REFERENCES

1. Heathcock, C. H.; Kosower, E. M.; Streitwieser, A. Introduction to Organic Chemistry, Macmillon Publishing Company. 4th ed. **1992,** 100-109.
2. Huheey, J. E.; Keiter, E. A.; Keiter, R. L. Inorganic Chemistry Principles of Structure and Reactivity. 4th ed. New York: Harper Collins College Publishers, **1993**, 705-706.
3. Breck, D. W. Zeolite Molecular Seives. R. E. Krieger Publisher, Florida, **1984,** 85-90.
4. Acosta, D.; Gabriunas, N.; Maggi, R.; Pa'ez-Mozo, E.; Ruiz, P. J. Mol. Catal., **1994**(91), 251-258.
5. Nelson, W. L. Petroleum Refinery Engineering, 4th ed. New York, Mc Graw-Hill, **1968,** 647.
6. Shreve, R. N. Chemical Process Industries, 3rd ed. New York, McGraw-Hill, **1967**, 325.
7. Reuben, B. G. and Burstall, M. L. The Chemical Economy, London, Longman, **1973**, 432.
8. Satterfield, C. N. Heterogeneous Catalysis in Practice. New York: McGraw-Hill, **1980**, 83.
9. Martens, J. H. A. A Spectroscopic Characterization of the Structure of Supported Metal Catalysts, Research Reported Thesis, Netherlands, **1998**, 223.

10. Maltha, A. and Ponec, V. "Selective Removal of Oxygen from Organic Oxygenates Using Oxide as Catalysts.", Catal. Today, **1991**(10), 387-392.

11. Raoarun, M., Oxidation of CO with O_2 and N_2O, Using Transition Metal Oxides as Catalysis. Master's Thesis, Program of Petrochemistry and Polymer Sciences, Graduate School, Chulalongkorn University, **1995**, 25-28.

12. Dyer, A. An Introduction to Zeolite Molecular Sieves, Singapore: John Wiley & Sons, **1988**, 12.

13. Smart, L.; and Moore, E. Solid State Chemistry, London: Chapman & Hall University, **1992**, 184.

14. Szostak, R. Molecular Sieves: Principles of Synthesis and Identification, New York: Van Nostrand Reinhold, **1989**, 51.

15. Jens, H. Industrial Catalysis: Shape-Selective Catalysis: Zeolite., Wiley-Vch. New York: Chichester, **1999**, 225-244.

16. Chen, N. Y., Garwood, W. E., Dwyer, F. G. Shape Selective Catalysis in Industrial Applications. Chemical Industries, A Series of Reference Books and Textbooks, Bd. 36. **1989**.

17. Tiβler, A., Muller, U., Unger, K. Nachr. Chem. Tech. Lab. **1989**(36), 624.

18. Gates, B. C. Catalytic Chemistry, New York: J. Wiley & Sons, **1992,** 248.

19. Edgar, M. D. Catalytic Reforming of Naphtha in Petroleum Refineries, **1989**, 125-129.

20. Wiseman P., B. Sc. (Hons.) Petrochemicals, Department of Chemistry University of Manchester Institute of Science and Technology. **1988**, 21-24.

21. Shilov, A. E., Activation of Saturated Hydrocarbons by Transition Metal Complexes; D. Reidel Publishing Co., Dordrecht, **1984**, 234.

22. Sinfelt, J. H., Hurwitz, H. and Rohrer, J. C., J. Phys. Chem., "Kinetics of *n*-pentane Isomerization Over Pt-Al_2O_3 Catalyst.", . **1960**(64), 892-894.

23. Hardy, R. H. and Davis, B. H., J. Acta Chim. Hung., "Alkane Dehydrocyclization and Alkylcyclopentane Conversions at 13.8 bar (120 psi) with Pt-Al_2O_3 Catalysts.", **1987**(124), 269-278.

24. Ciapetta, F. G. and Plank, C. J., Catalysis Preparation. In P. H. Emmett (ed.), New York, **1954**(1), 315-343.

25. Lindfors, L. P. Rautiainin, E. and Lakomaa, E. L., "Catalyst for Aromatization of Light Hydrocarbons.", U.S. Patent No.5,124,293, **1992**.

26. Dehertog, W. J. H. and Fromen, G. F., "A Catalytic Route for Aromatics Production from LPG.", Appl. Catal., **1999**(189), 63-75.

27. Wei-Qiao, L., Lin, Z., Gui-Da, S. and En-Ze, M., "Saturation of Aromatics and Aromatization of C_3 and C_4 Hydrocarbons Over Metal Loaded Pillared Clay Catalysts.", Catal. Today, **1999**(51), 135-140.

28. Fujimoto, K., Nakamura, I. And Yodota, K., "Aromatization of Lower Paraffin with Hybrid Catalysts Containing ZSM-5.", Chem. Lett., **1989**, 681-682.

29. Yide, X. and Liwu, L., "Recent Advances in Methane Dehydro-aromatization Over Transition Metal Ion-modified Zeolite Catalysts under Non-oxidative Conditions.", Appl. Catal., 1999(188), 53-67.

30. Minachev, K. M., Dergachev, A. A.,"Aromatization of Low-molecular Weight Paraffins on Gallium-containing Pentasils." Pet. Chem. USSR (Engl. Transl.), 1994(34:5), 373-392.

31. Yakerson, V. I., Nissenbaum, V. D., Vasina, T. V., Lafer, L. I. And Isaev, S.A. , "Study of the Catalytic Properties of Pentasil-containing Composites in Transformation of Hydrocarbons. 4. Formation of Products of Condensation during Oligomerization and Aromatization of Ethylene on the Pentasil-Aluminum Oxide System.", Bull. Acad. Sci. USSR Div. Chem. Sci. (Engl. Transl.), 1990(39:6), 1115-1120.

32. Promart, P., Aromatization of natural gas liquid using fluoride doped platinum catalyst. Master's Thesis, Program of Petrochemistry and Polymer Sciences, Graduate School, Chulalongkorn University., **1998**.

33. Bannakarnboworn, S., Isomerization of Natural Gas Liquid. Master's Thesis, Program of Petrochemistry and Polymer Sciences, Graduate School, Chulalongkorn University., **1997**.

34. Bournonville, J. P., Raatz, F., Juguin, J., and Juguin, S. "Process for the Aromatization of Hydrocarbons Containing 5 to 9 Carbon Atoms Per Molecule in the Presence of .a Particular Catalyst". U.S. Patent No. 5,268,522, **1993.**

35. Brand, R., and Rotgerink, H. L. "Method for the Catalytic Reforming of Naphtha". U.S. Patent No. 5,496,467, **1996.**

36. Kuchar, P. J., and Gosling, C.D. "Process for Producing Aromatics from a C5/C6 Feed Steam". U.S. Patent No. 5,386,071, **1995.**

37. Bennett, I. C., and Hall, H. P. "Aromatization of Parafins". U.S. Patent No. 4,766,264, **1988.**

APPENDIX

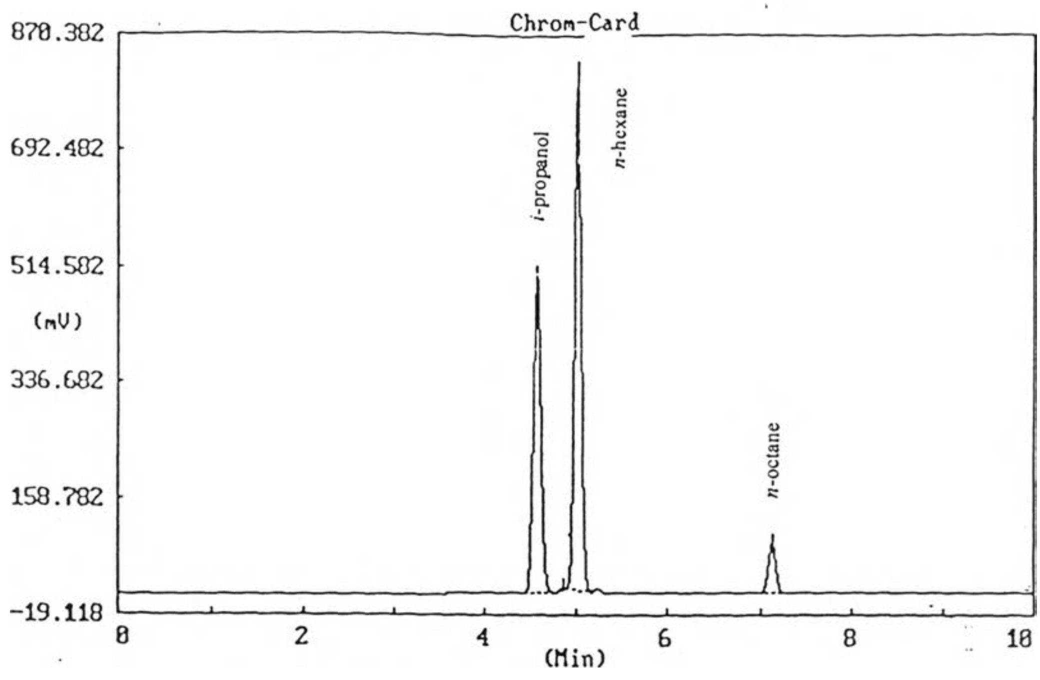

Figure A1 GC Chromatogram of products from using 0.6%Pt-1.0%F/Al_2O_3 catalyst, under 1.0 ml/min feeding rate and 400°C

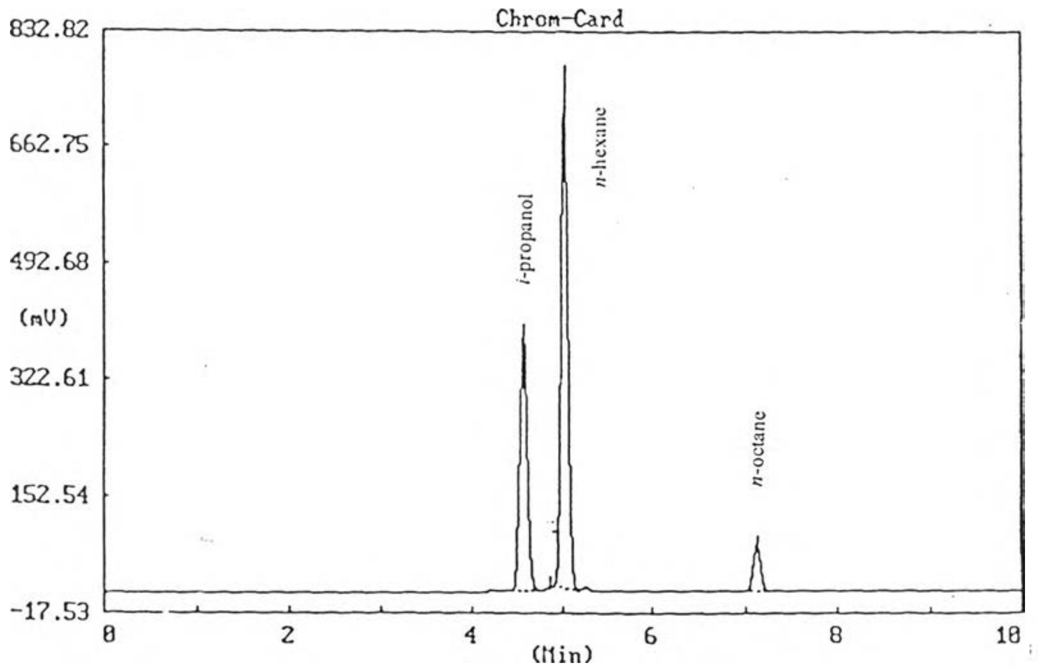

Figure A2 GC Chromatogram of products from using 0.6%Pt-1.0%F/Al_2O_3 catalyst, under 0.8 ml/min feeding rate and 400°C

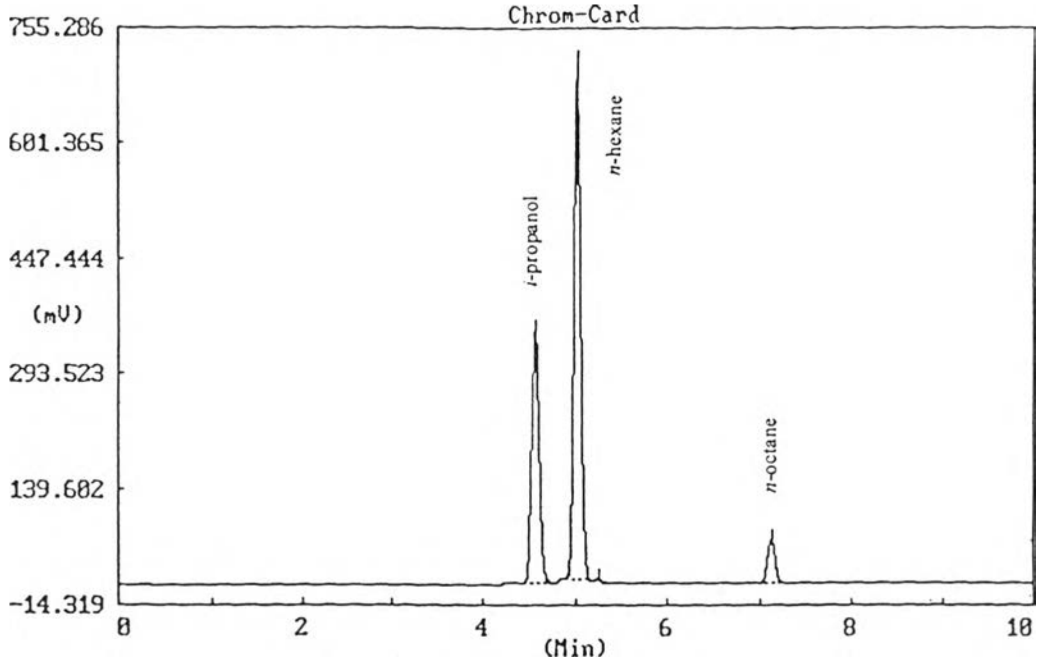

Figure A3 GC Chromatogram of products from using 0.6%Pt-1.0%F/Al_2O_3 catalyst, under 0.6 ml/min feeding rate and 400°C

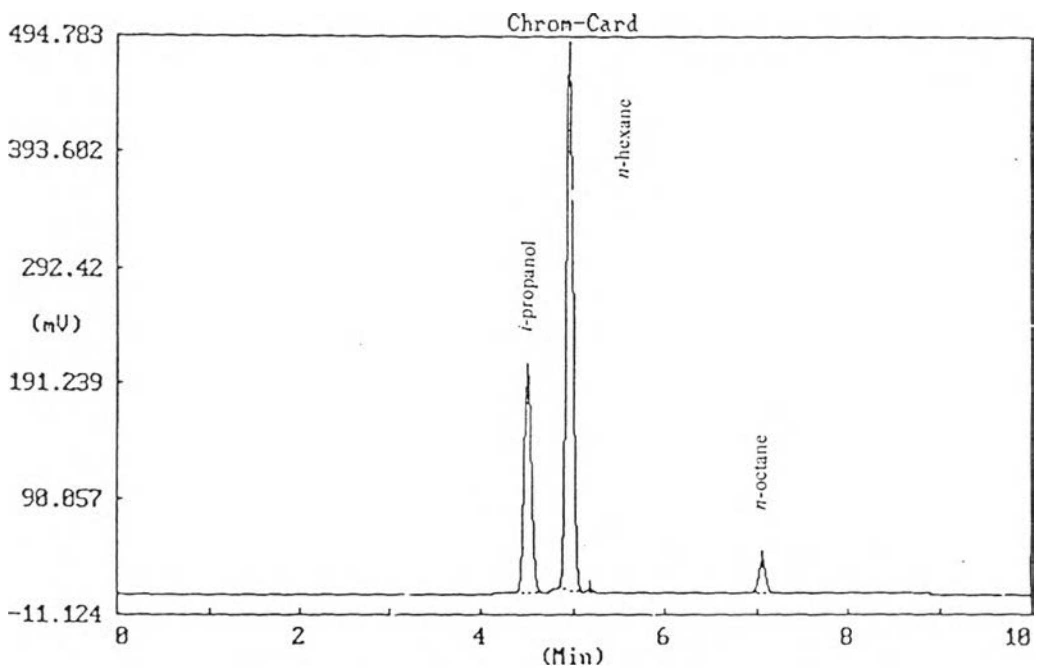

Figure A4 GC Chromatogram of products from using 0.6%Pt-1.0%F/Al_2O_3 catalyst, under 0.4 ml/min feeding rate and 400°C

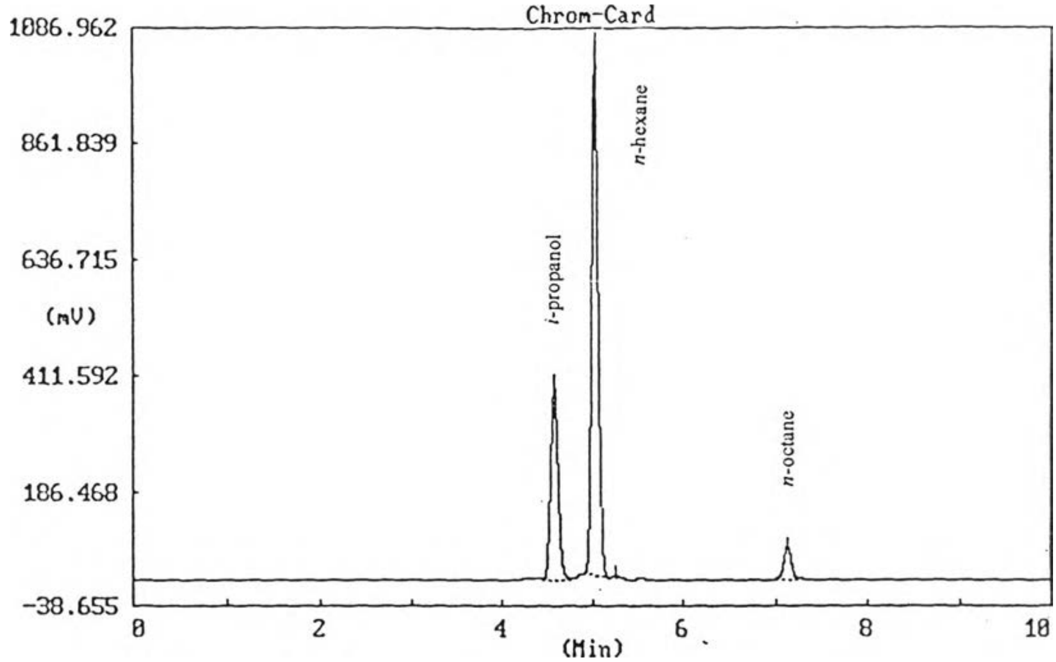

Figure A5 GC Chromatogram of products from using 0.6%Pt-1.0%F/Al_2O_3 catalyst, under 0.2 ml/min feeding rate and 400°C

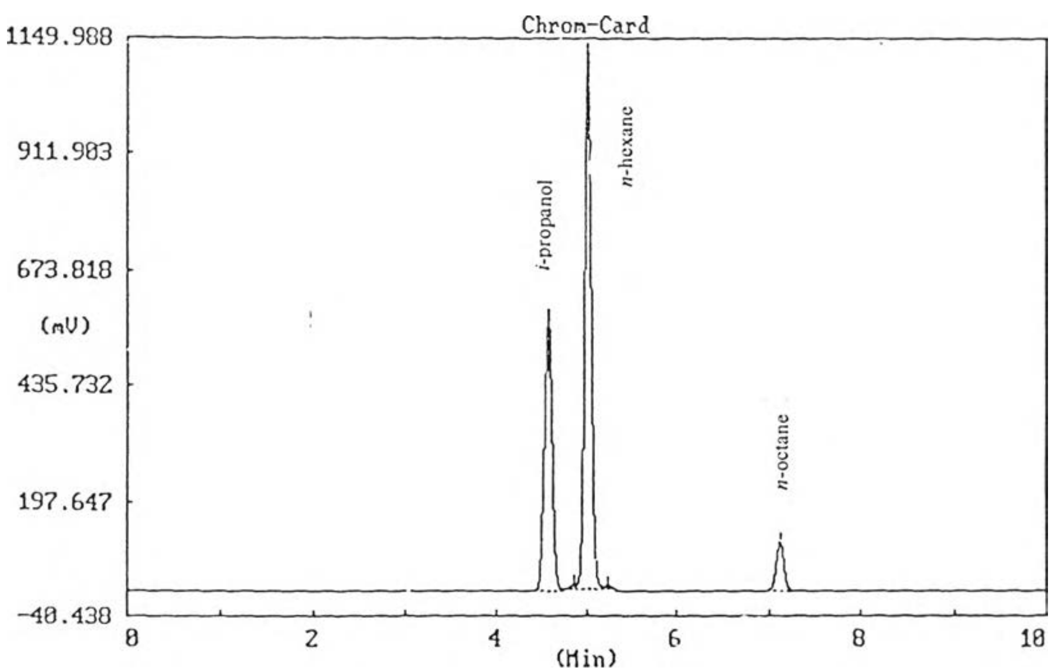

Figure A6 GC Chromatogram of products from using 0.6%Pt-1.0%F/Al_2O_3 catalyst, under 1.0 ml/min feeding rate and 450°C

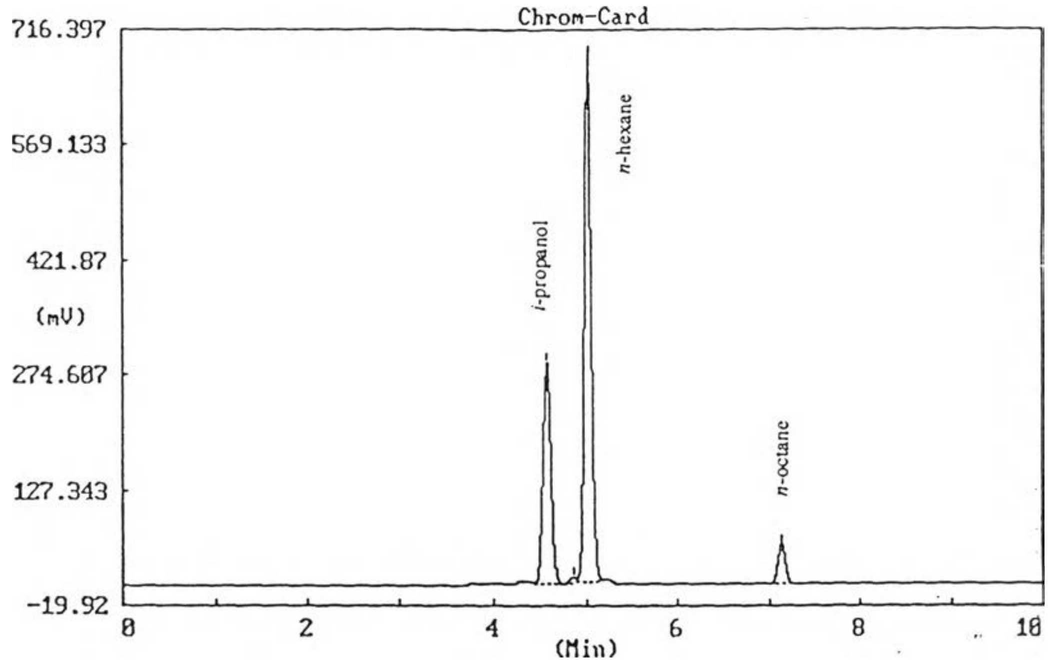

Figure A7 GC Chromatogram of products from using 0.6%Pt-1.0%F/Al_2O_3 catalyst, under 0.8 ml/min feeding rate and 450°C

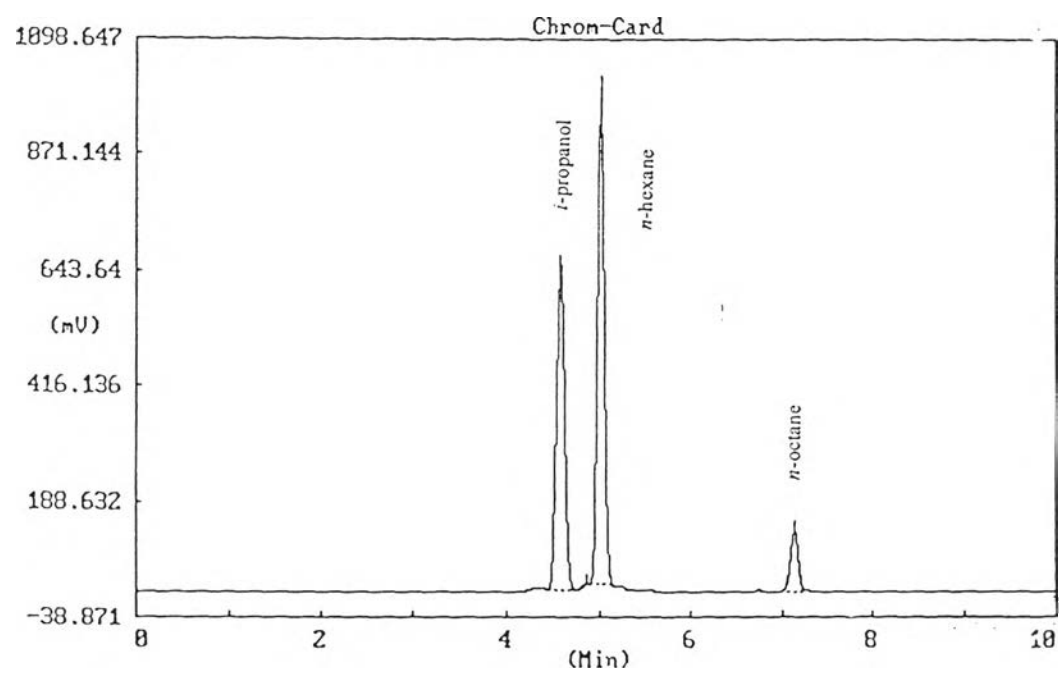

Figure A8 GC Chromatogram of products from using 0.6%Pt-1.0%F/Al_2O_3 catalyst, under 0.6 ml/min feeding rate and 450°C

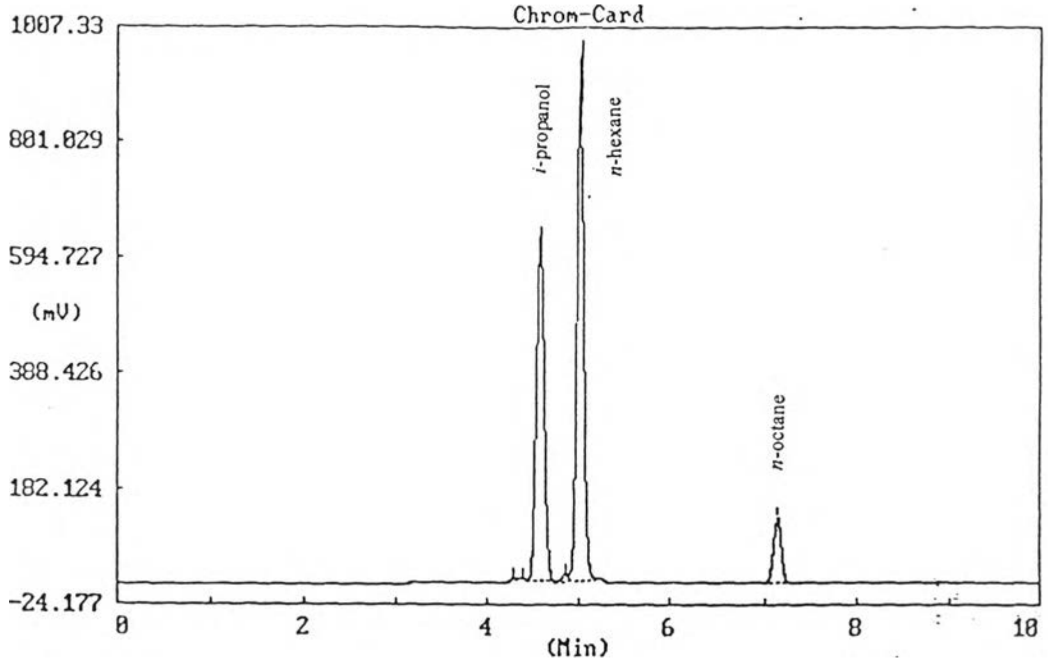

Figure A9 GC Chromatogram of products from using 0.6%Pt-1.0%F/Al_2O_3 catalyst, under 0.4 ml/min feeding rate and 450°C

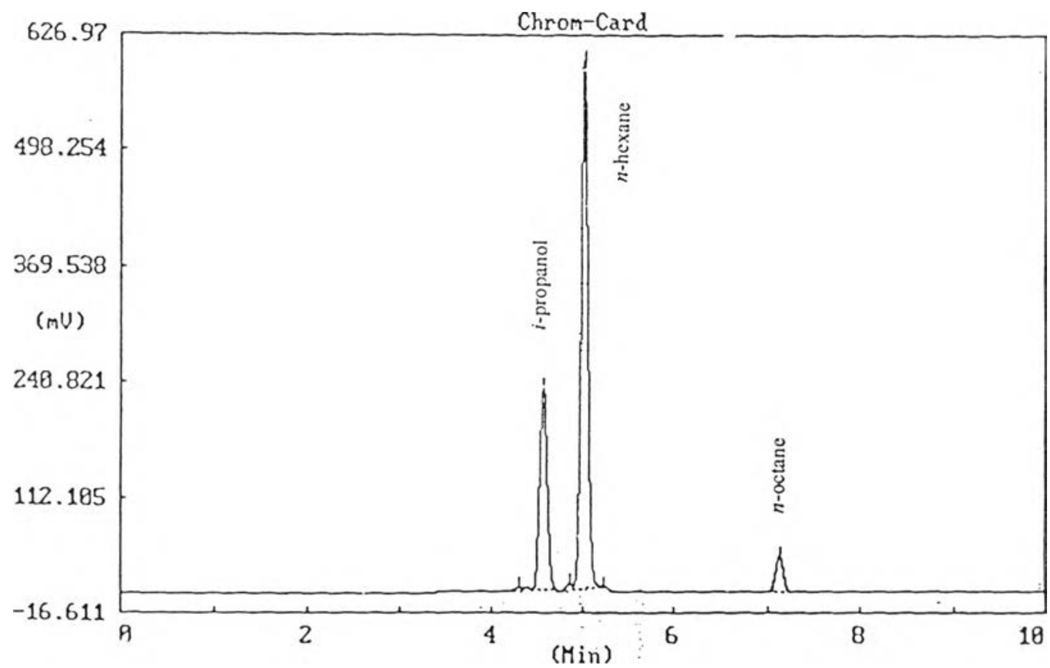

Figure A10 GC Chromatogram of products from using 0.6%Pt-1.0%F/Al_2O_3 catalyst, under 0.2 ml/min feeding rate and 450°C

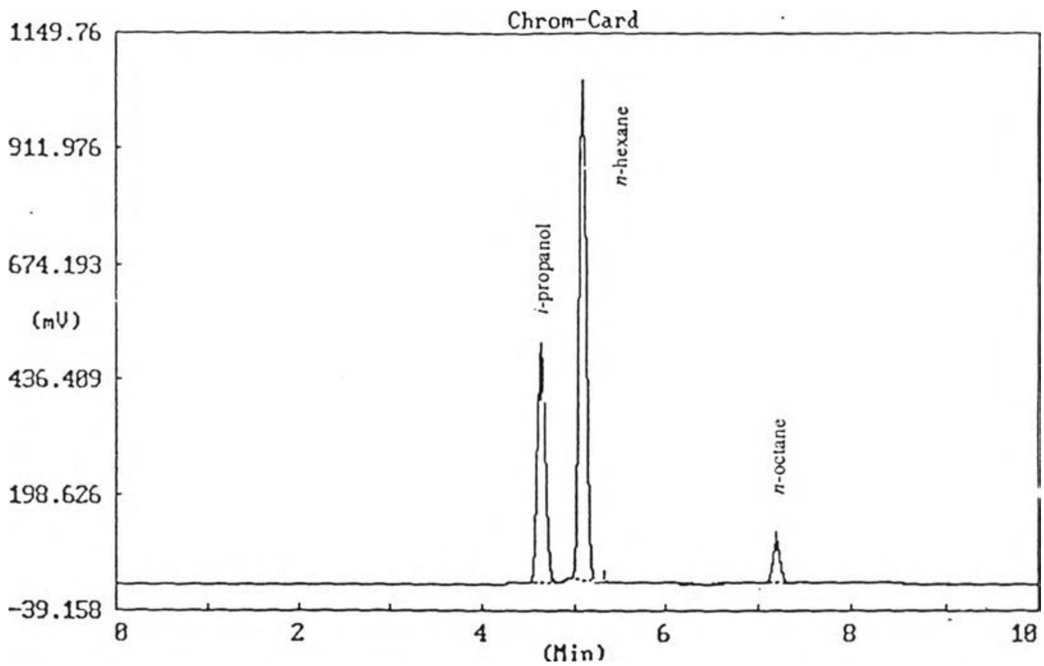

Figure A11 GC Chromatogram of products from using 8% Zn-ZSM-5 catalyst, under 1.0 ml/min feeding rate and 400°C

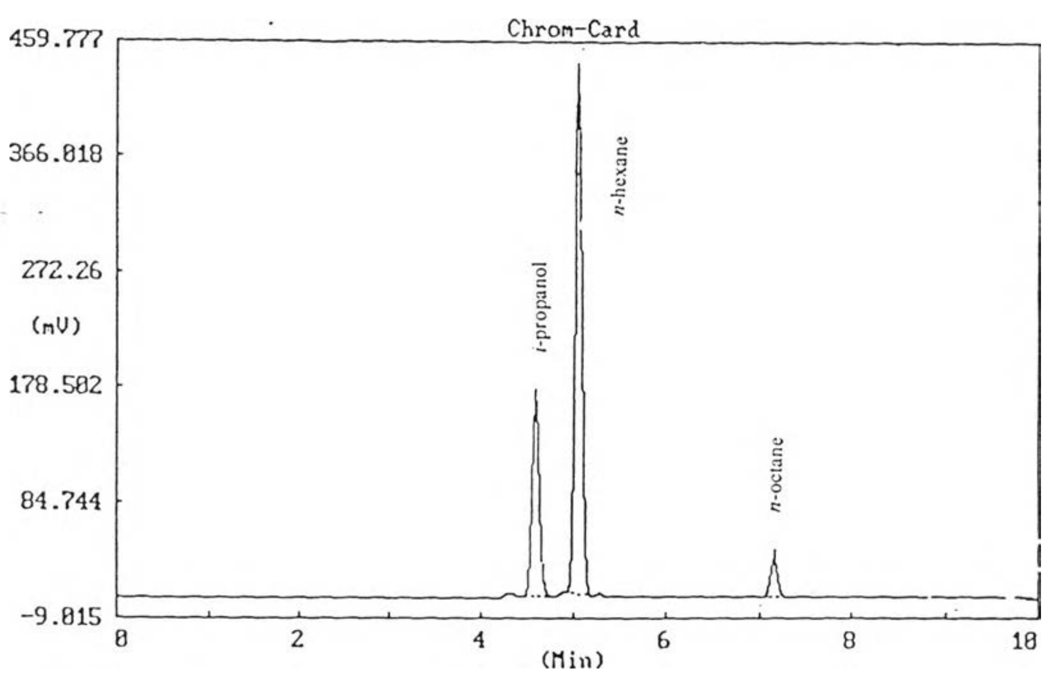

Figure A12 GC Chromatogram of products from using 8% Zn-ZSM-5 catalyst, under 0.8 ml/min feeding rate and 400°C

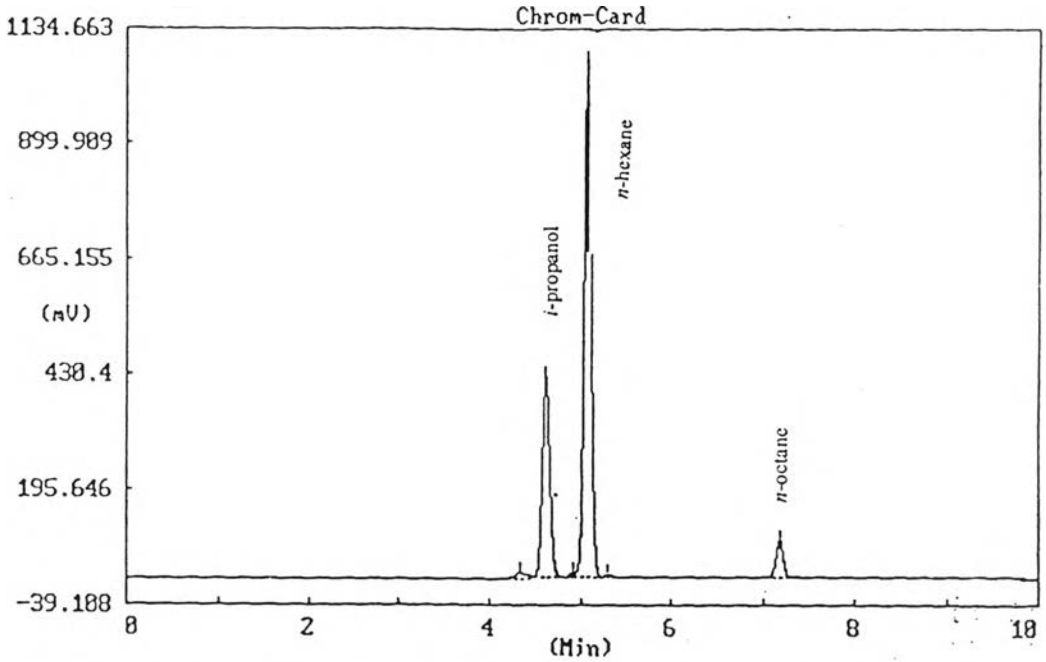

Figure A13 GC Chromatogram of products from using 8% Zn-ZSM-5 catalyst, under 0.6 ml/min feeding rate and 400°C

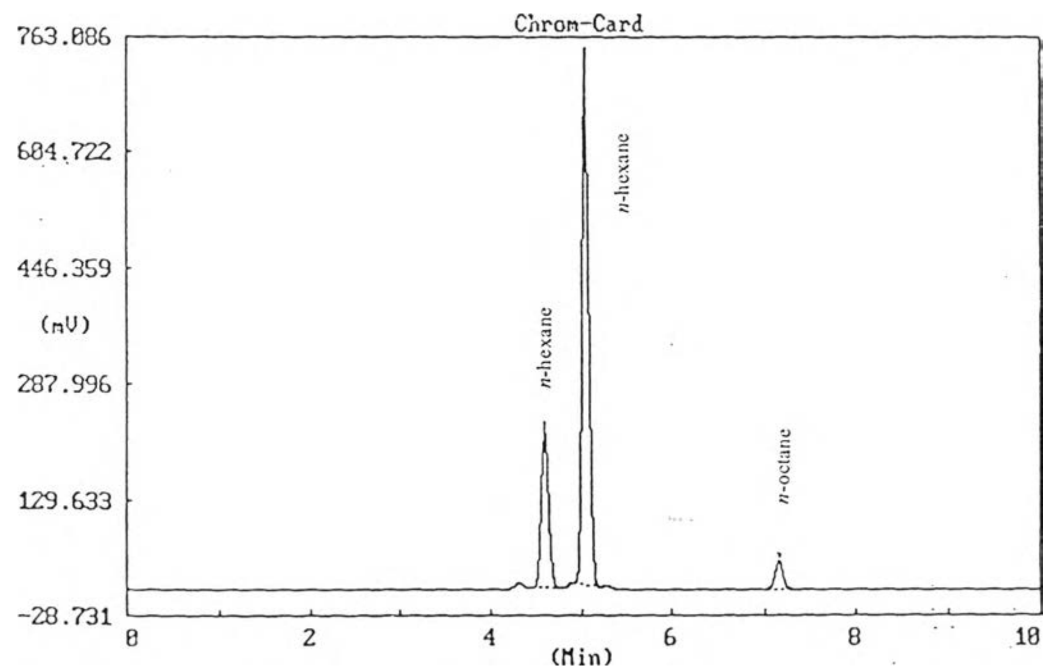

Figure A14 GC Chromatogram of products from using 8% Zn-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 400°C

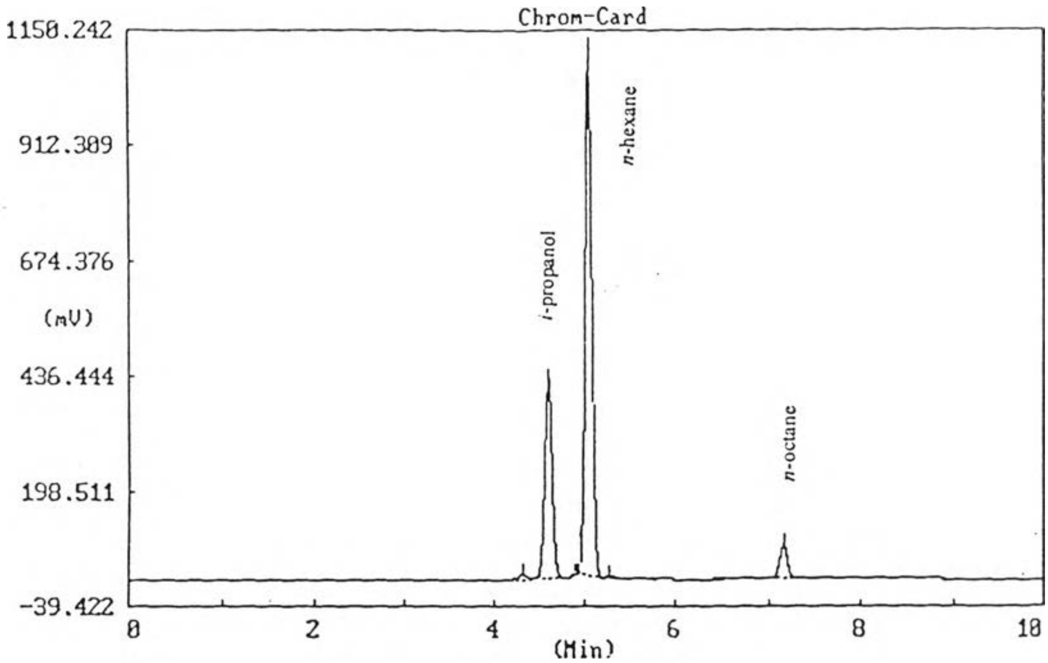

Figure A15 GC Chromatogram of products from using 8% Zn-ZSM-5 catalyst, under 0.2 ml/min feeding rate and 400°C

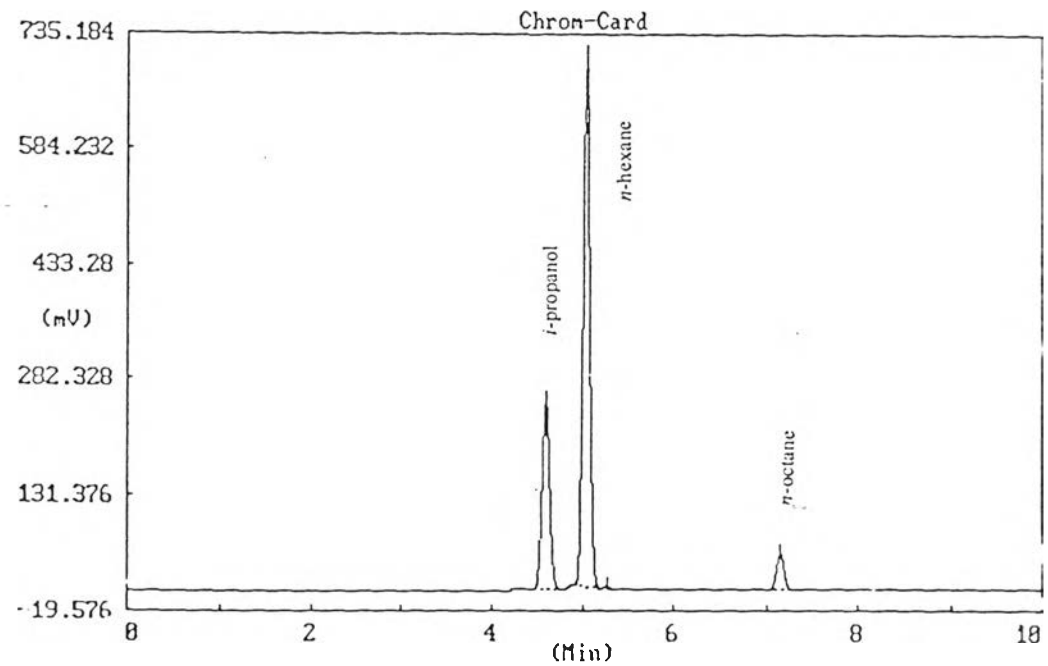

Figure A16 GC Chromatogram of products from using 8% Zn-ZSM-5 catalyst, under 1.0 ml/min feeding rate and 450°C

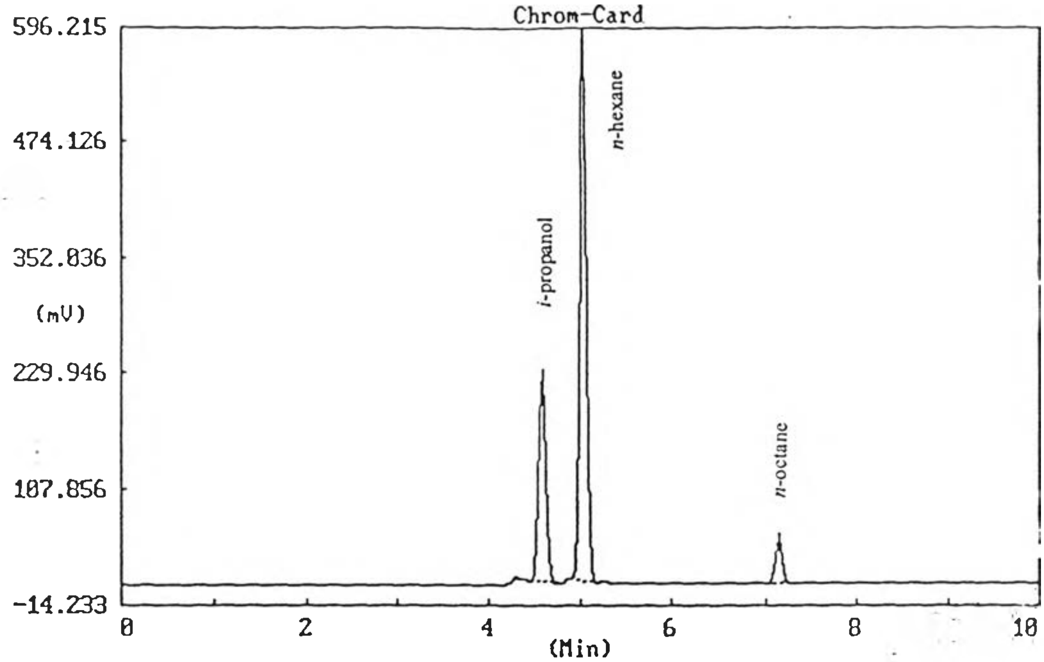

Figure A17 GC Chromatogram of products from using 8% Zn-ZSM-5 catalyst, under 0.8 ml/min feeding rate and 450°C

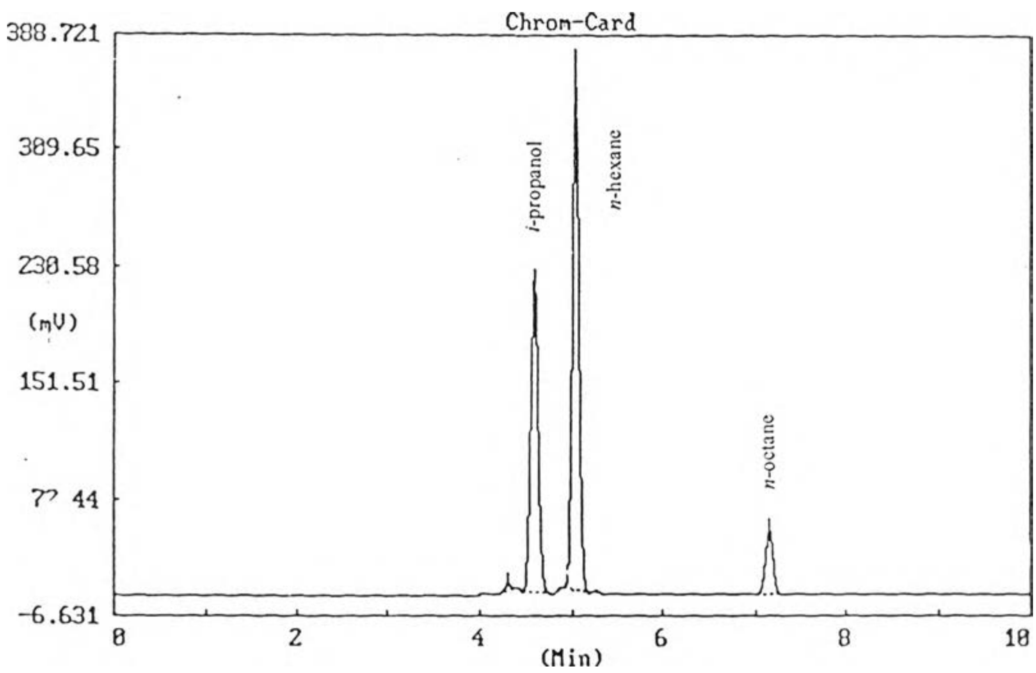

Figure A18 GC Chromatogram of products from using 8% Zn-ZSM-5 catalyst, under 0.6 ml/min feeding rate and 450°C

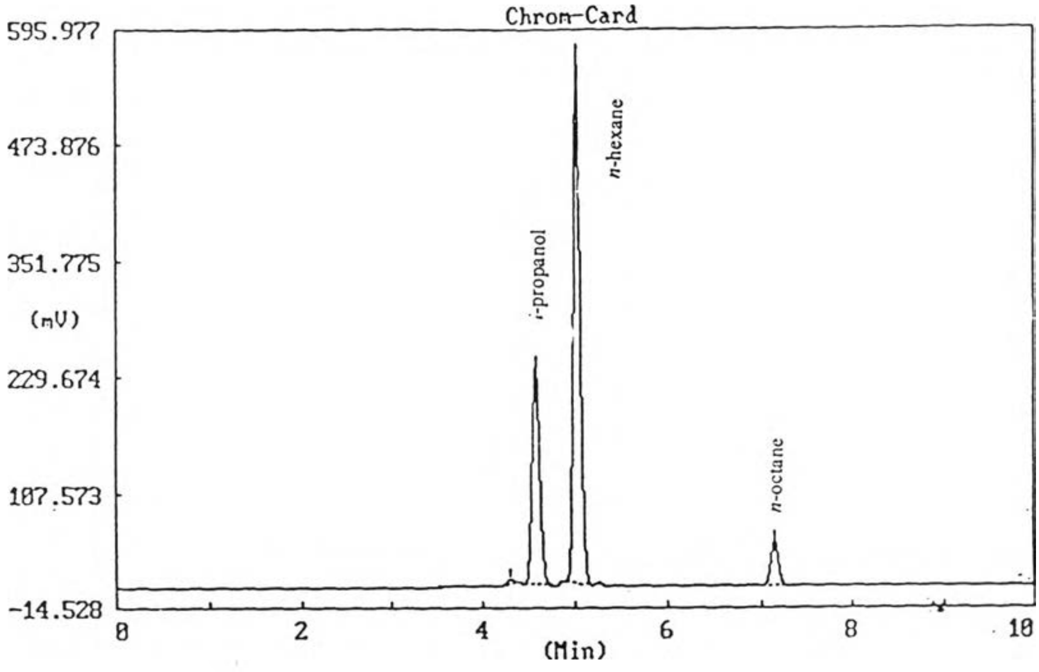

Figure A19 GC Chromatogram of products from using 8% Zn-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 450°C

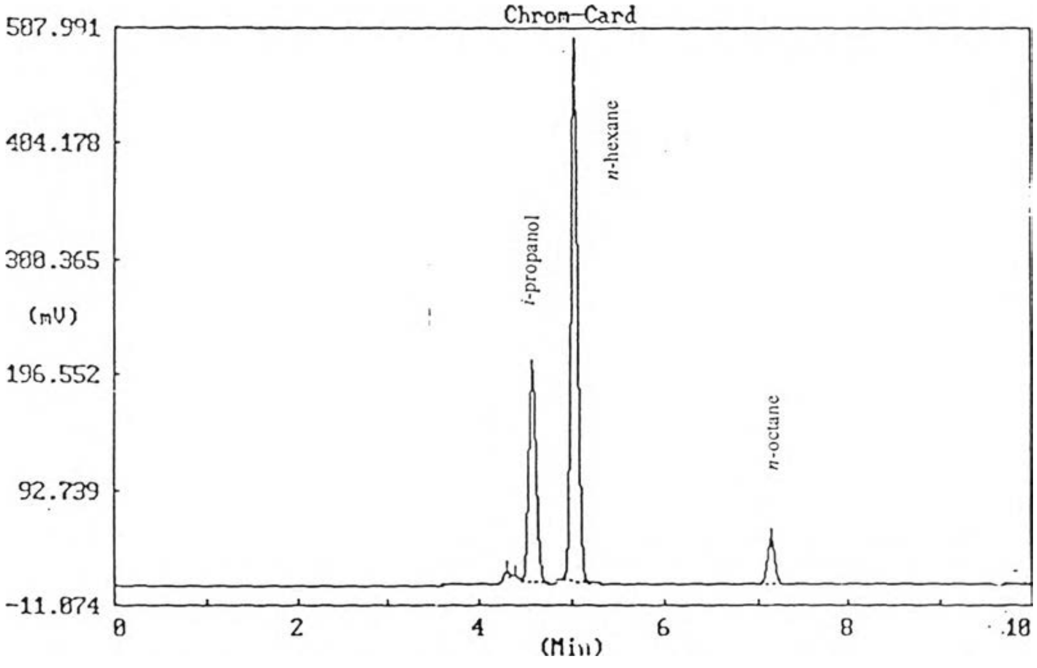

Figure A20 GC Chromatogram of products from using 8% Zn-ZSM-5 catalyst, under 0.2 ml/min feeding rate and 450°C

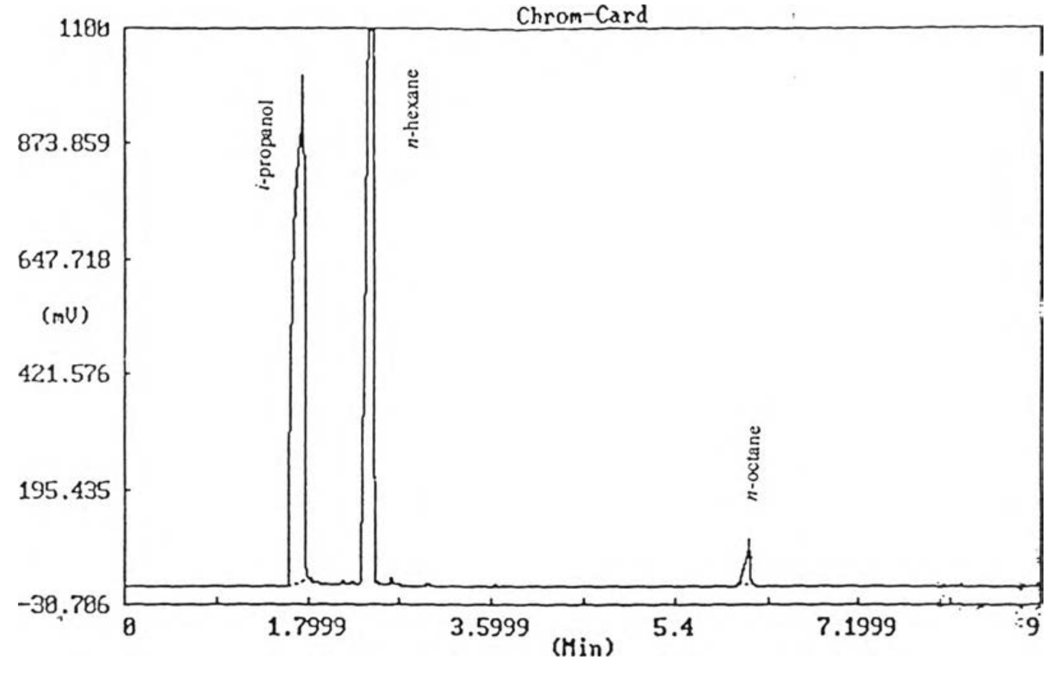

Figure A21 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 1.0 ml/min feeding rate and 200 °C

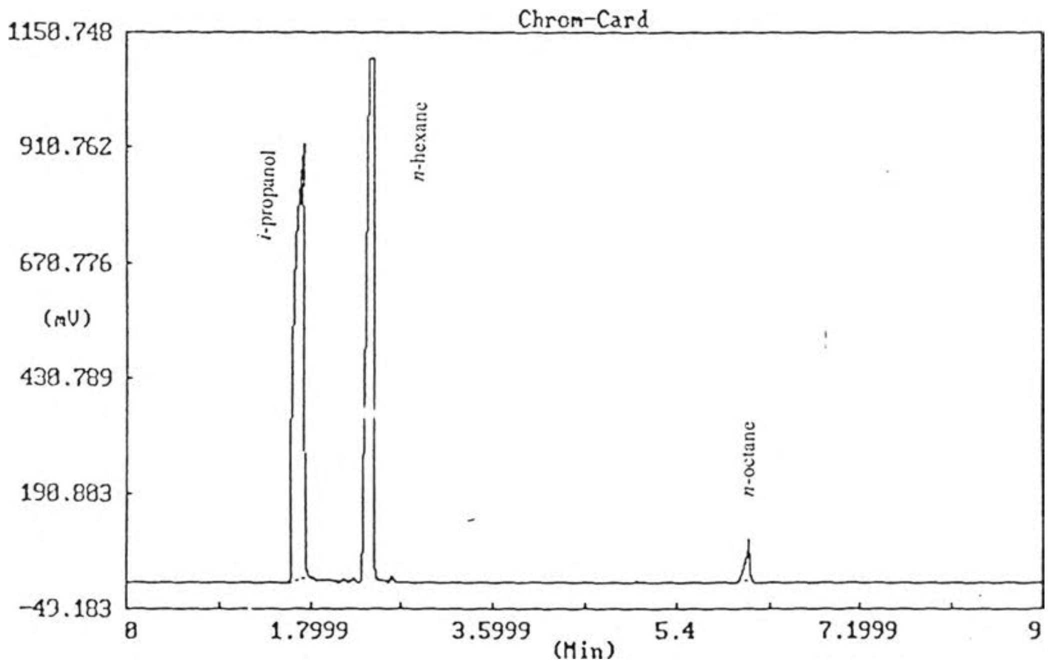

Figure A22 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.8 ml/min feeding rate and 200°C

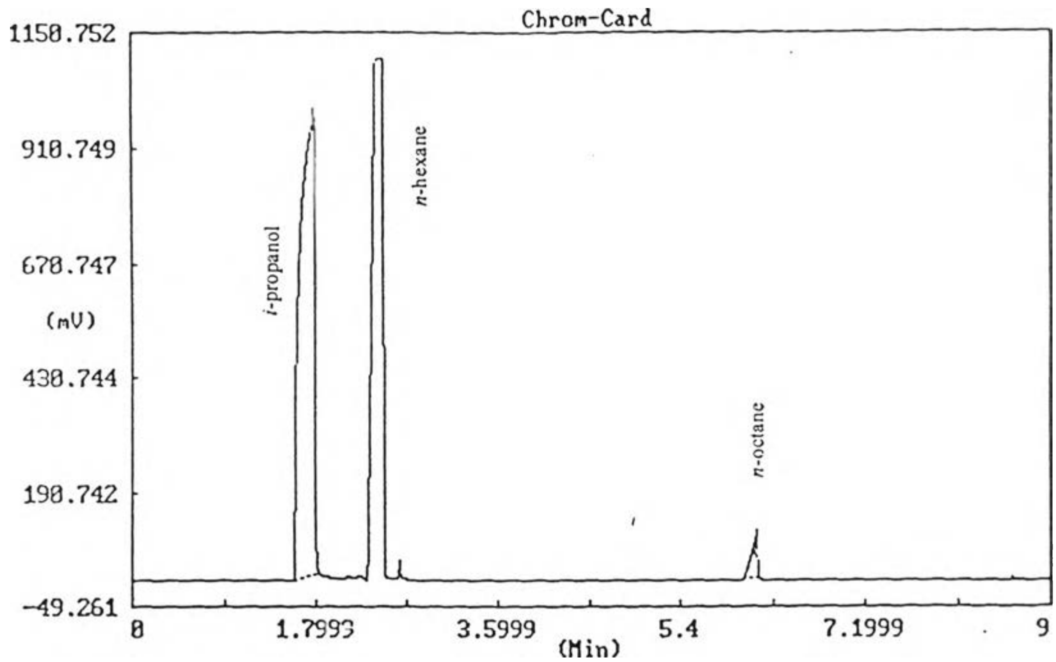

Figure A23 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.6 ml/min feeding rate and 200°C

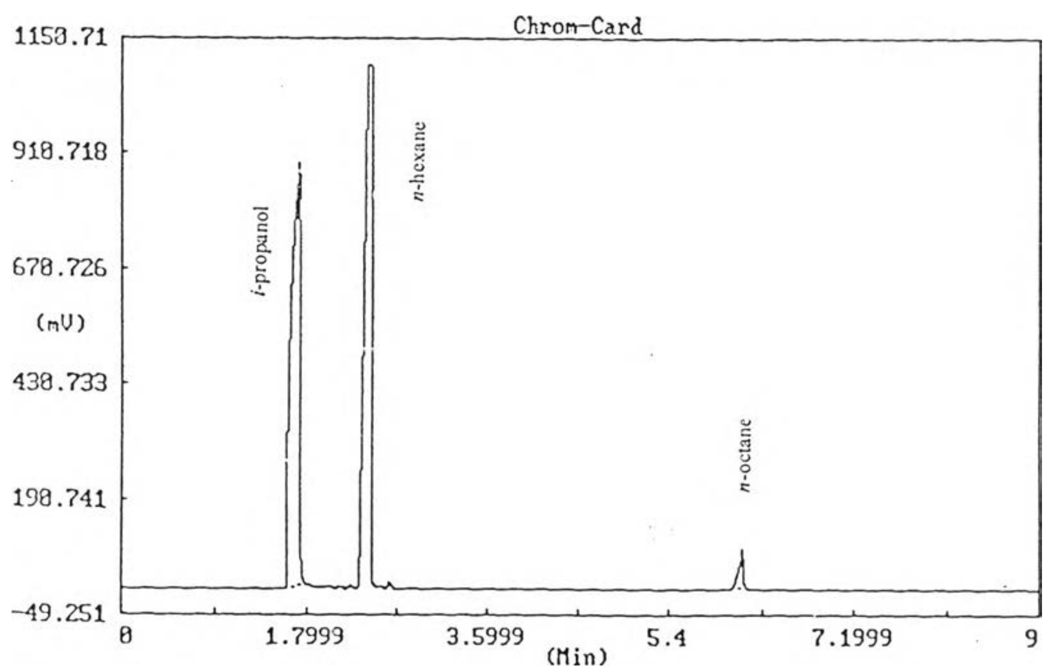

Figure A24 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 200°C

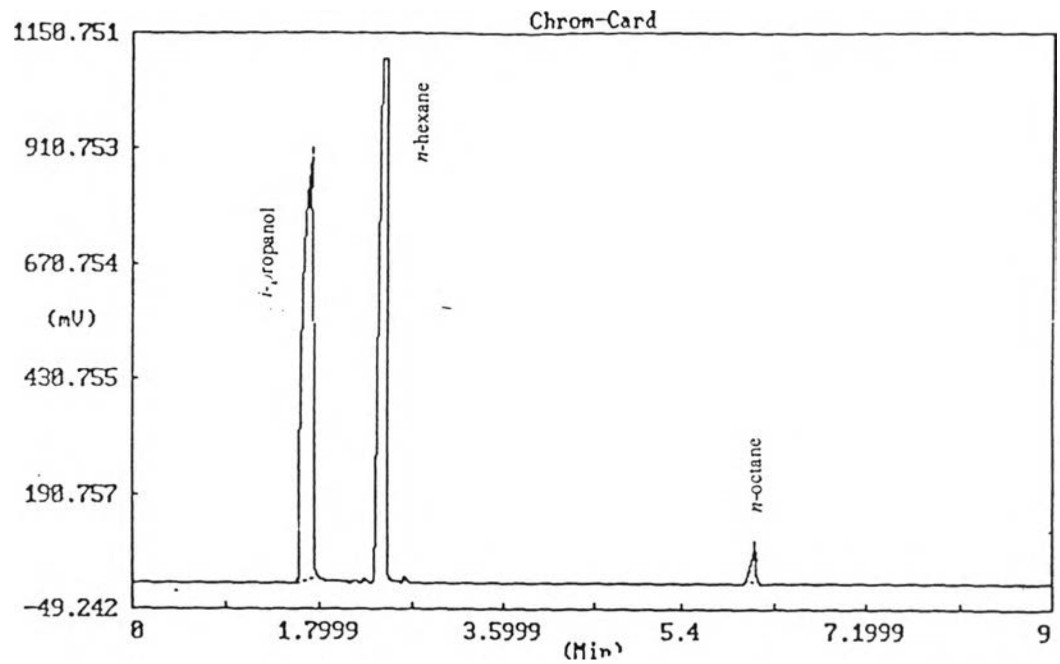

Figure A25 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.2 ml/min feeding rate and 200°C

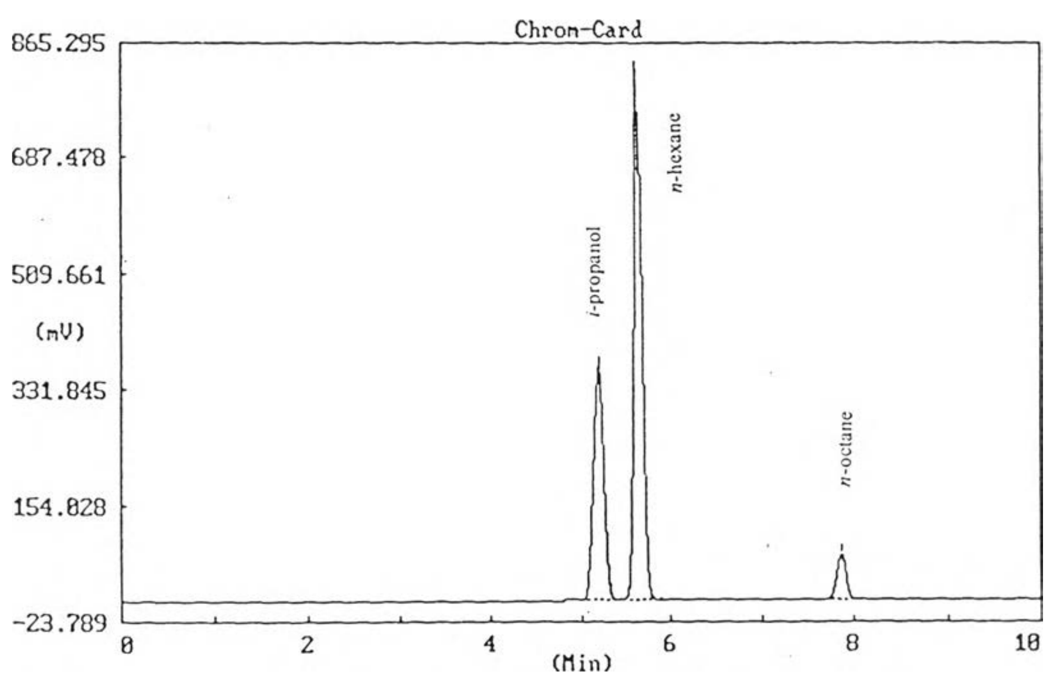

Figure A26 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 1.0 ml/min feeding rate and 250°C

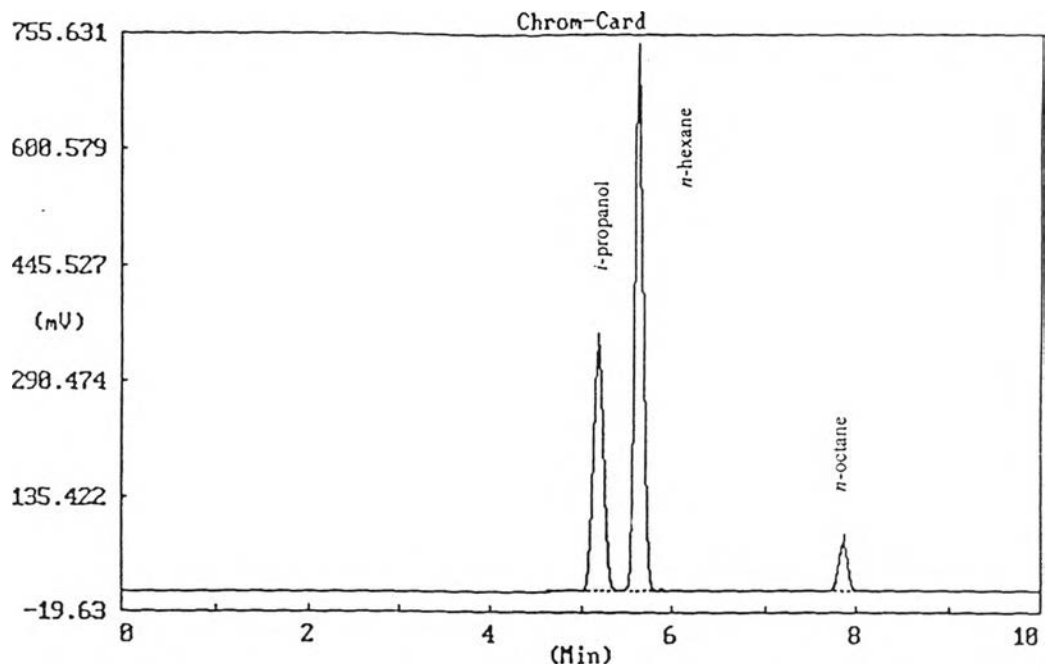

Figure A27 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.8 ml/min feeding rate and 250°C

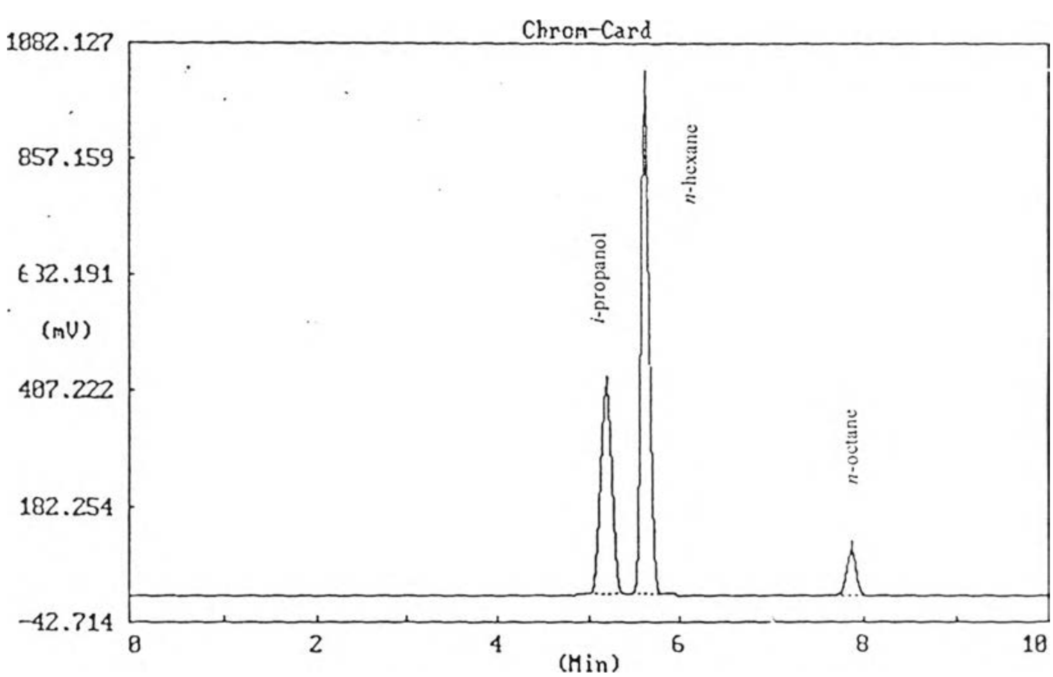

Figure A28 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.6 ml/min feeding rate and 250°C

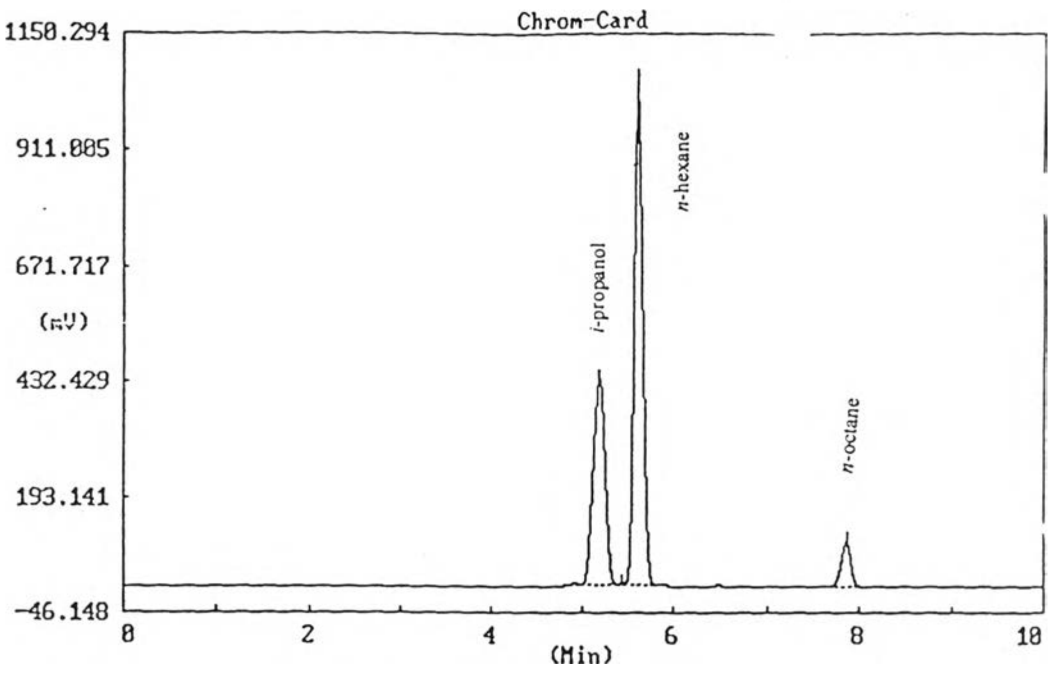

Figure A29 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 250°C

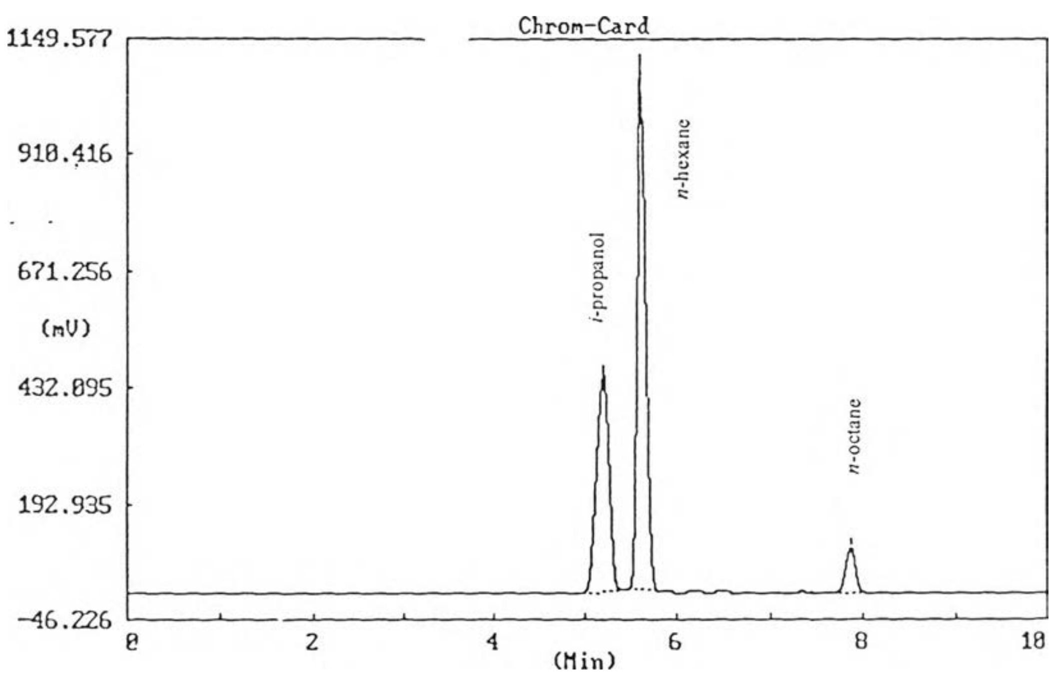

Figure A30 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.2 ml/min feeding rate and 250°C

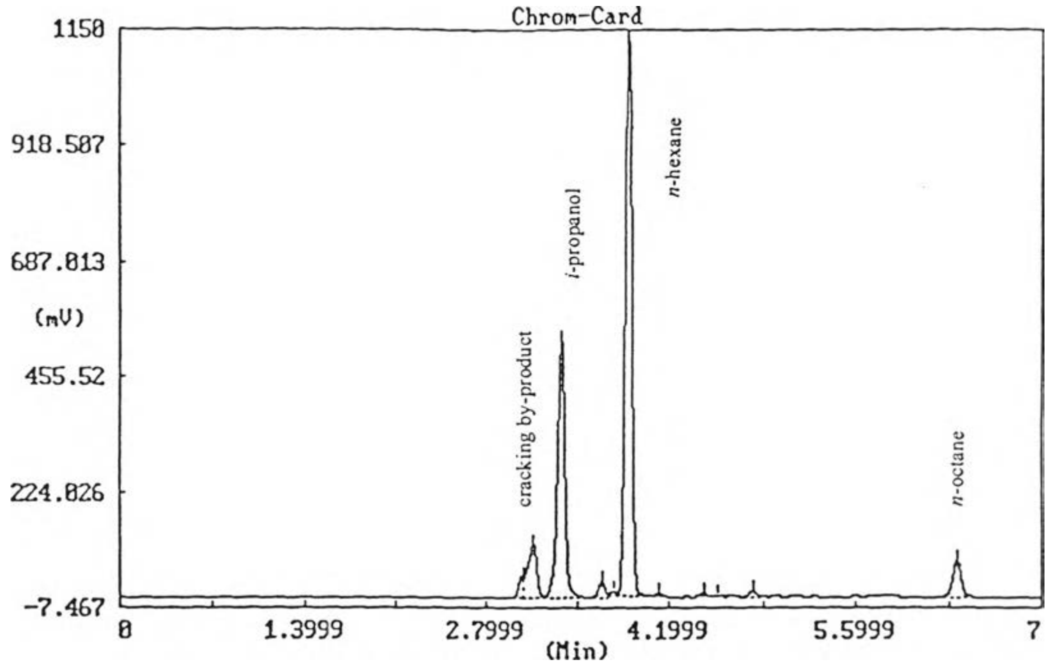

Figure A31 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 1.0 ml/min feeding rate and 300 °C

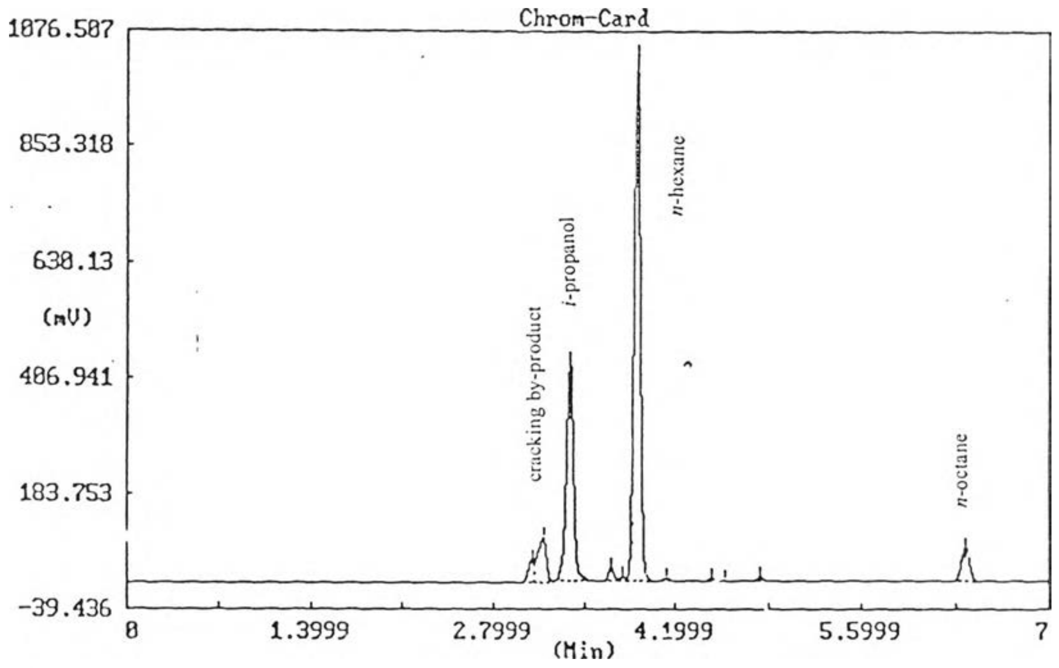

Figure A32 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.8 ml/min feeding rate and 300°C

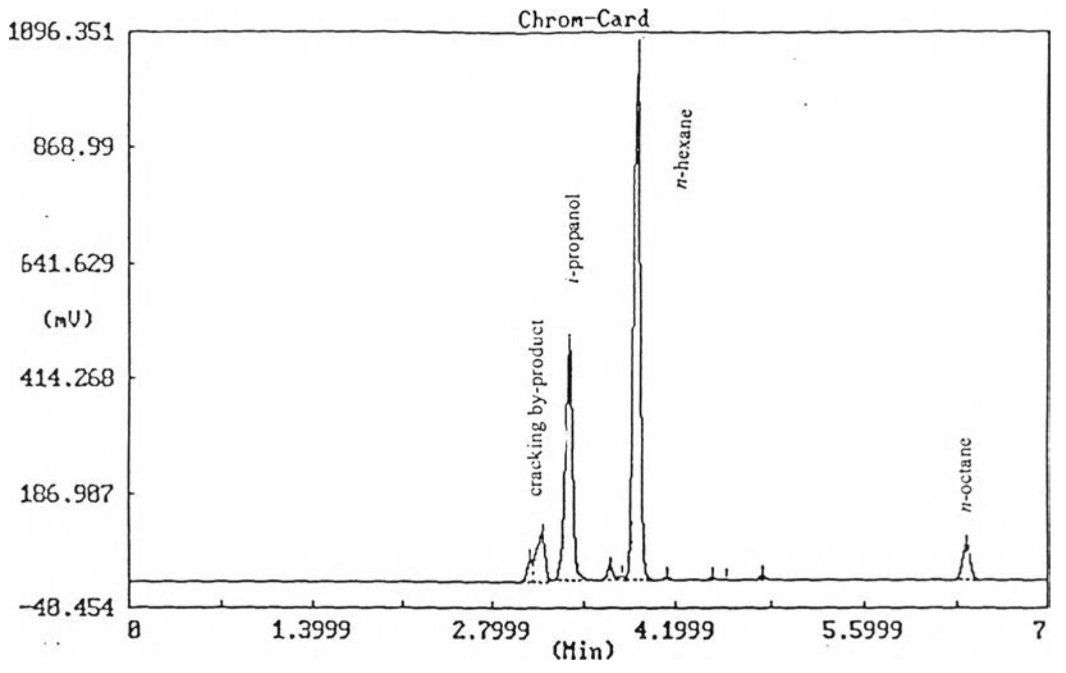

Figure A33 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.6 ml/min feeding rate and 300°C

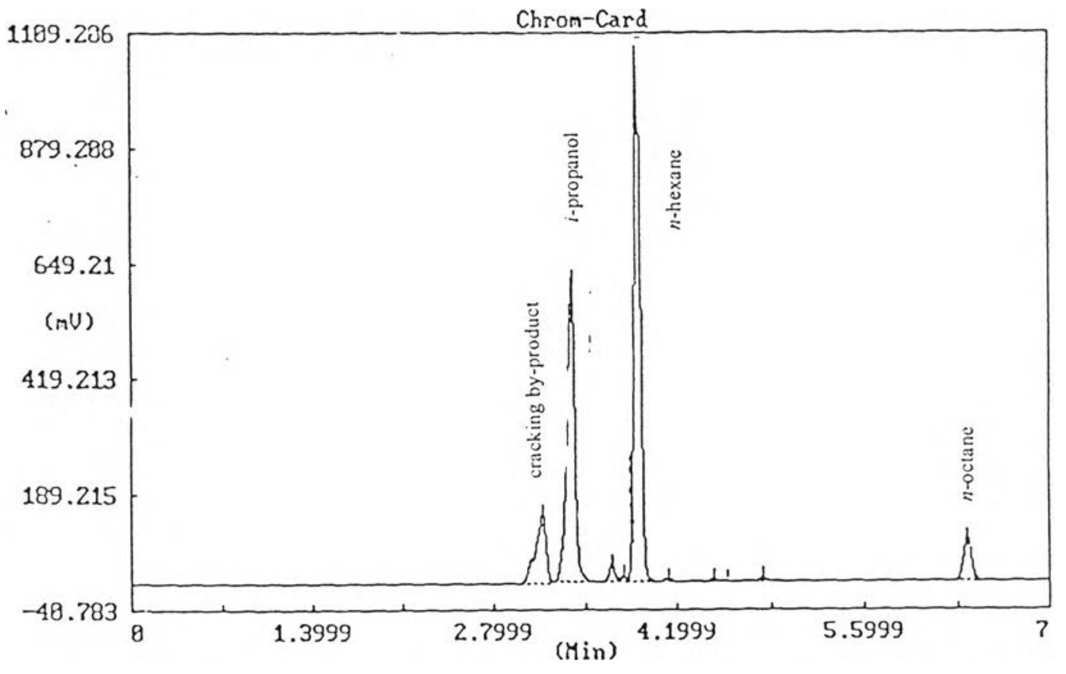

Figure A34 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 300°C

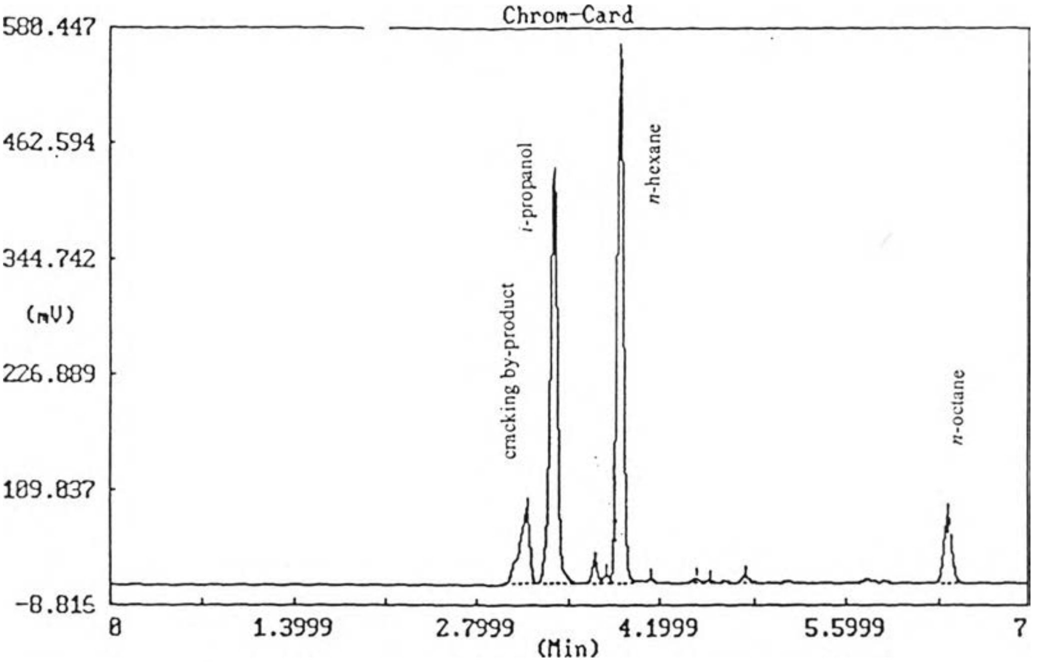

Figure A36 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 1.0 ml/min feeding rate and 350°C

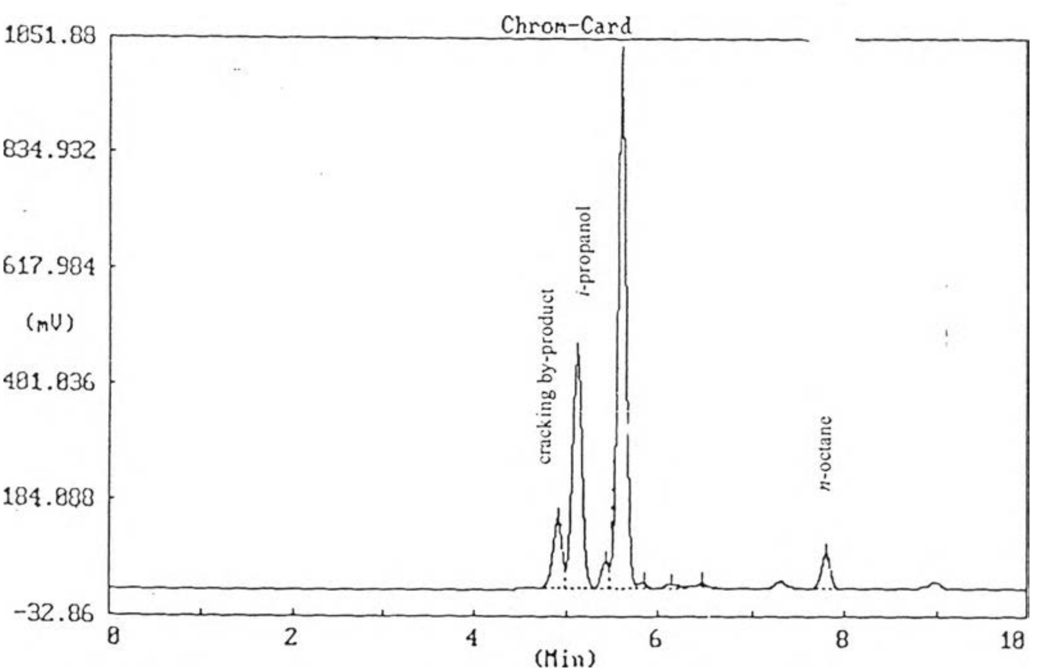

Figure A35 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.2 ml/min feeding rate and 300°C

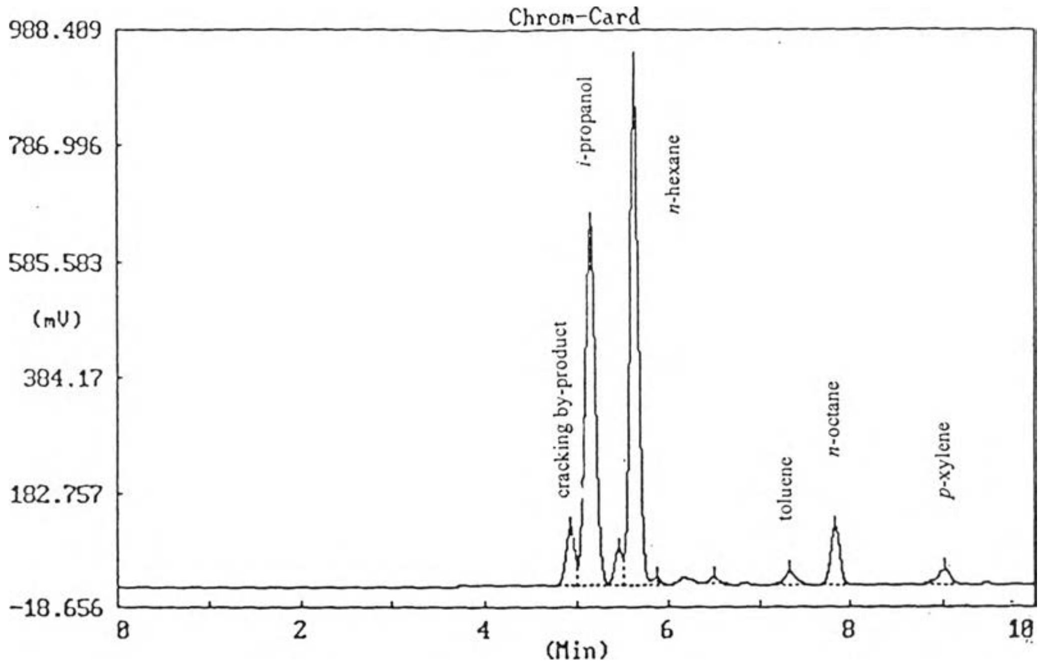

Figure A37 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.8 ml/min feeding rate and 350°C

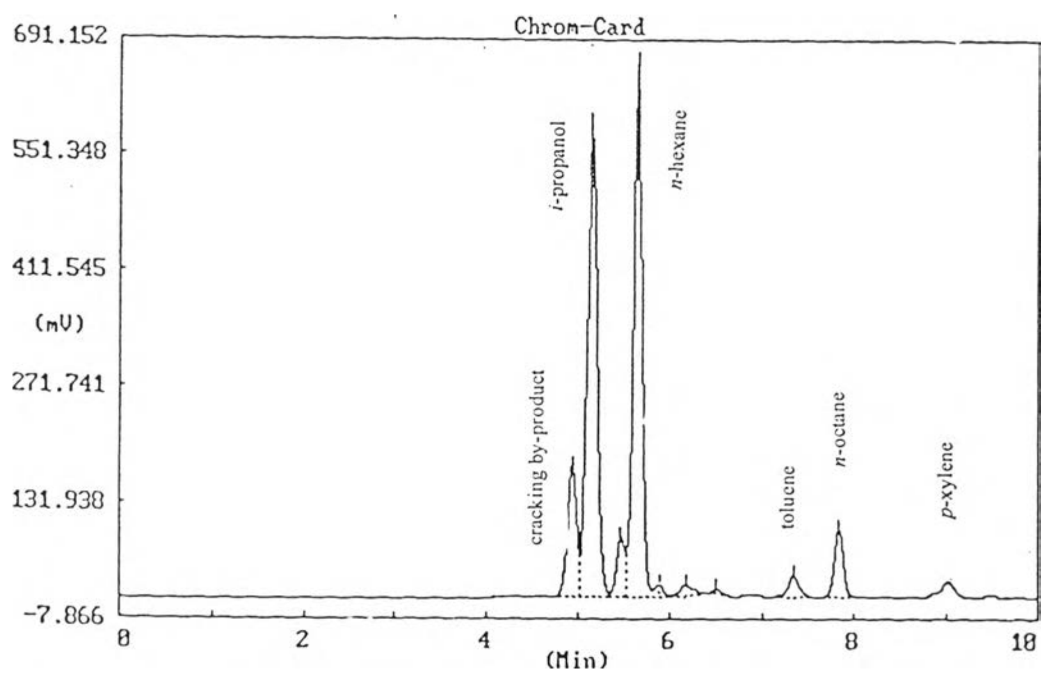

Figure A38 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.6 ml/min feeding rate and 350°C

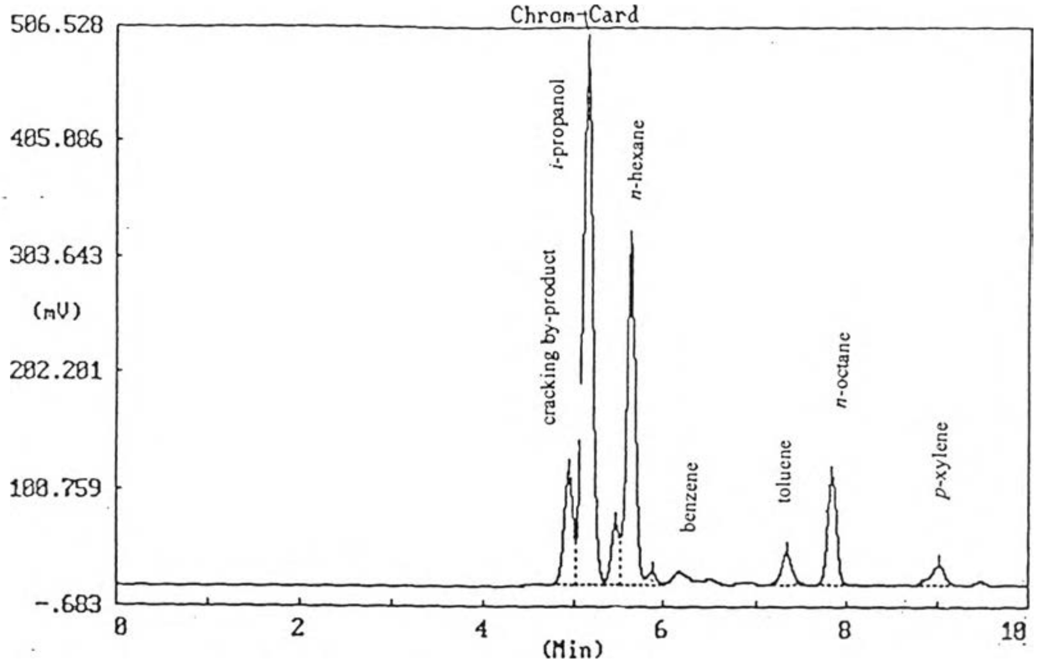

Figure A39 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 350°C

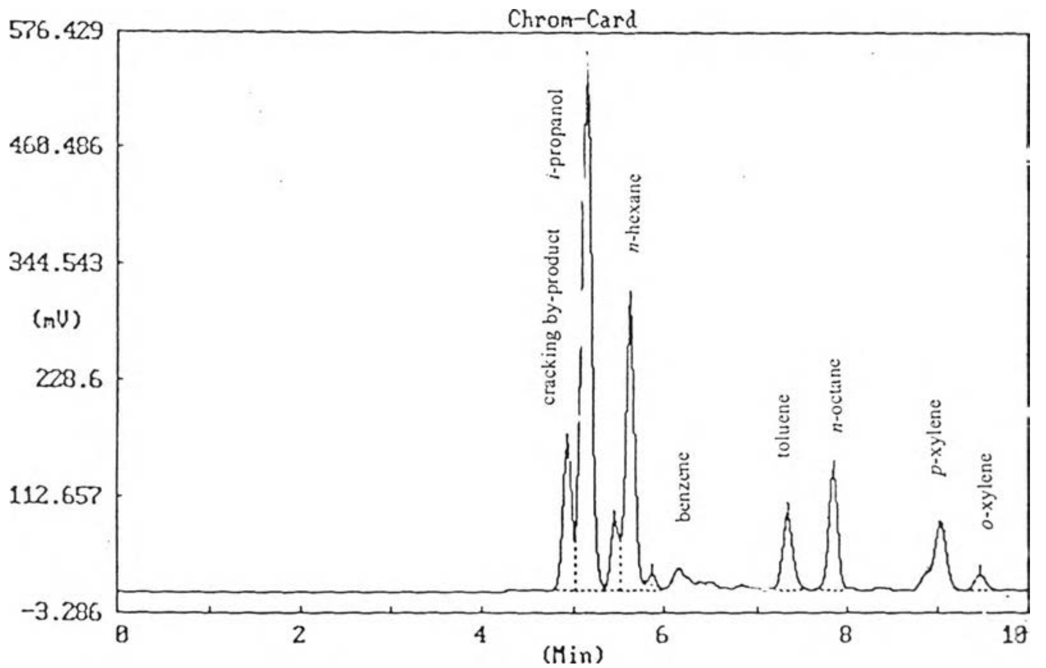

Figure A40 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.2 ml/min feeding rate and 350°C

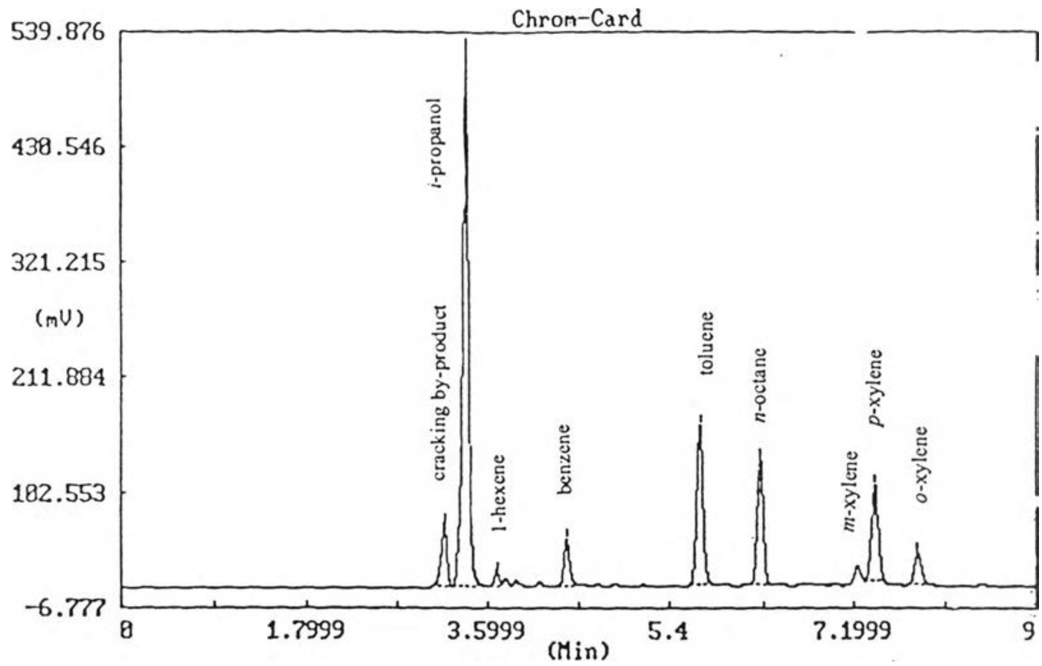

Figure A41 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 1.0 ml/min feeding rate and 400 °C

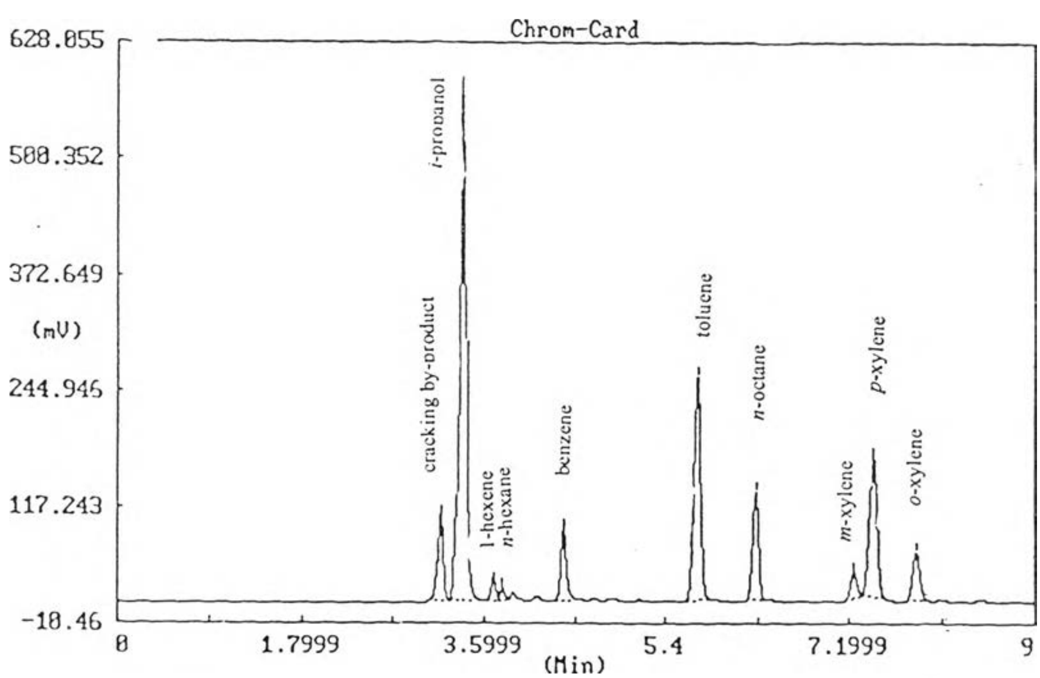

Figure A42 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.8 ml/min feeding rate and 400°C

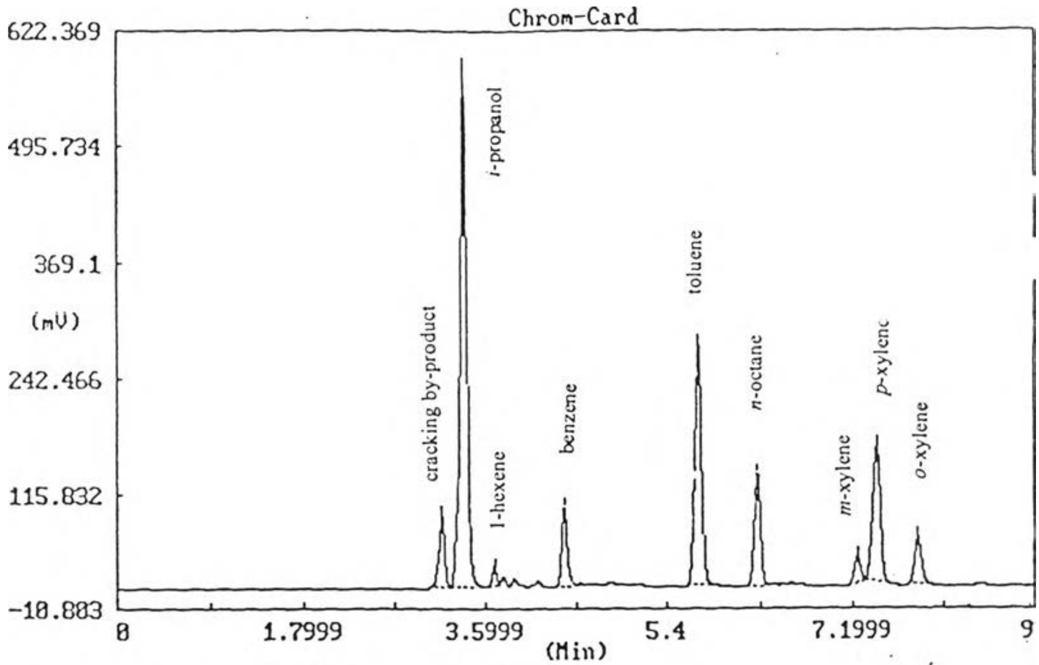

Figure A43 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.6 ml/min feeding rate and 400°C

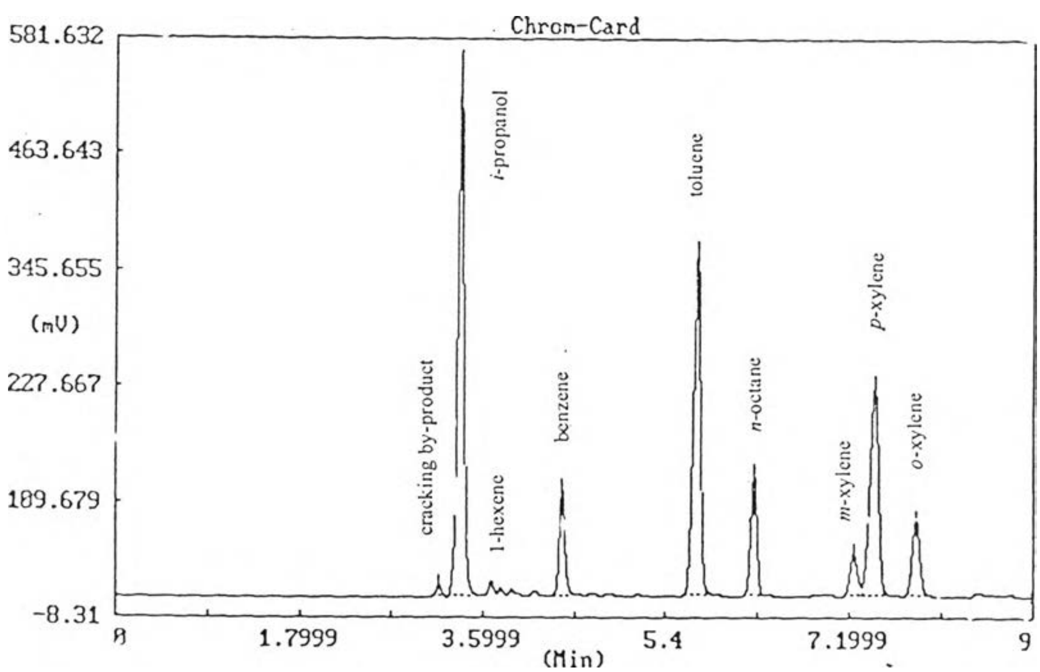

Figure A44 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 400°C

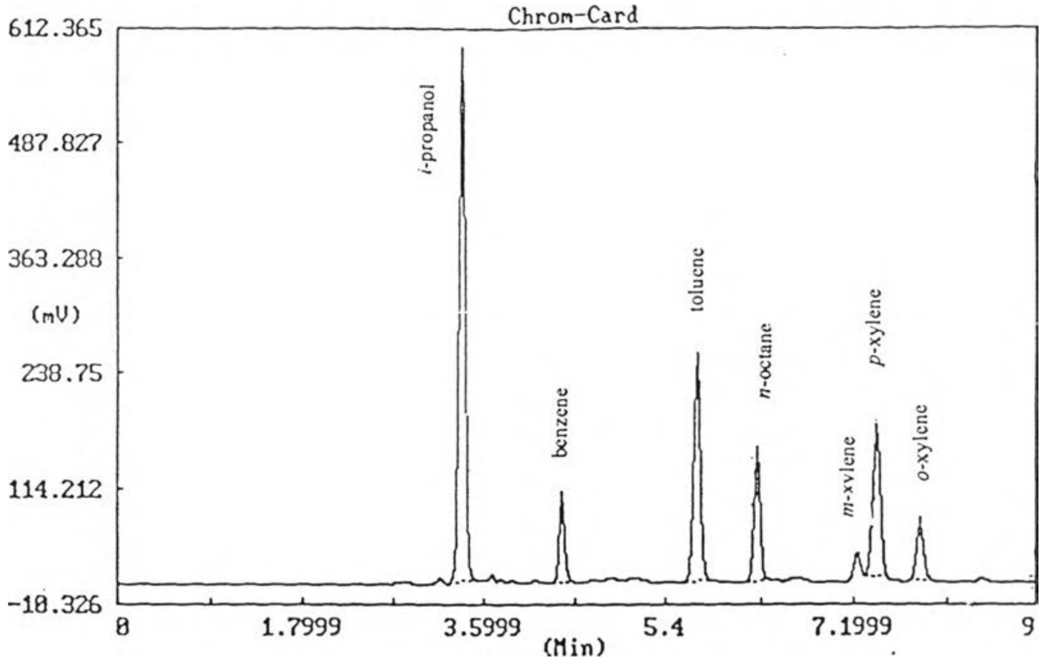

Figure A45 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.2 ml/min feeding rate and 400°C

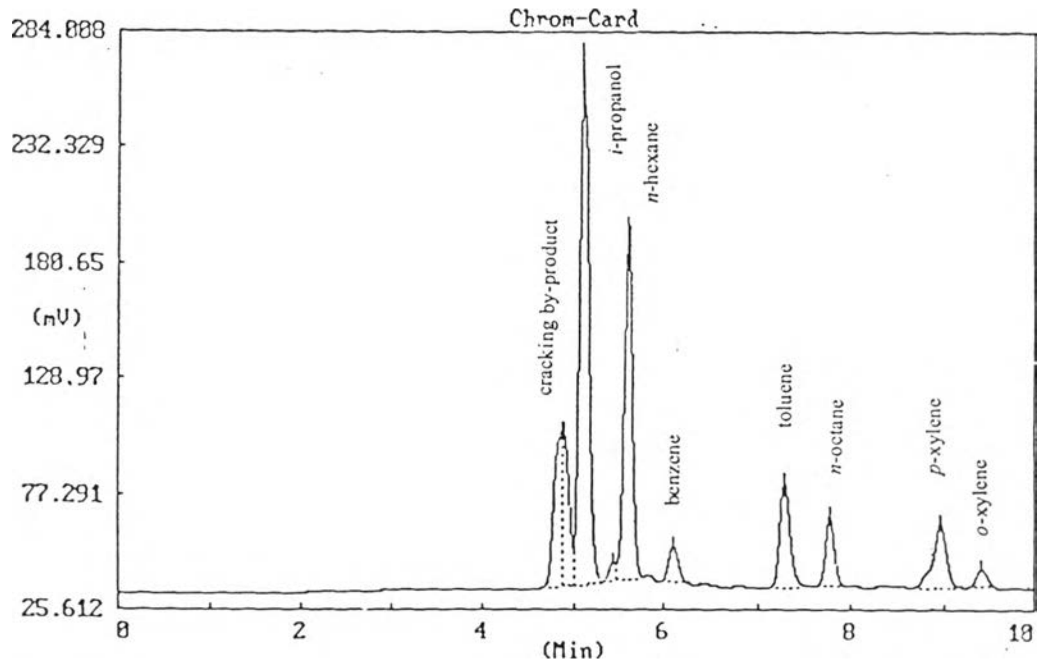

Figure A46 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 1.0 ml/min feeding rate and 450°C

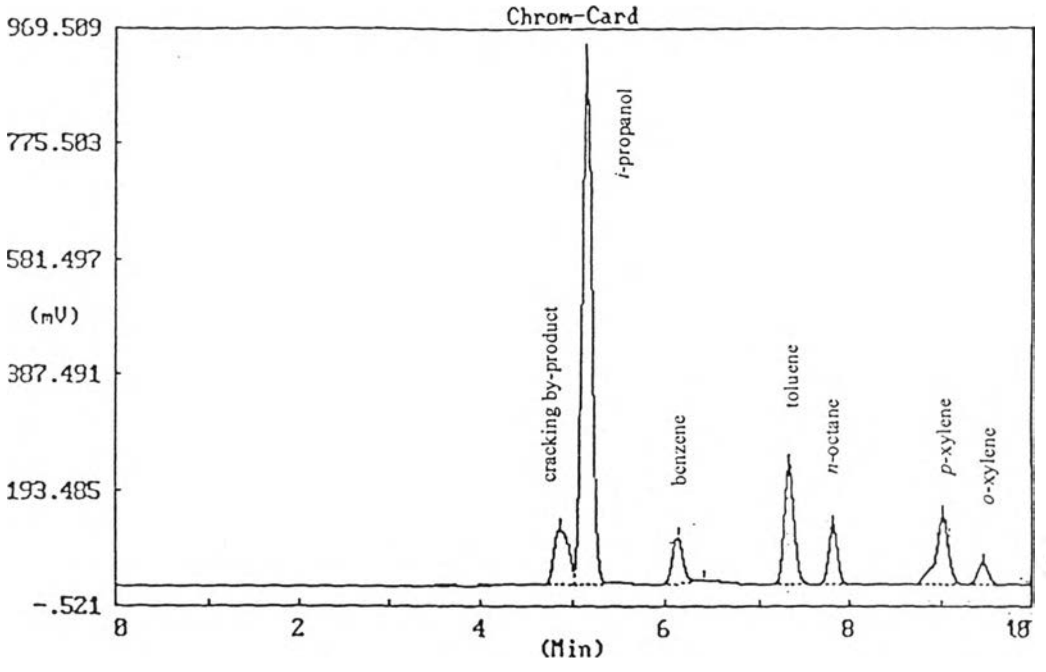

Figure A47 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.8 ml/min feeding rate and 450°C

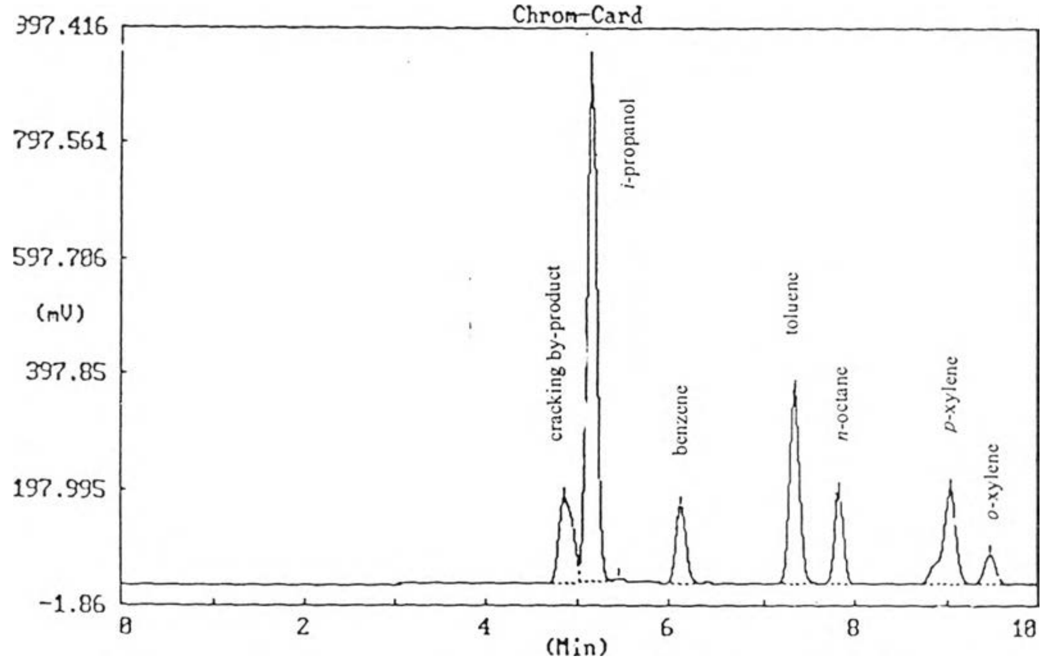

Figure A48 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.6 ml/min feeding rate and 450°C

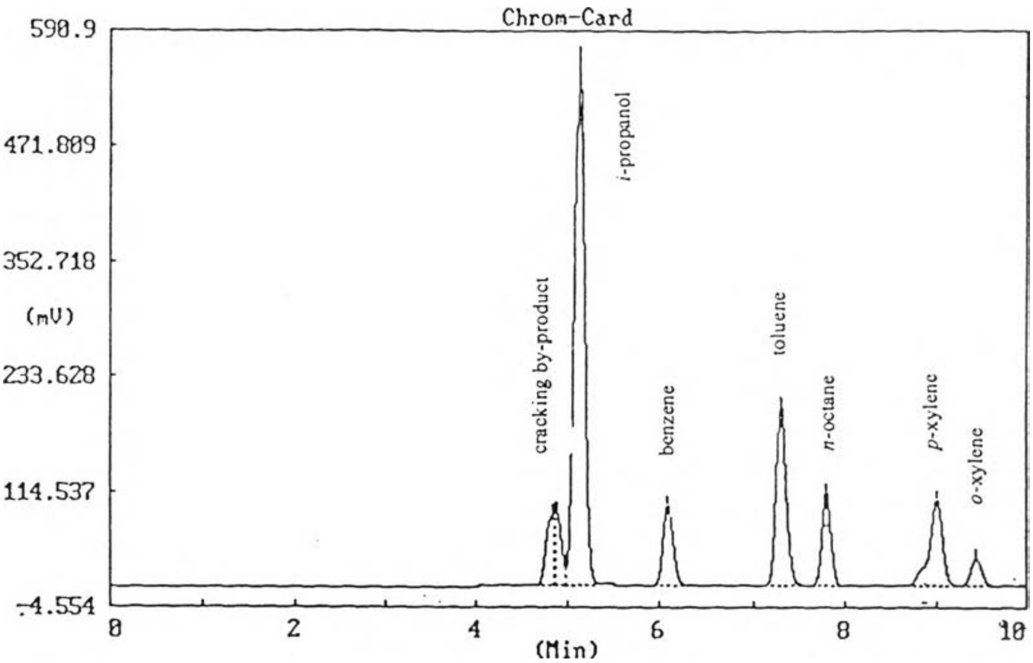

Figure A49 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 450°C

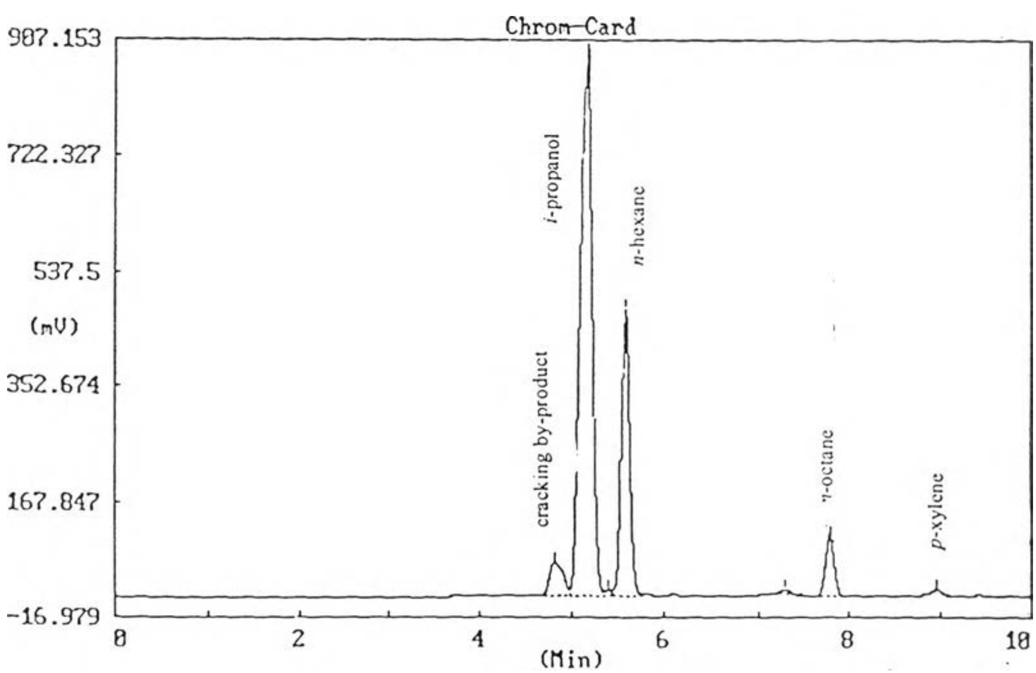

Figure A50 GC Chromatogram of products from using 2% Pd-ZSM-5 catalyst, under 0.2 ml/min feeding rate and 450°C

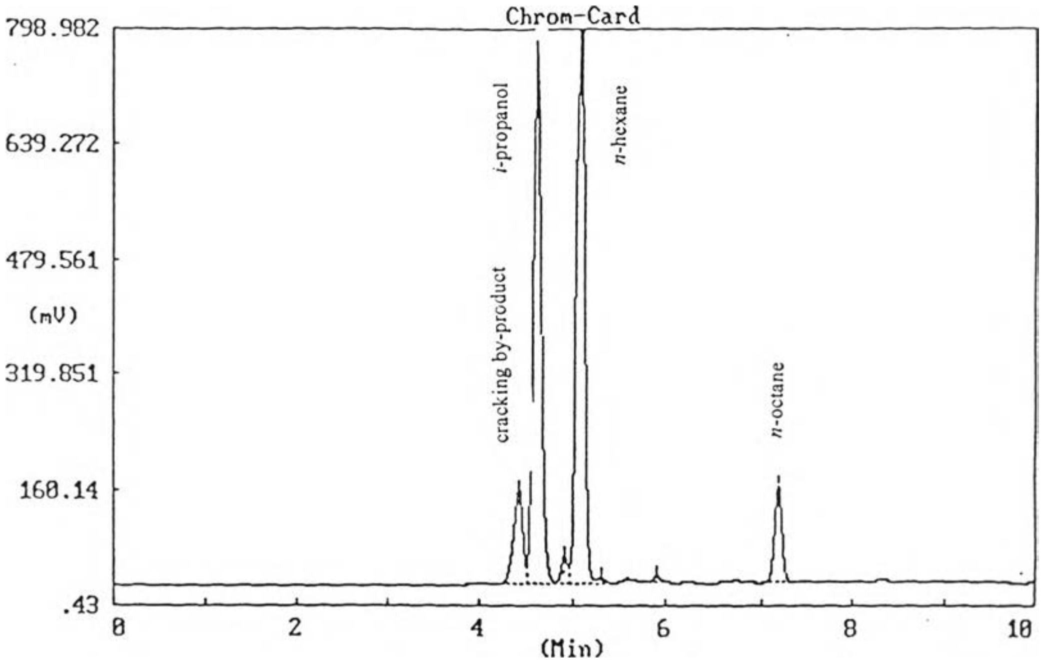

Figure A51 GC Chromatogram of products from using 0.5% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 300°C

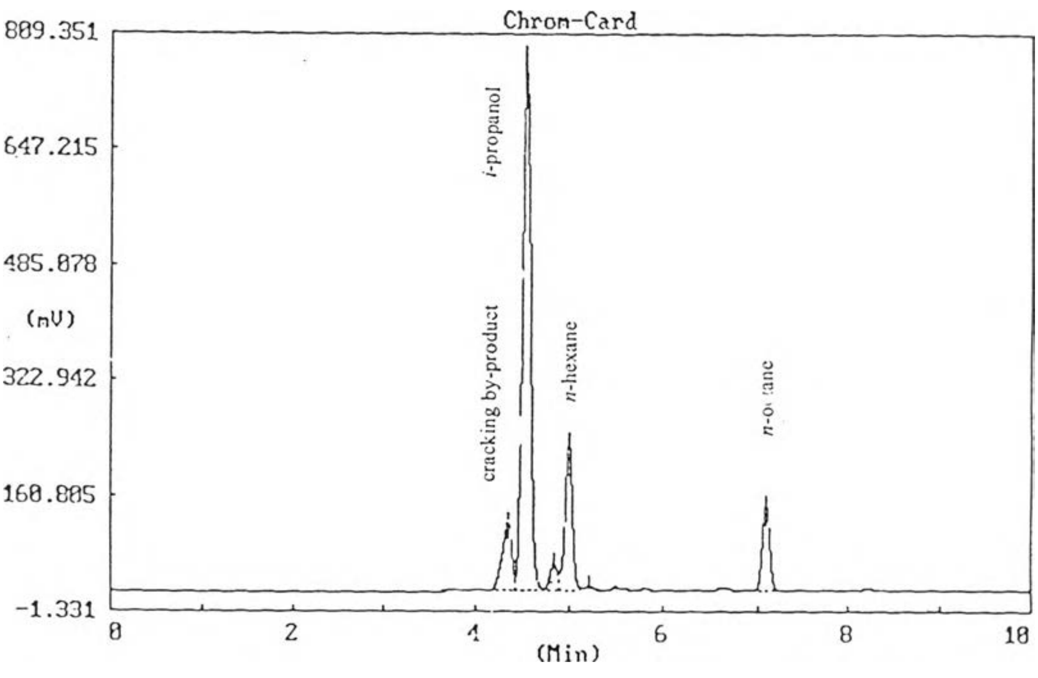

Figure A52 GC Chromatogram of products from using 0.5% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 350°C

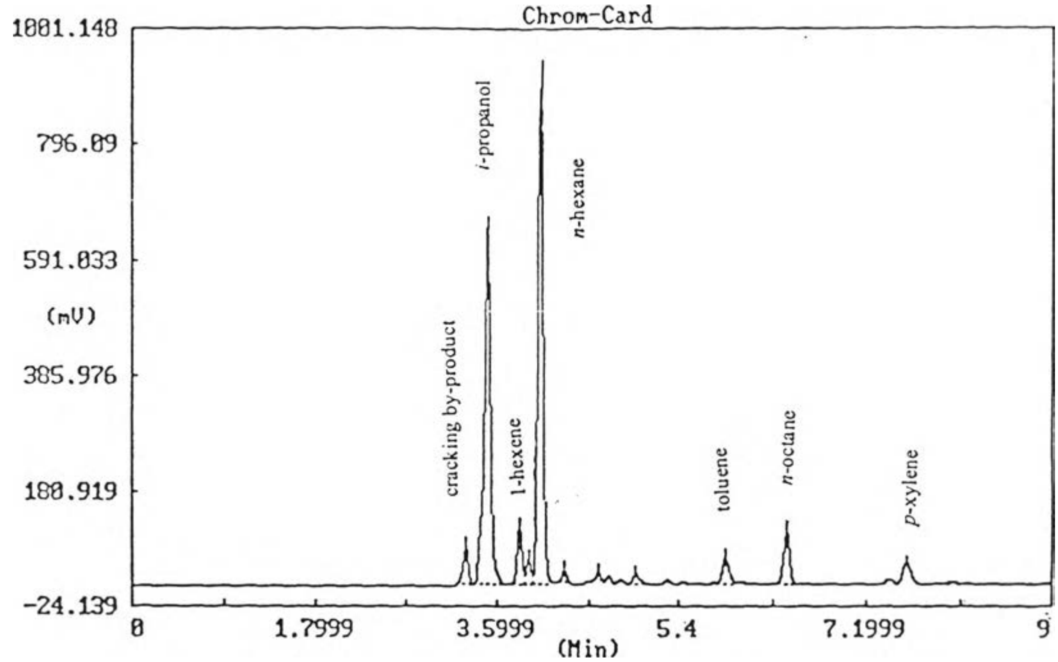

Figure A53 GC Chromatogram of products from using 0.5% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 400°

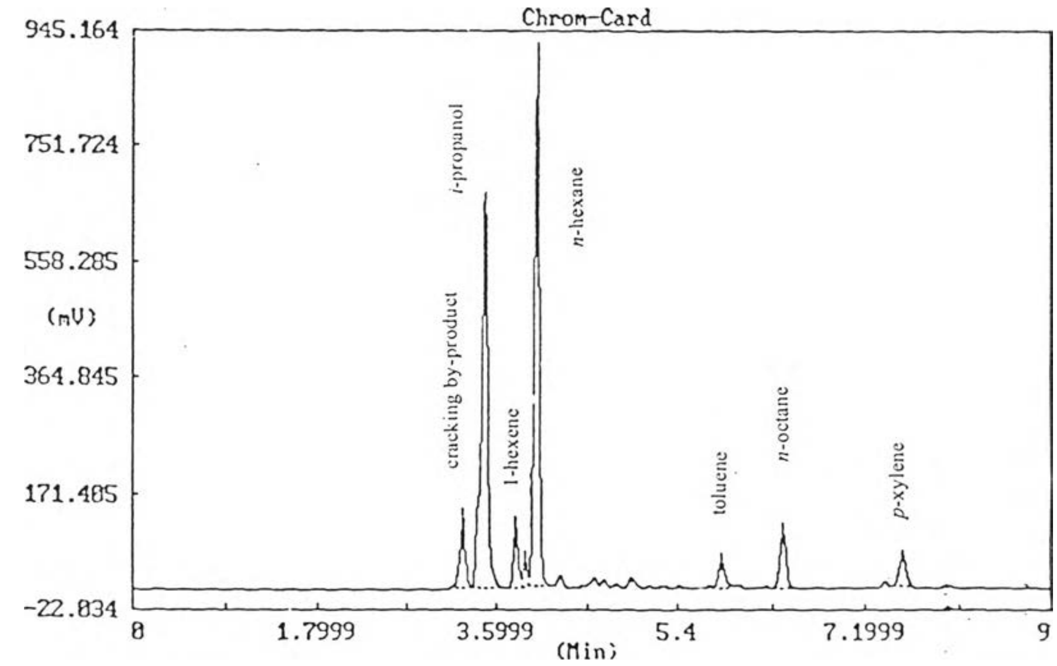

Figure A54 GC Chromatogram of products from using 0.5% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 450°C

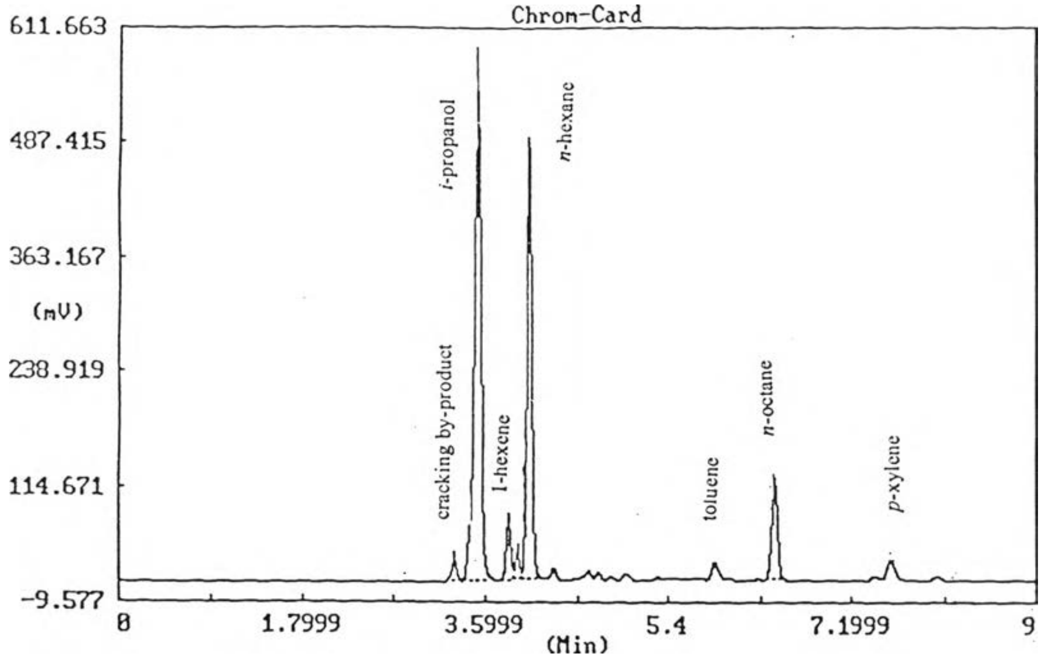

Figure A55 GC Chromatogram of products from using 1.0% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 300°C

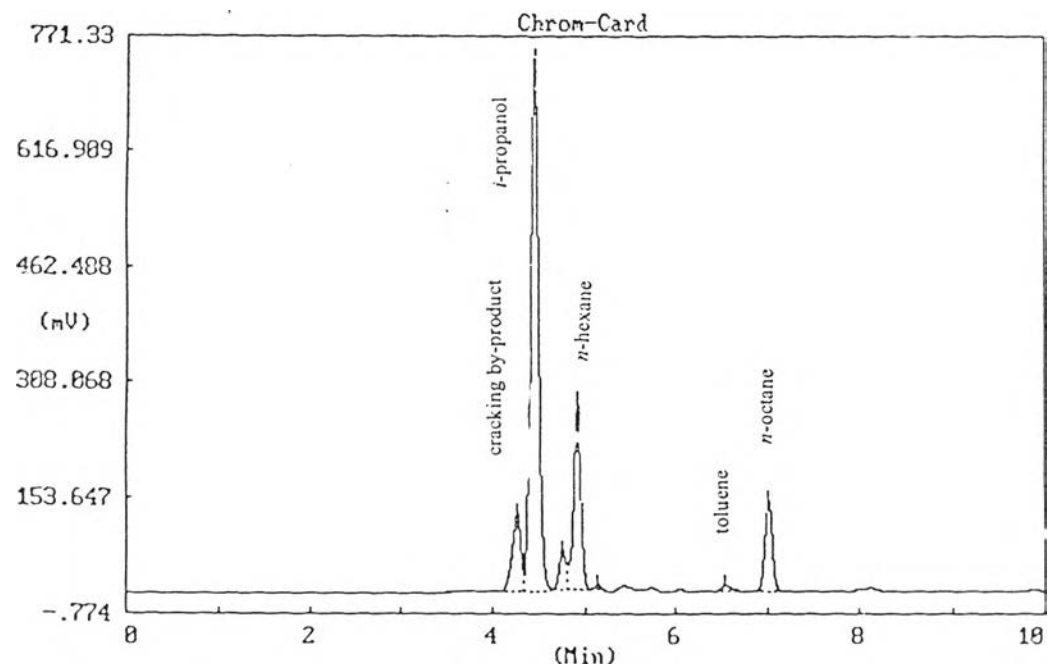

Figure A56 GC Chromatogram of products from using 1.0% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 350°C

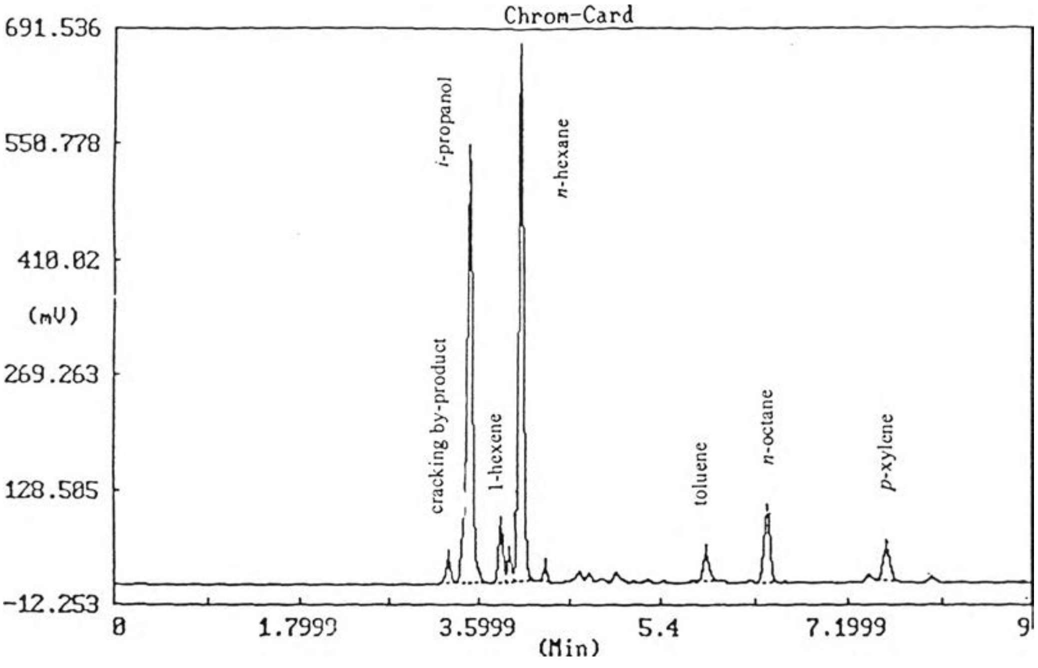

Figure A57 GC Chromatogram of products from using 1.0% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 400°C

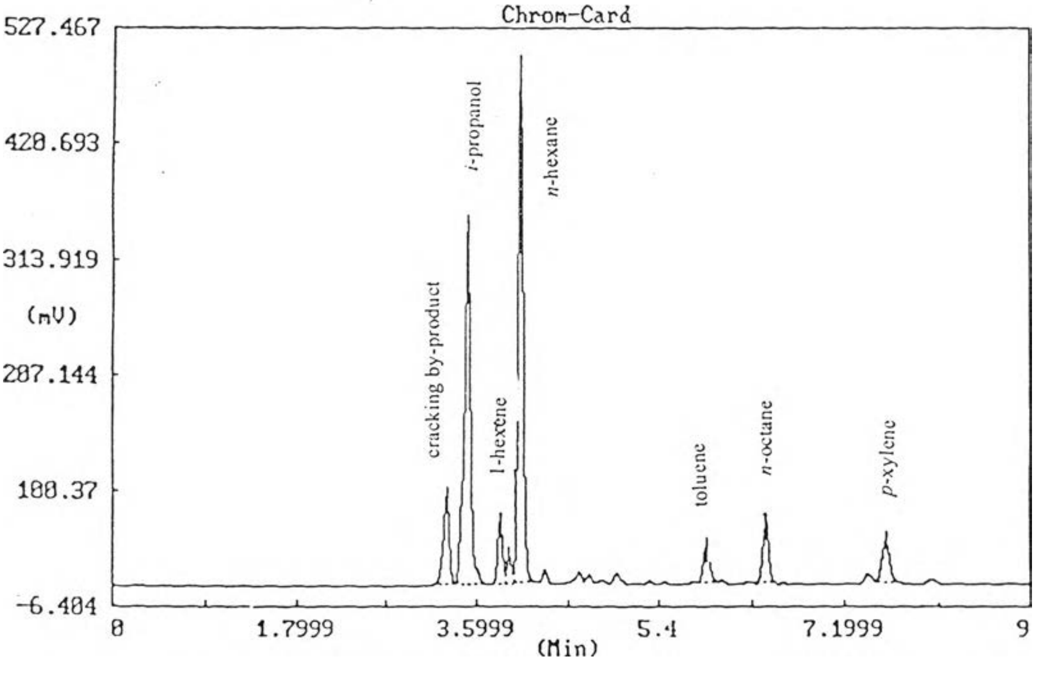

Figure A58 GC Chromatogram of products from using 1.0% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 450°C

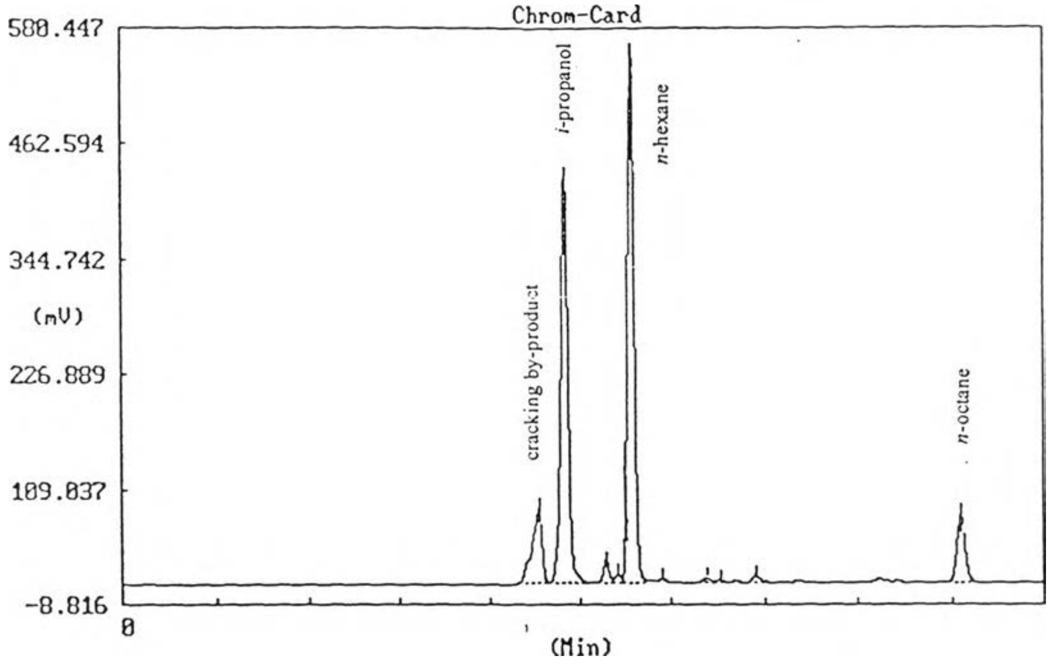

Figure A59 GC Chromatogram of products from using 2.0% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 300°C

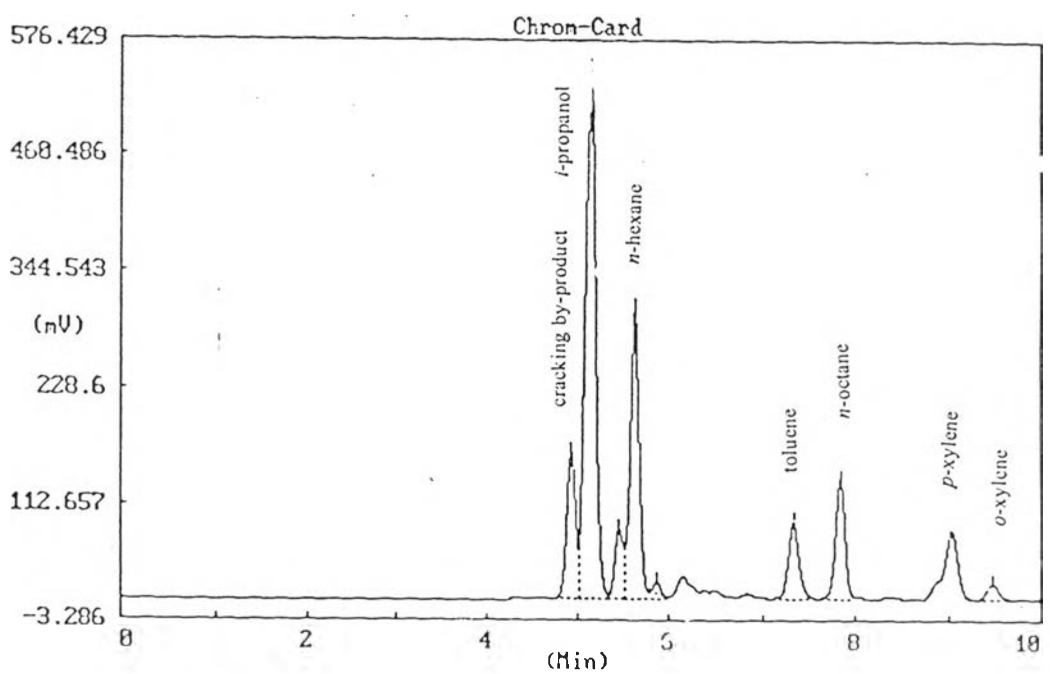

Figure A60 GC Chromatogram of products from using 2.0% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 350°C

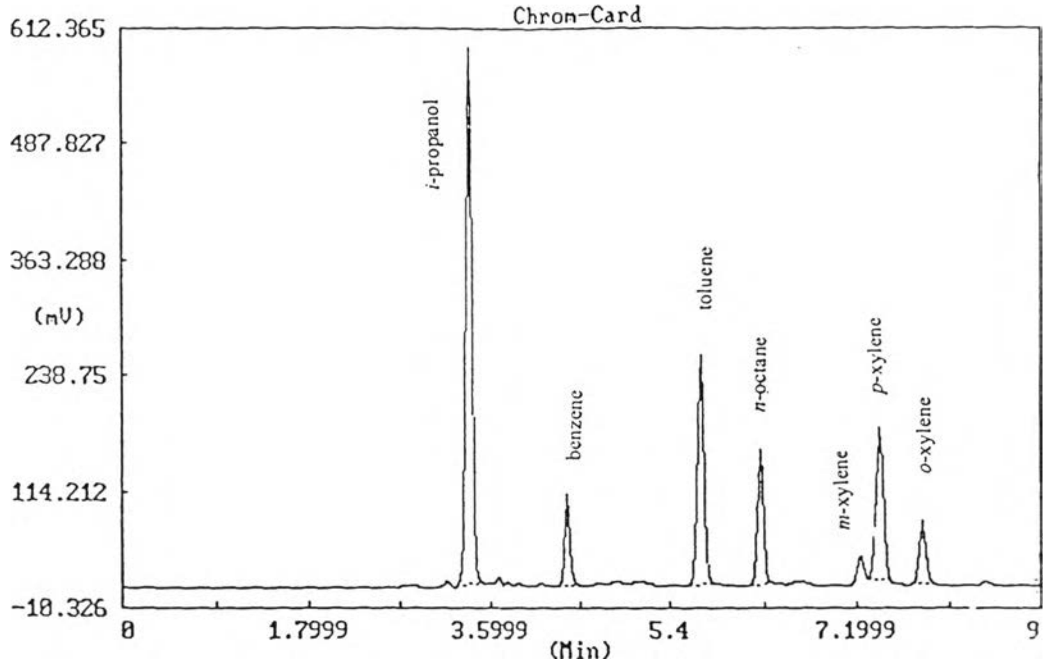

Figure A61 GC Chromatogram of products from using 2.0% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 400°C

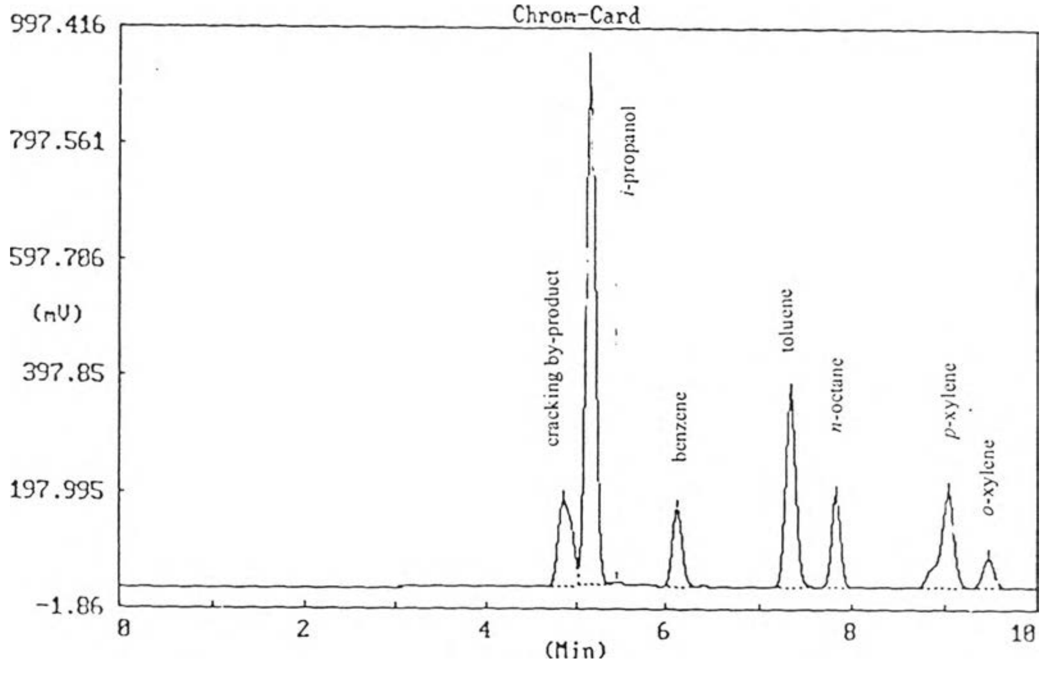

Figure A62 GC Chromatogram of products from using 2.0% Pd-ZSM-5 catalyst, under 0.4 ml/min feeding rate and 450°C

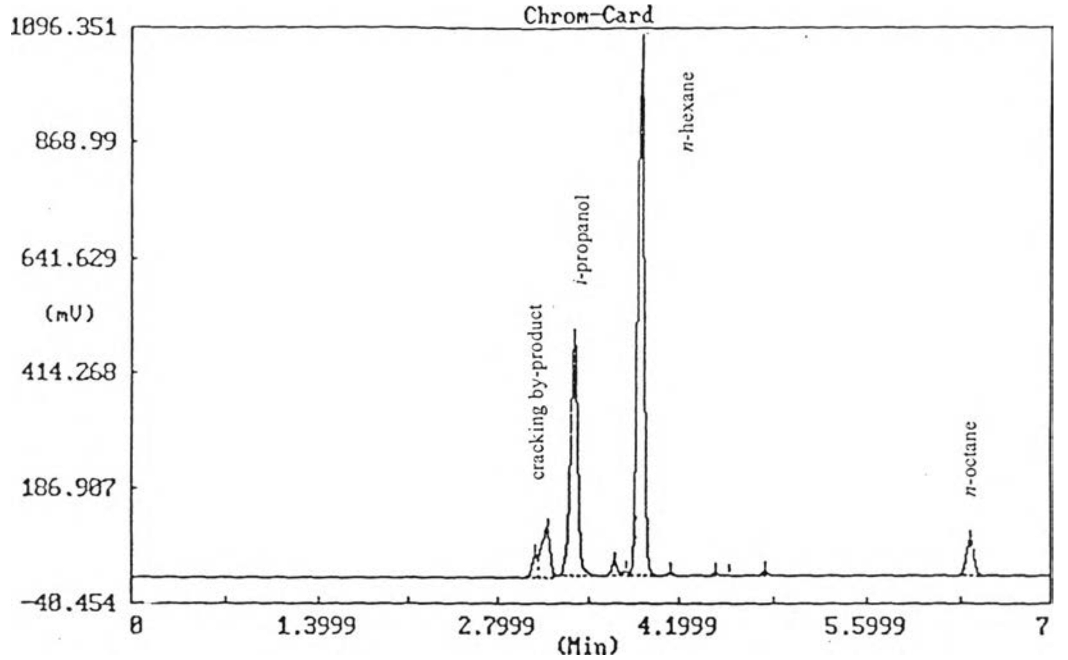

Figure A63 GC Chromatogram of products from using 2.0% Pd-ZSM-5 first regenerated catalyst, under 0.4 ml/min feeding rate and 300°C

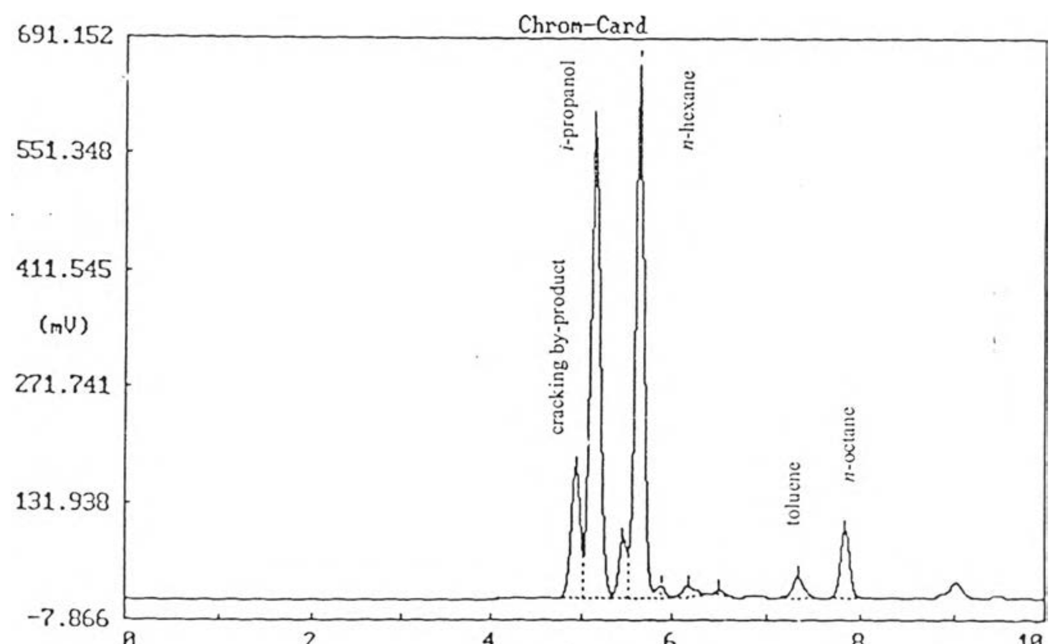

Figure A64 GC Chromatogram of products from using 2.0% Pd-ZSM-5 first regenerated catalyst, under 0.4 ml/min feeding rate and 350°C

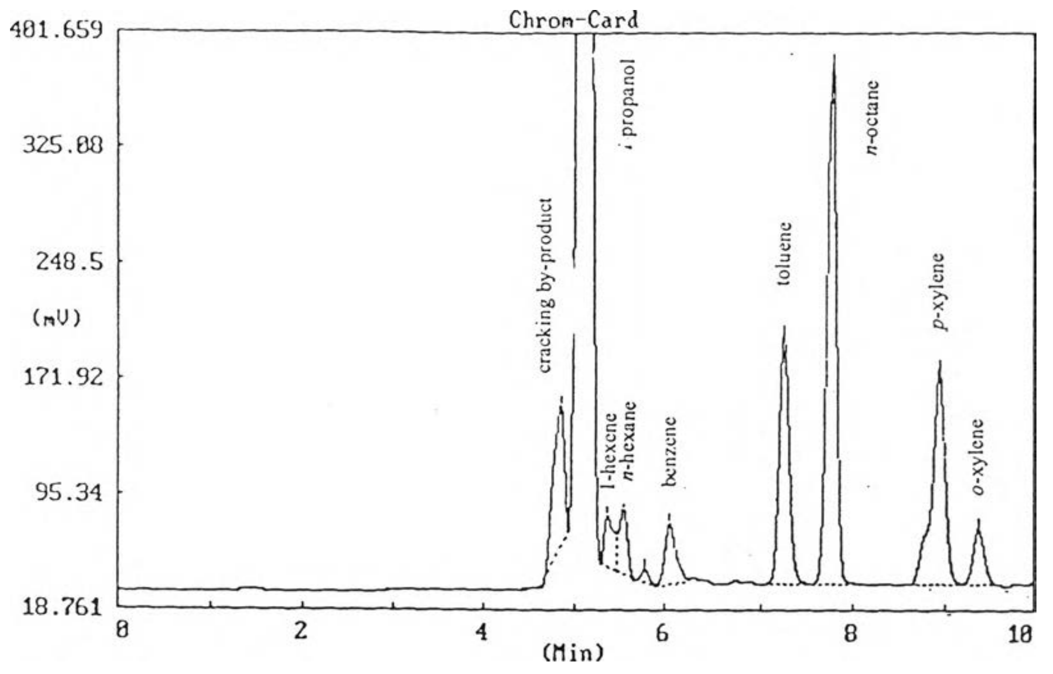

Figure A65 GC Chromatogram of products from using 2.0% Pd-ZSM-5 first regenerated catalyst, under 0.4 ml/min feeding rate and 400°C

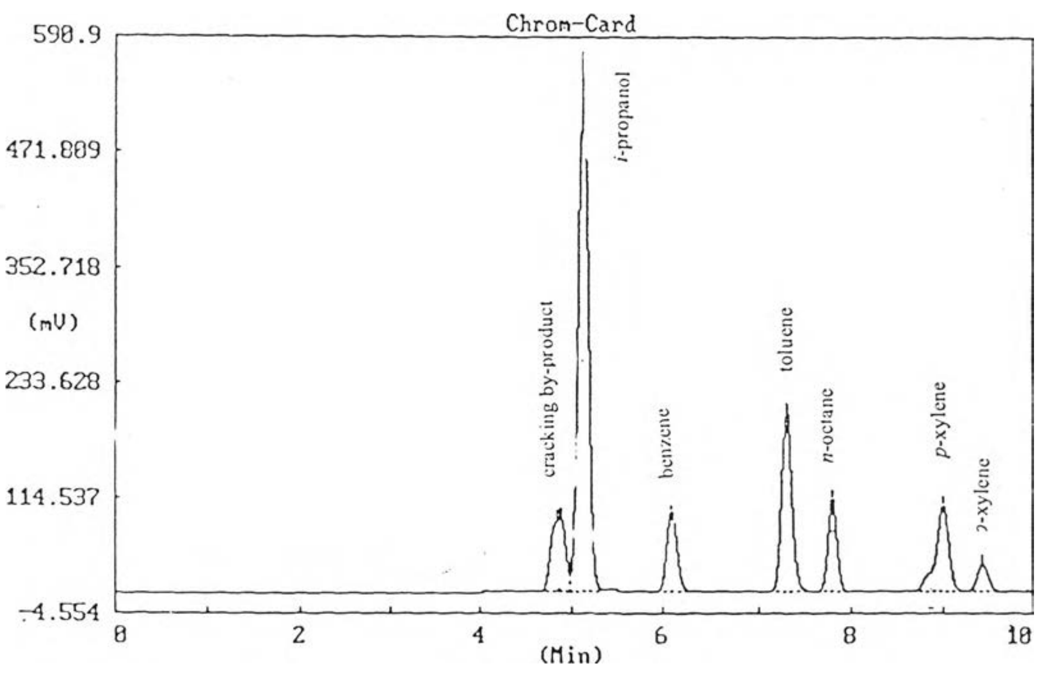

Figure A66 GC Chromatogram of products from using 2.0% Pd-ZSM-5 first regenerated catalyst, under 0.4 ml/min feeding rate and 450°C

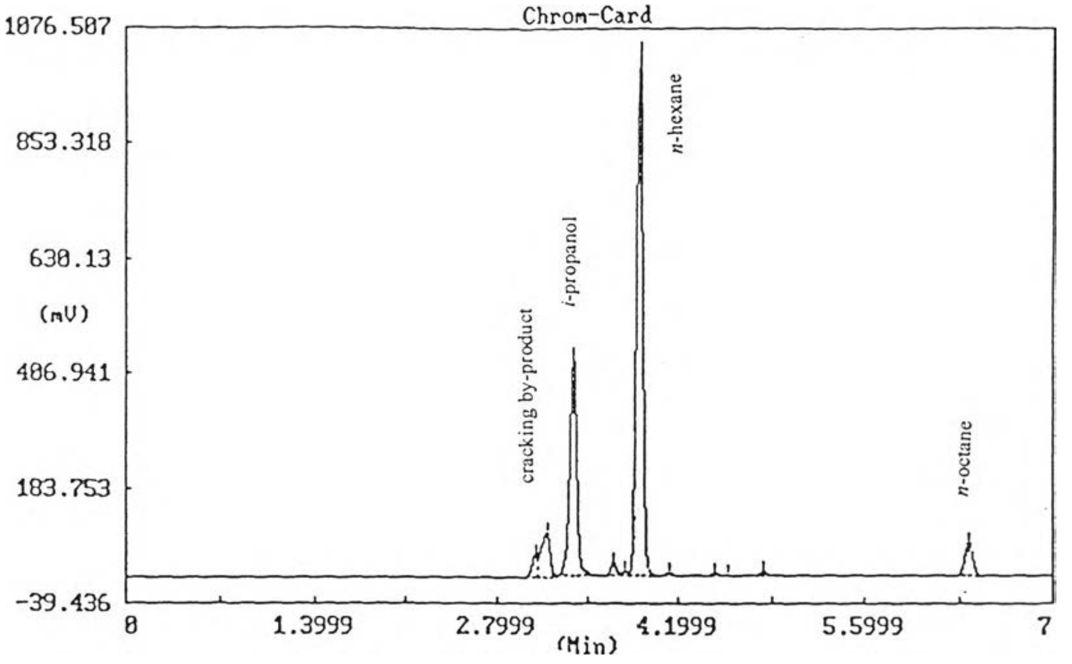

Figure A67 GC Chromatogram of products from using 2.0% Pd-ZSM-5 2^{nd} regenerated catalyst, under 0.4 ml/min feeding rate and 300°C

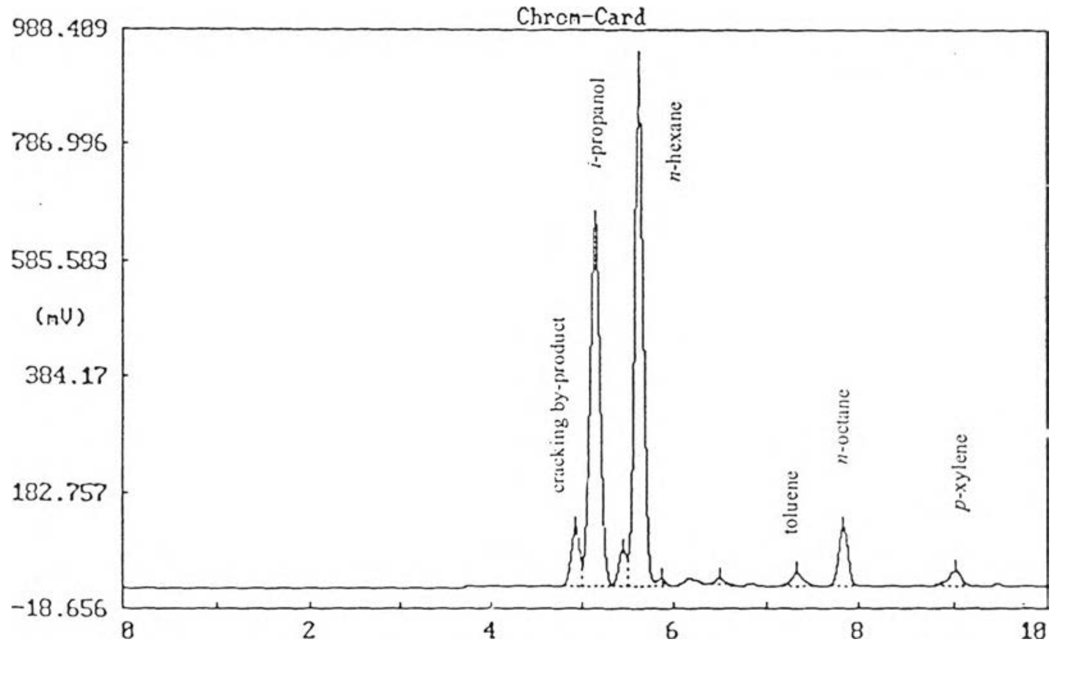

Figure A68 GC Chromatogram of products from using 2.0% Pd-ZSM-5 2^{nd} regenerated catalyst, under 0.4 ml/min feeding rate and 350°C

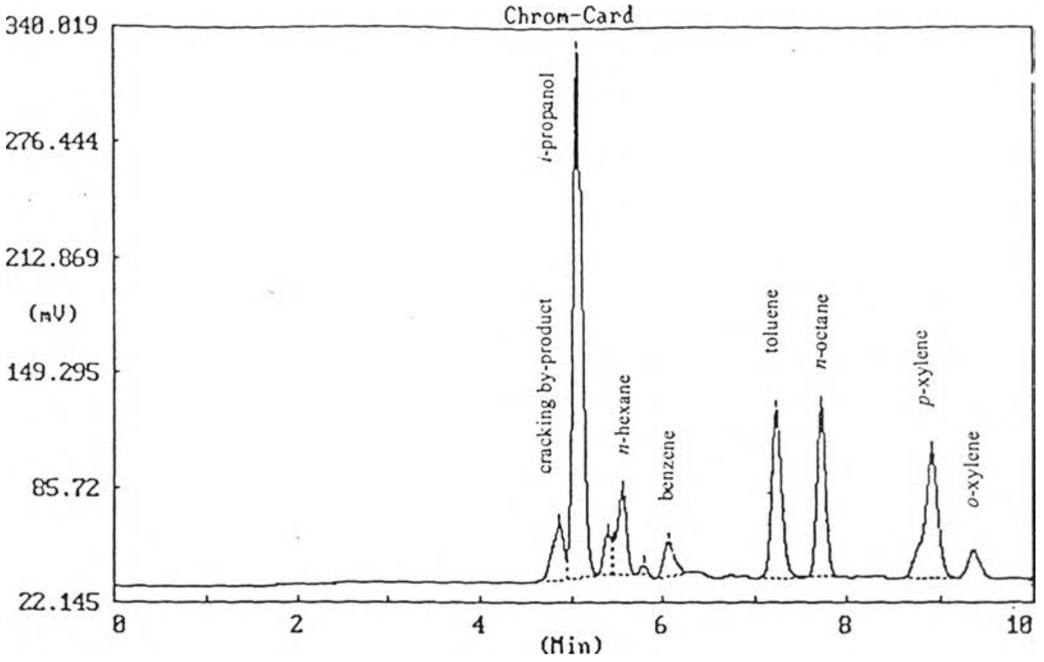

Figure A69 GC Chromatogram of products from using 2.0% Pd-ZSM-5 2nd regenerated catalyst, under 0.4 ml/min feeding rate and 400°C

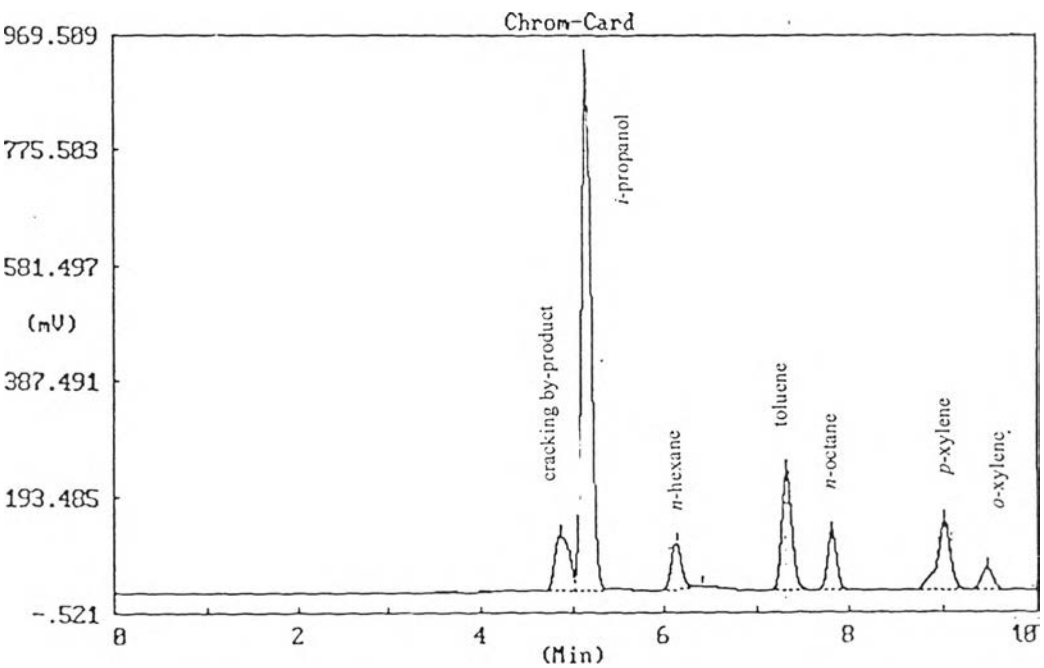

Figure A70 GC Chromatogram of products from using 2.0% Pd-ZSM-5 2nd regenerated catalyst, under 0.4 ml/min feeding rate and 450°C

Table B1 Results of test efficiency under 0.6%Pt-0.5%F/Al_2O_3 at 400°C

Number	Rate (ml/min feeding rate)	% Conversion
1	1.0	1.05
2	0.8	0.20
3	0.6	1.21
4	0.4	1.20
5	0.2	1.49

Table B2 Results of test efficiency under 0.6%Pt-0.5%F/Al_2O_3 at 450°C

Number	Rate (ml/min feeding rate)	% Conversion
6	1.0	3.55
7	0.8	3.50
8	0.6	2.09
9	0.4	5.67
10	0.2	6.89

Table B3 Results of test efficiency under 8% Zn/ZSM-5 at 400°C

Number	Rate (ml/min feeding rate)	% Conversion
11	1.0	2.64
12	0.8	1.52
13	0.6	3.30
14	0.4	3.25
15	0.2	7.12

Table B4 Results of test efficiency under 8% Zn/ZSM-5 at 450°C

Number	Rate (ml/min feeding rate)	% Conversion
16	1.0	2.47
17	0.8	3.26
18	0.6	4.50
19	0.4	4.20
20	0.2	6.31

Table B5 Results of test efficiency of 2.0% Pd/ZSM-5 at 200°C

Number	Rate (ml/min feeding rate)	% Conversion	% Aromatic
21	1.0	0.00	0
22	0.8	0.00	0
23	0.6	0.24	0
24	0.4	0.80	0
25	0.2	0.72	0

Table B6 Results of test efficiency of 2.0% Pd/ZSM-5 at 250°C

Number	Rate (ml/min feeding rate)	% Conversion	% Aromatic
26	1.0	0.00	0
27	0.8	0.00	0
28	0.6	0.00	0
29	0.4	0.25	0
30	0.2	1.20	0

Table B7 Results of test efficiency of 2.0% Pd/ZSM-5 at 300°C

Number	Rate (ml/min feeding rate)	% Conversion	% Aromatic
31	1.0	16.91	0
32	0.8	20.01	0
33	0.6	21.27	0
34	0.4	25.94	0
35	0.2	29.78	0

Table B8 Results of test efficiency of 2.0% Pd/ZSM-5 at 350°C

Number	Rate (ml/min feeding rate)	% Conversion	% Aromatic
36	1.0	22.01	0
37	0.8	26.89	2.20
38	0.6	40.44	2.24
39	0.4	49.11	4.98
40	0.2	66.50	8.64

Table B9 Results of test efficiency of 2.0% Pd/ZSM-5 at 400°C

Number	Rate (ml/min feeding rate)	% Conversion	% Aromatic
41	1.0	100.00	54.31
42	0.8	99.20	60.22
43	0.6	100.00	63.81
44	0.4	100.00	75.90
45	0.2	100.00	76.20

Table B10 Results of test efficiency of 2.0% Pd/ZSM-5 at 450°C

Number	Rate (ml/min feeding rate)	% Conversion	% Aromatic
46	1.0	82.24	32.51
47	0.8	100	56.74
48	0.6	100	58.42
49	0.4	100	64.30
50	0.2	100	66.51

Table B11 Results of test efficiency of 0.5% Pd/ZSM-5 at 0.4 ml/min feeding rate

Number	Temperature(°C)	% Conversion	% Aromatic
51	300	30.55	0
52	350	46.90	0
53	400	48.02	4.05
54	450	66.38	8.91

Table B12 Results of test efficiency of 1.0% Pd/ZSM-5 at 0.4 ml/min feeding rate

Number	Temperature(°C)	% Conversion	% Aromatic
55	300	32.02	0.00
56	350	48.11	2.14
57	400	49.25	10.51
58	450	68.12	11.84

Table B13 Results of test efficiency of 2.0% Pd/ZSM-5 at 0.4 ml/min feeding rate (the first for reproducibility)

Number	Temperature(°C)	% Conversion	% Aromatic
34	300	25.94	0.00
39	350	49.11	2.24
44	400	100.00	75.90
49	450	100.00	64.30

Table B14 Results of test efficiency of 2.0% Pd/ZSM-5 at 0.4 ml/min feeding rate (the second for reproducibility)

Number	Temperature(°C)	% Conversion	% Aromatic
59	300	28.21	0.00
60	350	48.22	2.14
61	400	100.00	73.51
62	450	100.00	65.32

Table B15 The results of test efficiency of 2.0% Pd/ZSM-5 at 0.4 ml/min feeding rate (The first regenerated catalyst for regeneration test)

Number	Temperature(°C)	%Conversion	%Aromatic
63	300	20.51	0.00
64	350	43.23	1.08
65	400	96.59	70.95
66	450	100.00	60.51

Table B16 The results of test efficiency of 2.0% Pd/ZSM-5 at 0.4 ml/min feeding rate (The second regenerated catalyst for regeneration test)

Number	Temperature(°C)	%Conversion	%Aromatic
67	300	18.22	0.00
68	350	44.21	0.82
69	400	90.15	65.88
70	450	100.00	58.92

Table B16 The results of continuous aromatization from optimum condition at 400°C under 0.4 ml/min feeding rate over 2%Pd/ZSM-5

Feeding Rate (ml/min)	% Conversion	% Aromatic	% Benzene	% Toluene	% *m*-Xylene	% *p*-Xylene	% *o*-Xylene
1.0	100	54.31	6.45	24.86	0.00	17.66	5.33
0.8	99.2	60.22	6.99	25.68	2.73	18.88	5.94
0.6	100	63.81	7.87	28.44	2.74	18.89	5.86
0.4	100	75.90	8.04	32.11	4.02	24.24	7.46
0.2	100	76.20	10.24	31.89	0.00	25.41	8.66

VITA

Mr. Pharkpoom Khamnuansiri was born on January 9, 1976, in Phetburi, Thailand. He received his Bachelor of Science degree in Chemistry, Chulalongkorn University, in 1998. Since 1998, he has been a graduate student under the Program of Petrochemistry and Polymer Science, Faculty of Science, at Chulalongkorn University, and completed his Master of Science degree in 2001.