KISLAP PILIPINAS: Kinetic in situ Characterization of Reinforced Composite Assembly of Cathode and Anode Materials Derived From Musa textilis (Abaca) Fibers and Carbonized Perna viridis (Green Mussel Shells) as Potential Integrated Layers Ion Electrode Plugged-in Coin Cell Based Battery for Energy Application Storage

Tamayo, Marc Fritzter (School: Bansud National High School Regional Science High School for MIMAROPA)

This study focuses on the sustainable use of biomass wastes (carbonized green mussel shells, abaca fibers) as possible electrode layers to build a reinforced composite assembly for energy storage devices based on CR2032 coin-cell-based device. The components were assembled into a full coin-cell CR2032 configuration to evaluate their electrochemical measurements for three distinct groups: abaca-based, carbonized green mussel shells, and composite-based (abaca fibers, carbonized green mussel shells). Cyclic voltammetry (CV) revealed improved redox activity in the composite, with oxidation peaks at 0.22V (vs. 0.14V for abaca and 0.12V for mussel shells with a reduction peak at -0.30V (vs. -0.48V and -0.43V). Galvano Electrochemical Impedance Spectroscopy (GEIS) analysis demonstrated superior conductivity and lower charge transfer resistance for the composite at 34.7 ohm, compared to 49.2 ohm for abaca and 63.1 ohm for mussel-based electrodes. Results from chronoamperometry showed that the composite group had a substantially higher discharge capability, with a peak current of 5.6 mA, as opposed to 3.2 mA for abaca and 2.1 mA for mussel shells. Potentio Electrochemical Impedance Spectroscopy (PEIS) displayed a reduced semicircle diameter for the composite in Nyquist plots, suggesting improved interfacial charge dynamics and ion transport. Open Circuit Voltage Analysis (OCV) testing also demonstrated the composite's improved energy retention, with an OCV of 2.3V, as opposed to 1.7V for mussel shells and 1.9V for abaca. These findings demonstrate the successful integration of biomass wastes into CR2032 coin-cell batteries, emphasizing the potential of these sustainable materials as layers ion electrode for energy storage system.

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