Supplementary Information for A Sustainable Production of Activated Carbon Spheres from Ethyl Cellulose

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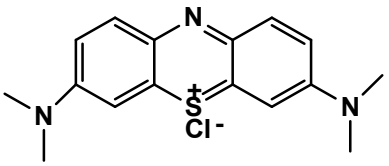
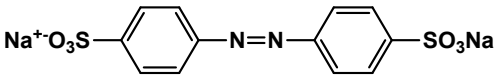
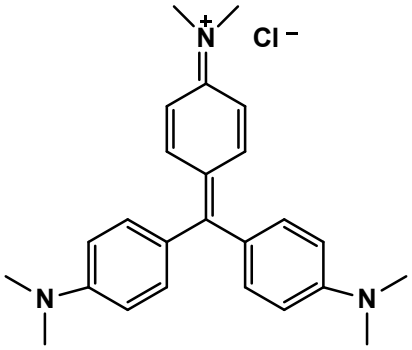
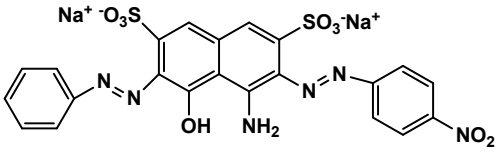
Table S1. Main characteristics of the selected dyes

Dye	Structural formula	λ_{max}/nm	Molecular weight
Methylene Blue (MB)		664	319.85
Methyl Orange (MO)		463	327.33
Crystal Violet (CV)		590	407.98
Amido Black 10B (AB)		618	616.49

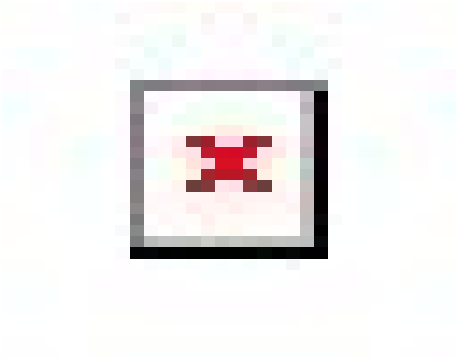


Fig.S1. X-ray diffraction spectra of (a) EC-250, (b) EC-250-600, (c) EC-250-700, (d) EC-250-800, (e) EC-250-900.

Figure S1 gave the XRD spectra of EC-250 and activated carbon in different temperatures. As can be seen from Figure S1, samples of EC-250 and carbon spheres activated at high temperature showed characteristic peak which was broad at 22.7°corresponding to 002 interlayer reflection of amorphous carbon. This result demonstrated that the amorphous structure of carbon materials was unchanged during heat activation. It was not hard to find that the broad peak shifts toward higher degrees with the temperature of activation going up, which suggested the interlayer spacing decreased [1]. In addition, we observed that there was a new peak emerges at 43.3°and the peak became more and more obvious with rising of temperature, which signified an increasing degree of order in activated CSs. Actually, the structure of the activated CSs changed towards a turbostratic type of disordered carbon[2].

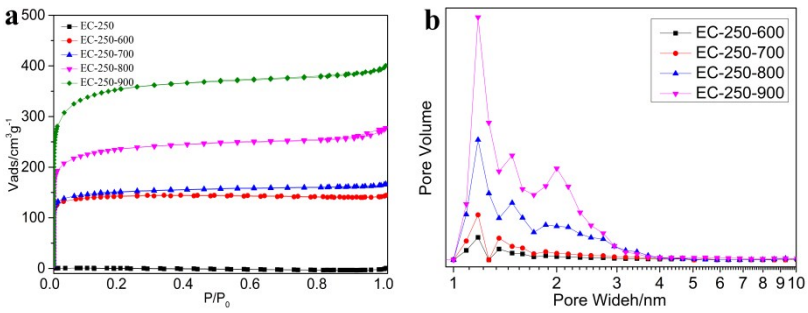


Fig.S2. (a) Nitrogen sorption isotherms, (b) corresponding DFT pore size distributions of obtained samples.

The isotherm of EC-250 showed negligible N_2 uptake as presented in Figure S2a. The isotherms of EC-250-600 and EC-250-700 were Type Ⅰ nitrogen isotherms according to the IUPAC classification. It was clearly that the activated carbons showed a sharp uptake of N_2 within relative pressure 0.1 and displayed a plateau above 0.1 P/P_0 with no hysteresis throughout the entire process, which meant the EC-250-600 and EC-250-700 were characteristic of microporous material. This result fully revealed micropores attributed to the elimination of gases (such as CO, CO_2 and CH_4) were formed in activated carbon material after heat activation[3]. The isotherms of EC-250-800 and EC-250-900 showed inconspicuous hysteresis loop, which indicated the existence of mesopore in the activated CSs. Last but not least, the sample showed significantly higher N_2 uptakes with an increase in activation temperature. The corresponding DFT pore size distributions revealed that the pores of EC-250-600 and EC-250-700 are less than 2 nanometers in diameter. The results showed some mesopores existed in EC-250-800 and EC-250-900. The corresponding DFT pore size distributions of obtained CSs provide evidence to support the HRTEM results.

References

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2. L. Zhao, N. Baccile, S. Gross, Y. Zhang, W. Wei, Y. Sun, M. Antonietti and M.-M. Titirici, *Carbon*, 2010, 48, 3778-3787.
3. L. Yu, C. Falco, J. Weber, R. J. White, J. Y. Howe and M.-M. Titirici, *Langmuir*, 2012, 28, 12373-12383.