المملكة العربية السعودية

وزارة التعليم

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ABSTRACT

The supercapacitors with prestigious electrochemical performance have achieved exceptional worth however, a facile environmentally friendly approach is still desired for electrode material with high charge storage capability. In this study, we have demonstrated and analyzed the charge storage mechanism of tea waste derived activated carbon (AC) for supercapacitor applications. The tea waste is collected, washed, and dried. Chemical activation is performed with different concentrations of potassium hydroxide (KOH) which is followed by carbonization at 800ºC in an argon environment. The surface morphology and crystal structure of the synthesized AC are and scanning investigated via performing X-ray diffraction (XRD) electron microscopy (SEM). The Electrochemical performance of synthesized AC is carried out in three electrode assembly. The AC activated by 50 % KOH delivers the high specific capacitance of 349.45 F/g at 3 mV/s and 319.41 Fg^{-1} at 1 Ag^{-1}. Further, the electrolytic environment was optimized by testing the best performer in different concentrations of electrolytes. The maximum specific capacitance of 550.37 F/g at a scan rate of 3 mV/s and 496.1 Fg^{-1} at the current density value of 0.5 Ag^{-1} is achieved for AC in 3M KOH electrolyte concentration. This optimized material and the electrolytic environment was further employed in a symmetric architecture for real device application. The fabricated device delivers excellent specific energy of 16.2 Wkg^{-1} along with specific power of 498.4 Wkg^{-1}. An outstanding power of 3499.1 $Wkg^{-1}$was also achieved via this supercapacitor along with specific energy of 4.8 $Whkg^{-1}$.