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APPENDICES

Appendix A The Amount of Methane Adsorbed on all Adsorbents

Table A1 The amount of methane adsorbed on surface of metal organic framework from Basolite C300 at 303 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
24.38	1.75
45.01	2.87
60.01	3.70
90.01	4.72
121.88	5.67
157.51	6.75
196.88	7.68
240.01	8.47
286.88	9.11
333.76	9.62
384.38	10.13
436.88	10.56
495.01	10.90
575.63	11.27
675.01	11.55
766.88	11.74
868.13	11.96
997.51	12.15

Table A2 The amount of methane adsorbed on surface of metal organic framework from Basolite C300 at 308 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
22.5	1.41
45	2.57
63.75	3.24
91.88	4.19
121.88	5.08
157.5	6.15
196.88	6.94
238.13	7.68
283.13	8.40
330	8.93
382.5	9.51
431.25	9.85
493.13	10.20
570	10.49
663.75	10.78
763.13	10.98
862.5	11.17
965.63	11.31

Table A3 The amount of methane adsorbed on surface of metal organic framework
from Basolite C300 at 313 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
24.38	1.31
43.13	2.21
60	2.81
90	3.79
120	4.66
155.63	5.56
191.25	6.34
236.25	6.99
283.13	7.56
335.63	8.10
384.38	8.45
435	8.72
485.63	8.95
570	9.25
731.25	9.60
860.63	9.78
995.63	9.87

Table A4 The amount of methane adsorbed on surface of metal organic framework from Basolite Z1200 at 303 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
30	0.67
43.13	1.03
57.19	1.25
86.25	1.66
105	1.93
133.13	2.46
159.38	2.84
195.94	3.36
238.13	3.85
285	4.43
341.25	5.06
395.63	5.55
446.25	6.01
511.88	6.50
600	7.167
691.88	7.84
781	8.50
881.88	9.30
997.5	10.04

Table A5 The amount of methane adsorbed on surface of metal organic framework from Basolite Z1200 at 308 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
30	0.43
46.88	0.58
73.13	0.92
101.25	1.44
126.565	1.73
154.69	2.07
183.75	2.39
234.88	2.82
285	3.28
339.38	3.68
397.5	4.06
438.75	4.31
494.065	4.60
577.5	5.05
669	5.50
770.63	6.03
877.5	6.49
980.63	7.04

Table A6 The amount of methane adsorbed on surface of metal organic framework from Basolite Z1200 at 313 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
73.13	0.75
108.75	1.17
140.63	1.45
187.5	1.94
232.5	2.35
284	2.76
341.25	3.16
391.88	3.50
440.63	3.75
489.38	4.02
589.565	4.58
675.94	4.94
765.94	5.30
899.065	5.73
984.065	5.99

Table A7 The amount of methane adsorbed on surface of activated carbon from coconut shell powder at 303 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
15	0.86
28.13	1.35
54.38	2.01
84.38	2.55
110.63	2.92
135	3.16
163.13	3.40
183.75	3.54
208.13	3.71
247.5	3.95
301.88	4.22
345	4.39
399.38	4.58
451.88	4.76
500.63	4.89
586.88	5.04
678.75	5.14
768.75	5.21
873.75	5.27
982.5	5.28

Table A8 The amount of methane adsorbed on surface of activated carbon from coconut shell powder at 308 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
15	0.75
31.88	1.28
61.88	1.78
93.75	2.16
125.63	2.46
163.13	2.72
202.5	2.97
251.25	3.24
300	3.46
350.63	3.65
400.5	3.83
453.75	4.01
504.38	4.13
551.25	4.24
600	4.33
680.63	4.44
772.5	4.52
875.63	4.59
975	4.60

Table A9 The amount of methane adsorbed on surface of activated carbon from coconut shell powder at 313 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
15	0.71
31.88	1.11
60	1.63
93.75	2.01
133.13	2.35
165	2.56
202.5	2.76
247.5	2.97
300	3.18
350.63	3.36
393.75	3.49
448.8	3.60
498	3.71
575	3.84
673.13	3.96
772.5	4.04
871.88	4.09
990	4.10

Table A10 The amount of methane adsorbed on surface of activated carbon from calgon at 303 K

| Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
20.63	1.13
37.5	1.62
61.88	2.14
80.63	2.40
108.75	2.78
136.88	3.10
166.88	3.38
198.75	3.66
243.75	4.00
292.5	4.27
337.5	4.49
393.75	4.71
446.25	4.89
498.75	5.02
571.88	5.19
669.38	5.35
763.13	5.46
864.38	5.54
988.13	5.61

Table A11 The amount of methane adsorbed on surface of activated carbon from calgon at 308 K

| Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
38.25	1.41
69.38	2.07
106.88	2.57
166.88	3.13
226.88	3.51
301.88	3.89
397.5	4.25
511.25	4.55
624.38	4.76
725.63	4.86
815.63	4.90
909.38	4.92
997.5	4.92

Table A12 The amount of methane adsorbed on surface of activated carbon from calgon at 313 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
18.75	0.82
31.88	1.20
54.38	1.64
82.5	2.02
103.13	2.27
138.75	2.61
187.5	3.00
236.25	3.27
288.75	3.49
337.5	3.65
390	3.81
444.38	3.93
493.13	4.03
577.5	4.15
669.38	4.22
768.13	4.27
865	4.30
965.63	4.32

Table A13 The amount of methane adsorbed on surface of activated carbon from coconut shell particle at 303 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
17.815	1.07
30	1.58
58.13	2.24
86.25	2.78
103.5	3.10
148.13	3.74
191.25	4.19
242.815	4.60
286.88	4.89
341	5.17
423.75	5.55
496.88	5.82
590.63	6.09
682.5	6.30
780	6.43
888.75	6.52
995.75	6.53

Table A14 The amount of methane adsorbed on surface of activated carbon from coconut shell particle at 308 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
22.51	1.25
58.13	2.09
75.01	2.43
105.01	2.89
131.76	3.20
197.38	3.80
243.01	4.13
290.63	4.38
341.01	4.61
403.13	4.82
466.88	5.00
530.01	5.11
605.63	5.21
710.63	5.29
809.13	5.35
904.48	5.38
999.38	5.42

Table A15 The amount of methane adsorbed on surface of activated carbon from coconut shell particle at 313 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
20.63	0.80
56.25	1.60
78.75	2.01
103.13	2.37
138.75	2.77
185.63	3.12
234.38	3.45
296.25	3.76
359.065	4.01
410.13	4.16
471.565	4.28
565.88	4.36
669.88	4.43
765.5	4.47
864.38	4.50
992.815	4.53

Table A16 The amount of methane adsorbed on surface of activated carbon from eucalyptus at 303 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
24.38	1.231270224
33.75	1.518948133
58.13	2.057041033
84.38	2.500384804
108.75	2.879495133
148.13	3.33987313
193.13	3.773348836
245.63	4.136459309
288.75	4.447544818
343.13	4.738955803
393.75	4.992661534
444.38	5.203209185
491.25	5.361653016
573.75	5.623648698
665.63	5.849064984
763.13	6.055061345
866.25	6.241589443
965.63	6.350166618

Table A17 The amount of methane adsorbed on surface of activated carbon from eucalyptus at 308 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
24.38	1.068625283
33.75	1.373180001
58.13	1.748653994
88.13	2.179776017
112.5	2.572858864
150	2.982303436
196.88	3.285173435
243.75	3.618988328
294.38	3.911244378
343.13	4.138724711
391.88	4.368114413
481.88	4.705213234
562.5	4.961519464
665.63	5.228677624
761.25	5.407208634
862.5	5.55386248
969.88	5.629522201

Table A18 The amount of methane adsorbed on surface of activated carbon from eucalyptus at 313 K

Equilibirum pressure (psia)	Methane adsorption capacity (mmol/g)
0	0
26.25	0.839971344
35.63	1.004179219
56.25	1.433629408
84.38	1.892434824
105	2.195334656
146.25	2.577248764
200.63	2.997589526
249.38	3.309698195
289.5	3.575032526
341.25	3.840029774
390	4.068154827
442.5	4.275742068
494.13	4.422484681
575.63	4.651057937
669.38	4.850886306
774.2	4.988730117
865	5.07105764
961.88	5.126267361

- **Appendix B The Modeling and Experimental Data for Methane Adsorption Isotherm on all Adsorbents**
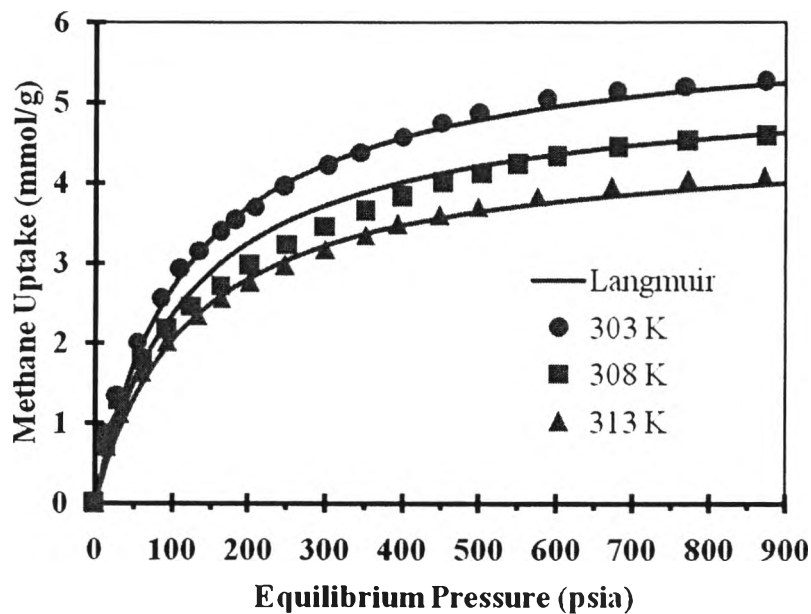
Figure B1 Methane adsorption on Coconut Shell Powder Activated Carbon. Symbols represent the experimental data while lines represent Langmuir isotherm model data.
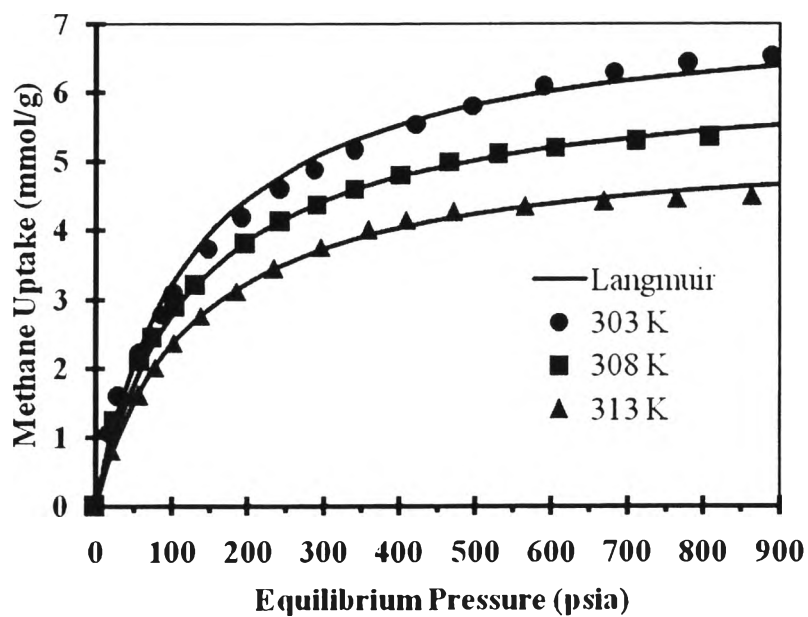
Figure B2 Methane adsorption on Coconut Shell Granular Activated Carbon. Symbols represent the experimental data while lines represent Langmuir isotherm model data.
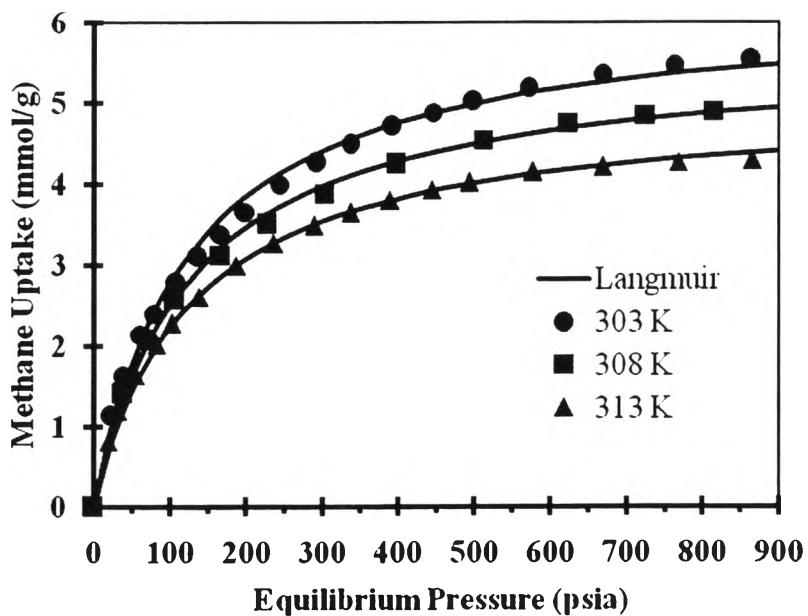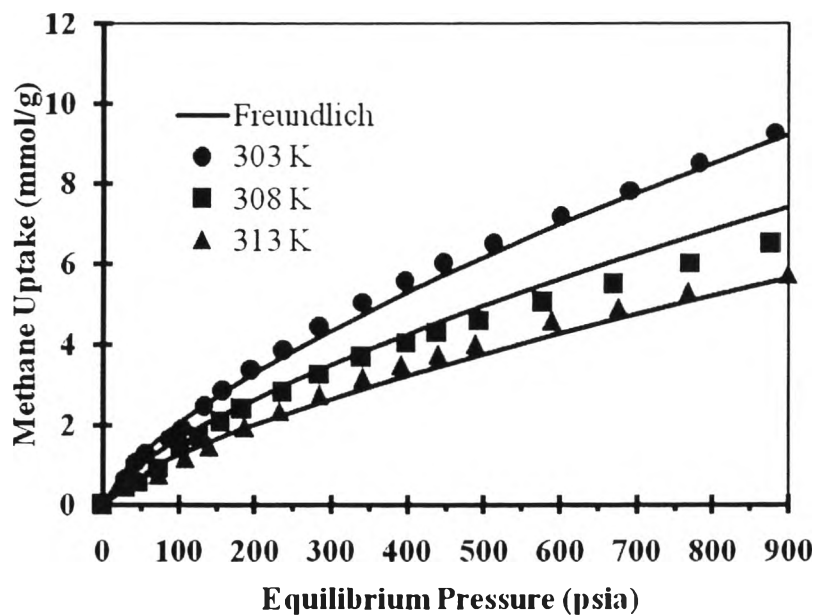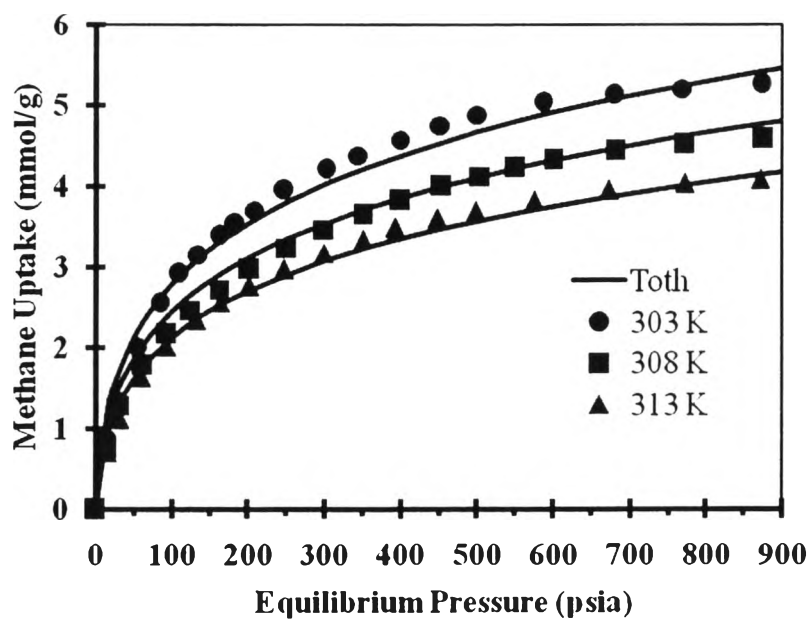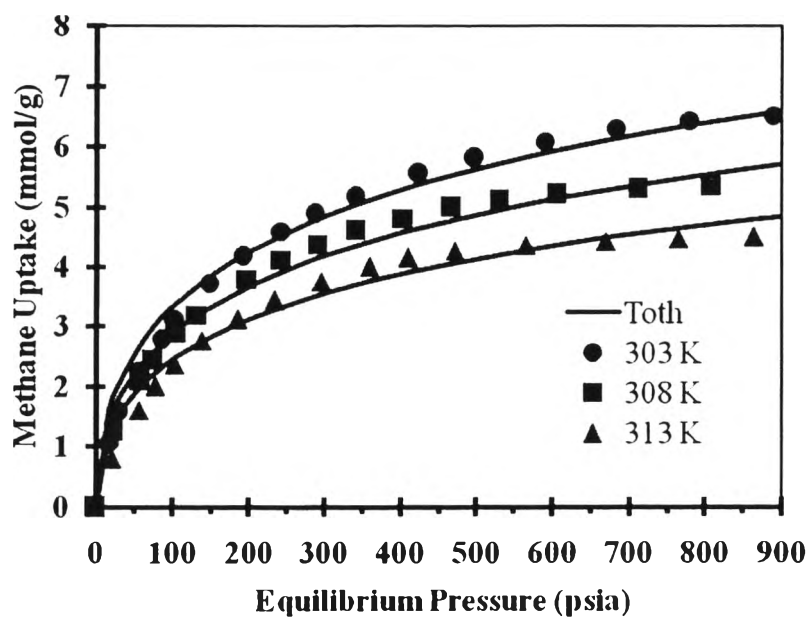

Figure B3 Methane adsorption on Calgon (20-40 meshes). Symbols represent the experimental data while lines represent Langmuir isotherm model data.
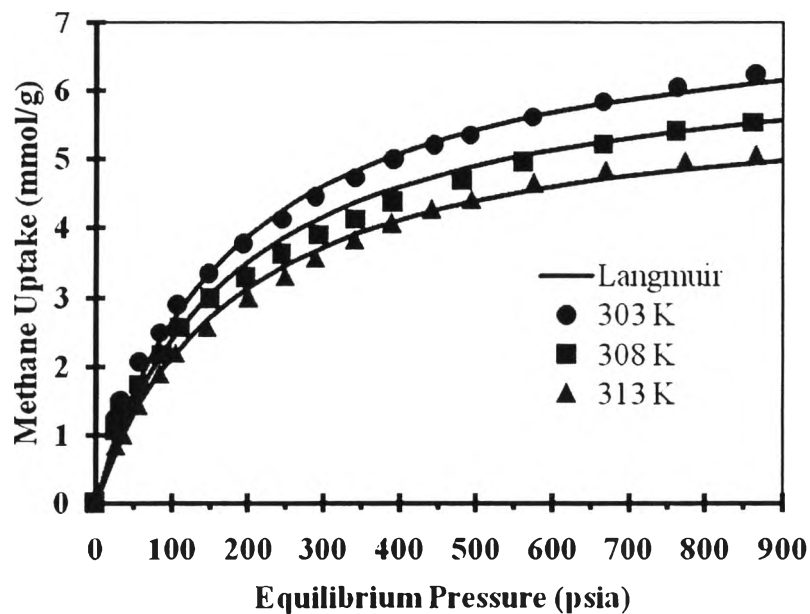
Figure B4 Methane adsorption on Eucalyptus Powder Activated Carbon. Symbols represent the experimental data while lines represent Langmuir isotherm model data.
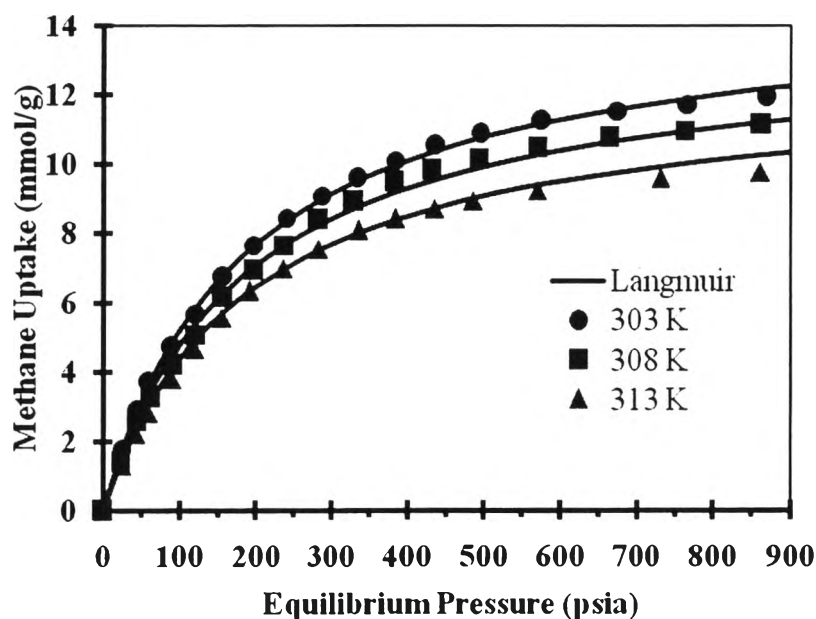
Figure B5 Methane adsorption on Basolite C300. Symbols represent the experimental data while lines represent Langmuir isotherm model data.
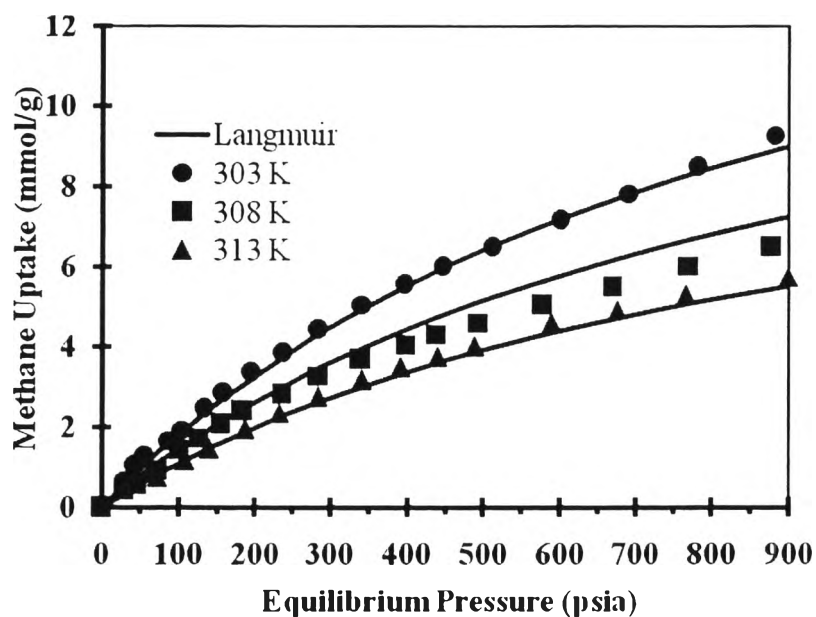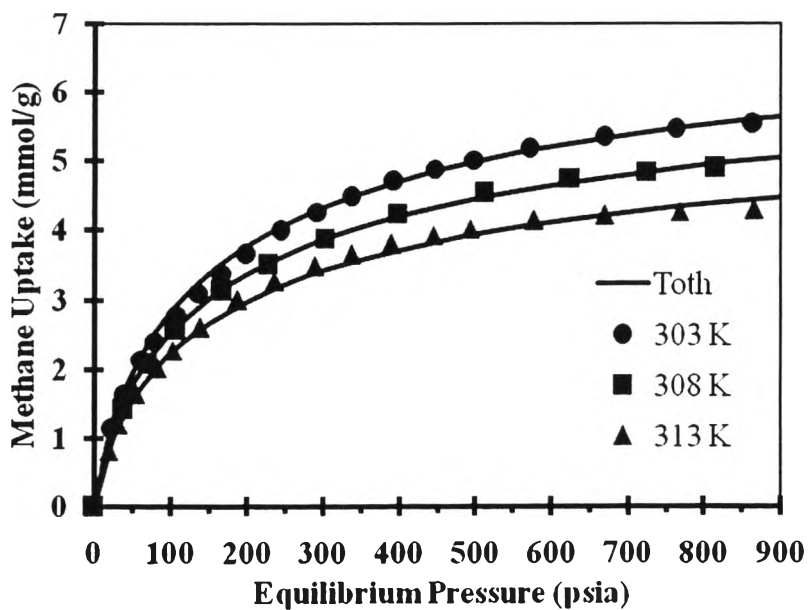
Figure B6   Methane adsorption on Basolite Z1200. Symbols represent the experimental data while lines represent Langmuir isotherm model data.
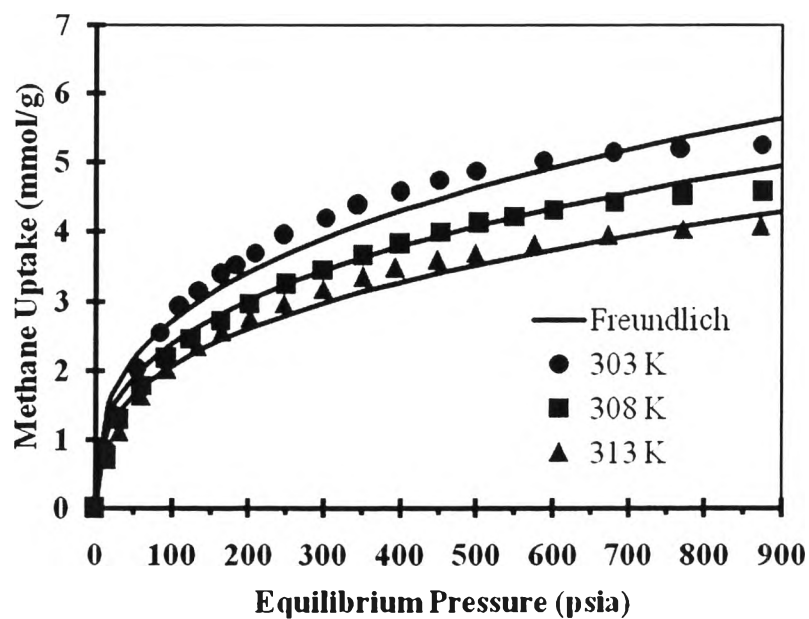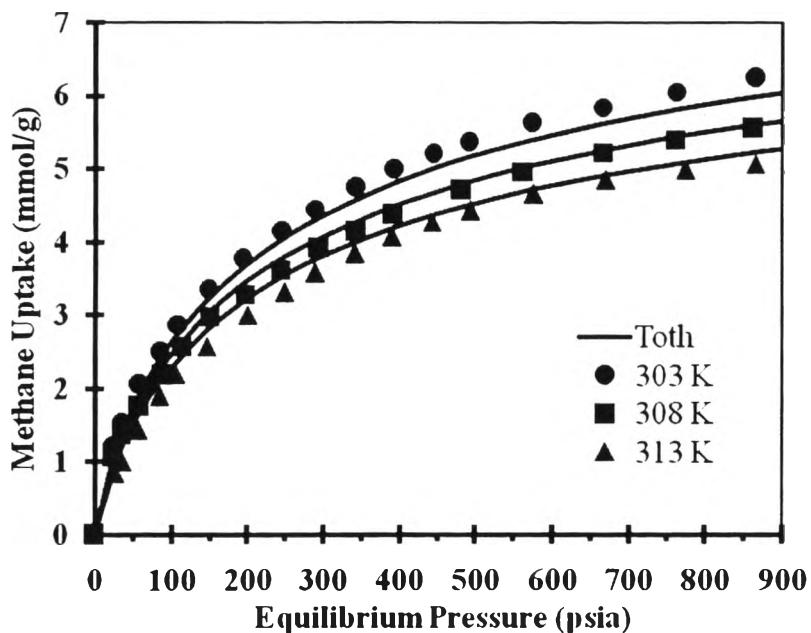

Figure B7   Methane adsorption on Coconut Shell Powder Activated Carbon. Symbols represent the experimental data while lines represent Freundlich isotherm model data.
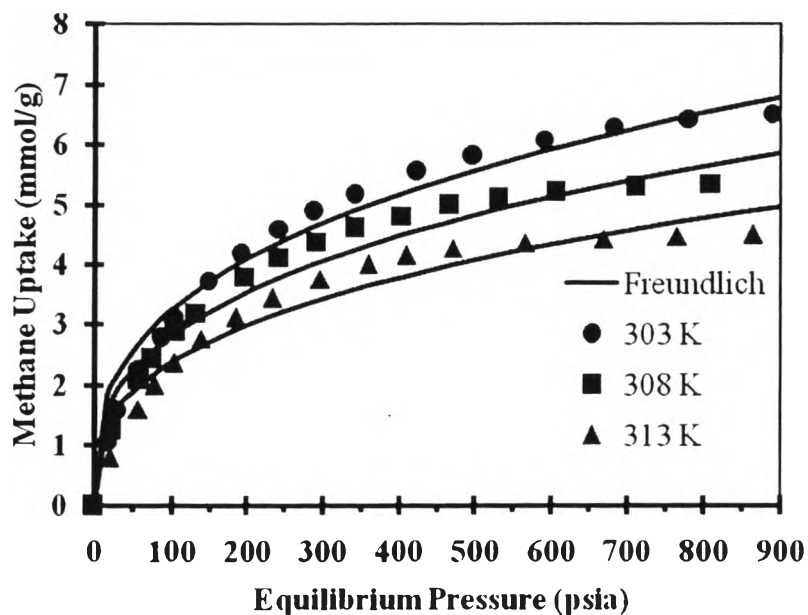
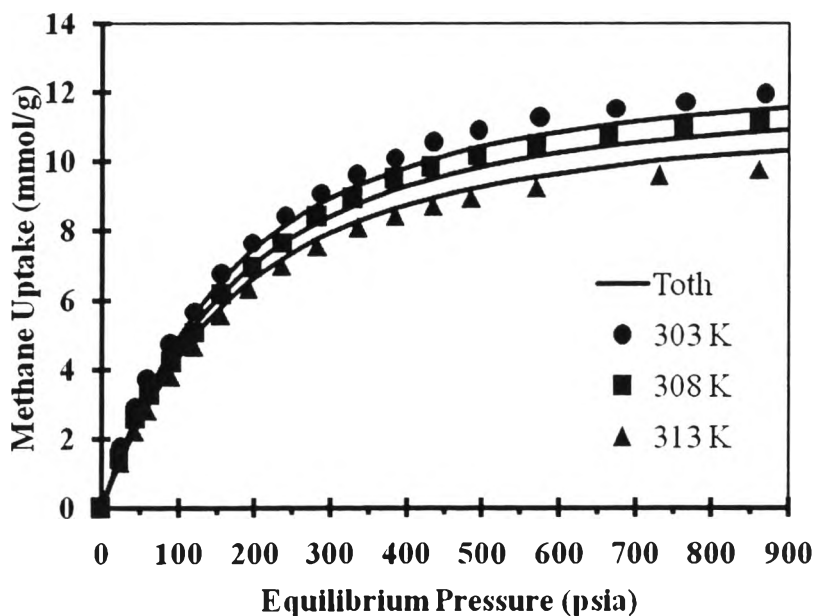**Figure B8** Methane adsorption on Coconut Shell Granular Activated Carbon. Symbols represent the experimental data while lines represent Freundlich isotherm model data.
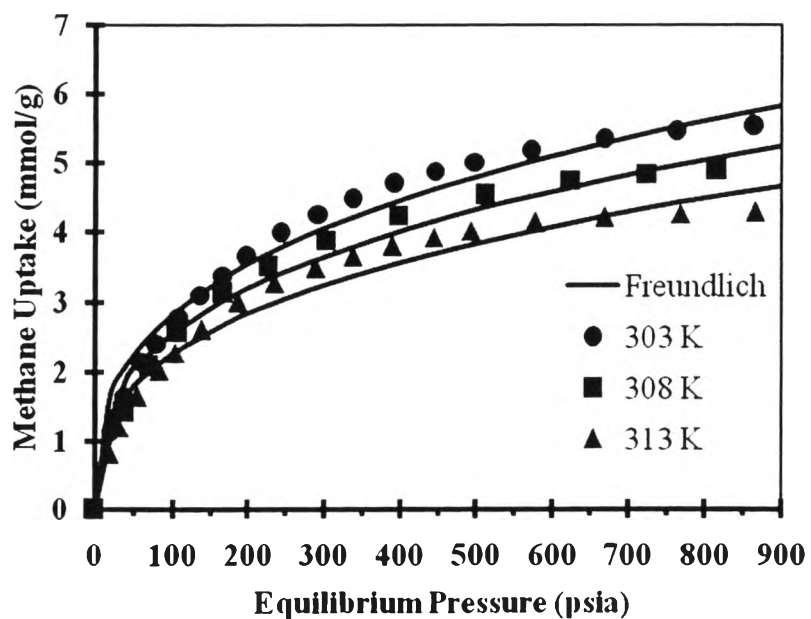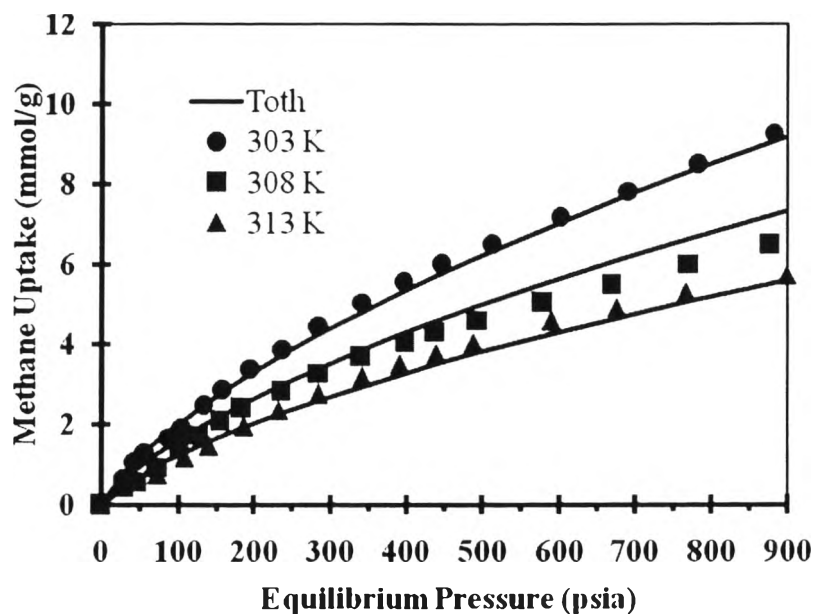

Figure B9 Methane adsorption on Calgon (20-40 meshes). Symbols represent the experimental data while lines represent Freundlich isotherm model data.
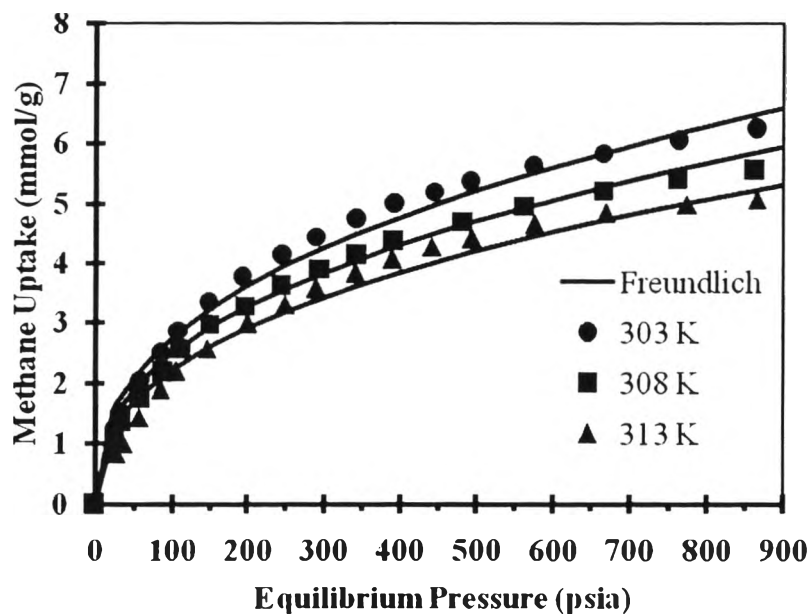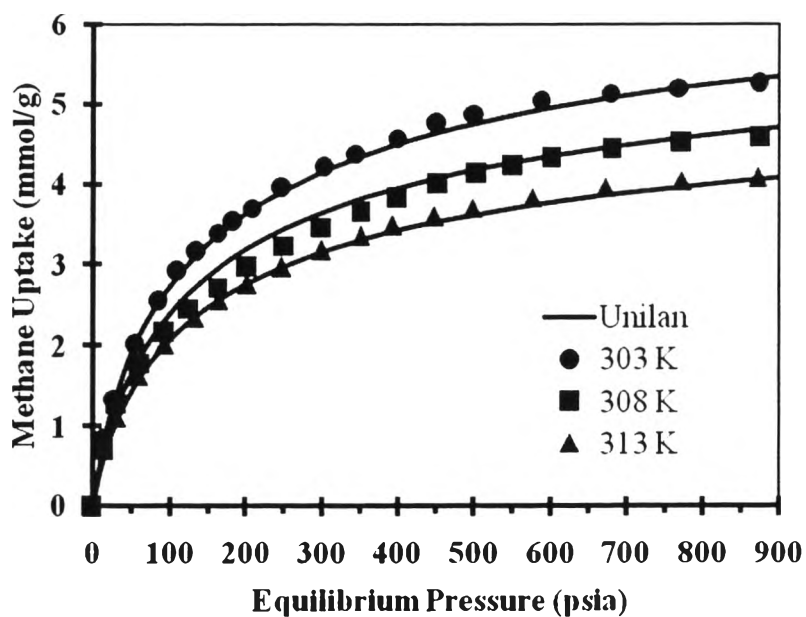
Figure B10 Methane adsorption on Eucalyptus Powder Activated Carbon. Symbols represent the experimental data while lines represent Freundlich isotherm model data.
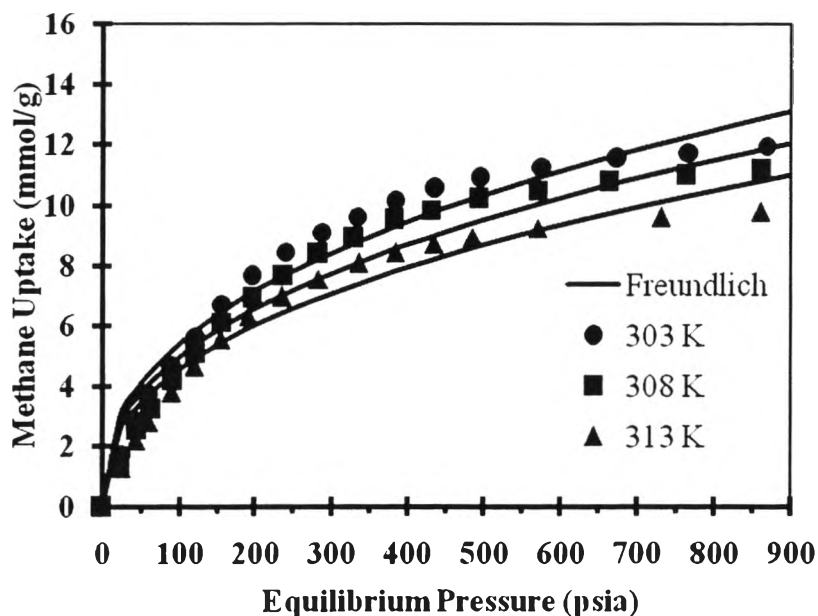
Figure B11 Methane adsorption on Basolite C300. Symbols represent the experimental data while lines represent Freundlich isotherm model data.
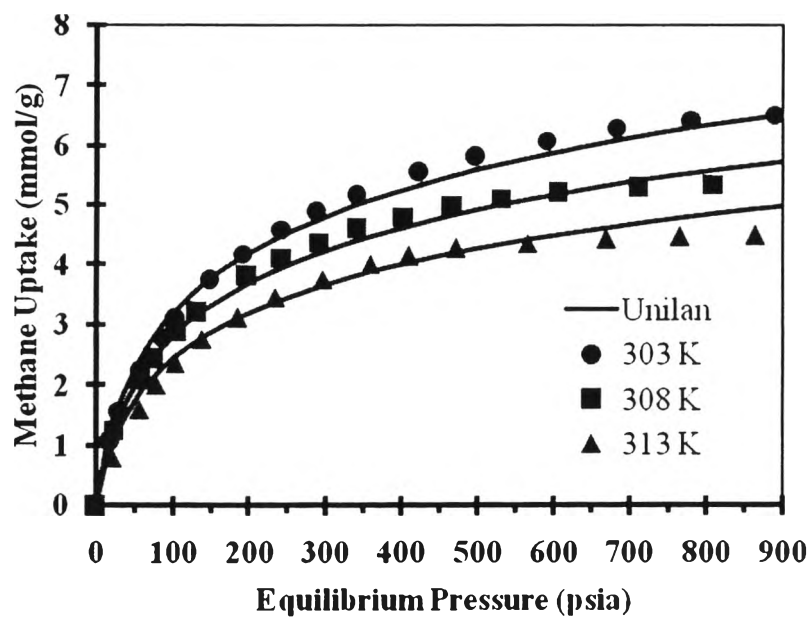
Figure B12   Methane adsorption on Basolite Z1200. Symbols represent the experimental data while lines represent Freundlich isotherm model data.

Figure B13   Methane adsorption on Coconut Shell Powder Activated Carbon. Symbols represent the experimental data while lines represent Toth isotherm model data.

Figure B14 Methane adsorption on Coconut Shell Granular Activated Carbon. Symbols represent the experimental data while lines represent Toth isotherm model data.

Figure B15 Methane adsorption on Calgon (20-40 meshes). Symbols represent the experimental data while lines represent Toth isotherm model data.

Figure B16 Methane adsorption on Eucalyptus Powder Activated Carbon. Symbols represent the experimental data while lines represent Toth isotherm model data.

Figure B17 Methane adsorption on Basolite C300. Symbols represent the experimental data while lines represent Toth isotherm model data.

Figure B18   Methane adsorption on Basolite Z1200. Symbols represent the experimental data while lines represent Toth isotherm model data.
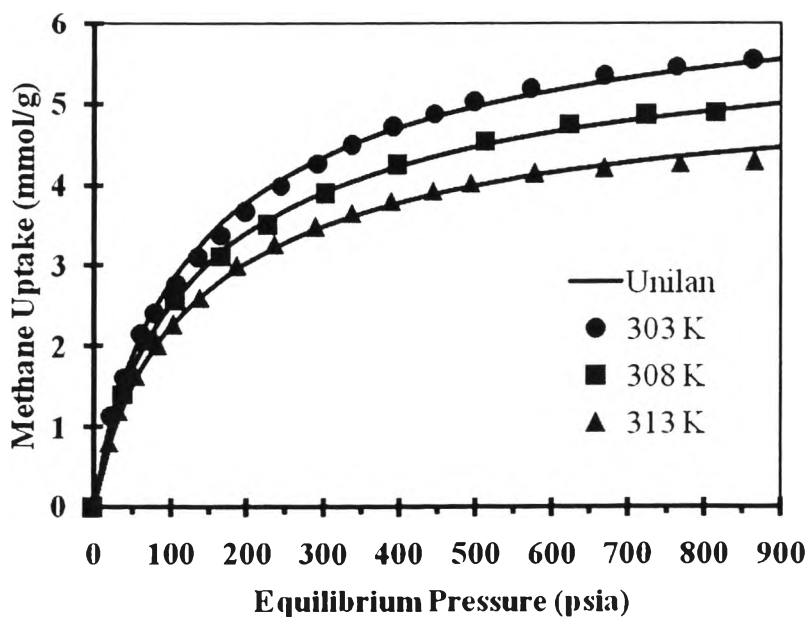

Figure B19   Methane adsorption on Coconut Shell Powder Activated Carbon. Symbols represent the experimental data while lines represent Unilan isotherm model data.
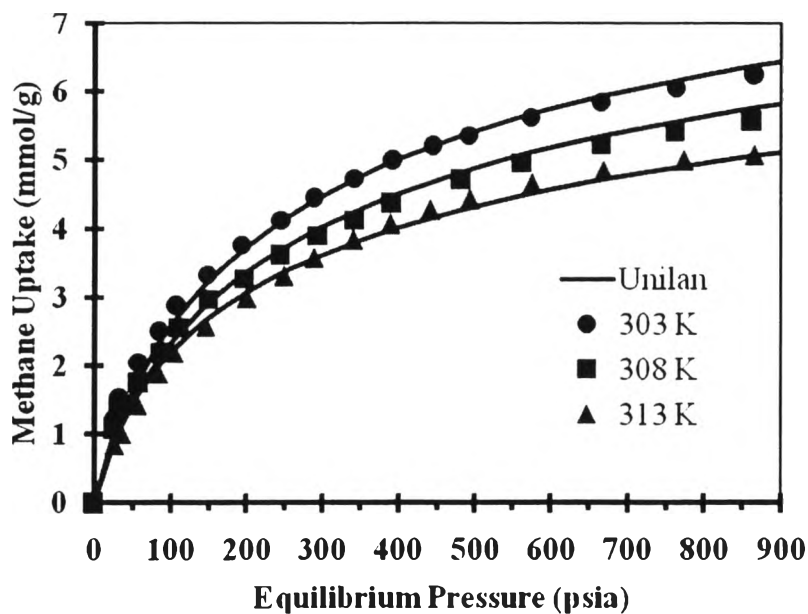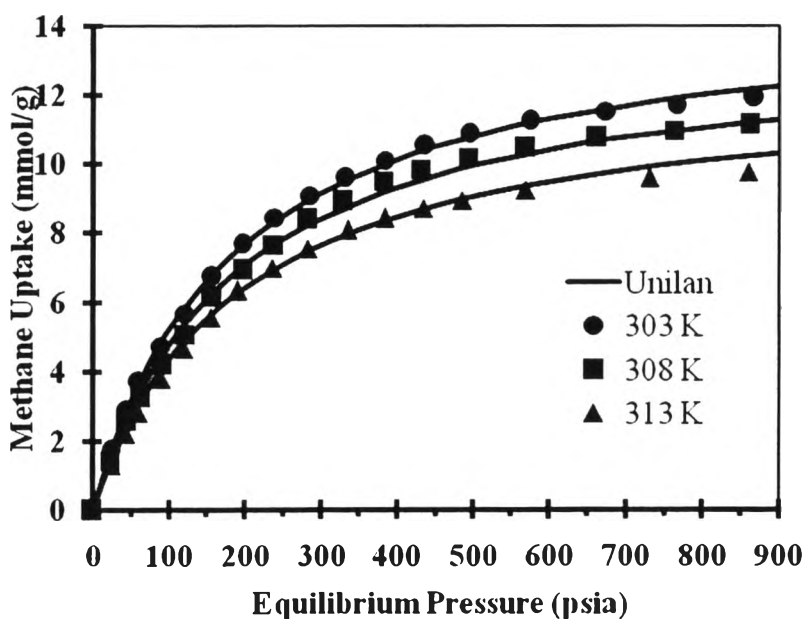
Figure B20   Methane adsorption on Coconut Shell Granular Activated Carbon. Symbols represent the experimental data while lines represent Unilan isotherm model data.
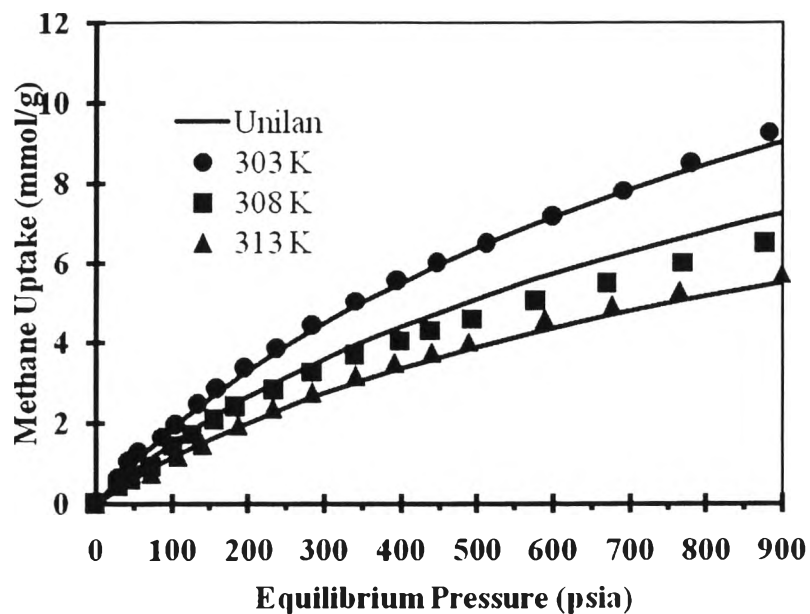

Figure B21   Methane adsorption on Calgon (20-40 meshes). Symbols represent the experimental data while lines represent Unilan isotherm model data.

Figure B22 Methane adsorption on Eucalyptus Powder Activated Carbon. Symbols represent the experimental data while lines represent Unilan isotherm model data.

Figure B23 Methane adsorption on Basolite C300. Symbols represent the experimental data while lines represent Unilan isotherm model data.

Figure B24 Methane adsorption on Basolite Z1200. Symbols represent the experimental data while lines represent Unilan isotherm model data.

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Presentations:

1. Kumpoomee, N.; Kitiyanan, B.; Rangsunvigit, P.; and Kulprathipanja, S. (2012, April 24) Comparative Study of Methane Adsorption on Metal Organic Frameworks and Activated Carbons. Poster presented at The 3th Research Symposium on Petroleum, Petrochemicals, and Advanced Materials and the 18th PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok Thailand.