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Improving energy density in symmetric supercapacitors from optimized activated carbon using non-aqueous electrolytes

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Improving energy density in symmetric supercapacitors from optimized activated carbon using non-aqueous electrolytes

The formation mechanism of the porous framework in nanostructured carbon materials is important in a wide variety of applications such as in supercapacitors, gas storage, adsorbents and catalyst supports. The accessibility to the pore sites by electrolyte ions and gases are highly determined by the precise synthesis techniques adopted for these materials. As such, biomass waste materials are a good choice for synthesis as they are available in abundance and cheap, while containing high carbon content and giving high specific surface area for electrochemical supercapacitor applications.
In this study, activated carbon (AC) was synthesized from renewable plant biomass waste using a chemical vapour deposition (CVD) technique via a pre-hydrothermal conversion step and compactivation along with the fine-tuning of key growth parameters, including activation time.
The textural, structural and morphological features were investigated by the Brunauer-Emmett-Teller (BET) technique, X-ray diffraction (XRD), Scanning/Transmission electron microscopy (SEM/TEM) and Energy Dispersive X-ray Spectroscopy (EDS) characterization. The material tested in a three-electrode configuration exhibited electric double-layer capacitor (EDLC) behaviour and working comfortably in KNO3 aqueous electrolyte in both negative and positive operating widow of 0.80 V. The material also exhibited higher gravimetric energy of over 55 Wh.kg-1 and gravimetric power of 700W.kg-1 at 0.5 A.g-1 gravimetric current in ionic liquid electrolyte. The results from this study provide the pathway into designing hierarchically porous materials from cheap and sustainable sources suitable in high power energy storage devices. The improvement of the energy densities are also achieved using of ionic liquid electrolytes.

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Yes

Level for award
 (Hons, MSc,
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PhD

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