Highly Porous Heteroatom Doped-Carbon Derived from Orange Peel as Electrode Materials for High-Performance Supercapacitors

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Biomass conversion to heteroatom-doped carbon materials is considered to be an effective and inexpensive method for energy conversion. Orange peel is rich in the elements carbon, nitrogen and oxygen. Herein, nitrogen and oxygen co-doped carbon is prepared by high-temperature carbonization and activation of orange peels. Two activating agents, KOH and K₂FeO₄, are adopted in the preparation. The OC-1-K sample derived from orange peel activated by KOH has a large specific surface area of 917.66 cm² g⁻¹. When used as a supercapacitor electrode material, the OC-1-K sample displays a high specific capacitance of 282.3 F g⁻¹ at 1 A g⁻¹. Even when the current density increases to 20 A g⁻¹, the discharge capacity is 212 F g⁻¹, indicating good rate performance. After 4000 charge-discharge cycles in 2 mol L⁻¹ KOH electrolyte, the capacitance is maintained at 209.8 F g⁻¹ at 20 A g⁻¹, achieving good cycling stability. All these results are superior to those of the OC-1-G sample obtained by K₂FeO₄ activation. These results indicate that KOH is more effective in activating orange peels. The excellent electrochemical performance of the OC-1-K sample suggests good application prospects in supercapacitors.

Keywords: biomass-derived carbon, porous material, supercapacitive, symmetric supercapacitor

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