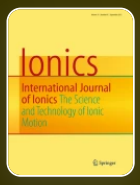
Uncovering the impact of commercial mass-loaded biocarbon electrodes on the ionic diffusion and performance of the supercapacitor

| Research | Published: 25 November 2024

| (2024) Cite this article



Ionics

Aims and scope →

Submit manuscript →

R. Gowsalya, N. Kamalaveni, S. Sathyamoorthi & A. Kumaravel

Abstract

Unlike the conventional process of selecting specific plant parts, real *Thespesia populnea* waste including the flowers, seeds, leaves, etc. was used to synthesize narrow pore-size distributed microporous biocarbon in the present work. Three (10, 20 and 30 mg cm^{-2}) practical-level areal mass loading were used to understand the areal mass loading on their electrochemical performance of supercapacitor. Various parameters in the EIS measurement indicate the impact of areal mass on the diffusion of ions. The Warburg diffusion resistance and the two types of relaxation time constant increase on increasing the areal mass of the electrodes reveal the hindered ionic diffusion. Reversible H_2 adsorption in the micropores enables the supercapacitor to deliver at a high cell voltage of 1.6 V in 1.0 M $Na_2SO_{4(aq.)}$. The supercapacitor delivers a specific capacitance of 140 F g^{-1}, a specific energy of 12.2 Wh kg^{-1} and a specific power of 770 W kg^{-1} for 10 mg cm^{-2} biocarbon loading. Further, imposing energy efficiency of 88% was measured. The performance of 99% was retained at the end of 10 K continuous GCPL measurements indicating the high endurance of the constructed full cell.