

**IONIC CONDUCTING SOLID BIOPOLYMER ELECTROLYTES BASED ON  
CARBOXYMETYL CELLULOSE DOPED AMMONIUM FLUORIDE**

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BASED ON CARBOXYMETHYL CELLULOSE DOPED  
AMMONIUM FLUORIDE**

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**July 2015**

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The development and characterizations of a new-type solid biopolymer electrolytes (SBE) based on carboxymethyl cellulose (CMC) doped with varied content of ammonium fluoride ( $\text{NH}_4\text{F}$ ) is presented in this thesis. The SBEs were prepared via solution casting technique. The SBEs were analyzed using Fourier Transform Infrared (FTIR), X-Ray Diffraction (XRD), Electrical Impedance (EI) and Transference Number Measurement (TNM) techniques. The interactions between CMC and  $\text{NH}_4\text{F}$  occurred at 1581, 1406, 1313 and  $1047\text{ cm}^{-1}$  as proven in FTIR. The addition of  $\text{NH}_4\text{F}$  has increased the amorphous domain of SBEs as observed from XRD analysis. The highest room temperature ionic conductivity achieved was  $2.68 \times 10^{-7}\text{ Scm}^{-1}$  for SBE containing 9 wt. %  $\text{NH}_4\text{F}$ . The ionic conductivity of the SBEs was found to be influenced by mobility and diffusion coefficient of ions. TNM analysis revealed that the SBEs were predominantly proton conductor.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu adalah untuk memenuhi syarat untuk Ijazah Sarjana Sains

**ELEKTROLIT PEPEJAL BIOPOLIMER TERKONDUKSI IONIK  
BERASASKAN SELULOSA KARBOKSIMETIL TERDOP  
AMONIUM FLORIDA**

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**Julai 2015**

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**Pusat pengajian: Pusat Pengajian Sains Asas**

Tesis ini adalah dokumentasi mengenai penghasilan dan analisa yang telah dilakukan terhadap polimer elektrolit pepejal (SBE) baharu yang berasaskan karbosimetil selulosa (CMC) dan didopkan dengan ammonium florida ( $\text{NH}_4\text{F}$ ). SBE tersebut disediakan dengan teknik "Solution casting". SBE tersebut telah dianalisis dengan menggunakan Fourier Transform Infrared (FTIR), X-Ray Diffraction (XRD), Electrical Impedance (EI) and Transference Number Measurement (TNM). Daripada analisa FTIR, interaksi di antara CMC dan  $\text{NH}_4\text{F}$  di 1581, 1406, 1313 dan 1047  $\text{cm}^{-1}$ . Penambahan  $\text{NH}_4\text{F}$  telah menambah keamorfusan SBE tersebut yang telah dilihat dengan teknik XRD. Nilai kekonduksian ionik paling tinggi yang dicatatkan pada suhu bilik adalah pada  $2.68 \times 10^{-7} \text{ Scm}^{-1}$  untuk sampel yang mengandungi 9 wt. %  $\text{NH}_4\text{F}$ . Kekonduksian ionik SBE tersebut didapati dipengaruhi oleh mobility

dan kadar diffusi ion. Teknik TNM telah menunjukkan bahawa SBE tersebut merupakan suatu bahan pengalir proton.