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APPENDIX

Table A1 Physical properties of lubricating base oils from various sources

| Properties | Test Method | England | Taiwan | Singapore |
|-----------------------------|-------------|----------|------------|-----------|
| Color,ASTM | ASTM D 1500 | max. 1.5 | max. 1.5 | max. 1.5 |
| Pour point (°C) | ASTM D 97 | max. -9 | max. -12.2 | max. -9 |
| Viscosity @ 40°C, cSt | ASTM D 445 | report | 31.9-34.1 | report |
| @ 100°C, cSt | | 4.4-5.4 | report | 4.4-5.4 |
| Viscosity index | ASTM D 2270 | min. 100 | min. 95 | min. 95 |
| Sulfur contents, %wt | ASTM D 129 | - | - | 0.2-0.8 |
| Oxidation point (°C) | TGA method | - | - | 300 |
| Oxidative compounds, %wt | | - | - | 16.67 |

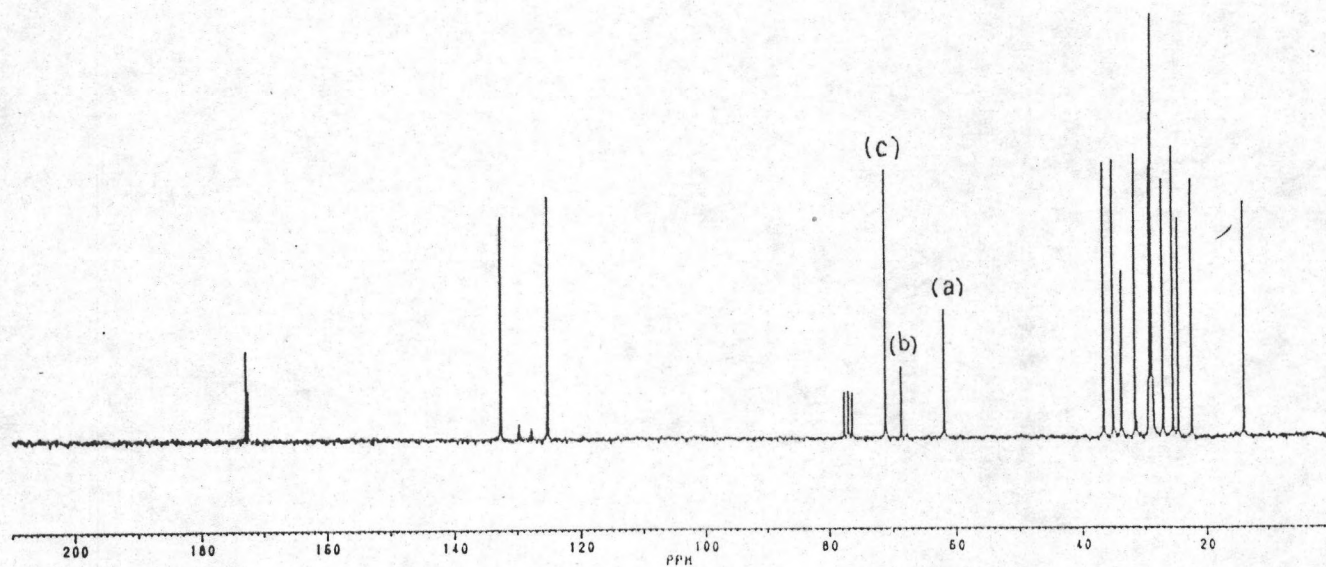
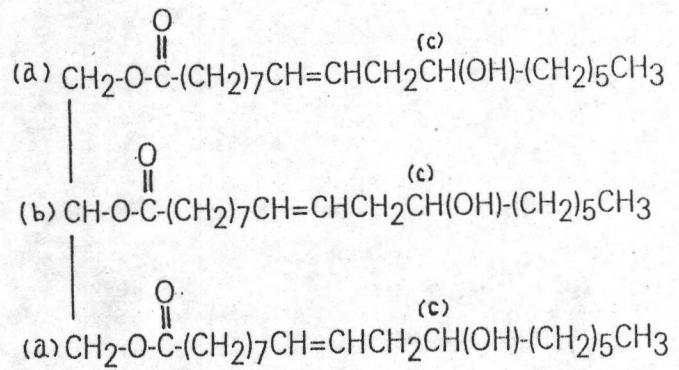


Figure A1 ^{13}C NMR (CDCl_3) spectrum of castor oil

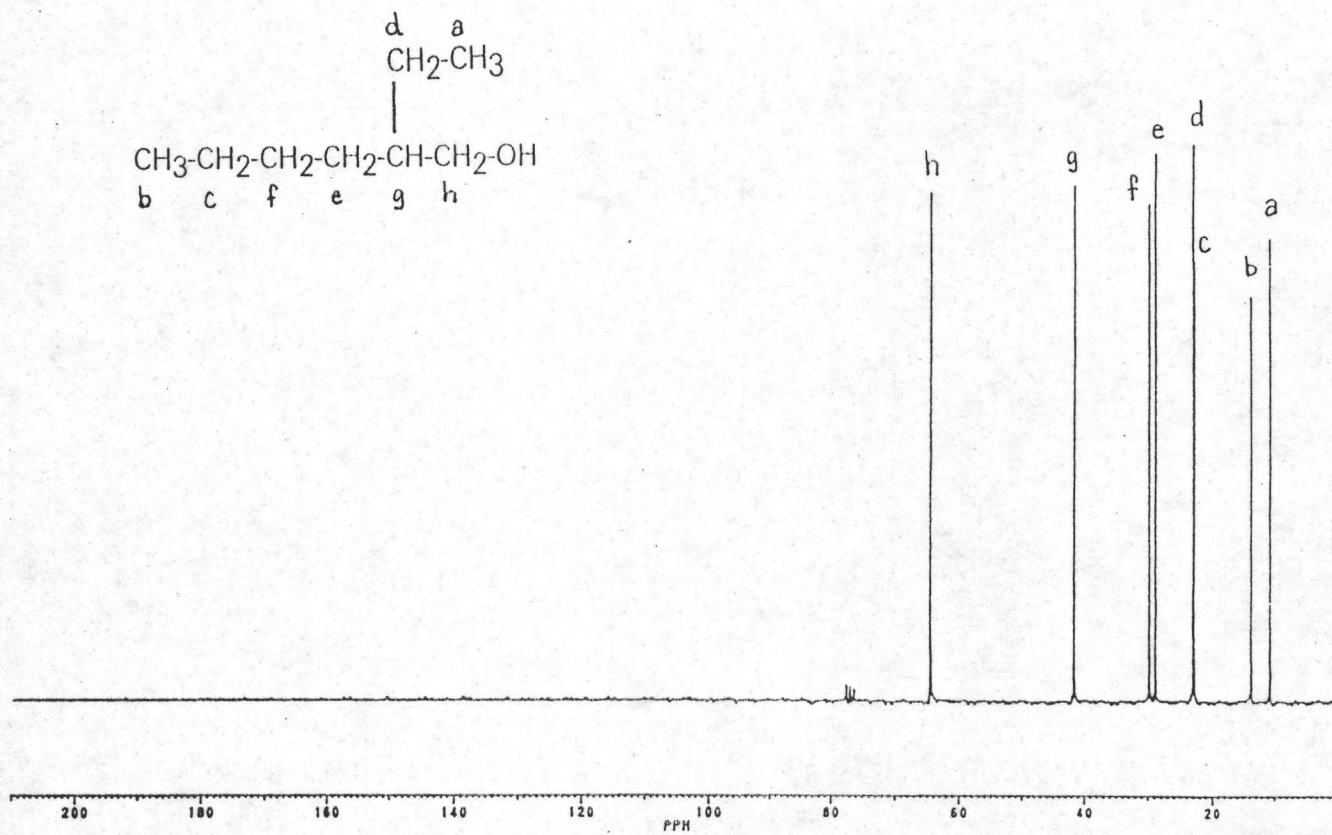


Figure A2 ^{13}C NMR (CDCl_3) spectrum of 2-ethylhexanol

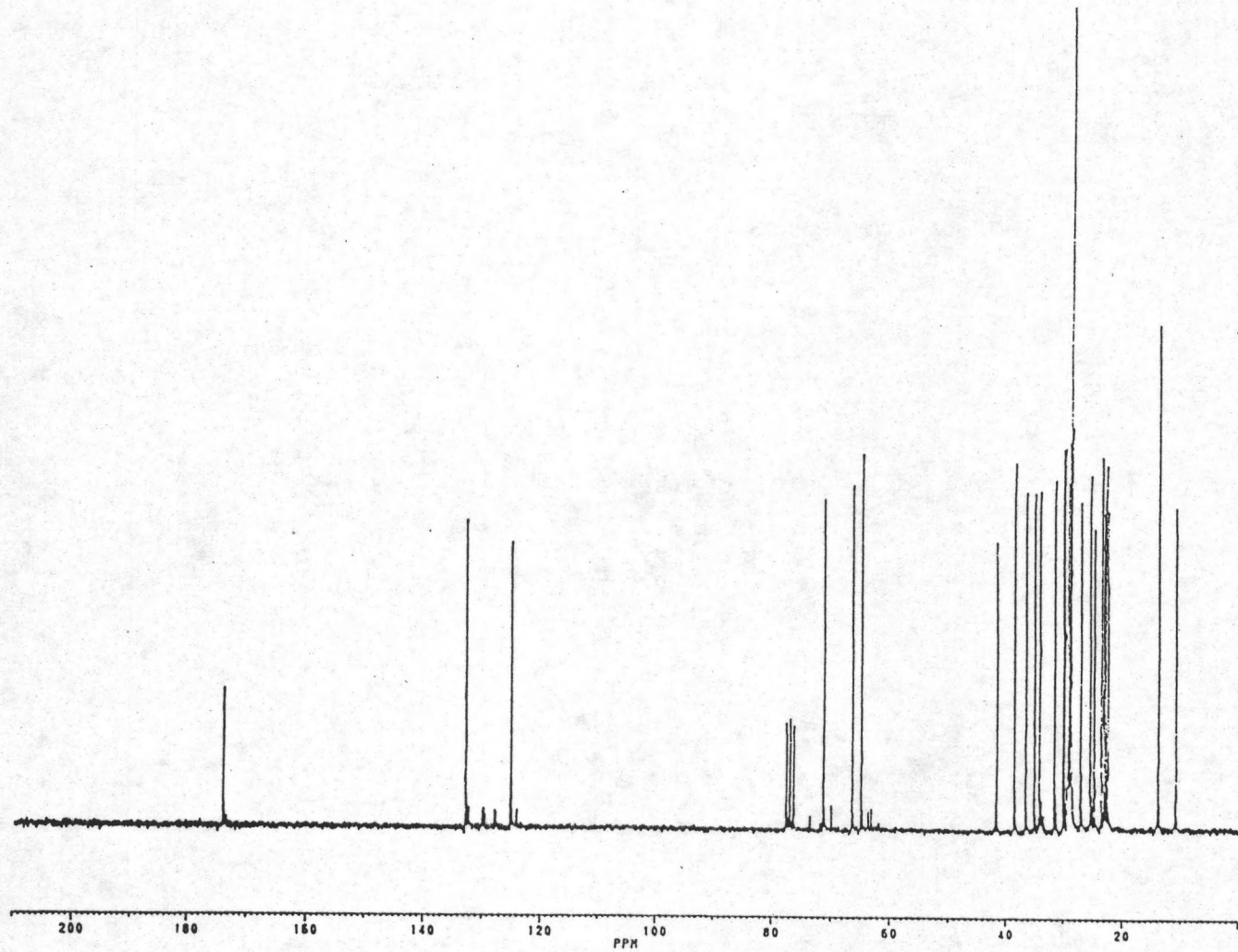


Figure A3 ^{13}C NMR (CDCl_3) spectrum of monoester obtained at 60°C , 3 hrs

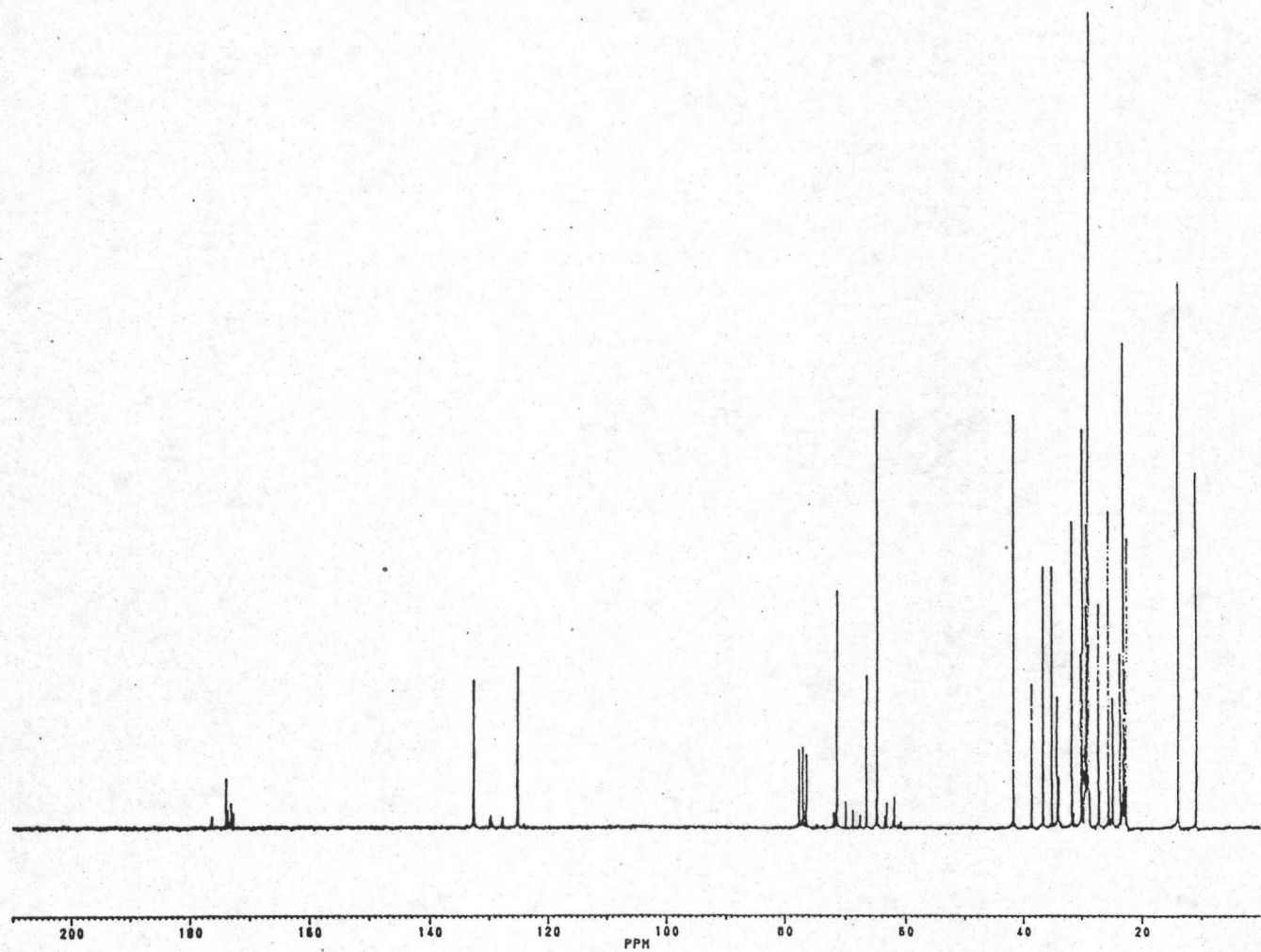


Figure A4 ^{13}C NMR (CDCl_3) spectrum of monoester obtained at 60°C , 6 hrs

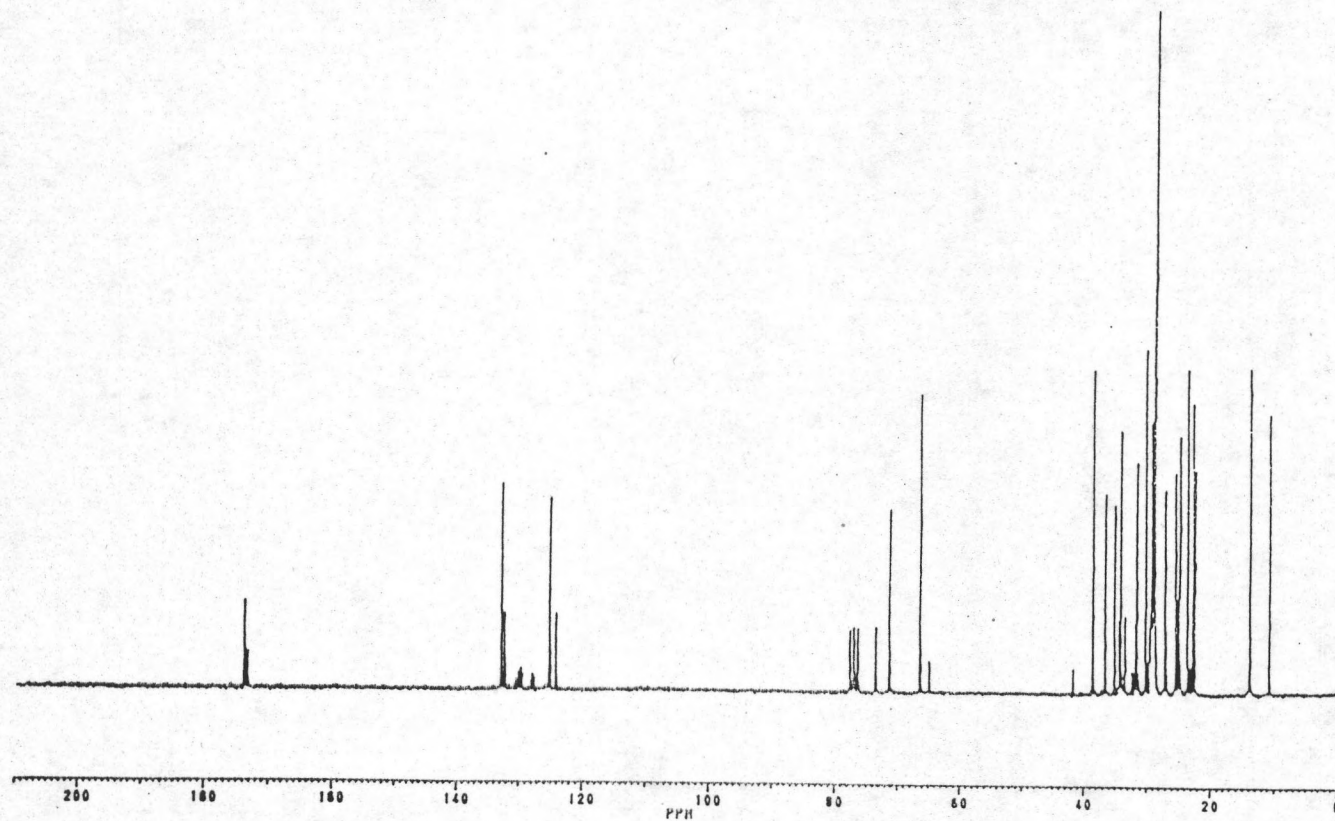


Figure A6 ^{13}C NMR (CDCl_3) spectrum of monoester obtained at 80°C , 6 hrs

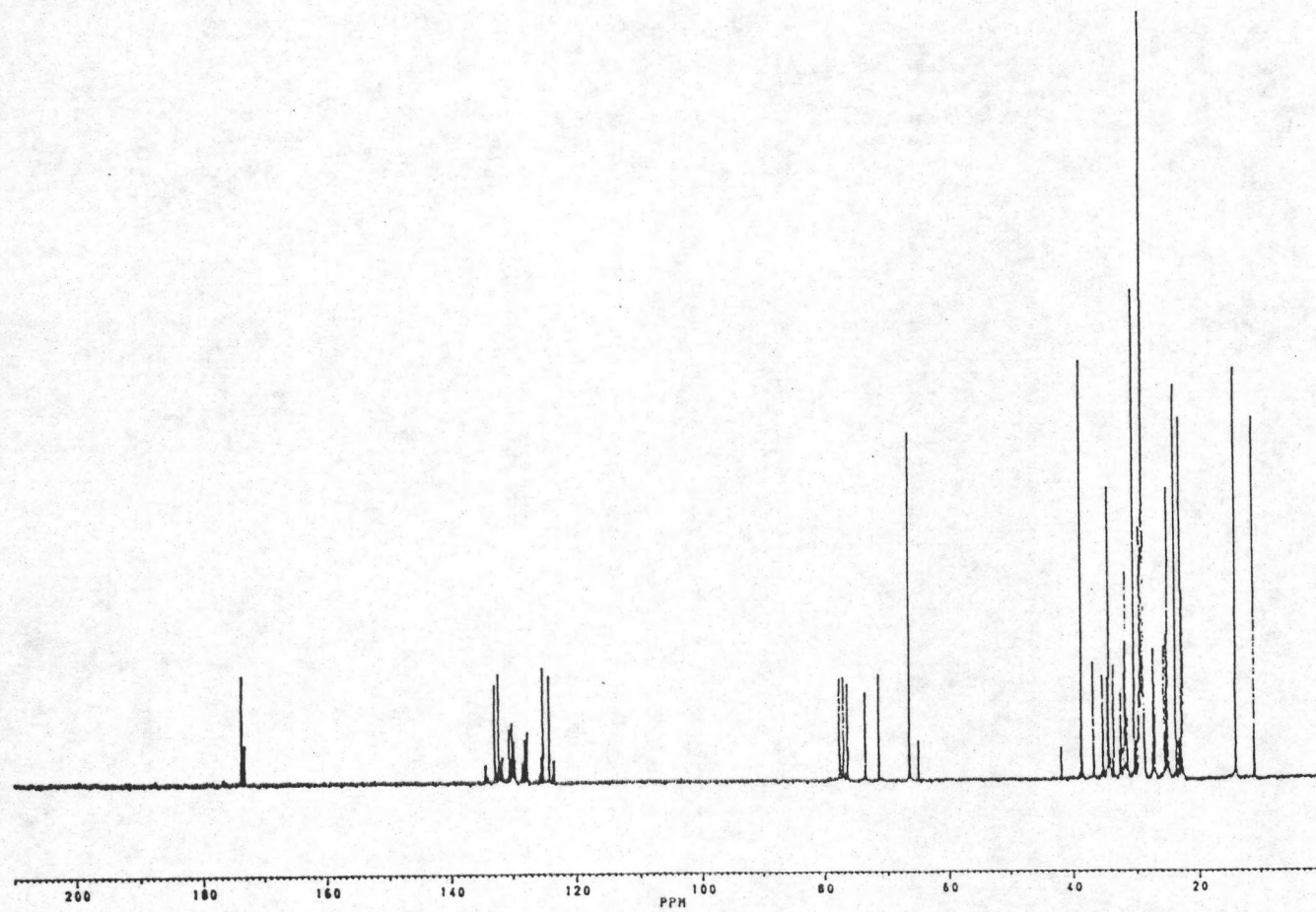


Figure A7 ^{13}C NMR (CDCl_3) spectrum of monoester obtained at 100°C , 3 hrs

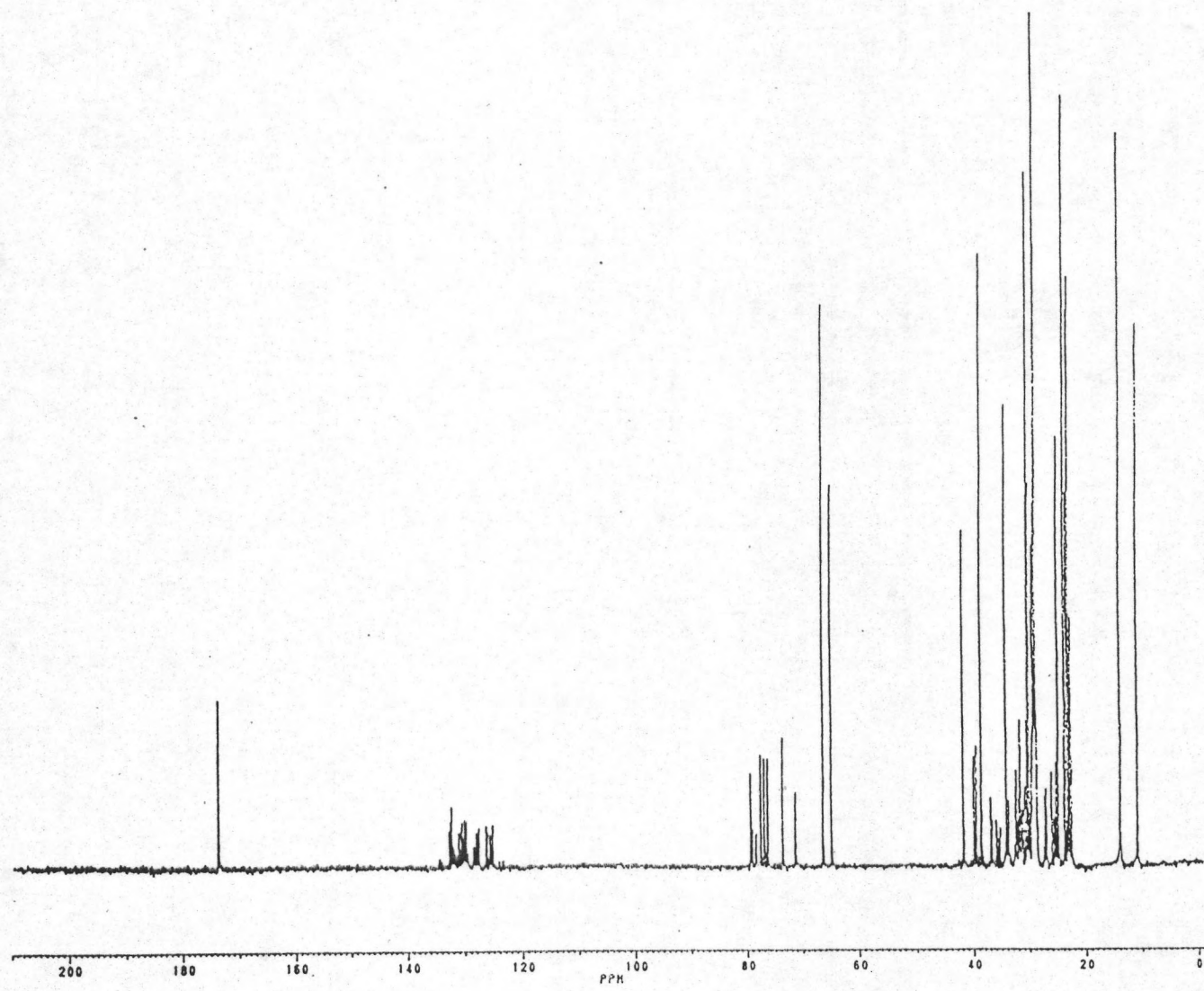


Figure A8 ^{13}C NMR (CDCl_3) spectrum of monoester obtained at 100°C , 6 hrs

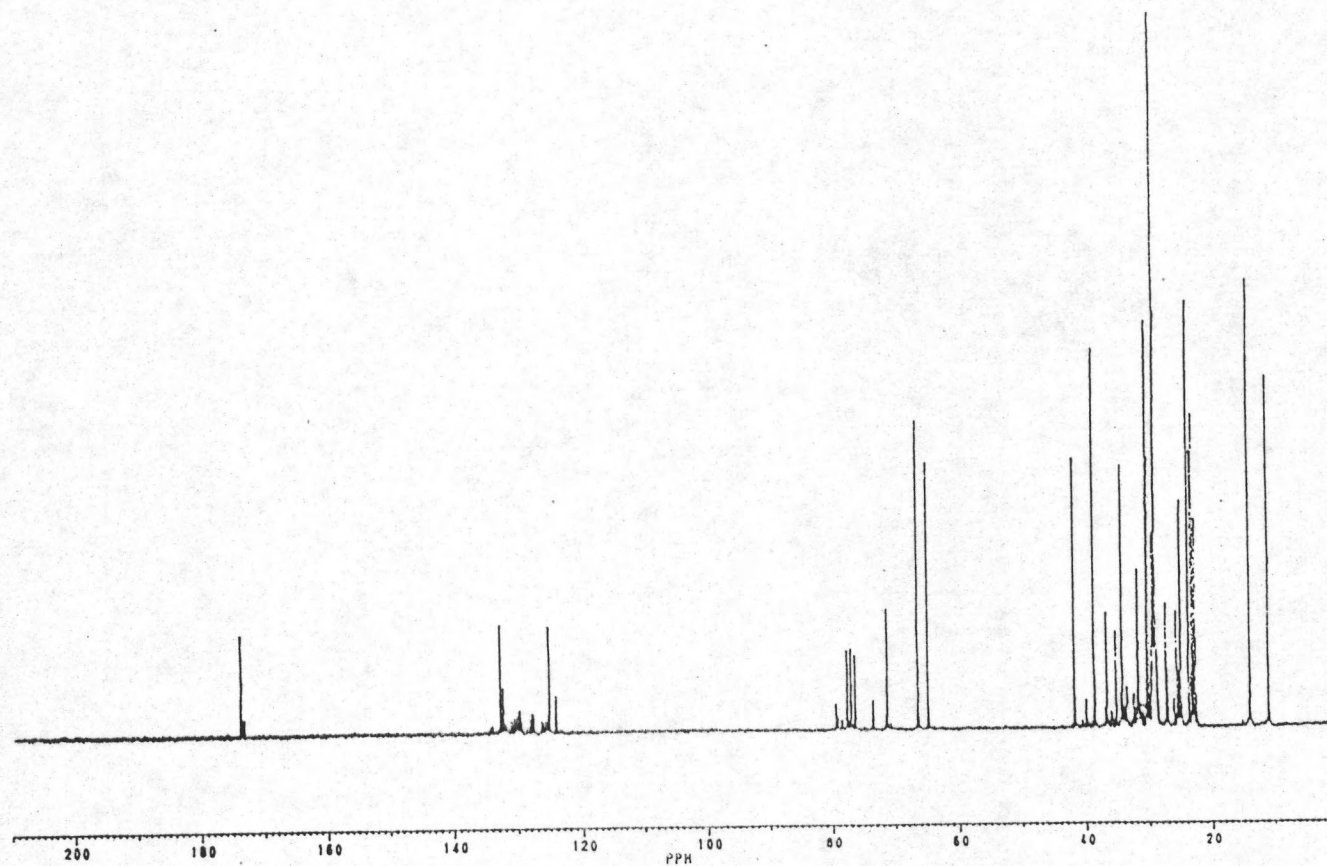


Figure A9 ^{13}C NMR (CDCl_3) spectrum of monoester obtained at 130°C , 3 hrs

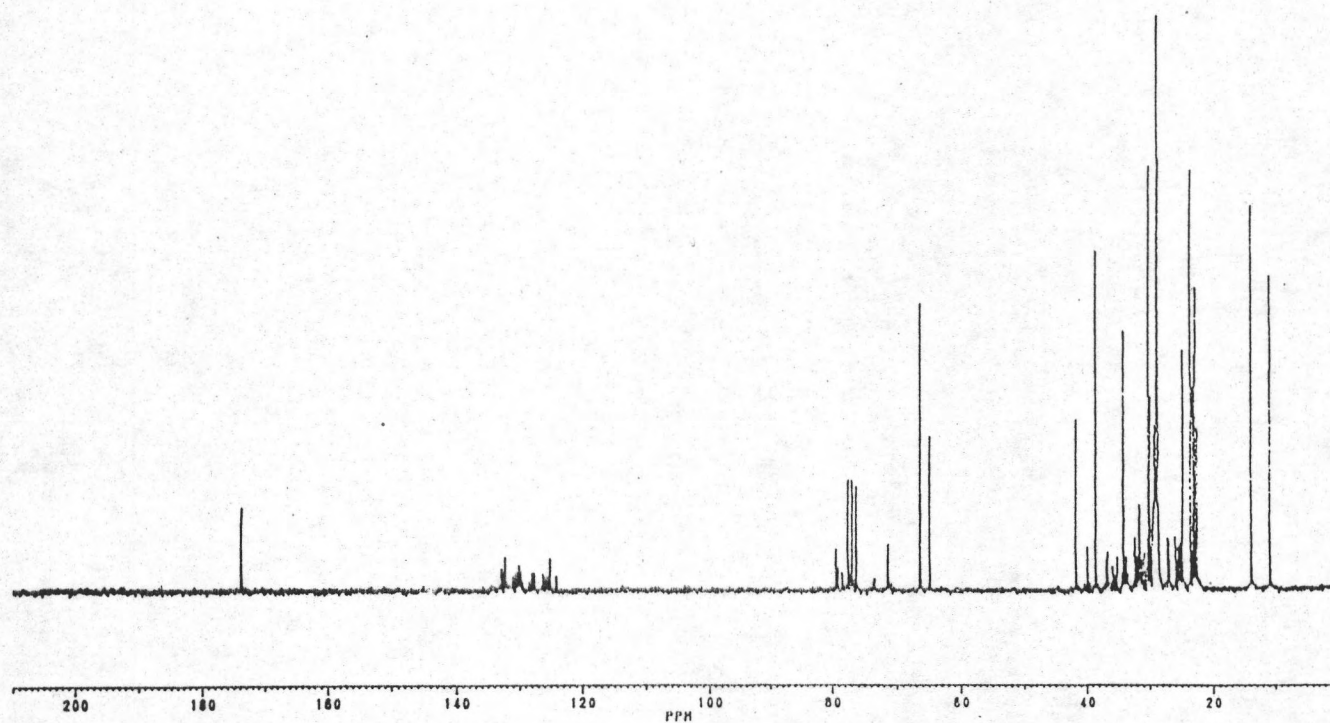


Figure A10 ^{13}C NMR (CDCl_3) spectrum of monoester obtained at 130°C , 6 hrs

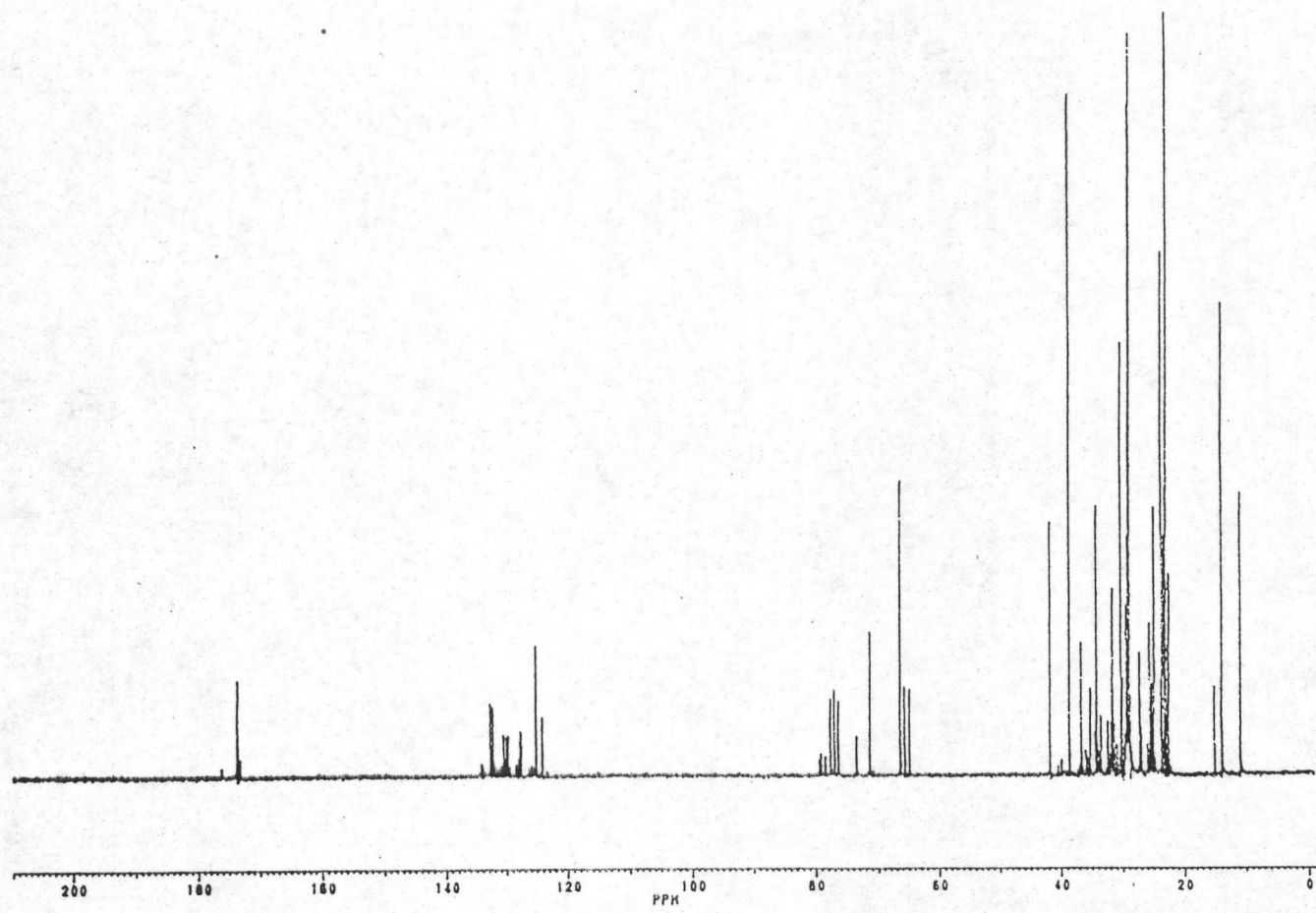


Figure A11 ^{13}C NMR (CDCl_3) spectrum of monoester obtained at 160°C , 3 hrs

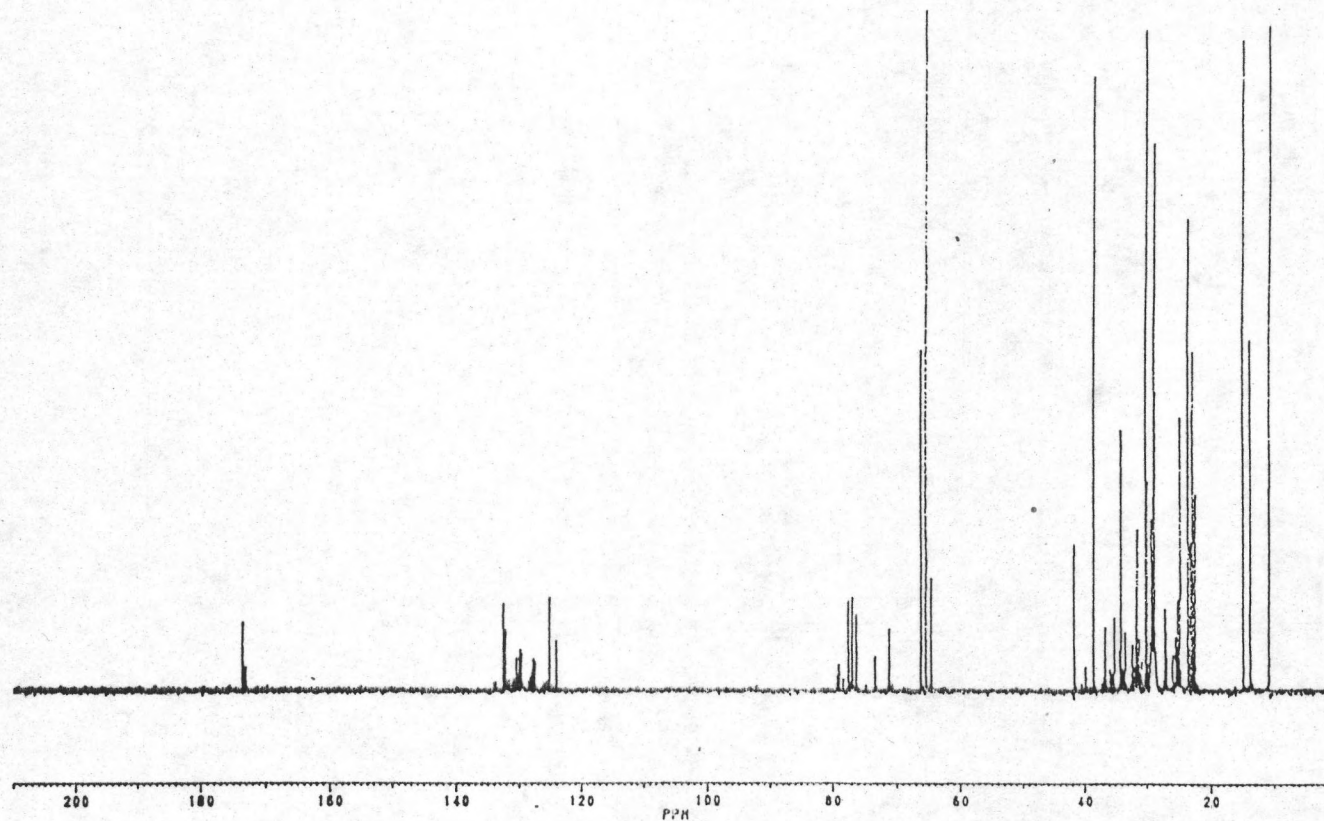


Figure A12 ^{13}C NMR (CDCl_3) spectrum of monoester obtained at 160°C , 6 hrs

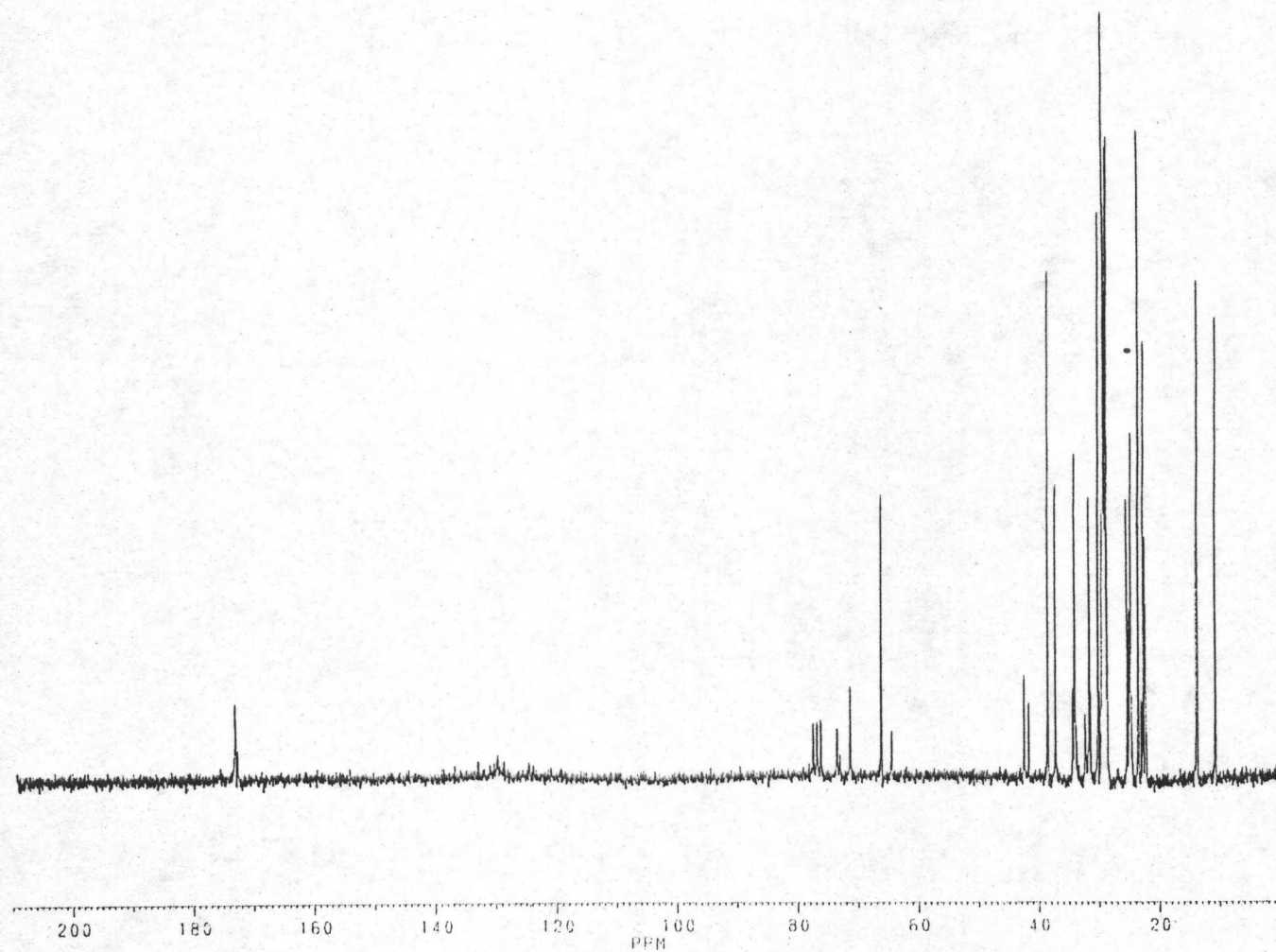


Figure A13 ^{13}C NMR (CDCl_3) spectrum of hydrogenated oil obtained at 3 hrs.,
 100°C , 100 psi, catalyst concentration 3%

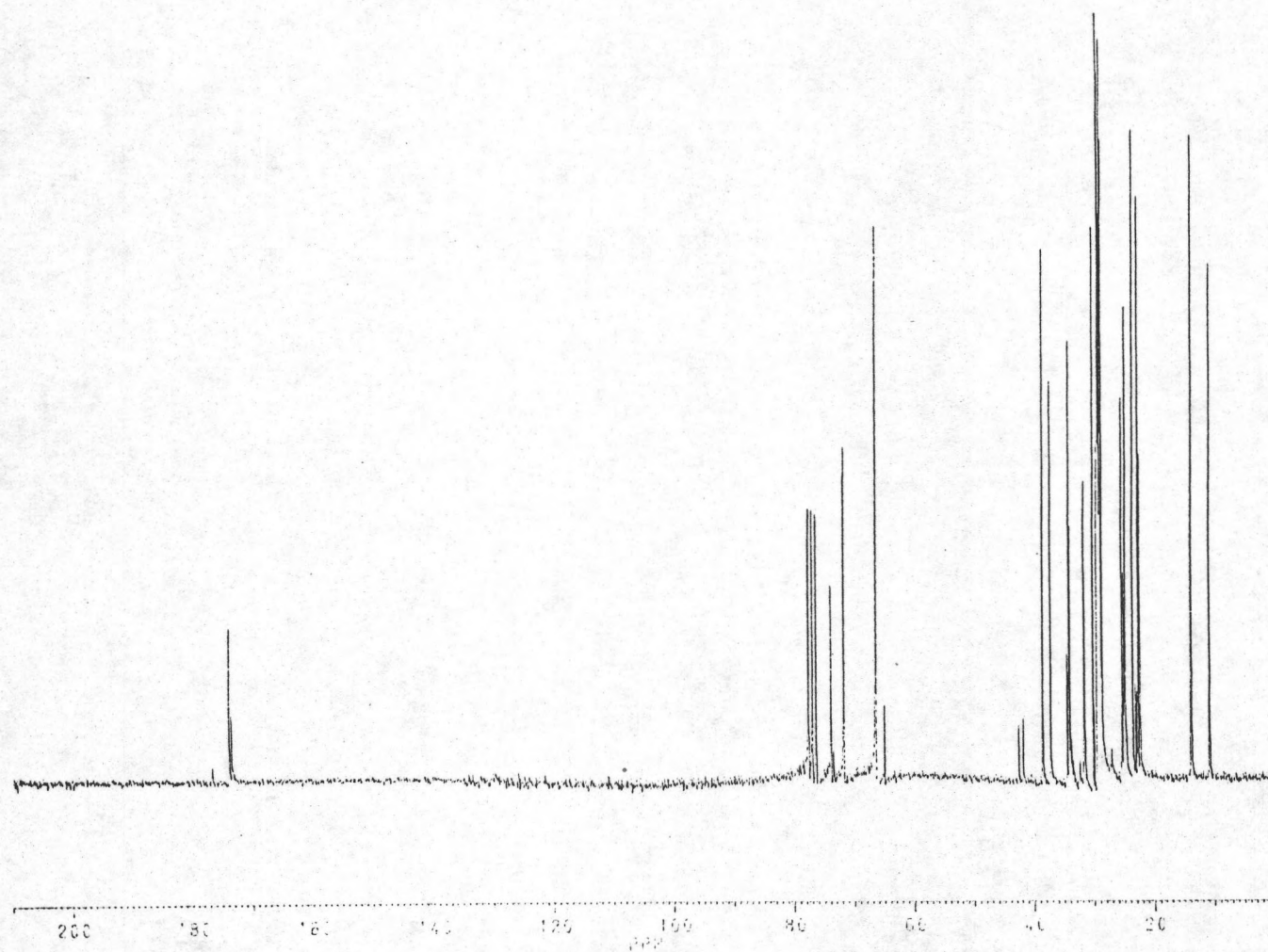


Figure A14 ^{13}C NMR (CDCl_3) spectrum of hydrogenated oil obtained at 3 hrs.,
 100°C , 300 psi, catalyst concentration 3%

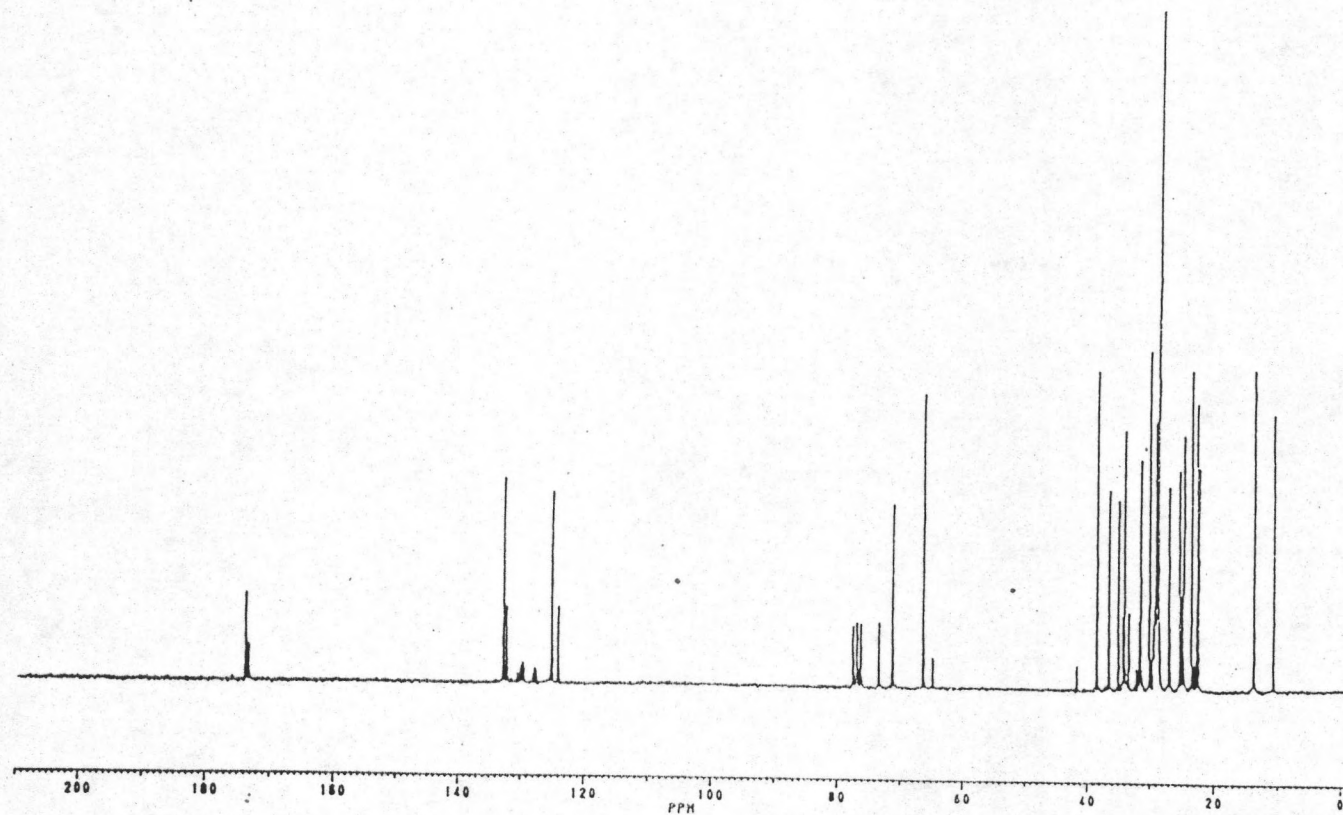


Figure A15 ^{13}C NMR (CDCl_3) spectrum of hydrogenated oil obtained at 3 hrs.,
 100°C , 100 psi, catalyst concentration 1%

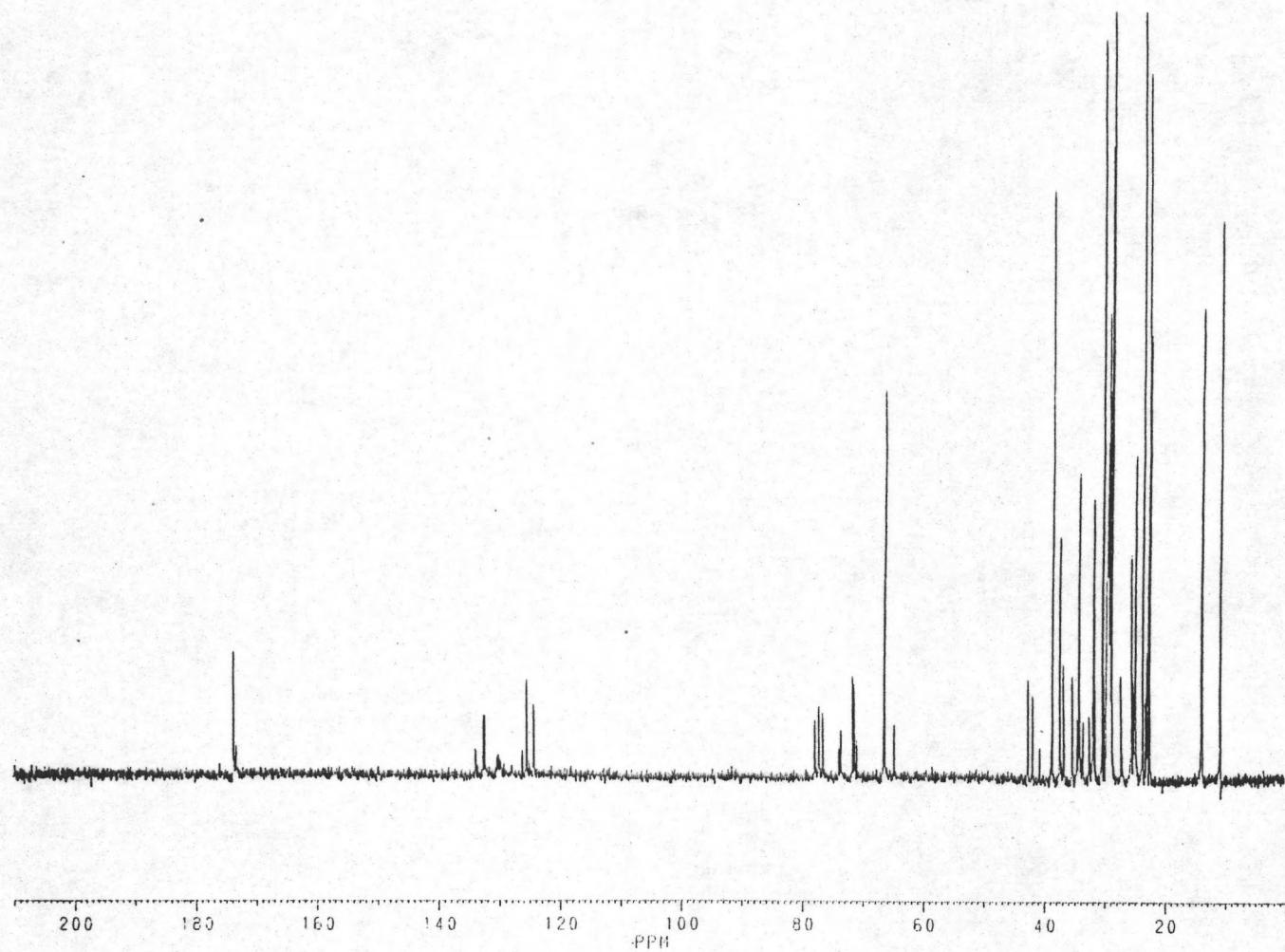


Figure A16 ^{13}C NMR (CDCl_3) spectrum of hydrogenated oil obtained at 3 hrs.,
100°C, 100 psi, catalyst concentration 2%

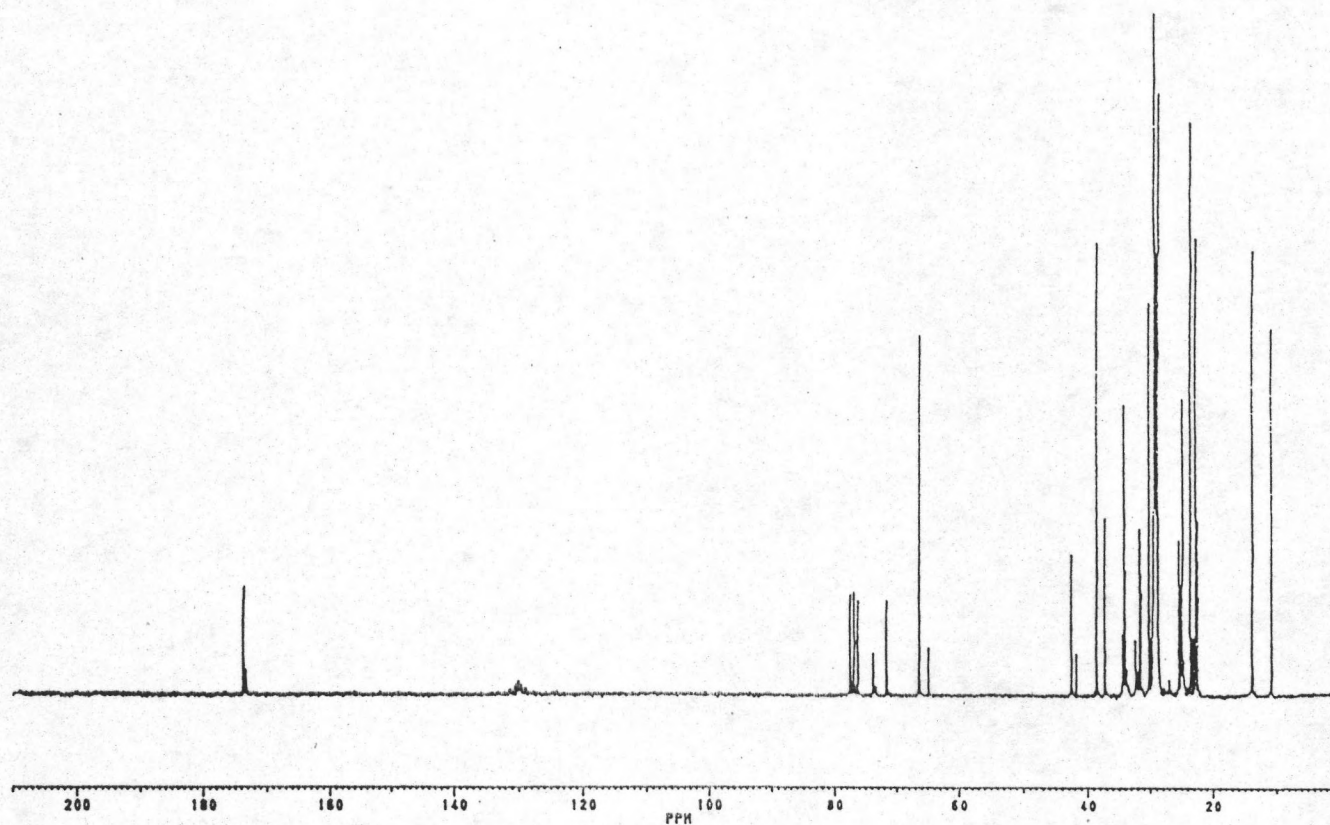


Figure A17 ^{13}C NMR (CDCl_3) spectrum of hydrogenated oil obtained at 3 hrs.,
100°C, 100 psi, catalyst concentration 4%

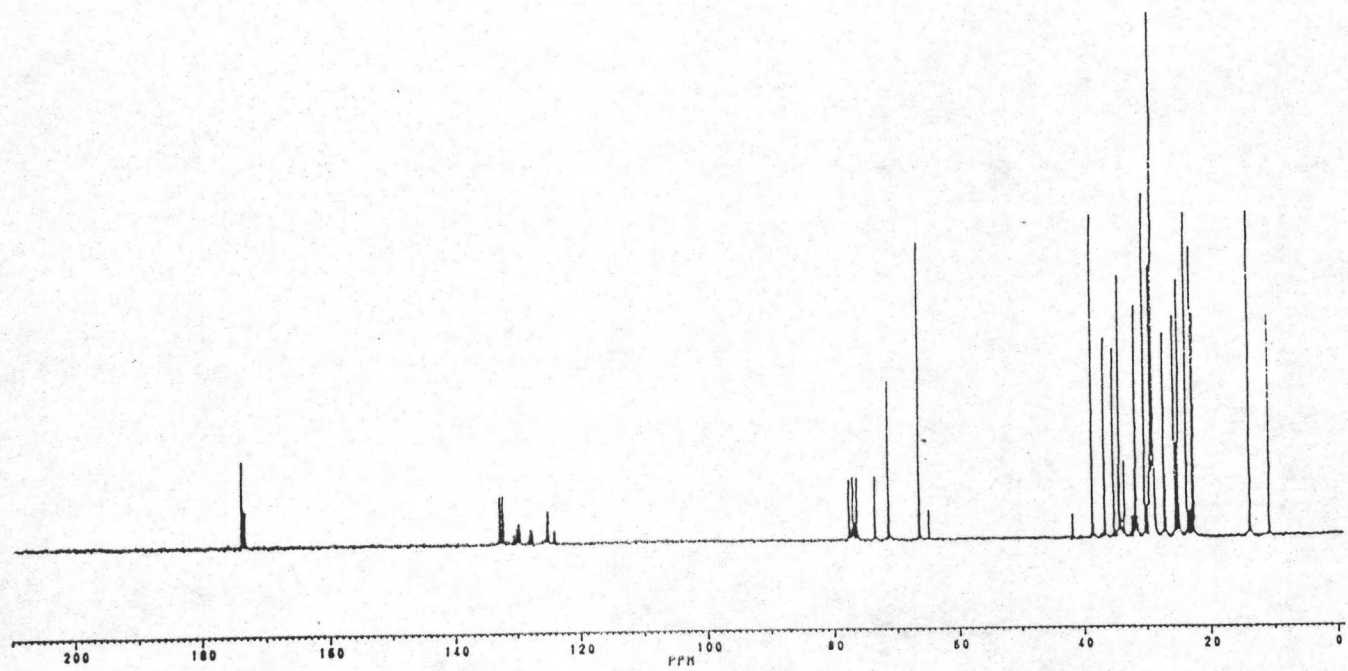


Figure A18 ^{13}C NMR (CDCl_3) spectrum of hydrogenated oil obtained at 2 hrs.,
100°C, 100 psi, catalyst concentration 4%

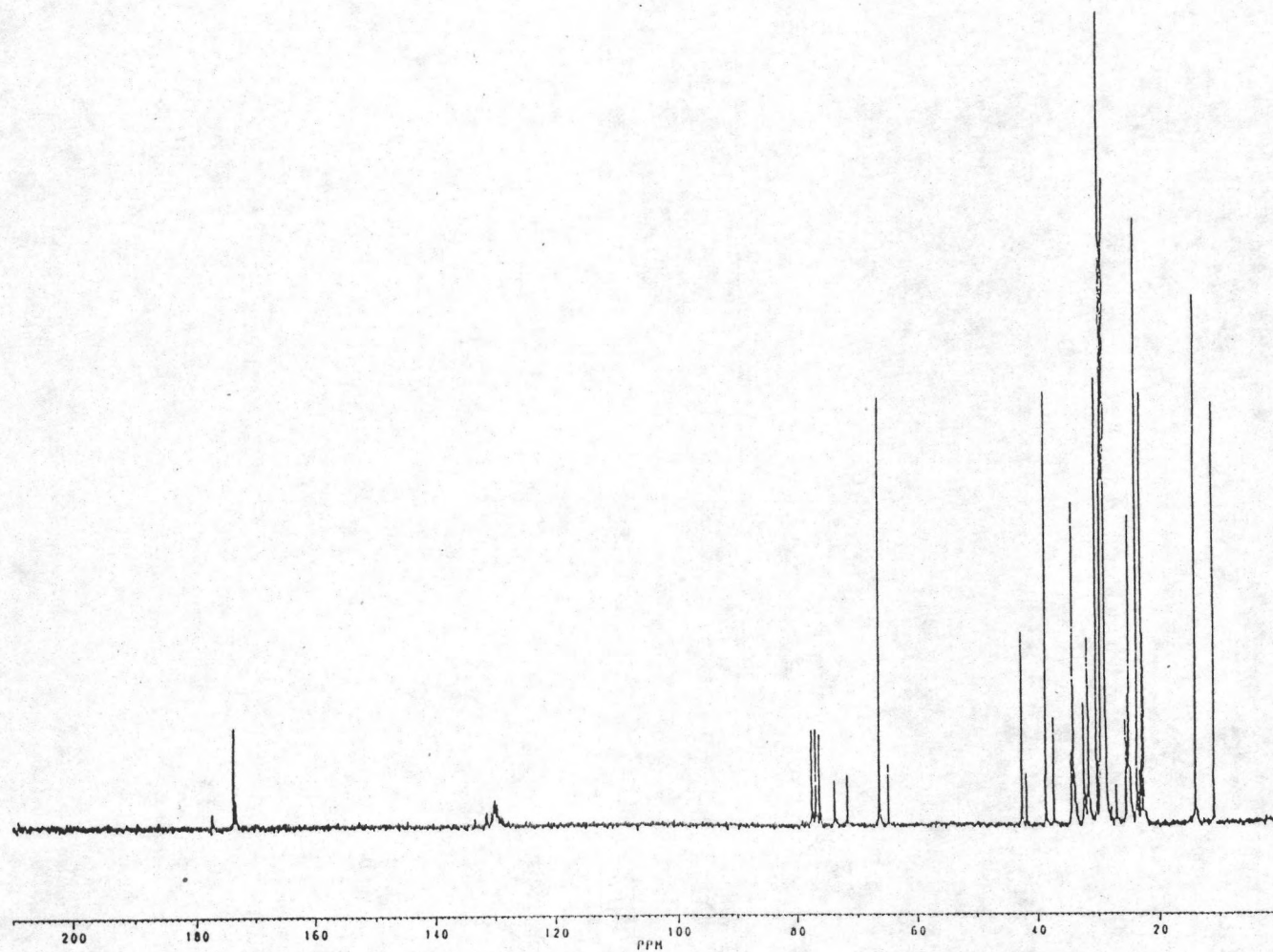


Figure A19 ^{13}C NMR (CDCl_3) spectrum of hydrogenated oil obtained at 4 hrs.,
100°C, 100 psi, catalyst concentration 4%

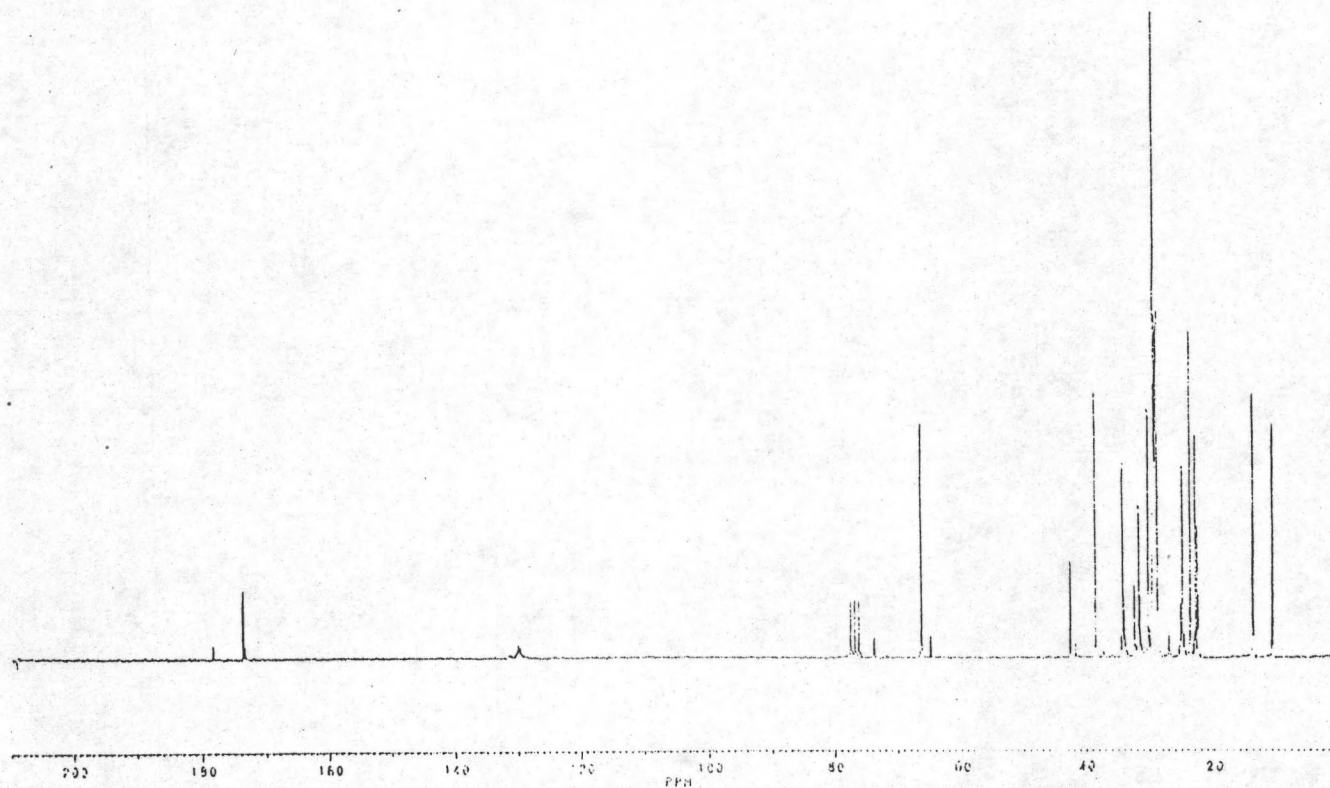


Figure A20 ^{13}C NMR (CDCl_3) spectrum of hydrogenated oil obtained at 5 hrs.,
100°C, 100 psi, catalyst concentration 4%

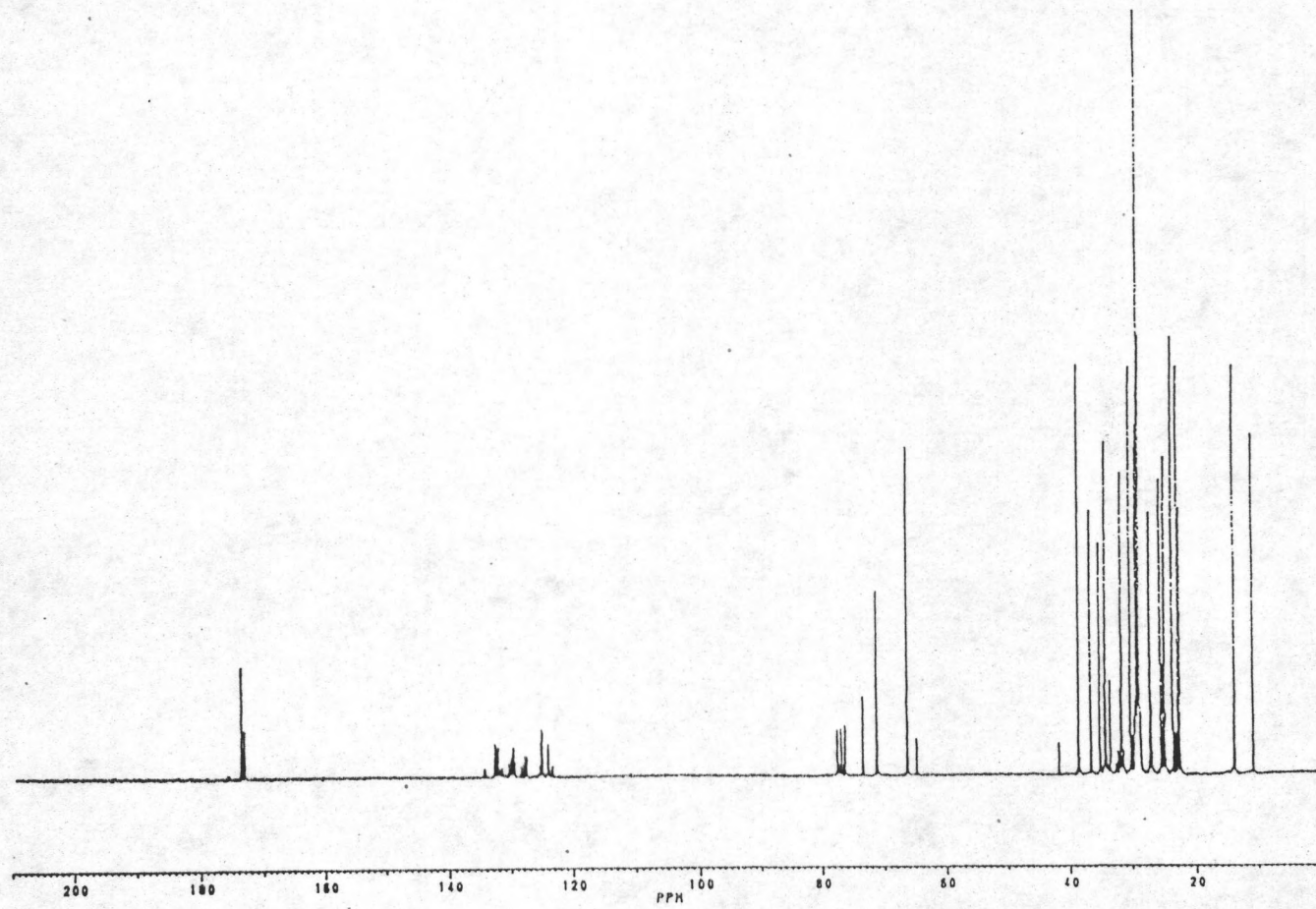


Figure A21 ^{13}C NMR (CDCl_3) spectrum of hydrogenated oil obtained at 3 hrs.,
80°C, 100 psi, catalyst concentration 4%

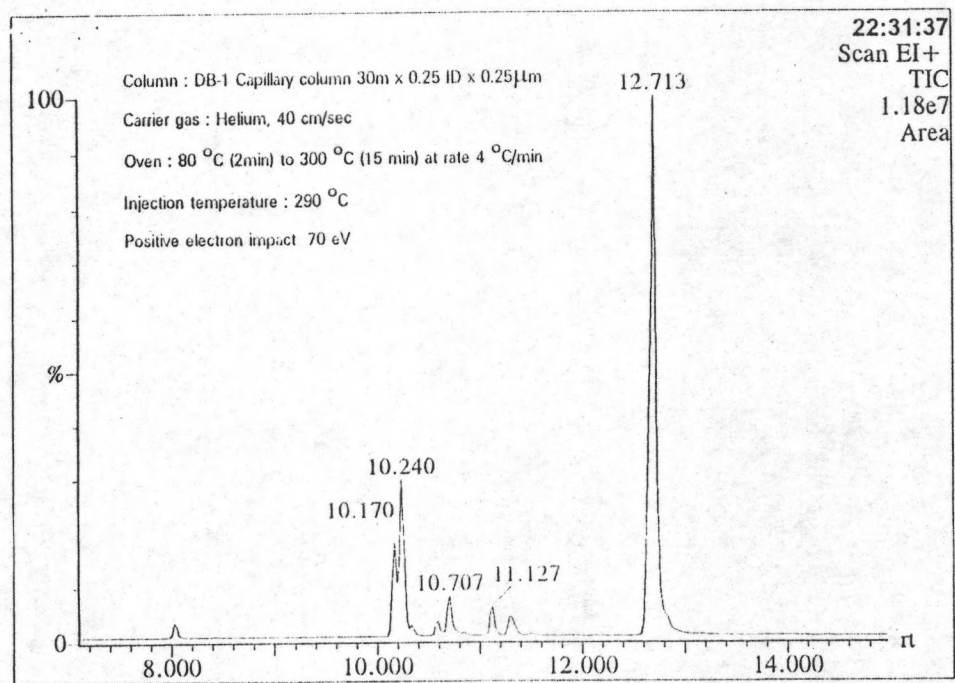


Figure A22 Total ions chromatogram of monoester product

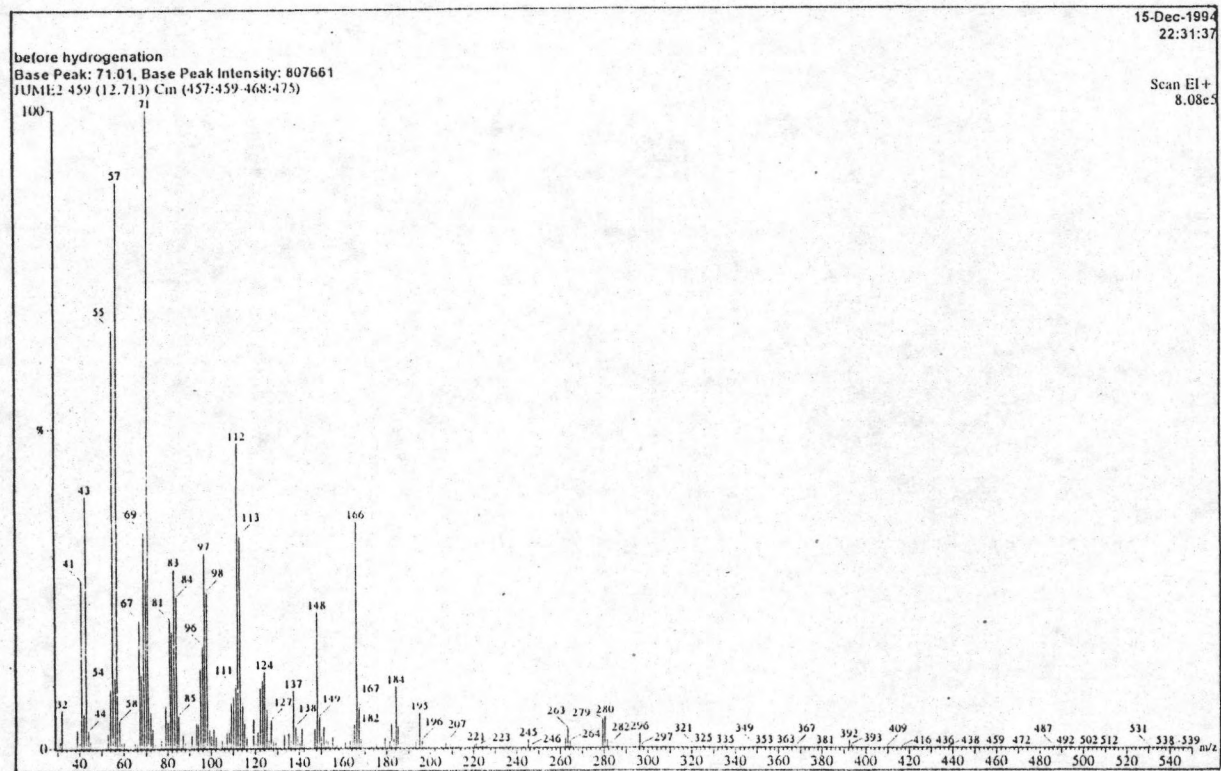


Figure A23 Mass spectrum of 2-ethylhexyl ricinoleate

A24

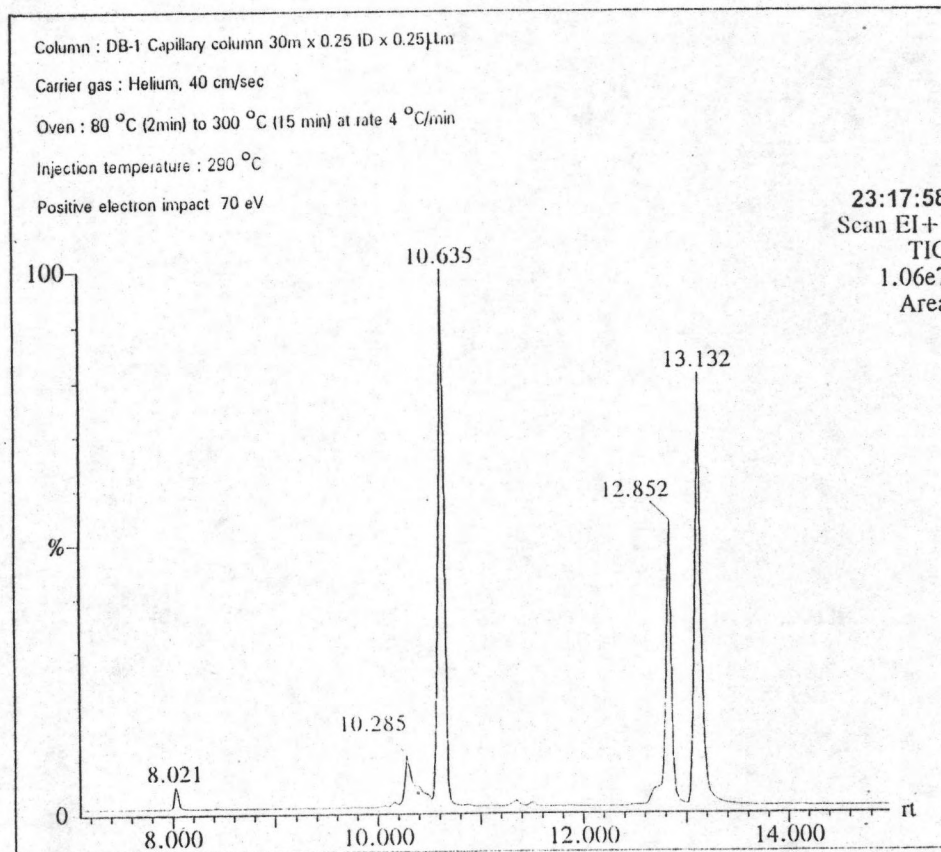


Figure A24 Total ions chromatogram of hydrogenated oil

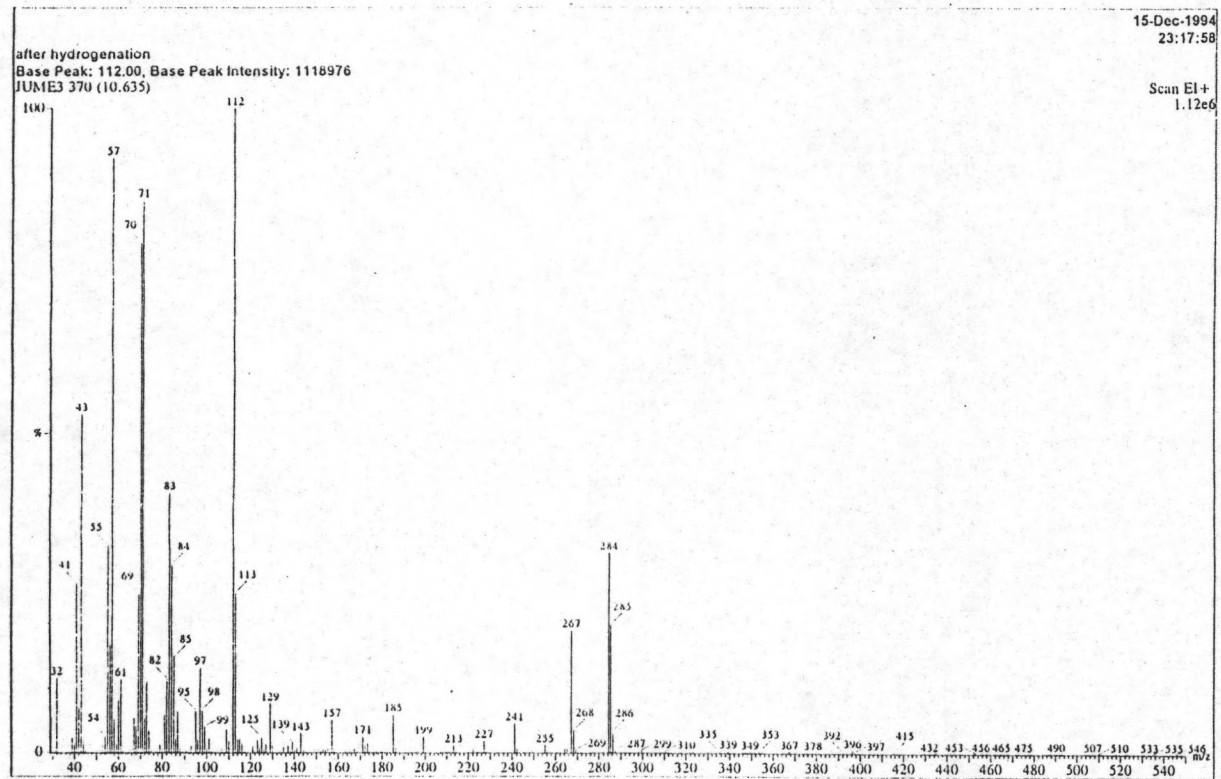


Figure A25 Mass spectrum of 2-ethylhexyl stearate

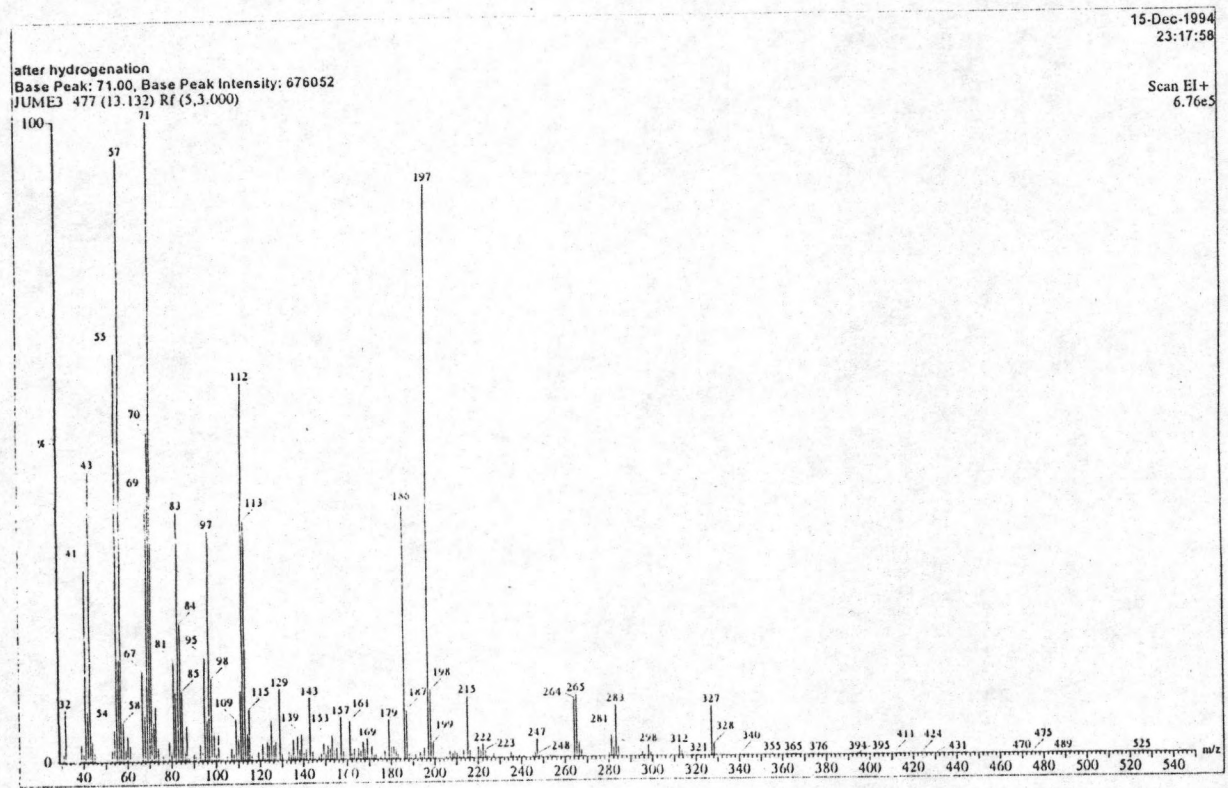


Figure A26 Mass spectrum of 2-ethylhexyl-12-hydroxy stearate

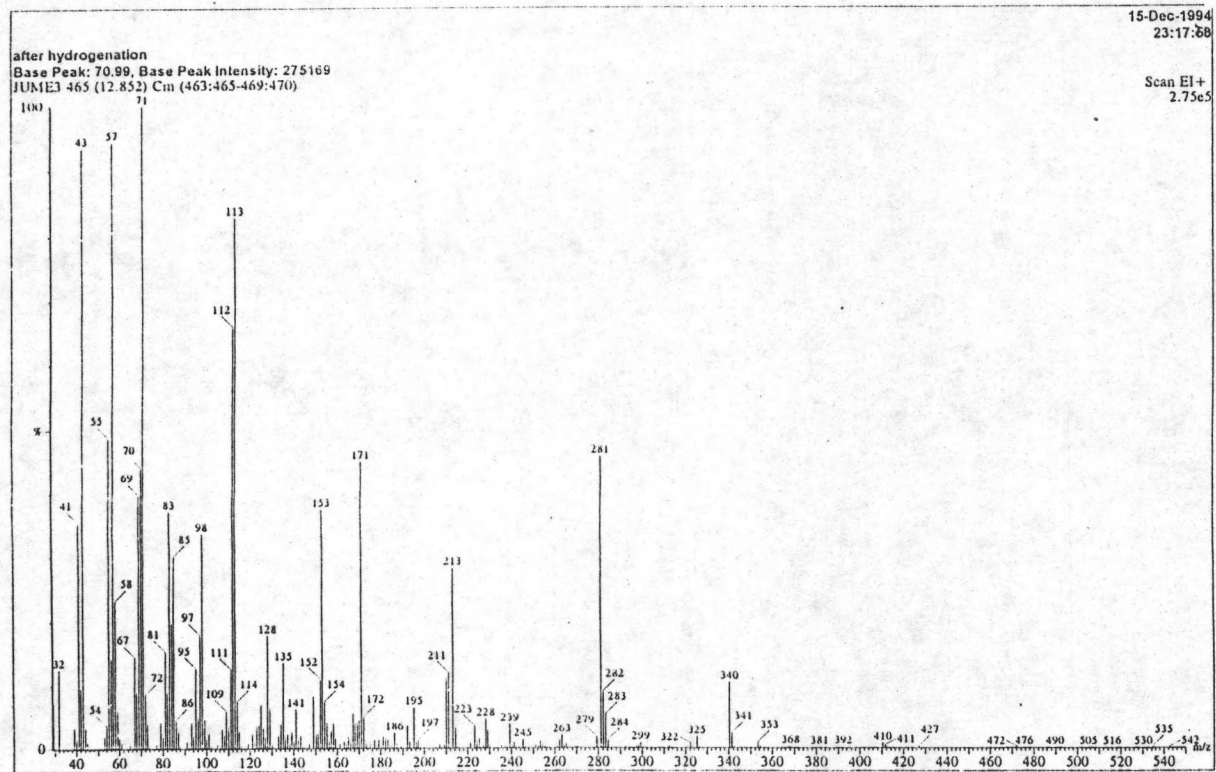


Figure A27 Mass spectrum of 2-ethylhexyl ricinoleate derivative(keto ester product)

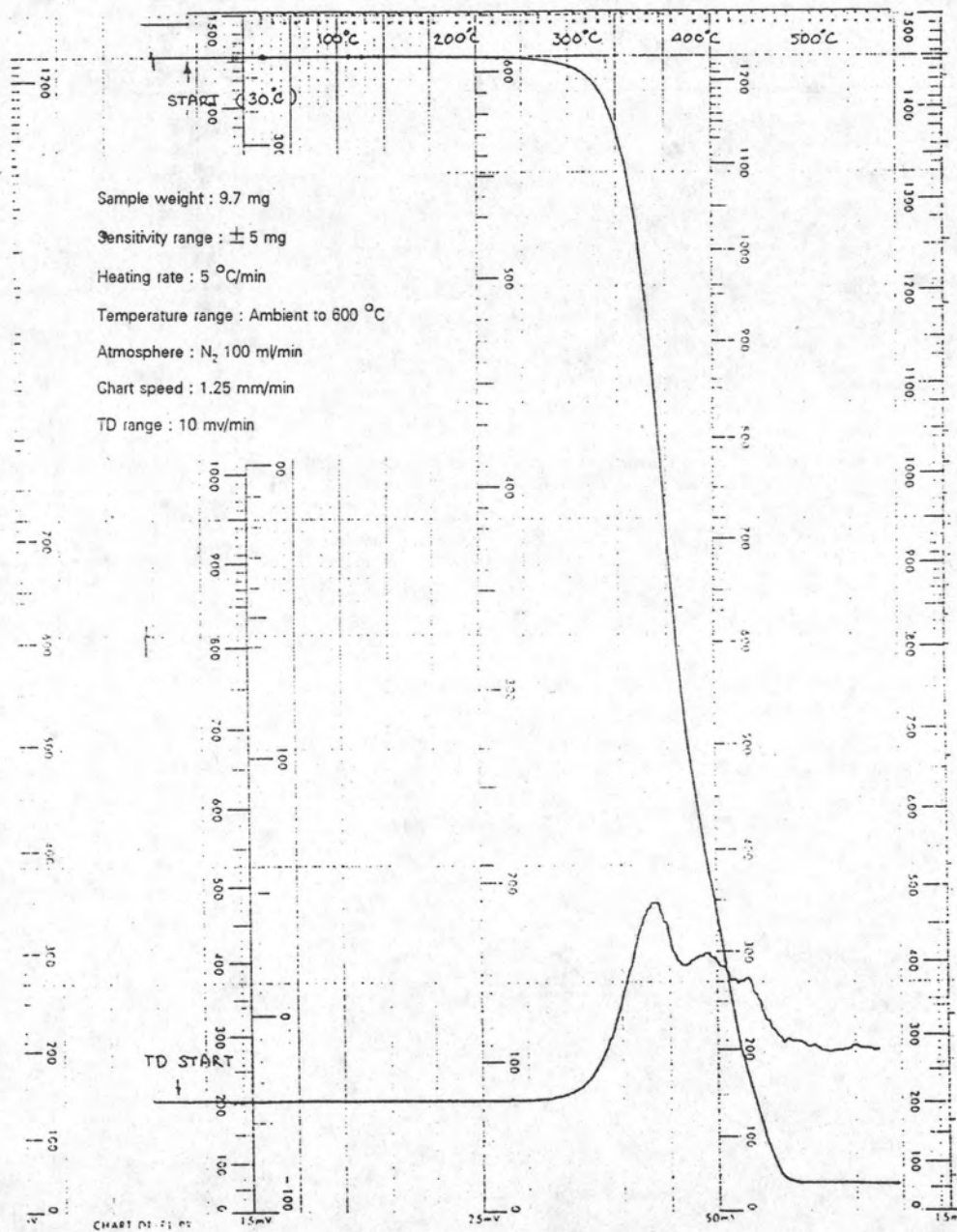


Figure A28 Thermogram under N₂ atmosphere of castor oil

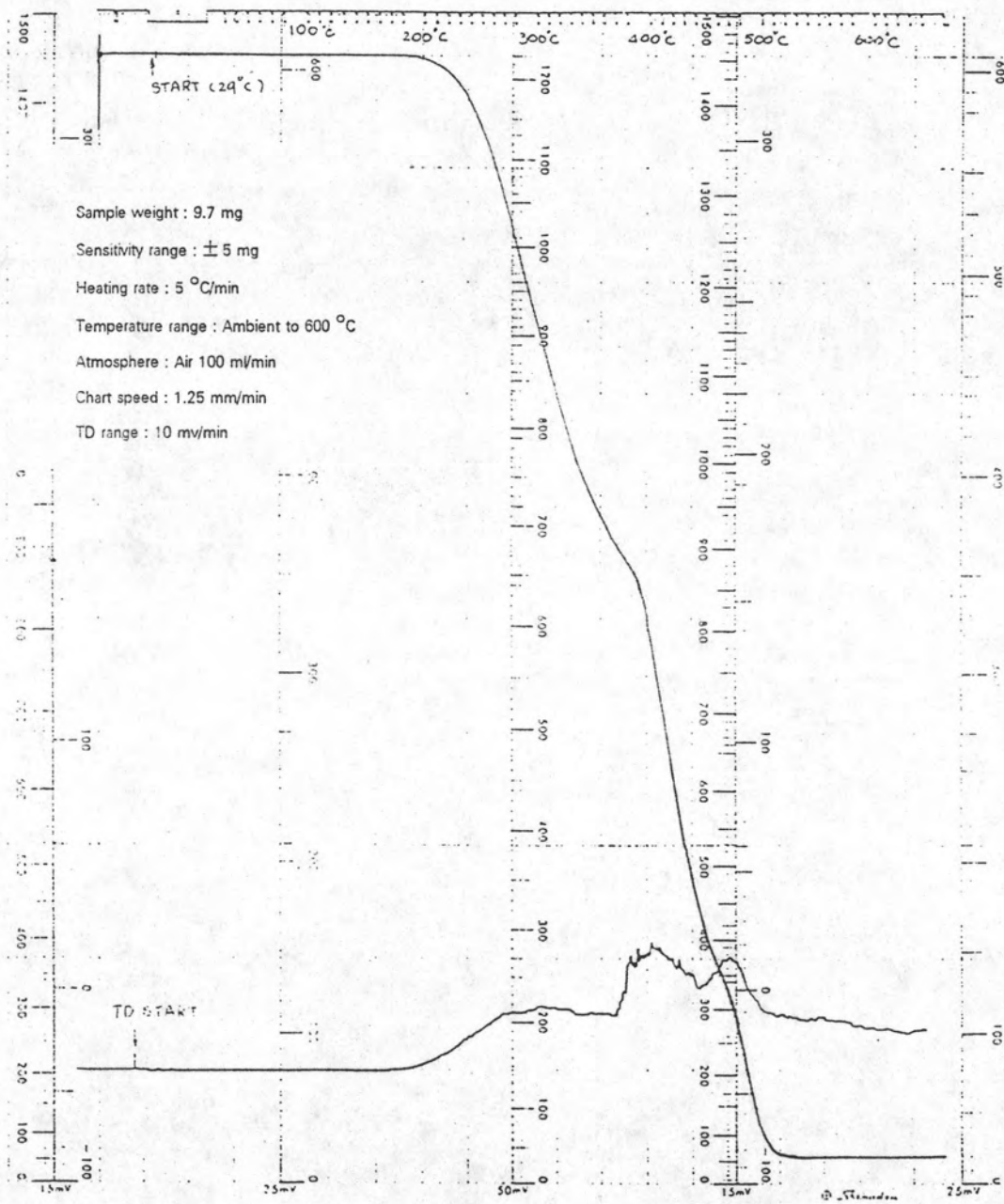


Figure A29 Thermogram under air atmosphere of castor oil

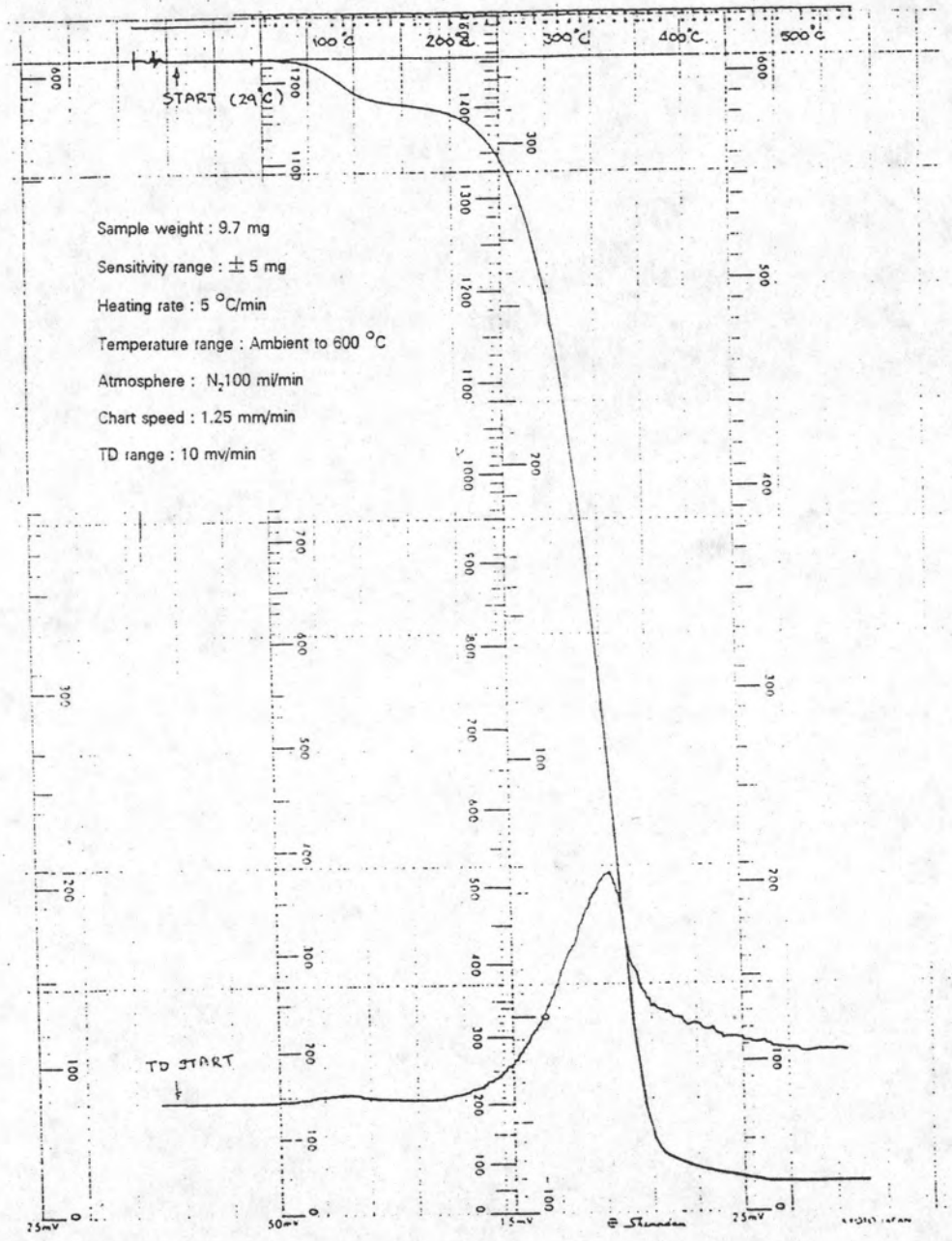


Figure A30 Thermogram under N₂ atmosphere of oil (before hydrogenation)

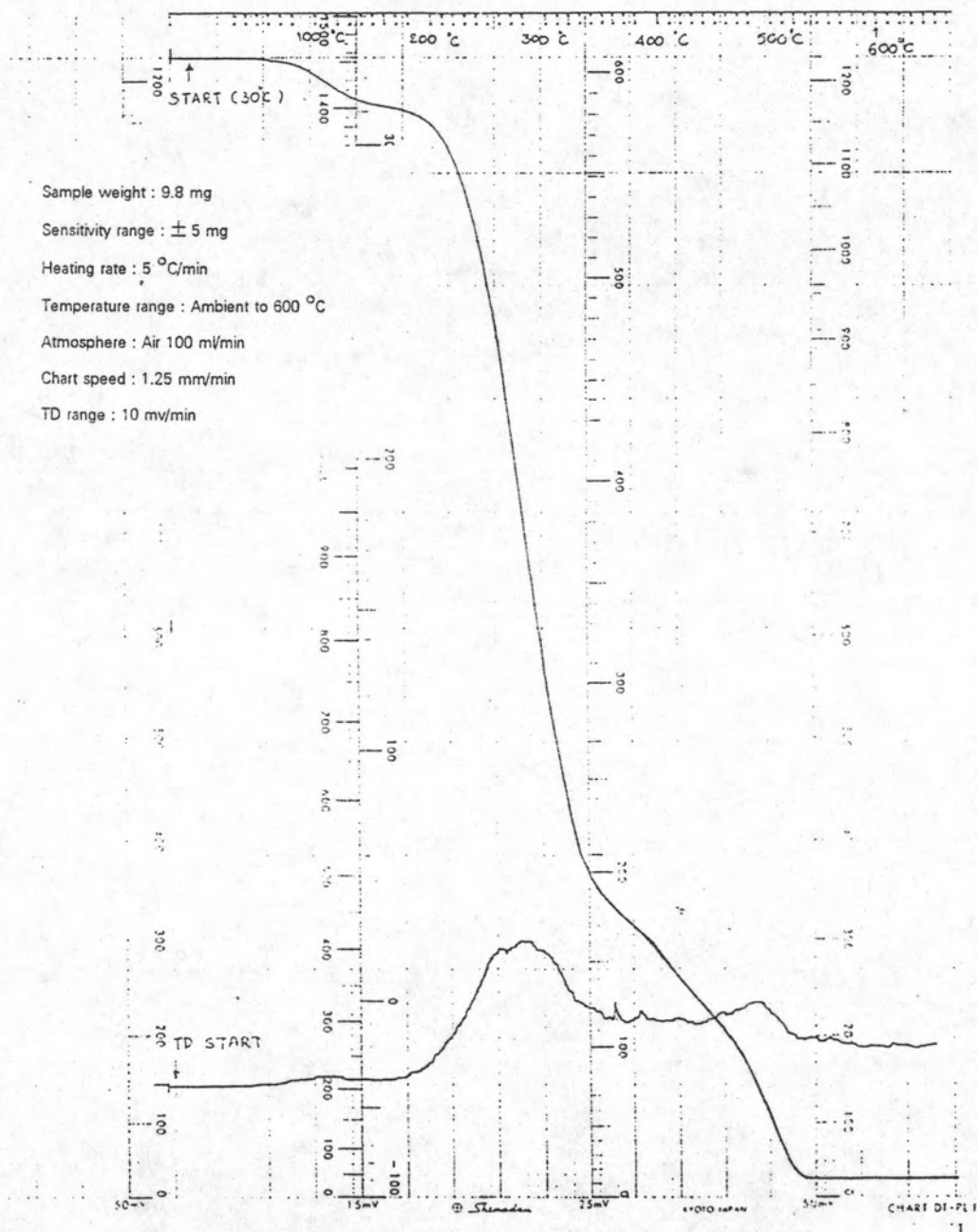


Figure A31 Thermogram under air atmosphere of oil (before hydrogenation)

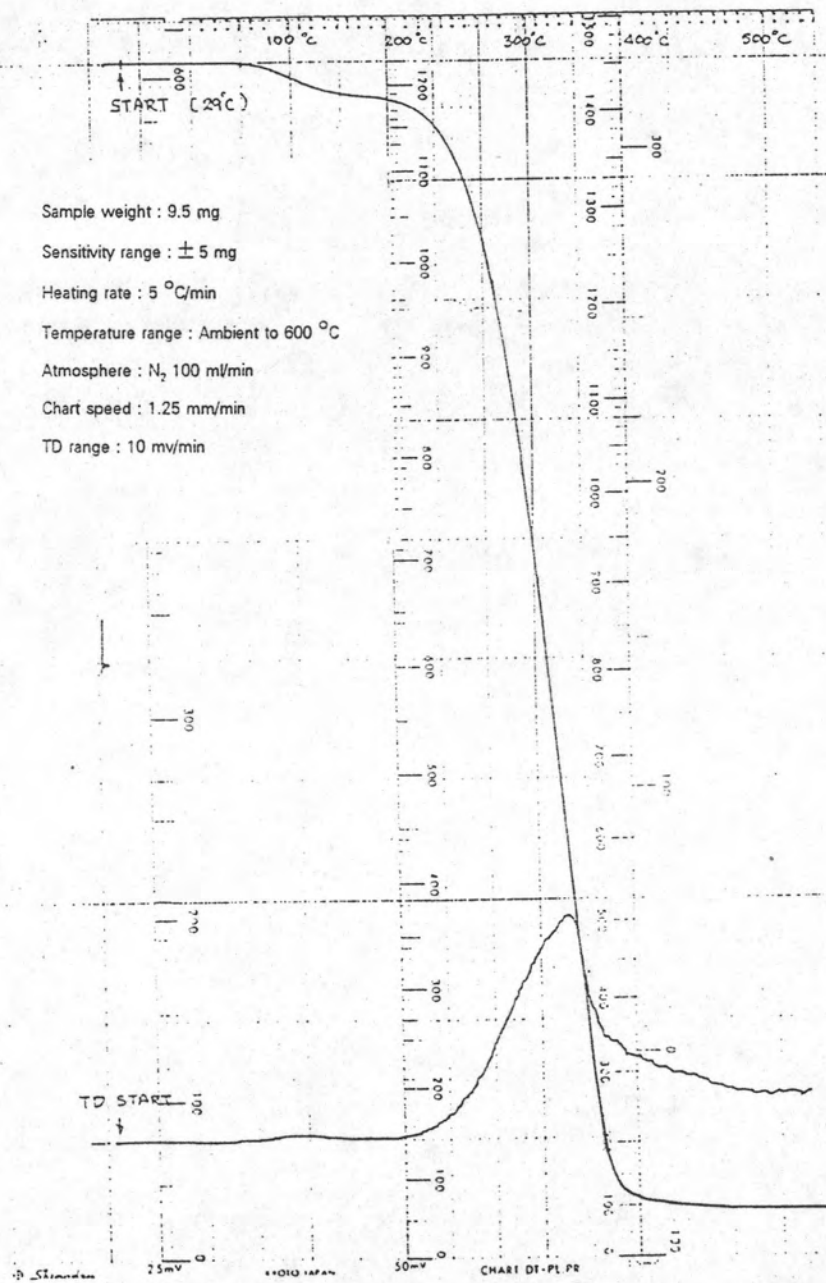


Figure A32 Thermogram under N₂ atmosphere of hydrogenated oil

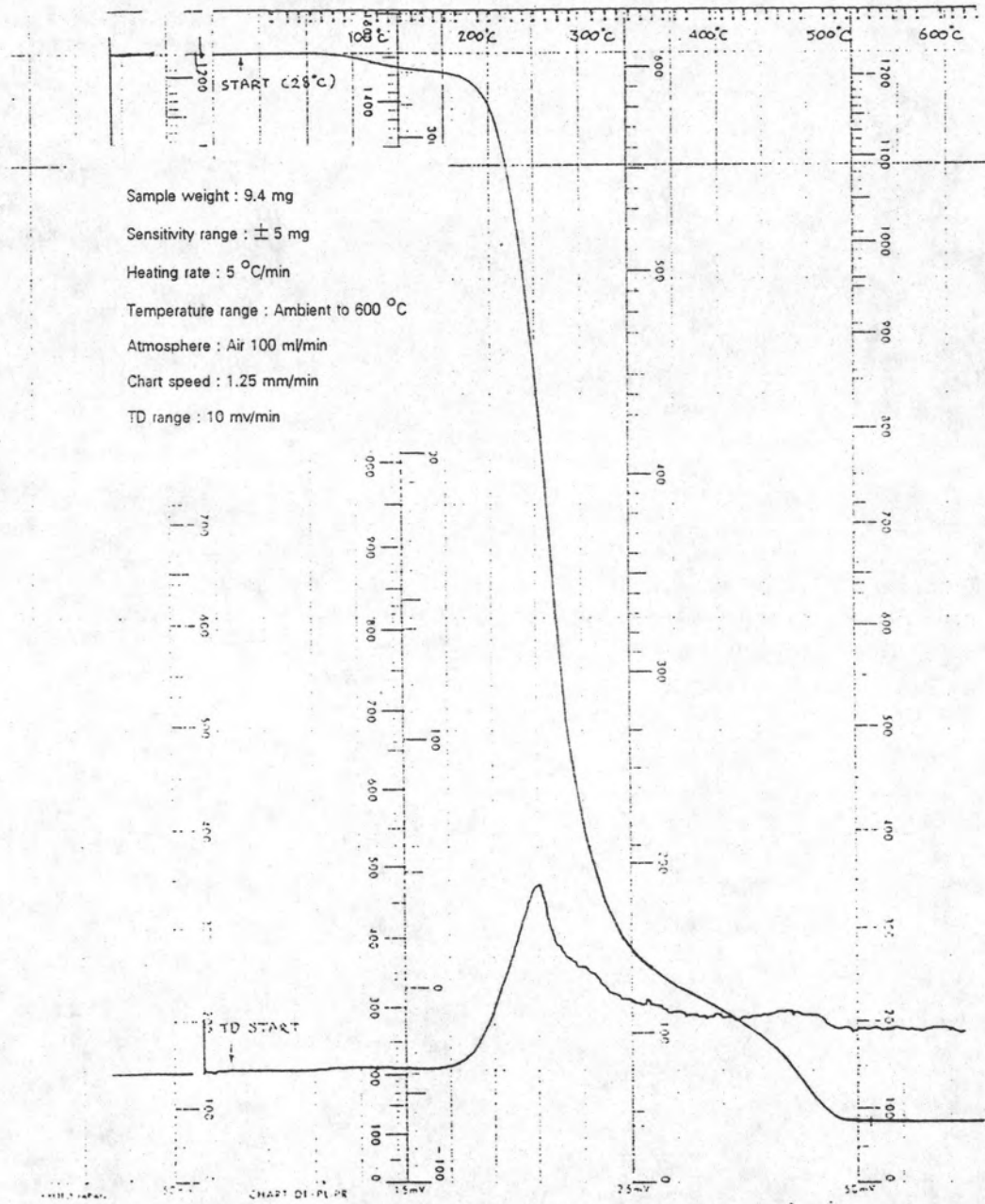


Figure A33 Thermogram under air atmosphere of hydrogenated oil

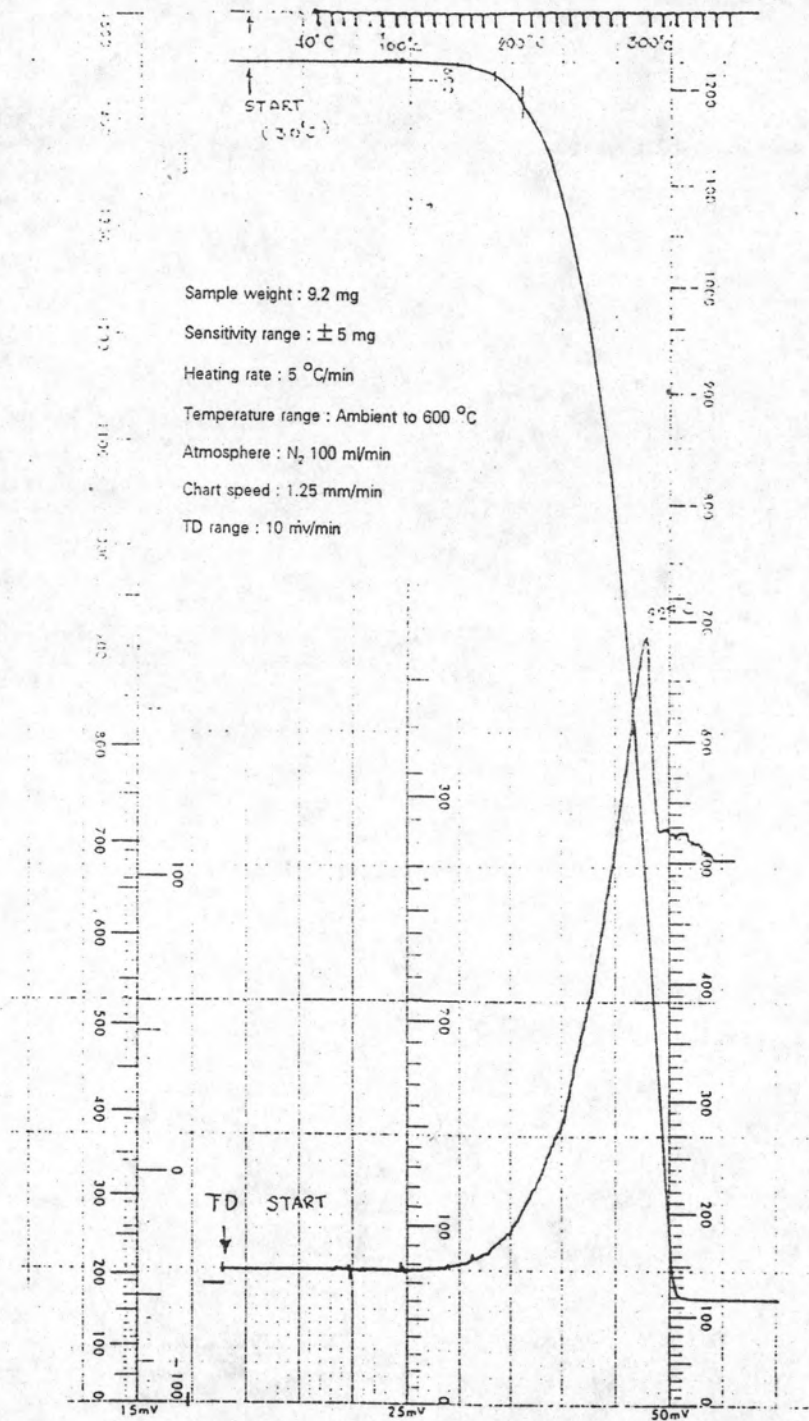


Figure A34 Thermogram under N_2 atmosphere of imported lubricating base oil from Singapore

VITA

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