Electronic Supplementary Material (ESI) for Energy & Environmental Science

Graphene oxide derived carbon: synthesis and gas adsorption properties

Gadipelli Srinivas[1, 2,] *, Jacob Burress[1], Taner Yildirim[1, 2,] *

[1]NIST Center for Neutron Research, National Institute of Standards and Technology, Gaithersburg, Maryland, 20899-6102, USA

[2]Department of Materials Science and Engineering, University of Pennsylvania, Philadelphia, Pennsylvania, 19104-6272, USA

*E-mail: gsrinivasphys@gmail.com (G. Srinivas); taner@seas.upenn.edu (T. Yildirim); Fax: +1-301-921-9847; Tel: +1-301-975-6228

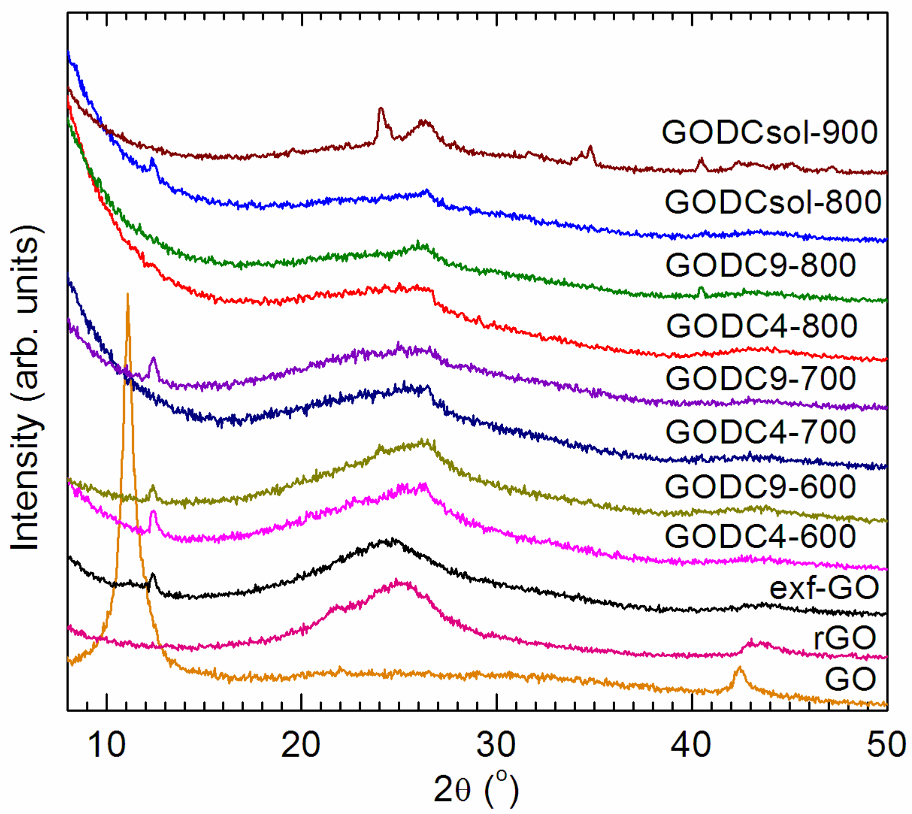

Figure S1. Powder X-ray diffraction patterns of initial GO, thermally exfoliated GO at 250 °C, and GODCs produced at different activation conditions; activation temperature in the range 600 °C to 800 °C and GO to KOH ratio is about 1:4 and 1:9.

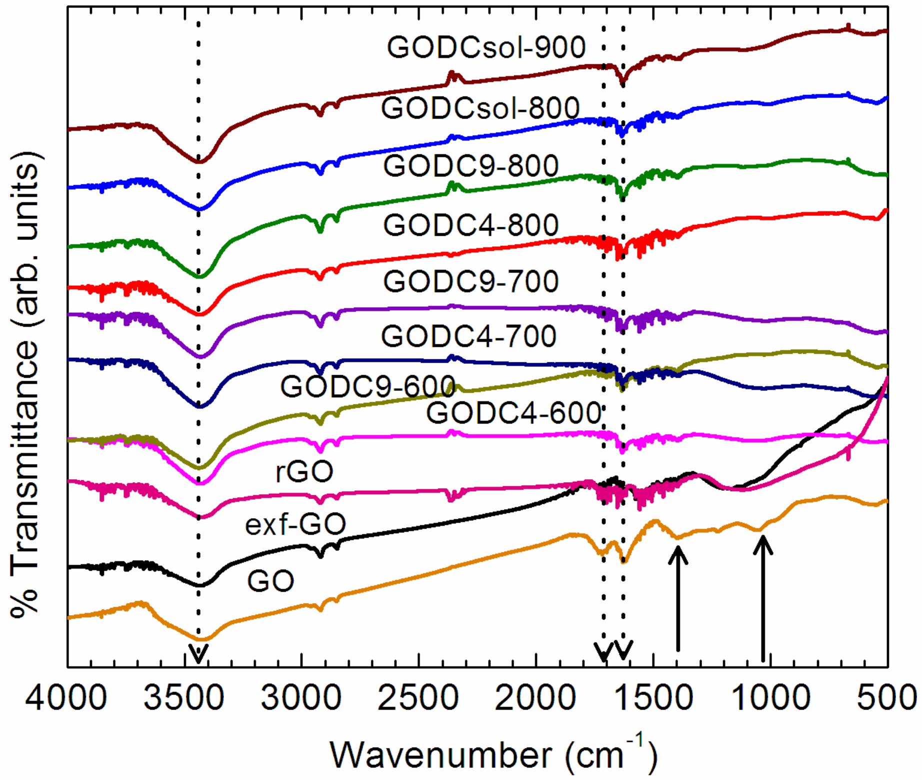

Figure S2. FTIR spectra of initial GO, thermally exfoliated GO at 250 ^{o}C, and GODCs produced at different activation conditions; activation temperature in the range 600 ^{o}C to 800 ^{o}C and GO to KOH ratio is about 1:4 and 1:9. The arrows indicate the vibrational bands at ca. 3410 cm^{-1}, 1720 cm^{-1}, 1630 cm^{-1}, 1380 cm^{-1} and 1053 cm^{-1}.

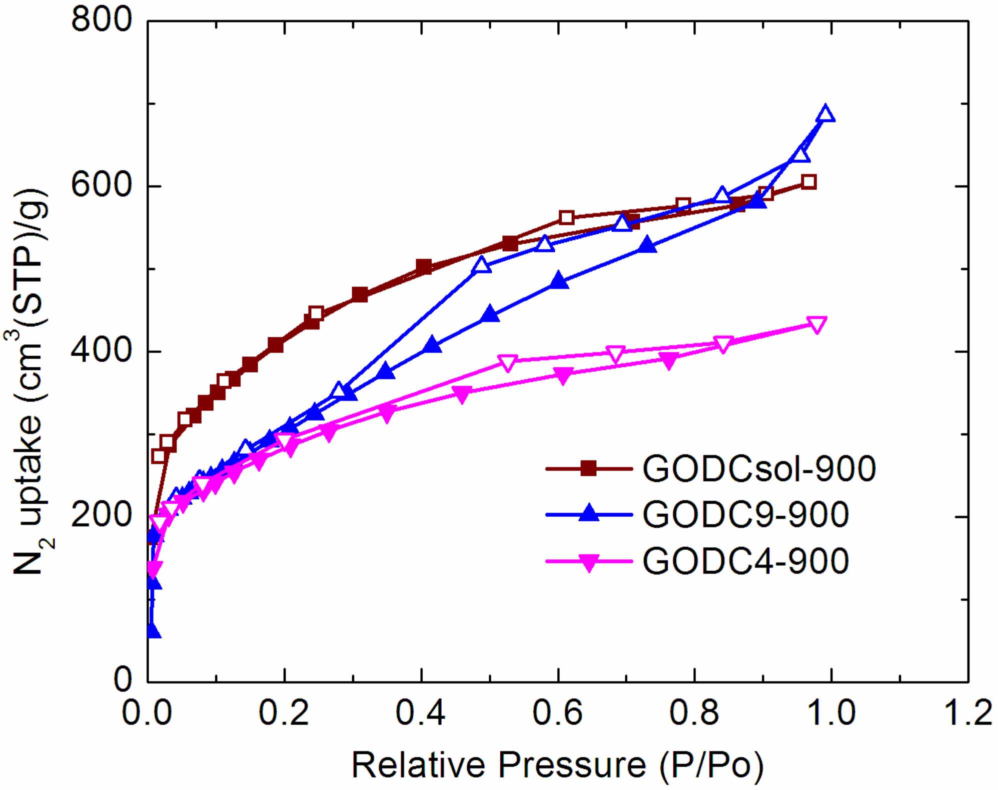

Figure S3. N_2 adsorption-desorption isotherms (at 77 K) of GODCs produced at activation temperature of 900 ^oC with different KOH/GO concentration and hand-milled and solution mixture method. The solid and open data points represent adsorption and desorption isotherms respectively.

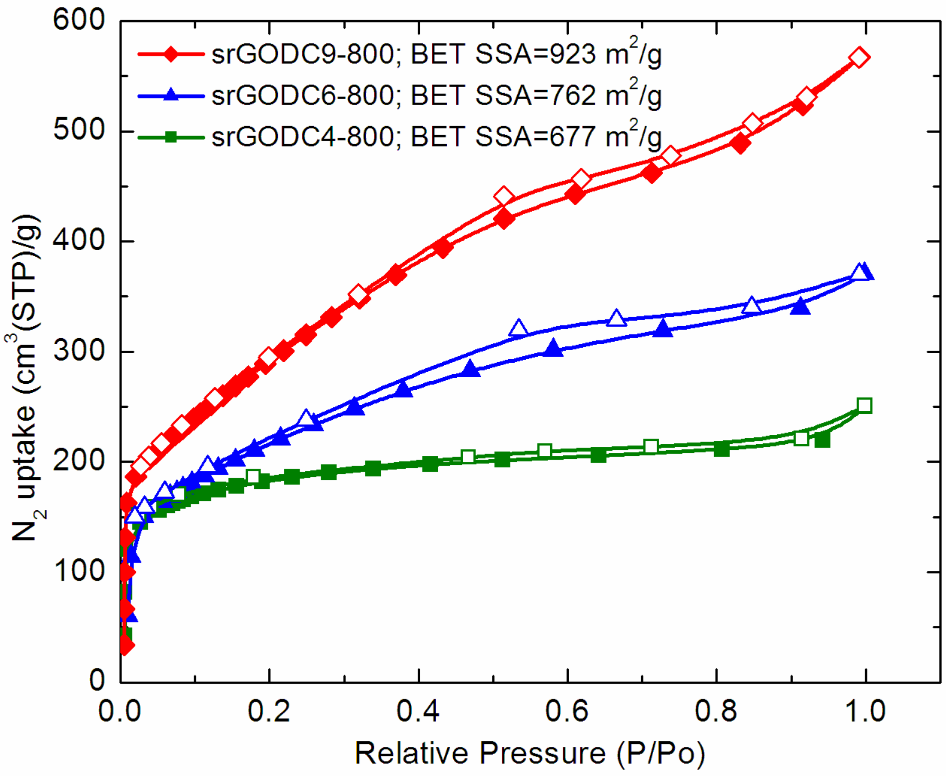

Figure S4. N_2 adsorption-desorption isotherms (at 77 K) of rGODCs produced at activation temperature of 800 ^oC with different KOH/GO concentration, 4, 6 and 9 using hand-milled mixture method. The solid and open data points represent adsorption and desorption isotherms respectively. The derived BET surface area is ~677 m^2/g, ~762 m^2/g and ~923 m^2/g for rGODC4-800, rGODC6-800 and rGODC9-800 respectively.

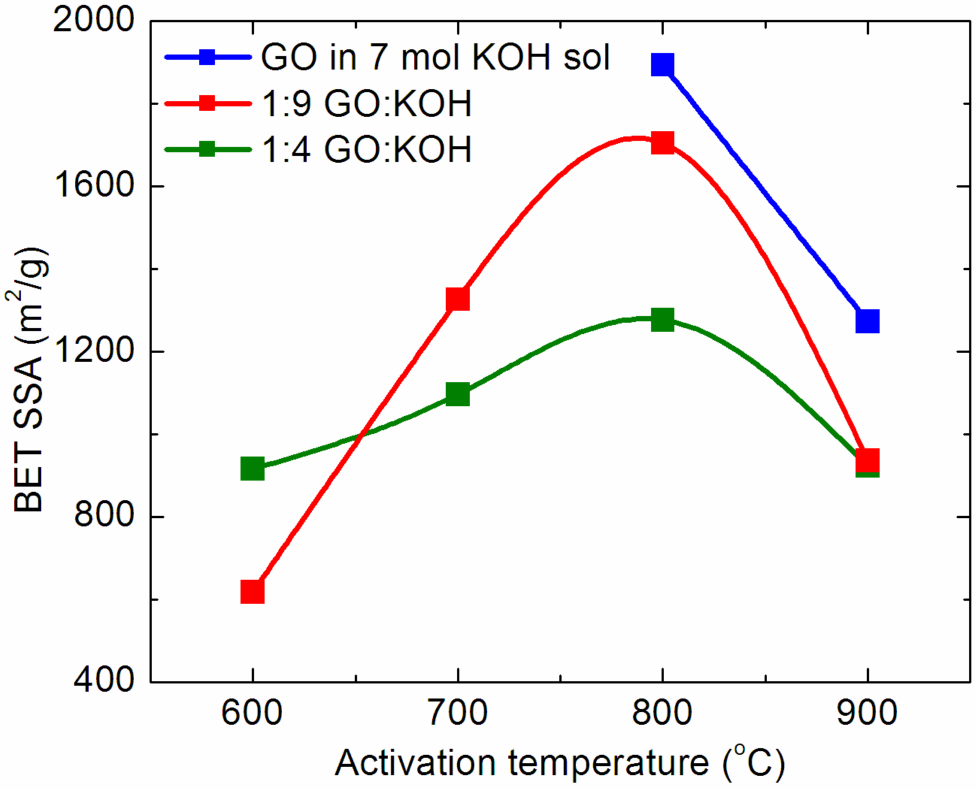

Figure S5. BET surface area of GODCs as a function of activation temperature and KOH concentration.

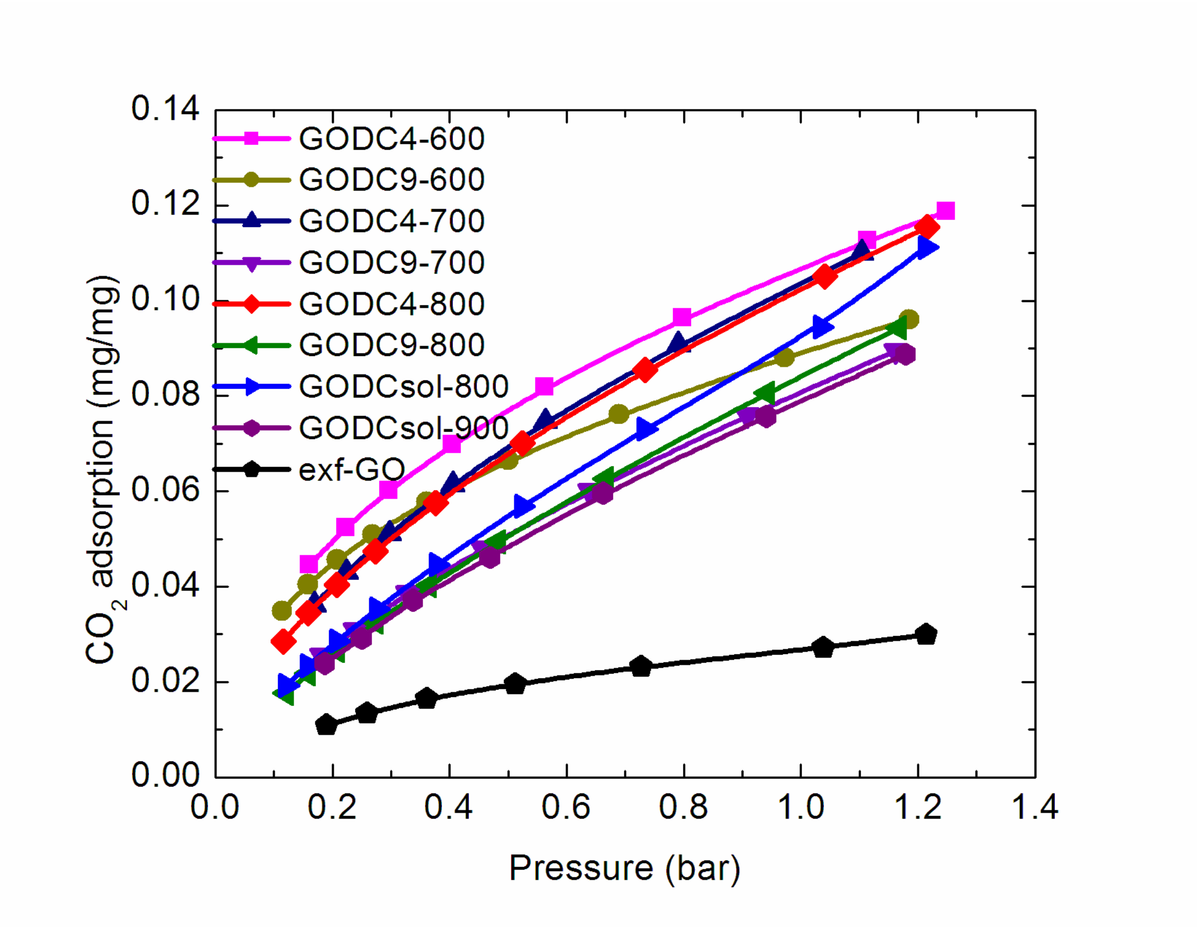

Figure S6. The low pressure, CO_2 adsorption isotherms (at 300 K) of GODCs. The CO_2 adsorption in exfoliated GO is also shown.

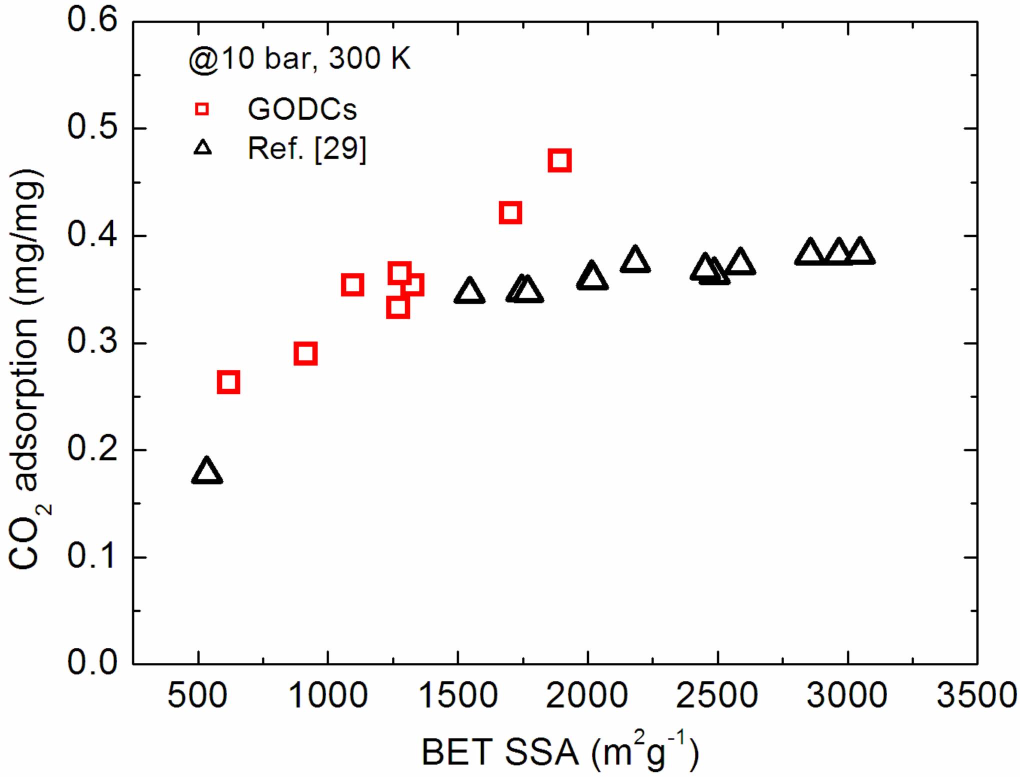

Figure S7. Comparison of CO_2 adsorption capacity at 10 bar and 300 K of our GODCs with other activated carbons against BET surface area.

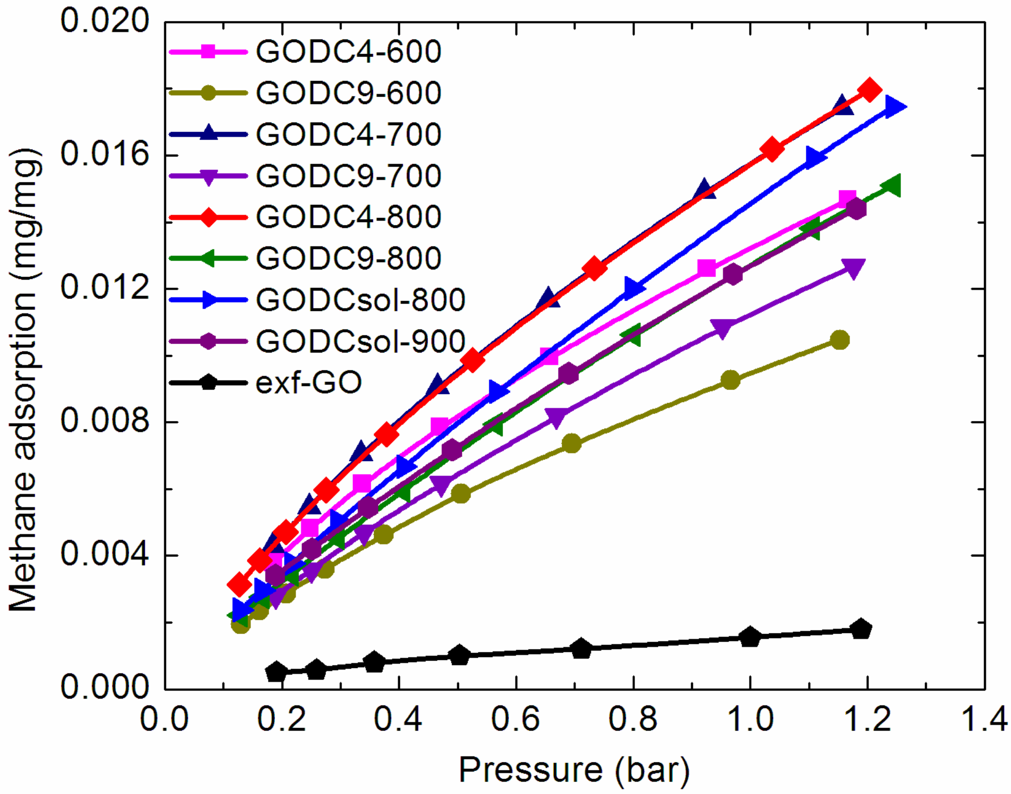

Figure S8. The low pressure, methane adsorption isotherms (at 300 K) of GODCs. The methane adsorption in exfoliated GO is also shown.

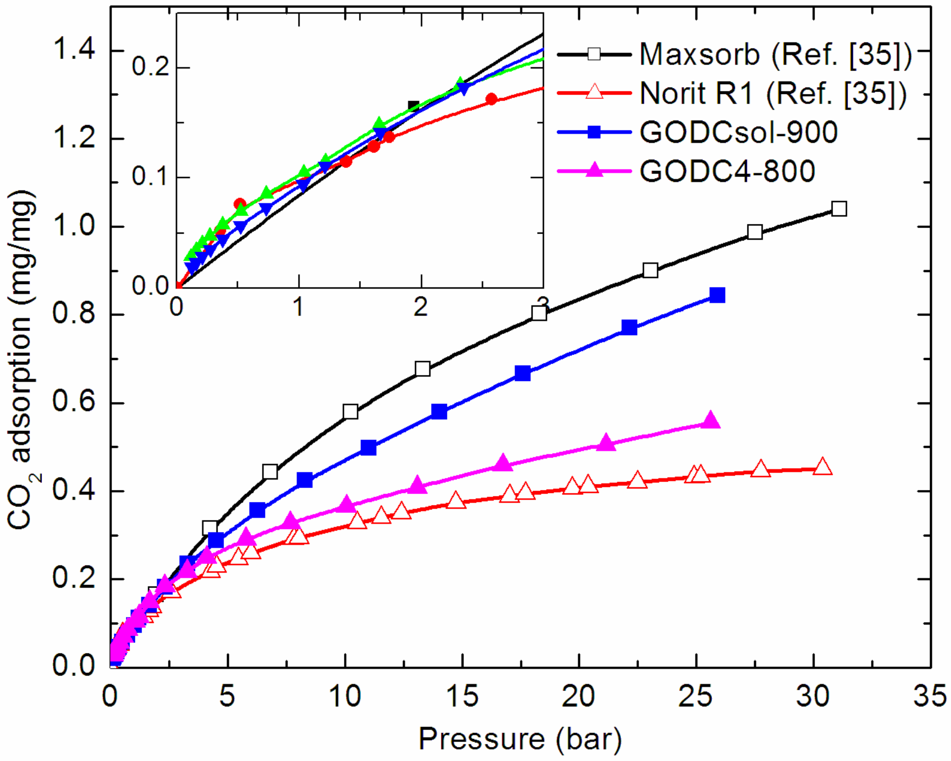

Figure S9. The comparison of CO_2 adsorption isotherms of our GODCs (at 300 K) with BET surface area of 1894 m^2/g and 1276 m^2/g to that of isotherms (at 298 K) of commercial Maxsorb and Norit R1 carbons with BET surface area of 3250 m^2/g and 1450 m^2/g. Inset shows low pressure, adsorption isotherms which exhibit similar adsorption values. All the isotherms exhibit a similar trend, and it is worth to note that our GODC with lower surface area 1276 m^2/g exhibits more adsorption than Norit R1 that has surface area of 1450 m^2/g.

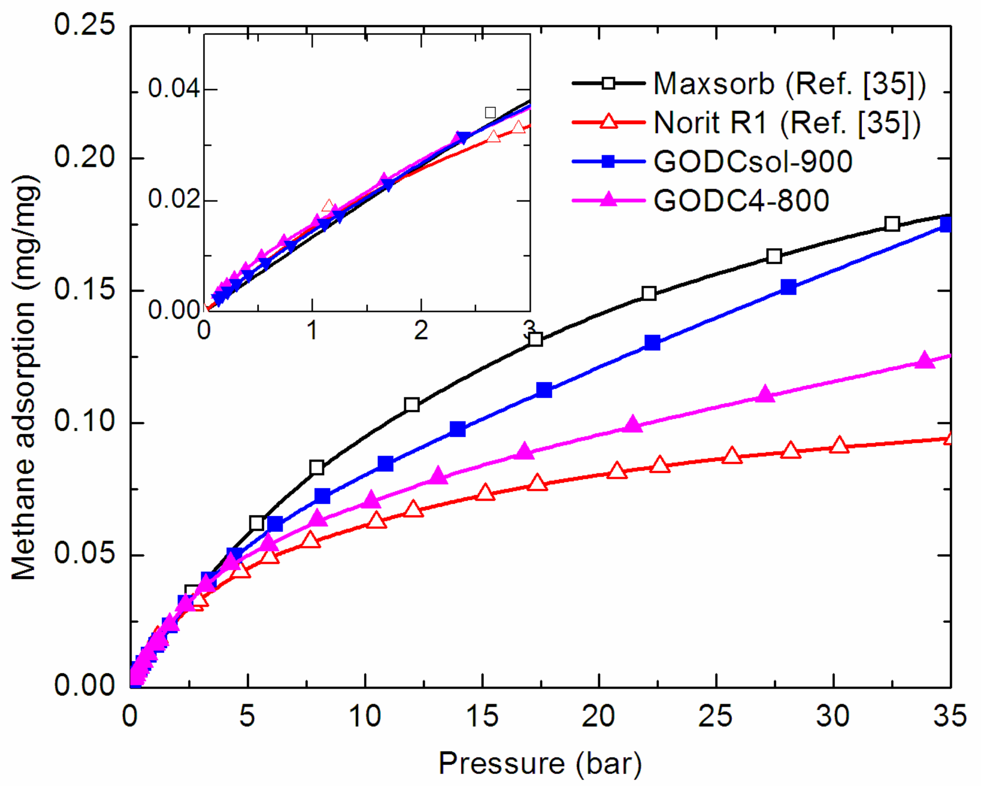

Figure S10. The comparison of methane adsorption isotherms of our GODCs (at 300 K) with BET surface area of 1894 m^2/g and 1276 m^2/g to that of isotherms (at 298 K) of commercial Maxsorb and Norit R1 carbons with BET surface area of 3250 m^2/g and 1450 m^2/g. In set shows low pressure adsorption isotherms which exhibits similar adsorption values. It is worth to note that our GODC with lower surface area 1276 m^2/g exhibits more adsorption than Norit R1 that has surface area of 1450 m^2/g.

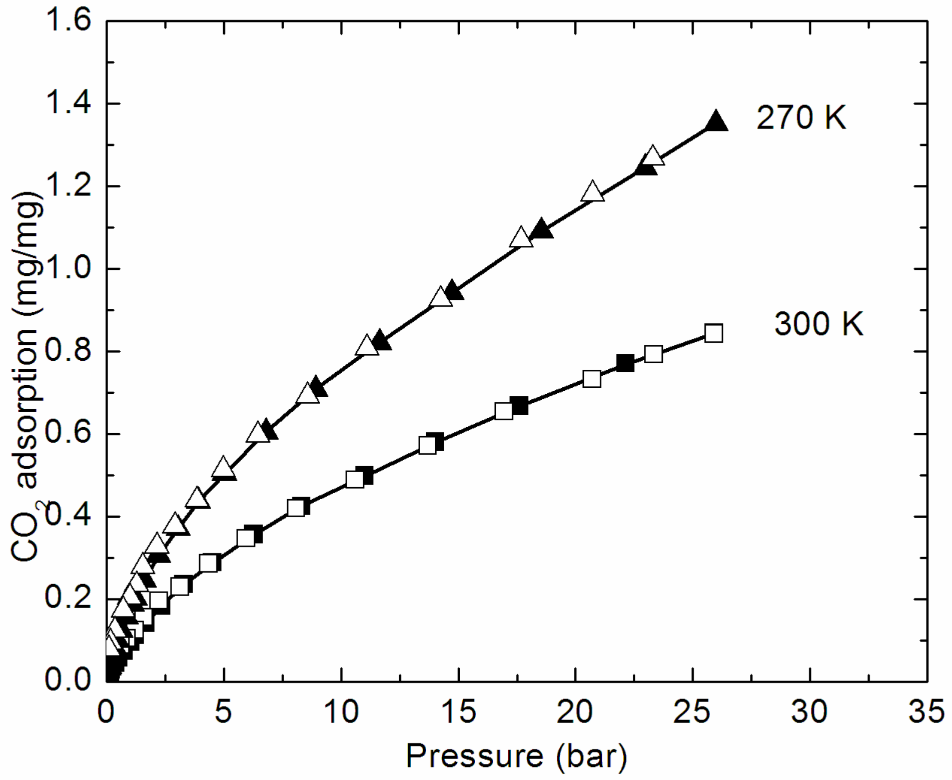

Figure S11. The CO_2 adsorption-desorption isotherms of GODCsol-800 sample, measured at constant temperatures, 270 K and 300 K.

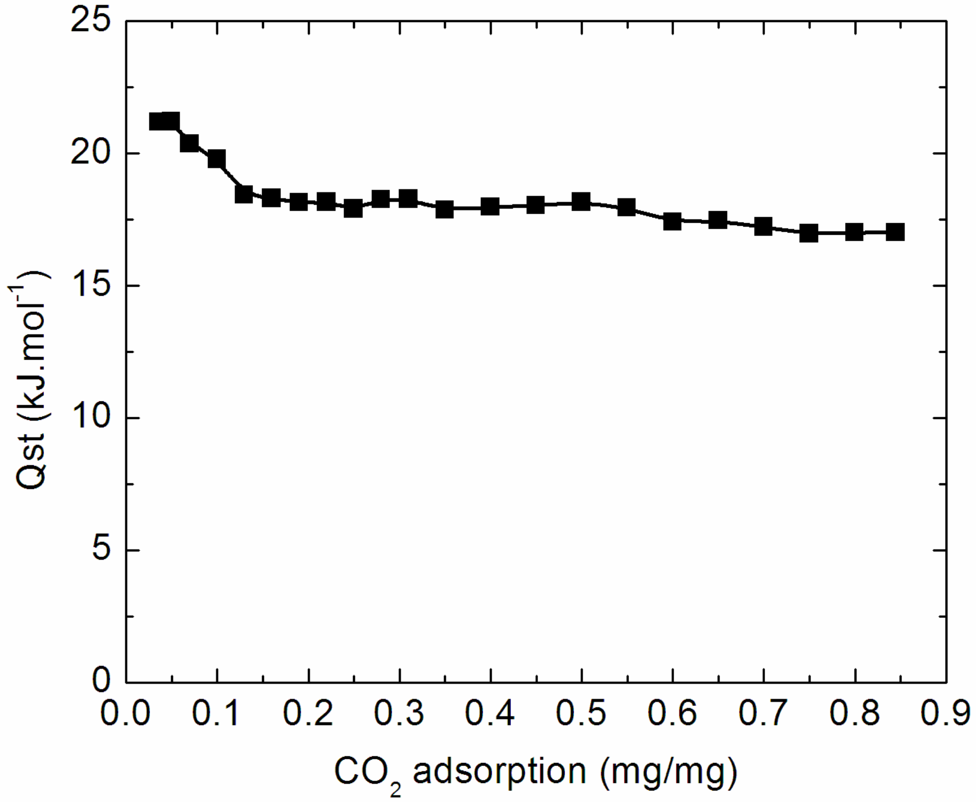

Figure S12. Isosteric heat of CO_2 adsorption in a GODCsol-800 sample.

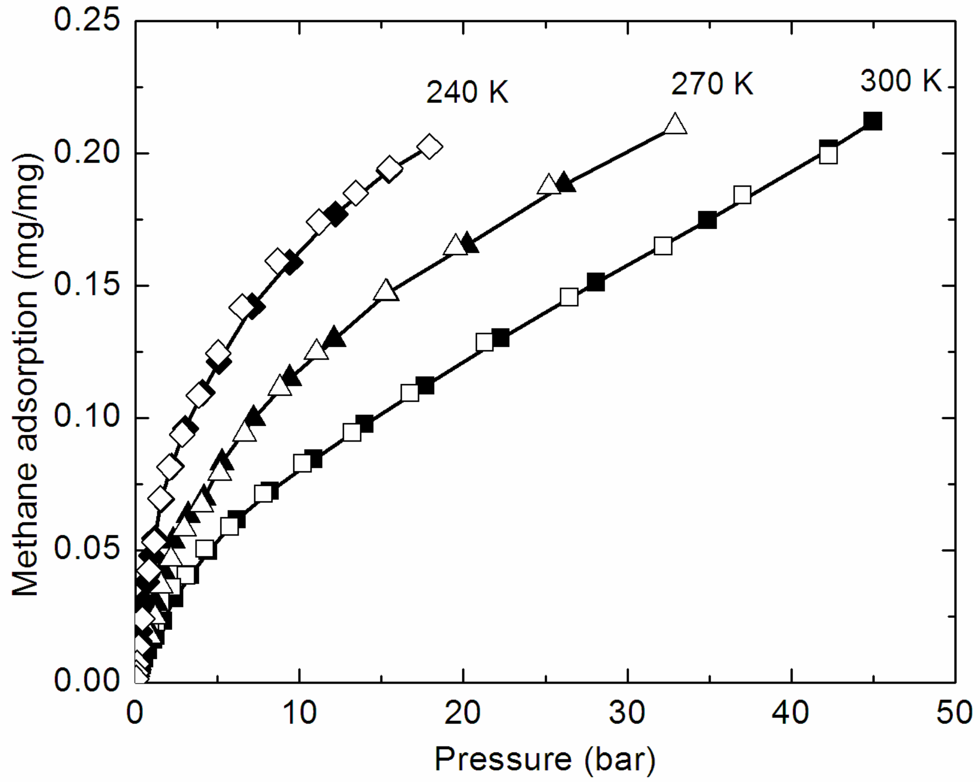

Figure S13. The methane adsorption-desorption isotherms of GODCsol-800 sample, measured at different constant temperatures, 240 K, 270 K and 300 K.

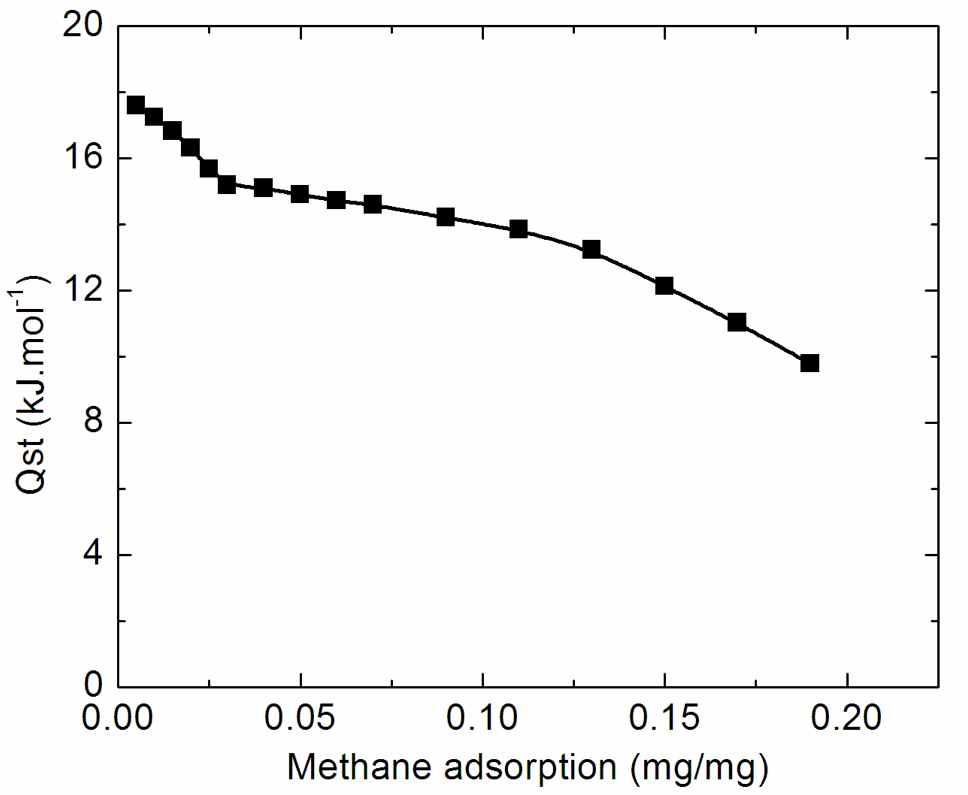

Figure S14. Isosteric heat of methane adsorption in a GODCsol-800 sample.