

IONIC CONDUCTION STUDY ON BIOPOLYMER
ELECTROLYTES BASED CARBOXYMETHYL
CELLULOSE/KAPPA CARRAGEENAN DOPED NH₄BR

SHUI JUN KIT

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UNIVERSITI MALAYSIA PAHANG

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ABSTRACT

Since the introduction of polymer based electrolytes in 1970s, numerous polymers were particularly interesting especially the using of biopolymer have been investigated. This type of electrolyte material was introduced in order to avoid many of the problems encountered when using in electrochemical devices with liquid electrolyte. Due to the reason, the present research with the development of blending carboxymethyl cellulose/kappa carrageenan (CMC/KC) was carried out by doping with ammonium bromide (NH₄Br) based biopolymer electrolytes. The CMC/KC doped different amount of NH₄Br were successfully prepared via solution casting technique and were characterized by using Fourier Transform Infrared Spectroscopy (FTIR), X-Ray Diffraction (XRD) and Electrical Impedance Spectroscopy (EIS) technique. In FTIR analysis it shows that the interaction between CMC/KC and NH₄Br has occurred and due to the protonation of H⁺ towards CMC/KC backbone. XRD analysis showed that the amorphousness had increased when NH₄Br was added and lead to the increasing in ionic conductivity. The optimum of ionic conductivity was observed at $4.25 \times 10^{-4} \text{ Scm}^{-1}$ for sample containing with 30 wt. % NH₄Br. The significant changes from FTIR data analysis was used to determine transport properties of CMC/KC-NH₄Br by using deconvolution method. From the deconvolution method, it can be found that the ionic conductivity affected by mobility of ions and diffusion coefficient for ion migration in this present research.

ABSTRAK

Sejak elektrolit yang berasaskan polimer diperkenalkan dalam tahun 1970-an, medan polimer tersebut terutamanya biopolimer telah menarik perhatian ahli-ahli sains untuk penerokaan. Tujuan penciptaan biopolimer ini adalah untuk menyelesaikan masalah-masalah yang dihadapi semasa penggunaan peranti-peranti elektrokimia yang mengandungi elektrolit cecair. Sebab itu, penyelidikan tentang penciptaan elektrolit biopolimer yang berasaskan carboxymethyl selulosa dan kappa carrageenan dengan penambahan ammonia bromida (NH_4Br) telah dijalankan. Dalam penyelidikan tersebut, elektrolit-elektrolit biopolimer yang berasaskan CMC/KC yang mengandungi kandungan NH_4Br yang berbeza telah berjaya diciptakan dengan teknik pengacuan rumusan dan menjalani ujian-ujian pencirian dengan menggunakan Fourier Transform Infrared Spektroskopi (FTIR), X-Ray Diffraction (XRD) dan Elektrikal Impedance Spektroskopi (EIS). Dalam analisis FTIR, ia menunjukkan bahawa terdapat interaksi oleh CMC/KC dan NH_4Br dan protonasi oleh H^+ terhadap rangka CMC/KC. Manakala, analisis XRD menyatakan bahawa terdapat peningkatan dalam kadar amorfus dengan penambahan NH_4Br dan ini menyebabkan peningkatan dalam konduktiviti ionik. Kadar konduktiviti ionik optimum yang didapati adalah $4.25 \times 10^{-4} \text{ Scm}^{-1}$ daripada sampel yang mengandungi 30 wt. % NH_4Br . Data-data yang diperolehi melalui analisis FTIR akan digunakan untuk menentukan ciri-ciri pengangkutan dalam CMC/KC- NH_4Br dengan menggunakan kaedah deconvolusi. Dalam kaedah ini, bahawa konduktiviti ionik adalah dijejaskan oleh mobiliti ion dan pekali penyebaran migrasi ion dalam penyelidikan tersebut.