

**SRI LANKAN NATURAL GRAPHITE/GEL POLYMER ELECTROLYTE BASED
ELECTROCHEMICAL DOUBLE LAYER CAPACITOR**

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Graphite has been identified as a good electrode material to be used in the supercapacitors. Graphite can be readily intercalated to host various atoms and molecules. Furthermore, it can reversibly accumulate/release ions at very high and low potentials. Thus, graphite is proven to be a better candidate for electrodes. Graphite can be found in synthetic and natural forms. Natural graphite is abundantly available in mines located in Sri Lanka, China, Brazil, Canada and Russia. In Sri Lanka, graphite can be obtained cheaply in the purest form. This study aims to give a value addition to Sri Lankan natural graphite by using it as an electrode material in electrochemical double layer capacitors (EDLCs). Laboratory-scale EDLCs were fabricated using the prepared graphite electrodes and polyvinylidene fluoride based gel polymer electrolyte (GPE). They were characterized using cyclic voltammetry (CV) and galvanostatic charge-discharge (GCD) tests. CV studies were carried out by varying the potential window, and the +0.001 V to +0.8 V potential window was chosen as the optimum, considering the maximum current and the required shape of the cyclic voltammogram. The GCD test was carried out in the voltage range of +0.1 V to +0.8 V with a constant current of 0.034 mA. Specific discharge capacitance (C_{sdc}) of 0.69 F g^{-1} was reduced to 0.63 F g^{-1} (91.3 % retention) after 10,000 charge-discharge cycles indicating outstanding rate capability. These results also indicate good contacts between the electrode/electrolyte interfaces. All these tests demonstrated the capacitive behavior of the graphite based EDLC and revealed its excellent cycling stability and rate capability. Further modifications are needed to improve the performance of Sri Lankan natural graphite to promote it as an industrial, low-cost and eco-friendly electrode material.

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Keywords: Graphite, Electrochemical double layer capacitor, Cyclic voltammetry, Specific capacitance, Galvanostatic charge discharge test