Composite Electrodes Based on Castor Oil Derivatives and Graphite: Development and Properties

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This work investigates chemically modified castor oil (CaOil) as a sustainable agglutinant for solid composite electrodes which offers several advantages, including easiness of fabrication, surface renewability, mechanical resistance, and chemical stability in non-aqueous media, long-term stability and the ability to incorporate modifiers both at the surface and throughout the bulk [1]. Epoxidation and maleinization of CaOil were carried according in accordance with Green Chemistry principles [2,3]. Composites were prepared with graphite-to-binder mass ratios of 60:40, 70:30, and 80:20, and characterized concerning morphological, thermal, and electrochemical features. Scanning Electron Microscopy revealed increasing graphite lamellae with reduced porosity as graphite content increased. Thermogravimetry confirmed the composition and homogeneous distribution of the components into the materials. Electrochemical behavior was evaluated by cyclic voltammetry with ferricyanide and hexamine ruthenium as probes. The 80%, (*m/m*) presented the best response (ΔEp and current percentages/GCE) when compared to glassy carbon. Surface treatments in phosphate solutions increased the overall double layer capacitance and current response, which can be associated to carboxylate groups formed during the activation. This also led to an increase in current and lower ΔEp values for the best condition.

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