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COLORIMETRIC CHEMOSENSORS FROM POLYDIACETYLENE CONTAINING SALICYLIC
ACID OR BORONIC ACID


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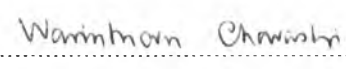
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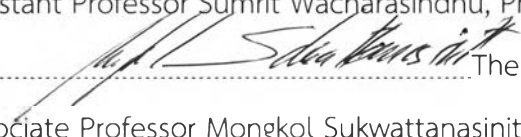
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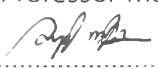

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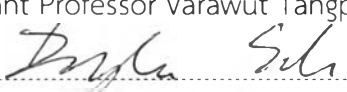
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ศัทยา สุขลิ้ม : สารตรวจวัดทางเคมีโดยใช้การเทียบสีจากพอลิไดแอเซทิลีนที่มีกรดซาลิไซลิกหรือกรดโบโรนิก. (COLORIMETRIC CHEMOSENSORS FROM POLYDIACETYLENE CONTAINING SALICYLIC ACID OR BORONIC ACID) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ. ดร.สัมพันธ์ วัชรสินธุ์, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: รศ. ดร.มงคล สุขวัฒนาสินธุ์, 80 หน้า.

งานวิจัยนี้ ได้สังเคราะห์ไดแอเซทิลีนมอนอเมอร์ที่มีหมู่เอไมด์โบโรนิก 3 ชนิด คือ 10,12-*p*NB-PCDA (1a), 10,12-*m*NB-PCDA (2a) และ 6,8-*m*NB-NCDA (3a) และไดแอเซทิลีนมอนอเมอร์ที่มีหมู่เอสเทอร์โบโรนิก 3 ชนิด คือ 10,12-*p*EB-PCDA (4e), 10,12-*m*EB-PCDA (5e) และ 6,8-*p*EB-NCDA (6e) จากนั้นนำไดแอเซทิลีนมอนอเมอร์ที่สังเคราะห์ได้มาเตรียมเป็นพอลิไดแอเซทิลีนในรูปเวสิเคิลโดยการฉายแสงยูวีได้เป็นพอลิไดแอเซทิลีน ยกเว้นไดแอเซทิลีนมอนอเมอร์ 6e ไม่สามารถเตรียมเป็นพอลิเมอร์ได้ ต่อมาได้ศึกษาสมบัติการเปลี่ยนสีตามอุณหภูมิ ในช่วง 25-90 เซลเซียส ด้วยเทคนิคยูวี-วิสิเบิลสเปกโตรสโกปี พบว่าพอลิไดแอเซทิลีนที่มีหมู่เอไมด์โบโรนิก 10,12-*m*NB-PDA (2a) และ 6,8-*m*NB-PDA (3a) การเปลี่ยนสีสามารถผันกลับได้สมบูรณ์ ในขณะที่พอลิไดแอเซทิลีนที่มีหมู่เอไมด์โบโรนิกตำแหน่ง พารา การเปลี่ยนสีสามารถผันกลับได้บางส่วน แต่พอลิไดแอเซทิลีนที่มีหมู่เอสเทอร์โบโรนิก 10,12-*p*EB-PDA (4e) และ 10,12-*m*EB-PDA (5e) การเปลี่ยนสีไม่สามารถผันกลับได้ จากนั้นได้ศึกษาผลของไอระเหยอินทรีย์ ริงส์ยูวี กรด-เบส และสารลดแรงตึงผิว พบว่าพอลิไดแอเซทิลีนที่มีหมู่เอไมด์โบโรนิก 10,12-*m*NB-PDA (2a) และ 6,8-*m*NB-PDA (3a) ที่สามารถทนการเปลี่ยนสีต่อปัจจัยดังกล่าวได้ ในขณะที่พอลิไดแอเซทิลีนที่มีหมู่เอสเทอร์โบโรนิก 10,12-*p*EB-PDA (4e) และ 10,12-*m*EB-PDA (5e) มีความไวต่อปัจจัยดังกล่าว

สาขาวิชา ปีโตรเคมีและวิทยาศาสตร์พอลิเมอร์ ลายมือชื่อนิสิต ศักดิ์ธนา ภูวดี

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SATTAYA SUKLIM: COLORIMETRIC CHEMOSENSORS FROM POLYDIACETYLENE CONTAINING SALICYLIC ACID OR BORONIC ACID. ADVISOR: ASST. PROF. SUMRIT WACHARASINDHU, Ph.D., CO-ADVISOR: ASSOC. PROF. MONGKOL SUKWATTANASINITT, Ph.D., 80 pp.

In this work, six diacetylene monomers containing boronic acid are prepared. The amido boronic diacetylene monomers such as 10,12-*p*NB-PCDA (**1a**), 10,12-*m*NB-PCDA (**2a**), 6,8-*m*NB-NCDA (**3a**) and the ester boronic acid diacetylene monomers such as 10,12-*p*EB-PCDA (**4e**), 10,12-*m*EB-PCDA (**5e**) and 6,8-*p*EB-NCDA (**6e**) are synthesized in 2 steps. All synthesized monomers can undergo molecularly self-assemble in aqueous media and are polymerized by UV 254 nm irradiation to give the blue PDA sols except 6,8-*p*EB-NCDA (**6e**). The thermochromisms of PDA blue sols are investigated using UV-vis spectroscopy with temperature probe in the range between 25-90°C. In the case of amido PDA containing *meta* boronic acid side chain such as 10,12-*m*NB-PDA (**2a**) and 6,8-*m*NB-PDA (**3a**), the complete reversibility of blue to red color transition is observed while 10,12-*p*NB-PDA (**1a**) containing *para* substituted boronic acid display partially thermochromic reversibility. On the other hand, all ester PDA analogues such as 10,12-*p*EB-PDA (**4e**) and 10,12-*m*EB-PDA (**5e**) demonstrate thermochromic irreversibility. Effects of solvent vapors, UV-light, pH and surfactants on color transition of the PDA are tested only small color changes are observed for the amide PDA while strong color transition is apparent for the ester. This work provides new structures of thermochromically reversible PDA containing amidobenzene boronic acid side chain (**1a**, **2a** and **3a**) which are highly stable to other stimuli.

Field of Study: Petrochemistry and
Polymer Science

Academic Year: 2013

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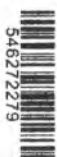


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Scheme 3.2 Synthetic route of salicylic acid diacetylene monomers (7s-9s).	51



LIST OF ABBREVIATIONS

PDA	Polydiacetylene
PCDA	10,12-Pentacosadiynoic acid
NCDA	6,8-Nonadecadiynoic acid
10,12- <i>p</i> NB-PCDA (1a)	4-pentacosa-10,12-diynamidophenylboronic acid
10,12- <i>m</i> NB-PCDA (2a)	3-pentacosa-10,12-diynamidophenylboronic acid
6,8- <i>m</i> NB-NCDA (3a)	3-nonadeca-6,8-diynamidophenylboronic acid
10,12- <i>p</i> EB-PCDA (4e)	4-(pentacosa-10,12-diynoyloxy)phenylboronic acid
10,12- <i>m</i> EB-PCDA (5e)	3-(pentacosa-10,12-diynoyloxy)phenylboronic acid
6,8- <i>p</i> EB-NCDA (6e)	4-(nonadeca-6,8-diynoyloxy)phenylboronic acid
10,12-TEGASA-PCDA (7s)	2-hydroxy-4-(2-(2-(2-(pentacosa-10,12- diynoyloxy)ethoxy)ethoxy)ethylamino)benzoic acid
10,12- <i>p</i> ASA-PCDA (8s)	2-hydroxy-4-pentacosa-10,12-diynamidobenzoic acid
10,12- <i>p</i> HSA-PCDA (9s)	2-hydroxy-4-(pentacosa-10,12-diynoyloxy)benzoic acid
%CR	Colorimetric response
%DR	Degree of reversibility
¹³ C-NMR	Carbon nuclear magnetic resonance
¹ H-NMR	Proton nuclear magnetic resonance
DLS	Dynamic light scattering
UV-vis	Ultra violet-visible
CDCl ₃	Deuterated chloroform
DMSO- <i>d</i> ₆	Deuterated dimethyl sulfoxide
THF	Tetrahydrofuran
MeOH	Methanol



CHCl_3	Chloroform
DCM	Dichloromethane
DCC	<i>N,N'</i> -dicyclohexylcarbodiimide
DMAP	4-(Dimethylamino) pyridine
TLC	Thin layer chromatography
$^{\circ}\text{C}$	Degree Celsius
δ	Chemical shift
J	Coupling constant
λ	Wavelength
Abs	Absorbance
m.p.	Melting point
g	Gram (s)
mL	Milliliter (s)
μL	Microliter (s)
mM	Millimolar
μM	Micromolar
nm	Nanometre
μm	Micrometre
MHz	Mega Hertz
mmol	Millimole
v/v	Volume by volume
CCT	Color transition temperature
%	percent
m.p.	Melting point

