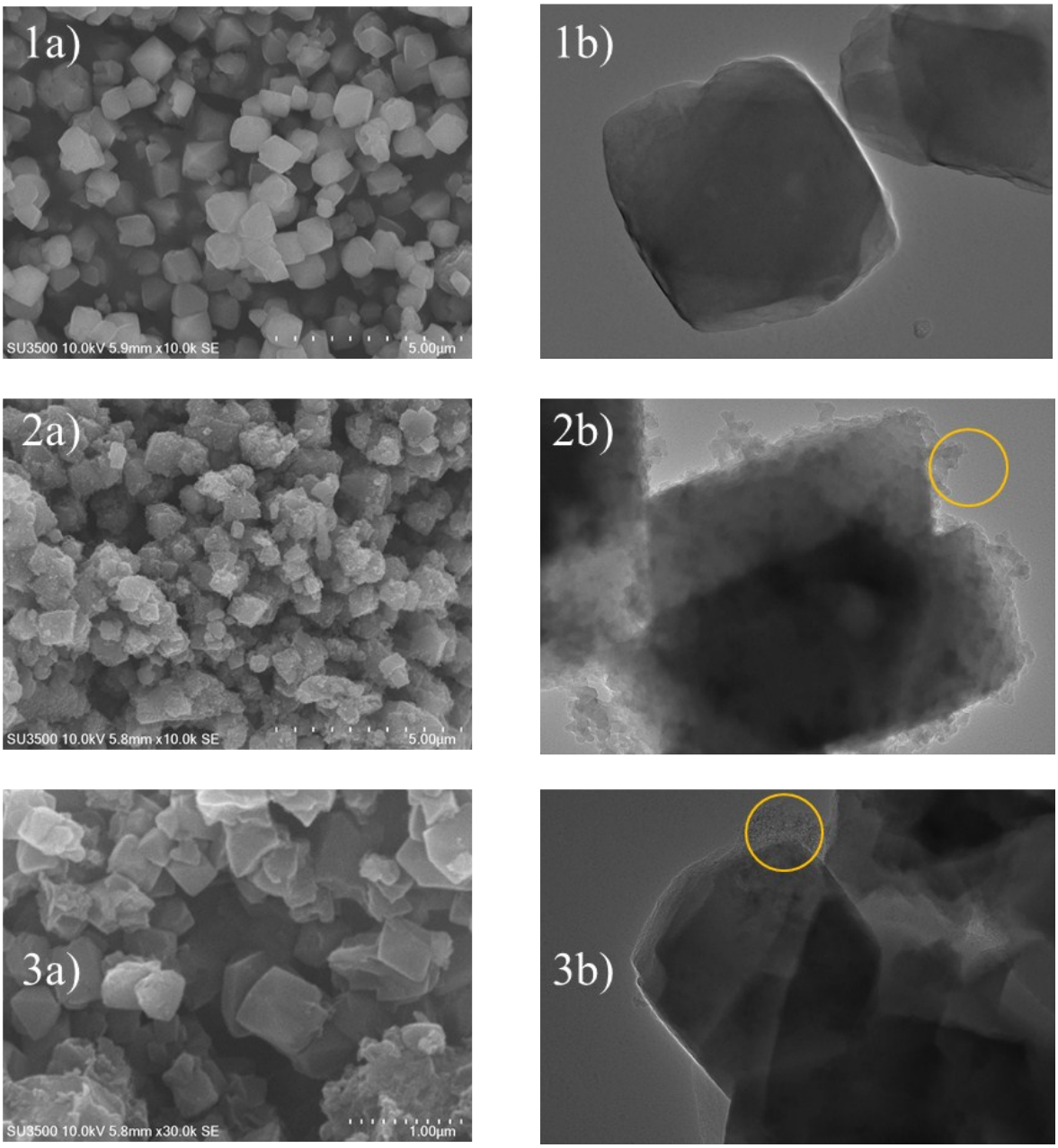

Fig S2 SEM (a) and TEM (b) image of zeolite-Y (1), composite carbon (2), and ZTC (3). Yellow circles correspond to the external graphitic carbon

The Fig S2, showing a similarity in particle shape of zeolite-Y, composite and ZTC. The octahedral structure of zeolite-Y still remained even after impregnation, carbonization and template removal.

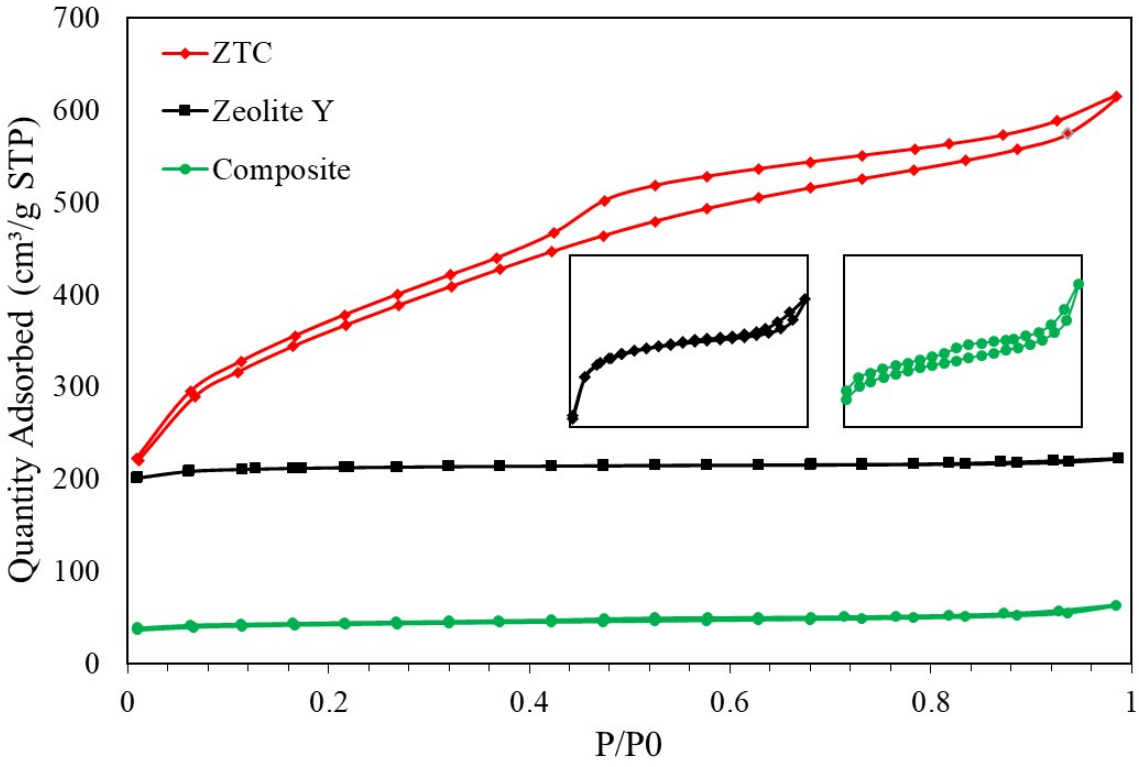

Fig S3 The N_2 isotherm graph of zeolite-Y, composite and ZTC

The N_2 isotherm showing a superior N_2 adsorbed on ZTC compared to the zeolite-Y and composite. The production of carbon via hard template method with zeolite was suitable method to obtain a high surface area and ordered pore structure of carbon.

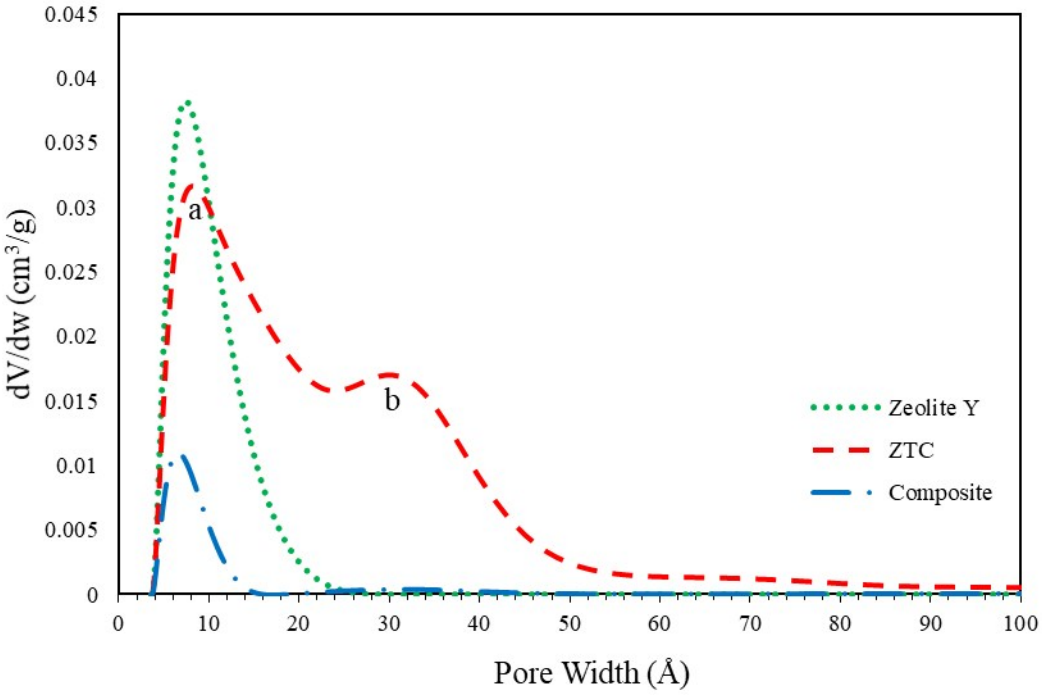

Fig S4 The PSD obtained from 2D-NLDFT calculation

The PSD obtained from SAIEUS software indicate that composite pore was filled by carbonized sucrose molecule which is noticed by the reduction average pore diameter and total N_2 volume adsorbed. Moreover, this method was successfully produced carbon with micro-meso structure.

Table S1 The physical properties of all sample

Parameters	ZTC	Composite	Zeolite-Y
SBET (m^2/g)	1254.3831	133.2933	678.48
t-Plot Micropore Area	1051.7182	96.0035	620
Pore volume (cc/g)	0.949935	0.097795	0.344
Average Pore size (nm)	1.55±0.64	0.729±0.04	0.861±0.07

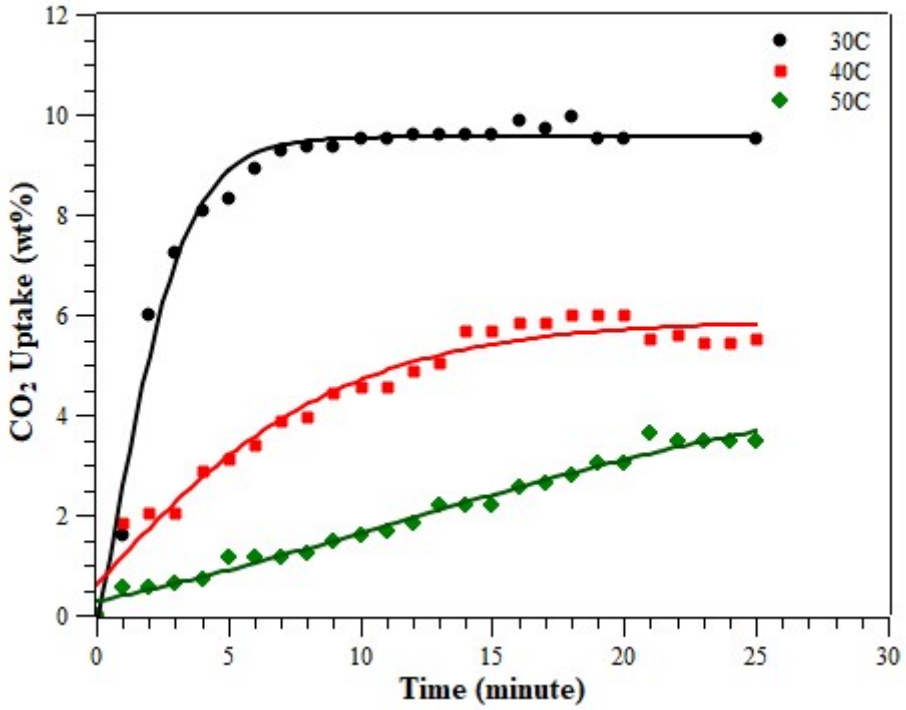

Fig S5 The adsorption of CO_2 on ZTC at various temperature and a pressure of 1 Bar

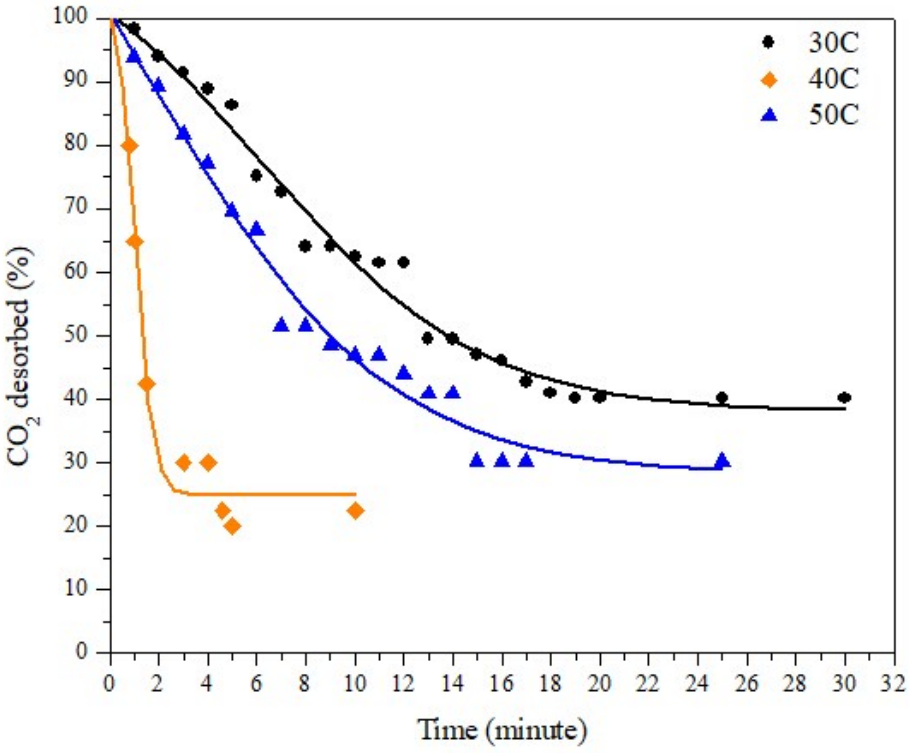

Fig S6 Desorption of CO_2 on ZTC at various temperature and pressure of 1 bar

Table S2 Parameters of each kinetic models

Model	**Parameters**		
Pseudo-first order	k_f	q_e	R^2
30°C	-0.036	1	0.282
40°C	-0.065	1	0.145
50°C	-0.081	1	0.763
Pseudo-second order	h	q_e	R^2
30°C	1.663	2.66	0.972
40°C	0.357	1.65	0.950
50°C	0.061	1.47	0.469
Intra-particle Diffusion	k_d	C	R^2
30°C	0.237	0.38	0.709
40°C	0.134	0.10	0.877
50°C	0.124	-0.17	0.923

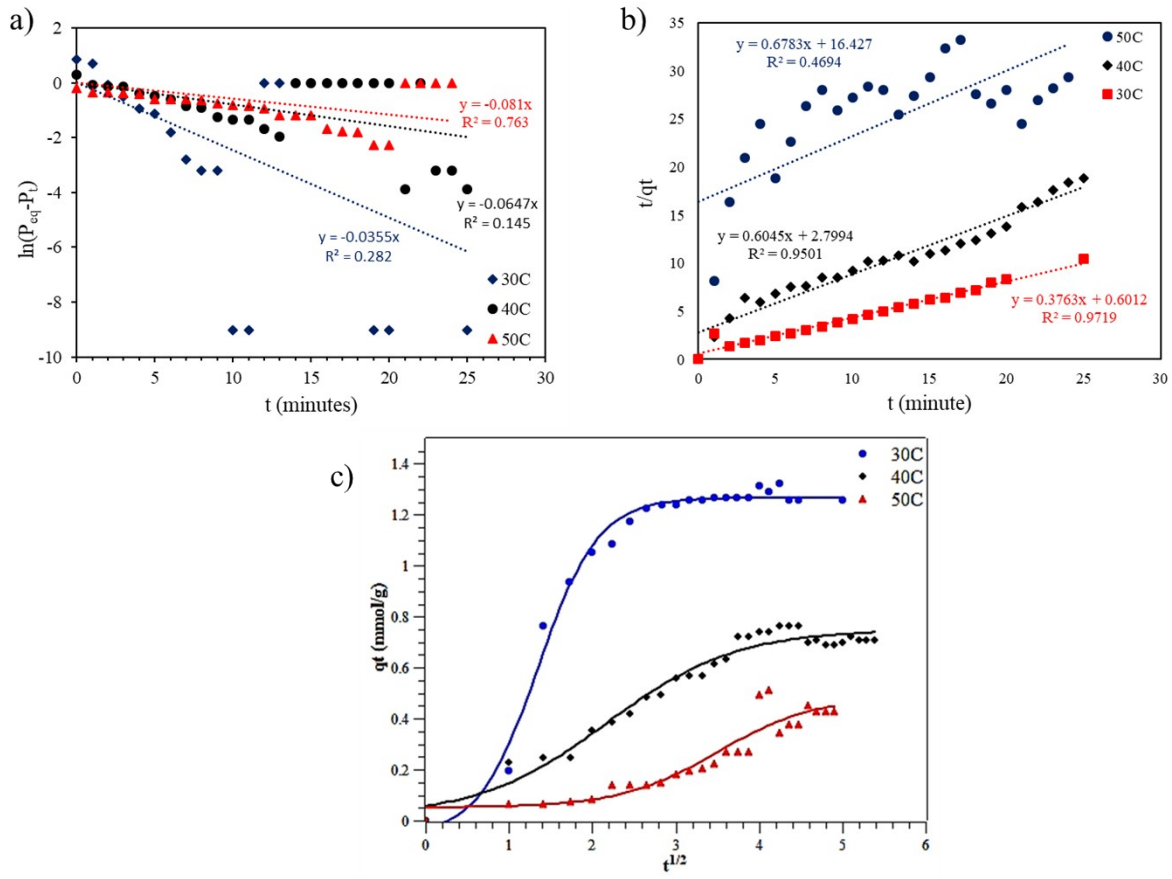

Fig S7 Graph of a) Pseudo-first order b) Pseudo-second order and c) Intra-particle diffusion

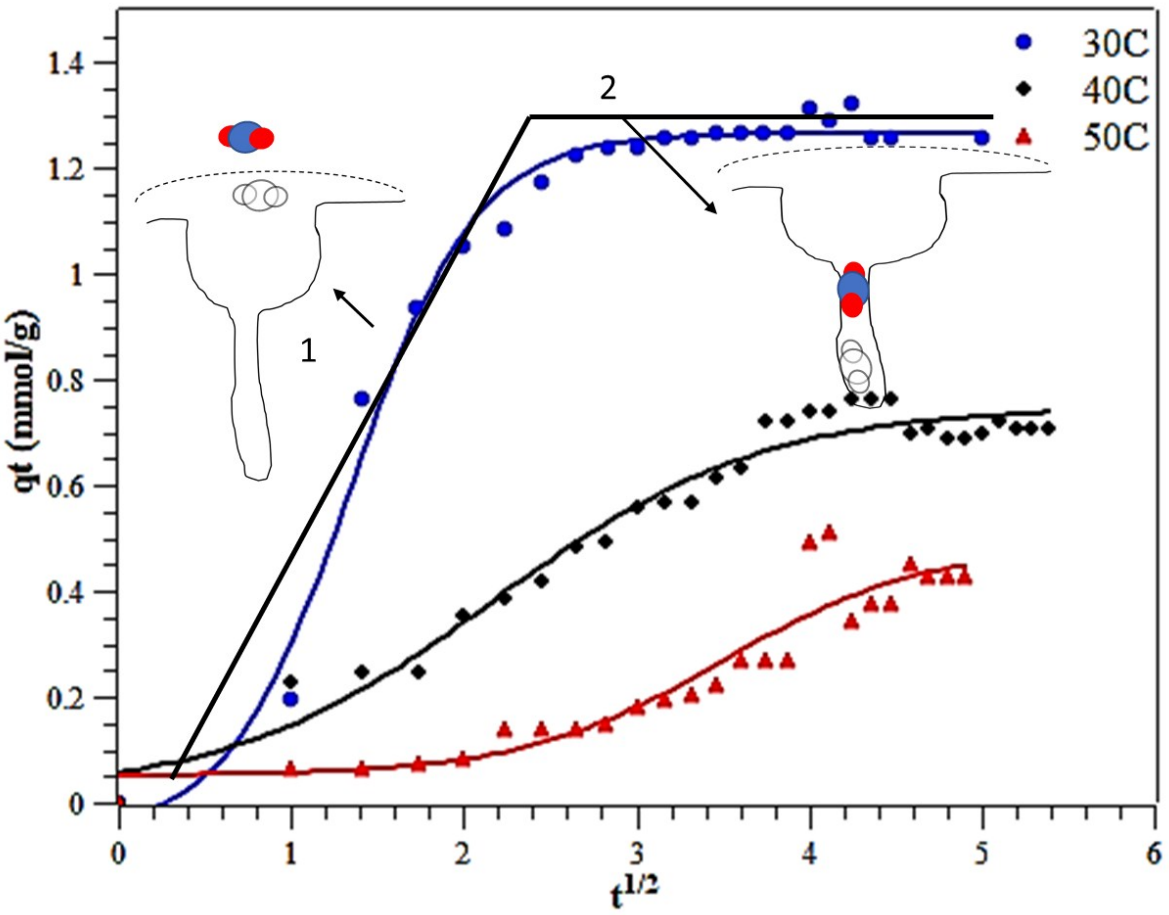

Fig S8 Proposed CO_2 transfer mechanism into ZTC from intraparticle diffusion model

The intra particle diffusion showing two steps of CO_2 adsorption mechanism. The first, the CO_2 molecule approaching the outer surface of the ZTC up to some point where the molecule movement was not limited by barrier. The second, CO_2 molecule making some adjustment in side the micropore and this step took longer time compared earlier steps.

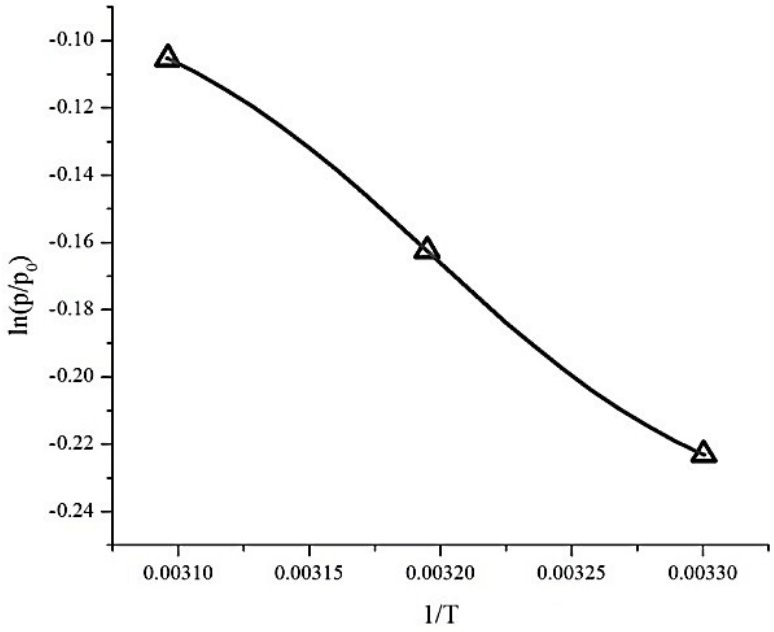

Fig S9 Graph of thermodynamic adsorption

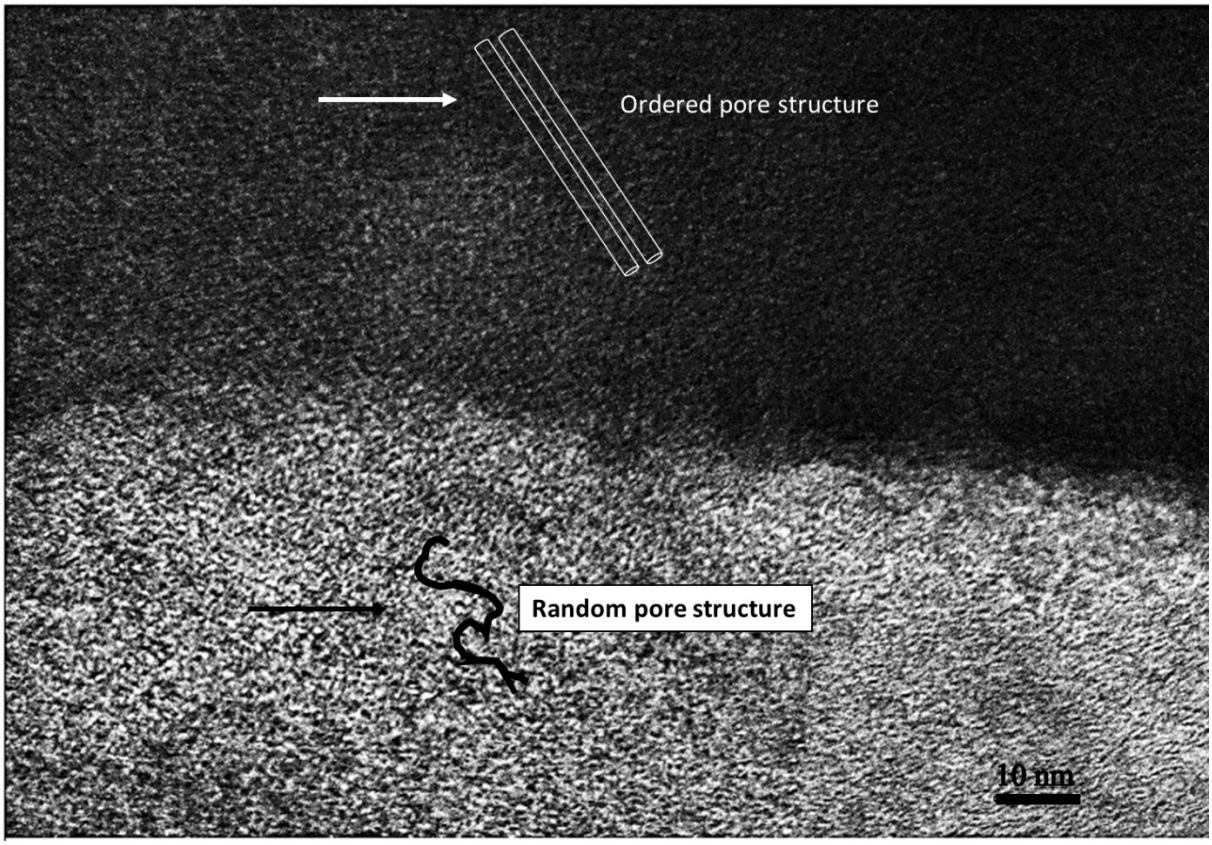

Fig S10 High contrast HRTEM image of ZTC

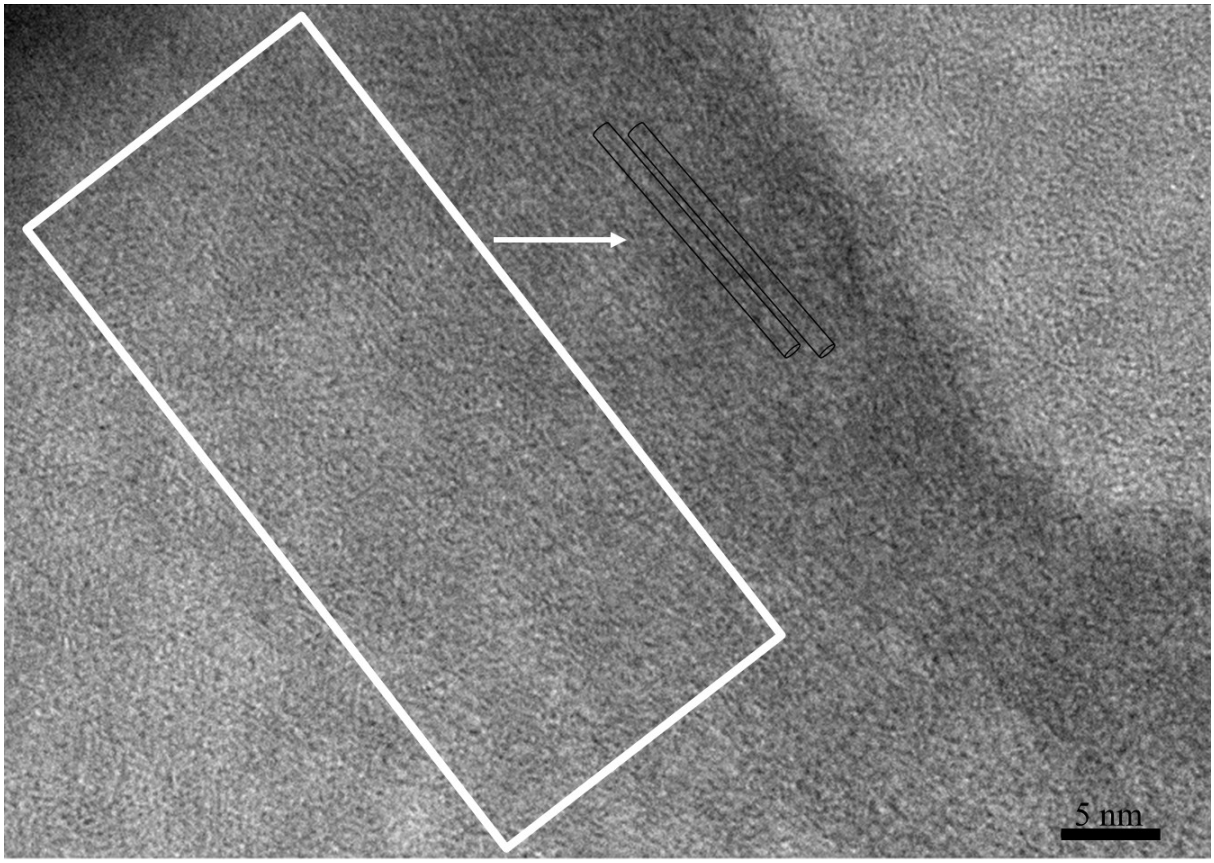

Fig S11 The Inner pore structure of ZTC

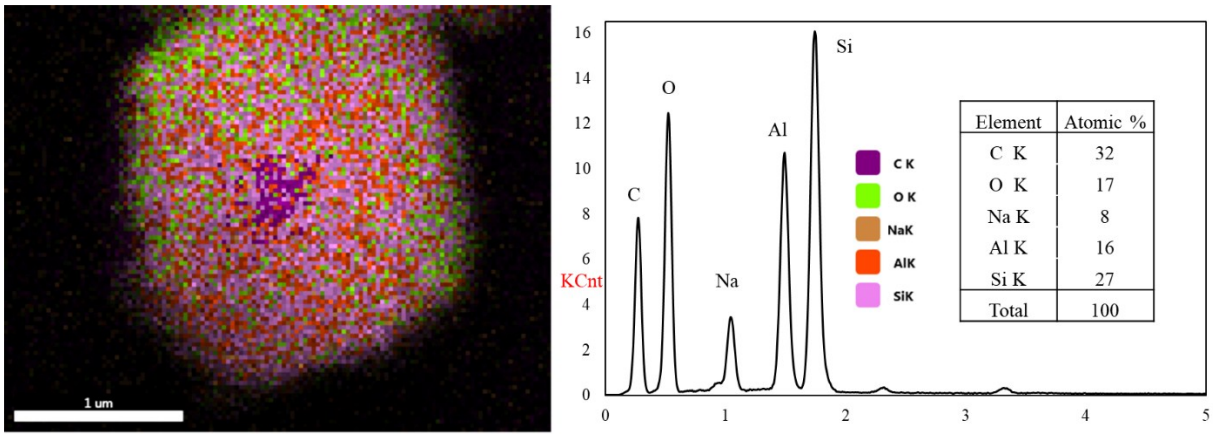

Fig S12 The EDX mapping of composite sample

The mapping indicated that most carbon occupied inner body of zeolite-Y

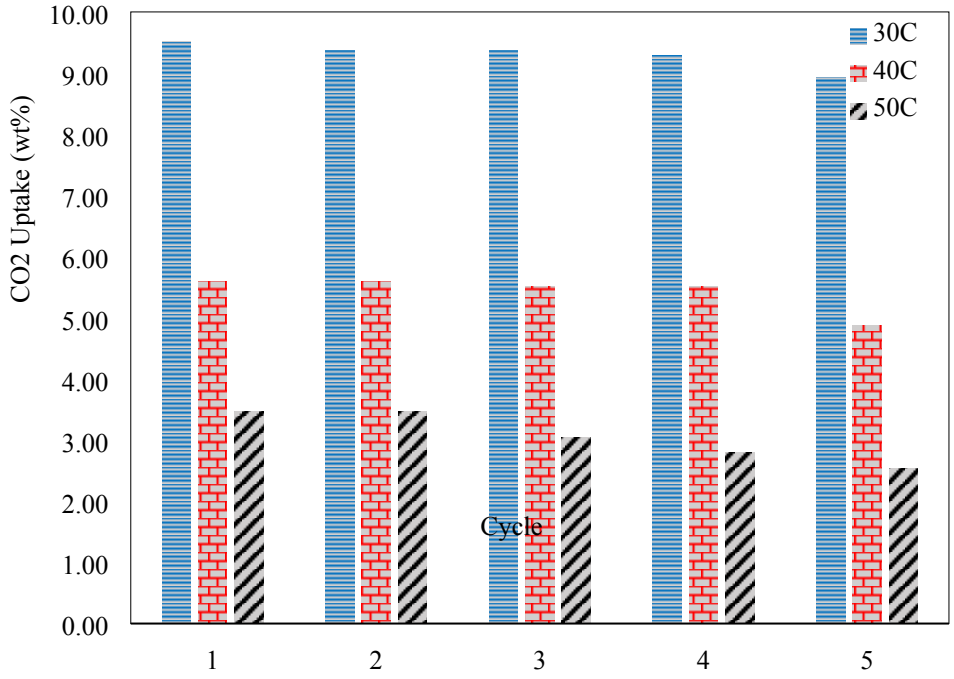

Fig S13 The CO_2 uptake capacity after five cycle

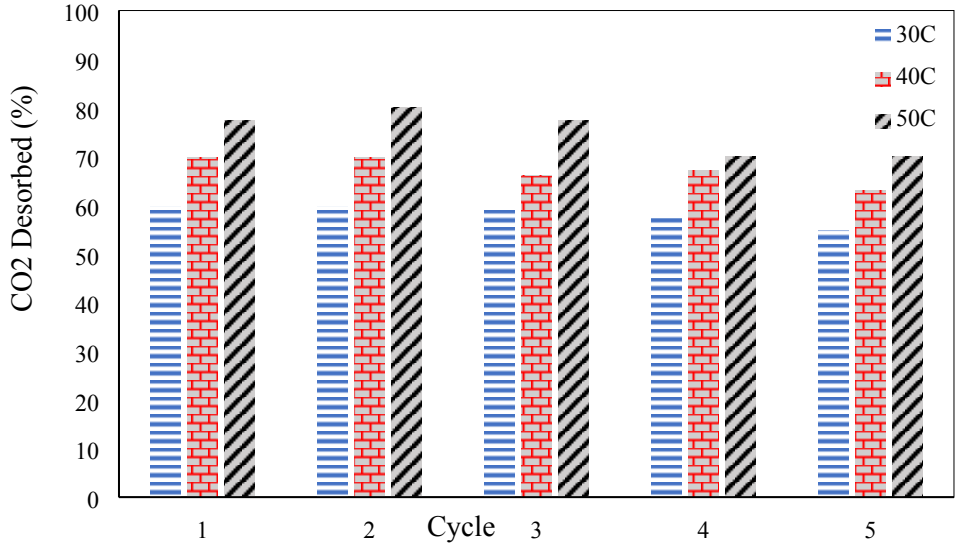

Fig S14 The CO_2 desorption capacity after five cycle