

Cauliflower-like poly(3,4 ethylenedioxythipohene)/nanocrystalline cellulose/manganese oxide ternary nanocomposite for supercapacitor

ABSTRACT

A cauliflower-like ternary nanocomposite of poly(3,4-ethylenedioxythipohene)/nanocrystalline cellulose/manganese oxide (PEDOT/NCC/MnO₂) was synthesized using one-step electropolymerization technique. The effect of manganese (Mn) concentration on the supercapacitive performance was investigated. The structural and morphology studies were conducted using field emission scanning electron microscope, Fourier transform infrared spectroscopy, Raman spectroscopy, and X-ray diffraction. The morphology of ternary nanocomposite at an optimized concentration of Mn resembles the cauliflower-like structure. The two-electrode electrochemical analysis of a ternary nanocomposite PEDOT/NCC/MnO₂ exhibited a higher specific capacitance of 144.69 F/g at 25 mV/s in 1.0 M potassium chloride compared to PEDOT/NCC(63.57 F/g). PEDOT/NCC/MnO₂ ternary nanocomposite was able to deliver a specific power of 494.9 W/kg and 10.3 Wh/kg of specific energy at 1 A g⁻¹ and retained 83% of initial capacitance after 2,000 cycles. These promising results from the incorporation of Mn displayed great prospective in developing PEDOT/NCC/MnO₂ as an electrode material for supercapacitor.