

CONDUCTIVITY STUDIES OF CHITOSAN
POLYMER DOPED SA-QA
ELECTROLYTES

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Conductivity studies of chitosan polymer doped sa-
electrolytes / Azlina Hassan.

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CONDUCTIVITY STUDIES OF CHITOSAN POLYMER
DOPED SA-OA ELECTROLYTES

By

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PENGAKUAN DAN PENGESAHAN LAPORAN PROJEK PENYELIDIKAN I DAN II

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk:

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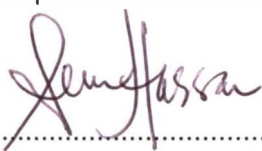
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LISTS OF ABBREVIATIONS

<u>Name</u>	<u>Abbreviation</u>
Chitosan-acetic acid solution	CA
Differential Scanning Calorimetry	DSC
Dimethyl formamide	DMF
Electrochemical Impedance Spectroscopy	EIS
Ethylene carbonate	EC
Frequency Response Analyzer	FRA
Gel polymer electrolytes	GPEs
Oleic acid	OA
Polyacrylonitrile	PAN
Polyethylene glycol	PEG
Polyethylene oxide	PEO
Poly(methyl methacrylate)	PMMA
Polyvinyl chloride	PVC
Polyvinylidene fluoride	PVdF
Propylene carbonate	PC
Resistor and capacitor in parallel	$R//C$
Resistor and capacitor in parallel with a resistor in series connection	$R-R//C$
Resistor and CPE in parallel with a resistor in series connection	$R_s-R_p//CPE$
Salicylic acid	SA
Thermo gravimetric analysis	TGA
X-ray diffraction	XRD

LIST SYMBOLS

<i>Name</i>	<i>Symbol</i>
Angular frequency	ω
Area of sample	A
Bulk resistance	R_b
Capacitance	C
Capacitive value of material	p
Complex admittance	A
Complex dielectric constant	ϵ^*
Complex dielectric modulus	M^*
Conductivity	σ
Constant Phase Element	CPE
Dielectric constant	ϵ_r
Dielectric loss	ϵ_i
Electrolytes resistance	R_p
Frequency	f
Impedance	Z
Impedance of CPE	Z_{CPE}
Imaginary impedance	Z_i
Imaginary electrical modulus	M_i
Loss tangent	$\tan \delta$
Permittivity of free space	ϵ_0
Real electrical modulus	M_r
Real impedance	Z_r
Relaxation time	τ_0
Resistor	R
Thickness	t
Uncompensated resistance	R_s
Weight percent	wt. %

ABSTRACT

In this study, polymer electrolytes were prepared by the technique of solution casting. These proton conducting electrolytes consist of high-molecular-weight poly(methyl methacrylate) (PMMA) matrix, ethylene carbonate (EC) /propylene carbonate (PC) and organic acid. Two different samples with the following molar weight percent were studied. The electrolytes are salicylic acid (SA): 5 wt.% /EC: 35 wt.% /PC: 35 wt.% /PMMA: 12.5 wt.% /CA: 12.5 wt.% and oleic acid (OA): 10 wt.% /CA: 50 g. This experiment involves Electrochemical Impedance Spectroscopy (EIS) measurement. From the impedance data, a Cole-Cole plot was obtained and therefore the bulk resistance, R_b can be calculated. The conductivity obtained for this work is $2.65 \times 10^{-5} \text{ Scm}^{-1}$ for sample containing SA whereas electrolytes containing OA gives the value of $1.02 \times 10^{-9} \text{ Scm}^{-1}$. Dielectric data were analyzed using complex permittivity ϵ^* and complex electrical modulus M^* for both sample. Information on relaxing dipole in a medium may be obtained from an analysis of complex permittivity.

ABSTRAK

Dalam eksperimen ini, polimer elektrolit telah disediakan melalui teknik 'solution casting'. Pengkonduksi proton ini terdiri daripada matriks polimer 'poly(methyl methacrylate)' (PMMA) dengan jisim molekul tinggi, etilena karbonat (EC) dan propilena karbonat (PC) dan asid organik. Dua sample yang berbeza dari segi penggunaan asid organik dan juga mol% telah dikaji. Elektrolit tersebut terdiri daripada asid salisilik (SA): 5 mol% /EC: 35 mol% /PC: 35 mol% / PMMA: 12.5 mol% /CA: 12.5 mol% manakala asid oleik (OA): 10 mol% / CA: 50 g. Eksperimen ini melibatkan pengukuran Impedans Spektroskopi (EIS). Daripada data-data impedans yang diperolehi, graf 'Cole-Cole' dapat diplotkan dan seterusnya jumlah rintangan (bulk resistance), R_b boleh dikira. Elektrolit yang mengandungi SA memberikan konduktiviti $2.65 \times 10^{-5} \text{ Scm}^{-1}$ manakala elektrolit yang mengandungi OA memberikan konduktiviti $1.02 \times 10^{-9} \text{ Scm}^{-1}$. Data dielektrik juga dianalisis menggunakan permittiviti kompleks ϵ^* dan modulus elektrikal kompleks M^* bagi kedua-dua sample. Pergerakan ion-ion positif dan negatif pada keadaan rehat dalam suatu medium dapat diperhatikan daripada analisis permittiviti kompleks yang telah dianalisis.