Porous Carbons Derived from Lignite Mixed with Zn²⁺-Doped Lignin for Electric Double-Layer Capacitor

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A series of porous carbons (PCs) were prepared from lignin chelating with Zn²⁺ and mixed with lignite. KOH was used as the activated agent during preparation process. The influences of preparation parameters including the content of lignin chelated with Zn²⁺, KOH/sample ratio and activation temperature on specific surface area (SSA), pore size distribution and electrochemical performances were investigated in this study. All the PCs were mainly micropores through nitrogen adsorption isotherms test. The PCs derived from the lignin chelating with Zn²⁺ present high SSA and total pore volume than that in the absence of Zn²⁺. In addition, the PC prepared from adding lignin to lignite has larger SSA than the PC prepared from lignite. The PC prepared with Zn²⁺ account for 30% of lignin mass, KOH/sample ratio of 3:1 and activation temperature of 700 °C has the largest SSA of 3311 m² g⁻¹. When it was used as electrode for electric double-layer capacitor, the specific capacitance reached the highest value of 280.43 F g⁻¹ at a current density of 40 mA g⁻¹. The results demonstrate that the lignin chelating with Zn²⁺ then add to the lignite can significantly improve PCs performance.

Keywords: Lignin; Lignite; Porous carbons; High surface area; EDLC

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