Electrochemical Analysis of an Aluminium-Citrate Ion Cell from Recycled Aluminium Wastes and *Dovyalis caffra* extracts electrolyte

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Abstract

Aluminium-citrate ion cell will be fabricated using waste aluminium foils and citric acid which will be extracted from *dovyalis caffra* plant (kei apple). The aluminium ions were derived from waste aluminium foils while citrate ions were obtained by co-precipitation of *Dovyalis caffra* macerated extracts and acid infusion. All analysis except morphology, crystallinity and oxide composition (done in The University of Witwatersrand, South Africa) analysis were carried out in Maasai Mara University, Chemistry and Physics research laboratories. To obtain aluminium oxide nanoparticles, waste aluminium foils were digested using 1M HCl acid (35% v/v) at room temperature. After effervescence, the Al_2Cl_6 digestate was thoroughly washed with running distilled water (equal volume) then co-precipitated with an equivalent aliquot of 0.5M sodium carbonate solution as the prepared nano aluminium oxide were analysed and compared with commercial aluminium oxide using FTIR, SEM, EDS, UV-VIS and XRF where the result differed just slightly because of presence of impurities. Synthesized citric acid was analysed and compared with commercial citric acid using FTIR analysis where it showed a slight difference due to presence of impurities such as tartaric acid and other acids in small quantities. The prepared particles ranged between 66.3.3 to 106.1 nm and exhibited alpha $–Al_2O_3$ moeities and crystalline boehmite polymorphs. The EDS tables indicated significant SiO_2 contamination of up to 33% arising from the method of preparation used. The amperometric properties of fabricated ion cell in closed circuit varied between 0.6 to 3.7 V. Increase in length of electrode increased the amount of current produced increased and decreased with the increase in time spent in the electrolyte as the concertation decreased. Due to impurity the pH decreased as the time increases, density increased with increase in time of reaction as there was increase in mass of the electrode of the cell was 3361 J/s and 17.23 Wh/kg respectively. The cells were found to be quite viable in production of energy storage devices