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High-energy supercapacitor based on activated carbon derived from Arachis hypogea biomass using different activating agents

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Abstract: In this work, porous activated carbon nanostructures were prepared from peanut (Arachis hypogea) shell waste (PSW) via two-step carbonization (CPSW) and activation process at elevated temperature using different activating agents KHCO3, K2CO3 and KOH with varying mass ratios. The textural properties obtained were depicted with relatively high specific surface area values of 1457 m2 g−1, 1625 m2 g−1 and 2547 m2 g−1 for KHCO3, K2CO3 and KOH respectively at a mass concentration of 1 to 4 which were complemented by the presence of a blend of micropores, mesopores and macropores. The structural analyses confirmed the successful transformation of the carbon-containing waste into an amorphous and disordered carbonaceous material. The electrochemical performance of the material electrodes was tested in a 2.5 M KNO3 aqueous electrolyte depicted its ability to operate reversibly in both negative and positive potential ranges of 0.90 V. The activated carbon obtained from the carbonized CPSW:AA with a mass ratio of 1:4 yielded the best electrode performance for all featured AAs. The porous carbons obtained using KOH activation displayed a higher specific capacitance and the lower equivalent series resistance as compared to others. The remarkable performance further corroborated the findings linked to the textural and structural properties of the material.

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