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Short communication

Moringa Oleifera leaf extract mediated synthesis of reduced graphene oxide-vanadium pentoxide nanocomposite for enhanced specific capacitance in supercapacitors

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ABSTRACT

Moringa Oleifera leaf extract has been prepared and used as an environmental-friendly reducing agent. Reduced graphene oxide (RGO) has been decorated with vanadium pentoxide (V_2O_5) in presence of *Moringa Oleifera* leaf extract to generate a RGO/V_2O_5 nanocomposite. Analytical, spectroscopic, and electrochemical characterizations of synthesized V_2O_5, RGO, and RGO/V_2O_5nanocomposite have been used to evaluate its morphology and structure. The RGO production and recombination with V_2O_5 are confirmed by the Characterization result. RGO, V_2O_5, and RGO/V_2O_5 nanocomposite have been evaluated for their electrochemical performances in supercapacitor applications by using various electrochemical techniques. The enhanced specific capacitance of 906 Fg^{-1} has been accomplished for RGO/V_2O_5 nanocomposite compared to 146 and 535 Fg^{-1} for V_2O_5 and RGO, respectively, at 2 mVs^{-1} scan rate using cyclic voltammetry (CV) technique. Chronopotentiometry technique has also been evaluated and observed the specific capacitance of 380 Fg^{-1} at a current density of 0.5 Ag^{-1}. RGO/V_2O_5 nanocomposite could be a choice of material in energy storage devices.

1. Introduction

Energy storage systems have garnered a lot of attention in recent decades, owing to increased demand for electronic devices, renewable energy cars and digital communications [1–5]. Because of improved power output, remarkable cycle life, low weight, ease of handling and flexibility supercapacitors have stimulated enormous interest in energy storage systems [6–8]. Supercapacitors could serve as next-generation power sources and probably plays a role in simple handy electronic devices like roll-up screens, tiny bio-medical devices, and wearable electronic gadgets due to their unique features [9–11]. However, supercapacitors working voltage is restricted for potential implementation, leading to low energy density, which has hindered their prevalent adoption [12].

Supercapacitors have a wide range of uses, from electronic gadgets to electric cars to large-scale storage power grids, thanks to their unique electrochemical features. Supercapacitors are classified into two classes depending on their energy storage phenomena.Class-1 supercapacitors are electrical double-layer capacitors (EDLCs) which stores energy due to electrostatic adsorption/desorption at electrode/electrolyte interface [13,14]. Class-2 is pseudocapacitors that involve fast and reversible Faradaic redox reactions of the active materials [15]. In general,

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