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# Salt encapsulated sand template for mesoporous honeycomb-shape carbon synthesis from castor seed shell and improvement of super capacitor

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**Statement of the Problem:** High ions storage target for supercapacitors still suffer from limited mesopores which hampers accommodation of most ionic sizes and also slows competitive/huge commercialization of electrochemical double layer capacitors especially where high power and rapid responses are necessary. Mesopores as indispensable factor of high ions storage, attract many diverse materials in researches over decades for this reason to improve specific capacitance and directly obtain high energy and power densities. Carbonaceous materials or its composites have shown that due to inherent/intrinsic adjustable property, mesopores are high predictable in carbon materials especially in variable shape/structural forms which usually improve by activation with potassium hydroxide (KOH). However, dual shape/structure by simple cost-effective preparation method (salt encapsulated sand template) has not been previously studied. This study centers on describing the interstice/intra-mesopores dual form in a systematic steps sand induces surface roughness which metamorphous into honeycomb-shape/flakes carbon.

**Methodology & Theoretical Orientation:** Typical acid anhydrous decomposition was employed to produce silicon carbide particles from the sand to induce rough surface on carbon flakes during the castor seed shell break down. The residual acid in the carbon was deprotonated by hydrothermal process to prevent acid salt formation in the presence of potassium hydroxide during activation process and also to reduce the formation of water molecules that may inhibit anhydrous KOH activation of the carbon. Imperative porosity characterization, structural/functional group investigation, and fundamental shape morphology were conducted to compare the two major samples. Conventional graphite symmetric electrodes were prepared as electrochemical double layer capacitors in 6 M KOH electrolyte.

**Findings:** The interstice/intra-mesopores mixture consists of high specific surface area of flakes and honeycomb-shape carbon required to boast the mesopores porosity. N2 adsorption-desorption curve shows type IV isotherm to confirm the presence of mesopores, wherefore related dV/dD particle distribution shows predominating mesopores range (2–50 nm) inset. Energy transmittance across the sample molecules shows effect of dual molecular related shapes of carbon consistently across the FTIR spectra. Oxygen-containing functional groups content satisfies the conditions for surface wettability and enhancement of ions transfer rate as represented in XPS chemical state. As supercapacitors electrode, the superior sample exhibited high specific capacitance (481 $Fg^{-1}$) in 6 M KOH as electrolyte. Almost no decay occurred after charging/discharging test of 15000 cycles and the capacitance retention remains 96 %.

**Conclusion & significance:** Indeed the degree of improvement in this study really shows that ions storage largely depends on mesopores to make high specific capacitance in the right context of better carbonaceous materials. This template decomposition of castor seed shell is quite promising, however more organic carbonaceous or composites are necessarily good approach to achieving the expectancy of ultra-high specific capacitance of supercapacitors.

## Biography

Chika Anthony Okonkwo has his expertise in products development and production with acquired knowledge in an interrelated electromechanical technology and chemical, and bio chemical engineering. This current cost-effective and high specific capacitance product enhancement is supplementary contribution out of numerous conceptualized, designed, and fabricated products that solve problems in energy conversion/storage and materials processing. These achievements accounted for his years of experience in research institute (National Agency for Science and Engineering Infrastructures NASENI Abuja Nigeria) and doctoral research in chemical and biochemical engineering Xiamen University China. Still, he is very optimistic for functional energy material from biomasses for high efficiency of solar cells and high specific capacitance of supercapacitor.

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