Effect of Sulfur Impregnation Temperature on Properties of N-Doped Activated Carbon for Supercapacitor Applications

Yue. Li, Ru-Quan Ren, Xiao-Juan Jin^{*}

Beijing Key Laboratory of Lignocellulosic Chemistry, MOE Engineering Research Center of Forestry Biomass Materials and Bioenergy, Beijing Forestry University, 35 Qinghua East Road, Haidian, 100083, Beijing, China.

^{*}E-mail: 13020028853@163.com

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Sulfur-and nitrogen-co-doped activated carbons were obtained from sulfur modified nitrogen-doped activated carbons prepared from waste medium density fiberboard (MDF) prepared by KOH at 850°C for 60 minutes at a weight ratio of 3:1. And the sulfur was adsorbed by nitrogen-doped activated carbon with different temperatures at 300°C, 400°C, 500°C, 600°C (AC300, AC400, AC500, AC600). The structural properties and chemical surface composition of the activated carbons were evaluated by Elemental analysis, Scanning electrical microscopy, Raman spectra, X-ray diffraction and Adsorption of nitrogen. The results showed that the content of sulfur ranging from 0.03 wt. %~1.64 wt. % in which the content of sulfur in AC400 (1.64 wt. %) is highest comparing with other activated carbons. The BET specific surface area is varying from 1805 m²g⁻¹ to 2081 m²g⁻¹. The activated carbons as the electrode material which was impregnated with 7 M KOH electrolytes were characterized and tested by galvanostatic charge-discharge curves, cyclic voltammetry and alternating current impedance. The specific capacitance was improved from 225 to 264 F/g and AC400 exhibited the best electrochemical behavior with a supreme specific capacitance (264 F/g) and rectangular cyclic voltammetry curves.

Keywords: supercapacitor; sulfur-and nitrogen-co-doped activated carbons; temperature; waste medium density fiberboard; specific capacitance

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