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Biocarbon for High-Performance Supercapacitors Derived from the Wastewater Treatment of Sewage Sludge

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Abstract : In this study, a biocarbon (BC) was made from sewage sludge from the water treatment plant (PTAR) in Saltillo, Coahuila, Mexico. The sludge was carbonized in water and then chemically activated by pyrolysis. The biocarbon was evaluated physicochemically using XRD, SEM-EDS, and FESEM. A broad (002) peak attributable to graphitic structures indicates that the material is amorphous. The resultant biocarbon has a high specific surface area (412 m2 g-1), a large pore volume (0.39 cm3 g-1), interconnected hierarchical porosity, and outstanding electrochemical performance. It is appropriate for high-performance supercapacitor electrode materials due to its high specific capacitance of 358 F g-1, great rate capability, and outstanding cycling stability (around 87% capacitance retention after 10,000 cycles, even at a high current density of 19 A g-1). In an aqueous solution, the constructed BC/BC symmetric supercapacitor exhibits increased super capacitor behavior with a high energy density of 29.5 Whkg-1. The concept provides an efficient method for producing high-performance electrode materials for supercapacitors from conventional water treatment biomass wastes.

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