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APPENDICES

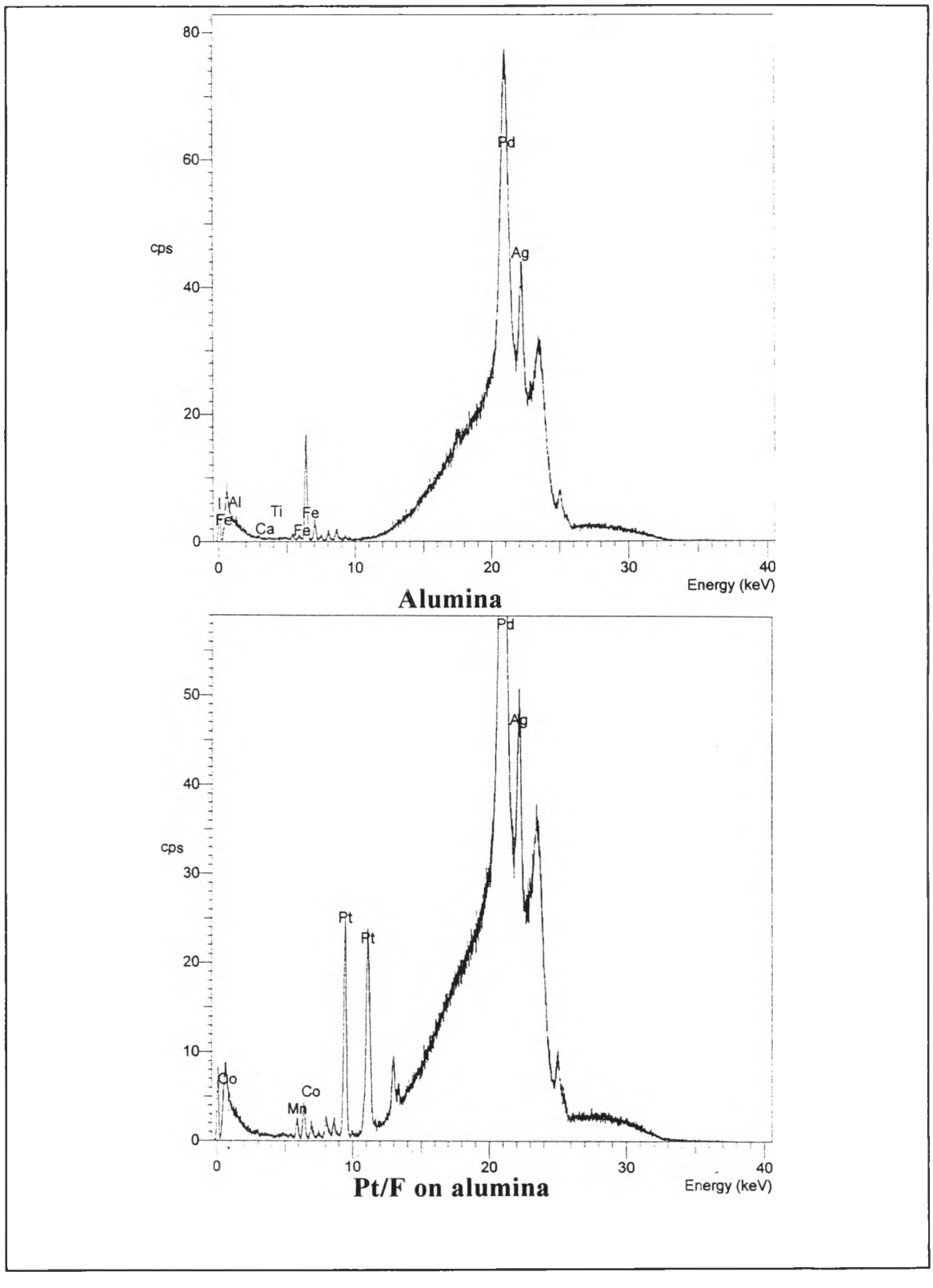


Figure A1 A plot of X-ray fluorescence data of alumina and catalyst type

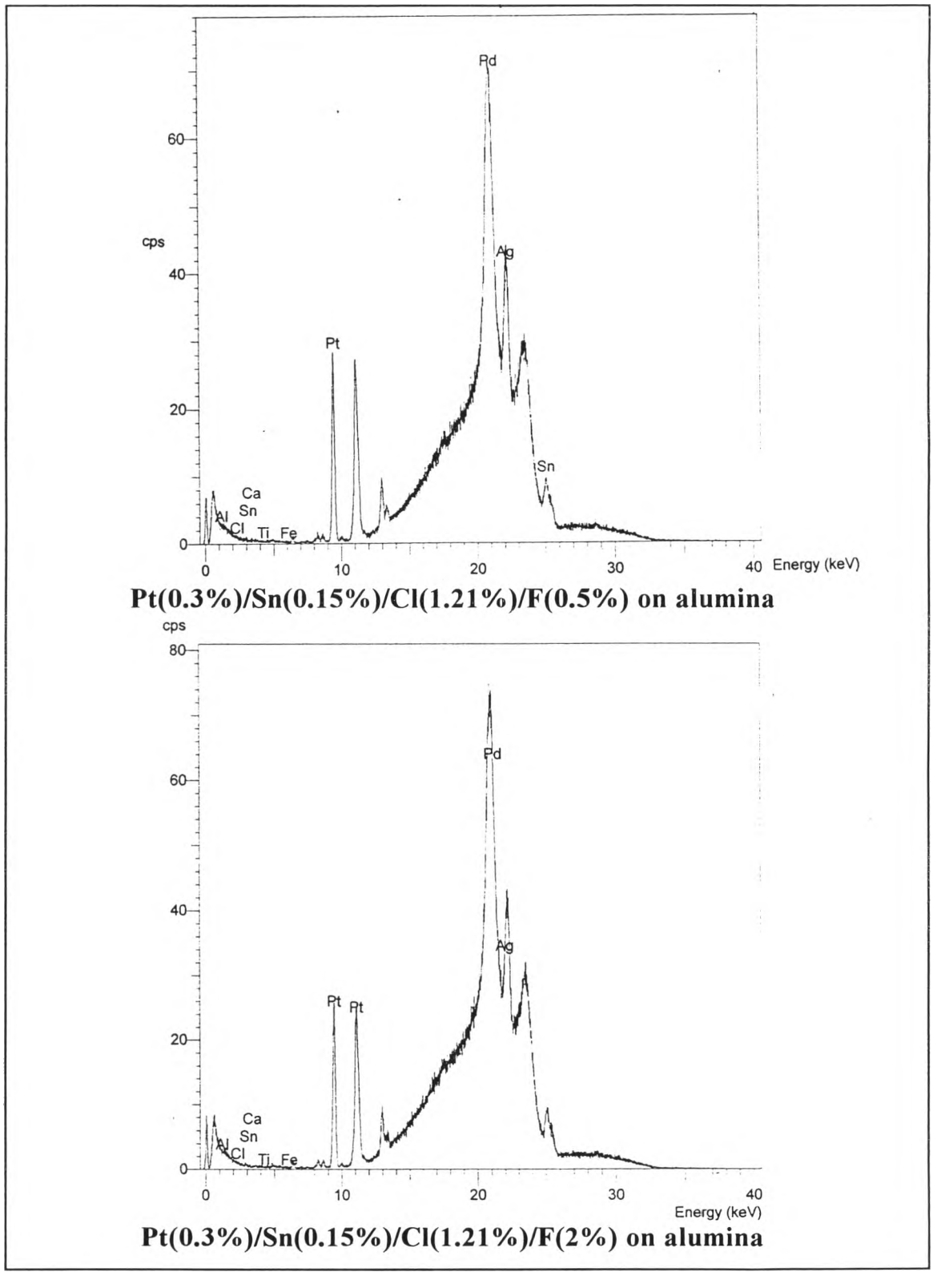


Figure A2 A plot of X-ray fluorescence data of alumina and catalyst type(continued)

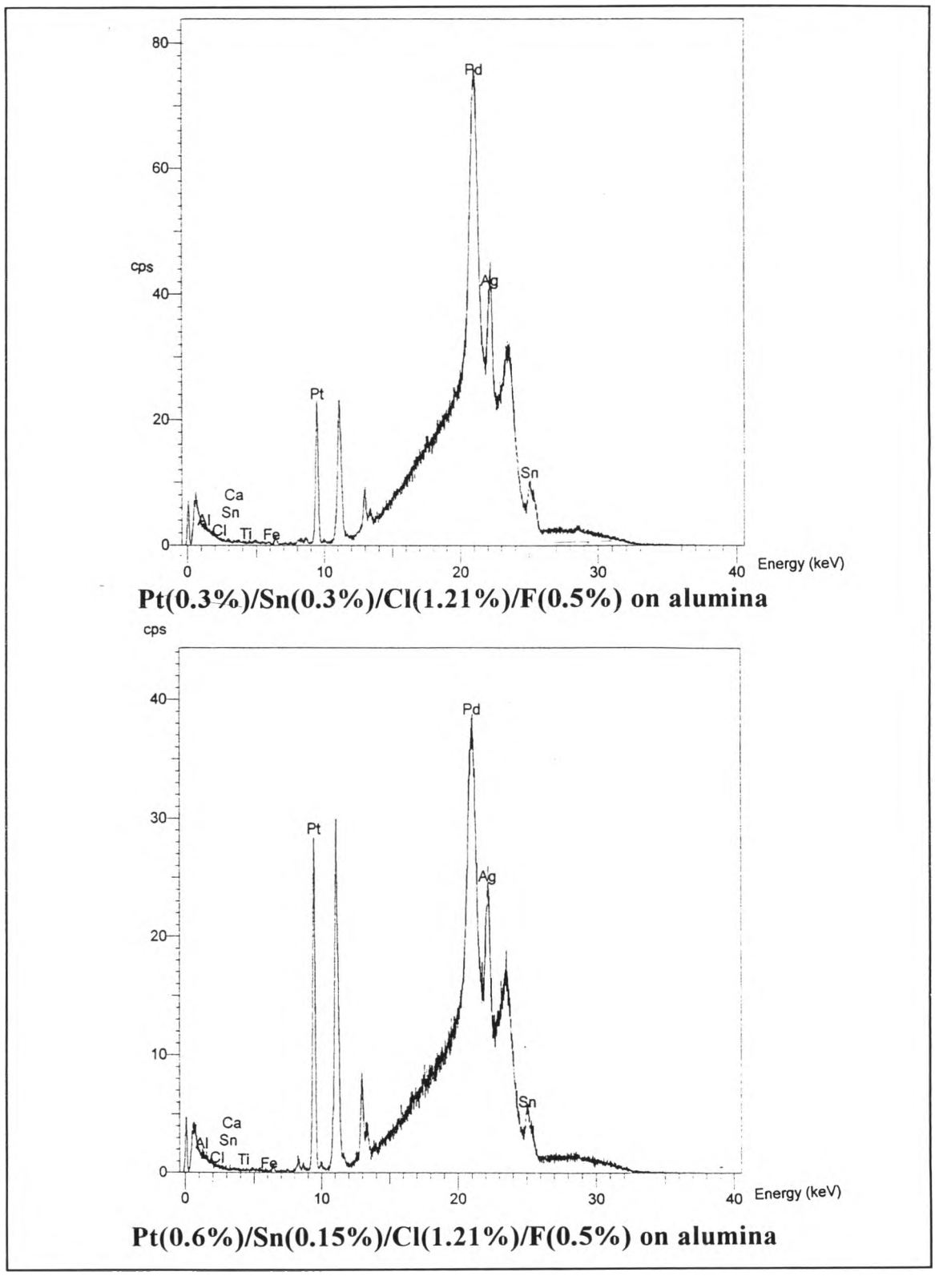


Figure A3 A plot of X-ray fluorescence data of alumina and catalyst type(continued)

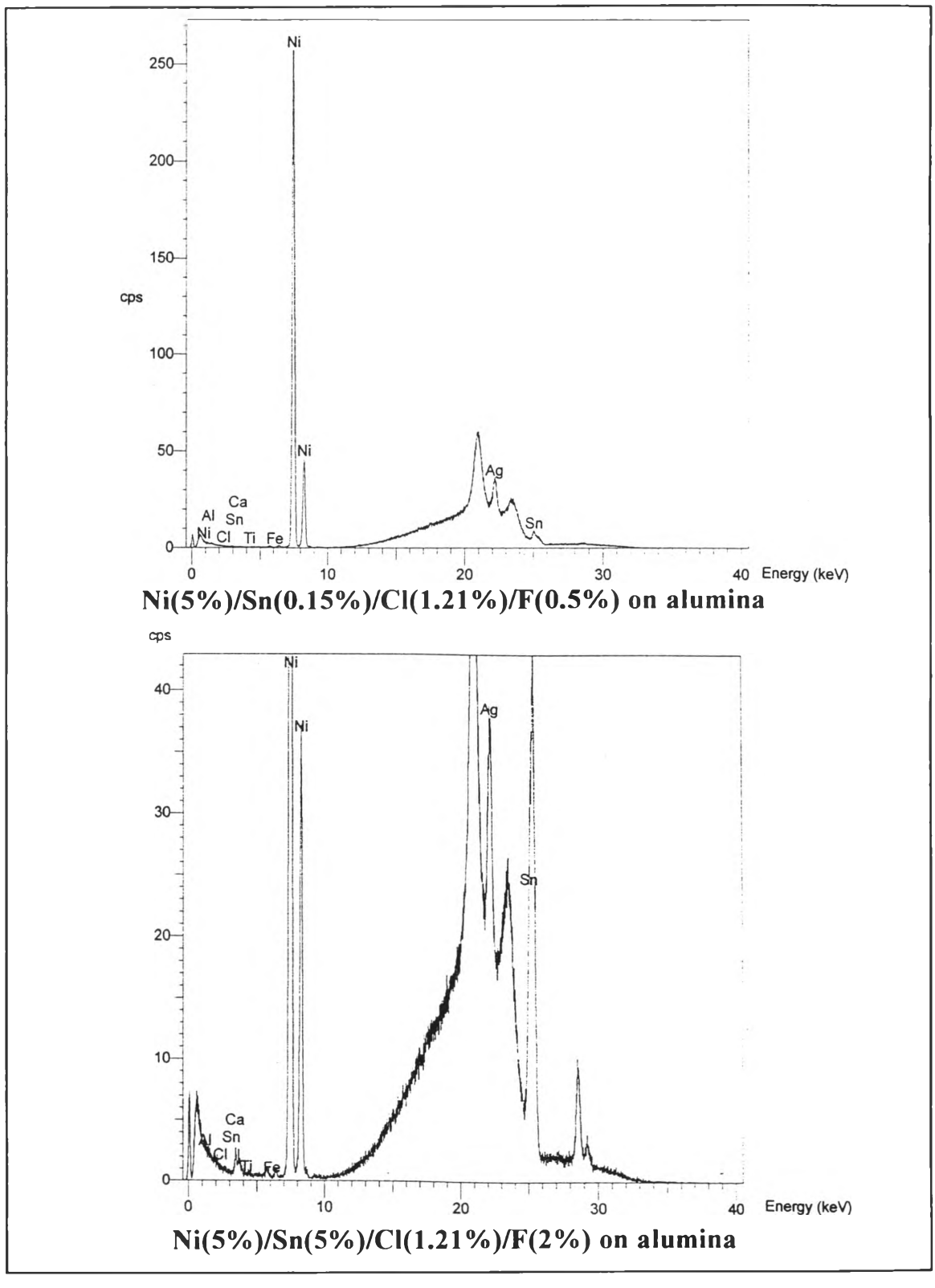


Figure A4 A plot of X-ray fluorescence data of alumina and catalyst type(continued)

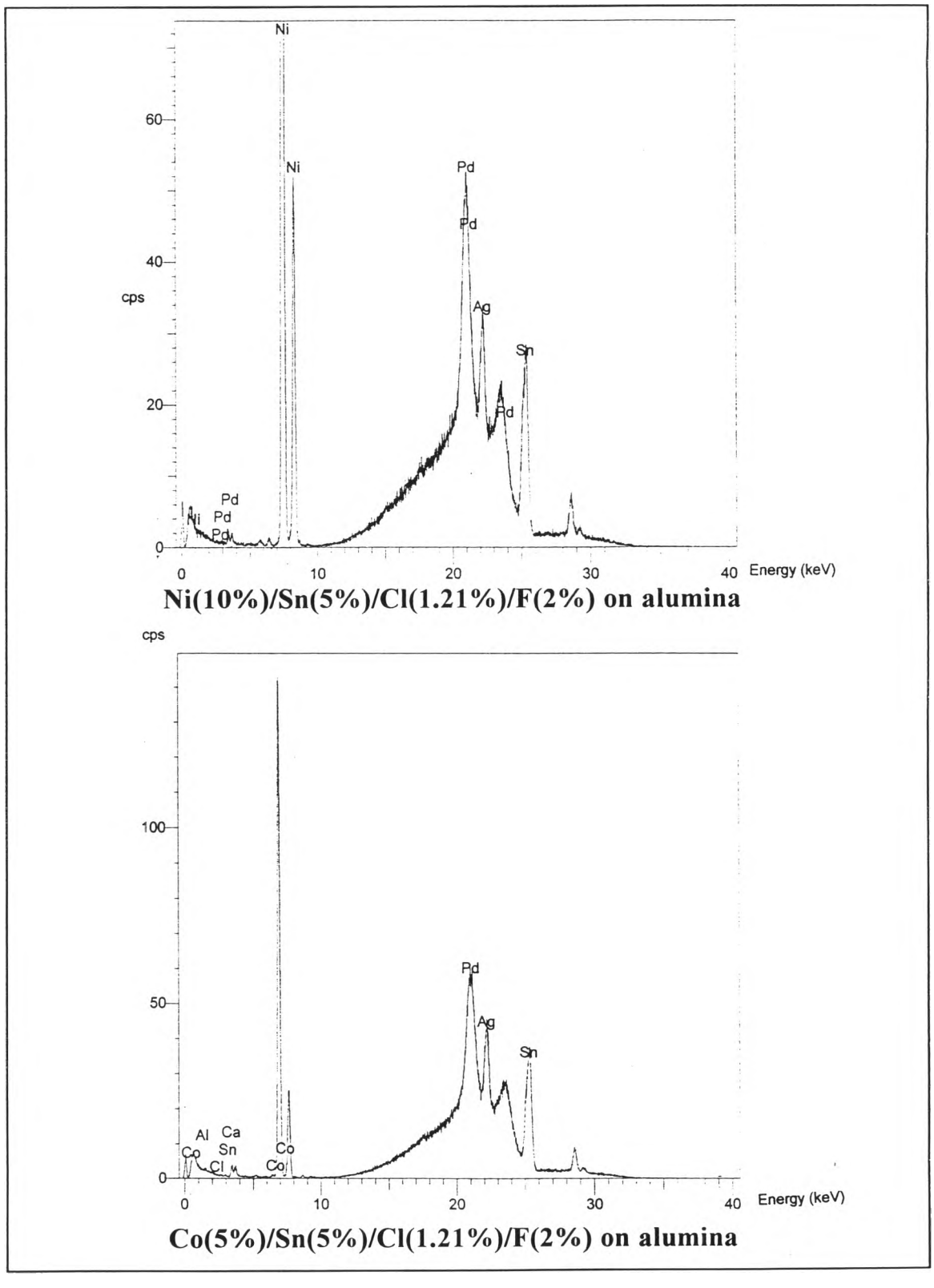


Figure A5 A plot of X-ray fluorescence data of alumina and catalyst type(continued)

Table B1 Composition of products from hydrocracking as a function of catalyst type

Molecular weight	No. of Carbon	Retention time (min)					
		Type 1	Type 3	Type 4	Type 5	Type 6	Type 7
142	isomerC_{10}	4.37	4.37				
142	C_{10}	4.68	4.68	4.20	4.64	4.21	4.58
156	isomerC_{11}	5.42	5.58	4.90	5.24	4.92	5.19
156	C_{11}	5.92	6.16	5.17	5.49	5.21	5.45
170	isomerC_{12}	6.90	7.38	6.04	6.22	6.10	6.26
170	C_{12}	7.49	7.93	6.59	6.78	6.65	6.76
184	isomerC_{13}	8.58	9.14	7.78	7.84	7.87	7.92
184	C_{13}	9.15	9.69	8.32	8.41	8.38	8.40
198	isomerC_{14}	10.19	10.84	9.54	9.65	9.63	9.63
198	C_{14}	10.78	11.35	10.09	10.15	10.14	10.14
212	C_{15}	12.33	12.96	11.77	11.83	11.82	11.81
226	C_{16}	14.02	14.75	13.44	13.54	13.51	13.52
240	C_{17}	16.01	16.77	15.35	15.46	15.41	15.43
254	C_{18}	18.02	18.74	17.36	17.46	17.42	17.44
268	C_{19}	19.92	20.62	19.33	19.43	19.39	19.42
282	C_{20}	21.67	22.42	21.20	21.29	21.28	21.28
296	C_{21}	23.52		23.08	23.21	23.18	23.20
310	C_{22}	25.59		25.14	25.29	25.27	25.28

Table B2 The molecular weight distributions of products from hydrocracking as a function of catalyst type

Molecular weight	No. of Carbon	% Peak Area					
		Type 1	Type 3	Type 4	Type 5	Type 6	Type 7
142	C_{10}	20.83	14.02	4.63	9.50	4.98	8.81
156	C_{11}	17.82	14.51	3.94	19.08	9.12	15.62
170	C_{12}	15.01	14.81	8.57	18.07	16.50	19.62
184	C_{13}	12.57	15.41	11.63	14.59	13.76	15.26
198	C_{14}	9.19	12.23	13.20	8.99	11.61	10.54
212	C_{15}	6.19	9.84	12.41	7.12	10.28	6.81
226	C_{16}	4.50	6.46	10.54	5.00	7.88	5.45
240	C_{17}	3.75	4.67	8.77	4.33	6.05	3.81
254	C_{18}	3.38	3.78	7.88	4.07	5.31	3.54
268	C_{19}	2.81	2.68	6.80	3.56	4.89	3.36
282	C_{20}	2.06	1.59	5.71	2.71	4.06	3.09
296	C_{21}	1.13		3.55	1.70	2.82	2.36
310	C_{22}	0.75		2.36	1.27	2.74	1.73

Table B3 Composition of products from hydrocracking as a function of composition of Pt/Sn/Cl/F on Al_2O_3 catalyst

Molecular weight	No. of Carbon	Retention time (min)			
		Component A	Component B	Component C	Component D
142	isomerC_{10}	4.33	4.26	4.44	4.65
142	C_{10}	4.69	4.63	4.75	5.06
156	isomerC_{11}	5.80	5.52	5.74	6.10
156	C_{11}	6.13	6.07	6.22	6.45
170	isomerC_{12}	7.40	7.33	7.42	7.85
170	C_{12}	7.87	7.80	7.98	8.43
184	isomerC_{13}	8.90	8.88	9.20	9.47
184	C_{13}	9.63	9.56	9.74	10.14
198	isomerC_{14}	10.81	10.77	10.91	11.49
198	C_{14}	11.30	11.23	11.42	11.81
212	C_{15}	12.92	12.85	13.04	13.50
226	C_{16}	14.83	14.65	14.85	15.42
240	C_{17}	16.84	16.68	16.87	17.43
254	C_{18}	18.83	18.68	18.75	19.41
268	C_{19}	20.75	20.56	20.75	21.28
282	C_{20}	23.20	22.45	22.45	23.19
296	C_{21}	25.28	24.43	24.43	25.28
310	C_{22}	27.40	26.62	26 65	
324	C_{23}	29.50	28.45	28 60	

Table B4 The molecular weight distributions of products from hydrocracking as a function of composition of Pt/Sn/Cl/F on Al_2O_3 catalyst

Molecular weight	No. of Carbon	% Peak Area			
		Component A	Component B	Component C	Component D
142	C_{10}	18.00	11.22	18.57	29.61
156	C_{11}	13.02	8.85	14.20	23.89
170	C_{12}	12.04	10.04	13.35	15.59
184	C_{13}	11.8	11.50	13.23	9.16
198	C_{14}	11.07	11.41	11.53	5.58
212	C_{15}	8.88	10.22	7.89	4.01
226	C_{16}	6.20	7.94	5.58	3.29
240	C_{17}	5.11	7.21	4.61	2.72
254	C_{18}	4.38	6.39	3.64	2.43
268	C_{19}	3.53	5.47	2.79	1.86
282	C_{20}	2.19	4.11	1.82	1.14
296	C_{21}	1.58	2.65	1.21	0.72
310	C_{22}	1.22	1.82	0.97	
324	C_{23}	0.97	1.19	0.61	

Table B5 Composition of products from hydrocracking as a function of catalyst concentration

Molecular weight	No. of Carbon	Retention time (min)		
		30%	35%	40%
142	isomerC_{10}	4.94	4.65	5.28
142	C_{10}	5.22	5.06	5.51
156	isomerC_{11}	6.28	6.12	6.19
156	C_{11}	6.6	6.45	6.65
170	isomerC_{12}	7.8	7.85	7.76
170	C_{12}	8.29	8.43	8.27
184	isomerC_{13}	9.52	9.47	9.60
184	C_{13}	10.03	10.14	10.17
198	isomerC_{14}	11.21	11.49	11.58
198	C_{14}	11.69	11.81	12.15
212	C_{15}	13.36	13.50	14.07
226	C_{16}	15.25	15.42	16.18
240	C_{17}	17.37	17.43	
254	C_{18}	19.33	19.41	
268	C_{19}	21.20	21.28	
282	C_{20}	23.08	23.19	
296	C_{21}	25.13	25.28	

Table B6 The molecular weight distributions of products from hydrocracking as a function of catalyst concentration

Molecular weight	No. of Carbon	% Peak Area		
		30%	35%	40%
142	C_{10}	17.58	29.61	31.53
156	C_{11}	23.58	23.89	28.65
170	C_{12}	16.72	15.59	17.30
184	C_{13}	12.65	9.16	10.99
198	C_{14}	7.29	5.58	5.77
212	C_{15}	5.89	4.01	3.60
226	C_{16}	4.18	3.29	2.16
240	C_{17}	3.43	2.72	
254	C_{18}	3.11	2.43	
268	C_{19}	2.47	1.86	
282	C_{20}	1.93	1.14	
296	C_{21}	1.18	0.72	

Table B7 Composition of products from hydrocracking as a function of reaction time

Molecular weight	No. of Carbon	Retention time (min)			
		4 hours	8 hours	10 hours	12 hours
142	isomerC_{10}		4.49	4.49	5.28
142	C_{10}	4.72	4.78	4.92	5.51
156	isomerC_{11}	5.66	5.75	5.79	6.19
156	C_{11}	6.05	6.19	6.28	6.65
170	isomerC_{12}	7.21	7.29	7.46	7.76
170	C_{12}	7.71	7.91	8.03	8.27
184	isomerC_{13}	8.92	9.15	9.23	9.60
184	C_{13}	9.44	9.68	9.79	10.17
198	isomerC_{14}	10.60	10.97	10.92	11.58
198	C_{14}	11.09	11.35	11.45	12.15
212	C_{15}	12.69	12.97	13.07	14.07
226	C_{16}	14.45	14.79	14.89	16.18
240	C_{17}	16.47	16.53	16.82	
254	C_{18}	18.47	18.80	18.82	
268	C_{19}	20.35	20.67	20.73	
282	C_{20}	22.14	22.48	22.62	
296	C_{21}	24.08			
310	C_{22}	26.20			
324	C_{23}	28.28			
338	C_{24}	30.32			

Table B8 The molecular weight distributions of products from hydrocracking as a function of reaction time

Molecular weight	No. of Carbon	% Peak Area			
		4 hours	8 hours	10 hours	12 hours
142	C_{10}	0.81	17.98	21.48	17.48
156	C_{11}	4.05	16.40	17.48	15.88
170	C_{12}	9.72	12.65	13.49	9.59
184	C_{13}	12.96	10.47	10.99	6.09
198	C_{14}	12.96	10.28	9.09	3.20
212	C_{15}	11.74	8.50	7.79	2.00
226	C_{16}	9.85	6.52	5.49	1.20
240	C_{17}	7.83	5.53	5.19	
254	C_{18}	7.56	4.74	3.70	
268	C_{19}	6.34	3.95	3.10	
282	C_{20}	5.40	2.96	2.20	
296	C_{21}	3.91			
310	C_{22}	3.10			
324	C_{23}	2.56			
338	C_{24}	1.21			

Table B9 Composition of products from hydrocracking as a function of reaction temperature

Molecular weight	No. of Carbon	Retention time (min)	
		350°C	400°C
142	isomerC_{10}		5.28
142	C_{10}	5.12	5.51
156	isomerC_{11}	6.09	6.19
156	C_{11}	6.55	6.65
170	isomerC_{12}	7.74	7.76
170	C_{12}	8.26	8.27
184	isomerC_{13}	9.49	9.60
184	C_{13}	10.04	10.17
198	isomerC_{14}	11.18	11.58
198	C_{14}	11.71	12.15
212	C_{15}	13.38	14.07
226	C_{16}	15.27	16.18
240	C_{17}	17.28	
254	C_{18}	19.26	
268	C_{19}	21.13	
282	C_{20}	23.08	
296	C_{21}	25.10	

Table B10 The molecular weight distributions of products from hydrocracking as a function of reaction temperature

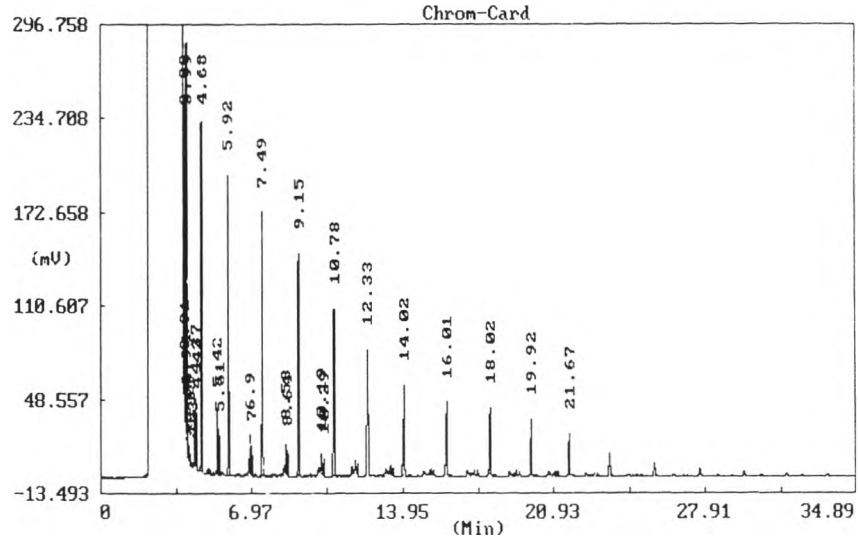
Molecular weight	No. of Carbon	% Peak Area	
		350°C	400°C
142	C_{10}	3.81	31.53
156	C_{11}	8.71	28.65
170	C_{12}	12.75	17.30
184	C_{13}	13.73	10.99
198	C_{14}	10.89	5.77
212	C_{15}	8.82	3.60
226	C_{16}	7.84	2.16
240	C_{17}	6.75	
254	C_{18}	5.56	
268	C_{19}	4.14	
282	C_{20}	2.51	
296	C_{21}	1.20	

Table B11 Composition of products from hydrocracking as a function of hydrogen pressure

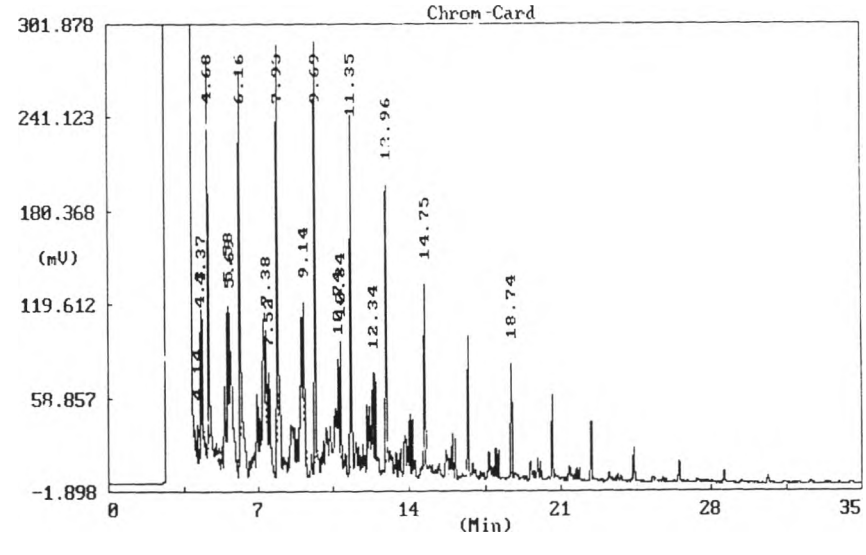
Molecular weight	No. of Carbon	Retention time (min)	
		500 psig	600 psig
142	isomerC_{10}	4.80	5.28
142	C_{10}	5.24	5.51
156	isomerC_{11}	6.05	6.19
156	C_{11}	6.51	6.65
170	isomerC_{12}	7.71	7.76
170	C_{12}	8.27	8.27
184	isomerC_{13}	9.47	9.60
184	C_{13}	10.05	10.17
198	isomerC_{14}	11.18	11.58
198	C_{14}	11.72	12.15
212	C_{15}	13.39	14.07
226	C_{16}	15.28	16.18
240	C_{17}	11.29	
254	C_{18}	19.26	
268	C_{19}	21.13	
282	C_{20}	23.02	
296	C_{21}	25.13	

Table B12 The molecular weight distributions of products from hydrocracking as a function of hydrogen pressure

Molecular weight	No. of Carbon	% Peak Area	
		500 psig	600 psig
142	C_{10}	9.21	31.53
156	C_{11}	8.31	28.65
170	C_{12}	11.69	17.30
184	C_{13}	13.48	10.99
198	C_{14}	12.58	5.77
212	C_{15}	10.56	3.60
226	C_{16}	8.54	2.16
240	C_{17}	7.87	
254	C_{18}	6.52	
268	C_{19}	5.39	
282	C_{20}	3.82	
296	C_{21}	2.02	

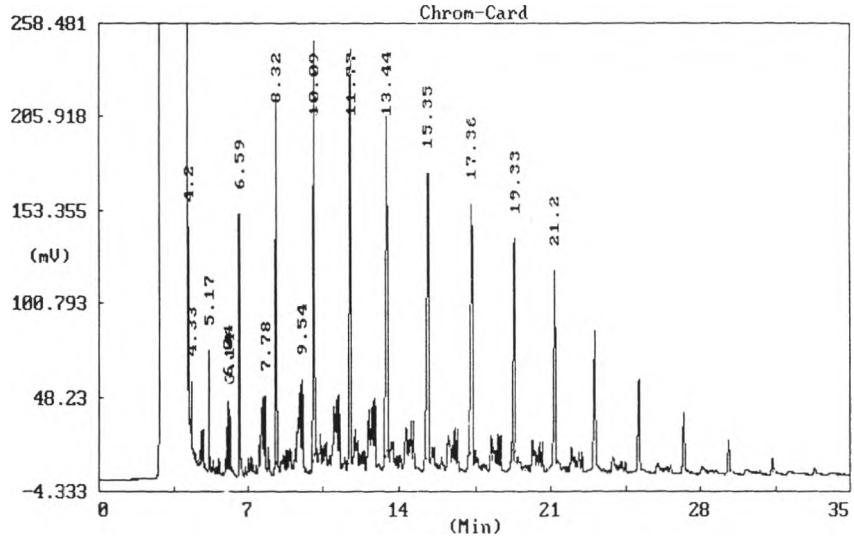


Type 1: Commercial catalyst

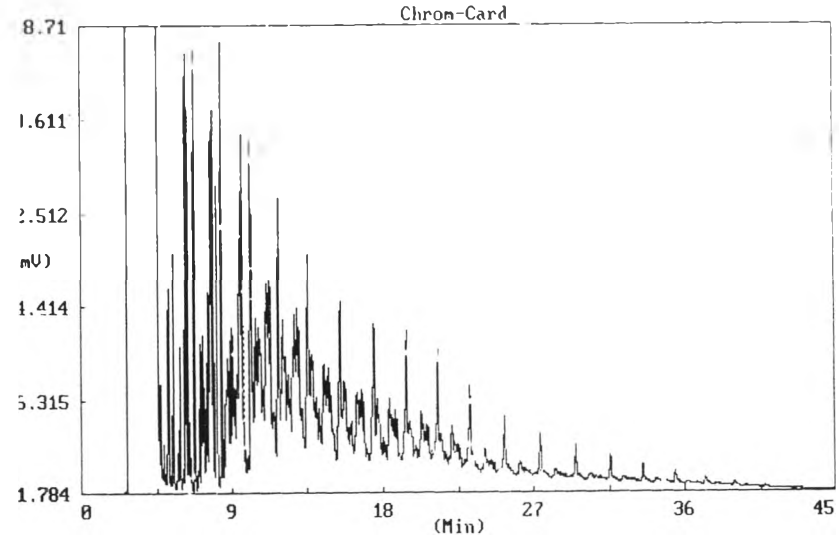


Type 3: Pt(0.3%)/Sn(0.15%)/Cl(1.21%)/F(0.5%) on Al_2O_3

Figure B1 GC/MS chromatogram of products from hydrocracking as a function of catalyst type

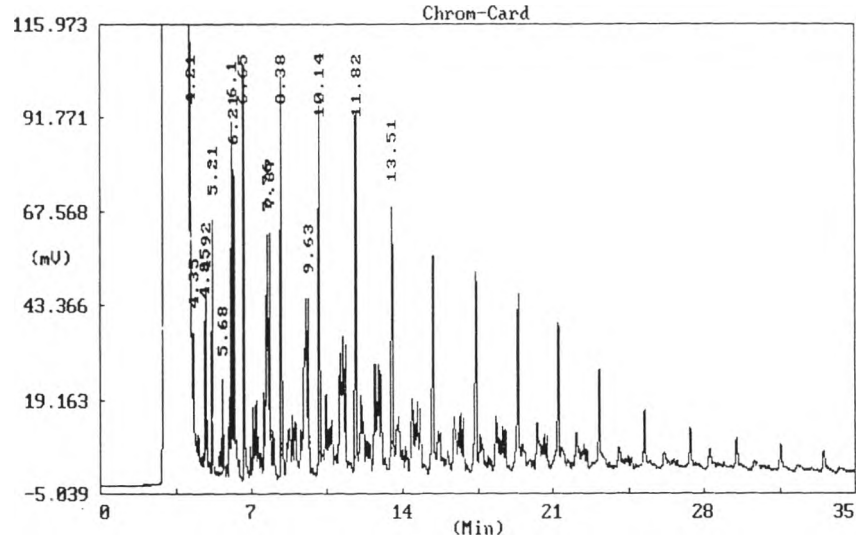


Type 4: Ni(5%)/Sn(0.15%)/Cl(1.21%)/F(0.5%) on Al_2O_3

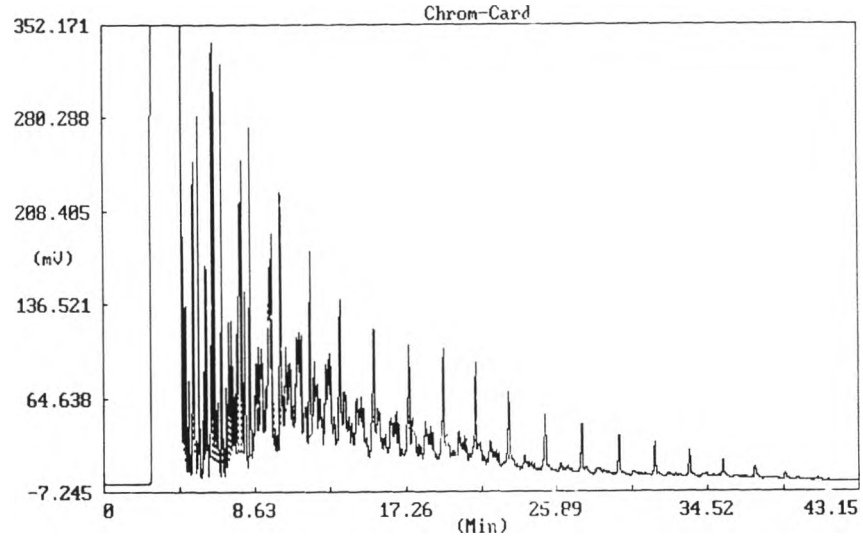


Type 5: Ni(5%)/Sn(5%)/Cl(1.21%)/F(2%) on Al_2O_3

Figure B2 GC/MS chromatogram of products from hydrocracking as a function of catalyst type (continued)

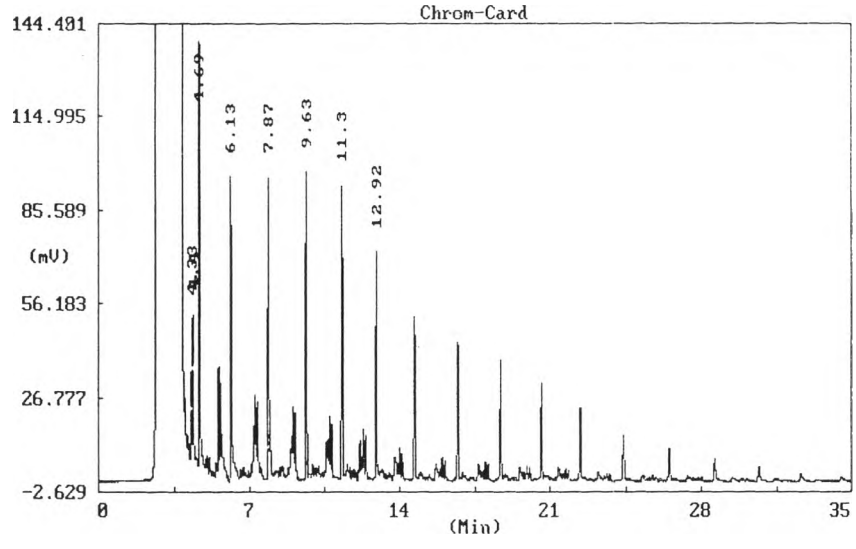


Type 6: Ni(10%)/Sn(5%)/Cl(1.21%)/F(2%) on Al_2O_3

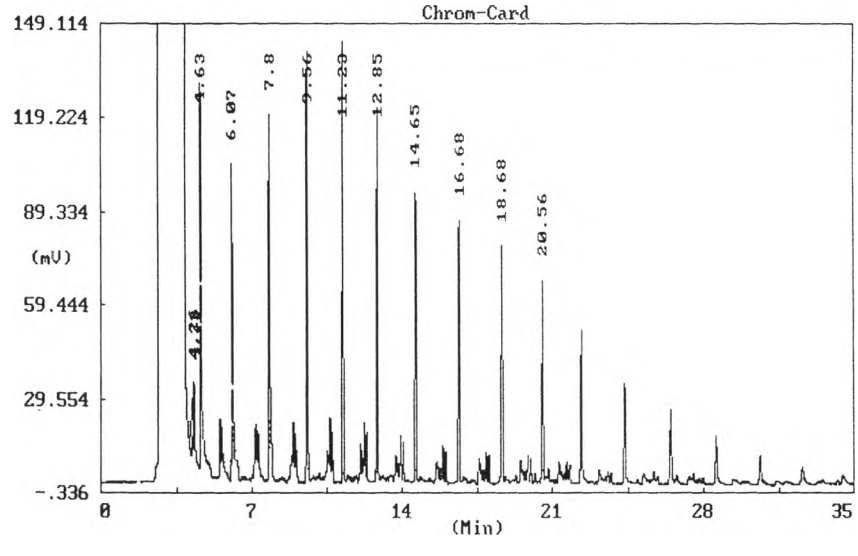


Type 7: Co(5%)/Sn(5%)/Cl(1.21%)/F(2%) on Al_2O_3

Figure B3 GC/MS chromatogram of products from hydrocracking as a function of catalyst type (continued)

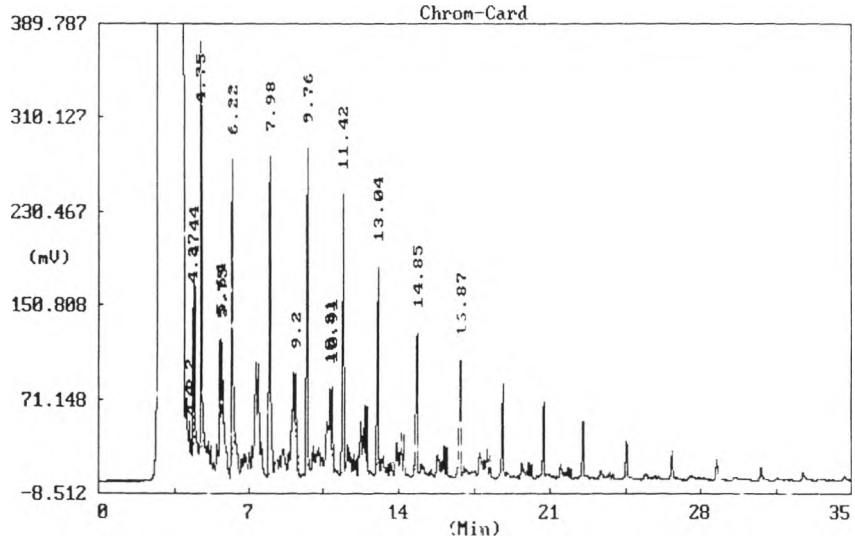


Component A: Pt(0.3%)/Sn(0.15%)/Cl(1.21%)/F(0.5%) on Al_2O_3

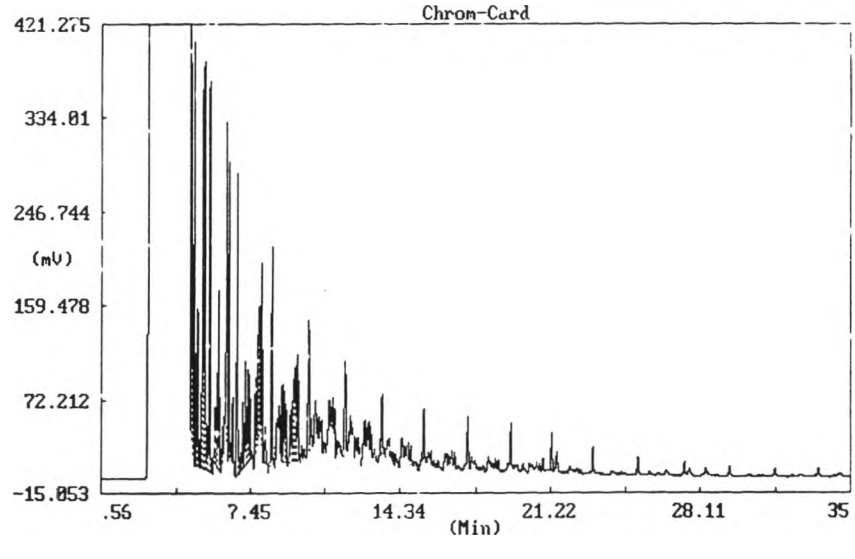


Component B: Pt(0.3%)/Sn(0.15%)/Cl(1.21%)/F(2%) on Al_2O_3

Figure B4 GC/MS chromatogram of products from hydrocracking as a function of %component of Pt/Sn/Cl/F on Al_2O_3 catalyst



Component C: Pt(0.3%)/Sn(0.3%)/Cl(1.21%)/F(0.5%) on Al_2O_3



Component D: Pt(0.6%)/Sn(0.15%)/Cl(1.21%)/F(0.5%) on Al_2O_3

Figure B5 GC/MS chromatogram of products from hydrocracking as a function of %component of Pt/Sn/Cl/F on Al_2O_3 catalyst (continued)

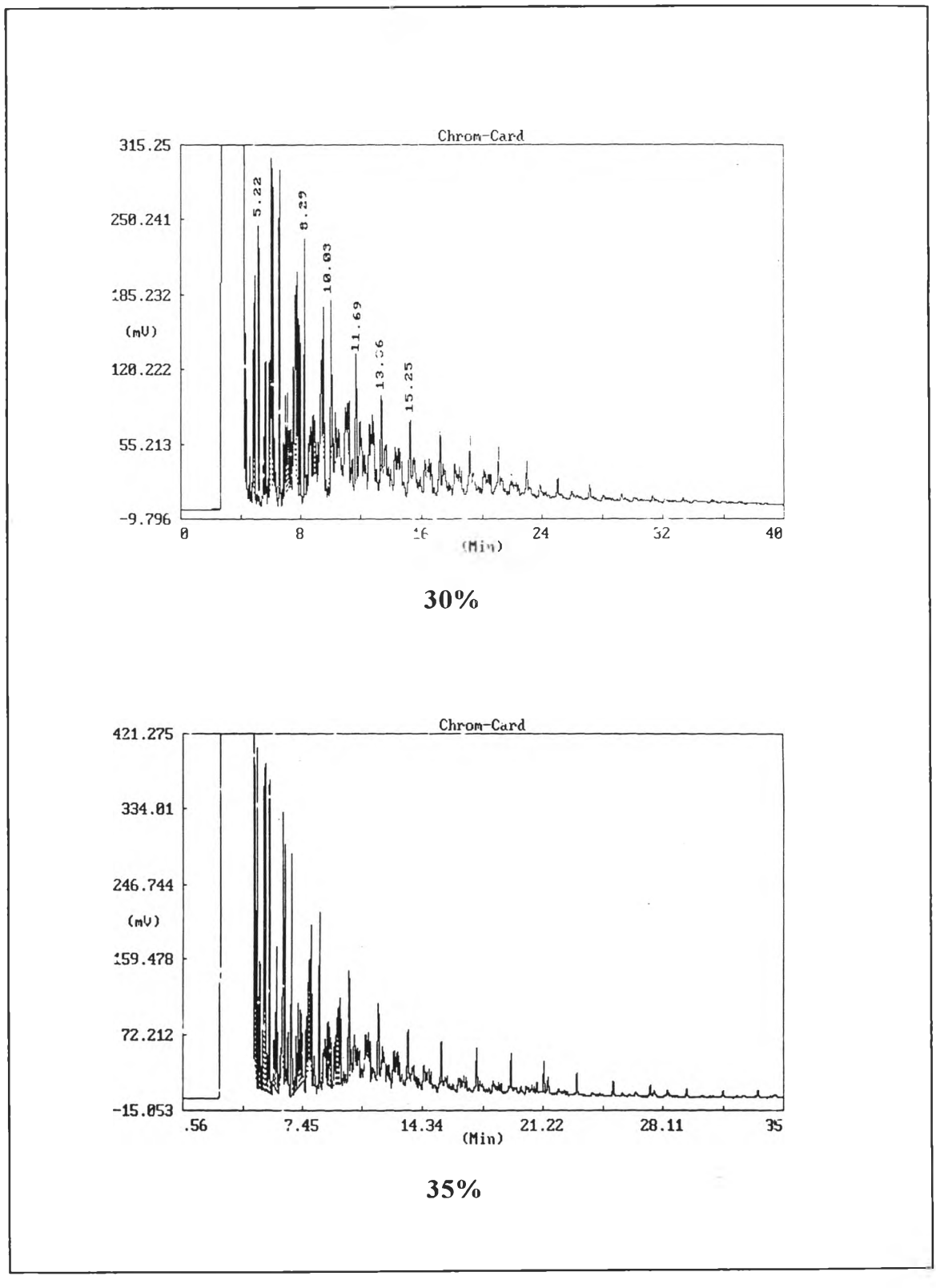
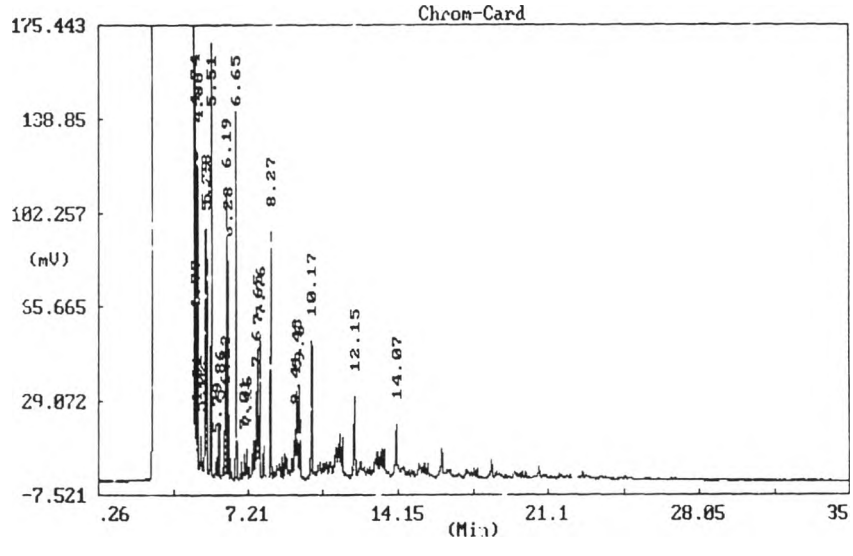
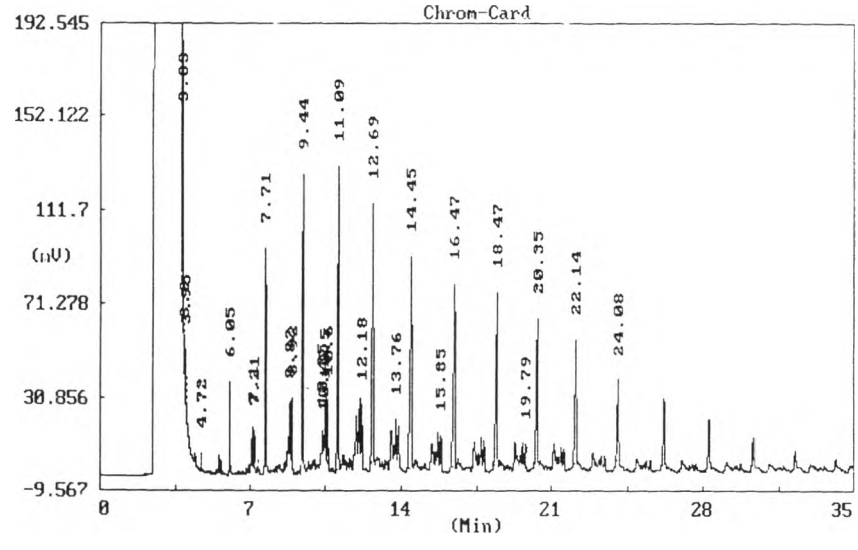


Figure B6 GC/MS chromatogram of products from hydrocracking as a function of catalyst concentration

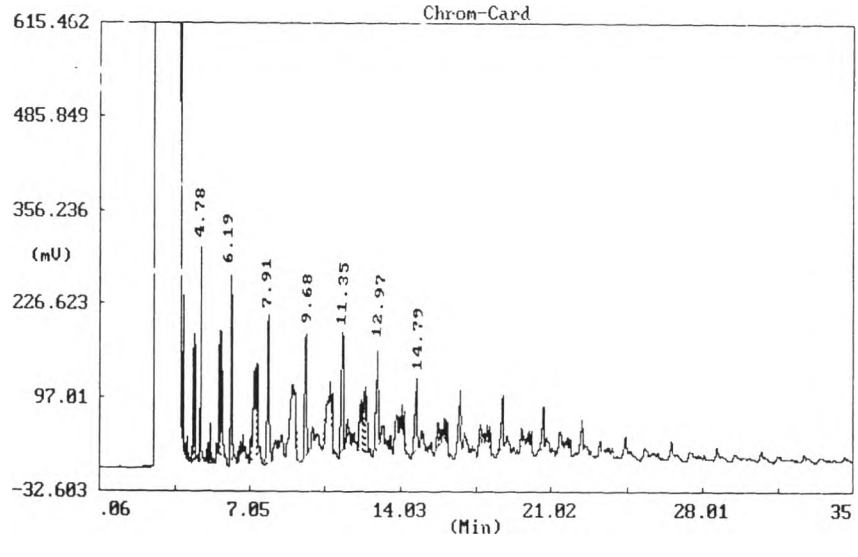


40%

Figure B7 GC/MS chromatogram of products from hydrocracking as a function of catalyst concentration (continued)

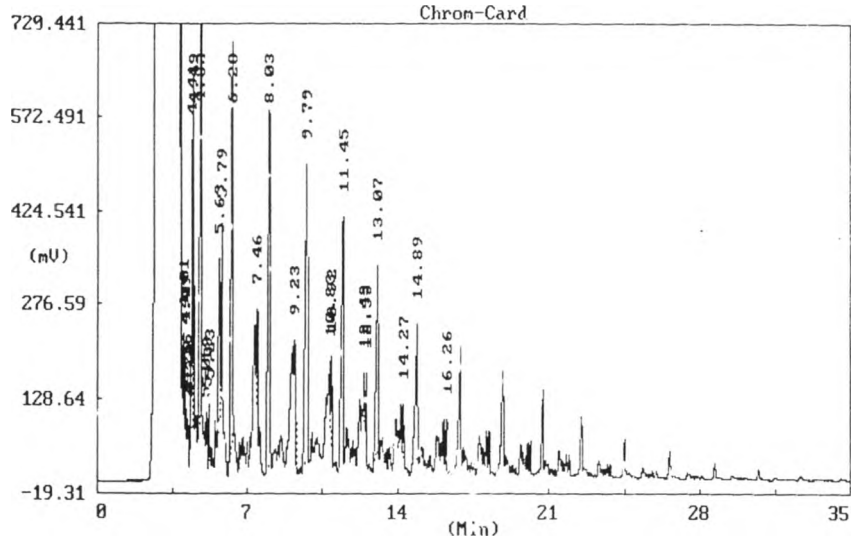


4 Hours

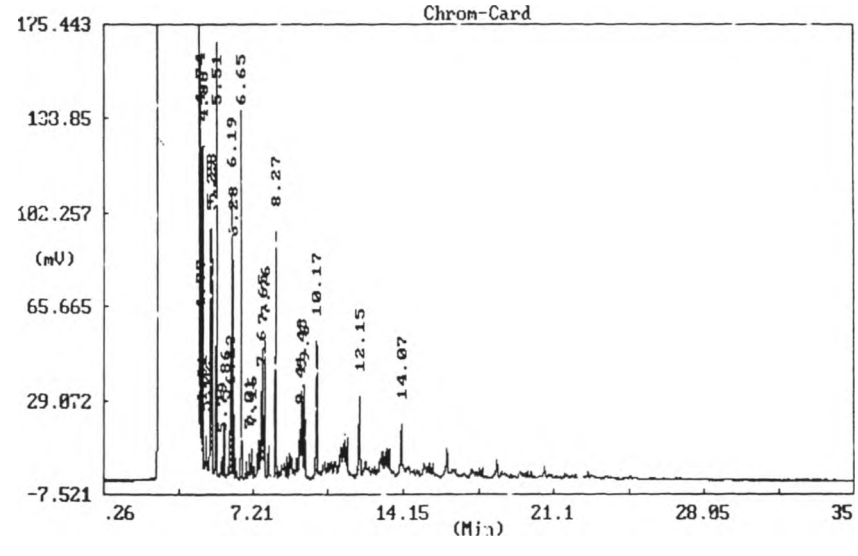


8 Hours

Figure B8 GC/MS chromatogram of products from hydrocracking as a function of reaction time



10 Hours



12 Hours

Figure B9 GC/MS chromatogram of products from hydrocracking as a function of reaction time (continued)

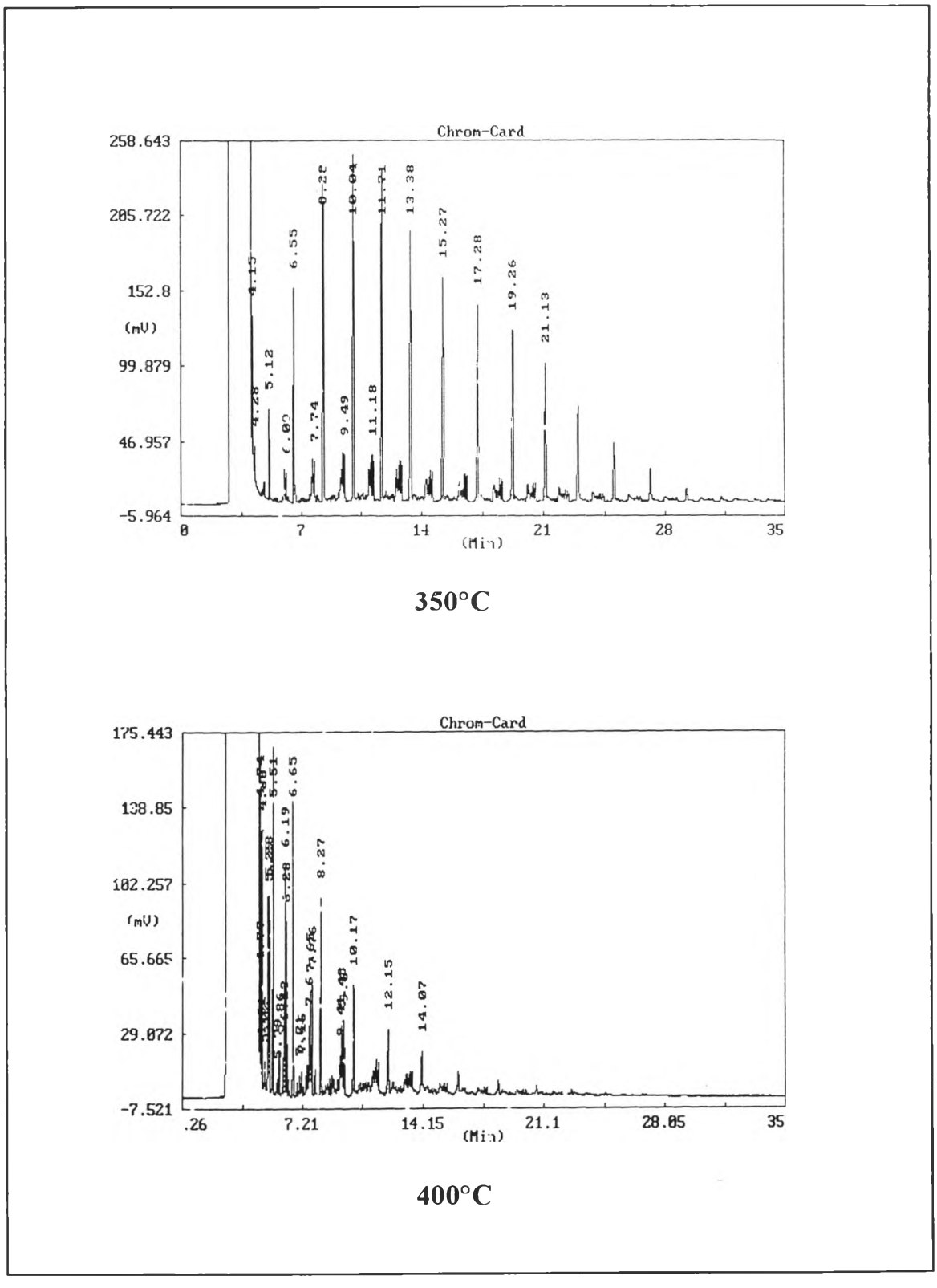
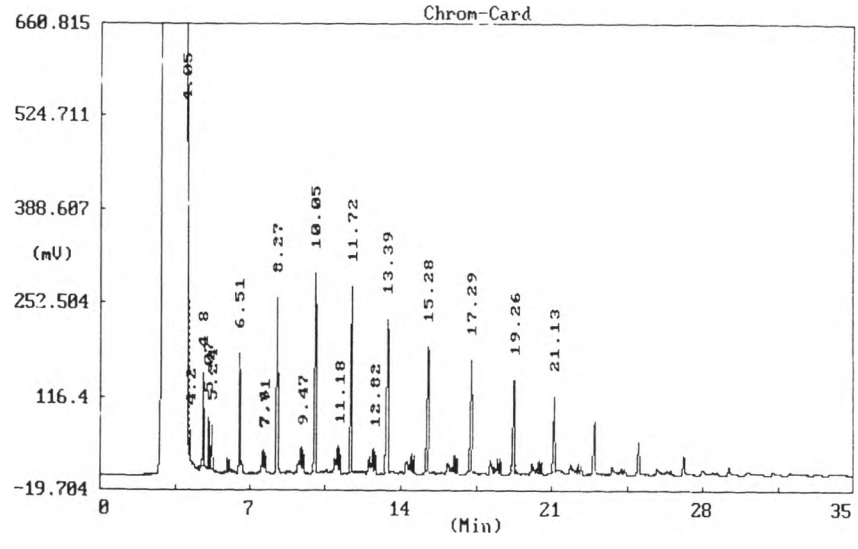
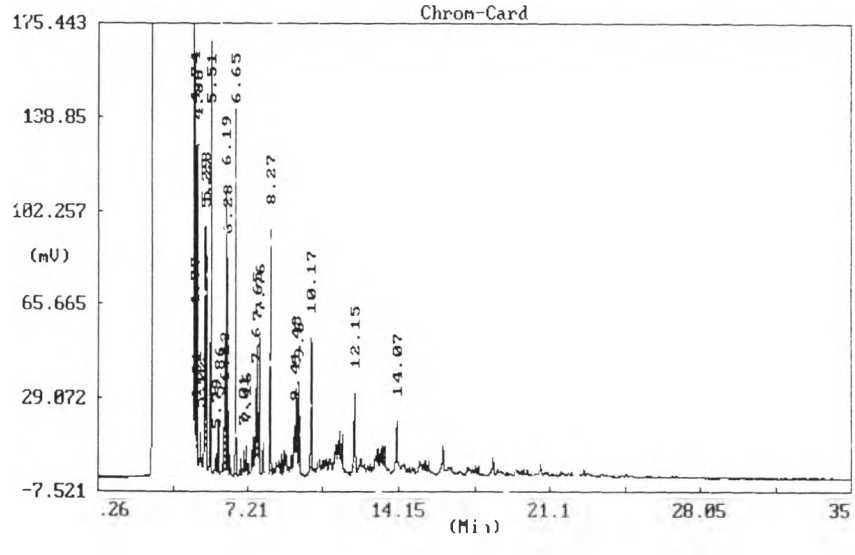


Figure B10 GC/MS chromatogram of products from hydrocracking as a function of reaction temperature



500 Psig



600 Psig

Figure B11 GC/MS chromatogram of products from hydrocracking as a function of hydrogen pressure

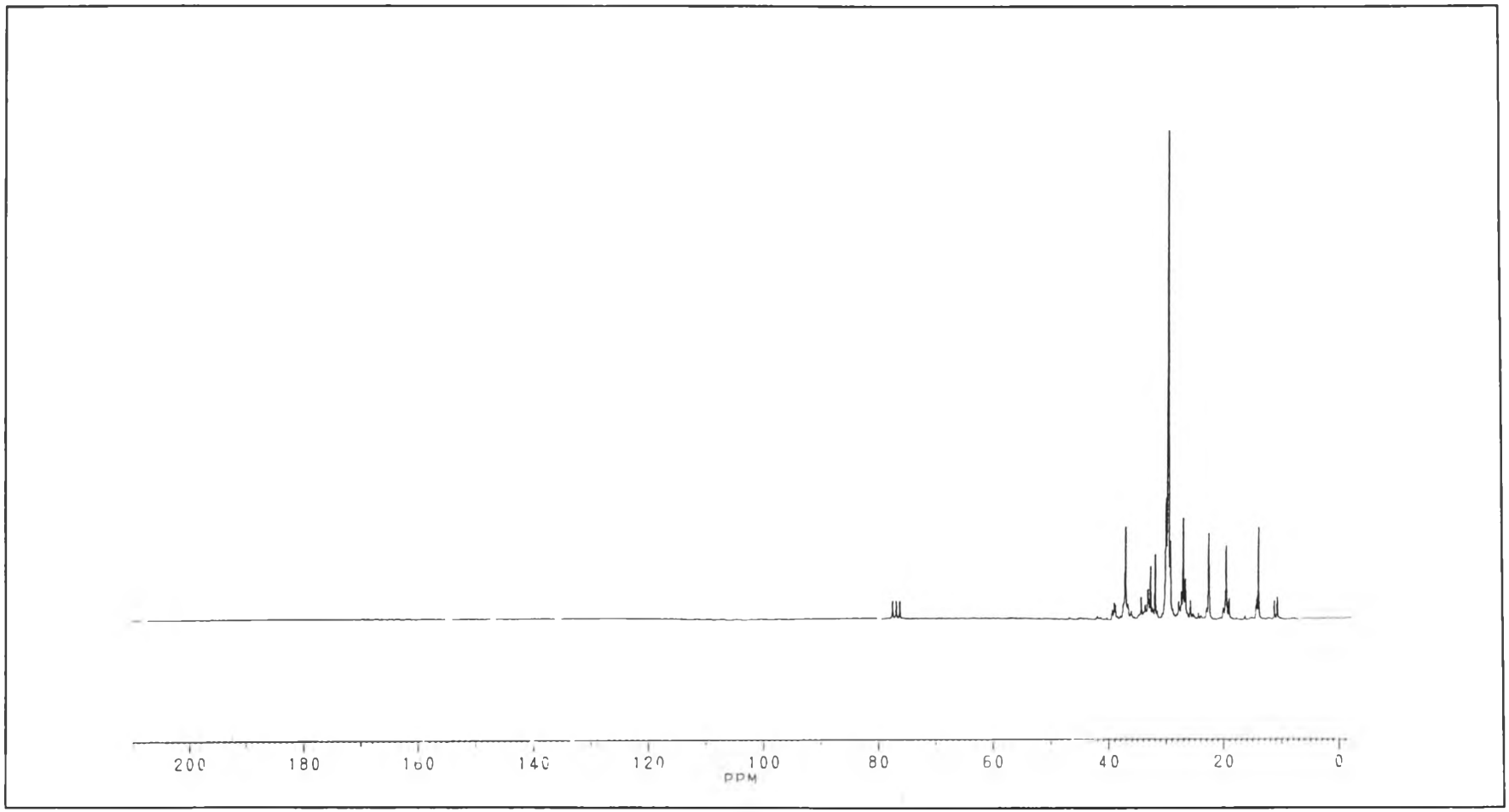


Figure B12 ^{13}C NMR ($CDCl_3$) spectrum of product from hydrocracking of used polyethylene at optimum condition (40%wt. of Pt(0.6%)/Sn(0.15%)/Cl(1.21%)/F(0.5%) on Al_2O_3 catalyst, 400°C, 600 psig, 12 hours)

VITA

Miss Ruthai Leesuksan was born on September 24, 1972 in Bangkok, Thailand. She received her Bachelor of Science degree in Chemistry, Srinakarinwirot University Southern Campus in 1994. She continued her studies towards her Master's degree at Chulalongkorn University, Multidisciplinary program of Petrochemistry and Polymer, Graduate School, in 1994 and completed the program in 1997.