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From pinecone biomass to three-dimensional porous activated carbon for supercapacitive electrodes

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Considering the gradual consumption of fossils fuels, it is imperative to develop schemes that are sustainable for socio-economic development of our society to meet the high energy demands. The performance of supercapacitive material largely depends on the interaction between electrode materials and the electrolyte ions. In this regard, we investigate the electrochemical behaviour of activated carbon produced by employing pine cones biomass waste as the carbon source in different aqueous electrolytes. The produced activated carbon exhibited a specific surface area of 1160.3 $m^2 g^{-1}$ with a high mesopore volume. The fabricated electrode material could deliver a specific capacitance of 200 F g^{-1} at a current density of 1 A g^{-1} in 1 M H_2SO_4 in three electrode configuration. Symmetric device fabricated based on the prepared carbon exhibited a maximum specific capacitance of 113 F g^{-1} at 0.25 A g^{-1} 1 by galvanostatic charge–discharge tests in the same electrolyte with cycle stability up to 5000 cycles. We anticipate that pine cone biomass could be a viable and sustainable source of the carbon material for supercapacitor application if fully explored.

Biography:

Prof. Ncholu Manyala is Professor of Physics and Chair of South African research chair initiative (SARChI) in Carbon Technology and Materials at the University of Pretoria, South Africa. Prof. Manyala got his PhD from Louisiana State University working on low temperature transport and magnetic properties of strongly correlated materials where published two papers in Nature and one in Nature Materials in this field. Prof. Manyala's recent research interest is on graphene based materials and their applications in energy storage and sensing. Prof. Manyala has published more than 40 papers in this subject. Prof. Manyala is the member of International Society of Electrochemistry.