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# BATTERY ELECTROLYTE BASED ON LITHIUM PERCHLORATE FOR ELECTROCHEMICAL SUPERCAPACITORS

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Resumo:

Propylene carbonate (PC) has been successfully employed in rechargeable batteries for quite a long time. Lithium perchlorate ( $\text{LiClO}_4$ ) was dissolved in propylene carbonate ( $\text{C}_4\text{H}_6\text{O}_3$ ) to form the liquid electrolyte for high energy battery systems. Due the high conductivity, common electrolytes for carbon-based electrochemical supercapacitors are the tetraethylammonium tetrafluoroborate salt ( $\text{NEt}_4\text{BF}_4$ ) dissolved in propylene carbonate or acetonitrile (ACN). These organic solvents have a drawback of requiring a glove box for handling due to moisture susceptibility and also for their intrinsic toxicity. A glove box, which can be routinely operated at oxygen levels below 30 ppm, has a considerable capital, operational and maintenance cost. Organic electrolytes also evaporate easily and commercial supercapacitors are limited to operation close to room temperature ( $<70^\circ\text{C}$ ). In this study propylene carbonate has been replaced for propylene glycol (PG) which is practically non-toxic. Propylene glycol ( $\text{C}_3\text{H}_8\text{O}_2$ ) can be released into the environment via industrial releases or by disposal of consumer products. It is readily soluble in water and has a low sorption partition coefficient, having the ability to move through soil and to leach into ground water. Low vapor pressure (0.1 mmHg at  $25^\circ\text{C}$ ) and high water solubility produces minimal volatilization to the atmosphere. Its low octanol/water partition coefficient indicates that bioconcentration should not happen. Propylene glycol is readily degraded in surface water and soil by chemical oxidation (or photochemical) and microbial digestion, with a short half-life (1–5 days) in aerobic or anaerobic conditions. Electrochemical supercapacitors have been produced with activated carbon commercial electrodes with electrolytes based on propylene glycol using lithium perchlorate in various molar ratios. These experimental devices have been tested by cyclic voltammetry under window potential from 1 V to 2.7 V and current from 10 mA to 150 mA at scanning rates of 1 mVs<sup>-1</sup> and 10 mVs<sup>-1</sup>. Galvanostatic cycling was carried out using several current densities from 1.1 V to 2.7 V. Electrochemical impedance spectroscopy (EIS) was used with a 1 mHz to 100 KHz interval and an applied bias potential varying from 0 V to 10 V. Voltammetry curves at room temperature resulted in a specific capacitance 143 Fg<sup>-1</sup> for the propylene glycol with lithium perchlorate electrolyte in a molar proportion of 2 to 1.