Eco-Flex Lite Capacitor

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With the rapid increase in the use of mobile electronic devices, the development of supercapacitors is in huge demand. These supercapacitors although have great performance advantages, they also pose serious environmental harm when disposed. The objective of this project is to design a green supercapacitor – which is genistein based. Genistein, extracted from ginkgo leaves, was preloaded on the sulfonated carbon nanospheres as the composite, while they were fabricated by hydrothermal synthesis of biomass, followed by surface functionalization to increase the loading capacity of the nanospheres. Nanostructured morphology and surface functional groups were analysed by SEM and IR. Specific capacitance can be boosted by optimizing types of natural redox molecules, surface polarity of carbon substrate, working pH environment and porosity of polymeric electrode. From the results, it is shown that the nano-architecture with active functional groups enables efficient charge transport and electrode stability, allowing high capacitance (260 F g-1) at a current density ranging from 2 to 10 mA cm-2, and retaining 95% capacitance after 70k cycles. Super performance of supercapacitor was due to the large accessible surface area with porous structure, low interfacial resistance and a stable structure. It shows that genistein can tolerate extreme pH and mechanical stress. The samples retained full capacitance under repeated flexing. Toxicity of materials were tested by clear zone test against bacteria E. coli and M. luteus. The supercapacitor exhibits a promising performance of 223 F g-1 and power density of 12.82 kW kg-1 while retaining 95% capacitance, opening up potential for the production of green, cost efficient, flexible and light energy storage system using renewable biomass.