A High-Performance Supercapacitor Based on Nitrogen-Doped Porous Carbon Derived from Cycas Leaves

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In this work, we proposed a new way to synthesize nitrogen-doped porous carbon materials. Nitrogen-doped porous carbon materials were prepared using cycas leaves as the carbon source and urea as the nitrogen source. Namely, the dried cycas leaves were first burned at 300 °C and then activated by KOH containing urea at 700 °C. The prepared samples display high specific surface areas; the highest specific surface area and largest total pore volumes are approximately 2628 m² g⁻¹ and 1.39 cm³ g⁻¹, respectively. A supercapacitor made by nitrogen-doped porous carbon shows attractive capacitive performance. Taking CU2-700 as an example, its specific capacitance is 373 F/g at 0.5 A/g, and 89% specific capacitance retention is reached after 10000 cycles in a three-electrode system. In addition, high specific capacitances of 260 F/g at 0.5 A/g and 203 F/g at 10 A/g are obtained, and CU2-700 has excellent cycling stability (85% specific capacitance retention after 10000 cycles at 5 A/g) in a two-electrode system. Furthermore, the energy density of the supercapacitor is approximately 9.13 W h/kg at 125 W/kg power density in a two-electrode system. These results indicate that cycas leaves are a good biomass carbon material for preparing high-performance supercapacitors.

Keywords: cycas leaves; porous carbon; urea; KOH activation; supercapacitors

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