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Chitosan based film electrolytes doped oleic acid : preparation  
and electrical study / Suhana Ramli.

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CHITOSAN BASED FILM ELECTROLYTES DOPED OLEIC ACID:  
PREPARATION AND ELECTRICAL STUDY

By

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Research Report submitted in partial fulfillment of  
the requirements for the degree of  
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Department of Physical Sciences  
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## **PENGAKUAN DAN PENGESAHAN LAPORAN PROJEK PENYELIDIKAN I DAN II**

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk : CHITOSAN BASED FILM ELECTROLYTES DOPED OLEIC ACID: PREPARATION AND ELECTRICAL STUDY oleh SUHANA BINTI RAMLI No. matrik: UK 10049 telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Fizik sebagai memenuhi sebahagian daripada keperluan memperoleh Ijazah SARJANA MUDA SAINS GUNAAN FIZIK (ELEKTRONIK DAN INSTRUMENTASI) Fakulti Sains dan Teknologi, Kolej Universiti Sains dan Teknologi Malaysia.

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## LIST OF ABBREVIATIONS

$\varepsilon_0$	Boltzman Constant
$\varepsilon_i$	Complex permittivity for real part
$\varepsilon_r$	Complex permittivity for imaginary part
$M_i$	Electrical modulus for real part
$M_r$	Electrical modulus for imaginary part
$\tan \delta$	Tangent loss
$\sigma$	Conductivity
$R_b$	Bulk resistance
$A$	Area of film electrode
$R$	Radius
$f$	Frequency
$C$	Capacitance
OA	Oleic acid
CA	Chitosan acetate
DMF	Dimethyl formamide
PC	Propylene carbonate
EC	Ethylene carbonate
DEC	Diethyl carbonate
PMMA	Poly (methyl methacrylate)
PEO	Poly (ethylene oxide)
EIS	Electrical Impedance Spectroscopy
FTIR	Fourier Transform Infrared
XRD	X-ray diffraction
SEM	Scanning electron microscopy
PEMFCs	Polymer electrolytes membrane fuel cell
$C_{18}H_{34}O_2$	Formula of Oleic acid
$HNCOCH_3$	Chitin
$LiCF_3SO_3$	Trifluoromethenesulfonate

## ABSTRACT

A polymer electrolyte is presented in this work. 1 g chitosan was dissolved in 100 ml of 1% acetic acid solution to make the chitosan solution. The solution was then mixed with oleic acid. This chitosan acetate – oleic acid was then made into thin film by the solution cast technique. Five films were prepared each containing 1 g chitosan in 100 ml of 1% acetic acid solution and 10 wt.%, 20 wt.%, 30 wt.%, 40 wt.% and 50 wt.% of oleic acid ( $C_{18}H_{34}O_2$ ) respectively. The conductivity of the samples were measured from ambient to elevated temperature. The film containing 10 wt.% of oleic acid (OA) having the highest conductivity of  $8.35 \times 10^{-9} \text{ S cm}^{-1}$  at room temperature. The addition of OA has increased the dielectric constant, which implies the increase of dissociation of the salt thereby producing more free ions for conducting, and hence increases the ionic conductivity.

## ABSTRAK

Satu polimer elektrolit akan dihasilkan dalam kerja ini. 1 g kitosan akan dilarutkan dengan 100 ml 1% asid asetik untuk menghasilkan sebatian kitosan. Sebanyak 50 g sebatian kitosan akan dicampurkan pada setiap sampel. Sebatian ini seterusnya akan dicampur dengan asid oleik. Kitosan-asid asetik-asid oleik akan dihasilkan membentuk filem daripada kaedah pengeringan. Lima filem akan disediakan di mana setiap satunya mengandungi 100 ml 1% asid asetik dan asid oleik sebanyak 10 wt.%, 20 wt.%, 30 wt.%, 40 wt.% dan 50 wt.%. Konduktiviti bagi sampel-sampel itu juga akan dikira dimula dengan suhu bilik. Filem yang mengandungi 10 wt.% mempunyai konduktiviti yang tertinggi iaitu  $8.35 \times 10^{-9} \text{ S cm}^{-1}$  pada suhu bilik. Penambahan asid oleik akan menyebabkan peningkatan pemalar dielektrik di mana ia menunjukkan peningkatan perpisahan antara molekul garam yang menghasilkan lebih banyak ion-ion bebas untuk mengkonduksi dan meningkatkan kekonduksian ionik.