Assessment of Mangrove Root-Derived Non-Activated Carbon from *Avicennia marina* for Supercapacitor Electrode Applications

N.A.A.M. Prabhath*, V.P.S. Perera
Department of Physics, Faculty of Natural Sciences, The Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka.
*prabhathmadhuranga35@gmail.com

Usage of biomass-derived carbon in supercapacitors is increasing, and specific capacitance is a key parameter to consider. In this study, non-activated carbon was prepared using respiratory roots of *Avicennia marina* with the aim of developing a supercapacitor with high specific capacitance based on the fact that *A. marina* roots are rich in carbon and porous in structure. The roots were cut, washed and dried, then pyrolyzed in a nitrogen atmosphere at different temperatures of 500°C, 600°C and 700°C. The obtained carbon was ground using a mortar and pestle and mixed with PVDF at a carbon to PVDF mass ratio of 9:1 with N-Methyl-2-pyrrolidone (NMP) as the solvent. The slurry was coated on FTO glasses using the Doctor Blade method, and the prepared electrodes were dried at 80°C for 6 hours. The electrodes were characterized using cyclic voltammetry using a Pt plate as counter electrode, Ag/AgCl as reference electrode and 1 M Sodium perchlorate aqueous solution as the electrolyte. For the carbon pyrolyzed at each temperature, CV curves were taken at varying scan rates. The same set of tests was carried out for non-activated coconut shell derived carbon as a benchmark. The specific capacitance of supercapacitors made of both *A. marina* and coconut shell carbon increased with increasing pyrolysis temperature, and at 700°C, mangrove carbon gave a specific capacitance of 3.59 F/g while coconut shell carbon exhibited 0.36 F/g under the potential difference of 1 volt and scan rate of 5 mV/s. This indicates that non-activated carbon derived from *A. marina* roots exhibits nearly ten times higher specific capacitance than the benchmark non-activated coconut shell derived carbon. Hence, it provides a promising potential for further development and optimization of *A. marina* root derived carbon for supercapacitor electrode applications in future work.

Keywords: *Avicennia marina*, *Mangrove root-derived carbon, Supercapacitor, Non-activated carbon, Specific capacitance*