

PREPARATION AND CHARACTERIZATION OF
CARBONNANOTUBE/POLYMER-
POLYMER ELECTROLYTE
BOPED WITH ODE-
CYLTRIMETHYL
AMMONIUM
BROMIDE

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FACULTY OF SCIENCE AND TECHNOLOGY
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Preparation and characterization of carboxymethyl- cellulose biopolymer electrolytes doped with dodecyltrimethyl ammonium bromide / Ahmad Salihin Samsudin.

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**PREPARATION AND CHARACTERIZATION OF CARBOXYMETHYL-
CELLULOSE BIOPOLYMER ELECTROLYTES
DOPED WITH DODECYLTRIMETHYL
AMMONIUM BROMIDE**

By
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the requirement for the award of the degree of
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DECLARATION

I hereby declare that this thesis entitled Preparation and Characterization Of Carboxymethylcellulose Biopolymer Electrolytes Doped With Dodecyltrimethyl Ammonium Bromide is the result of my own research except as cited in the references.

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**PREPARATION AND CHARACTERIZATION OF CARBOXYMETHYL-
CELLULOSE BIOPOLYMER ELECTROLYTES
DOPED WITH DODECYLTRIMETHYL
AMMONIUM BROMIDE**

ABSTRACT

In this research, carboxymethylcellulose (CMC)-dodecyltrimethyl ammonium bromide (DTAB) solid polymer electrolyte system was prepared. CMC was used as the polymer host and doped with DTAB salt. The concentration of salt was carried between 5 to 40wt.% and has been prepared by solution casting method. The polymer-salt complex formation and the polymer-proton interactions have been analyzed by FT-IR spectroscopy. The peak of COO^- in CMC at 1602 cm^{-1} shifted to 1573 cm^{-1} and peak of C-H at 1479 cm^{-1} shifted to 1459 cm^{-1} respectively with addition of DTAB. The conductivity and dielectric measurements were carried out for this system at various temperatures. The complex impedance spectroscopy results reveal that the high-frequency semicircle is due to the bulk effect of the material. The conductivity was found to increase in the order of 10^{-6} to 10^{-4} S cm^{-1} at room temperature with the increase in salt concentration. The system was found to obey the Arrhenius rule. Analysis of the conductivity data and the frequency exponent shows that the small polaron hopping (SPH) model for conduction mechanism. From ionic transport parameter study, the number density of ions, η , mobile ions, μ and diffusion coefficient, D was calculated. The TNM and FTIR results proven that the CMC-DTAB is a proton conducting polymer electrolytes.

**PENGHASILAN DAN PENCIRIAN BAGI CARBOXYMETHYL-
CELLULOSE BIOPOLIMER ELEKTROLIT
DIDOPAN DODECYLTRIMETHYL
AMMONIUM BROMIDE**

ABSTRAK

Dalam kajian ini polimer elektrolit daripada carboxymethylcellulose (CMC)-dodecyltrimethyl ammonium bromide (DTAB) telah disediakan. Di dalam system ini CMC bertindak sebagai perumah bagi pendopan garam DTAB. Polimer elektrolit ini telah disediakan melalui kaedah tebar larutan dengan kepelbagaian variasi kandungan garam bermula dari 5wt% - 40wt%. Interaksi di antara polimer dan garam telah dicirikan melalui analisis FTIR. Melalui pencirian FTIR didapati puncak COO⁻ bagi CMC telah mengalami anjakan dari frekuensi 1602 cm⁻¹ kepada 1573 cm⁻¹, manakala pada puncak terhadap C-H mengalami anjakan dari 1479 cm⁻¹ kepada 1459 cm⁻¹ dengan pertambahan variasi kandungan DTAB. Kekonduksian dan pengukuran dielektrik bagi sistem polimer ini telah dilakukan mengikut perubahan suhu. Data bagi impedan kompleks menunjukkan nilai separa bulatan pada frekuensi tinggi adalah disebabkan oleh rintangan pukal bagi bahan yang dikaji. Kekonduksian bagi polimer elektrolit ini telah meningkat dengan pertambahan garam bermula dari 10⁻⁶ hingga 10⁻⁴ S cm⁻¹ pada suhu bilik. Melalui terbitan Arrhenius, polimer elektrolit ini mengikut ciri Arrhenius melalui pertambahan nilai kekonduksian yang berkadar terus dengan kenaikan suhu. Analisis kekonduksian dan frekuensi telah dijalankan bagi megenal pasti jenis gerakan ion didalam polimer elektrolit ini, dan didapati mekanisma gerakan ion di dalam elektrolit ini telah mengikut prinsip loncatan kecil polaron (SPH). Nilai bagi bilangan ion, η , keboleh gerakan ion, μ , dan pekali pelakuran, D , telah dikira daripada analisis pergerakan ionik. Melalui analisis TNM terbukti bahawa CMC-DTAB adalah proton konduktor.