Nitrogen-doped Porous Carbon Derived from Rapeseed residues for High-performance Supercapacitors

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doi: 10.20964/2016.06.22

Received: 4 December 2015 / Accepted: 30 March 2016 / Published: 4 May 2016

In this paper, nitrogen-doped activated carbons obtained from rapeseed residues (N-RCs) as supercapacitor electrodes are successfully synthesized by a simple chemical activation method. The field emission scanning microscope, transmission electron microscopy, and N₂ adsorption-desorption tests demonstrate that N-RCs treated with ZnCl₂ can produce a large number of mesopores. Additionally, the N-RCs have certain amount of nitrogen (nitrogen content in N-RC2 is 6.55% by element content analysis). As the electrode material, N-RC2 exhibits ideal capacitive behavior in 6 mol L⁻¹ KOH aqueous electrolyte in a three-electrode system tests, and the maximum specific capacitance reaches 250 F g⁻¹ at a current density of 0.5 A g⁻¹. Furthermore, in 0.5 mol L⁻¹ Na₂SO₄ aqueous electrolyte, the as-assembled N-RC2//N-RC2 symmetric cell exhibits high energy density of 13.55 Wh kg⁻¹ at a power density of 399.80 W kg⁻¹ operated at the voltage range of 0 to 1.8 V and an excellent cycleability retaining about 92.8% initial capacitance after 5000 cycles.

Keywords: Rapeseed residues, Activated carbon, Nitrogen-doped, Supercapacitor

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