

SYNTHESIS AND CHARACTERIZATION OF  
CONDENSATE AS A CONDUCTING POLYMER IN  
THE PRESENCE OF SURFACTANTS

CONTENTS

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SYNTHESIS AND CHARACTERIZATION OF POLYTHIOPHENE AS A  
CONDUCTING POLYMER IN THE PRESENCE OF SURFACTANTS

By  
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**PENGAKUAN DAN PENGESAHAN LAPORAN PROJEK PENYELIDIKAN**

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: Synthesis and Characterization of Polythiophene As A Conducting Polymer in The Presence of Surfactants oleh Gan Bee Kim, No. Matrik UK 7654 telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Kimia sebagai memenuhi sebahagian daripada keperluan memperoleh Ijazah Sarjana Muda Sains – Sains Kimia, Fakulti Sains dan Teknologi, Kolej Universiti Sains dan Teknologi Malaysia.

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## LIST OF ABBREVIATIONS

ATR	Attenuated Total Reflectance
CMC	Critical Micelle Concentration
FeCl <sub>3</sub>	Ferric Chloride / Iron (III) Chloride
FTIR	Fourier Transform-Infrared
IR	Infrared
PA	Polyacetylene
PLM	Polarized Light Microscopic
PPy	Polypyrrole
PT	Polythiophene
r.m.w	Relative Molecular Weight
SDS	Sodium Dodecyl Sulphate
(SN) <sub>x</sub>	Polythiazyl @ Polysulphurnitride
TGA	Thermogravimetry analysis
UV-vis	Ultraviolet-visible
$\sigma$	Conductivity
$\rho$	Resistivity

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## ABSTRACT

Conducting polymer named polythiophene has a poor processability due to its insolubility and infusibility. These properties limit their potential in industry and technology. Therefore polythiophene is suggested to be synthesized in the presence of anionic surfactants, sodium dodecyl sulphates, SDS. Anionic surfactants is believed to be able to improve contact between polar and non-polar media. Therefore it is added to improve the solubility and processability of polythiophene. The polythiophenes deriving from oxidative polymerization of the thiophene monomer have also been characterized using FTIR spectroscopic techniques, UV-Vis spectroscopic techniques, thermogravimetric analysis (TGA), polarized light microscopic (PLM) and conductivity test. FTIR spectra supported the polymerization where the increasing of conjugation shifted the absorption frequency to a lower wavenumber. In additions, it also proved the presence of SDS in the polythiophene structure. The UV-Vis spectra demonstrated that the wavelength belongs to  $\pi$ - $\pi^*$  transitions were observed to be red shift after polymerization. SDS-doped polymers exhibited a good thermal stability and solubility in some organic solvent such as chloroform and N,N-Dimethylformamide (DMF). Besides that, PLM study indicated that the presence of SDS influenced the morphology of polythiophene. The conductivities of the polythiophenes increased variedly proportional to the number of mol of SDS. This study also proved that aqueous medium containing small portion of acetone (water-acetone) is the best medium for polymerization in the presence of SDS.

## **SINTESIS DAN PENCIRIAN POLITIOFENA SEBAGAI POLIMER PENGALIR DENGAN KEHADIRAN SURFAKTAN.**

### **ABSTRAK**

Polimer pengalir yang dinamakan politiofena mempunyai keupayaan yang rendah untuk diproses disebabkan oleh ketidaklarutan dalam kebanyakan pelarut organik yang biasa. Oleh itu, politiofena dicadangkan untuk disintesis dengan kehadiran anionik surfaktan, natrium dodesil sulfat (SDS). Anionik surfaktant berkeupayaan untuk meningkatkan hubungan antara medium berkutub dan tak berkutub. Oleh itu, ia ditambahkan untuk meningkatkan keterlarutan politiofena dan keupayaan untuk diproses. Politiofena yang terhasil telah dicirikan dengan menggunakan teknik spektroskopik infra-merah, spektroskopik UV-Vis, termagravimetri analisis (TGA), mikroskop cahaya terpolarisasi (PLM) dan ujian kekonduksian. Spektra FTIR menyokong pempolimeran berlaku di mana konjugasi telah mengalihkan frekuensi penyerapan ke nombor gelombang yang lebih rendah. Tambahan pula, ia juga membuktikan kehadiran SDS dalam struktur politiofena. Spektra UV-Vis menunjukkan bahawa gelombang yang dipunyai oleh  $\pi-\pi^*$  transisi mengalami pengalihan ke kanan. Politiofena yang didop dengan SDS menunjukkan kestabilan terma yang lebih baik dan keterlarutan dalam pelarut organik seperti kloroform dan DMF. Di samping itu, kajian dari PLM menunjukkan kehadiran SDS mempengaruhi morfologi politiofena. Kekonduksian politiofena meningkat berkadar langsung dengan bilangan mol SDS. Kajian ini juga membuktikan bahawa medium akueus yang mengandungi sedikit aseton adalah medium terbaik bagi proses pempolimeran dalam kehadiran SDS.