

**ONE STEP SYNTHESIS OF A NOVEL COPOLYMER DIRECTLY  
FROM  $\text{SiO}_2$ , CATECHOL AND HYDROQUINONE**

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for the Degree of Master of Science  
The Petroleum and Petrochemical College, Chulalongkorn University  
in Academic Partnership with  
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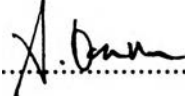
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## บทคัดย่อ

มนตรี ศิลปอาชา : การสังเคราะห์โคพอลิเมอร์ประเภทใหม่โดยตรงจากซิลิกา แคะทะคอล และไฮโดรควิโนนแบบขั้นตอนเดียว(One-Step Synthesis of a Novel Copolymer Directly from SiO<sub>2</sub>, Catechol and Hydroquinone)  
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สารพอลิเมอร์อนินทรีย์ส่วนใหญ่จะสลายตัวที่อุณหภูมิต่ำ แต่สารพอลิเมอร์ผลึกเหลวประเภทอนินทรีย์สารเป็นวัสดุที่เป็นทางเลือกใหม่ที่เหมาะสมสำหรับอุตสาหกรรมที่ต้องการสารพอลิเมอร์ที่มีสมบัติในการทนทานอุณหภูมิสูง ซิลิกา เป็นสารประกอบอนินทรีย์ที่มีราคาถูกและหาได้ง่าย จึงได้นำมาใช้ในการศึกษาในงานวิจัยนี้ สารประกอบอนินทรีย์โคพอลิเมอร์นี้ซึ่งจะพัฒนาเป็นพอลิเมอร์ผลึกเหลวสามารถสังเคราะห์ได้จากปฏิกิริยาของซิลิกากับทั้งแคะทะคอลและไฮโดรควิโนน

ขั้นตอนการสังเคราะห์เป็นเพียงขั้นตอนเดียว โดยการผสมซิลิกา แคะทะคอล และไฮโดรควิโนน ในตัวทำละลายเอทิลีนไกลคอลโดยมีด่างอินทรีย์ชื่อ ไตรเอทิลีนเตตระมีนเป็นตัวเร่งปฏิกิริยา สารที่ได้มีลักษณะเป็นผงละเอียดสีเหลืองอ่อน หลังจากทำให้ผลิตภัณฑ์บริสุทธิ์ตามกระบวนการทางเคมีแล้ว จึงนำไปตรวจสอบโครงสร้าง โดยใช้เทคนิคทางเคมีวิเคราะห์ ได้แก่ FTIR, NMR, EI<sup>+</sup>-MS, DSC, TGA และ XRD นอกจากนี้ยังได้ทำการศึกษาถึงปริมาณของตัวเร่งปฏิกิริยา, เวลาในการทำปฏิกิริยา, รวมไปถึงอัตราส่วนของแคะทะคอลต่อไฮโดรควิโนนที่เหมาะสมในการสังเคราะห์ โคพอลิเมอร์ชนิดนี้

## ABSTRACT

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Most polymers are organic substances that decompose at relatively low temperatures. Inorganic/organic polymers are new alternative materials for industry that offer low cost and high-temperature resistance. The widespread availability and extremely low cost of silica ( $\text{SiO}_2$ ) serves as a primary feedstock for this research. The inorganic/organic copolymer developed is readily synthesized by reacting silica with both catechol and hydroquinone in the presence of an amine base.

Copolymer synthesis requires only one step using silica, catechol and hydroquinone in ethylene glycol solvent and triethylenetetramine (TETA) as catalyst for the reaction. After purification, the product is a yellowish fine powder that was characterized by FT-IR, EI<sup>+</sup>-MS, DSC, TGA, and XRD. To optimize the synthesis/reaction kinetics the amount of catalyst, reaction time, and also optimum ratio of catechol to hydroquinone were studied.

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## TABLE OF CONTENTS

CHAPTER	PAGE
Title Page	i
Abstract	iii
Acknowledgments	v
Table of Contents	vi
List of Tables	viii
List of Figures	ix
List of Schemes	xi
<b>I INTRODUCTION</b>	
1.1 Background	1
1.2 Historical Review	3
1.3 Objectives	8
<b>II EXPERIMENTAL SECTION</b>	
2.1 General Material Handling	9
2.2 Instrumentation / Characterization	10
2.2.1 Spectroscopic Characterization	10
2.2.2 Thermal Analysis	11
2.2.3 X-Ray Diffraction	12

<b>CHAPTER</b>	<b>PAGE</b>
2.3 Experiments	12
2.3.1 One step synthesis copolymer of silica, catechol, and hydroquinone	13
2.3.2 Variation of catechol:hydroquinone mole ratio	14
2.3.3 Reaction time variation	15
2.3.4 Variation of TETA	15
<b>III RESULTS AND DISCUSSION</b>	
3.1 Synthesis	16
3.2 Characterization	21
3.2.1 Differential Scanning Calorimetry (DSC)	21
3.2.2 Thermogravimetric Analysis (TGA)	26
3.2.3 X-ray Diffraction	28
3.2.4 Mass Spectrometry (MS)	38
3.2.5 Fourier Transform Infrared Spectroscopy (FTIR)	45
3.2.6 Nuclear Magnetic Resonance Spectroscopy (NMR)	48
<b>IV CONCLUSIONS</b>	56
<b>REFERENCES</b>	58
<b>CURRICULUM VITAE</b>	61

**LIST OF TABLES**

<b>TABLE</b>	<b>PAGE</b>
2.1 Mole ratio variation of catechol : hydroquinone	14
3.1 Percent yield product H3 in each reaction time	19
3.2 Percent yield product H3 in each TETA variation at the reaction time and temperature of 5 h and 200 °C respectively	20
3.3 Typical yield product H3 at each reaction time	21
3.4 Purposed fragmentation structure of product H3 from EI <sup>+</sup> -MS	39
3.5 Relative height intensity of fragments from MS spectra	44
3.6 Frequency vibration and suggested functional group of product H3	46
3.7 <sup>1</sup> H and <sup>13</sup> C-NMR chemical shift of H3 product	54



## LIST OF FIGURES

FIGURE	PAGE
1.1 Bis(1,2-dioxyphenyl)silane polymer	5
1.2 Main chain structure : ortho-linked unit and para-linked unit	7
3.1 DSC profile of product H3	22
3.2 DSC profile of product H1 and H6 at 5 h reaction time	22
3.3 DSC profile of product H2-H5 at 5h reaction time	23
3.4 DSC profile of products H1, H3, H7, H9 at 3 h reaction time	24
3.5 DSC profile of products H1, H3, H4, H5 at 4 h reaction time	24
3.6 DSC profile of product H3 of TETA variation	25
3.7 DSC profile of product H3 at each reaction time	25
3.8 TGA profile of product H3 under N <sub>2</sub> and O <sub>2</sub> atm	26
3.9 Relationship of %ceramic yield at each mole ratio at 3h, 4h. and 5h reaction time	27
3.10 Percent ceramic yield at each amount of TETA	28
3.11 XRD pattern of starting material silica	28
3.12 XRD pattern of product H3	29
3.13-A XRD pattern of product H1 at 5 h reaction time	30
-B XRD pattern of product H2 at 5 h reaction time	30
-C XRD pattern of product H4 at 5 h reaction time	31
-D XRD pattern of product H5 at 5 h reaction time	31
-E XRD pattern of product H6 at 5 h reaction time	32
3.14-A XRD pattern of product H3 at 3 h reaction time	32
-B XRD pattern of product H6 at 3 h reaction time	33

<b>FIGURE</b>	<b>PAGE</b>
3.14-C XRD pattern of product H8 at 3 h reaction time	33
-D XRD pattern of product H1 at 4 h reaction time	34
-E XRD pattern of product H3 at 4 h reaction time	34
-F XRD pattern of product H5 at 4 h reaction time	35
3.15-A XRD pattern of product 100% mol Si of TETA	35
-B XRD pattern of product 84% mol Si of TETA	36
-C XRD pattern of product 67% mol Si of TETA	36
-D XRD pattern of product 33% mol Si of TETA	37
-E XRD pattern of product 17% mol Si of TETA	37
3.16 EI <sup>+</sup> -MS spectrum of product H3	38
3.17-A MS spectra of product H1	40
-B MS spectra of product H2	41
-C MS spectra of product H4	41
-D MS spectra of product H5	42
-E MS spectra of product H6	42
3.18 FTIR Spectrum of product H3	45
3.19 Percent increment at 813 cm <sup>-1</sup> and decrement at 750 cm <sup>-1</sup> with the increment of hydroquinone	47
3.20 <sup>1</sup> H-NMR of para substituted benzene ring of hydroquinone	48
3.21 <sup>1</sup> H-NMR of p-chloroanisole	49
3.22 <sup>1</sup> H-NMR of catechol	49
3.23-A <sup>1</sup> H-NMR spectrum of product H3	50
-B Maximized spectra at 6.00-6.80 ppm	50
3.24 <sup>13</sup> C-NMR of product H3	52
3.25 <sup>29</sup> Si-NMR of product H3	53

**LIST OF SCHEMES**

<b>SCHEME</b>	<b>PAGE</b>
3.1 Si-O bond of (a) hydroquinone, (b) catechol	5
3.2 Suggested structure of synthesized product	51
3.3 Direction of electron induced by Si atom	53