

**METHANE ADSORPTION BY ACTIVATED CARBONS:
COMPARISON AMONG COCONUT-, PALM-, AND BITUMINOUS
COAL BASED ACTIVATED CARBONS**

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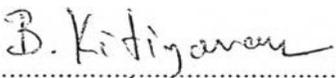
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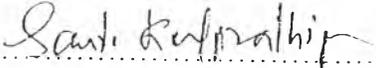
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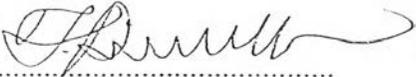

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ABSTRACT

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Consumption of natural gas as a vehicular fuel has continuously increased in Thailand. Compressed natural gas (CNG) is natural gas which is compressed and stored under high pressure ~3,600 psi. To increase the travel distance per fill up, the storage capacity needs to be enhanced. It has been suggested that a porous material such as activated carbon can adsorb natural gas, and thus, increase the capacity of natural gas storage. Therefore, this research focuses on methane adsorption using several types of commercial activated carbon, such as activated carbons derived from coconut shell, palm shell, and bituminous coal with different iodine number; and coconut-based activated carbon by chemical activation process. Methane adsorption was measured by a volumetric apparatus under the pressure up to 1,000 psia at temperatures of 35, 40, and 45 °C. In addition, the physical properties of activated carbons were characterized by BET surface analysis, and Field Emission Scanning Electron Microscope (FE-SEM). The surface area, micropore volume, total pore volume, and average pore diameter played an important role in methane adsorption. A higher surface area of activated carbons led to greater methane adsorption capacity (mmol/g).

บทคัดย่อ

วยา สุนทรสุริยวงศ์: การดูดซับก๊าซมีเทนด้วยถ่านกัมมันต์ : เปรียบเทียบระหว่างถ่านกัมมันต์ที่ผลิตจากกะลามะพร้าว, กะลาปาล์ม และถ่านหินบิทูมินัส (Methane Adsorption by Activated Carbons: Comparison among Coconut-, Palm-, and Bituminous Coal Based Activated Carbons) อ.ที่ปรึกษา: ผศ. ดร. บุญยรัชต์ กิตยานันท์ รศ. ดร. ปราโมช รั้งสรรพวิจิตร และ ดร.สันติ กุลประทีปปัญญา 74 หน้า

ในปัจจุบันการใช้นานพาหนะที่ใช้ก๊าซธรรมชาติเป็นเชื้อเพลิงมีปริมาณเพิ่มขึ้นอย่างต่อเนื่องในประเทศไทย เชื้อเพลิงที่ถูกนำมาใช้เรียกว่า ก๊าซธรรมชาติอัด คือก๊าซธรรมชาติที่ถูกอัดจนมีความดันสูงกว่า 3,600 ปอนด์/ตารางนิ้วและถูกเก็บไว้ในถังเก็บทนแรงดันสูง การที่ยานพาหนะจะสามารถขับเคลื่อนได้ในระยะทางที่เพิ่มขึ้นต่อการเติมก๊าซธรรมชาติในหนึ่งครั้ง จึงจำเป็นต้องเพิ่มประสิทธิภาพของถังกักเก็บก๊าซธรรมชาติ การเติมตัวดูดซับ เช่น ถ่านกัมมันต์ ลงในถังเพื่อเพิ่มปริมาณการดูดซับของก๊าซธรรมชาติอัดในถังบรรจุก๊าซเป็นวิธีที่ได้รับการสนใจศึกษา ดังนั้น งานวิจัยนี้จึงศึกษาการดูดซับก๊าซมีเทนด้วยถ่านกัมมันต์เชิงพาณิชย์ซึ่งเตรียมมาจากสารตั้งต้นต่างชนิดกันและมีเลขไอโอได้นแตกต่างกัน ได้แก่ ถ่านกัมมันต์ที่เตรียมจากกะลามะพร้าว กะลาปาล์ม และถ่านหินบิทูมินัส อีกทั้งศึกษาการใช้ถ่านกัมมันต์ที่ผลิตขึ้นเองจากกะลามะพร้าว และใช้วิธีการกระตุ้นทางเคมีโดยสารละลายโพแทสเซียมคาร์บอเนตด้วย ปริมาณการดูดซับก๊าซมีเทนหาได้จากเครื่องมือเชิงปริมาตร ภายได้ความดันสูงถึง 1,000 ปอนด์/ตารางนิ้ว ที่อุณหภูมิ 35, 40 และ 45 องศาเซลเซียส โดยทดสอบสมบัติทางกายภาพของถ่านกัมมันต์ด้วยเครื่องมือวิเคราะห์พื้นที่ผิวบีอีที (BET surface analysis) และกล้องจุลทรรศน์อิเล็กตรอนแบบส่องกราด (Field Emission Scanning Electron Microscope (FE-SEM)) จากผลการทดลองพบว่า พื้นที่ผิว ปริมาตรรูพรุน ปริมาตรรูพรุนทั้งหมด และขนาดของรูพรุน เป็นตัวแปรสำคัญในการดูดซับก๊าซมีเทน โดยเฉพาะอย่างยิ่ง ถ่านกัมมันต์มีพื้นที่ผิวมากจะทำให้ความสามารถในการดูดซับก๊าซมีเทน (มิลลิโมลต่อกรัม) มากด้วย

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TABLE OF CONTENTS

	PAGE
Title page	i
Abstract (in English)	iii
Abstract (in Thai)	iv
Acknowledgements	v
Table of Contents	vi
List of Tables	viii
List of Figures	x
Abbreviations	xii

CHAPTER

I	INTRODUCTION	1
II	LITERATURE REVIEW	3
	2.1 Natural Gas	3
	2.2 Natural Gas Storage	4
	2.2.1 Compressed Natural Gas (CNG)	4
	2.2.2 Liquefied Natural Gas (LNG)	5
	2.2.3 Adsorbed Natural Gas (ANG)	5
	2.3 Adsorption	5
	2.3.1 Adsorption Isotherms	7
	2.4 Activated Carbon	9
	2.4.1 Production of Activated Carbon	9
	2.5 Literature Review	11
III	EXPERIMENTAL	20
	3.1 Materials and Equipments	20
	3.2 Experimental Procedures	21
	3.2.1 Characterization of Adsorbents	21

CHAPTER	PAGE
3.2.2 Methane Adsorption by Activated Carbons	23
3.2.3 Production of Activated Carbons	26
IV RESULTS AND DISCUSSION	28
4.1 Characterization of Adsorbents	28
4.2 Methane Adsorption by Activated Carbons	33
4.3 Production of Activated Carbons	44
V CONCLUSIONS AND RECOMMENDATIONS	50
5.1 Conclusions	50
5.2 Recommendations	51
REFERENCES	52
APPENDICES	57
Appendix A Specifications of the Commercial Activated carbons	57
Appendix B Amount of Methane Adsorbed on all Activated Carbons	58
CURRICULUM VITAE	74

LIST OF TABLES

TABLE		PAGE
2.1	Typical composition of natural gas	3
4.1	Physical BET surface properties of studied activated carbons	28
4.2	The capacity of methane adsorption (mmol/g) at 1,000 psia and different temperature	39
4.3	The capacity of methane adsorption per BET surface area (mmol/m ²) at 1,000 psia and different temperature	42
4.4	Characteristics of carbonized coconut shell at different conditions	44
4.5	Characteristics of coconut-based activated carbon at different activation conditions	47
A1	Specifications of the commercial activated carbons	57
A2	Physical properties of adsorbents (Kumpoomee, 2012)	57
B1	The amount of methane adsorption on A (IN 1100) at 35 °C	58
B2	The amount of methane adsorption on A (IN 1100) at 40 °C	59
B3	The amount of methane adsorption on A (IN 1100) at 45 °C	59
B4	The amount of methane adsorption on B (IN 1067) at 35 °C	60
B5	The amount of methane adsorption on B (IN 1067) at 40 °C	60
B6	The amount of methane adsorption on B (IN 1067) at 45 °C	61
B7	The amount of methane adsorption on C (IN 1100) at 35 °C	61
B8	The amount of methane adsorption on C (IN 1100) at 40 °C	62
B9	The amount of methane adsorption on C (IN 1100) at 45 °C	62
B10	The amount of methane adsorption on D (IN 937) at 35 °C	63
B11	The amount of methane adsorption on D (IN 937) at 40 °C	63
B12	The amount of methane adsorption on D (IN 937) at 45 °C	64
B13	The amount of methane adsorption on E (IN 1035) at 35 °C	64
B14	The amount of methane adsorption on E (IN 1035) at 40 °C	65
B15	The amount of methane adsorption on E (IN 1035) at 45 °C	65

TABLE		PAGE
B16	The amount of methane adsorption on F (IN 879) at 35 °C	66
B17	The amount of methane adsorption on F (IN 879) at 40 °C	66
B18	The amount of methane adsorption on F (IN 879) at 45 °C	67
B19	The amount of methane adsorption on G (IN 987) at 35 °C	67
B20	The amount of methane adsorption on G (IN 987) at 40 °C	68
B21	The amount of methane adsorption on G (IN 987) at 45 °C	68
B22	The amount of methane adsorption on Co-K ₂ CO ₃ /1h at 35 °C	69
B23	The amount of methane adsorption on Co-K ₂ CO ₃ /1h at 40 °C	69
B24	The amount of methane adsorption on Co-K ₂ CO ₃ /1h at 45 °C	70
B25	The amount of methane adsorption on Co-K ₂ CO ₃ /2h at 35 °C	70
B26	The amount of methane adsorption on Co-K ₂ CO ₃ /2h at 40 °C	71
B27	The amount of methane adsorption on Co-K ₂ CO ₃ /2h at 45 °C	71
B28	The amount of methane adsorption on Co-K ₂ CO ₃ /3h at 35 °C	72
B29	The amount of methane adsorption on Co-K ₂ CO ₃ /3h at 40 °C	72
B30	The amount of methane adsorption on Co-K ₂ CO ₃ /3h at 45 °C	73

LIST OF FIGURES

FIGURE	PAGE
2.1 The IUPAC classification for adsorption isotherms	8
3.1 Schematic of volumetric apparatus	24
3.2 Schematic diagram of apparatus to produce activated carbon	27
4.1 FE-SEM micrographs of raw coconut shell	29
4.2 FE-SEM images of coconut-based activated carbon (IN-1100)	30
4.3 FE-SEM images of bituminous coal-based activated carbon (IN-1067)	30
4.4 FE-SEM images of palm-based activated carbon (IN-1100)	30
4.5 FE-SEM images of bituminous coal-based activated carbon (IN-937)	31
4.6 FE-SEM images of bituminous coal-based activated carbon (IN-1035)	31
4.7 FE-SEM images of bituminous coal-based activated carbon (IN-879)	31
4.8 FE-SEM images of bituminous coal-based activated carbon (IN-987)	32
4.9 FE-SEM images of coconut-based char at 400 °C and 60 min	32
4.10 FE-SEM images of coconut-based activated carbon with $K_2CO_3/1h$	32
4.11 FE-SEM images of coconut-based activated carbon with $K_2CO_3/2 h$	33
4.12 FE-SEM images of coconut-based activated carbon with $K_2CO_3/3 h$	33
4.13 Methane adsorption (mmol/g) at 1,000 psia and 40 °C as a function of BET surface area (m^2/g)	34

FIGURE	PAGE
4.14 Methane adsorption (mmol/g) at 1,000 psia and 40 °C as a function of micropore volume (cc/g)	34
4.15 Methane adsorption (mmol/g) at 1,000 psia and 40 °C as a function of total pore volume (cc/g)	35
4.16 Methane adsorption (mmol/g) at 1,000 psia and 40 °C as a function of DR micropore (Å)	35
4.17 Methane adsorption per BET surface area (mmol/m ²) at 1,000 psia and 40 °C as a function of BET surface area (m ² /g)	36
4.18 Methane adsorption on activated carbons at 35°C	37
4.19 Methane adsorption on activated carbons at 40°C	37
4.20 Methane adsorption on activated carbons at 45°C	38
4.21 Methane adsorption per BET surface (mmol/m ²) of activated carbons as a function of equilibrium pressure (psia) at 35°C	40
4.22 Methane adsorption per BET surface (mmol/m ²) of activated carbons as a function of equilibrium pressure (psia) at 40°C	41
4.23 Methane adsorption per BET surface (mmol/m ²) of activated carbons as a function of equilibrium pressure (psia) at 45°C	41
4.24 Methane adsorption per BET surface (mmol/m ²) of activated carbons as a function of equilibrium pressure (psia) at 35°C compared with previous work (Kumpoomee, 2012)	43
4.25 Yield (%) and Burn-off (%) vs. time (min) of carbonized char at 400°C	45
4.26 Yield (%) and Burn-off (%) vs. temperature (°C) of carbonized char at 60 min	46
4.27 Influence of activation time on the micropore volume (cc/g) and total pore volume of Co- K ₂ CO ₃	48
4.28 Influence of activation time on BET surface area (m ² /g) of Co-K ₂ CO ₃	48

ABBREVIATIONS

A (IN 1100)	Coconut-based activated carbon at iodine number of 1100
B (IN 1067)	Bituminous coal-based activated carbon at iodine number of 1067
C (IN 1100)	Palm-based activated carbon at iodine number of 1100
Co-K ₂ CO ₃ /1h	Coconut-based activated carbon by K ₂ CO ₃ activation at 1 h of activation time
Co-K ₂ CO ₃ /2h	Coconut-based activated carbon by K ₂ CO ₃ activation at 2 h of activation time
Co-K ₂ CO ₃ /3h	Coconut-based activated carbon by K ₂ CO ₃ activation at 3 h of activation time
D (IN 937)	Bituminous coal-based activated carbon at iodine number of 937
E (IN 1035)	Bituminous coal-based activated carbon at iodine number of 1035
F (IN 879)	Bituminous coal-based activated carbon at iodine number of 879
G (IN 987)	Bituminous coal-based activated carbon at iodine number of 987