Low Cost, High Performance Supercapacitor Electrode Using Coconut Wastes: Eco-Friendly Approach

Divyashree A.[a], Shoriya Aruni Bt Abdul Manaf[b], Yallappa S.[a], Chaitra K.[c], Kathyayini N.[c], Gurumurthy Hegde[a,]

[a] BMS R and D Centre, BMS College of Engineering, Basavanagudi, Bangalore, 560019, India

[b] Faculty of Industrial Sciences and Technology, Universiti Malaysia Pahang, 26300, Gambang, Kuantan, Malaysia

[c] Jain University, Jain Global Campus, Jakkasandra Post, Kanakapura Taluk, 562112, India

ABSTRACT

Low cost, high performance supercapacitor electrodes were fabricated using coconut waste as precursor. Simple one step pyrolysis is adopted to get the spherical shaped particle where lignocellulosic nature of carbon converts into porous carbon nanospheres. Three types of coconut wastes, namely, coconut fiber (CF), coconut leaves (CL) and coconut stick (CS) have been studied and compared for their application in supercapacitors. Uniform spherical shape with particle size ranging from 30 to 60 nm for leaves and sticks and ~20 nm for fibers was obtained. The electrochemical properties of the porous carbon nanospheres were studied using cyclic voltammetry (CV), chronopotentiometry (CP) and electrochemical impedance spectroscopy (EIS). The porous carbon nanospheres derived from all the three biowaste samples show good electrochemical performance for supercapacitor application. Porous carbon nanospheres derived from coconut fiber exhibited maximum specific capacitance of 236 F/g followed by coconut stick and coconut leaves with 208 and 116 F/g respectively at a scan rate of 2 mV/s. Further impedance studies showed a charge transfer resistance of 4.9 Ω for the porous carbon nanospheres derived from coconut fiber, while those from coconut leaves and coconut stick exhibited a slightly higher resistance of 6 and 14.2 Ω, respectively. The simple eco-friendly approach we have demonstrated for synthesizing coconut waste based carbon nanospheres makes them excellent candidates for future, low-cost, energy storage devices.

KEYWORDS: Low cost; Coconut waste; Biowaste; High performance; Supercapacitor; Energy storage

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