Supporting Information

A general and facile synthesis strategy to highly porous carbons: carbonization of organic salts

Marta Sevilla and Antonio B. Fuertes*

Instituto Nacional del Carbón (CSIC), P.O. Box 73, Oviedo 33080, Spain.

Experimental Section

Synthesis of Materials

In a typical synthesis ~ 3 g of organic salt was heat treatment in a stainless steel reactor under a flow of nitrogen at 800 ºC (1 h, 3 ºC/min). Subsequently, the black solid residue was washed with HCl (10 %). Finally, the carbon sample is collected by filtration, washed with abundant distilled water and dried at 120 ºC for several hours.

Characterization

The nitrogen sorption isotherms of the carbon samples were measured at −196 °C using a Micromeritics ASAP 2020 sorptometer. The apparent surface area (S_{BET}) was calculated from the N_2 isotherms using the BET method. An appropriate relative pressure range was selected to ensure that a positive line intersect of multipoint BET fitting ($C > 0$) would be obtained and $V_{ads}(1 - p/p_o)$ would increase with p/p_o.[1, 2] The total pore volume (V_p) was determined from the amount of nitrogen adsorbed at a relative pressure (p/p_o) of 0.95. The micropore volume (V_m) was obtained by applying a t-plot analysis (Harkins and Jura thickness equation) to the N_2 sorption isotherms.[3] The mesopore size distribution was determined by means of the Kruk-Jaroniec-Sayari method applied to N_2 adsorption branch.[4] The micropore size distributions were determined by means of the quenched-solid density functional theory (QSDFT) method applied to the nitrogen adsorption data and assuming a slit pore model. The average micropore width, *L*, was calculated from the characteristic adsorption energy deduced by applying the Dubinin−Radushkevich (D−R) equation to the nitrogen adsorption branch.[5] Scanning electron microscopy (SEM) images were obtained on a Quanta

FEG650 (FEI) instrument. X-ray diffraction (XRD) patterns were obtained on a Siemens D5000 instrument operating at 40 kV and 20 mA, using CuKa radiation. Transmission electron micrographs (TEM) were taken on a JEOL (JEM 2100-F) apparatus operating at 200 kV.

References

[1] Rouquerol, F.; Rouquerol, J.; Sing, K. In *Adsorption by powders and porous solids: principles, methodology and applications*; Academic Press: San Diego, **1999**.

[2] ISO. ISO standard 9277:2010, Determination of the specific surface area of solids by gas adsorption - BET method, Second Edition of ISO 9277; ISO: Geneve, **2012**.

[3] Gregg, S. J.; Sing, K. S. W. In *Adsorption, surface area and porosity*; Academic Press: London, **1991**.

[4] M. Kruk, M. Jaroniec, A. Sayari, *Langmuir* **1997**, *13*, 6267-6274.

[5] Stoeckli, H. F.; Rebstein, P.; Ballerini, L. *Carbon* **1990**, *28*, 907−909.

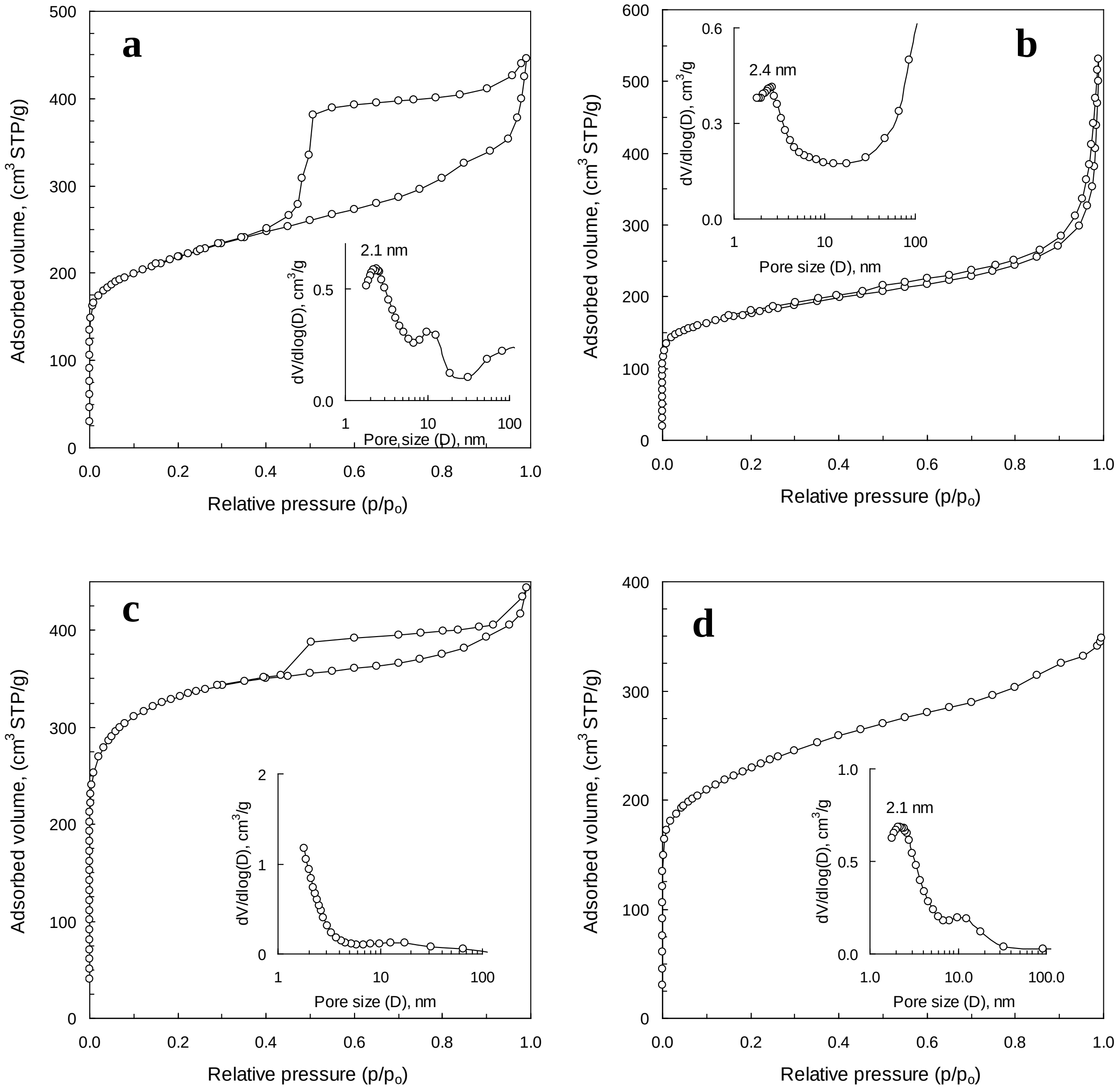

Figure S1. Nitrogen sorption isotherms and pore size distributions in the mesopore range (Insets) of carbons produced by heat treatment at 800 ºC of: (a) calcium gluconate (C-CaG), (b) sodium citrate (C-NaC), (c) sodium alginate (C-NaA) and (d) calcium alginate (C-CaA).

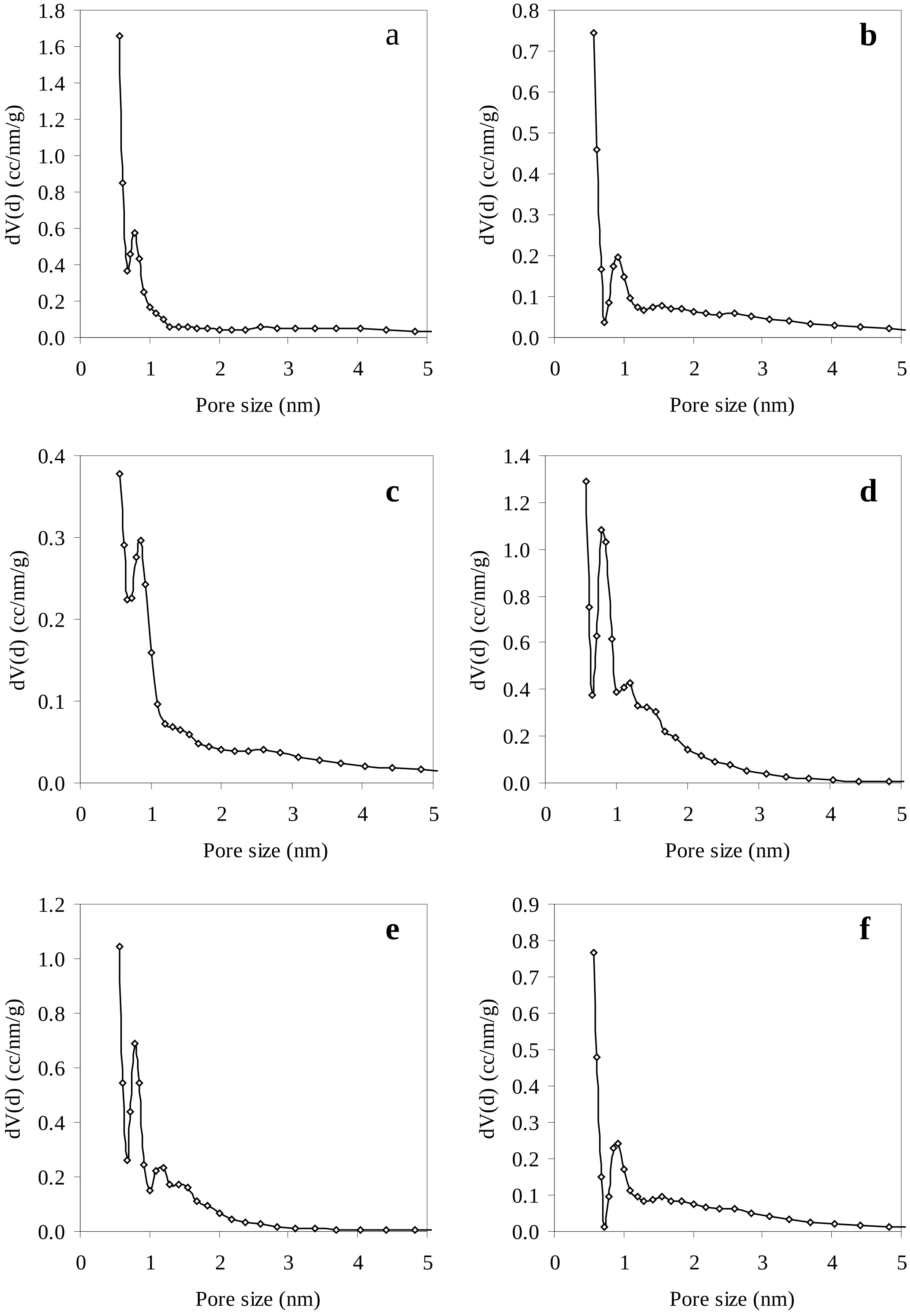

Figure S2. Pore size distributions of the micropore-mesopore range obtained by applying the QSDFT method to nitrogen adsorption branch for the samples: (a) C-KG, (b) C-CaG, (c) C-NaC, (d) C-KC, (e) C-NaA and (f) C-CaA

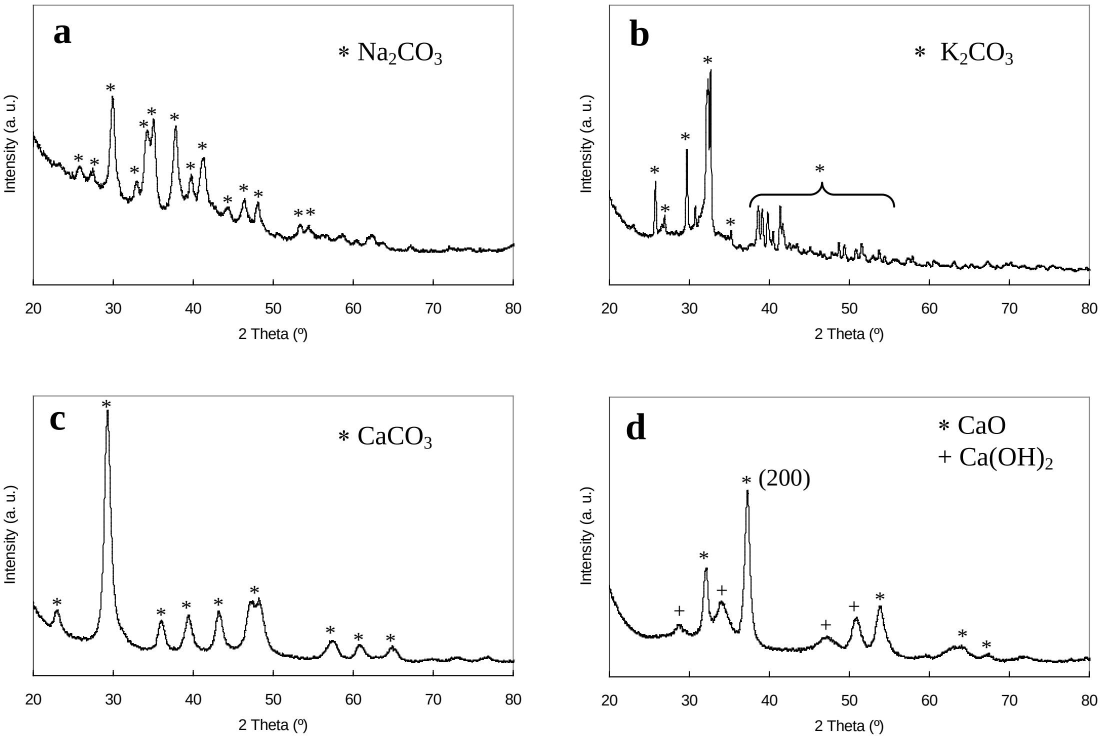

Figure S3. XRD patterns of: a) sodium gluconate treated at 650 ºC, b) potassium gluconate treated at 650 ºC, c) calcium citrate treated at 500 ºC and c) calcium citrate treated at 800 ºC (the presence of $Ca(OH)_2$ is consequence of the reaction of CaO with humidity of air once is exposed to the environment).