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APPENDIX

SAMPLE : Used marine lubricating oil
 HEATING RATE : 5 °C/min
 TEMP RANGE : 20/650 °C
 ATMOSPHERE : Air
 FLOW RATE : 60 ml/min
 REFERENCE : Empty
 INSTRUMENT : NETZSCH STA 409 C
 WEIGHT : SAMPLE (49.9 mg), REFERENCE (0.0 mg)

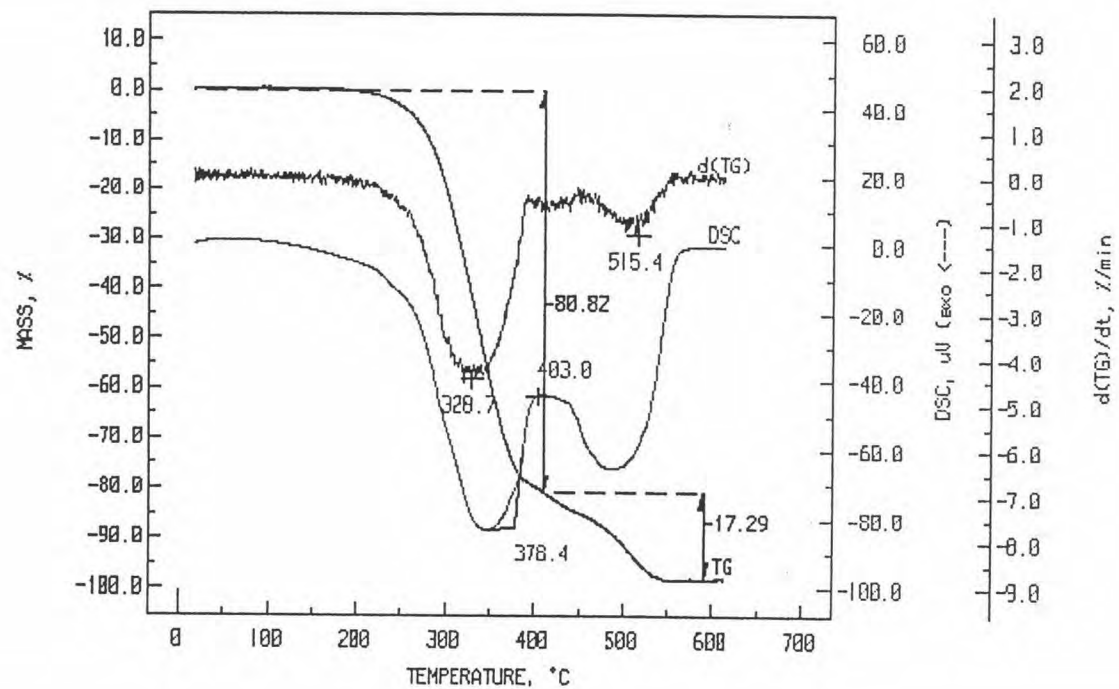


Figure A1 Thermogram of used marine lubricating oil.

SAMPLE : Hydrogenated oil obtained from suitable condition by using
 30 % NiO/WO₃/Al₂O₃ catalyst at reaction time of 2 minutes.
 HEATING RATE : 5 °C/min
 TEMP RANGE : 20/650 °C
 ATMOSPHERE : Air
 FLOW RATE : 60 ml/min
 REFERENCE : Empty
 INSTRUMENT : NETZSCH STA 409 C
 WEIGHT : SAMPLE (50.1 mg), REFERENCE (0.0 mg)

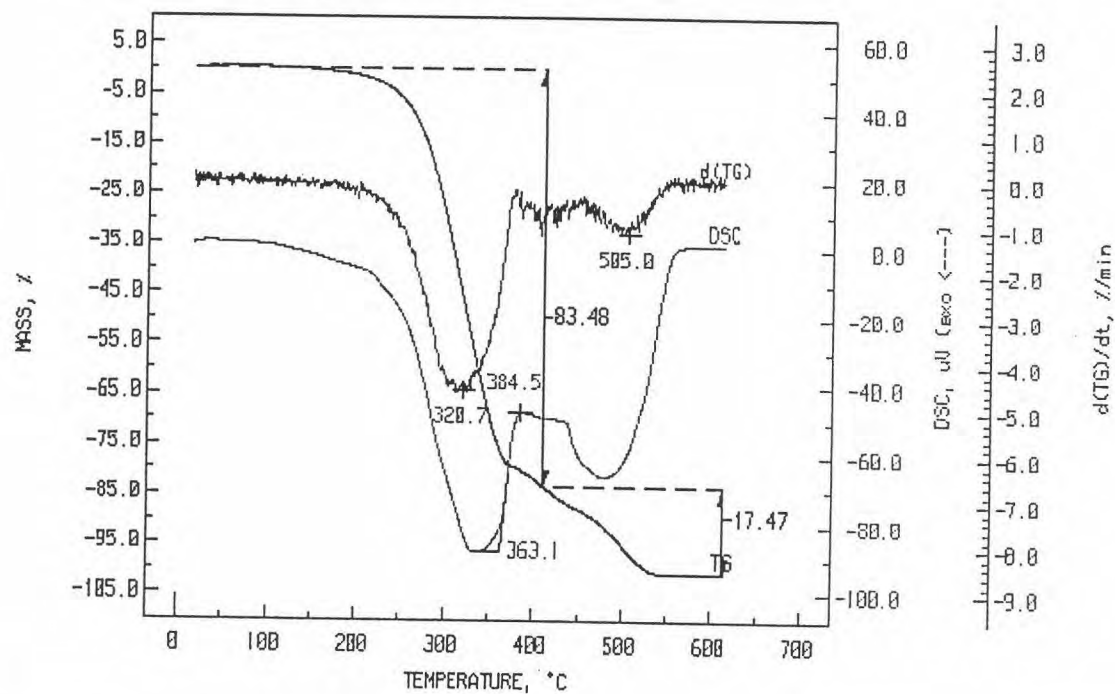


Figure A2 Thermogram of hydrogenated oil obtained from suitable condition
 by using NiO/WO₃/Al₂O₃ catalyst.

SAMPLE : Hydrogenated oil obtained from suitable condition by using
 35 % NiO/MoO₃/Al₂O₃ catalyst at reaction time of 10 minutes.
 HEATING RATE : 5 °C/min
 TEMP RANGE : 20/650 °C
 ATMOSPHERE : Air
 FLOW RATE : 60 ml/min
 REFERENCE : Empty
 INSTRUMENT : NETZSCH STA 409 C
 WEIGHT : SAMPLE (49.3 mg), REFERENCE (0.0 mg)

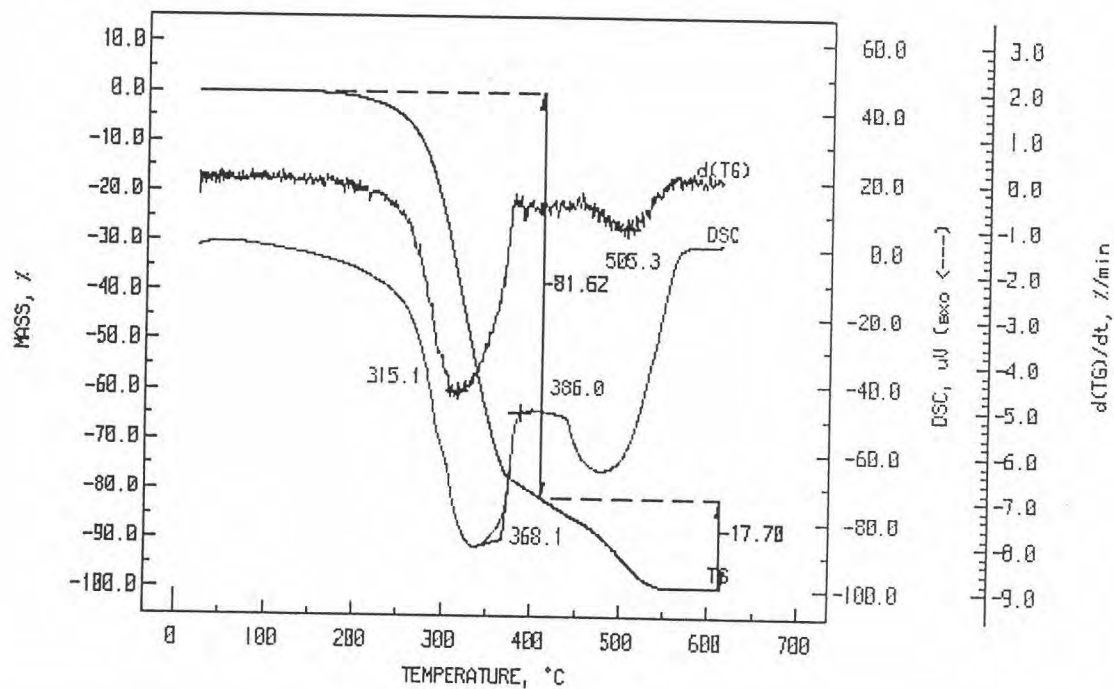


Figure A3 Thermogram of hydrogenated oil obtained from suitable condition
 by using NiO/MoO₃/Al₂O₃ catalyst.

SAMPLE : Hydrogenated oil obtained from suitable condition by using
 35 % Raney nickel catalyst at reaction time of 10 minutes.
 HEATING RATE : 5 °C/min
 TEMP RANGE : 20/650 °C
 ATMOSPHERE : Air
 FLOW RATE : 60 ml/min
 REFERENCE : Empty
 INSTRUMENT : NETZSCH STA 409 C
 WEIGHT : SAMPLE (52.2 mg), REFERENCE (0.0 mg)

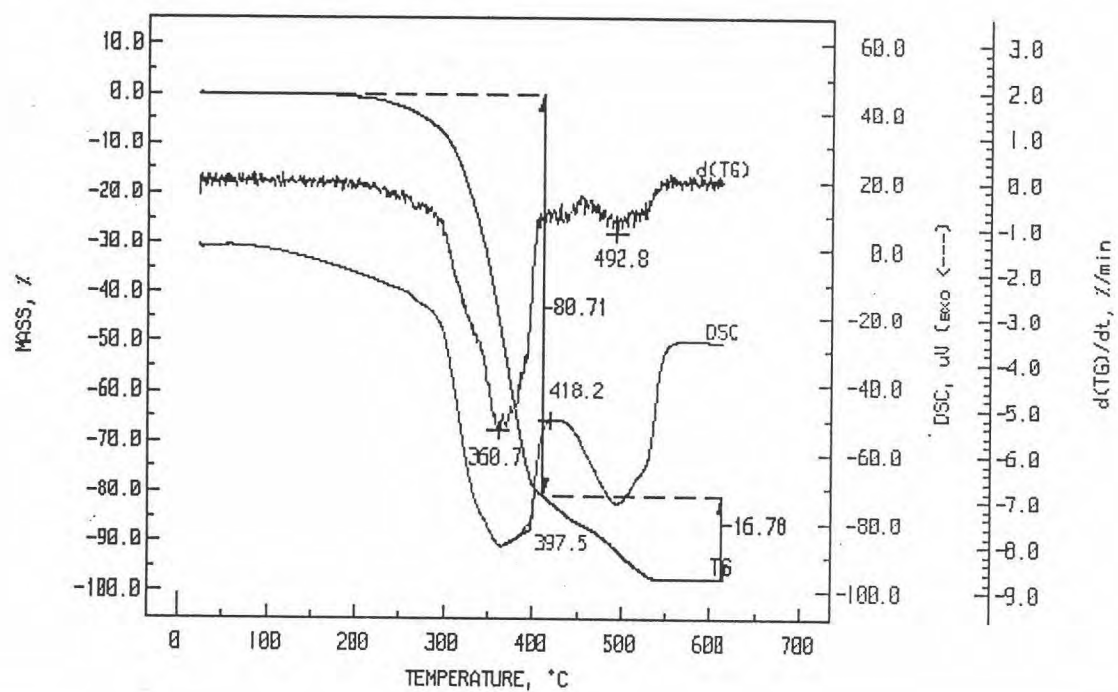


Figure A4 Thermogram of hydrogenated oil obtained from suitable condition
 by using Raney nickel catalyst.

SAMPLE : Unused marine lubricating oil
 HEATING RATE : 5 °C/min
 TEMP RANGE : 20/650 °C
 ATMOSPHERE : Air
 FLOW RATE : 60 ml/min
 REFERENCE : Empty
 INSTRUMENT : NETZSCH STA 409 C
 WEIGHT : SAMPLE (50.3 mg), REFERENCE (0.0 mg)

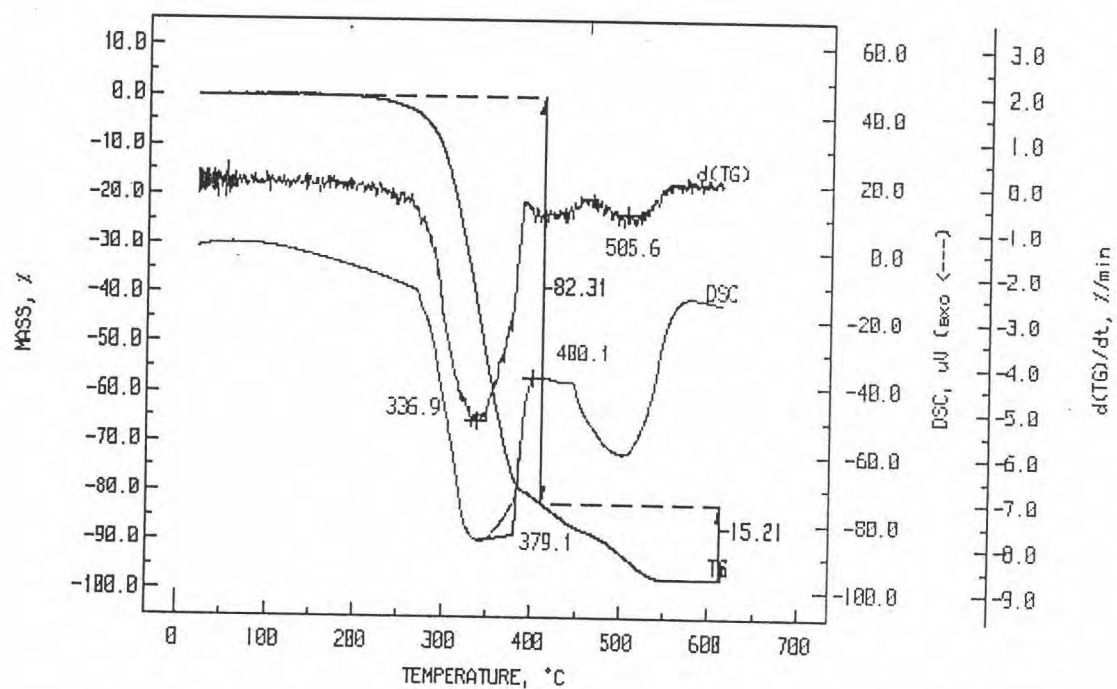


Figure A5 Thermogram of unused marine lubricating oil.

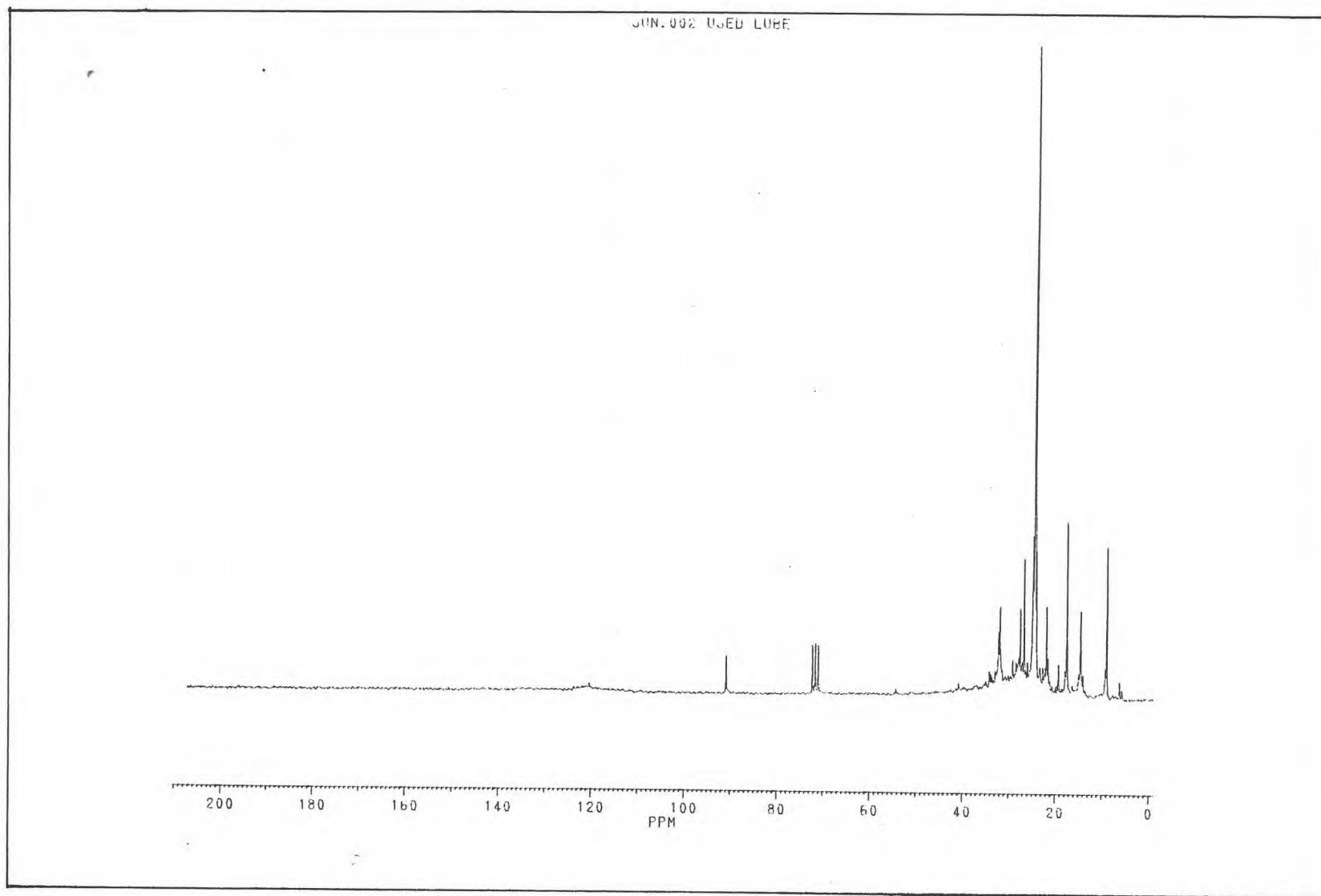


Figure A6 ^{13}C -NMR Spectrum of used marine lubricating oil.

SUN.008

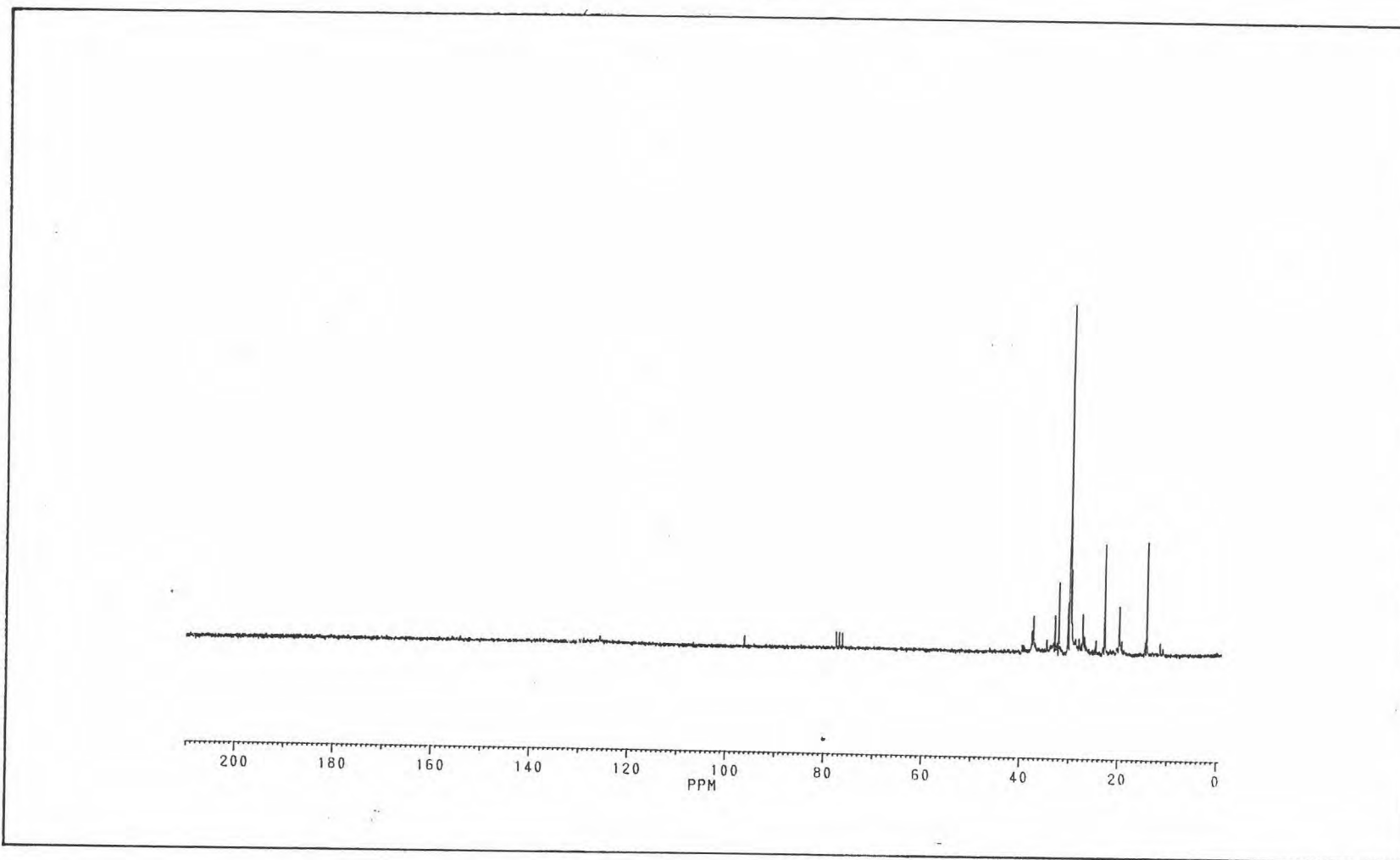


Figure A7 ^{13}C -NMR Spectrum of hydrogenated oil obtained from suitable condition by using $\text{NiO}/\text{WO}_3/\text{Al}_2\text{O}_3$ catalyst.

SUN.005

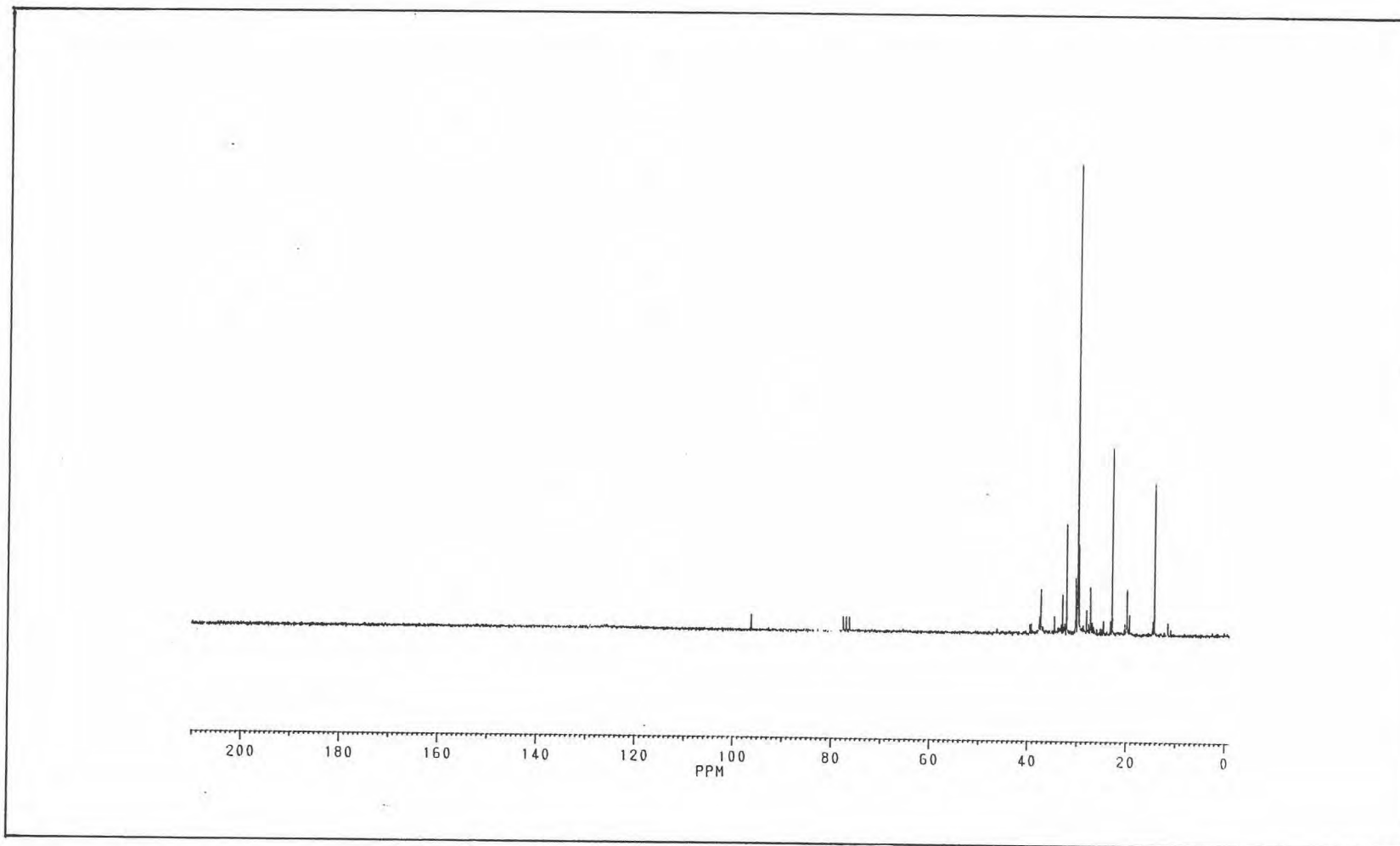


Figure A8 ^{13}C -NMR Spectrum of hydrogenated oil obtained from suitable condition by using $\text{NiO}/\text{MoO}_3/\text{Al}_2\text{O}_3$ catalyst.

SUN.006

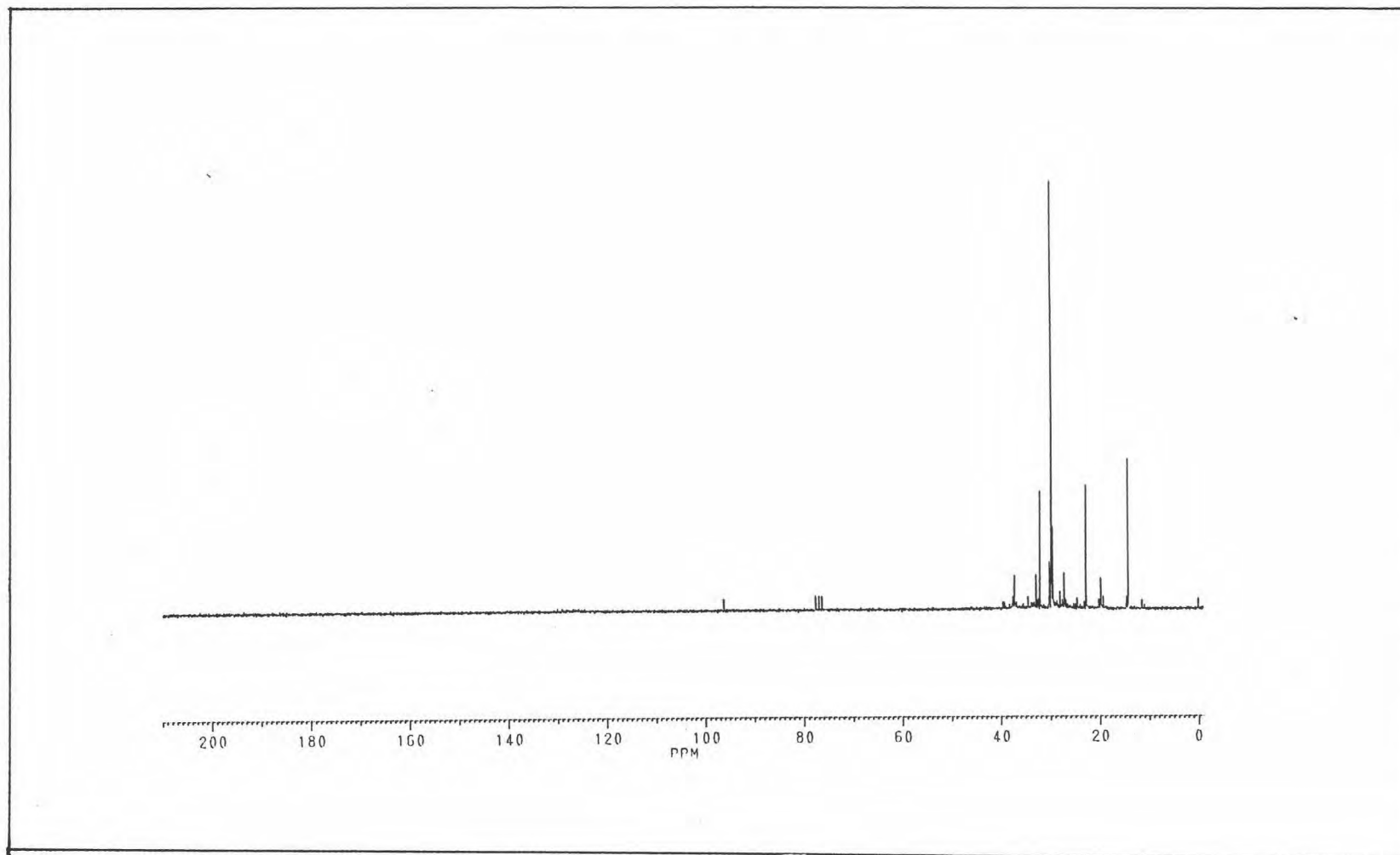


Figure A9 ^{13}C -NMR Spectrum of hydrogenated oil obtained from suitable condition by using Raney nickel catalyst.

SUN.009

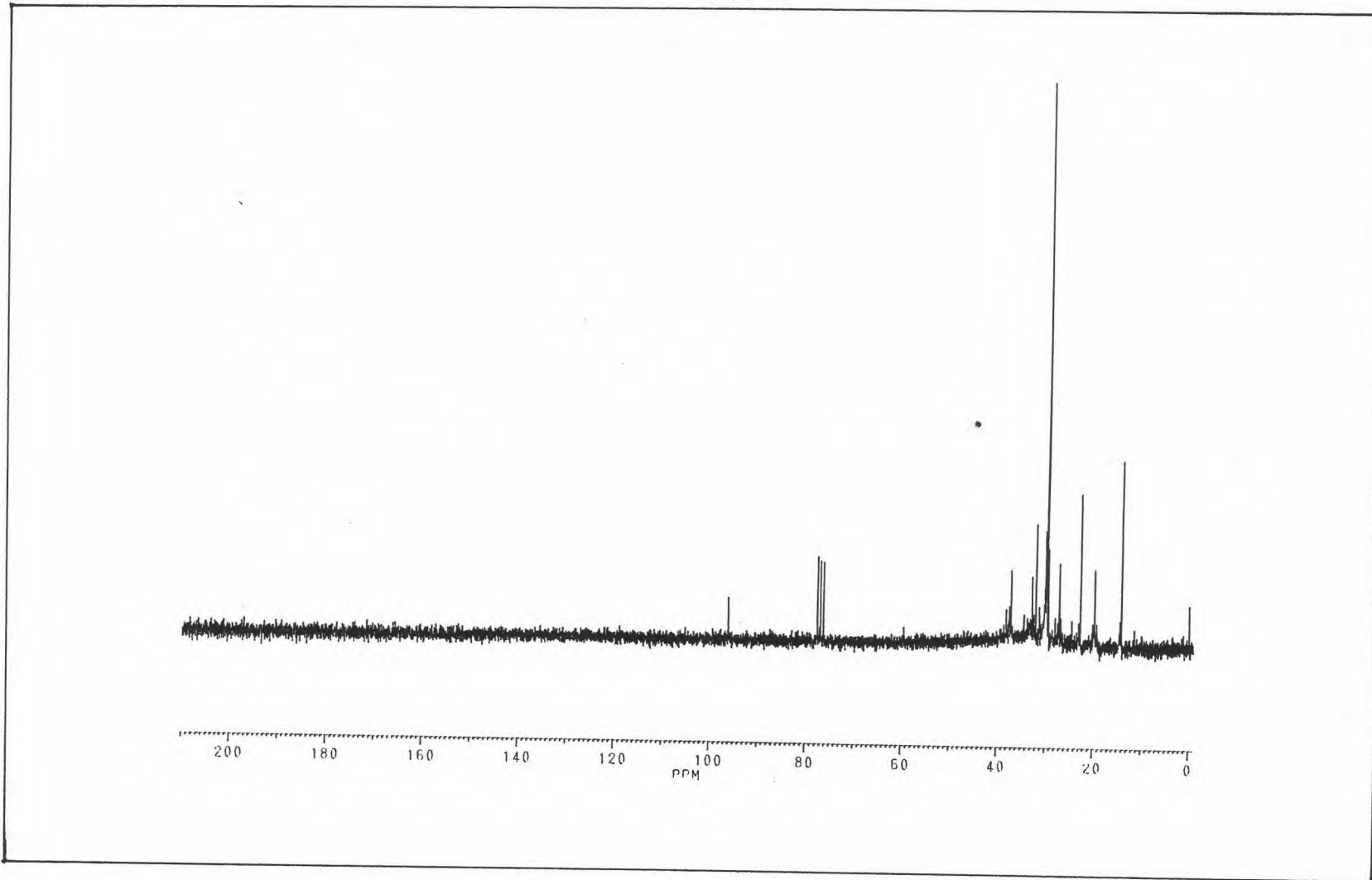


Figure A10 ¹³C-NMR Spectrum of unused marine lubricating oil.

VITA

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