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QUASI-SOLID-STATE SUPERCAPACITOR WITH COCONUT SHELL-DERIVED ACTIVATED CARBON ELECTRODES AND H_3PO_4/ POLYVINYL ALCOHOL GEL ELECTROLYTE

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Coconut shells are excellent sources of activated carbon because of their highly porous structure, which gives a larger surface area. However, reports on solid and quasi-solid-state supercapacitors are relatively scarce. More environmentally friendly activated carbon can be produced via the physical activation process, and the physical activation approach is frequently regarded as being better than the chemical approach for deriving carbon from coconut shells. Furthermore, compared to the chemical technique, which might introduce impurities via activating chemicals, the physical method typically yields cleaner and purer activated carbon by reducing the potential for impurities to react with the electrolyte. Here, coconut shell charcoal is carbonized and heated to a high temperature to expose it to activating gases such as steam or carbon dioxide. Supercapacitor electrodes were prepared using activated carbon ink incorporated with 5% polyvinylidene formation of electrodes. This activated carbon ink was coated on graphite sheets, which were used as capacitor current collectors via the drop-casting method. The significance of the study is the use of polyvinyl alcohol (PVA)/H_3PO_4 based gel polymer electrolyte prepared using the hot press method. This gel polymer electrolyte exhibited the highest ionic conductivity of 46 Ms/cm when 3.5 g of H_3PO_4 was used with 10 mL of PVA. The specific capacitance of the corresponding assembled quasi-solid-state supercapacitor was 2.29 F/g, which is comparatively lower than that of liquid electrolyte-based supercapacitors. However, the gel electrolyte supercapacitor offers improved stability, minimized electrolyte evaporation, and reduced leakage due to its elevated viscosity and the structural integrity of the gel matrix. Cyclic voltammetric graphs appreciably resembled the behaviour of an electrical double-layer supercapacitor. The quasi-solid-state supercapacitor exhibited power and energy densities of 263.3 W/kg and 7.31×10^{-2} Wh/kg respectively. This preliminary study establishes a basis for further optimization of photo-supercapacitors with stable gel electrolytes.

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