ABSTRACT

The problem of the scarcity of lithium materials, high cost and flammability of electrolytes in lithium batteries, the development of alternative batteries is needed. Aluminum-sulfur (Al-S) batteries with their abundant materials, density and high volumetric capacity are rated as an alternative battery. The emergence of the shuttle effect can reduce the efficiency of the battery in the long term, so it is necessary to develop a material as a host to bind sulfur in the Al-S battery, with the use of the right electrolyte concentration. The use of $AlCl_3$ electrolytes, which are commonly used to have complex ions of $AlCl_4^-$ or $Al_2Cl_7^-$ in the system, can form unwanted deposits and interfere with electrochemical reactions in sulfur electrodes, so other electrolyte alternatives are needed to overcome this. The manufacture of sulfur/activated carbon/MWCNT-based cathodes has been carried out using the doctor blade method using a variety of electrolyte types and concentrations, namely NaCl, Na_2SO_4, and KCl electrolytes with concentrations of 0.05 M, 0.1 M, 0.25 M, and 0.5 M. Based on the research that has been conducted, it was obtained that of the three types of electrolytes used. The electrolyte solution Na_2SO_4 is more effective as an ion source and medium against sulfur/activated carbon/MWCNT-based battery cathodes because it has a multivalent anion SO_4^{2-} with electrostatically double charge in neutralizing the cathode charge. Each molecule of Na_2SO_4 contributes three total ions so that the conductivity of the solution is higher compared to other electrolytes at the same concentration, resulting in the highest specific capacitance value and ionic conductivity. The specific capacitance values and ionic conductivity using the NaCl electrolyte solution were 0.137 F/g, 0.266 F/g, 0.503 F/g, and 0.40 F/g as well as 1.20 S/cm, 3.48 S/cm, 5.54 S/cm, and 0.015 S/cm. Using Na_2SO_4 solution, specific capacitance values were obtained namely 0.284 F/g, 0.439 F/g, 0.548 F/g, 0.602 F/g and the ionic conductivity values obtained were 2.01 S/cm, 4.37 S/cm, 17.8 S/cm, 22.64 S/cm. For specific capacitance values using KCl electrolytes, namely 0.281 F/g, 0.399 F/g, 0.432 F/g, and 0.456 F/g, the ionic conductivity values were obtained were 2.71 S/cm, 4.83 S/cm, 12.06 S/cm, and 13.38 S/cm.

Keywords: battery cathode, electrolyte, specific capacitance, ionic conductivity