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APPENDICES

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



APPENDIX A

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

**Table A-1 :** The condition reactions of all parameter for conversion of Polybutene-1 to liquid fuels on Fe/AC catalyst

BATCH NO.	CONDITION					PB-1 (g)	CAT. (g)	GAS		SOLID		OIL YIELD (%)
	TEMP (°C)	P (kg/cm <sup>2</sup> )	T (min)	CAT. (g)	%Fe (0.3 mm)			AMOUNT (g)	YIELD (%)	AMOUNT (g)	YIELD (%)	
1	410	20	60	0.3	5	15.0044	0.3062	1.03	6.86	2.1651	14.43	78.71
2	425	20	60	0.3	5	15.0141	0.3021	1.94	12.92	2.7269	18.16	68.92
3	375	30	60	0.3	5	15.0110	0.3028	0.60	4.00	1.6140	10.75	85.25
4	385	30	60	0.3	5	15.0190	0.3062	0.78	5.19	0.4117	2.74	92.07
5	385	30	60	-	-	15.0087	-	0.53	3.53	1.2058	8.03	88.44
6	385	30	60	0.45	5	15.0206	0.4500	0.88	5.86	0.9020	6.01	88.13
7	385	30	60	0.60	5	15.0867	0.6003	0.96	6.36	1.1031	7.32	86.32
8	395	30	60	0.3	5	15.0088	0.3026	0.86	5.73	0.5793	3.86	90.41
9	410	30	60	0.3	5	15.0080	0.3107	0.99	6.60	1.2232	8.15	85.25
10	425	30	60	0.3	5	15.0270	0.3044	3.00	19.95	2.5595	17.03	63.11
11	375	40	60	0.3	5	15.0144	0.3017	0.21	1.40	4.2610	28.38	70.22
12	385	40	60	0.3	5	15.0180	0.3044	0.41	2.73	0.6833	4.55	92.72
13	385	40	60	-	-	15.0096	-	0.41	2.73	2.3853	15.89	81.38

Table A-1 (Cont.)

BATCH NO.	CONDITION					PB-1 (g)	CAT. (g)	GAS		SOLID		OIL YIELD (%)
	TEMP (°C)	P (kg/cm <sup>2</sup> )	T (min)	CAT. (g)	%Fe (0.3 mm)			AMOUNT (g)	YIELD (%)	AMOUNT (g)	YIELD (%)	
14	385	40	60	0.45	5	15.0193	0.4505	0.94	6.26	1.4824	9.87	83.87
15	385	40	60	0.60	5	15.0303	0.6002	0.97	6.45	2.5306	16.84	76.71
16	395	40	60	0.3	5	15.0230	0.3004	0.49	3.26	1.0993	7.32	89.42
17	410	40	60	0.3	5	15.0080	0.3107	0.99	6.70	0.7100	4.73	88.57
18	410	40	60	0.3	5	15.0276	0.3016	1.11	7.39	1.0239	6.81	85.8
19	425	40	60	0.3	5	15.0380	0.3015	2.53	16.82	3.0005	19.95	63.23
20	410	50	60	0.3	5	15.0310	0.3036	1.13	7.50	1.5663	10.42	82.08
21	410	40	60	0.45	5	15.0047	0.4503	1.02	6.80	0.7295	4.86	88.34
22	410	40	60	0.45	5	15.0135	0.4503	0.86	5.73	0.7701	5.13	89.14
23	410	40	30	0.45	5	15.0410	0.4500	0.58	3.86	2.1405	14.23	81.91
24	410	40	90	0.45	5	15.0105	0.4500	3.18	21.19	2.9395	19.58	59.23
25	410	40	60	0.6	5	15.0139	0.6009	2.62	17.45	2.0570	13.70	68.85
26	410	40	60	-	-	15.0137	-	0.87	5.79	2.1574	14.36	79.84
27	410	40	30	0.3	5	15.0124	0.3000	1.07	7.13	1.475	9.83	83.05

Table A-1 (Cont.)

BATCH NO.	CONDITION					PB-1 (g)	CAT. (g)	GAS		SOLID		OIL YIELD (%)
	TEMP (°C)	P (kg/cm <sup>2</sup> )	T (min)	CAT. (g)	%Fe (0.3 mm)			AMOUNT(g)	YIELD (%)	AMOUNT (g)	YIELD (%)	
28	410	40	45	0.3	5	15.0144	0.3008	1.90	12.65	1.3754	9.16	76.18
29	410	40	75	0.3	5	15.0276	0.3016	1.11	7.39	0.9177	8.11	84.50
30	410	40	75	0.3	5	15.0081	0.3010	1.05	7.00	0.8907	5.93	85.05
31	410	40	90	0.3	5	15.0046	0.3000	3.61	24.06	4.0277	31.51	42.43
32	410	40	60	0.3	1	15.0100	0.3021	0.81	5.40	0.5605	3.73	91.00
33	410	40	60	0.3	10	15.0130	0.3016	1.16	7.73	0.8304	5.53	86.74
34	410	40	60	0.15	5	15.0041	0.1503	0.88	5.92	1.9475	12.98	81.10

**Table A-2:** The percentage of oil composition by GC Simulated Distillation.

BATCH NO.	Naphtha 65-200 °C	Kerosene 200-250 °C	Light Gas Oil 300-350 °C	Heavy Gas Oil 300-350 °C	Long Residues >350 °C
1	54.72	21.67	11.39	6.11	15.55
4	38.27	15.11	11.27	9.72	25.63
8	45.27	15.22	11.50	8.66	19.35
9	52.88	16.66	11.50	7.0	11.96
10	56.44	18.66	10.27	6.05	9.58
17	51.67	15.55	10.83	7.78	14.17
20	50.83	19.15	13.33	3.33	13.36
26	48.88	16.68	12.50	7.50	14.44
27	43.61	15.28	11.67	8.33	21.11
29	53.33	17.78	10.83	6.67	11.39
31	64.72	15.28	8.33	5.00	6.67
32	50.66	16.94	11.39	7.50	13.51

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย





Appendix B

ศูนย์วิจัยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

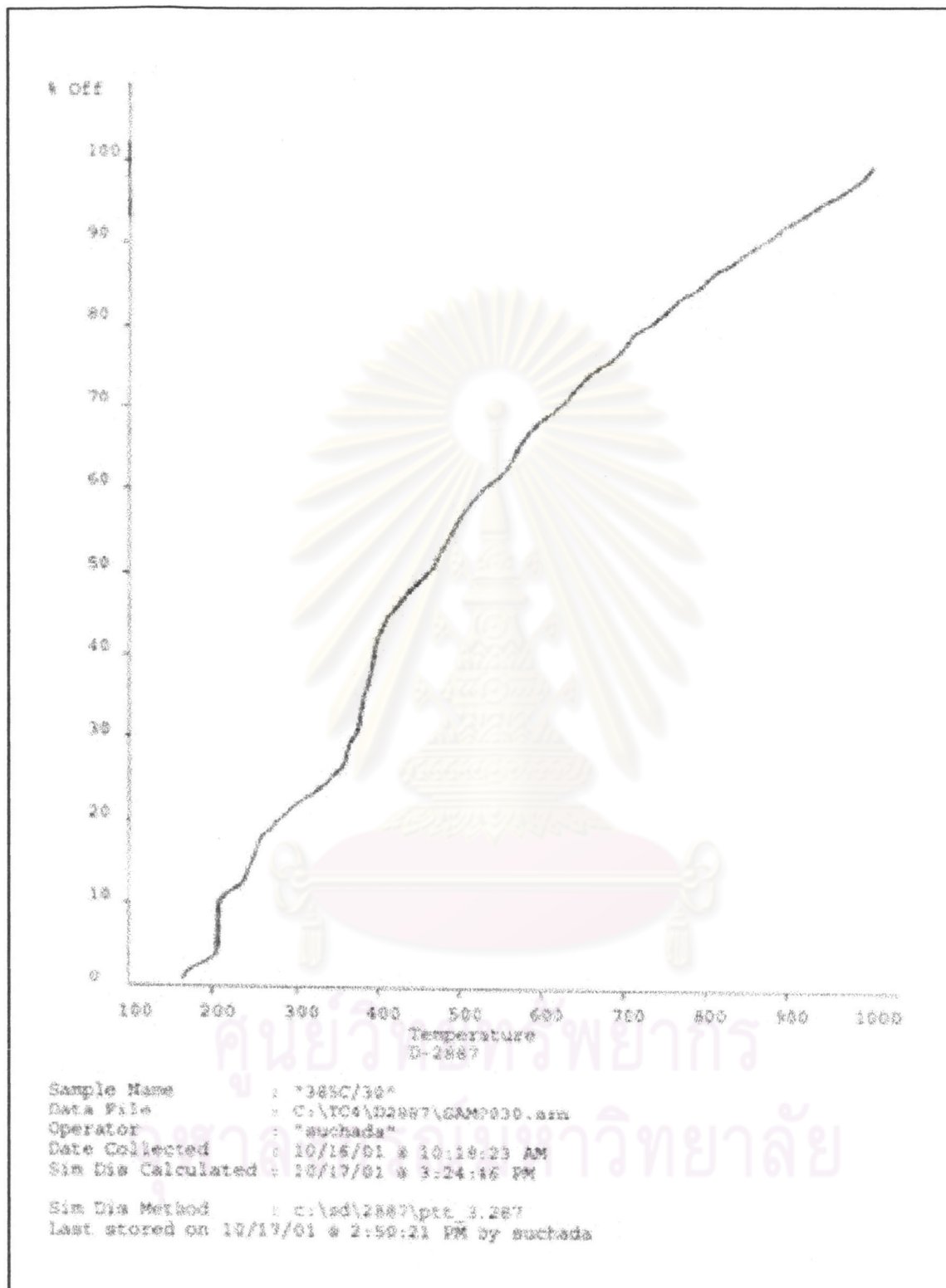


Figure B.1 Oil composition at condition 385 °C of reaction temperature, 30 kg/cm<sup>2</sup> of hydrogen, 60 min of reaction time and 0.3 g of 5% Fe/AC catalyst by GC Simulated Distillation.

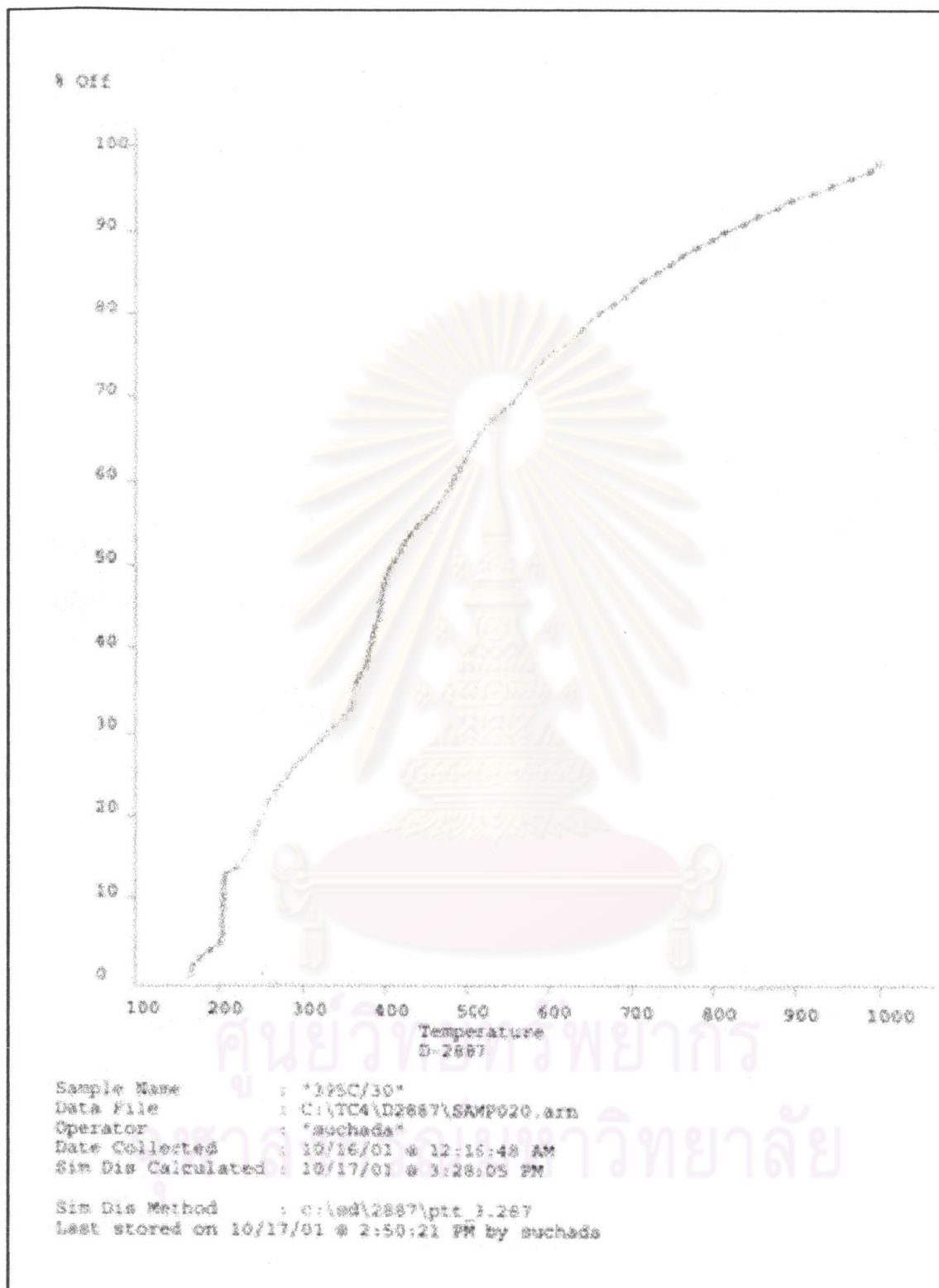


Figure B.2 Oil composition at condition 395 °C of reaction temperature, 30 kg/cm<sup>2</sup> of hydrogen, 60 min of reaction time and 0.3 g of 5% Fe/AC catalyst by GC Simulated Distillation.

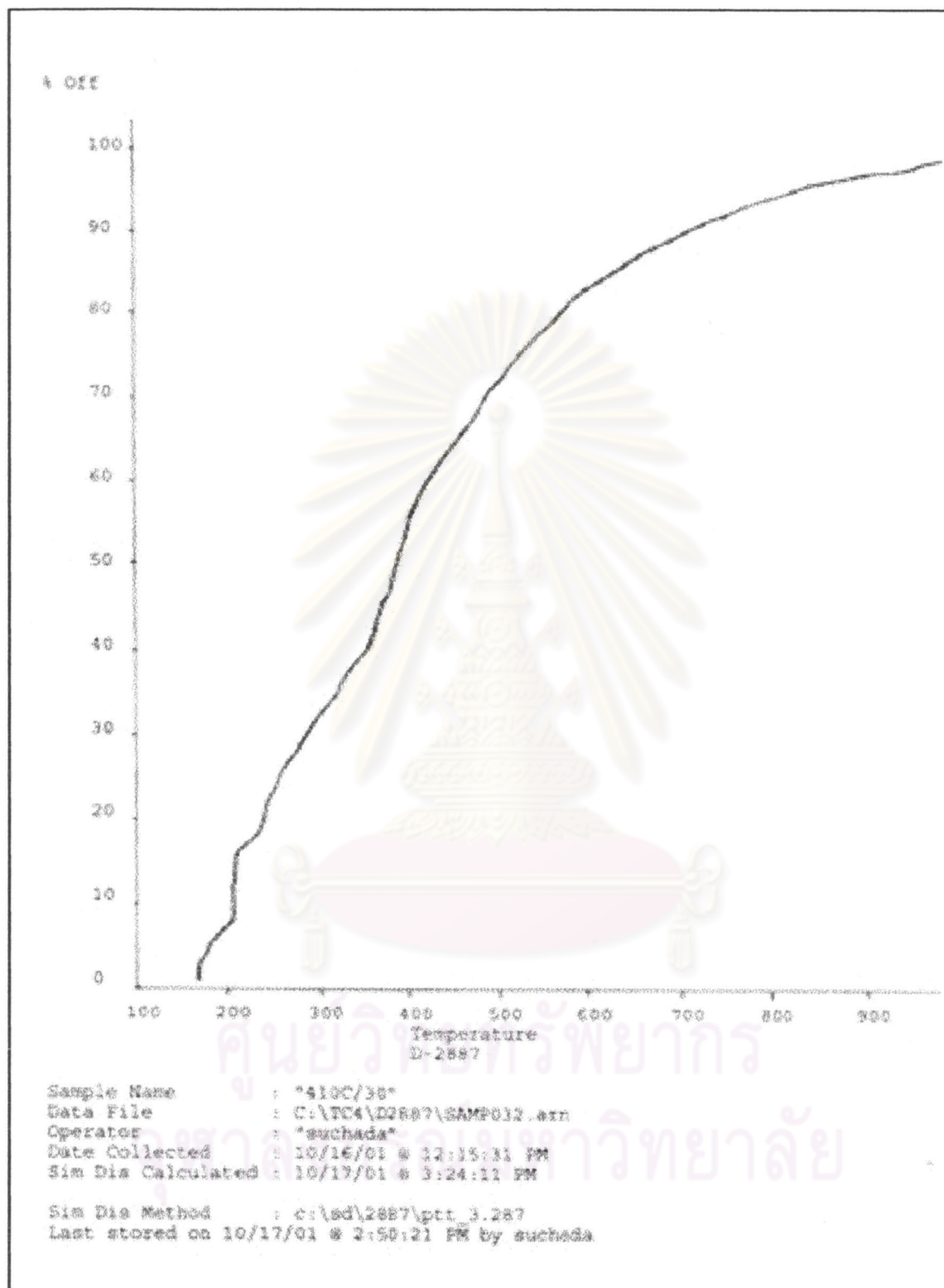


Figure B.3 Oil composition at condition 410 °C of reaction temperature, 30 kg/cm<sup>2</sup> of hydrogen, 60 min of reaction time and 0.3 g of 5% Fe/AC catalyst by GC Simulated Distillation.

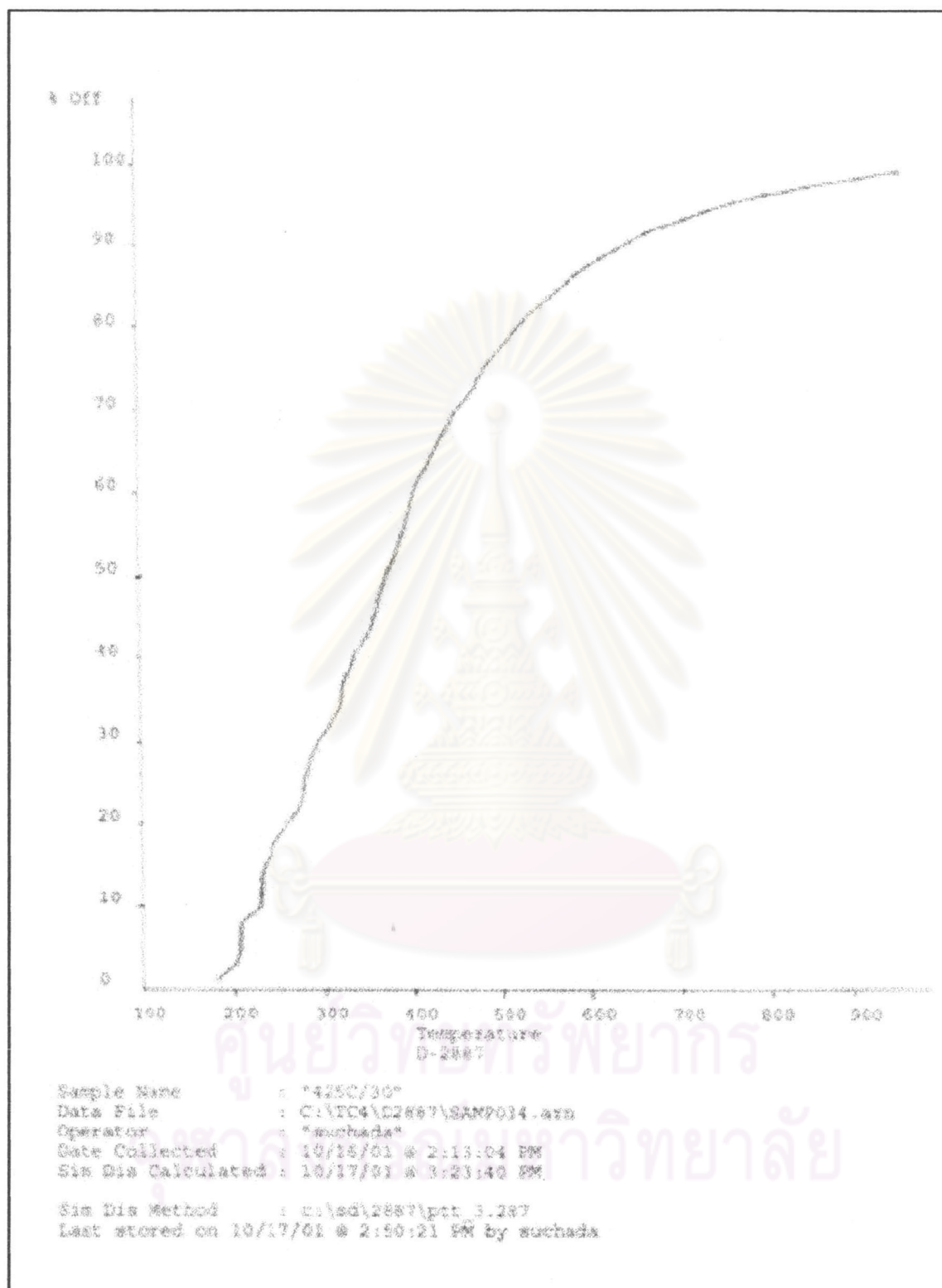


Figure B.4 Oil composition at condition 425 °C of reaction temperature, 30 kg/cm<sup>2</sup> of hydrogen, 60 min of reaction time and 0.3 g of 5% Fe/AC catalyst by GC Simulated Distillation.

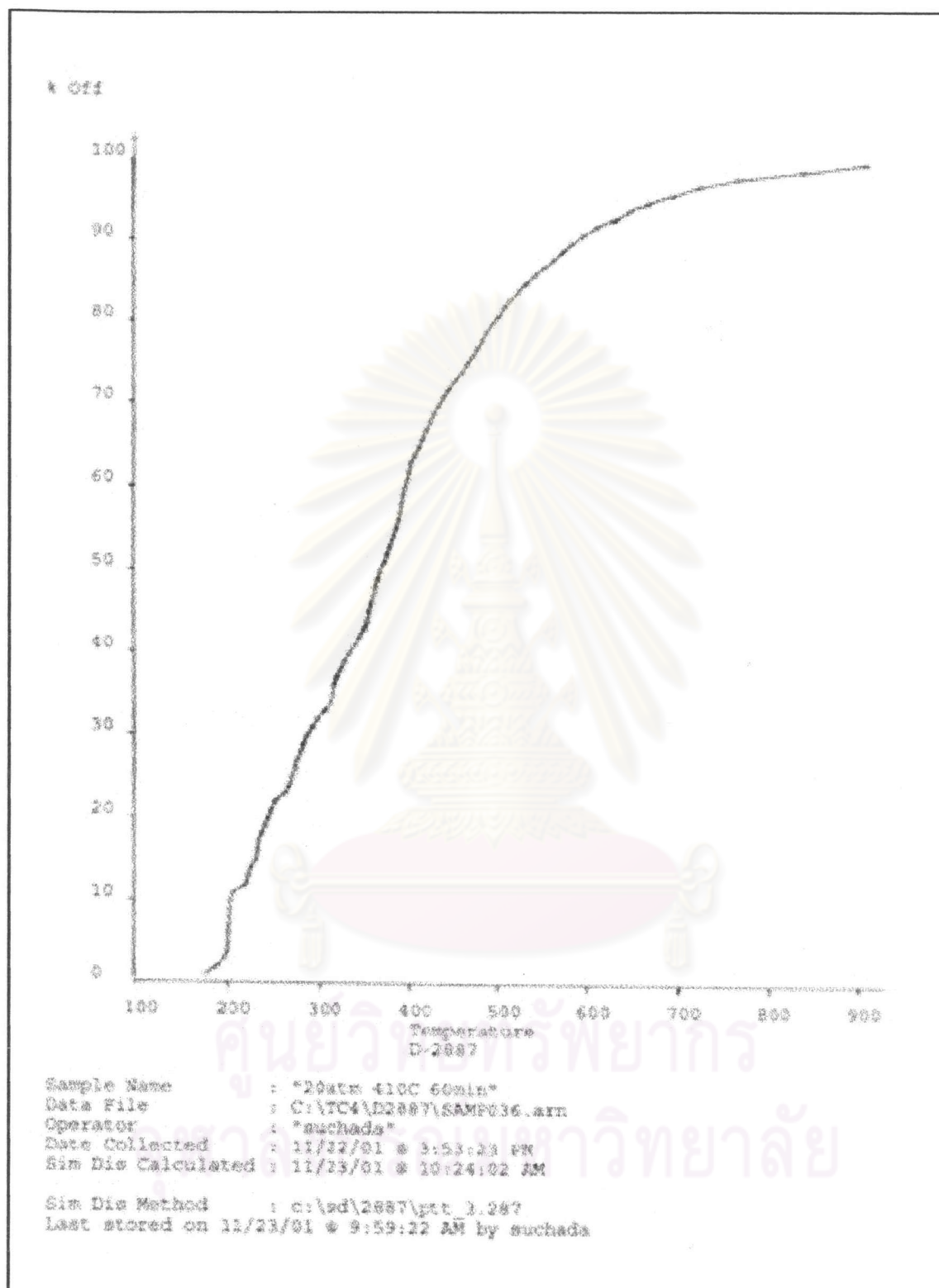


Figure B.5 Oil composition at condition 410 °C of reaction temperature, 20 kg/cm<sup>2</sup> of hydrogen, 60 min of reaction time and 0.3 g of 5% Fe/AC catalyst by GC Simulated Distillation.

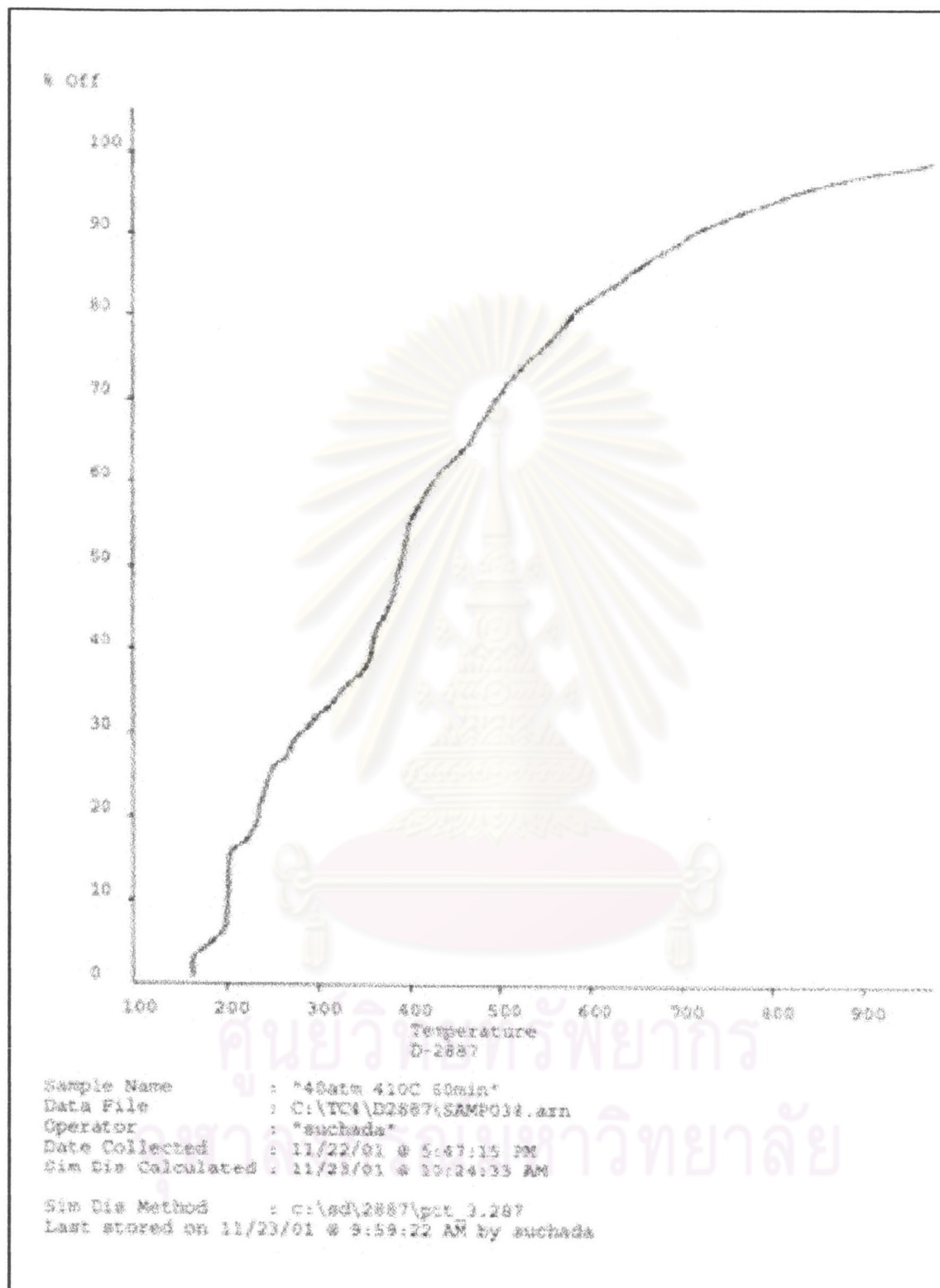
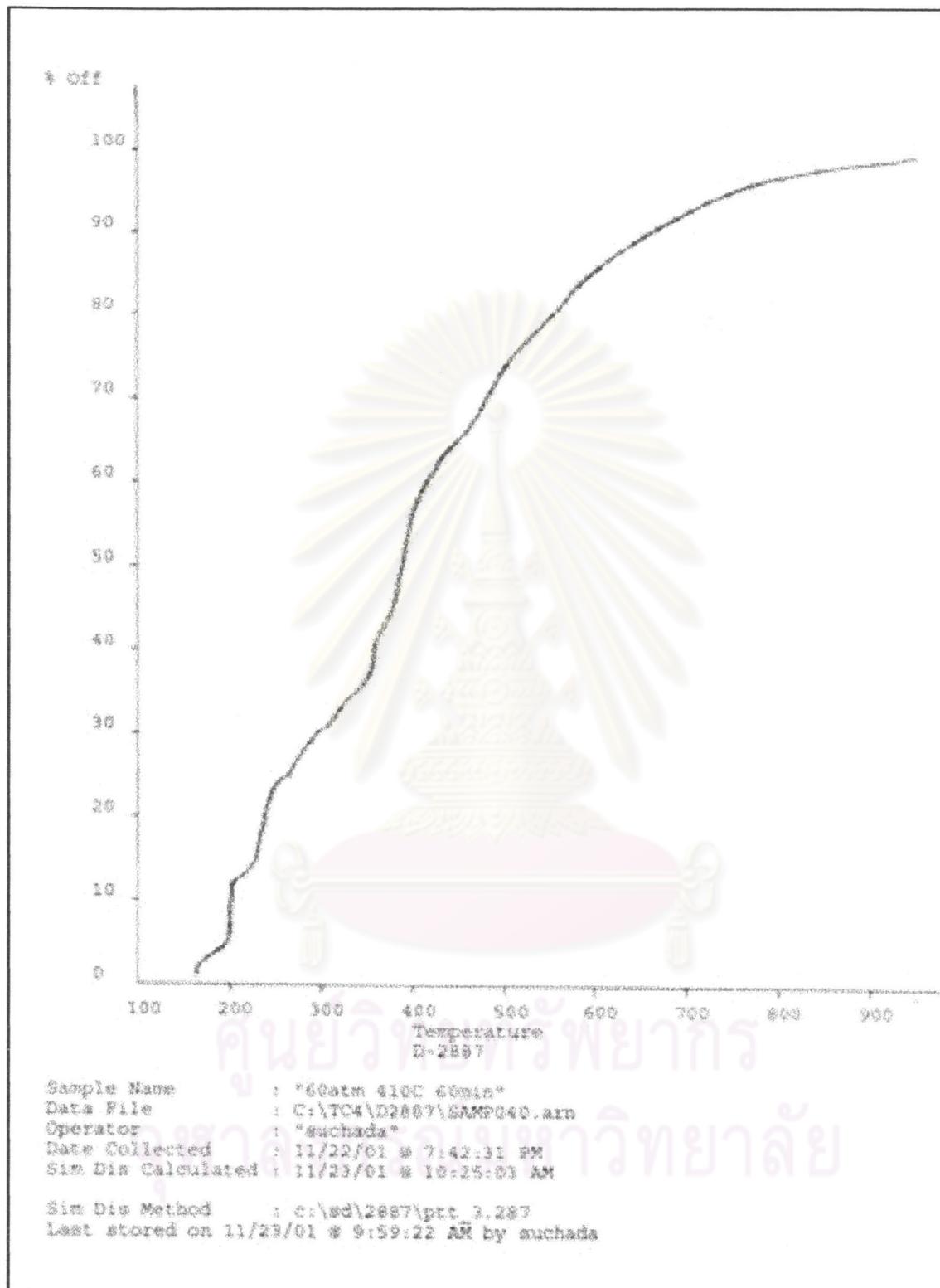
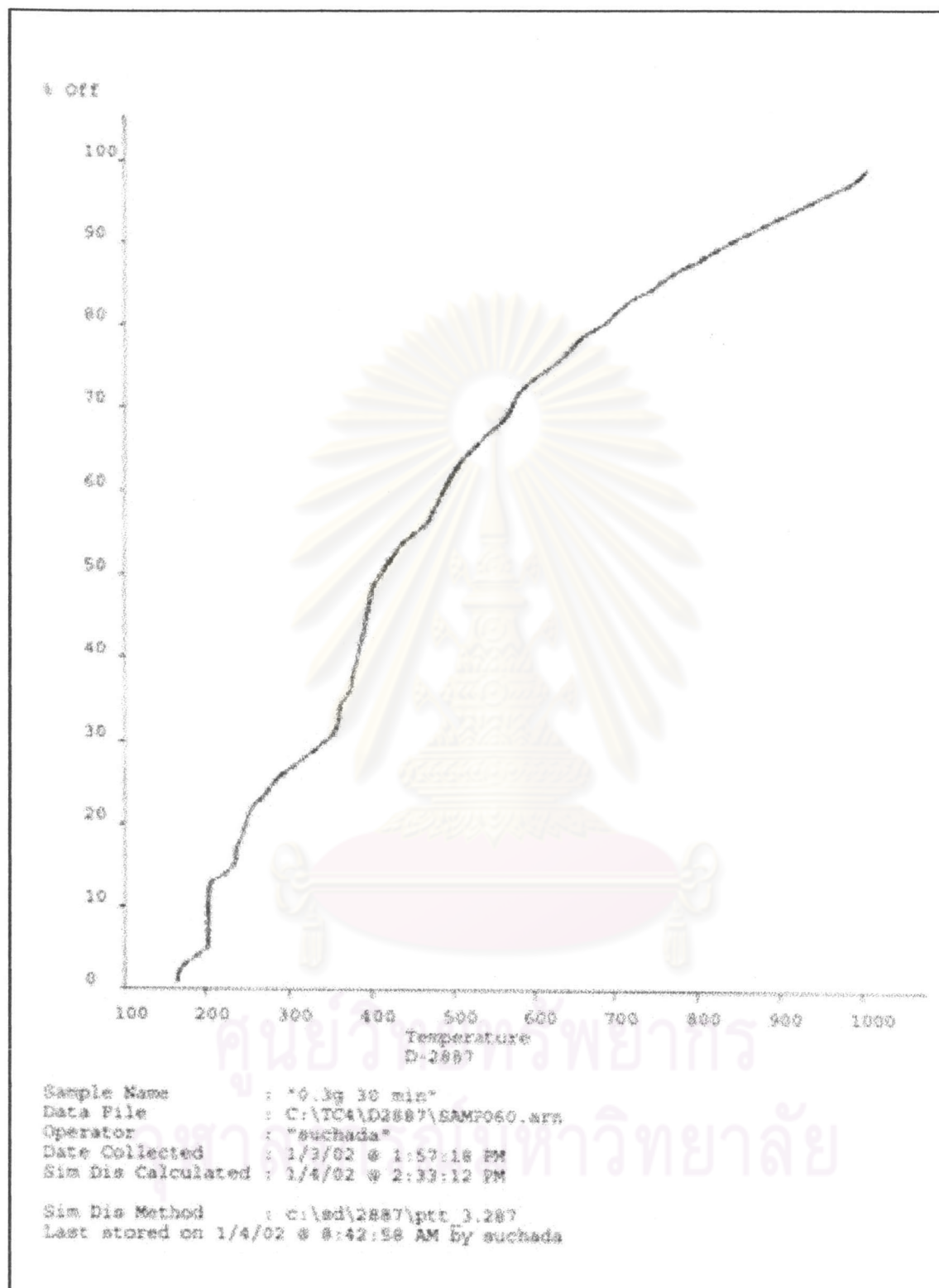


Figure B.6 Oil composition at condition 410 °C of reaction temperature, 40 kg/cm<sup>2</sup> of hydrogen, 60 min of reaction time and 0.3 g of 5% Fe/AC catalyst by GC Simulated Distillation.



**Figure B.7** Oil composition at condition 410 °C of reaction temperature, 50 kg/cm<sup>2</sup> of hydrogen, 60 min of reaction time and 0.3 g of 5% Fe/AC catalyst by GC Simulated Distillation.





**Figure B.8** Oil composition at condition 410 °C of reaction temperature, 40 kg/cm<sup>2</sup> of hydrogen, 30 min of reaction time and 0.3 g of 5% Fe/AC catalyst by GC Simulated Distillation.

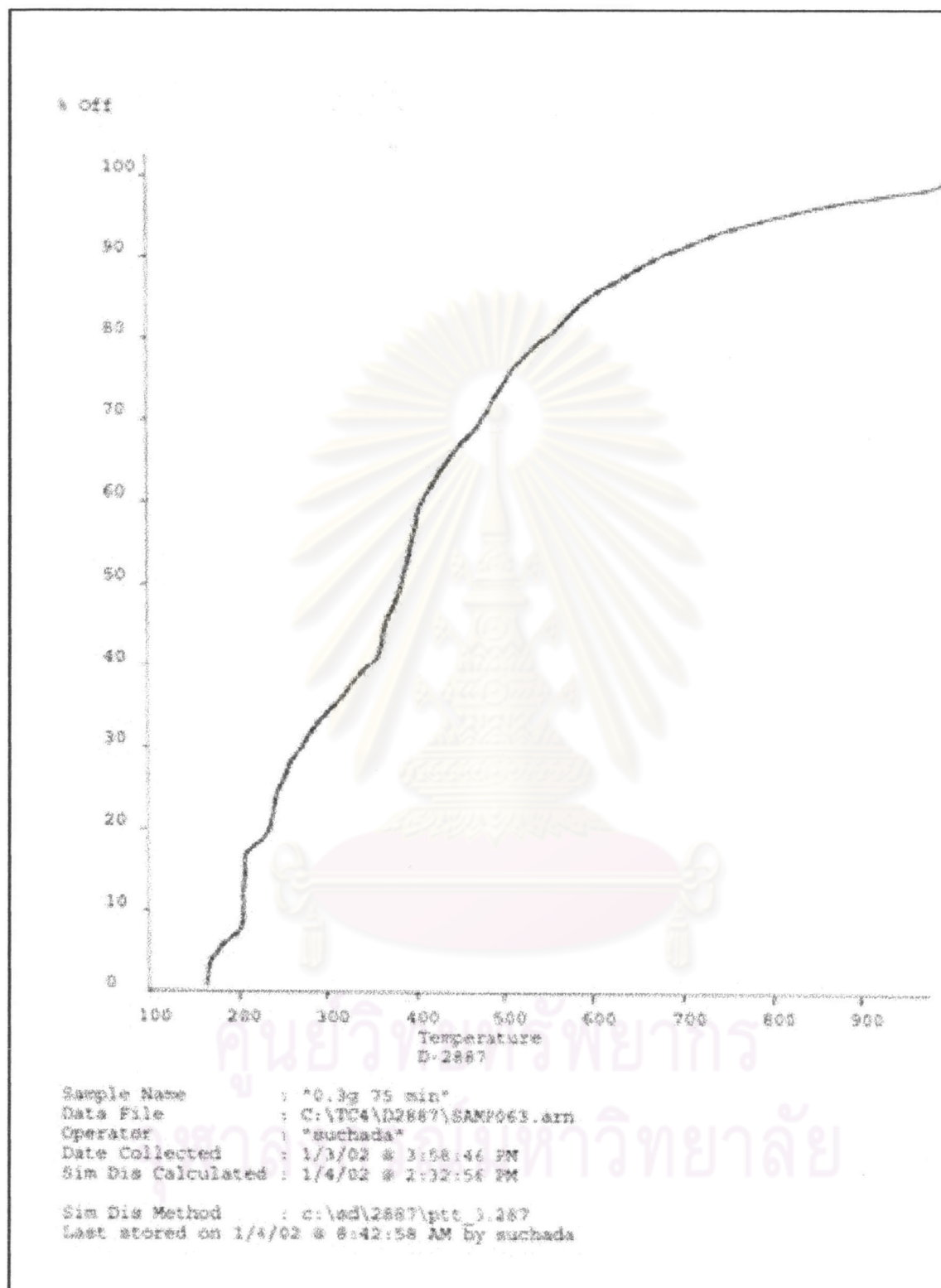


Figure B.9 Oil composition at condition 410 °C of reaction temperature, 40 kg/cm<sup>2</sup> of hydrogen, 75 min of reaction time and 0.3 g of 5% Fe/AC catalyst by GC Simulated Distillation.

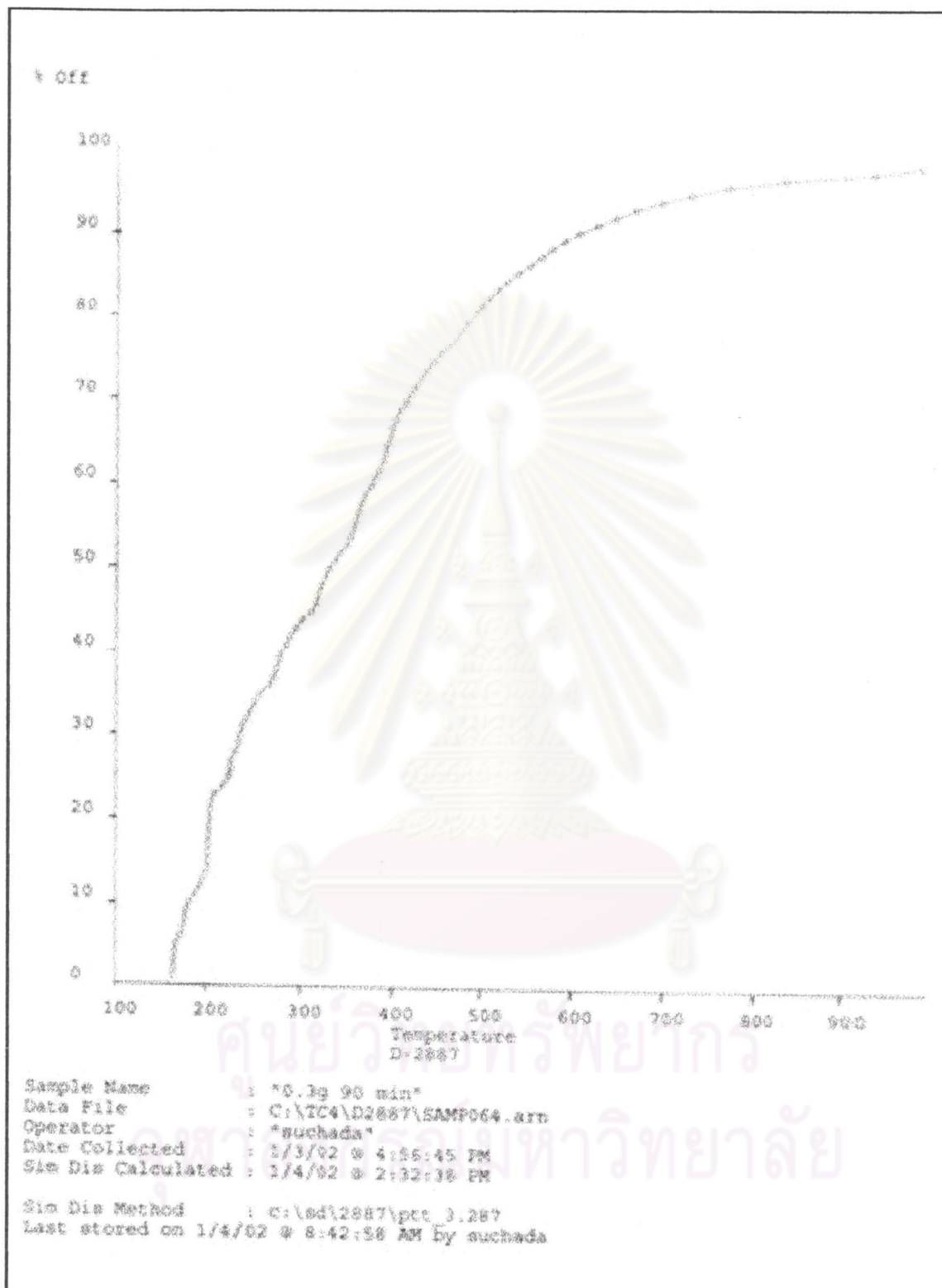


Figure B.10 Oil composition at condition 410 °C of reaction temperature, 40 kg/cm<sup>2</sup> of hydrogen, 90 min of reaction time and 0.3 g of 5% Fe/AC catalyst by GC Simulated Distillation.

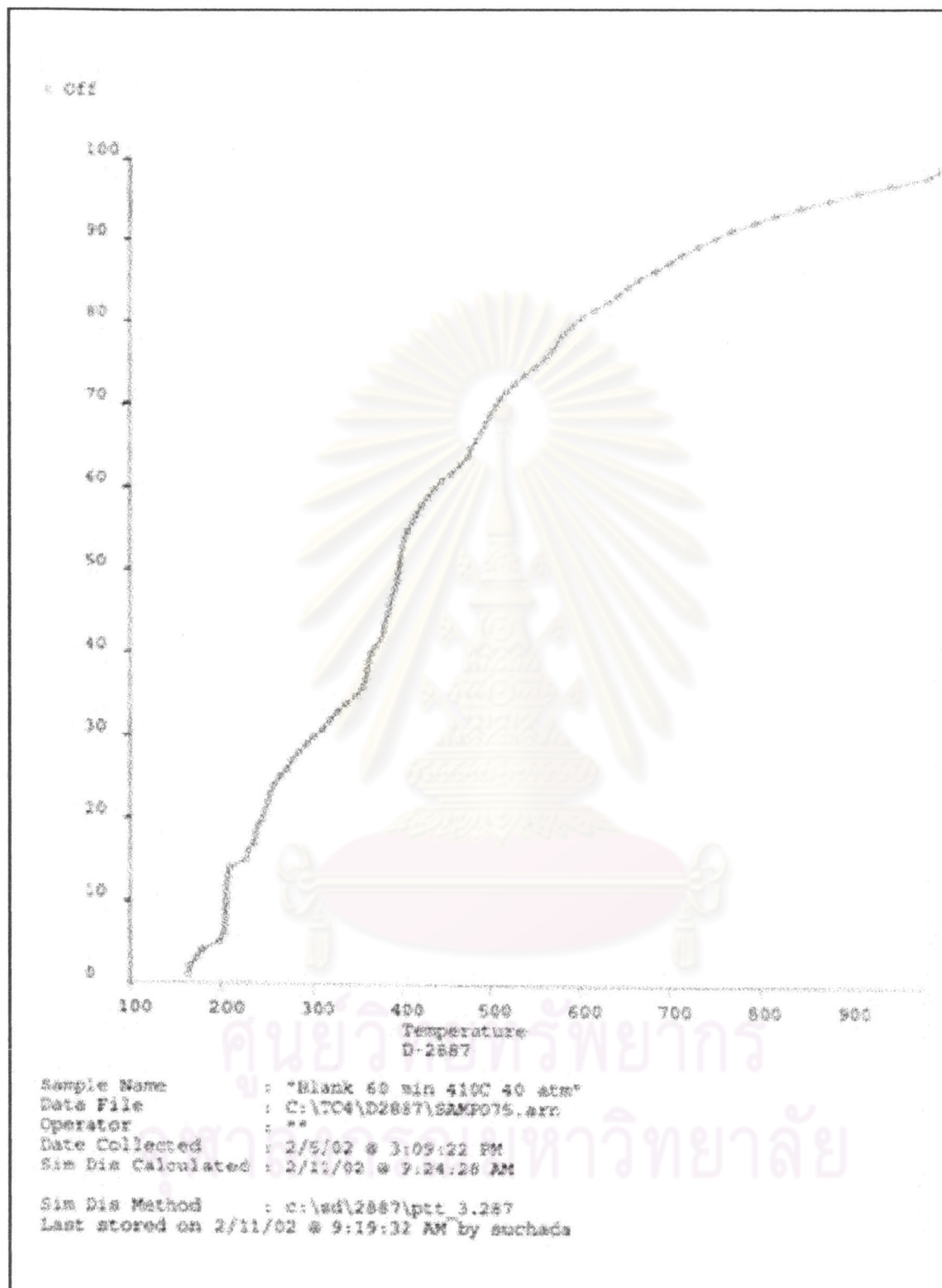
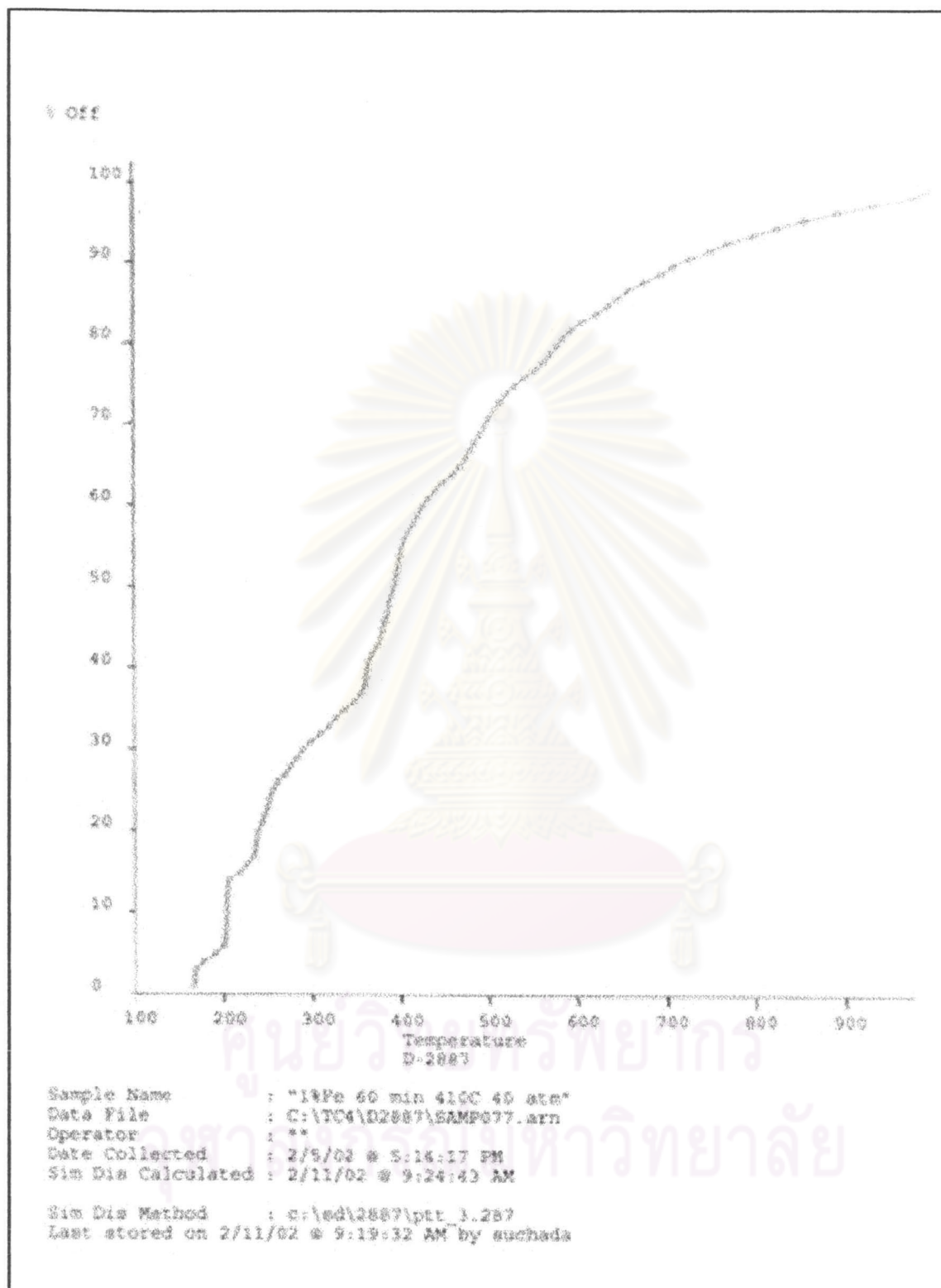


Figure B.11 Oil composition at condition 410 °C of reaction temperature, 40 kg/cm<sup>2</sup> of hydrogen, 60 min of reaction time and no catalyst by GC Simulated Distillation.



**Figure B.12** Oil composition at condition 410 °C of reaction temperature, 40 kg/cm<sup>2</sup> of hydrogen, 60 min of reaction time and 0.3 g of 1% Fe/AC catalyst by GC Simulated Distillation.



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## CERTIFICATE OF ANALYSIS

CERT NO. : 149244 (PAGE 1/2) REF NO. : 561/44

SAMPLE NAME : C5C/39 SAMPLING DATE : .....

SAMPLE TYPE : (G) SAMPLING CONDITION : Good

SAMPLE ID. : FJ17044 SAMPLE LOCATION : .....

RECEIVED DATE : 12/20/44 ANALYSIS DATE : 12/20/44 - 12/20/44

SAMPLE FROM : Chulalongkorn University

Test Item	Method	Unit	Result
Boiling Range Distribution	ASTM D2007-99 (Modified Method)	%	
% Recovered			
BHP			176
5			257
10			223
15			254
20			259
25			286
30			292
35			320
40			334
45			357
50			370
55			380
60			401

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**CERTIFICATE OF ANALYSIS**

CERT NO. : 2637544 Page: 2/21

Test Item	Method	Unit	Result
% Recovered (Cont.)			
65			423
70			449
75			482
80			517
85			564
90			632
95			723
FBP			948

**REMARK :** IBP (Initial Boiling Point) - the temperature at which a cumulative corrected mass would equal to 0.5% of the total sample mass

FBP (Final Boiling Point) - the temperature at which a cumulative corrected mass would equal to 99.5% of the total sample mass

APPROVED BY :   
 (Mr. Chaiyos Tonkarakorn)  
 POSITION : Senior Researcher  
 DATE OF ISSUE : 24 / 10 / 10

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CERTIFICATE OF ANALYSIS

CERT NO. : 3432544 (PAGE 1/2) REF NO. : 201744  
 SAMPLE NAME : 410C02 SAMPLING DATE :             
 SAMPLE TYPE : Oil SAMPLING CONDITION : Crude  
 SAMPLE ID : FU11944 SAMPLE LOCATION :             
 RECEIVED DATE : 12/10/44 ANALYSIS DATE : 12/10/44 - 16/10/44  
 SAMPLE FROM : Chulalongkorn University

Test Item	Method	Unit	Result
Distilling Range Distribution	ASTM D2007-93 (Modified Method)	T	
% Recovered			
IBP			156
5			180
10			202
15			206
20			240
25			256
30			283
35			316
40			350
45			367
50			385
55			396
60			415

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CERTIFICATE OF ANALYSIS

CERT NO. : MS2244 [Page 2/2]

Test Item	Method	Unit	Result
% Recovered (Cont.)			
65			453
70			484
75			517
80			564
85			618
90			694
95			804
FBP			989

**REMARK :** IBP (Initial Boiling Point) - the temperature at which a cumulative corrected area count equal to 0.5% of the total sample area

FBP (Final Boiling Point) - the temperature at which a cumulative corrected area count equal to 99.5% of the total sample area

APPROVED BY : *C. Jom*  
(Mr. Chaiwee Tonkasakorn)

POSITION : Senior Researcher

DATE OF ISSUE : 24 / 10 / 01

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**CERTIFICATE OF ANALYSIS**

CERT NO. : 3622344 PAGE 1/21 REF NO. : 25104

SAMPLE NAME : 335C33 SAMPLING DATE : \_\_\_\_\_

SAMPLE TYPE : CU SAMPLING CONDITION : Liquid

SAMPLE ID : 2111944 SAMPLING LOCATION : \_\_\_\_\_

RECEIVED DATE : 11/10/44 ANALYSIS DATE : 11/10/44 - 11/10/44

SAMPLE FROM : Chalabongkorn University

Test Item	Method	Unit	Result
Boiling Range Distribution	ASTM D2837-91 (Modified Method)	%	
% Recovered			
100			100
5			100
10			100
15			100
20			100
25			100
30			100
35			100
40			100
45			100
50			100
55			100
60			100

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CERTIFICATE OF ANALYSIS

CERT NO. 26202584 Page 2/2

Test Item	Method	Unit	Result
% Recovered (Casid)			
65			510
70			259
75			404
80			652
85			716
90			799
95			804
TSP			1001

**REMARK :** IRP (Initial Boiling Point) - the temperature at which a cumulative recovered area percent equal to 0.1% of the total sample area

FBP (Final Boiling Point) - the temperature at which a cumulative recovered area percent equal to 99.9% of the total sample area

APPROVED BY :   
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 POSITION : Senior Researcher  
 DATE OF ISSUE : 24 / 12 / 63

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CERTIFICATE OF ANALYSIS

CERT NO. : 76022446 (PAGE 1/1) REF NO. : 588141  
 SAMPLE NAME : 205C00 SAMPLING DATE :  
 SAMPLE TYPE : Oil SAMPLING CONDITION : Good  
 SAMPLE ID : F111744 SAMPLE LOCATION :  
 RECEIVED DATE : 13/02/01 ANALYSIS DATE : 13/02/01 - 16/02/01  
 SAMPLE FROM : Chulalongkorn University

Test Item	Method	Unit	Result
Boiling Range Distribution	ASTM D2887-93 (Modified Method)	%	
% Recovered			
BP			167
5			206
10			206
15			248
20			278
25			340
30			370
35			386
40			397
45			417
50			453
55			494
60			528

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CERTIFICATE OF ANALYSIS

CERT NO. : 26112244 [Page 1/2]

Test Item	Method	Unit	Result
% Recovered (Cont.)			
65			974
70			620
75			668
80			728
85			794
90			859
95			935
FBP			100%

**REMARK :** IBP (Initial Boiling Point) - the temperature at which a cumulative corrected area count equal to 0.5% of the total sample area

FBP (Final Boiling Point) - the temperature at which a cumulative corrected area count equal to 99.5% of the total sample area

APPROVED BY :   
(Mr. Chaler Tanakanorn)

POSITION : Senior Researcher

DATE OF ISSUE : 24 / 10 / 01

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Analytical and Petrochemical Research Department

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## CERTIFICATE OF ANALYSIS

CERT NO. : 4120244 (PAGE 01) REF NO. : 70844  
 SAMPLE NAME : 0.3 g. 40.000, 21.000 SAMPLING DATE :  
 SAMPLE TYPE : 00 SAMPLING CONDITION : Good  
 SAMPLE ID. : P114244 SAMPLE LOCATION :  
 RECEIVED DATE : 27/12/44 ANALYSIS DATE : 28/01/45  
 SAMPLE FROM : Chulalongkorn University

Test Item	Method	Unit	Result
Boiling Range Distribution	ASTM D2887-93 (Modified Method)	%	
% Recovered			
ISP			164
5			178
10			204
15			206
20			217
25			261
30			271
35			306
40			246
45			162
50			284
55			198
60			405

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 RESULTS IN ANY FUTURE. FACTS IN FULL. THIS CERTIFICATE SHALL NOT BE REPRODUCED WITHOUT THE WRITTEN  
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**CERTIFICATE OF ANALYSIS**

CERT NO. : 38/12544 (Page 2/2)

Test Item	Method	Unit	Result
% Recovered (Coast)			
65			834
70			620
75			608
80			728
85			793
90			858
95			935
FBP			1000

**REMARK :** IBP (Initial Boiling Point) - the temperature at which a cumulative corrected area count equal to 0.5% of the total sample area

FBP (Final Boiling Point) - the temperature at which a cumulative corrected area count equal to 99.5% of the total sample area

APPROVED BY :   
 (Mr. Chitree Intakarnkorn)  
 POSITION : Senior Researcher  
 DATE OF ISSUE : 26 / 10 / 01

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**CERTIFICATE OF ANALYSIS**

CERT NO. : 4322144 (PAGE 07) REF NO. : 70844  
 SAMPLE NAME : 0.1 g, 40 min, 75 min SAMPLING DATE :  
 SAMPLE TYPE : 500 SAMPLING CONDITIONS : 0200  
 SAMPLE ID. : P114244 SAMPLE LOCATION :  
 RECEIVED DATE : 27/12/84 ANALYSIS DATE : 28/01/85  
 SAMPLE FROM : Chalabongkorn University

Test Item	Method	Unit	Result
Boiling Range Distribution	ASTM D2887-93 (Modified Method)	%	
% Recovered			
10P			164
5			176
10			204
15			206
20			237
25			263
30			272
35			305
40			348
45			363
50			384
55			395
60			405

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CERTIFICATE OF ANALYSIS

CERT NO. : 4302244 (Page 2/2)

Test Item	Method	Unit	Result
% Recovered (Cont.)			
65			433
70			473
75			507
80			543
85			580
90			623
95			770
FBP			988

**REMARK :** 100° (Initial Boiling Point) - the temperature at which a cumulative corrected area count equal to 0.5% of the total sample area

FBP (Final Boiling Point) - the temperature at which a cumulative corrected area count equal to 99.5% of the total sample area

APPROVED BY :

(Mr. Chutree Youkankorn)

POSITION :

Senior Researcher

DATE OF ISSUE :

02/07/255

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**CERTIFICATE OF ANALYSIS**

CERT NO. : 111522-04 PAGE 1/1 REF NO. : 79744  
 SAMPLE NAME : G.L.P., 40.000, 10.000 SAMPLING DATE :  
 SAMPLE TYPE : GSI SAMPLING CONDITION : Cond  
 SAMPLE ID. : FA/14144 SAMPLE LOCATION :  
 RECEIVED DATE : 17/1/2004 ANALYSIS DATE : 22/1/2004  
 SAMPLE FROM : Chulalongkorn University

Test Item	Method	Unit	Results
Boiling Range Distribution	ASTM D2887-91 (Modified Method)	%	
% Recovered			
IBP			154
5			200
10			234
15			265
20			293
25			321
30			348
35			370
40			385
45			395
50			412
55			426
60			430

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**VITA**

Pattama Choochuay was born on April 18, 1975 in Bangkok, Thailand. She received Bachelor's Degree of Science (Petrochemicals and Polymeric Materials) from Silpakorn University in 1996. She continued her Master's study at Program of Petrochemical and Polymer Science, Faculty of science, Chulalongkorn University in 2000 and completed the program in 2001.



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