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APPENDIXES

Appendix A

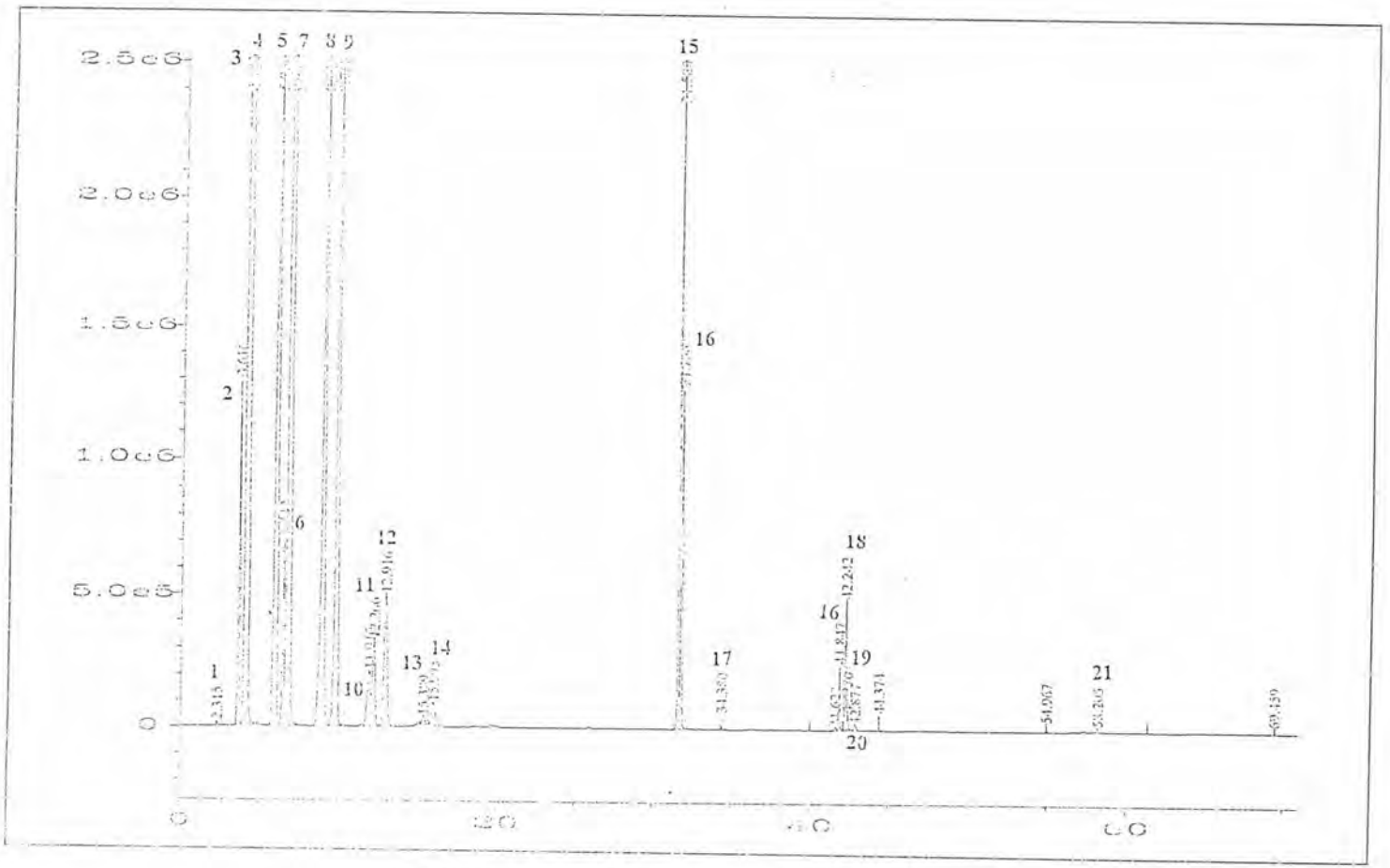


Figure A1 GC Chromatogram of NGL.

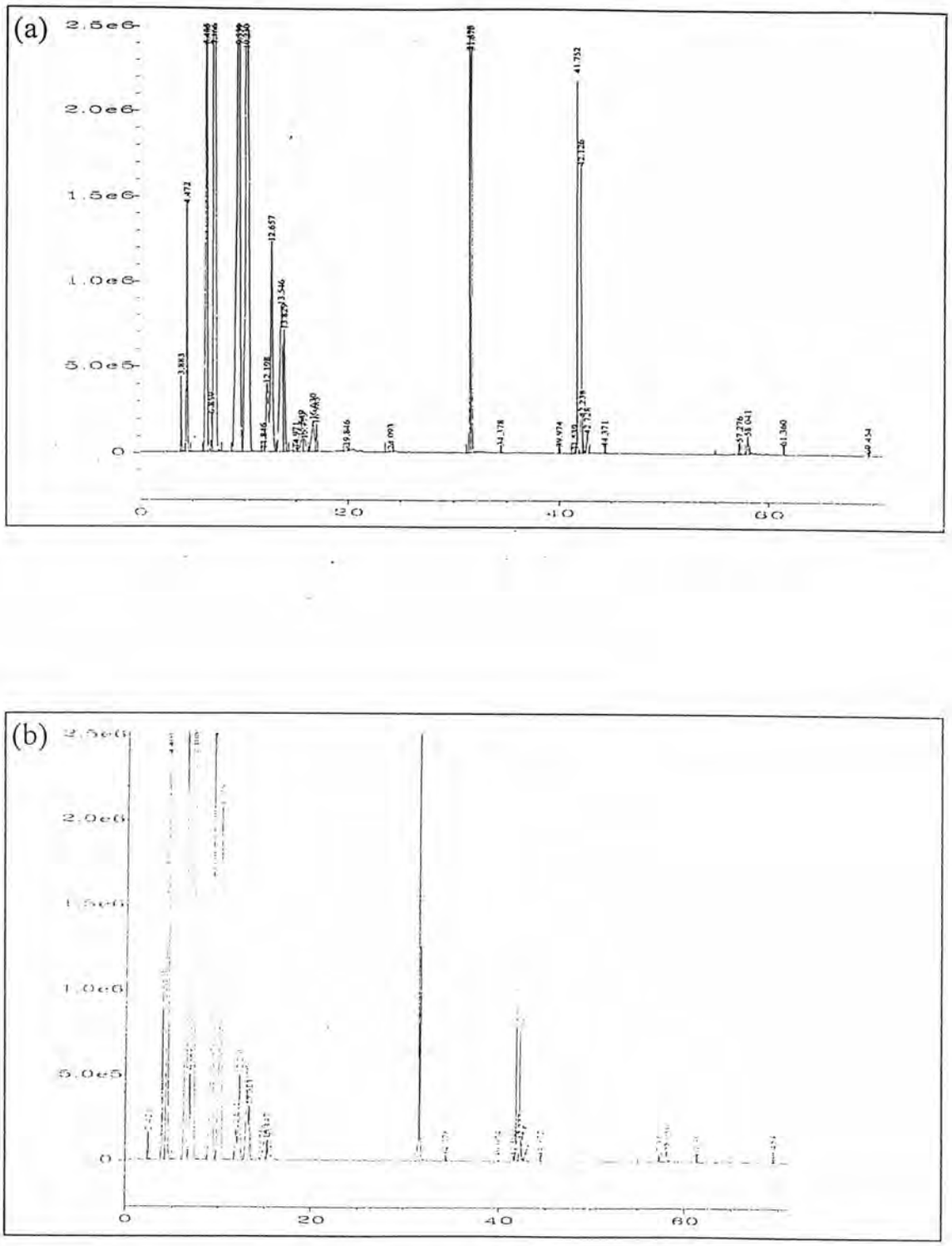
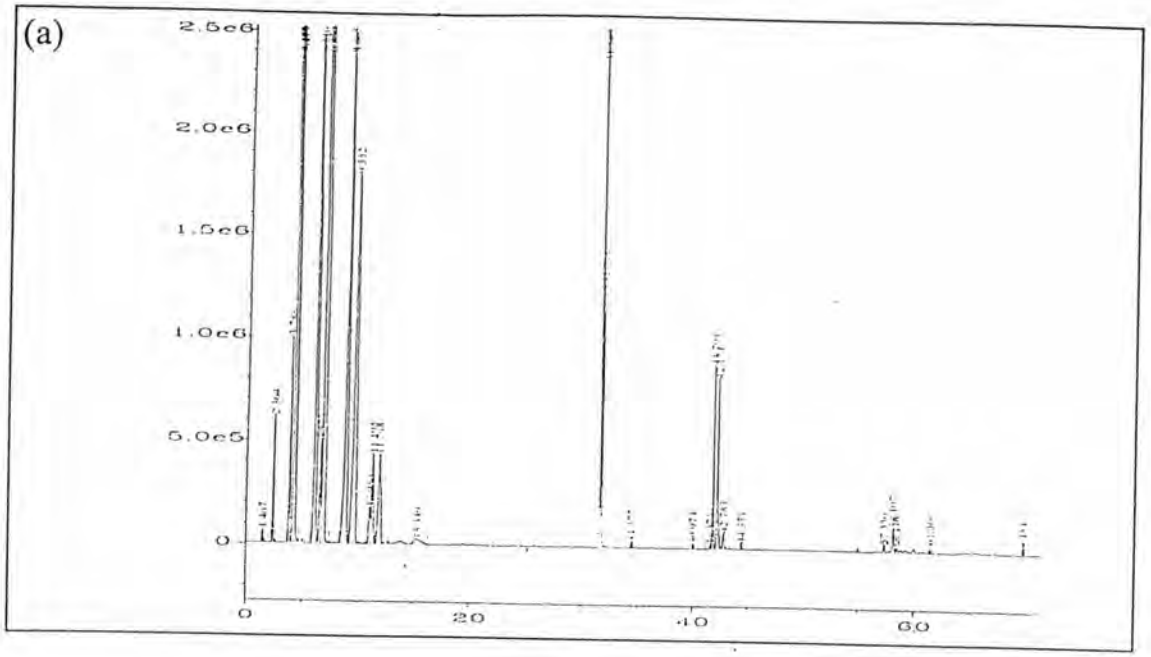


Figure A2 GC Chromatograms of products from using 0.3% Pt & 0.5% F/Al_2O_3 under 40 psi H_2, (a) 350°C and (b) 370°C.



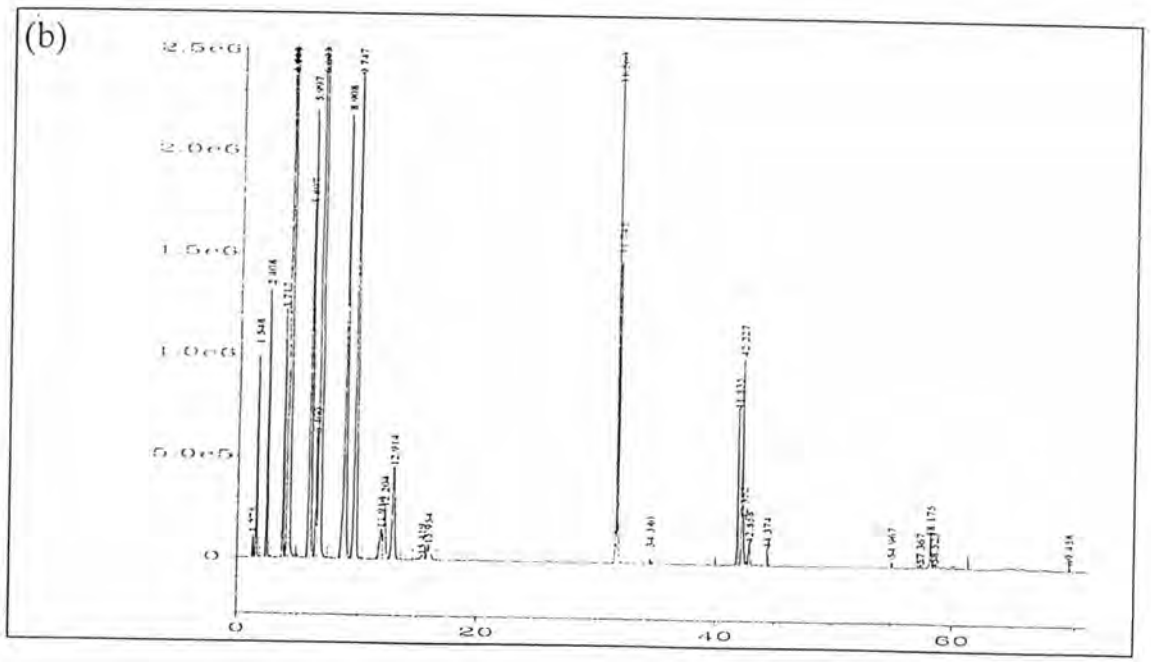


Figure A3 GC Chromatograms of products from using 0.3% Pt & 0.5% F/Al_2O_3 under 40 psi H_2, (a) 400°C and (b) 430°C.

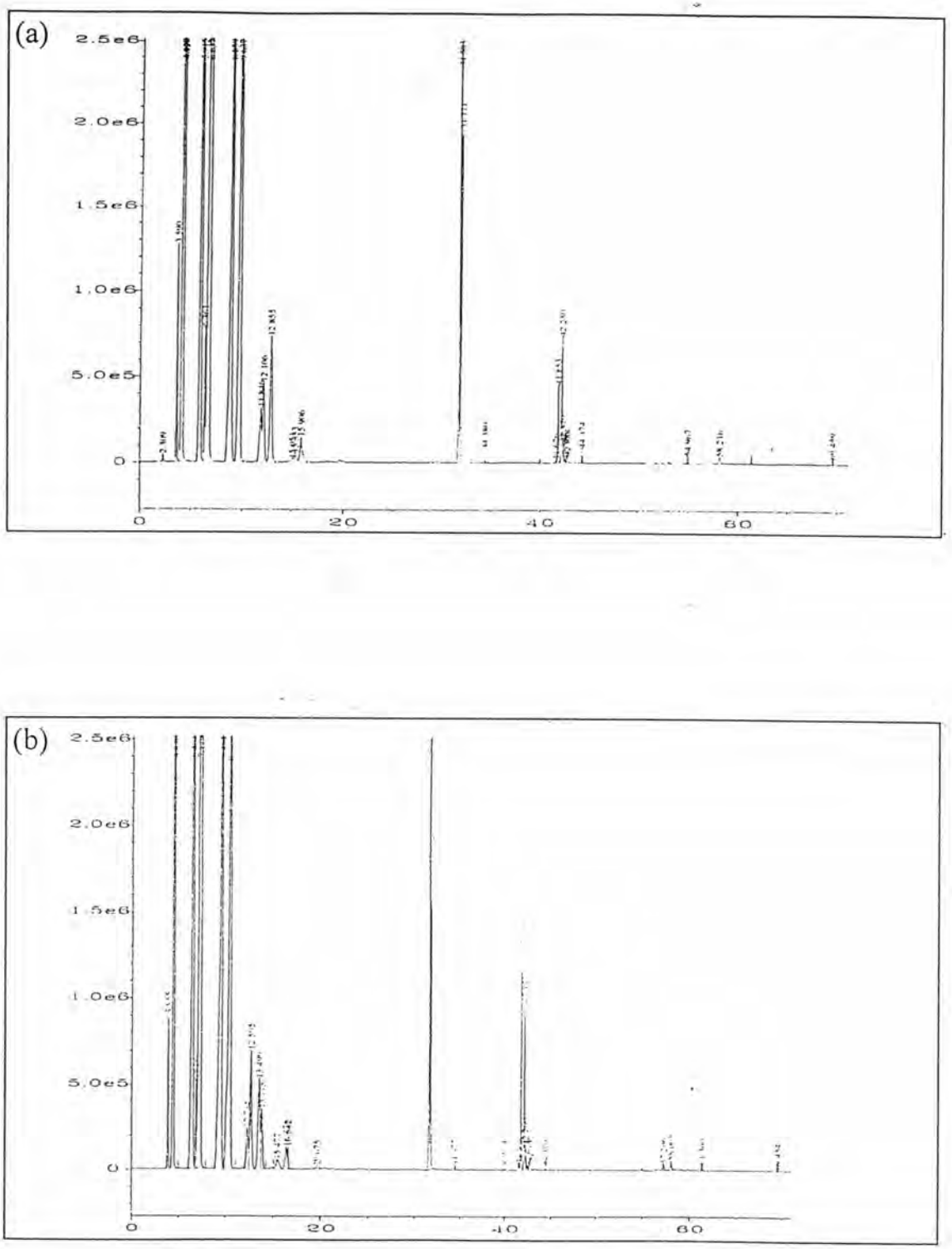


Figure A4 GC Chromatograms of products from using 0.3% Pt & 1% F/Al_2O_3 under 40 psi H_2, (a) 350°C and (b) 370°C.

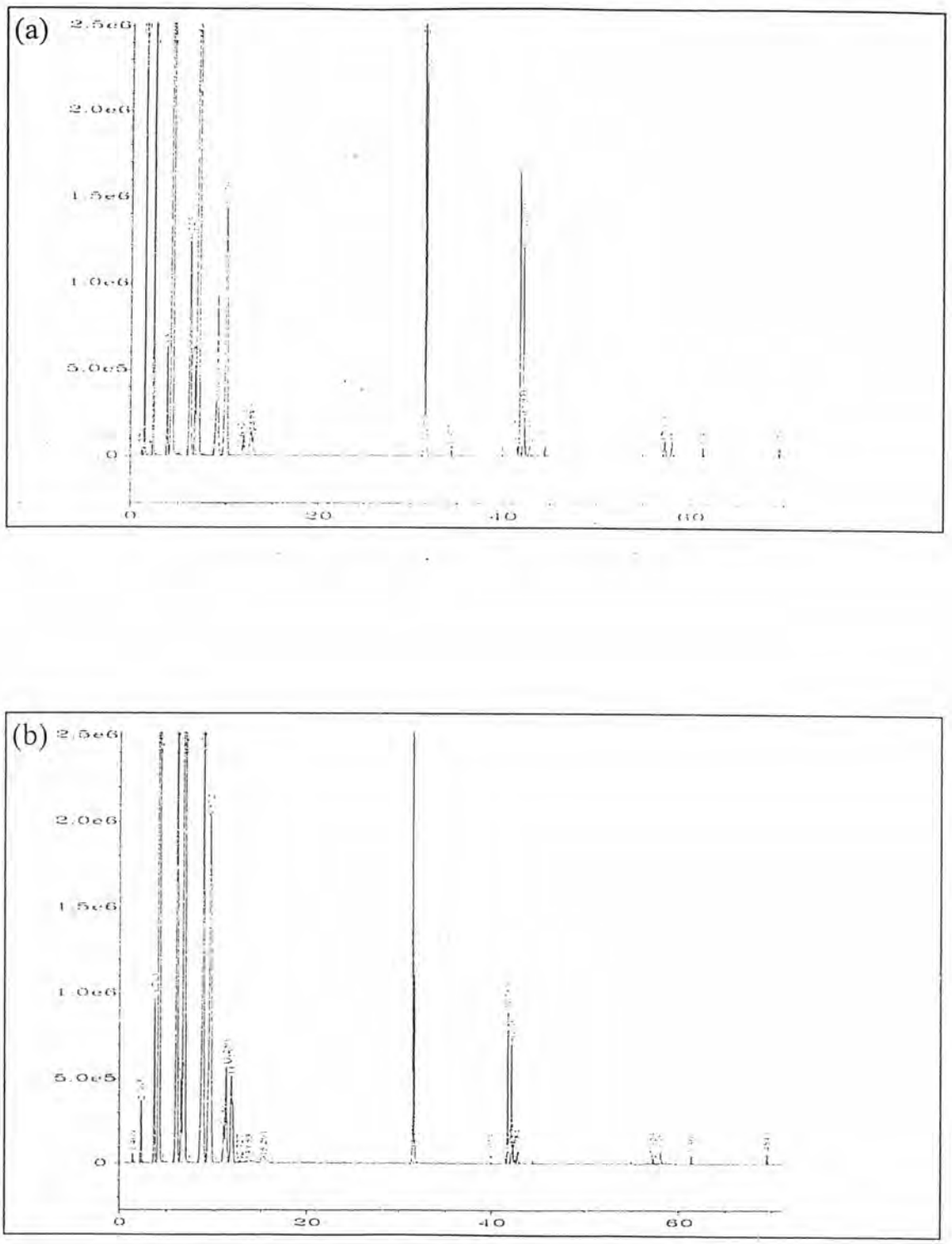


Figure A5 GC Chromatograms of products from using 0.3% Pt & 1% F/Al_2O_3 under 40 psi H_2, (a) 400°C and (b) 430°C.

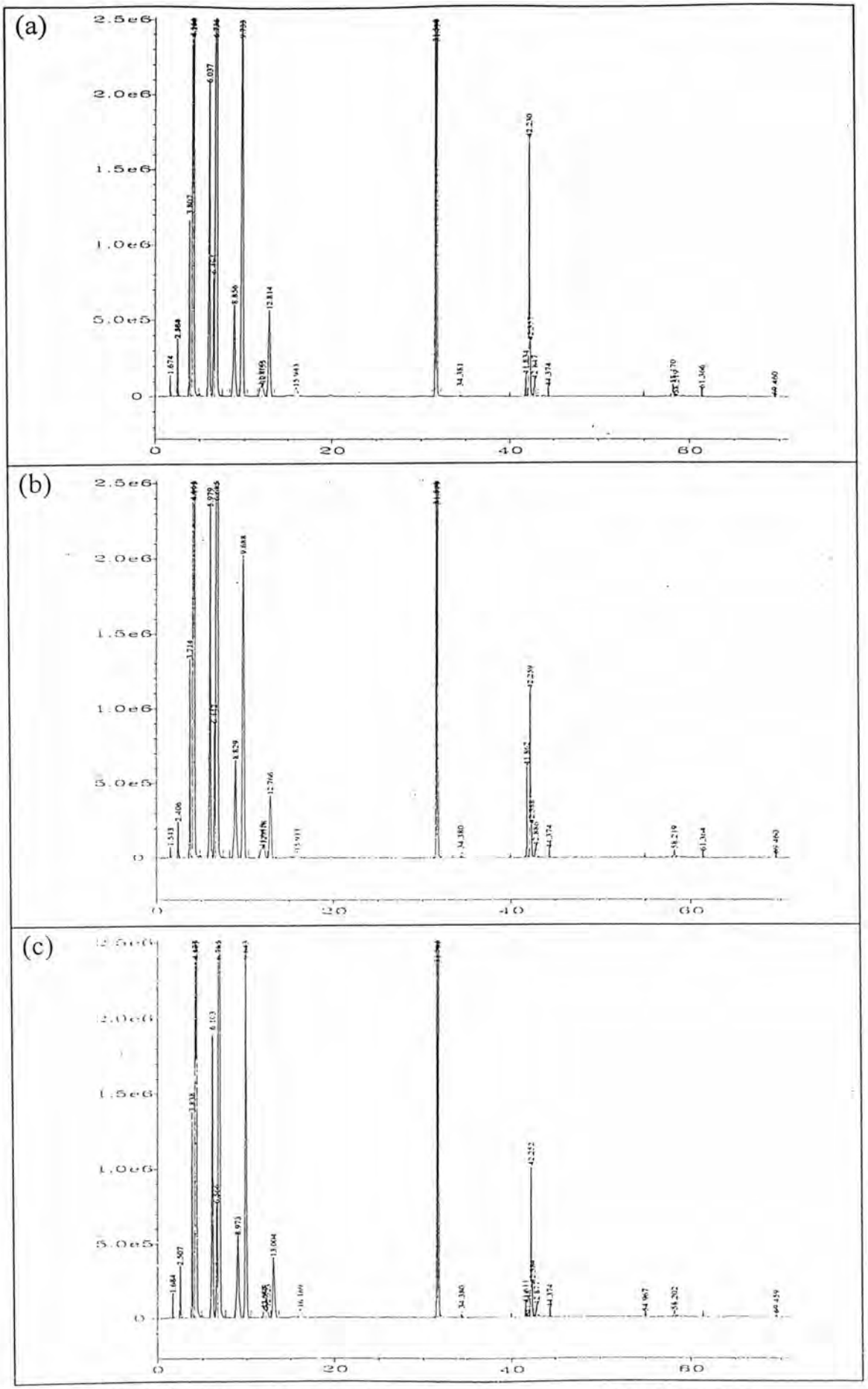


Figure A6 GC Chromatograms of products from using 0.6% Pt & 0.5% F/Al_2O_3 at 350°C (a) 20 psi, (b) 40 psi, and (c) 60 psi H_2.

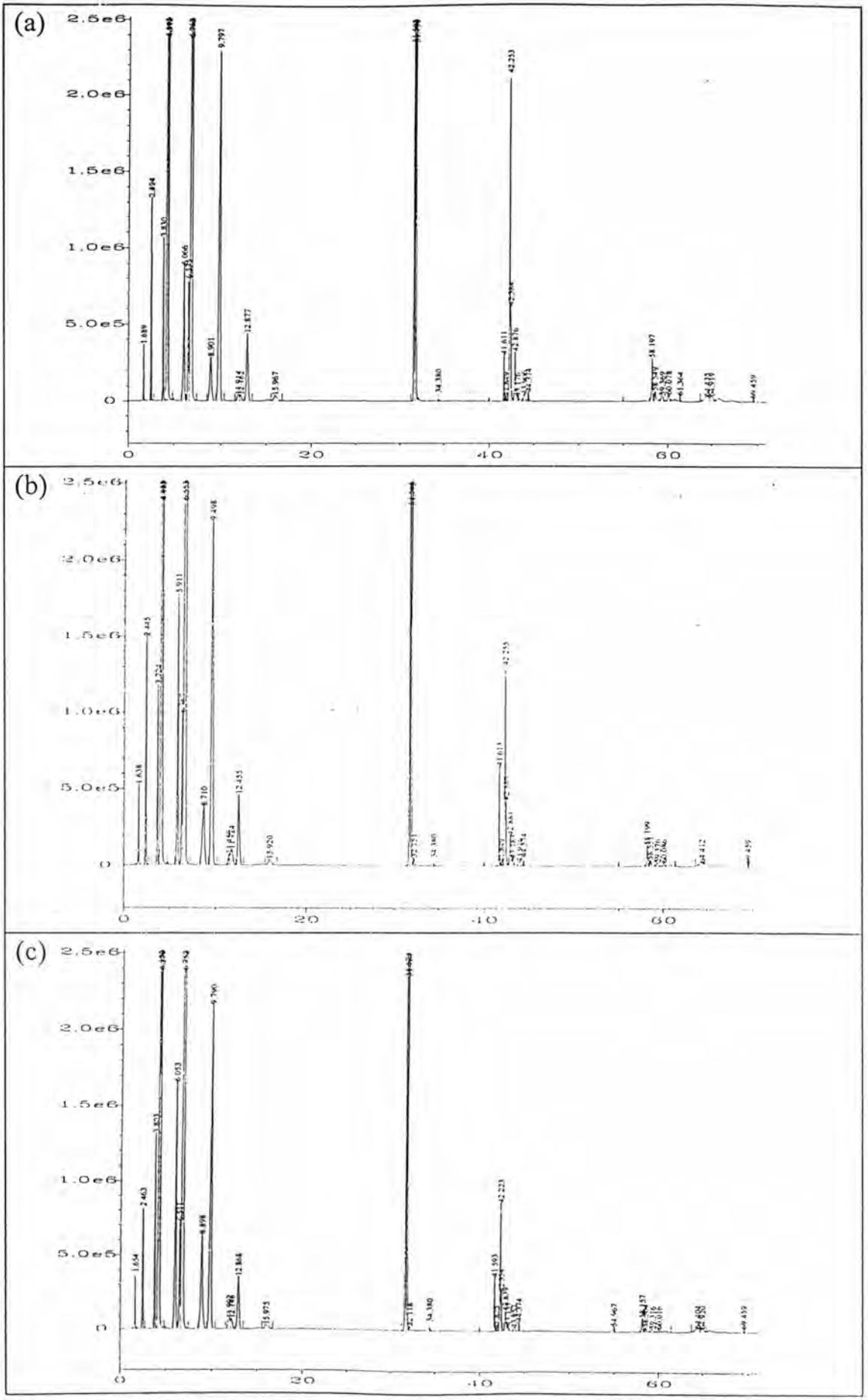


Figure A7 GC Chromatograms of products from using 0.6% Pt & 0.5% F/Al_2O_3 at 370°C (a) 20 psi, (b) 40 psi, and (c) 60 psi H_2.

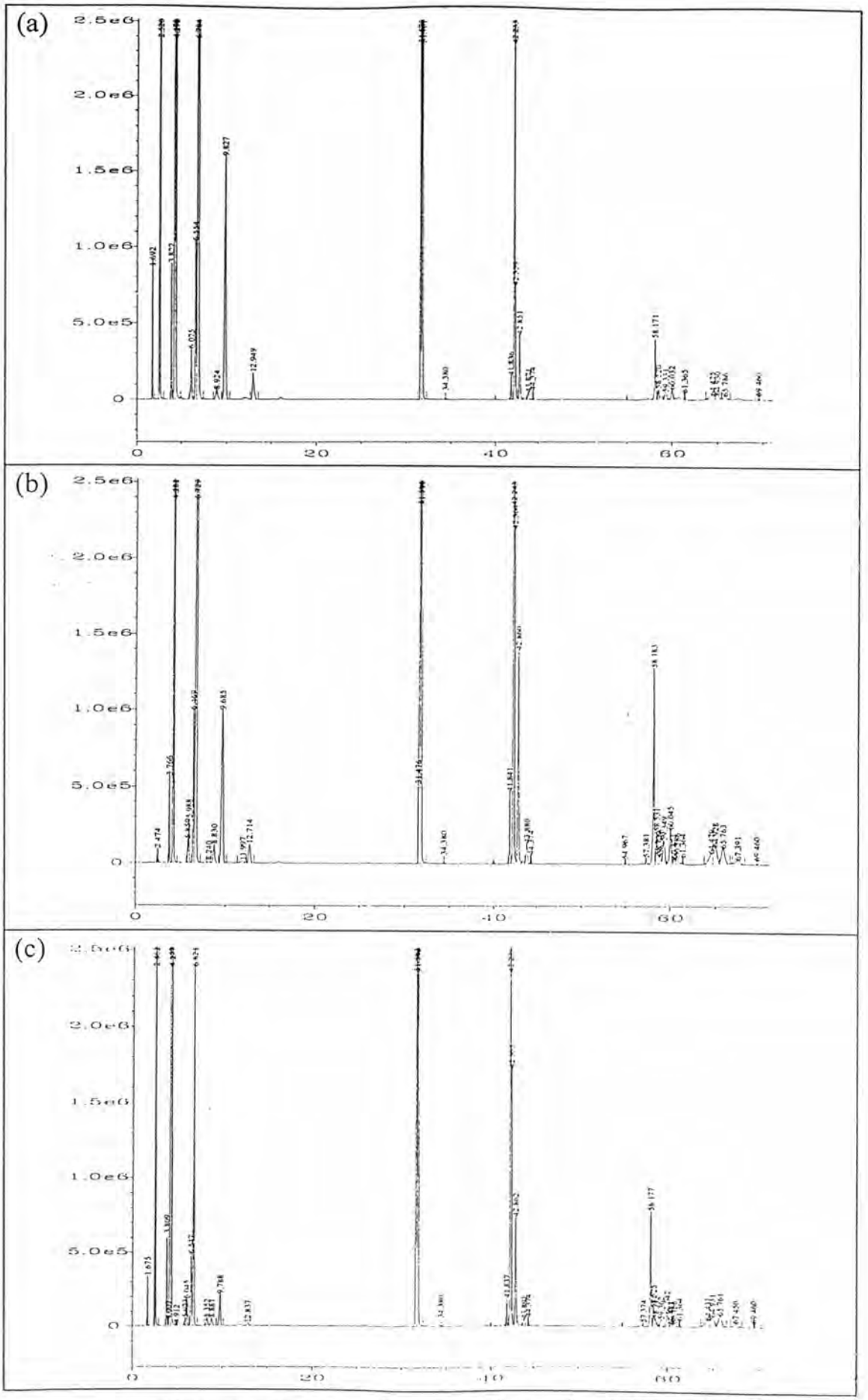


Figure A8 GC Chromatograms of products from using 0.6% Pt & 0.5% F/Al_2O_3 at 400°C (a) 20 psi, (b) 40 psi, and (c) 60 psi H_2.

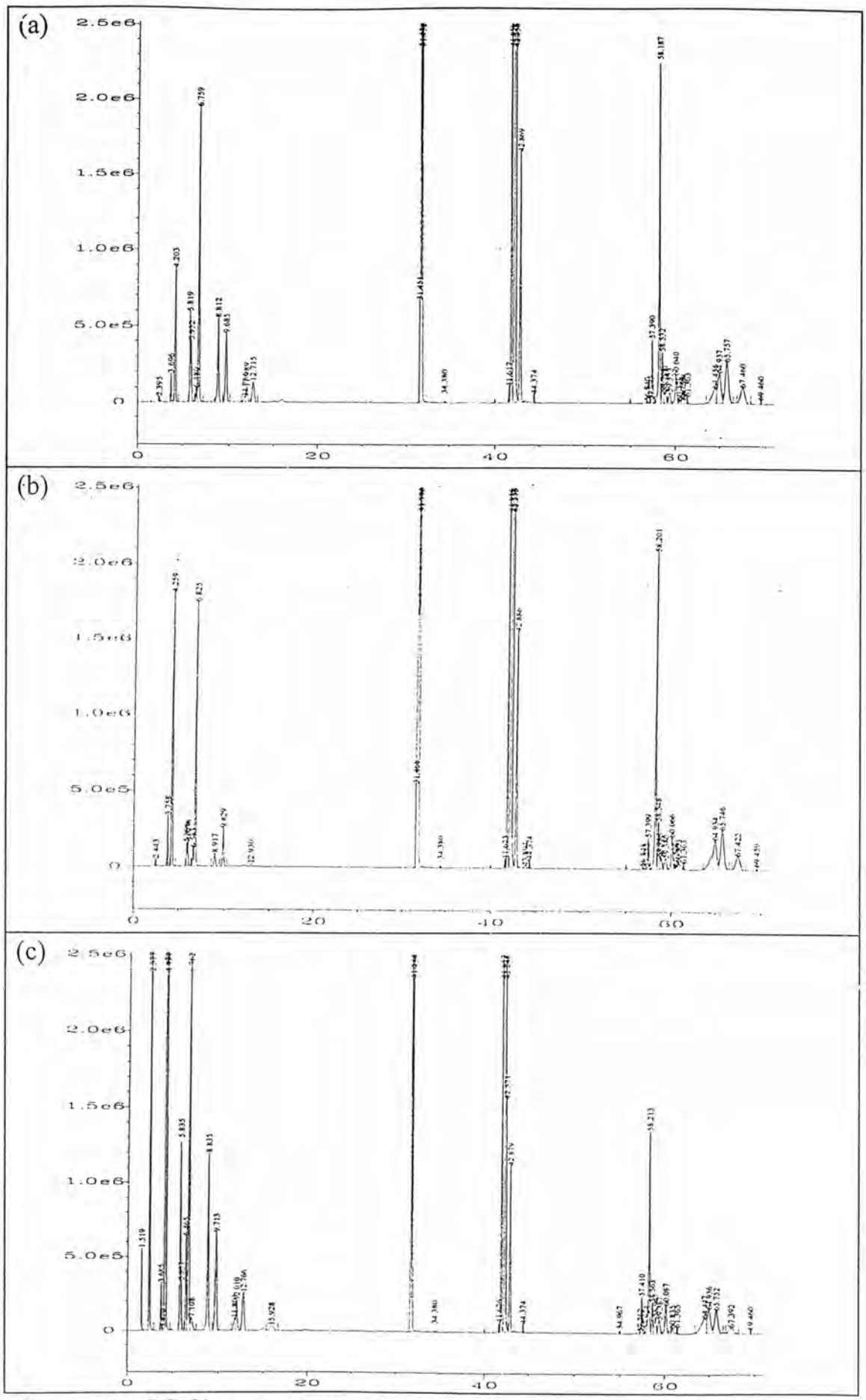


Figure A9 GC Chromatograms of products from using 0.6% Pt & 0.5% F/Al_2O_3 at 430°C (a) 20 psi, (b) 40 psi, and (c) 60 psi H_2.

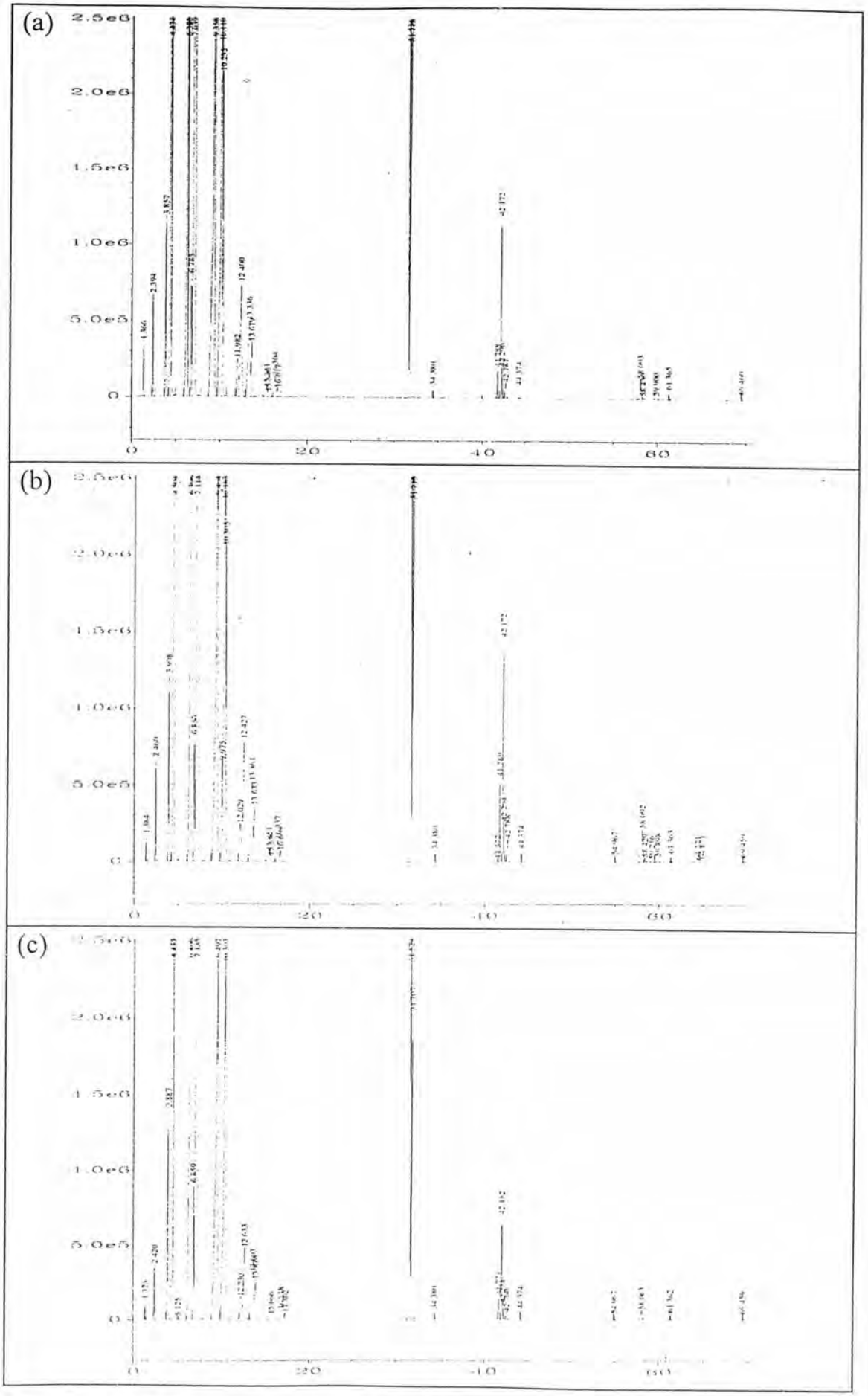


Figure A10 GC Chromatograms of products from using 0.6% Pt & 1% F/Al_2O_3 at 350°C (a) 20 psi. (b) 40 psi, and (c) 60 psi H_2.

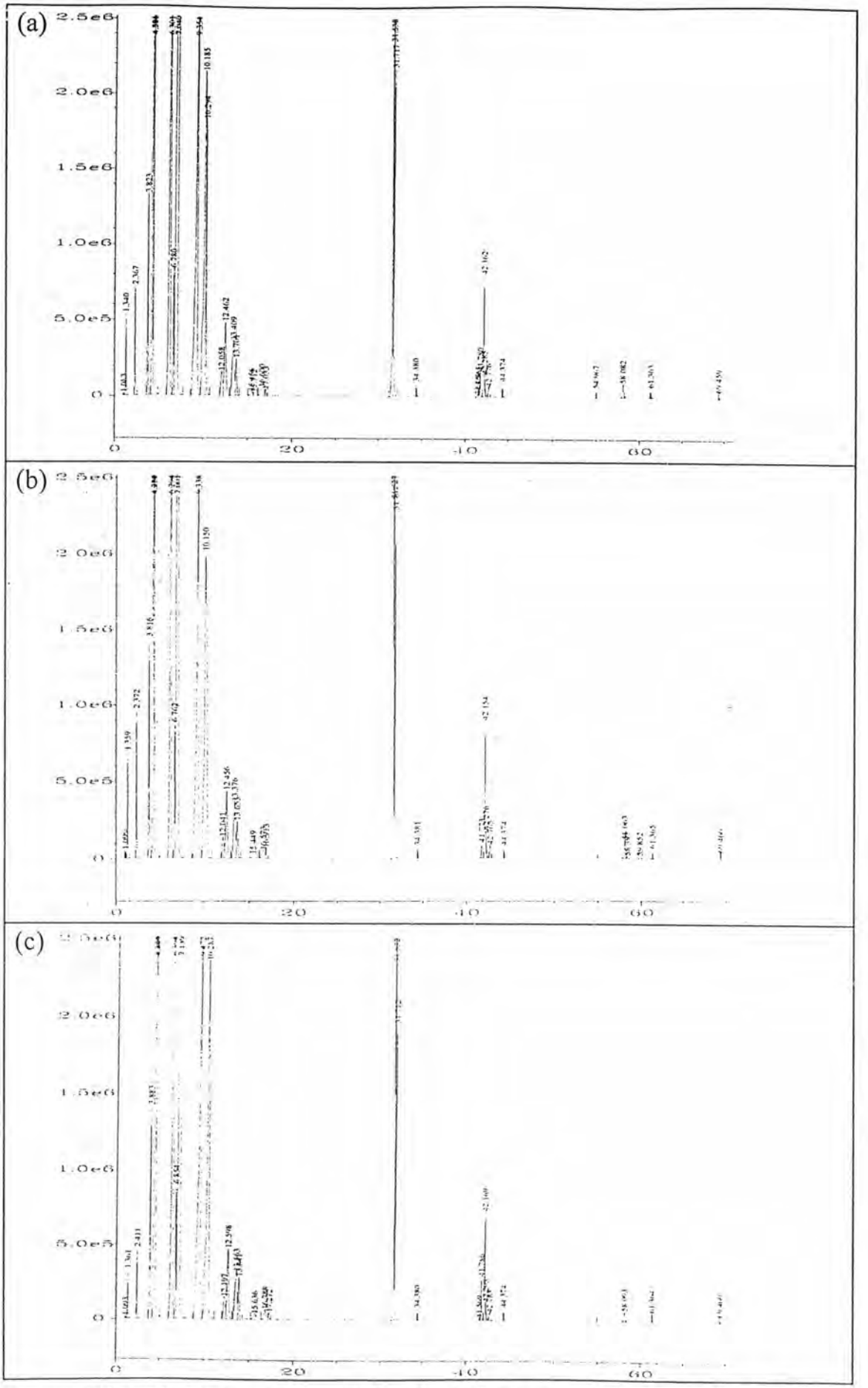


Figure A11 GC Chromatograms of products from using 0.6% Pt & 1% F/Al_2O_3 at 370°C (a) 20 psi, (b) 40 psi, and (c) 60 psi H_2.

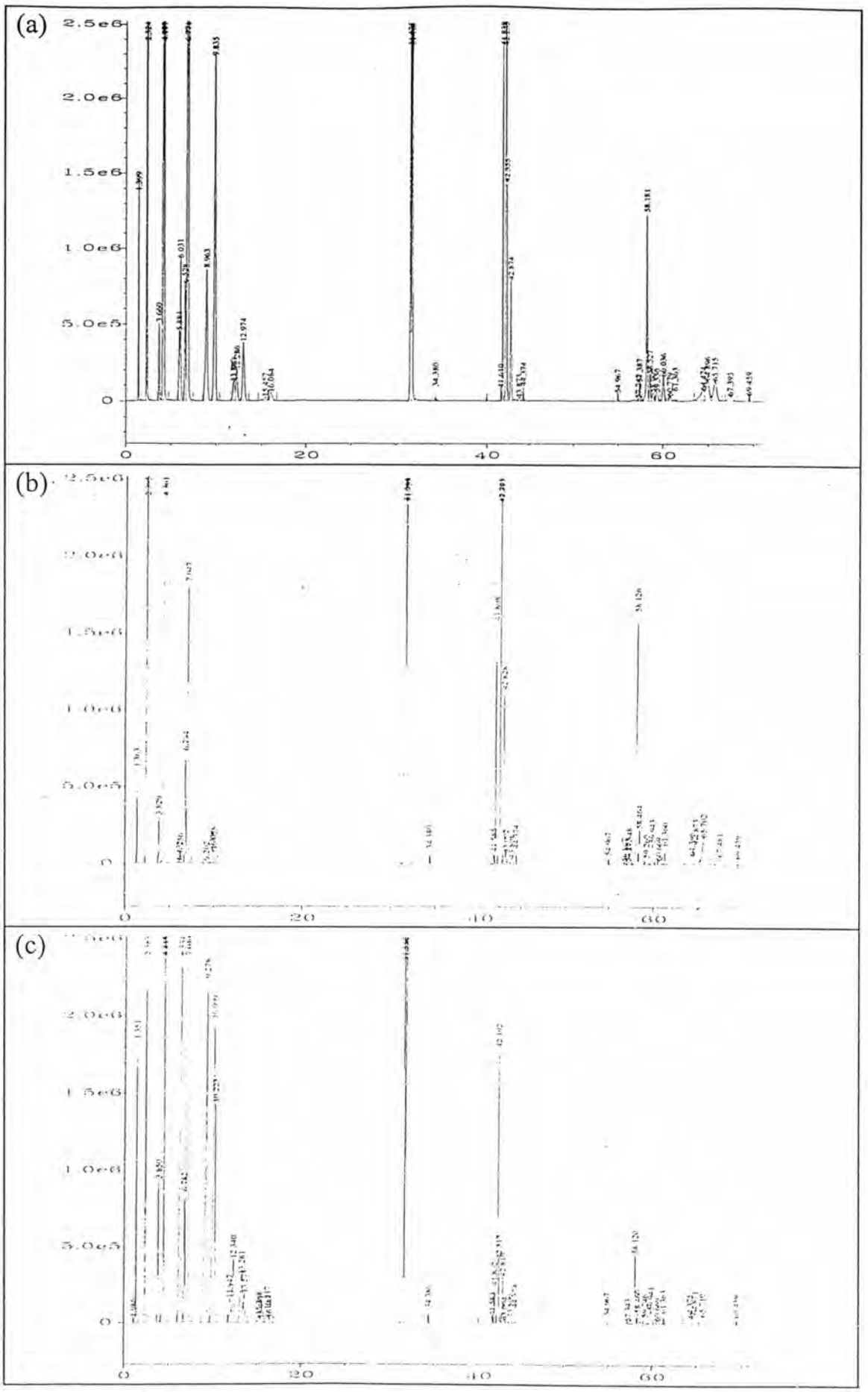


Figure A12 GC Chromatograms of products from using 0.6% Pt & 1% F/Al_2O_3 at 400°C (a) 20 psi, (b) 40 psi, and (c) 60 psi H_2.

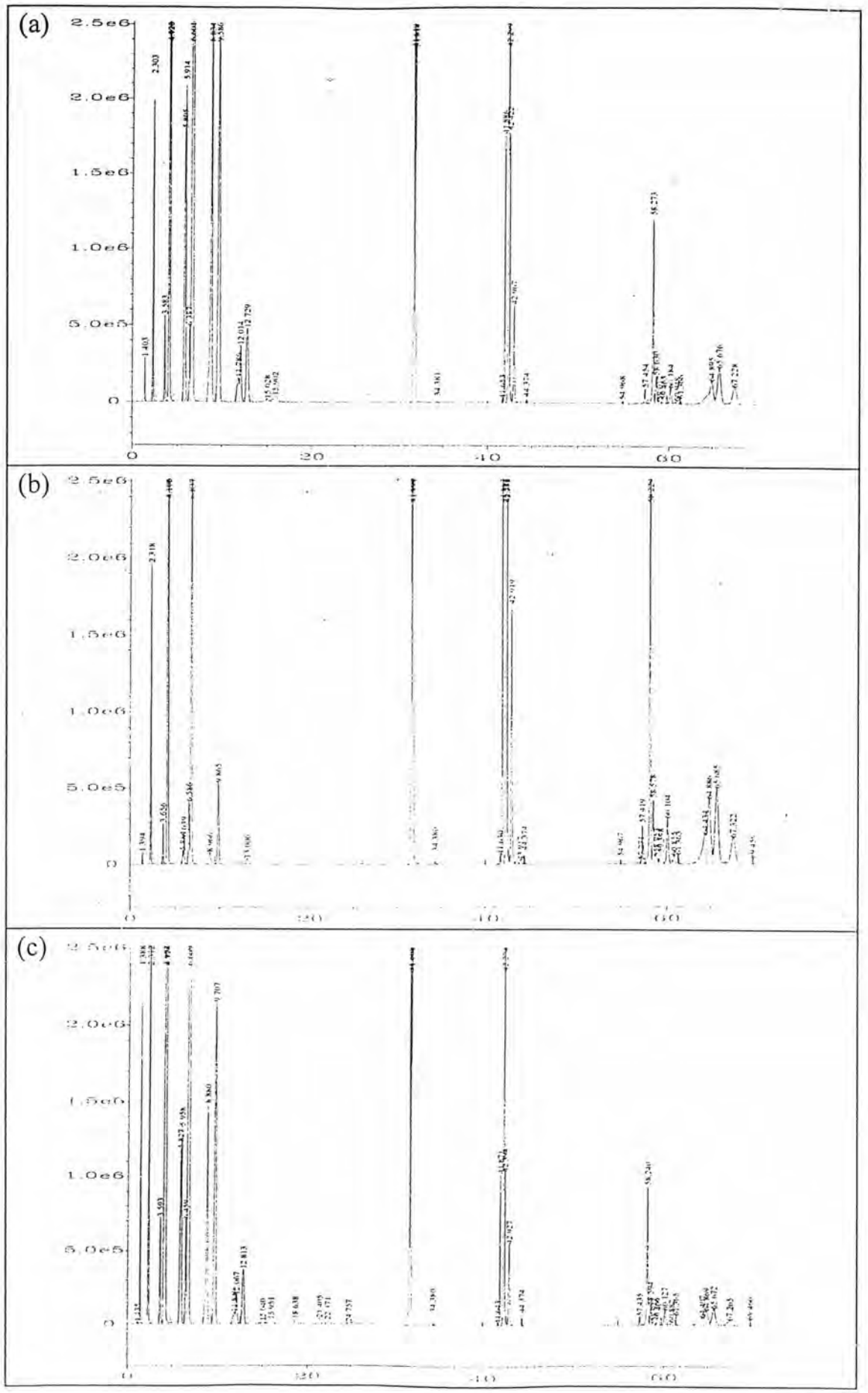


Figure A13 GC Chromatograms of products from using 0.6% Pt & 1% F/Al_2O_3 at 430°C (a) 20 psi, (b) 40 psi, and (c) 60 psi H_2.

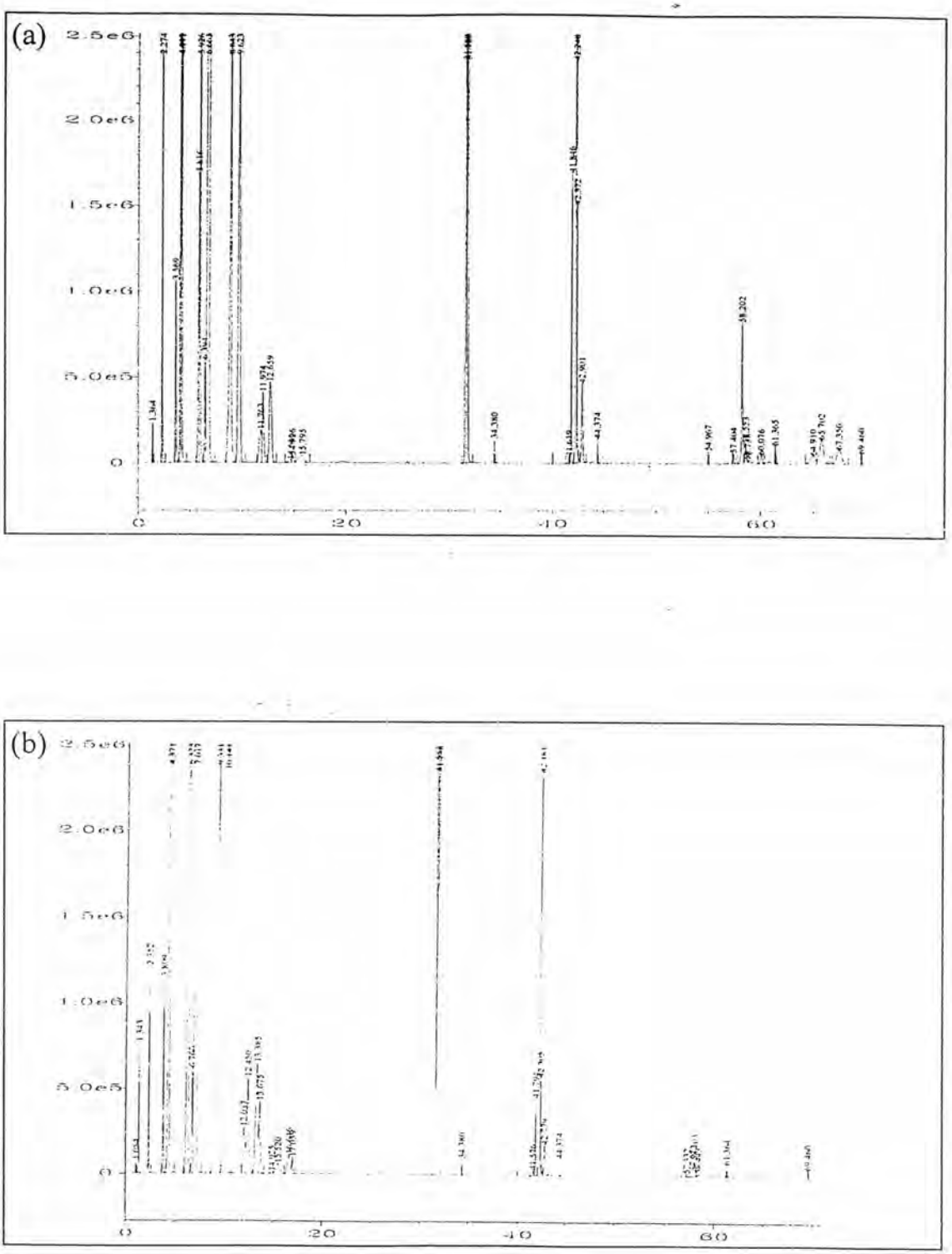
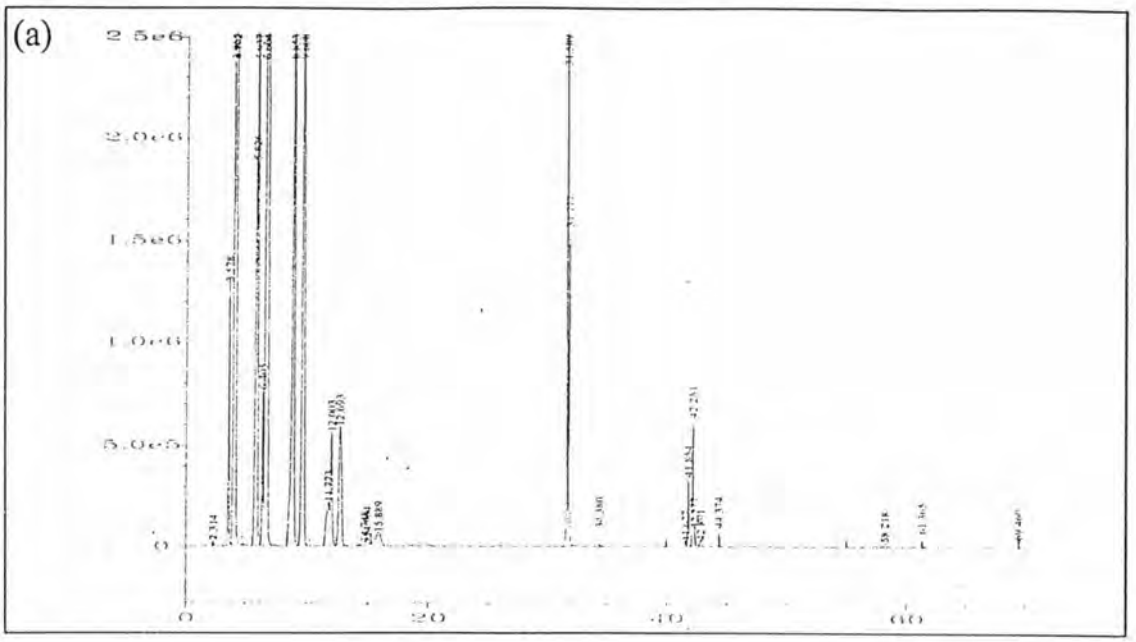


Figure A14 GC Chromatograms of products at 430°C under 40 psi H_2,
(a) 0.3% Pt & 0.5% F/4A molecular sieve
(b) 0.3% Pt & 1% F/4A molecular sieve



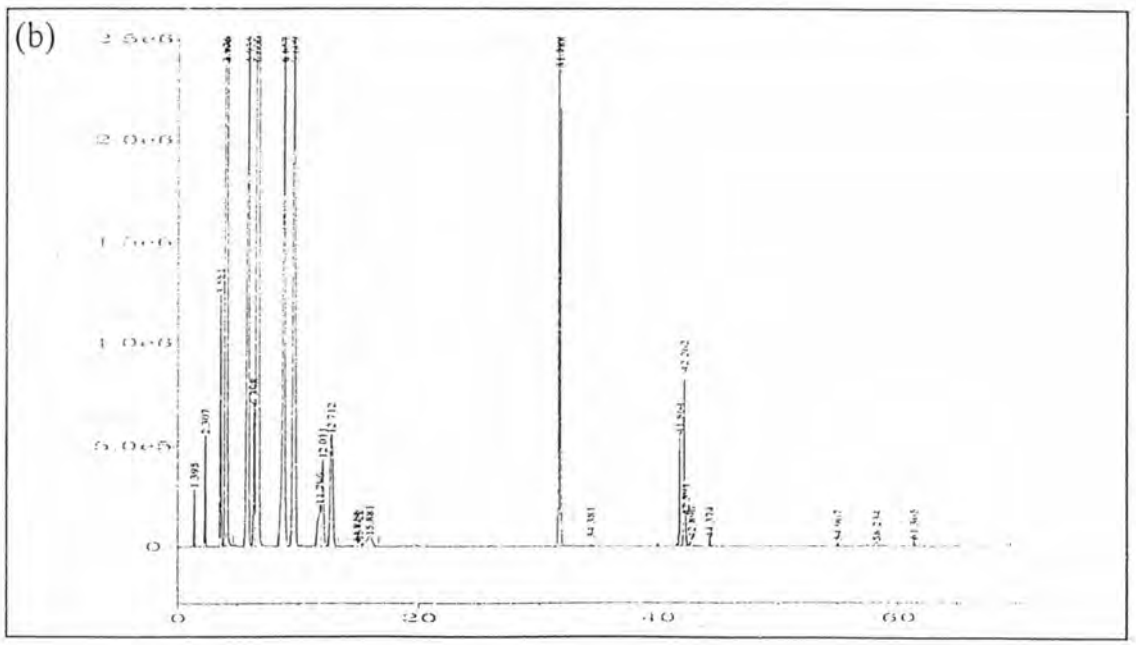


Figure A15 GC Chromatograms of products at 430°C under 40 psi H_2,

(a) 0.6% Pt & 0.5% F/4A molecular sieve

(b) 0.6% Pt & 1% F/4A molecular sieve

Appendix B

Table B1 % Composition of products from using 0.3 % Pt & 0.5 % F/Al_2O_3.

sample	condition		composition (%)										
	temp.	pressure		total C_5		total C_6		total C_7^+				total C_8^+	total
No.	(°C)	(psi)	total C_4^-	naphthenes	paraffins	naphthenes	paraffins	naphthenes	paraffins	benzene	toluene	aromatics	aromatics
1	350	20	0.74	1.36	33.91	6.84	26.71	7.52	9.11	5.33	3.18	2.33	10.84
2	350	20	0.82	1.60	34.89	7.88	28.03	1.11	11.25	3.29	2.48	1.63	7.40
3	350	40	0.87	1.41	29.48	8.10	26.50	9.45	11.25	3.61	3.05	0.96	7.62
4	350	40	1.03	1.53	29.98	9.14	27.88	10.55	15.11	4.85	2.59	2.66	10.10
5	350	60	0.05	0.93	12.90	9.42	28.26	5.41	33.00	5.21	4.15	1.51	10.87
6	350	60	0.30	1.07	13.38	11.74	26.74	2.99	36.60	1.73	2.87	1.99	6.59
7	370	20	0.01	0.50	4.11	8.02	14.93	23.50	35.95	2.48	5.10	3.04	10.62
8	370	20	0.03	0.58	5.07	8.32	17.91	24.38	32.59	4.00	6.88	4.56	15.44
9	370	40	0	0.04	3.58	9.60	23.20	7.08	46.71	3.10	4.92	4.12	12.14
10	370	40	0	0.08	3.90	11.68	19.24	5.16	44.45	4.82	5.38	1.88	12.08
11	370	60	0.28	1.45	24.75	8.96	27.11	4.30	25.03	2.59	4.09	2.79	9.47
12	370	60	0.20	1.55	25.73	9.52	30.77	1.08	21.01	6.07	2.13	0.63	8.83
13	400	20	0.42	1.58	35.90	7.70	27.25	2.12	16.51	3.70	1.08	0.98	5.76
14	400	20	0.48	1.72	36.16	8.22	27.96	1.28	18.71	4.26	3.20	0.78	8.24
15	400	40	0.09	0.74	8.07	9.18	23.41	5.54	39.95	1.03	5.12	2.10	8.25
16	400	40	0.13	0.60	8.47	9.66	21.45	6.80	43.69	4.21	4.44	5.30	13.95
17	400	60	0	0.50	2.27	9.80	21.57	8.00	47.16	3.18	6.78	3.41	13.37
18	400	60	0	0.58	3.51	11.58	19.09	4.50	46.72	4.70	3.60	2.93	11.23
19	430	20	3.02	1.41	35.84	7.54	23.98	7.19	7.74	4.71	3.20	4.00	11.91
20	430	20	3.36	1.51	36.98	6.14	26.62	8.37	11.47	2.83	2.18	0.80	5.81
21	430	40	0.21	1.01	13.90	9.11	29.17	14.05	17.45	5.87	6.61	4.11	16.59
22	430	40	0.27	1.17	15.20	9.59	27.43	15.77	14.81	4.77	3.69	5.82	14.28
23	430	60	0.49	1.20	22.00	6.02	26.55	11.03	13.55	4.13	5.30	7.08	16.51
24	430	60	0.61	1.28	23.76	9.22	29.37	8.05	14.97	6.91	4.72	3.72	15.35

Table B2 % Composition of products from using 0.3 % Pt & 1 % F/Al_2O_3.

sample No.	condition		composition (%)										
	temp. (°C)	pressure (psi)	total C_4^-	total C_5		total C_6		total C_7^+		benzene	toluene	total C_8^+ aromatics	total aromatics
				naphthenes	paraffins	naphthenes	paraffins	naphthenes	paraffins				
25	350	20	0.01	1.01	13.71	11.07	30.00	14.20	15.76	3.59	3.74	1.10	8.43
26	350	20	0.70	1.73	16.65	10.41	32.30	17.26	17.02	5.71	2.24	2.36	10.31
27	350	40	0.03	1.29	20.89	9.72	31.31	14.17	14.20	4.92	2.02	1.89	8.83
28	350	40	0.05	1.79	23.19	10.30	25.31	12.55	3.78	4.36	3.48	0.51	8.35
29	350	60	0.08	0.97	38.40	6.53	28.96	8.72	8.11	3.17	0.95	0.57	4.69
30	350	60	0.16	2.45	38.58	9.33	24.04	10.00	10.93	4.17	2.71	1.17	8.05
310	370	20	0.35	0.91	12.49	13.10	28.74	14.00	16.85	4.13	2.81	3.02	9.96
32	370	20	0.53	1.47	15.97	8.40	29.48	14.44	21.33	6.51	5.05	0.38	11.94
33	370	40	0.50	0.86	13.33	9.05	24.85	2.14	32.82	5.27	3.30	2.90	11.47
34	370	40	0.68	1.28	18.61	10.91	27.81	4.88	30.94	4.15	3.86	1.86	9.87
35	370	60	0	1.00	10.73	12.33	33.38	4.21	29.09	3.83	4.14	1.57	9.54
36	370	60	0	1.46	11.67	10.01	29.20	2.77	32.93	6.09	3.28	2.33	11.70
37	400	20	1.13	0.58	28.08	8.47	26.10	3.16	22.40	4.50	2.40	0.78	7.68
38	400	20	1.25	2.34	31.86	8.36	27.56	1.52	20.02	3.28	3.10	2.86	9.24
39	400	40	0.49	0.43	26.32	8.99	27.97	11.07	11.11	3.89	3.02	2.52	9.43
40	400	40	0.73	2.57	25.70	9.47	30.27	13.01	14.27	4.73	2.56	0.86	8.15
41	400	60	1.08	1.34	38.40	8.20	29.86	1.08	14.37	6.00	3.10	1.08	10.18
42	400	60	1.64	1.78	33.84	7.04	24.54	2.32	18.97	2.30	1.61	1.32	5.23
43	430	20	4.04	1.95	26.75	5.64	27.10	7.67	13.00	4.92	4.79	2.47	12.18
44	430	20	5.42	1.37	27.75	7.62	29.06	5.55	9.30	6.14	5.13	4.63	15.90
45	430	40	7.20	0.77	30.80	5.22	28.23	3.20	7.85	7.70	5.02	3.12	15.84
46	430	40	8.30	1.21	34.24	3.76	27.07	3.84	8.19	5.30	6.32	2.68	14.30
47	430	60	3.82	0.40	36.61	5.90	25.64	6.11	7.91	3.39	3.03	2.20	8.62
48	430	60	5.30	2.26	38.79	4.96	27.56	4.13	9.15	5.37	4.13	3.24	12.74

Table B3 % Composition of products from using 0.6 % Pt & 0.5 % F/Al_2O_3.

sample	condition		composition (%)										
	temp.	pressure		total C_5		total C_6		total C_7^+				total C_8^+	total
No.	(°C)	(psi)	total C_4^-	naphthenes	paraffins	naphthenes	paraffins	naphthenes	paraffins	benzene	toluene	aromatics	aromatics
49	350	20	0.58	0.38	28.62	1.78	20.66	1.86	24.29	9.49	10.00	2.08	21.57
50	350	20	0.90	0.04	30.32	2.60	18.92	2.84	22.99	9.39	11.24	1.02	21.65
51	350	40	0.44	0.29	31.06	9.15	21.03	6.73	20.76	6.13	3.50	0.34	9.97
52	350	40	0.58	0.47	29.60	5.41	26.53	3.43	19.08	4.25	3.70	1.34	9.29
53	350	60	0.45	0.10	28.80	8.58	19.97	1.11	25.05	3.94	5.75	0.61	10.30
54	350	60	0.35	0.30	31.52	7.08	21.87	2.73	29.49	5.12	7.25	0.93	13.30
55	370	20	3.43	0.77	27.81	7.24	19.94	1.50	22.70	5.88	13.09	2.98	21.95
56	370	20	2.53	0.49	23.17	3.72	18.86	0.64	24.02	6.50	10.80	3.94	21.24
57	370	40	1.69	0.98	31.90	5.92	15.26	1.66	22.01	12.20	8.92	2.71	23.83
58	370	40	2.79	1.30	31.72	6.84	11.54	2.82	18.09	8.50	11.62	1.43	21.55
59	370	60	1.10	1.15	39.55	6.00	19.70	0.84	19.77	3.99	6.91	1.19	12.09
60	370	60	2.38	2.13	34.85	4.20	22.26	1.48	18.99	6.01	6.35	1.15	13.51
61	400	20	1.51	0.76	23.07	4.77	26.19	0.90	10.70	9.95	11.79	7.78	29.52
62	400	20	0.09	1.40	25.27	2.55	24.47	1.64	14.02	13.75	12.63	6.76	33.14
63	400	40	0	0.03	5.98	2.18	5.85	1.08	4.12	21.70	33.38	20.86	75.94
64	400	40	0	0.06	6.76	3.54	8.87	1.00	3.78	22.58	38.34	20.00	80.92
65	400	60	8.42	2.13	15.42	3.95	19.23	3.07	2.45	19.03	20.76	9.84	49.63
66	400	60	9.06	0.45	12.86	5.33	19.65	1.34	0.33	16.71	18.72	11.46	46.89
67	430	20	0	0.07	1.19	1.07	2.61	0.34	0.49	26.74	40.05	26.00	92.79
68	430	20	0	0.01	0.63	1.31	1.19	0.88	1.67	24.02	43.37	27.36	94.75
69	430	40	0	0.01	1.86	2.17	1.74	0.51	1.10	28.97	41.01	25.12	95.10
70	430	40	0	0.01	1.18	3.79	0.48	0.05	0.44	29.93	39.65	21.98	91.56
71	430	60	6.70	4.89	13.22	6.08	4.04	1.79	4.86	20.75	21.98	15.15	57.88
72	430	60	4.10	4.29	15.90	6.92	5.02	3.03	2.20	22.21	22.24	14.63	59.08

Table B3 % Composition of products from using 0.6 % Pt & 0.5 % F/Al_2O_3. (continue)

sample No.	condition		composition (%)										
	temp. (°C)	pressure (psi)	total C_4^-	total C_5		total C_6		total C_7^+		benzene	toluene	total C_8^+ aromatics	total aromatics
				naphthenes	paraffins	naphthenes	paraffins	naphthenes	paraffins				
73	350	40	0.26	0.65	28.76	6.78	24.89	7.10	19.75	4.38	3.80	1.02	9.20
74	350	40	0.76	0.11	31.90	7.78	28.67	3.06	20.09	6.18	3.40	0.66	10.24
75	370	40	1.78	2.07	30.86	7.54	14.11	1.95	21.82	9.93	12.12	2.00	24.05
76	370	40	3.96	0.21	32.76	5.22	12.79	2.93	18.28	10.77	8.42	2.14	21.33
77	400	40	0	0.04	7.47	6.02	6.92	0.08	3.74	21.23	29.37	18.29	68.89
78	400	40	0	0.32	5.27	9.70	7.80	2.00	4.16	23.05	31.97	22.57	77.59
79	430	40	0	0.01	1.06	3.14	1.00	0.17	0.56	29.66	41.70	23.18	94.54
80	430	40	0	0.01	2.02	2.82	1.82	0.39	0.98	29.24	38.32	23.92	91.48
81	350	40	0.01	0.24	28.50	9.86	20.73	5.06	20.01	3.10	4.57	2.94	10.61
82	350	40	0.05	0.94	38.78	12.06	19.55	7.48	20.98	3.86	5.85	3.34	13.05
83	350	40	1.97	0.95	36.74	8.10	23.79	10.01	11.29	2.98	23.42	0.57	26.97
84	350	40	3.31	2.09	35.70	7.66	24.85	10.43	7.39	4.38	4.22	1.31	9.91
85	370	40	2.48	1.78	35.83	3.70	27.80	2.77	10.03	7.51	7.04	4.11	18.66
86	370	40	1.00	1.05	39.37	4.26	27.70	3.87	8.20	6.51	3.42	1.23	11.66
87	370	40	0.08	1.34	38.12	8.39	29.94	6.00	13.05	3.90	1.59	1.85	7.34
88	370	40	0.38	1.96	34.36	6.97	26.02	3.32	14.57	3.68	2.93	2.35	35.89
89	400	40	4.10	0.28	28.00	3.25	17.77	0.88	1.11	9.59	14.10	12.20	30.39
90	400	40	6.32	1.34	26.46	3.65	18.71	1.28	10.53	11.49	10.66	8.24	10.28
91	400	40	7.07	1.00	21.71	5.45	29.92	6.50	25.94	2.75	6.36	1.17	11.38
92	400	40	5.57	0.08	23.97	3.11	20.24	7.44	27.34	5.21	4.06	2.11	66.92
93	430	40	0.03	0.40	11.20	4.37	9.57	0.23	5.21	18.99	24.90	23.03	64.56
94	430	40	0.19	0.44	12.26	5.65	10.92	0.65	7.74	17.31	26.50	20.75	21.56
95	430	40	0.43	0.17	31.21	2.99	19.00	3.23	14.19	10.23	9.97	1.46	21.66
96	430	40	1.05	0.25	27.73	1.39	20.58	1.47	23.09	8.65	11.27	1.64	

Sample No.73-80 were obtained from reproducibility experiments.
Sample No. 81,82,85,86,89,90,93, and 94 were obtained from using the first regenerate catalysts.
Sample No. 83,84,87,88,91,92,95, and 96 were obtained from using the second regenerate catalysts.

Table B4 % Composition of products from using 0.6 % Pt & 1 % F/Al_2O_3.

sample	condition		composition (%)										
	temp.	pressure		total C_5		total C_6		total C_7^+				total C_8^+	total
No.	(°C)	(psi)	total C_4^-	naphthenes	paraffins	naphthenes	paraffins	naphthenes	paraffins	benzene	toluene	aromatics	aromatics
97	350	20	1.05	2.20	20.25	8.94	29.52	13.30	13.02	4.19	4.23	2.27	10.49
98	350	20	0.41	0.46	22.55	8.42	26.60	14.60	15.92	5.61	3.29	3.59	12.49
99	350	40	1.23	0.90	21.79	6.21	25.16	14.69	15.43	5.62	2.17	2.48	10.27
100	350	40	0.53	1.62	23.37	3.83	26.76	13.27	12.79	3.82	4.51	1.72	10.05
101	350	60	0.63	0.97	32.02	7.14	27.57	9.57	13.04	4.79	4.02	1.01	9.82
102	350	60	0.23	2.15	31.38	9.84	29.67	11.61	8.74	3.69	0.06	1.33	5.08
103	370	20	0.81	1.21	29.00	8.16	29.11	11.47	10.96	4.10	2.13	2.49	8.72
104	370	20	1.33	1.37	30.56	8.96	26.95	10.57	12.61	4.48	3.36	0.49	8.33
105	370	40	1.01	2.07	35.29	8.57	26.75	8.55	10.52	3.07	1.98	1.06	6.11
106	370	40	2.11	0.97	32.59	7.01	27.63	10.51	10.18	4.84	2.94	2.36	10.14
107	370	60	0.94	1.08	31.17	7.72	26.00	11.00	11.11	2.97	2.77	2.10	7.84
108	370	60	0.48	2.10	35.55	8.84	29.38	9.44	10.17	5.09	1.83	0.03	6.95
109	400	20	6.19	0.67	16.90	2.01	19.92	4.01	10.30	14.46	15.11	10.99	40.56
110	400	20	8.89	0.43	17.78	2.11	17.74	3.17	8.16	10.08	15.25	15.85	41.18
111	400	40	5.00	0.11	12.84	0.04	3.71	0.08	1.99	19.25	33.05	21.31	73.61
112	400	40	8.56	0.43	13.34	0.16	4.35	0.06	3.29	20.79	32.01	19.39	72.19
113	400	60	.4.82	0.26	29.03	7.10	24.94	7.80	9.83	4.17	4.19	5.21	13.57
114	400	60	2.94	1.92	28.77	4.64	27.13	9.46	11.69	6.65	4.59	4.27	15.51
115	430	20	2.20	0.30	12.83	5.29	19.10	6.91	12.07	13.23	15.09	13.80	42.12
116	430	20	2.06	0.92	10.53	5.63	20.48	7.71	13.61	9.77	13.41	14.92	38.10
117	430	40	1.17	0.31	6.17	0.22	6.71	0.25	6.51	20.31	32.00	26.14	78.45
118	430	40	1.89	0.15	7.31	0.38	5.09	0.15	7.63	19.55	30.06	27.96	77.57
119	430	60	6.23	1.20	29.80	2.84	22.45	3.81	11.00	8.00	7.84	9.05	24.89
120	430	60	5.29	0.48	27.10	4.62	24.07	5.53	8.54	5.34	6.26	10.55	22.15

Table B5 % Composition of products from using 0.3 % Pt & 0.5 % F/4A molecular sieve.

sample	condition		composition (%)										
	temp.	pressure		total C_5		total C_6		total C_7^+				total C_8^+	total
No.	(°C)	(psi)	total C_4^-	naphthenes	paraffins	naphthenes	paraffins	naphthenes	paraffins	benzene	toluene	aromatics	aromatics
121	350	20	0.79	2.43	17.09	4.68	24.20	21.97	20.71	8.34	4.16	0.43	12.93
122	350	20	0.53	0.01	19.37	5.76	23.36	18.45	48.95	6.02	2.14	0.61	8.77
123	350	40	0	1.00	19.47	11.50	22.28	20.19	18.79	4.85	3.15	0.33	8.33
124	350	40	0	1.14	18.09	6.78	22.72	18.55	20.39	2.29	4.23	0.17	6.69
125	350	60	0.84	0.95	22.00	5.19	35.96	13.20	16.94	4.56	0.36	0.05	4.97
126	350	60	0.02	1.75	18.64	6.69	36.18	9.00	19.54	6.64	1.18	0.31	8.13
127	370	20	1.17	1.21	19.55	6.47	21.83	18.99	16.69	7.78	3.13	1.00	11.91
128	370	20	0.47	1.64	21.75	3.99	25.85	19.71	18.99	6.06	3.41	0.32	9.79
129	370	40	0.84	0	16.96	10.01	21.93	30.83	6.00	3.10	4.09	1.51	8.70
130	370	40	1.48	0	20.72	10.53	23.69	31.37	6.02	4.72	3.33	2.87	10.92
131	370	60	0.89	2.11	27.61	5.55	32.33	9.79	13.11	6.46	1.07	0.11	7.64
132	370	60	1.27	1.17	29.97	4.13	29.91	13.39	10.67	6.90	2.71	0.31	9.92
133	400	20	1.24	0.39	19.21	2.17	33.73	8.04	16.59	6.42	10.30	2.15	18.87
134	400	20	0.28	1.35	20.03	1.41	35.05	6.26	18.79	9.42	5.86	1.11	16.39
135	400	40	1.03	0.41	26.89	4.20	27.17	7.57	16.66	6.41	9.91	1.98	18.30
136	400	40	1.59	0.79	25.97	4.02	26.79	7.19	14.16	8.69	6.81	1.72	17.22
137	400	60	2.08	0.38	27.78	2.08	27.16	4.65	12.93	6.30	8.54	2.01	16.85
138	400	60	1.28	1.08	30.28	5.80	25.86	6.47	15.47	8.72	9.74	1.39	19.85
139	430	20	0.43	2.05	26.02	3.41	23.44	9.82	16.81	9.32	5.95	1.57	16.84
140	430	20	0.61	1.59	27.16	3.49	26.74	10.65	14.97	6.98	7.33	1.75	16.06
141	430	40	1.98	1.77	16.84	8.11	22.95	13.16	14.98	6.10	9.86	4.17	20.13
142	430	40	1.02	0.57	19.10	7.17	23.79	11.94	16.28	6.22	8.66	5.31	20.19
143	430	60	3.98	0.30	24.09	2.39	24.89	13.92	10.20	14.02	4.87	0.44	19.33
144	430	60	2.58	1.74	23.83	4.25	23.43	15.04	11.90	12.40	4.41	1.24	18.05

Table B6 % Composition of products from using 0.3 % Pt & 1 % F/4A molecular sieve.

sample No.	condition		composition (%)										
	temp. (°C)	pressure (psi)	total C_4^-	total C_5		total C_6		total C_7^+		benzene	toluene	total C_8^+ aromatics	total aromatics
				naphthenes	paraffins	naphthenes	paraffins	naphthenes	paraffins				
145	350	20	0.77	0.46	34.93	5.66	23.38	7.65	18.44	3.67	0.89	0.21	4.77
146	350	20	1.97	1.04	39.01	4.66	22.34	8.37	21.24	3.55	2.09	0.67	6.31
147	350	40	0.01	1.14	35.64	9.31	25.00	11.24	10.17	4.80	1.74	1.60	8.14
148	350	40	0.01	2.12	37.80	6.93	27.76	9.08	11.97	2.62	2.14	0.08	4.84
149	350	60	2.10	1.50	41.10	4.89	27.99	7.45	12.00	3.23	0.90	0.85	4.98
150	350	60	0.96	1.74	38.64	6.67	24.49	5.49	11.68	3.85	3.04	1.43	8.32
151	370	20	1.08	1.95	38.88	5.40	23.21	6.18	16.79	3.18	2.22	1.78	7.18
152	370	20	1.74	1.05	35.14	1.76	24.81	9.96	18.95	4.14	0.74	1.04	5.92
153	370	40	0.01	1.87	35.02	9.19	24.86	11.90	12.30	2.68	2.00	1.61	6.29
154	370	40	0.01	1.37	34.26	7.51	27.72	9.96	10.02	5.00	2.30	0.41	7.71
155	370	60	0.02	2.13	38.90	2.97	26.55	7.68	19.42	2.97	2.95	0.80	6.72
156	370	60	0.32	0.97	37.94	2.13	25.93	5.20	17.64	4.25	0.21	1.80	6.26
157	400	20	0.22	0.86	32.91	4.15	31.27	7.50	9.51	3.23	1.99	2.71	7.93
158	400	20	0.08	1.22	35.89	2.47	33.41	9.98	12.45	4.39	1.74	2.87	9.00
159	400	40	2.13	0.72	34.47	3.73	30.81	8.12	13.31	5.05	0.87	3.38	9.30
160	400	40	1.43	0.62	33.43	4.51	34.39	5.70	8.81	4.81	2.46	1.54	8.81
161	400	60	3.70	1.10	37.87	2.79	32.58	7.77	8.64	3.87	1.10	1.15	6.12
162	400	60	4.16	0.34	41.19	4.39	31.38	7.41	4.98	5.81	1.54	1.99	9.34
163	430	20	0.88	0.55	33.29	5.68	35.10	8.71	9.64	2.86	2.28	0.99	6.13
164	430	20	2.20	1.03	32.07	2.70	31.68	11.19	12.40	3.18	1.50	2.17	6.85
165	430	40	0.03	1.89	33.69	8.10	26.41	12.35	11.03	3.39	2.84	0.85	7.08
166	430	40	0.01	1.29	35.57	8.46	25.37	9.99	1.45	3.79	1.68	1.27	6.74
167	430	60	3.62	2.55	36.20	4.90	27.18	5.01	7.87	5.10	2.94	1.79	9.83
168	430	60	5.50	0.40	39.20	5.96	26.02	5.23	9.14	3.66	4.32	3.65	11.63

Table B7 % Composition of products from using 0.6 % Pt & 0.5 % F/4A molecular sieve.

sample No.	condition		composition (%)										
	temp. (°C)	pressure (psi)	total C_4^+	total C_5		total C_6		total C_7^+		benzene	toluene	total C_8^+ aromatics	total aromatics
				naphthenes	paraffins	naphthenes	paraffins	naphthenes	paraffins				
169	350	40	0.14	2.20	31.30	5.58	14.69	19.99	15.78	4.17	7.79	3.39	15.35
170	350	40	0.40	0.60	28.54	4.68	14.45	16.75	12.58	5.71	10.09	1.17	16.97
171	370	40	0.90	1.17	28.92	4.97	22.30	5.26	17.14	8.75	5.71	0.92	15.38
172	370	40	0.04	1.11	32.26	6.29	18.12	9.00	19.24	10.11	5.33	1.92	17.36
173	400	40	0.08	0.89	28.00	6.71	17.14	14.01	15.12	4.20	11.72	2.54	18.46
174	400	40	0.24	1.55	30.58	4.39	16.38	14.79	15.92	5.24	9.72	1.70	16.66
175	430	40	0.39	0.57	23.34	6.11	15.39	12.53	15.10	8.95	12.80	9.59	31.34
176	430	40	1.75	1.07	22.18	3.05	12.05	15.83	10.56	5.89	15.16	7.59	28.64

Table B8 % Composition of products from using 0.6 % Pt &1 % F/4A molecular sieve.

sample No.	Condition		composition (%)										
	temp. (°C)	pressure (psi)	total C_4^+	total C_5		total C_6		total C_7^+		benzene	toluene	total C_8^+ aromatics	total aromatics
				naphthenes	paraffins	naphthenes	paraffins	naphthenes	paraffins				
177	350	40	0.10	1.97	28.79	7.98	28.01	12.43	11.79	4.86	2.12	2.09	9.07
178	350	40	0.01	0.95	29.31	9.87	24.07	14.45	14.89	3.26	2.92	0.23	6.41
179	370	40	1.20	1.87	23.84	7.69	28.77	10.90	16.21	4.80	3.14	0.37	8.31
180	370	40	0.44	1.09	27.65	6.30	30.25	13.70	13.83	6.66	1.30	0.19	8.15
181	400	40	0.01	0.89	26.00	8.01	30.50	12.26	15.92	2.79	2.60	2.83	8.22
182	400	40	0.01	2.39	28.02	8.63	28.98	8.20	15.24	0.62	1.88	0.99	3.49
183	430	40	0.51	3.15	30.20	7.53	30.75	7.83	31.44	4.16	1.91	0.55	6.62
184	430	40	1.45	0.07	30.42	9.93	31.69	8.35	11.14	3.46	3.45	0.15	7.06

Appendix C

The conversion percents in each table were calculated from 2 experiments. The calculation method shows in the end of this appendix.

Table C1 % Total C_5 conversion on 0.3 % Pt & 0.5 % F/Al_2O_3.

experiment	temp. (°C)	H_2 pressure (psi)	%con C_5
1	350	20	88.70
2	350	40	92.25
3	350	60	66.56
4	370	20	22.98
5	370	40	40.58
6	370	60	90.34
7	400	20	27.45
8	400	40	15.60
9	400	60	78.86
10	430	20	47.62
11	430	40	12.36
12	430	60	62.96

Table C2 % Total C_5 conversion on 0.3 % Pt & 1 % F/Al_2O_3.

experiment	temp. (°C)	H_2 pressure (psi)	%con C_5
1	350	20	66.19
2	350	40	50.52
3	350	60	4.28
4	370	20	66.61
5	370	40	63.05
6	370	60	70.72
7	400	20	29.16
8	400	40	36.20
9	400	60	12.20
10	430	20	37.05
11	430	40	21.76
12	430	60	13.20

Table C3 % Conversion of significant compositions on 0.6 % Pt & 0.5 % F/Al_2O_3.

experiment	temp. (°C)	H_2 pressure (psi)	% conversion			
			C_5	C_6	C_7^+	total (C_5^+)
25	350	20	42.47	21.89	33.04	33.35
26	350	40	16.56	10.85	38.14	18.88
27	350	60	13.19	6.28	34.00	14.93
28	370	20	34.13	21.48	41.99	31.26
29	370	40	26.23	16.60	34.82	24.57
30	370	60	13.96	7.43	35.59	16.00
31	400	20	23.54	37.44	67.70	36.21
32	400	40	78.98	55.41	67.95	68.50
33	400	60	40.00	82.79	86.52	64.34
34	430	20	96.48	86.51	63.00	86.27
35	430	40	92.20	89.91	76.40	88.23
36	430	60	53.78	70.98	46.38	58.34
37	350	40	15.62	10.40	37.03	9.05
38	370	40	26.78	16.53	33.79	25.18
39	400	40	84.80	69.14	64.22	71.76
40	430	40	96.41	88.19	78.45	88.10
41	350	40	31.29	9.70	36.43	10.14
42	350	40	16.91	9.44	3.59	11.62
43	370	40	13.28	10.00	37.51	16.98
44	370	40	13.27	nc	5.35	5.94
45	400	40	33.68	34.47	37.00	34.62
46	400	40	44.41	21.46	nc	11.64
47	430	40	76.64	62.14	71.68	70.56
48	430	40	35.27	38.77	26.90	24.04

Sample No. 25-36 were obtained from using fresh catalyst.
Sample No.37-40 were obtained from reproducibility experiments.
Sample No. 41, 43, 45, and 47 were obtained from using the first regenerate catalysts.
Sample No. 42, 44, 46, and 48 were obtained from using the second regenerate catalysts.
nc = not calculate

Table C4 % Conversion of significant compositions on 0.6 % Pt & 1 % F/Al_2O_3.

experiment	temp. (°C)	H_2 pressure (psi)	% conversion			
			C5	C6	$C7^+$	total ($C5^+$)
49	350	20	31.95	23.90	nc	15.97
50	350	40	32.44	12.40	nc	11.98
51	350	60	13.92	0.16	nc	7.35
52	370	20	33.96	nc	nc	22.47
53	370	40	43.20	0.53	nc	14.02
54	370	60	33.48	34.33	nc	10.56
55	400	20	45.58	38.22	59.18	45.72
56	400	40	66.71	69.14	92.68	72.77
57	400	60	25.12	1.81	nc	15.58
58	430	20	70.87	59.60	nc	68.73
59	430	40	83.00	80.19	78.45	81.10
60	430	60	23.10	26.37	57.85	31.21

nc = not calculate

Table C5 % Conversion of significant compositions on 0.3% Pt & 0.5 % F/4A molecular sieve.

experiment	temp. (°C)	H_2 pressure (psi)	% conversion			
			C_5	C_6	C_7^+	total (C_5^+)
61	350	20	62.61	28.79	nc	23.71
62	350	40	47.05	15.42	nc	12.37
63	350	60	50.74	nc	nc	5.16
64	370	20	51.41	18.25	nc	12.78
65	370	40	47.75	11.70	nc	13.29
66	370	60	30.35	nc	nc	7.46
67	400	20	51.54	nc	nc	13.43
68	400	40	35.68	5.57	nc	13.69
69	400	60	29.19	7.45	nc	14.66
70	430	20	32.45	13.32	nc	11.45
71	430	40	47.96	7.39	nc	14.63
72	430	60	40.52	16.42	nc	16.71

nc = not calculate

Table C6 % Conversion of significant compositions on 0.3% Pt & 1 % F/4A molecular sieve.

experiment	temp. (°C)	H_2 pressure (psi)	% conversion			
			C_5	C_6	C_7^+	total (C_5^+)
73	350	20	27.49	41.02	nc	22.76
74	350	40	20.79	31.77	nc	13.57
75	350	60	5.69	24.45	6.82	12.51
76	370	20	15.22	36.47	nc	14.05
77	370	40	15.57	10.34	6.04	11.82
78	370	60	8.51	27.49	nc	7.87
79	400	20	16.18	4.38	nc	7.91
80	400	40	17.68	0.68	nc	8.11
81	400	60	4.23	4.04	0.66	7.98
82	430	20	20.42	1.04	nc	7.19
83	430	40	19.05	nc	0.55	10.17
84	430	60	7.07	2.58	0.77	9.54

nc = not calculate

Table C7 % Conversion of significant compositions on 0.6% Pt & 0.5 % F/4A molecular sieve.

experiment	temp. (°C)	H_2 pressure (psi)	% conversion			
			C_5	C_6	C_7^+	total (C_5^+)
85	350	40	31.69	45.12	nc	9.76
86	370	40	28.94	26.71	nc	9.41
87	400	40	27.45	32.24	nc	1.33
88	430	40	43.89	44.38	nc	1.62

nc = not calculate

Table C8 % Conversion of significant compositions on 0.6% Pt & 1 % F/4A molecular sieve.

experiment	temp. (°C)	H_2 pressure (psi)	% conversion			
			C_5	C_6	C_7^+	total (C_5^+)
89	350	40	33.46	2.60	nc	18.25
90	370	40	39.64	nc	nc	17.17
91	400	40	31.88	nc	nc	11.76
92	430	40	24.22	nc	nc	26.48

nc = not calculate

Calculation Method of Percentage of Conversion of Significant Compositions

1. % Conversion of C_5

The percentage of conversion of C_5 could be calculated by equation C-1 below:

$$\% \text{ conversion of } C_5 = \frac{C_{5(NGL)} - C_{5(prod.)}}{C_{5(NGL)}} \times 100 \quad \% \qquad \text{(C-1)}$$

which, $C_{5(NGL)}$ = g. of C_5 naphthenes in NGL + g. of C_5 paraffins in NGL

$C_{5(prod)}$ = g. of C_5 naphthenes in product + g. of C_5 paraffins in product

2. % Conversion of C_6

The percentage of conversion of C_6 could be calculated by equation C-2 below:

$$\% \text{ conversion of } C_6 = \frac{C_{6(NGL)} - C_{6(prod.)}}{C_{6(NGL)}} \times 100 \quad \% \qquad \text{(C-2)}$$

which, $C_{6(NGL)}$ = g. of C_6 naphthenes in NGL + g. of C_6 paraffins in NGL

$C_{6(prod)}$ = g. of C_6 naphthenes in product + g. of C_6 paraffins in product

3. % Conversion of C_7^+

The percentage of conversion of C_7^+ could be calculated by equation C-3 below:

$$\% \text{ conversion of } C_7^+ = \frac{C_7^+{}_{(NGL)} - C_7^+{}_{(prod.)}}{C_7^+{}_{(NGL)}} \times 100 \quad \% \qquad \text{(C-3)}$$

which, $C_7^+{}_{(NGL)}$= g. of C_7^+ naphthenes in NGL + g. of C_7^+ paraffins in NGL

$C_7^+{}_{(prod)}$ = g. of C_7^+ naphthenes in product + g. of C_7^+ paraffins in product

4. % Total Conversion (C_5^+)

The percentage of total conversion (C_5^+) could be calculated by equation C-4 below:

$$\% \text{ total conversion} = \frac{C_5^+{}_{(NGL)} - C_5^+{}_{(prod.)}}{C_5^+{}_{(NGL)}} \times 100 \quad \% \qquad \text{(C-4)}$$

which, $C_5^+{}_{(NGL)}$= g. of C_5^+ naphthenes in NGL + g. of C_5^+ paraffins in NGL

$C_5^+{}_{(prod)}$ = g. of C_5^+ naphthenes in product + g. of C_5^+ paraffins in product

Appendix D

Table D1 % Yield of significant aromatics from reaction over 0.3 % Pt & 0.5% F/Al_2O_3 catalyst.

experiment	temp (°C)	% yield[a]				
		H_2 pressure (psi)	benzene	toluene	C8+ aromatics	total aromatics
1	350	20	nc	9.93	7.15	15.32
2	350	40	0.23	8.06	5.57	13.85
3	350	60	nc	5.88	3.17	8.32
4	370	20	0.34	1.45	nc	1.42
5	370	40	2.30	6.24	4.38	12.91
6	370	60	0.14	7.84	5.15	13.12
7	400	20	4.18	7.93	7.96	20.07
8	400	40	9.29	14.59	16.89	40.77
9	400	60	nc	8.78	8.56	14.18
10	430	20	6.92	13.64	20.46	41.03
11	430	40	2.26	16.34	29.83	48.44
12	430	60	6.21	12.41	15.44	34.06

[a] % yield related to C_5 conversion.
nc = not calculate

Table D2 % Yield of significant aromatics from reaction over 0.3 % Pt & 1% F/Al_2O_3 catalyst.

experiment	temp (°C)	% yield[a]				
		H_2 pressure (psi)	benzene	toluene	C8+ aromatics	total aromatics
13	350	20	1.22	2.61	2.28	6.11
14	350	40	2.07	2.75	1.48	6.30
15	350	60	1.11	nc	1.11	1.67
16	370	20	4.24	6.20	2.49	12.93
17	370	40	2.41	5.36	4.97	12.75
18	370	60	4.23	6.16	3.63	14.03
19	400	20	0.26	6.23	7.13	13.63
20	400	40	3.60	5.77	5.24	14.61
21	400	60	8.03	9.17	7.48	24.67
22	430	20	9.62	17.84	15.78	43.23
23	430	40	29.81	40.71	21.82	92.35
24	430	60	7.95	27.11	30.48	65.54

[a] % yield related to C_5 conversion.
nc = not calculated

Table D3 % Yield of significant aromatics from reaction over 0.6 % Pt & 0.5% F/Al_2O_3 catalyst.

experiment	temp (°C)	% yield[a]				
		H_2 pressure (psi)	benzene	toluene	C_8^+ aromatics	total aromatics
25	350	20	9.84	20.14	6.48	36.46
26	350	40	16.82	25.92	6.12	48.86
27	350	60	22.78	32.24	9.82	64.85
28	370	20	17.41	31.62	16.96	66.00
29	370	40	17.21	31.52	11.14	59.88
30	370	60	20.61	31.09	11.46	63.16
31	400	20	26.09	33.18	20.16	79.43
32	400	40	27.66	42.44	29.58	99.68
33	400	60	31.54	37.22	20.95	89.70
34	430	20	24.43	40.26	35.13	99.82
35	430	40	28.47	39.70	31.73	99.90
36	430	60	22.73	29.23	31.01	82.98
37	350	40	16.03	18.58	0.12	34.73
38	370	40	25.49	32.85	4.59	62.94
39	400	40	27.12	42.35	28.77	98.24
40	430	40	28.76	43.04	25.38	96.80
41	350	40	5.41	16.26	10.99	32.66
42	350	40	nc	10.79	0.18	8.53
43	370	40	18.16	19.10	10.31	47.58
44	370	40	nc	5.98	21.01	26.87
45	400	40	14.14	21.68	19.28	55.10
46	400	40	2.44	25.22	5.91	33.57
47	430	40	16.65	28.62	25.46	70.73
48	430	40	nc	6.82	4.67	10.78

[a] % yield related to total conversion.
nc = not calculate
Sample No. 25-36 were obtained from using fresh catalyst.
Sample No.37-40 were obtained from reproducibility experiments.
Sample No. 41, 43, 45, and 47 were obtained from using the first regenerate catalysts.
Sample No. 42, 44, 46, and 48 were obtained from using the second regenerate catalysts.

Table D4 % Yield of significant aromatics from reaction over 0.6 % Pt & 1% F/Al_2O_3 catalyst.

experiment	temp (°C)	% yield[a]				
		H_2 pressure (psi)	benzene	toluene	C_8^+ aromatics	total aromatics
49	350	20	28.40	12.93	4.21	45.54
50	350	40	37.39	9.30	0.79	47.49
51	350	60	88.91	2.26	nc	85.88
52	370	20	28.48	1.01	nc	28.55
53	370	40	36.81	4.11	nc	39.78
54	370	60	31.82	3.61	nc	31.65
55	400	20	24.69	36.70	21.78	83.17
56	400	40	17.31	49.41	29.00	95.72
57	400	60	30.88	23.13	16.50	70.51
58	430	20	21.89	36.17	31.92	89.98
59	430	40	24.11	41.10	28.46	93.66
60	430	60	37.17	19.27	17.10	73.53

[a] % yield related to total coversion.
nc = not calaulate

Table D5 % Yield of significant aromatics from reaction over 0.3 % Pt & 0.5% F/4A molecular sieve catalyst.

experiment	temp (°C)	% yield[a]				
		H_2 pressure (psi)	benzene	toluene	C_8^+ aromatics	total aromatics
61	350	20	6.87	2.25	nc	7.75
62	350	40	17.85	3.27	nc	17.61
63	350	60	12.13	nc	nc	
64	370	20	9.39	4.04	nc	12.61
65	370	40	17.05	3.68	0.36	21.09
66	370	60	18.50	nc	nc	14.02
67	400	20	12.44	18.24	2.27	32.95
68	400	40	6.06	10.15	1.56	17.77
69	400	60	6.40	12.10	1.41	19.91
70	430	20	5.56	5.93	1.00	12.49
71	430	40	6.31	8.25	0.99	15.55
72	430	60	17.57	5.12	nc	22.68

[a] % yield related to total conversion.
nc = not calculate

Table D6 % Yield of significant aromatics from reaction over 0.3 % Pt & 1% F/4A molecular sieve catalyst.

experiment	temp (°C)	% yield[a]				
		H_2 pressure (psi)	benzene	toluene	C_8^+ aromatics	total aromatics
73	350	20	7.98	nc	nc	4.36
74	350	40	22.41	nc	nc	19.58
75	350	60	39.03	0.29	1.70	11.03
76	370	20	14.88	nc	1.55	14.82
77	370	40	17.17	nc	2.06	17.44
78	370	60	24.46	nc	2.67	22.42
79	400	20	14.98	nc	4.88	19.50
80	400	40	6.66	nc	2.50	8.89
81	400	60	5.78	nc	0.88	5.81
82	430	20	5.40	0.05	0.85	6.29
83	430	40	5.61	nc	1.81	6.45
84	430	60	1.34	3.28	3.42	8.04

[a] % yield related to total conversion.
nc = not calculate

Table D7 % Yield of significant aromatics from reaction over 0.6 % Pt & 0.5% F/4A molecular sieve catalyst.

experiment	temp (°C)	% yield[a]				
		H_2 pressure (psi)	benzene	toluene	C_8^+ aromatics	total aromatics
85	350	40	4. 95	35.92	7.01	47.88
86	370	40	22.36	14.38	2.06	38.80
87	400	40	1.66	13.11	1.98	16.74
88	430	40	4.56	14.68	9.42	28.66

[a] % yield related to total conversion.

Table D8 % Yield of significant aromatics from reaction over 0.6 % Pt & 1% F/4A molecular sieve catalyst.

sample No.	temp (°C)	% yield[a]				
		H_2 pressure (psi)	benzene	toluene	C_8^+ aromatics	total aromatics
89	350	40	37.39	9.30	0.79	47.49
90	370	40	36.81	4.11	nc	39.78
91	400	40	17.31	49.41	29.00	95.72
92	430	40	24.11	41.10	28.46	93.66

[a] % yield related to total conversion.
nc = not calculate

Calculation Method of Percentage Yield of Significant Aromatics

1. % Yield of Benzene Related to C_5 Conversion

The percentage yield of benzene related to C_5 conversion could be calculated by equation D-1 below:

$$\text{\% yield of benzene related to } C_5 \text{ conversion} = \frac{\text{yield of benzene}}{\text{converted } C_5} \times 100 \quad \% \quad \text{(D-1)}$$

which, yield of benzene = g. of benzene in product - g. of benzene in NGL

converted C_5 = g. of $C_{5(NGL)}$ - g. of $C_{5(prod.)}$

2. % Yield of Benzene Related to total Conversion

The percentage yield of benzene related to total conversion could be calculated by equation D-2 below:

$$\text{\% yield of benzene related to total conversion} = \frac{\text{yield of benzene}}{\text{total conversion}} \times 100 \quad \% \quad \text{(D-2)}$$

which, yield of benzene = g. of benzene in product - g. of benzene in NGL

total conversion = g. of $C_5^+{}_{(NGL)}$ - g. of $C_5^+{}_{(prod.)}$

3. % Yield of Toluene Related to total Conversion

The percentage yield of toluene related to total conversion could be calculated by equation D-3 below:

$$\text{\% yield of toluene related to total conversion} = \frac{\text{yield of toluene}}{\text{total conversion}} \times 100 \quad \% \quad \text{(D-3)}$$

which, yield of toluene = g. of toluene in product - g. of toluene in NGL

total conversion = g. of C_5^+ (NGL) - g. of C_5^+ (prod.)

4 % Yield of C_8^+ aromatics Related to total Conversion

The percentage yield of C_8^+ aromatics related to total conversion could be calculated by equation D-4 below:

$$\text{\% yield of } C_8^+ \text{ aromatics related to total conversion} = \frac{\text{yield of } C_8^+ \text{ aromatics}}{\text{total conversion}} \times 100 \quad \% \quad \text{(D-4)}$$

which,

yield of C_8^+ aromatics = g. of C_8^+ aromatics in product - g. of C_8^+ aromatics in NGL

total conversion = g. of C_5^+ (NGL) - g. of C_5^+ (prod.)

5. % Yield of Total Aromatics Related to total Conversion

The percentage yield of total aromatics related to total conversion could be calculated by equation D-5 below:

$$\text{\% yield of total aromatics related to total conversion} = \frac{\text{yield of total aromatics}}{\text{total conversion}} \times 100 \quad \% \quad \text{(D-5)}$$

which,

yield of total aromatics = g. of aromatics in product - g. of aromatics in NGL

total conversion = g. of C_5^+ (NGL) - g. of C_5^+ (prod.)

Appendix E

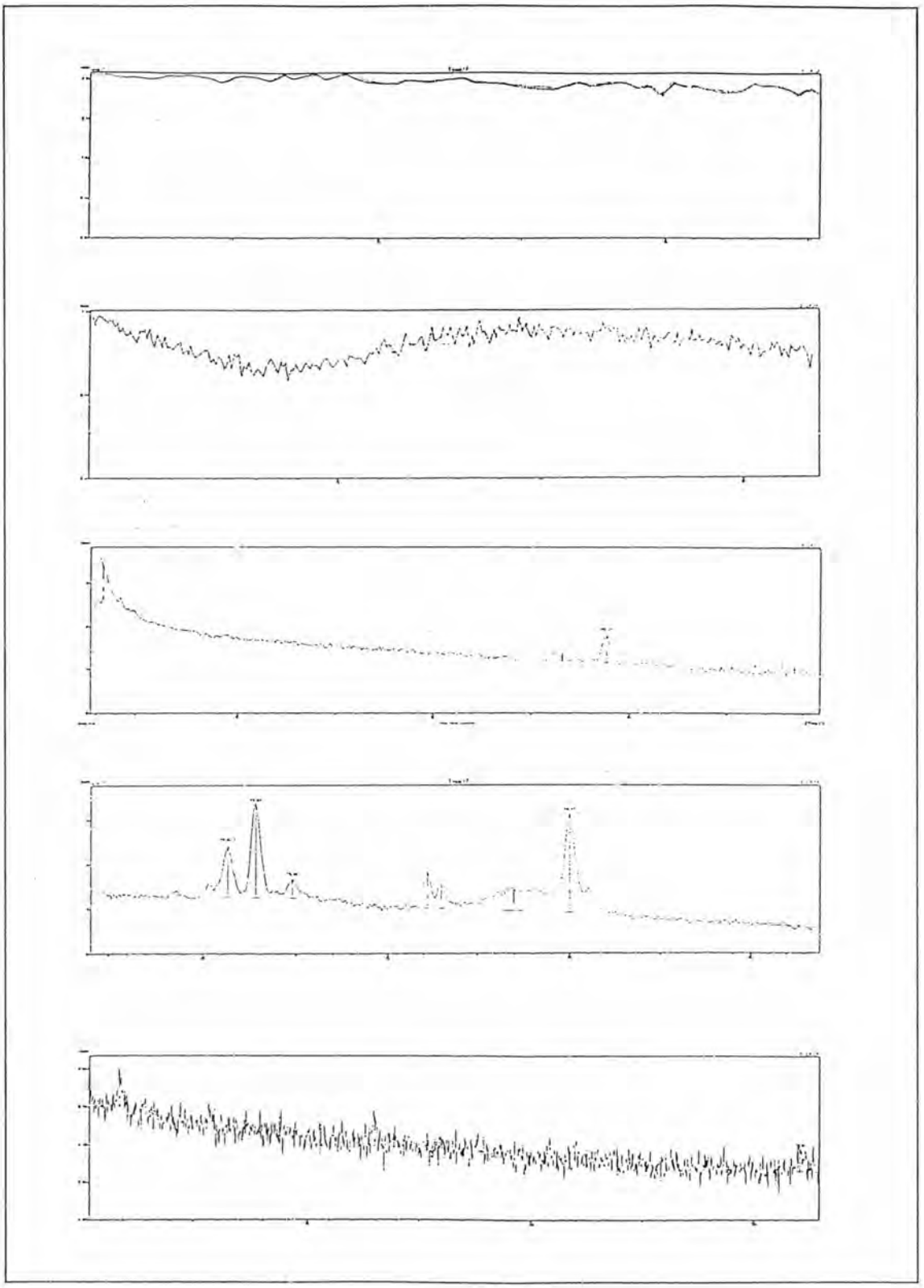


Figure E1 XRF Spectrum of 0.3% Pt/ Al_2O_3 catalyst.

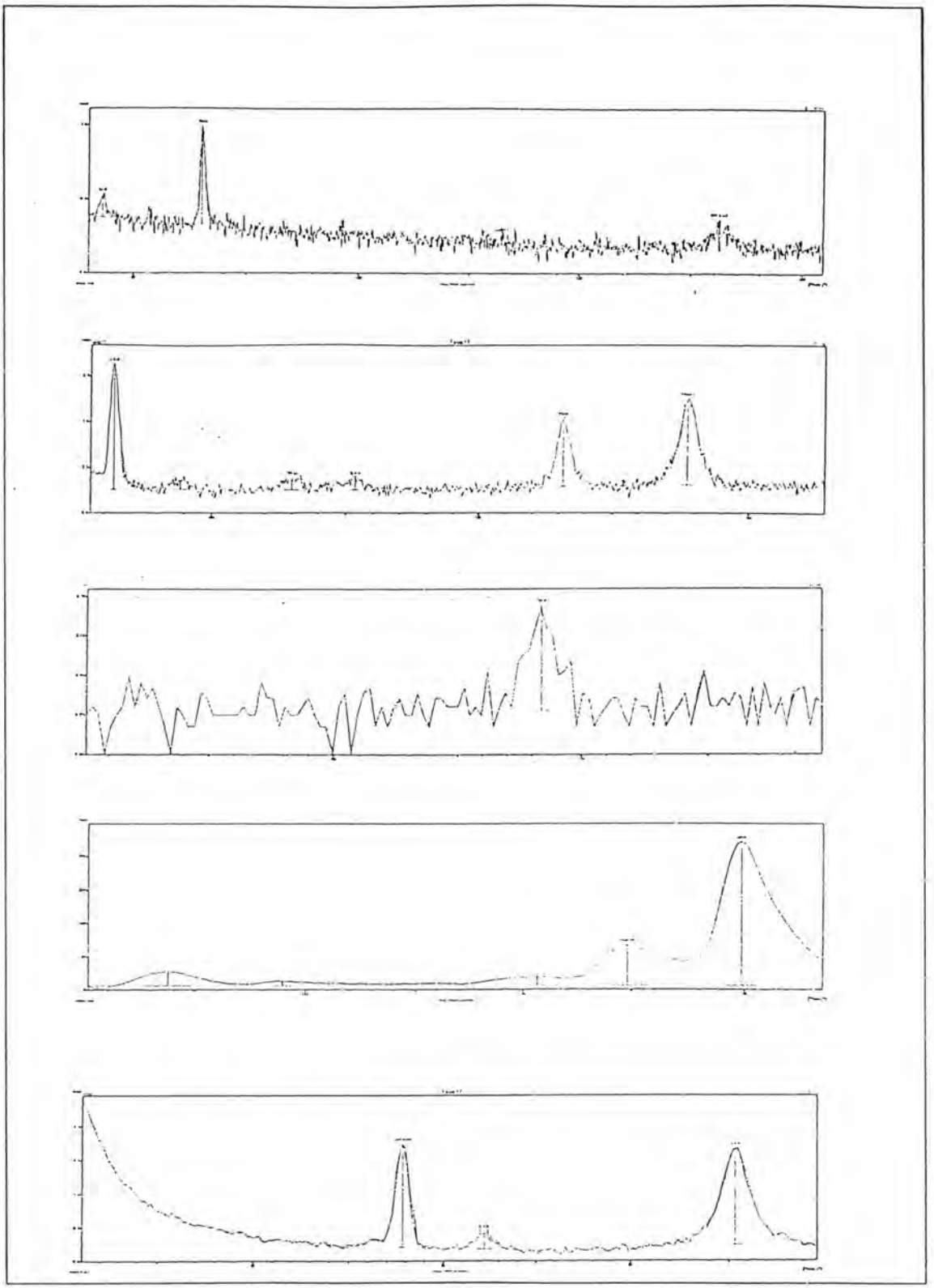


Figure E1 XRF Spectrum of 0.3% Pt/ Al_2O_3 catalyst. (continue)

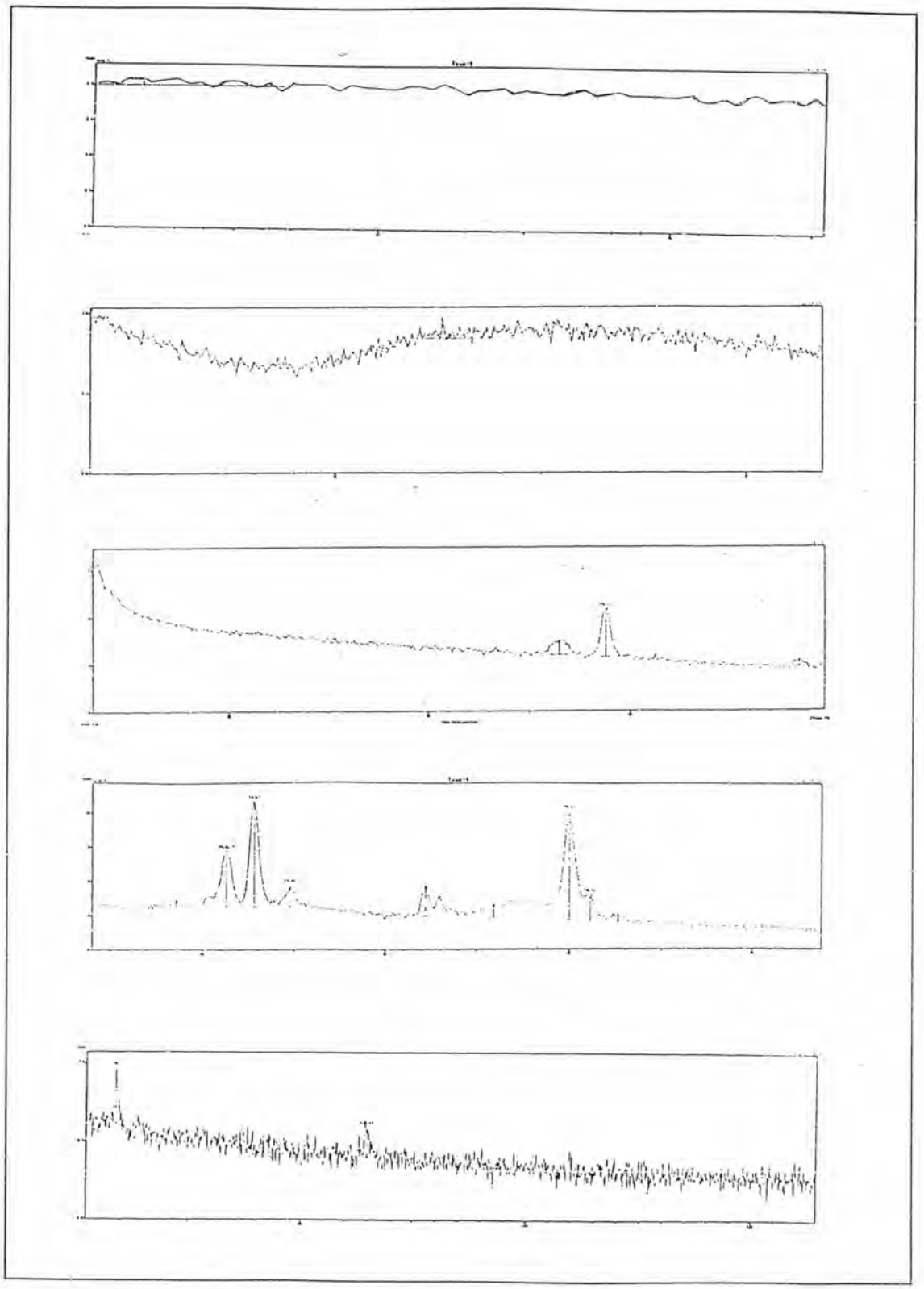


Figure E2 XRF Spectrum of 0.6% Pt/ Al_2O_3 catalyst.

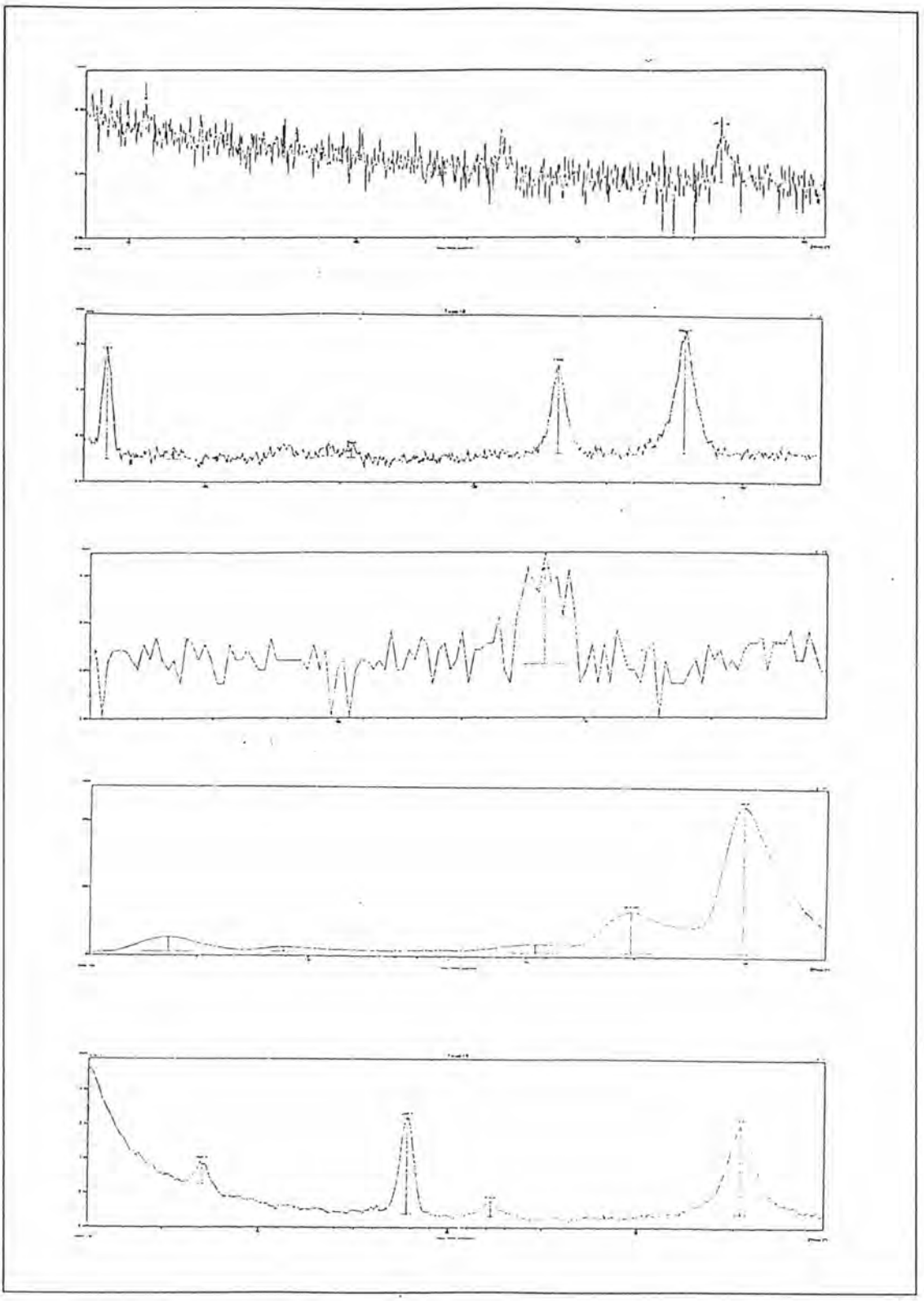


Figure E2 XRF Spectrum of 0.3% Pt/ Al_2O_3 catalyst. (continue)

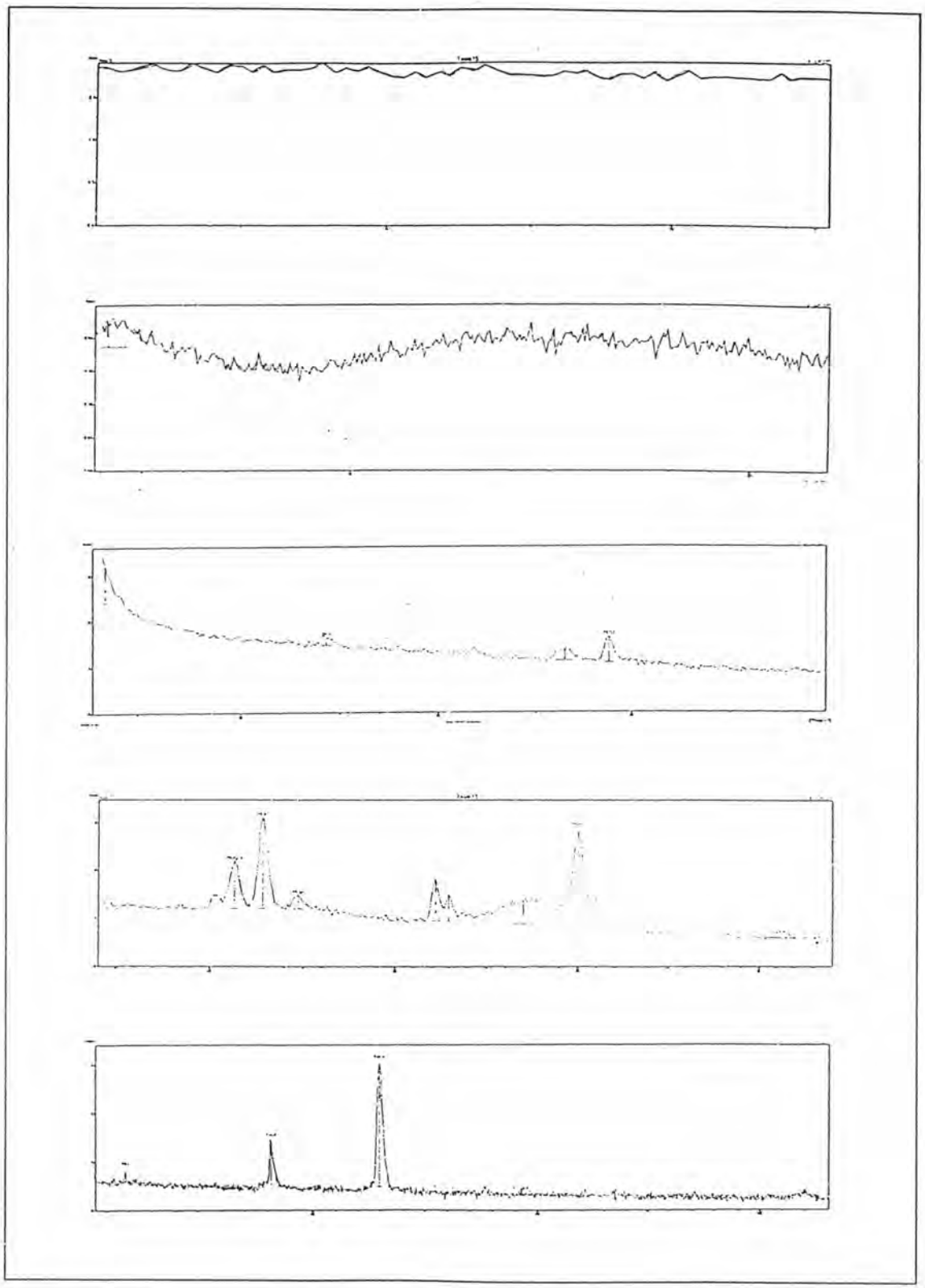


Figure E3 XRF Spectrum of 0.3% Pt/ 4A molecular sieve catalyst.

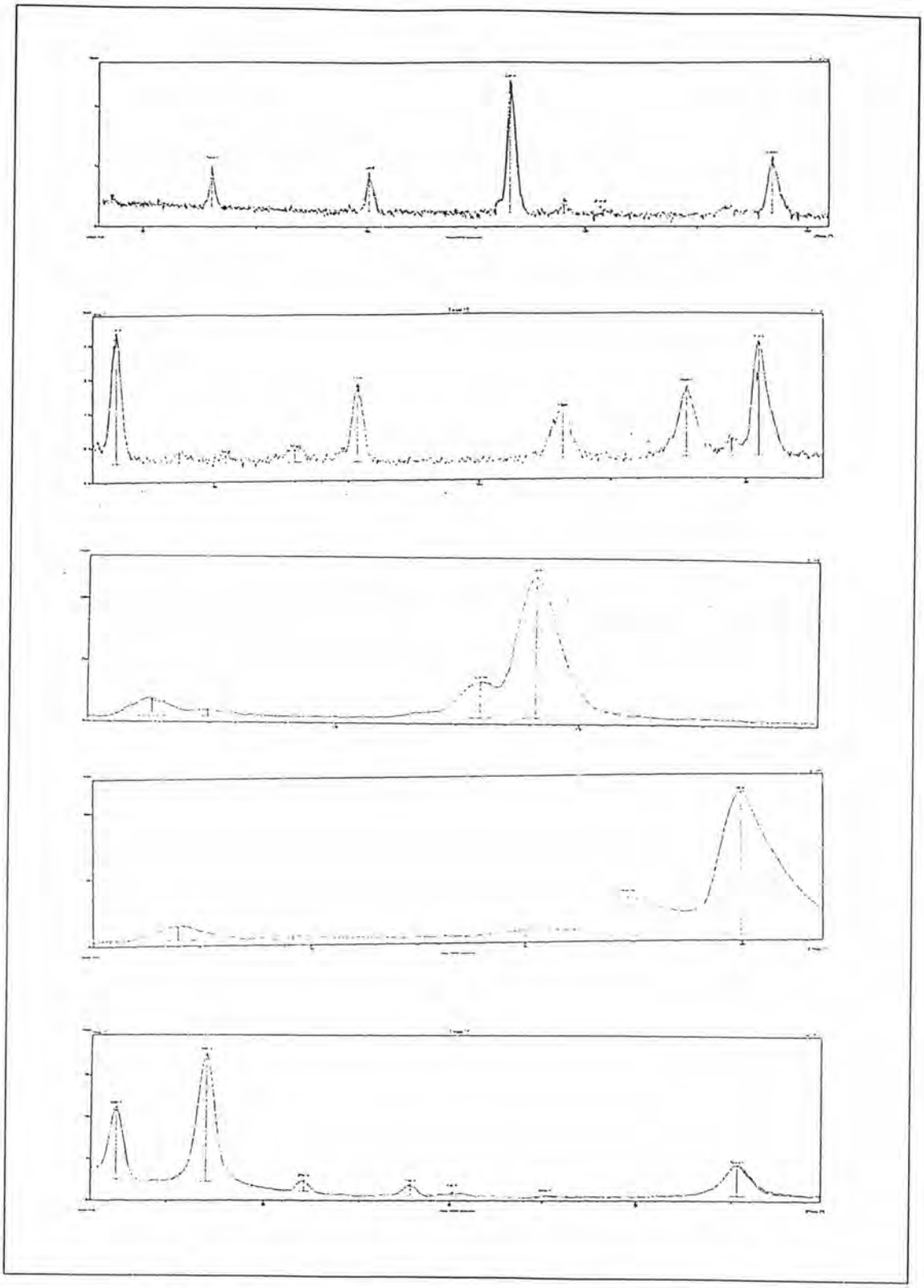


Figure E3 XRF Spectrum of 0.3% Pt/ 4A molecular sieve catalyst. (continue)

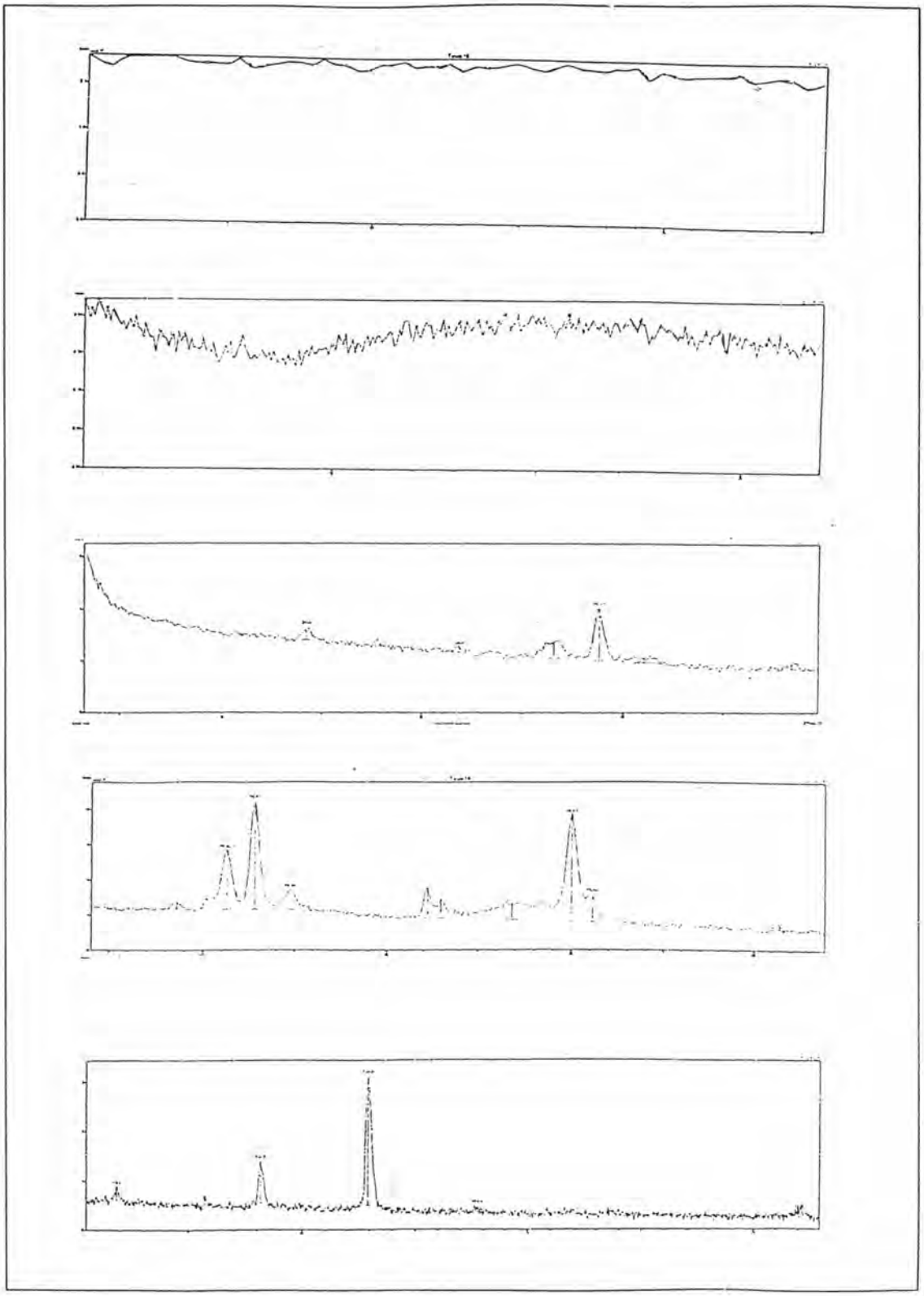


Figure E4 XRF Spectrum of 0.6% Pt/ 4A molecular sieve catalyst.

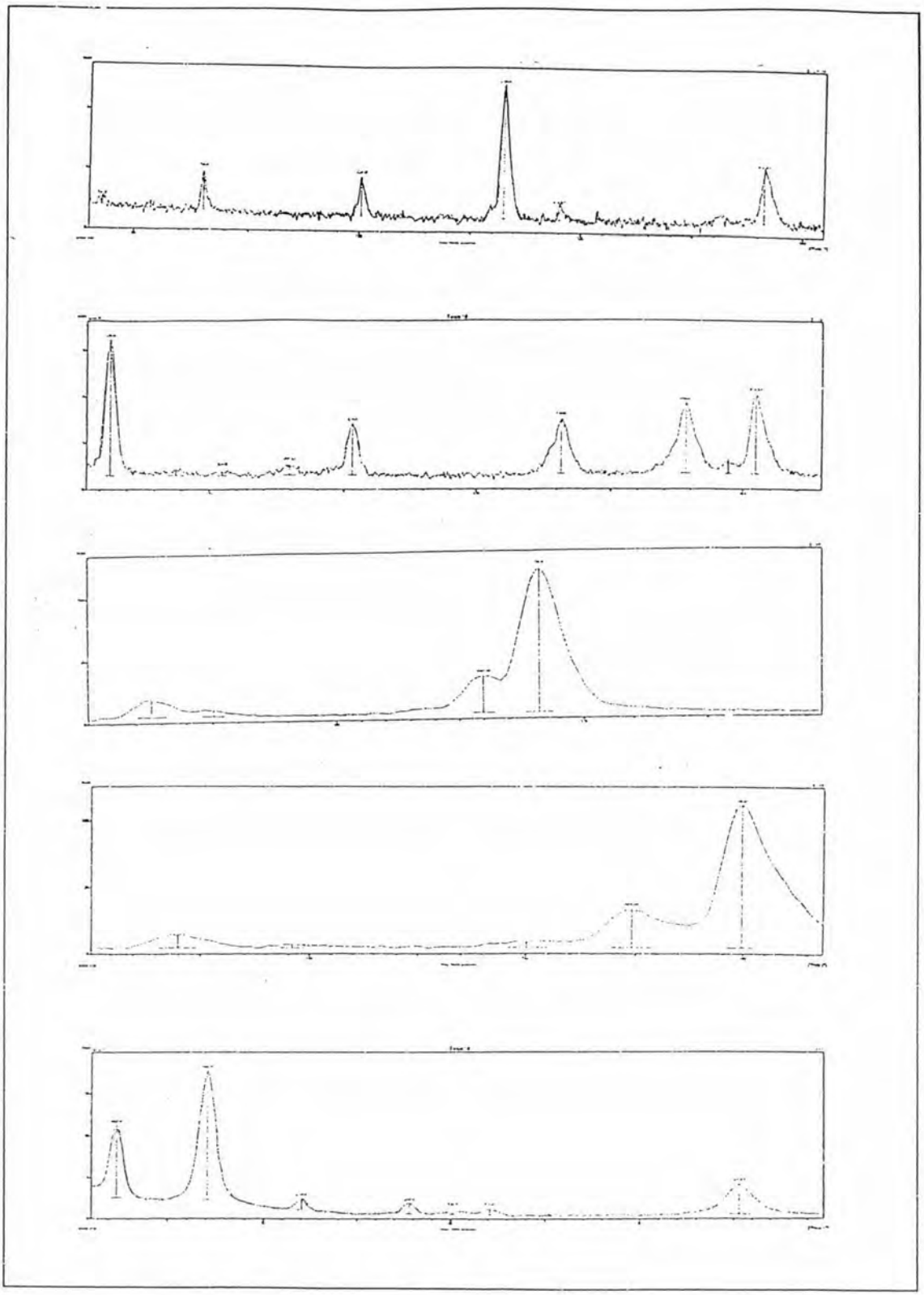


Figure E4 XRF Spectrum of 0.6% Pt/ 4A molecular sieve catalyst. (continue)

VITA

Miss Pornsawan Prommart was born on June 16, 1975 in Nakornsawan province. She received her Bachelor's degree of Science in Chemistry from Department of Chemistry, Faculty of Science and Technology, Thammasart University in 1996. She began her Master study at Department of Petrochemistry and Polymer Science, Graduate School, Chulalongkorn University, in 1996 and completed the program in 1999.