

SYNTHESIS AND CHARACTERIZATION OF POLY (THIOPHENE):  
EFFECT OF INCUBATION PERIOD

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Synthesis and characterization of poly(thiophene) : effect of incubation period.

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SYNTHESIS AND CHARACTERIZATION OF POLY (THIOPHENE):  
EFFECT OF INCUBATION PERIOD

BY

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Adalah diakui dan disahkan bahawa laporan penyelidikan bertajuk:

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## LIST OF ABBREVIATIONS

PTh	poly(thiophene)
PA	poly(acetylene)
PANi	poly(aniline)
PPy	poly(pyrrole)
FeCl <sub>3</sub>	ferric (III) chloride
FTIR	fourier-transform infrared
TGA	thermogravimetry analysis
SA	sigma-aldrich
M	mol dm <sup>-3</sup>
KBr	potassium bromide
LED	light-emitting diod
Sm <sup>-1</sup>	siemen per meter
ICP	inherently conducting polymer
PDA	personal digital assistant
HCl	hydrochloride acid
ESD	electrostatic dissipation
OLEDs	organic light emitting diodes
SEM	scanning electron microscopy
NMR	nuclear magnetic resonance
GPC	gel permeation chromatography
$\sigma$	conductivity
$\rho$	resistivity
A	area

## ABSTRACT

The purpose of this research is to study the effect of prolonged incubation period on the characteristic of the produced poly(thiophene) as a whole. Poly(thiophene), a conducting polymer, was prepared from the polymerization of thiophene and ferric (III) chloride in chloroform. In the experiment, ferric (III) chloride will act as an oxidant reagent. Poly(thiophene) was prepared through three different incubation periods which are 2 days, 4 days and 8 days. Three different techniques were used to characterize the poly(thiophene) product in this experiment: Fourier-Transform Infrared, UV-VIS, and TGA. Based on the results obtained, it is found that the longer the incubation periods, the higher the yield of polymerization and the longer the chain length. In order to determine the micro structure of poly(thiophene), Halide Disc Method was used to obtain the IR spectra. The results obtained prove that the 3 samples prepared from 3 different incubation periods are poly(thiophene). The relative length of conjugated double bond of the samples prepared can be obtained by using ultraviolet spectroscopy, it is shown that the longer the incubation period, the longer the poly(thiophene) chain obtained. Thermogravimetric analysis (TGA) was used to detect the decomposition point of samples. The sample with the longer incubation period has higher decomposition point. The electronic circuit test was used to measure the conductivity of sample and it is found that sample with longer polymer chains are better conductors.

## **SINTESIS DAN PENCIRIAN POLI(TIOFENA): KESAN MASA INKUBASI**

### **ABSTRAK**

Tujuan kajian ini adalah untuk menentukan kesan tempoh inkubasi yang dipanjangkan terhadap sifat poli(tiofena) yang dihasilkan. Poli(tiofena) merupakan sejenis polimer konduktor. Poli(tiofena) disediakan daripada pempolimeran tiofena dan Ferum(III) Klorida dalam kloroform. Pempolimeran ini akan disediakan dalam tiga tempoh berlainan iaitu 2, 4 dan 8 hari. Terdapat tiga kaedah yang digunakan untuk menguji sifat poli(tiofena) iaitu FTIR, UV-VIS, and TGA. Kajian ini telah membuktikan bahawa semakin panjang tempoh incubasi, semakin banyak hasil pempolimeran dan semakin panjang rantai poli(tiofena). Halide Disc Method digunakan untuk menentukan struktur mikro poli(tiofena) melalui spektra IR. Spektrum-spektrum yang diperolehi daripada IR analisis membuktikan sampel yang dihasilkan adalah poli(tiofena). Ikatan dubel konjugat sampel boleh didapati dengan menggunakan UV-VIS. Didapati bahawa semakin panjang tempoh incubasi, semakin panjang rantai poli(tiofena) terhasil. TGA digunakan untuk mengesan titik kelupusan sampel poli(tiofena). Sampel yang mempunyai tempoh inkubasi yang lebih panjang titik kelupusannya adalah lebih tinggi. Ujian litar elektronik pula digunakan untuk mengukur konduktiviti poli(tiofena). Didapati poli(tiofena) yang mempunyai rantai yang lebih panjang merupakan ia sebagai konduktor yang lebih baik.