Biomass-Derived Porous Carbons for Energy and Chemical Storage

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The conversion of lignocellulose into high-value carbon nanomaterials is of prime importance because of the sustainable chemistry, valorization of waste, and replacement of fossil fuel-derived counterparts. However, existing synthetic methods are hindered by difficulties concerning fine tuning of their physical and chemical properties starting from a heterogeneous source and mass production. In this study, we report a straightforward valorization chemistry of lignocellulose into heteroatom-doped and undoped carbon dots (CDs) and nanoporous carbons (CNs) using a one-pot hydrothermal method. The PL spectra of P, S and N doped CDs show the distinct peak shifts and splittings and fluorescences, originating from the different optoelectronic circumstances. The P doped CNs demonstrates the cyclic stability of 96.0% over 100,000 cycles in full cell, achieving a high capacitance of 265.43 F g-1 and rate capability of 75%. These Na-ion pseudocapacitive features of P doped CNs arising from the hierarchical interconnected porosity and the redox-active P=O bonds are comprehensively investigated by experimental and computational analyses.