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EFFECTS OF DOPING AGENTS ON OPTICAL AND CONDUCTIVE PROPERTIES
OF POLY(3-HEXYLTHIOPHENE)

Miss Wanna Bannarukkul

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science Program in Petrochemistry and Polymer Science

Faculty of Science

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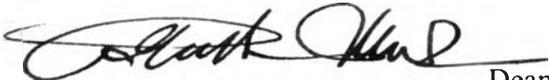
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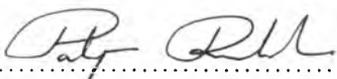
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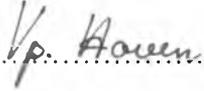
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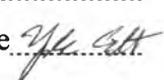
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This research investigated various doping methods of poly(3-hexylthiophene) including acid, oxidative and, solvato-controlled doping. The doped products were subjected to many spectroscopic analysis and conductivity measurements in the form of either a solution or a film. The acid doping was found to increase the conductivity of both the solution and film of poly(3-hexylthiophene). For oxidative doping, premixed urea hydrogenperoxide and trifluoroacetic acid could oxidize poly(3-hexylthiophene) to yield the polymer with bathochromic shift of λ_{\max} . Solvato-controlled doping with methanesulfonic acid and thiophene gave the film of dope polymer without pre-precipitation problem. The AC-index calculation was used for monitoring the change in UV-visible absorption induced by doping that could be related to the effective conjugation length of the polymer. It was found that AC-index calculation was applicable with the monitoring of acid and oxidative doping process. Their values corresponded well with the results from λ_{\max} of UV-visible spectra and conductivity.

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LIST OF ABBREVIATIONS

[o]	: oxidation
°C	: degree celsius
μL	: microliter
μmol	: micromole
A	: absorbance
CA	: chloroacetic acid
CDCl ₃	: deuterated chloroform
CHCl ₃	: chloroform
CH ₂ Cl ₂	: dichloromethane
CH ₃ CN	: acetonitrile
CH ₃ COOH	: acetic acid
cm ⁻¹	: per centimeter
DCA	: dichloroacetic acid
dppe	: 1,2-bis(diphenylphosphino)ethane
FeCl ₃	: ferric chloride
g	: gram
GPC	: gel permeation chromatography
HCl	: hydrochloric acid
HH	: head to head
H ₂ O ₂	: hydrogen peroxide
hr	: hour
HT	: head to tail
IR	: infrared spectrophotometer
<i>M_n</i>	: number average molecular weight
<i>M_w</i>	: weight average molecular weight
MeOH	: methanol
mg	: milligram
min	: minute
mL	: milliliter

mmol	: millimole
MSA	: methanesulfonic acid
NaOH	: sodium hydroxide
nm	: nanometre
NMR	: nuclear magnetic resonance spectroscopy
P3AT	: poly(3-alkylthiophene)
P3HT	: poly(3-hexylthiophene)
ppm	: part per million
PT	: polythiophene
S	: siemen
TCA	: trichloroacetic acid
TFA	: trifluoroacetic Acid
THF	: tetrahydrofuran
TsOH	: toluene-4-sulfonic acid
TsOH·H ₂ O	: toluene-4-sulfonic acid monohydrate
TT	: tail to tail
UHP	: urea Hydrogen Peroxide
UV	: ultra-violet