

**METAL COMPLEXATION VIA BENZOXAZINE-BASED MOLECULES:  
AN APPROACH OF MEMBRANE ELECTRODE FOR PROTON  
EXCHANGE MEMBRANE FUEL CELL**



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**Program:** Polymer Science

**Thesis Advisors:** Assoc. Prof. Suwabun Chirachanchai  
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## ABSTRACT

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*N,N*-bis(2-hydroxy-3,5-dimethylbenzyl)methylamine forms host-guest compound with platinum ions. The inclusion phenomena in solution are confirmed from a new peak at 352 nm as observed by UV-Visible spectroscopy and chemical shift as observed by <sup>1</sup>H-NMR. The efficiency of platinum ion interaction quantified by Pedersen's technique clarifies that the platinum ion extraction is as high as 80%. The single crystal analysis shows the complex structure of *N,N*-bis(2-hydroxy-3,5-dimethylbenzyl)methylamine with platinum chloride in solid state under the host-guest ratio of 2:1. A well-defined allyl-containing benzoxazine dimer, *N*-(2-hydroxy-3-methoxy-5-allylbenzyl)-*N*-(2'-hydroxy-3',5'-dimethylbenzyl)cyclohexylamine is further proposed as a model to develop a membrane electrode.

## บทคัดย่อ

อัจฉรา แต้งอ่อน : การเกิดคอมเพลกซ์ของโลหะโดยโมเลกุลของเบนซอกซาซีน: วิธีการใหม่สำหรับการพัฒนาอิเล็กโทรดเมมเบรนของเซลล์เชื้อเพลิงแบบเมมเบรนแลกเปลี่ยนโปรตอน (Metal Complexation via Benzoxazine-Based Molecules: An Approach of Membrane Electrode for Proton Exchange Membrane Fuel Cell) อาจารย์ที่ปรึกษา: รองศาสตราจารย์ ดร. สุวบุญ จิระชาญชัย และ ผู้ช่วยศาสตราจารย์ ดร. อภิรัตน์ เหล่าบุตรี, 53 หน้า

เอ็น,เอ็น-บิส(2-ไฮดรอกซี-3,5-ไดเมทิลเบนซิล)เมทิลามีน สร้างสารประกอบสารหลัก-สารรองกับไอออนของแพลททินัม ปรากฏการณ์การรวมตัวในสารละลายขึ้นขึ้นจากการเกิดฟิสิกใหม่ ที่ 352 นาโนเมตร โดยยูวี-วิซิเบิลสเปกโตรสโกปี และการเลื่อนตำแหน่งของเคมิกอลชิฟในโปรตอนเอ็นเอ็มอาร์ ประสิทธิภาพของอันตรกิริยาของไอออนของแพลททินัมเชิงปริมาณหาได้จากเทคนิคปีเคอเซ็น โดยชี้ว่า การสกัดไอออนของแพลททินัมสูงถึง 80 เปอร์เซ็นต์ การวิเคราะห์ผลึกเดี่ยวแสดงโครงสร้างสารเชิงซ้อนของ เอ็น,เอ็น-บิส(2-ไฮดรอกซี-3,5-ไดเมทิลเบนซิล)เมทิลามีน กับแพลททินัมคลอไรด์ ในสถานะของแข็งภายในอัตราส่วนสารหลัก-สารรองเท่ากับ 2:1 เบนซอกซาซีนไดเมอร์ที่ประกอบด้วยแอลิว, เอ็น-(2-ไฮดรอกซี-3-เมทอกซี-5-แอลิวเบนซิล)-เอ็น'(2'-ไฮดรอกซี-3',5'-ไดเมทิลเบนซิล)ไซโคลเฮกซิลอามีน ได้ถูกเสนอเพื่อจะเป็นต้นแบบในการพัฒนาเมมเบรนอิเล็กโทรดต่อไป

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## ABBREVIATIONS

PFSA	perfluorosulfonic acid
PFCA	perfluorocarboxylic acid
PFSI	bis(perfluoroalkylsulfonyl)imide
PTFE-g-TFS	$\alpha,\beta,\beta$ -trifluorostyrene grafted onto poly(tetrafluoroethylene) with post sulfonation
PVDF-g-PSSA	styrene grated on sulfonated poly(vinylidene fluoride)
NPI	naphthalenic polyimide
BAM3G	ballard advance material of third generation membrane
SPEEK	sulfonated poly(ether ether ketone)
SPPBP	sulfonated poly(4-phenoxy benzoyl-1,4-phenylene)
MBS-PBI	methyl benzensulfonated polybenzimidazoles
PBI	polybenzimidazole
P4VP	poly(4-vinyl pyrrolidone)
PEI	poly(ethyleneimine)
PSU(NH <sub>2</sub> ) <sub>2</sub>	ortho-sulfone aminated polysulfone
SPSU	sulfonated polysulfone
Poly-AMPS	poly(2-acrylamido-2-methylpropanesulfonic acid)
PVA	poly(vinyl alcohol)
PC	sulfonated polycarbonate
PPO	poly(phenylene oxide)
PI	sulfonated polyimide
PSU	sulfonated polysulfone
PPS	sulfonated poly(phenylene sulfide)
PPSU	poly(phenyl sulfone)
TBA+	tetrabutylammonium
TBAOH	tetrabutylammonium hydroxide