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# APPENDIX

A1 The method for calculating pore volume of alumina support CS-303

Weight of alumina support = 100 g

Weight of alumina support and trapped water = 125.46 g

Density of water = 1 $g/cm^3$

Volume of trapped water = 25.46 $cm^3$

Pore volume of this support = $\frac{25.46 \ cm^3}{100 \ g}$ = 0.2546 $cm^3/g$

A2 The method for calculating the amount of ammonium molybdate and nickel nitrate hexahydrate for impregnation

Weight of impreagnated support = 100 g

MW of ammonium molybdate $(NH_4)_6Mo_7O_{24}.4H_2O$

= 1235.86 g/mol

MW of nickel nitrate hexahydrate $Ni(No_3)_2.6H_2O$

= 290.81 g/mol

MW of molybdenum trioxide $MoO_3$ = 143.94 g/mol

MW of nickel oxide NiO = 74.69 g/mol

Atomic weight of molybdenum = 95.94

Atomic weight of nickel = 58.71

The catalyst contained 10 % of moloybdenum trioxide and 5 % of nickel oxide therefore in 90 g of support have 10 g of molybdenum trioxide and in 95 g of support have 5 g of nickel oxide.

The amount of ammonium molybdate =

$$\frac{11.11 \times \text{Atomic weight of Mo} \times \text{MW of } (NH_4)_6Mo_7O_{24}.4H_2O \times 100}{\text{MW of } MoO_3 \times 7 \times \text{Atomic weight of Mo} \times 99}$$

$$= \frac{11.11 \times 95.94 \times 1235.86 \times 100}{143.94 \times 671.58 \times 99} = 13.77 \text{ g}$$

The amount of nickel nitrate =

$$\frac{5.26 \times \text{Atomic weight of Ni} \times \text{MW of } Ni(NO_3)_2.6H_2O \times 100}{\text{MW of NiO} \times \text{Atomic weight of Ni} \times 99}$$

$$= \frac{5.26 \times 58.71 \times 290.81 \times 100}{74.69 \times 58.71 \times 99} = 20.70 \text{ g}$$

The volume of distillated water was calculated from the pore volume and the amount of support.

volume of water = weight of alumina support x pore volume

= 100 g x 0.2546 $cm^3/g$

= 25.46 $cm^3$

Table A1 Physical properties of lubricating base oils from various sources [5]

| 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 92 | max -9 | max.-12.2 | max. -9 |
| Viscosity | ASTM D 445 | | | |
| @ 40 °C, cSt | | Report | 31.90-34.10 | 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, % wt | ASTM D 129 | | | 0.2-0.8 |

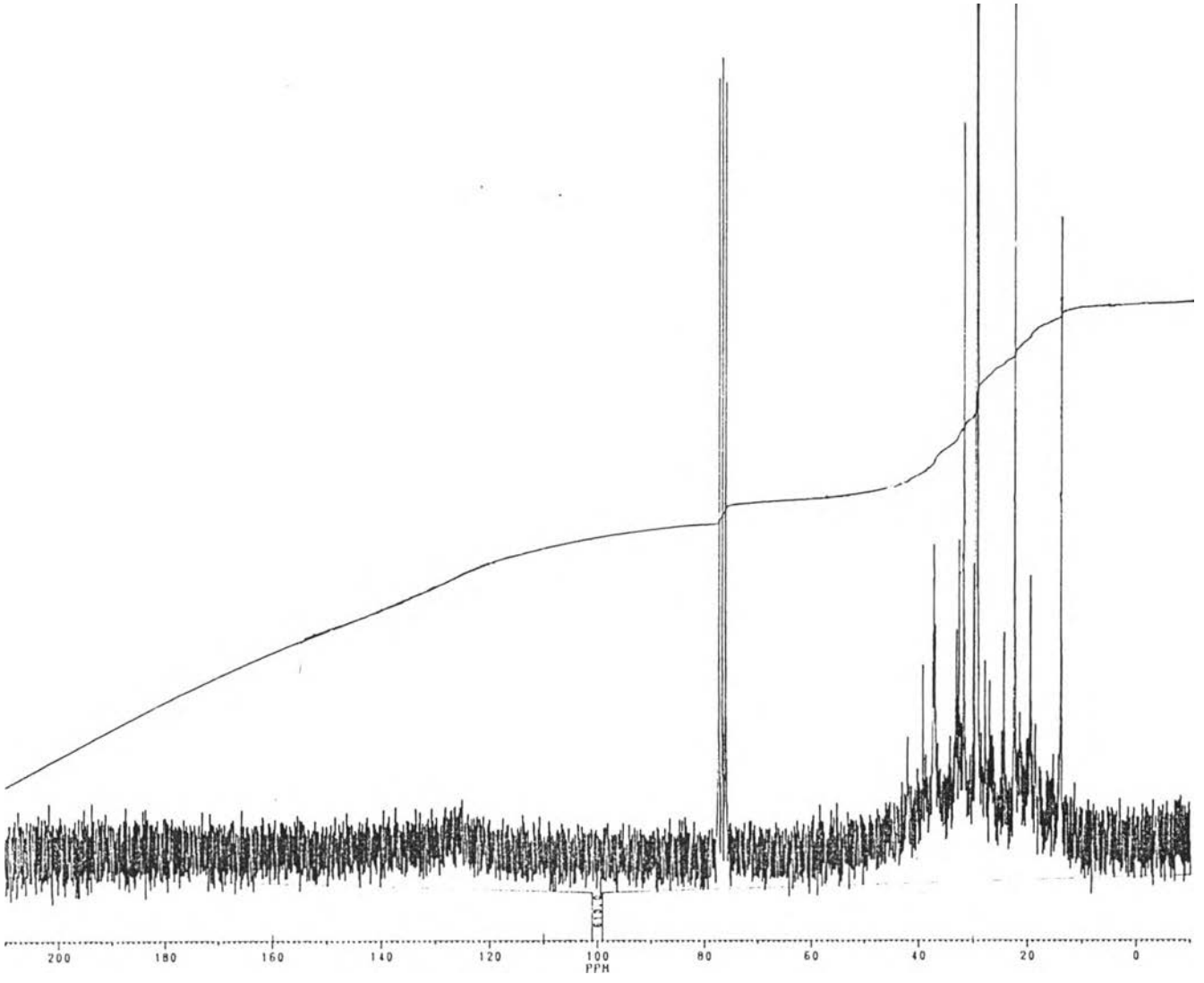


Figure A1 $^{13}$C-NMR spectrum of acid-clay treated oil

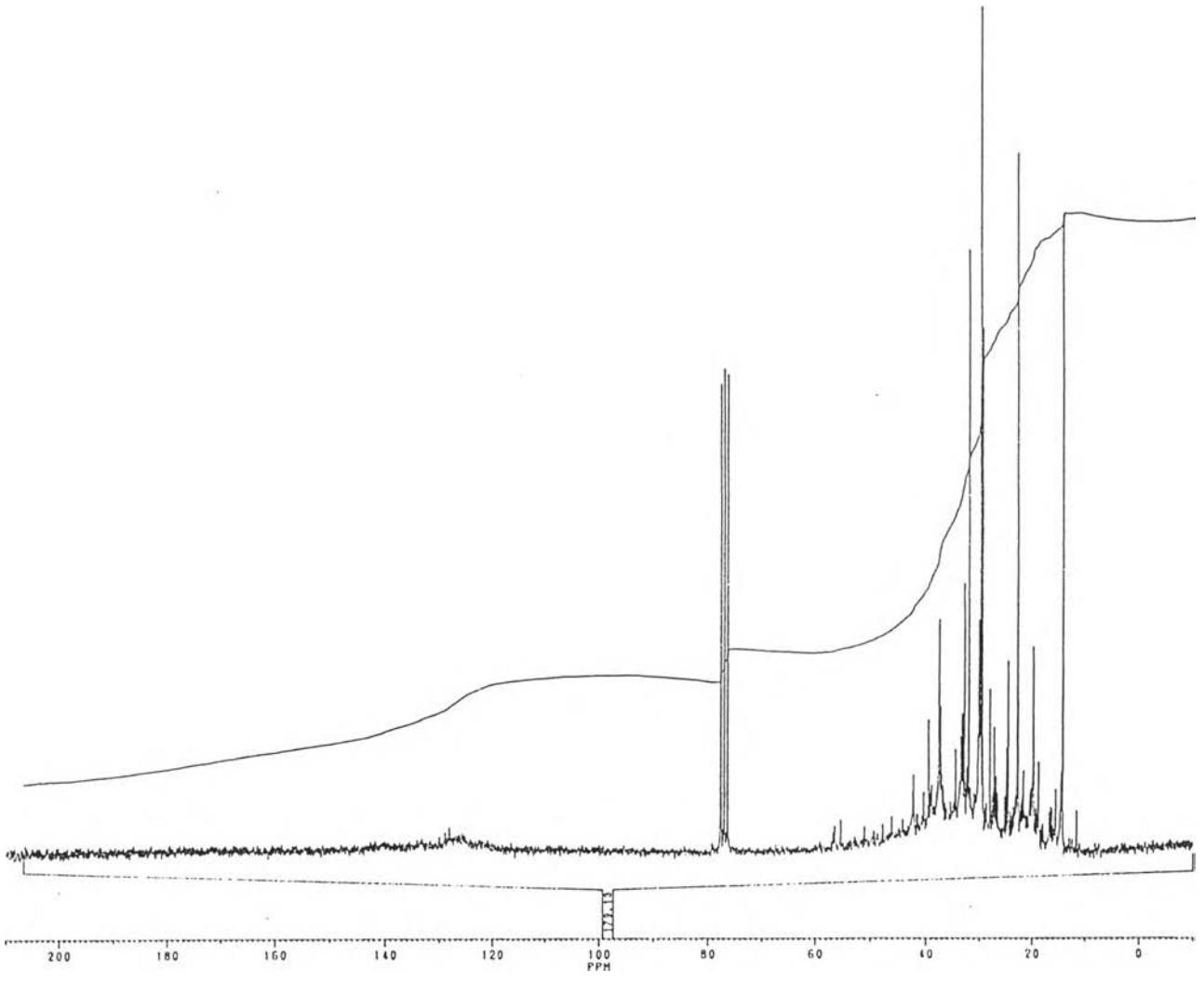


Figure A2 $^{13}$C-NMR spectrum of hydrotreated oil

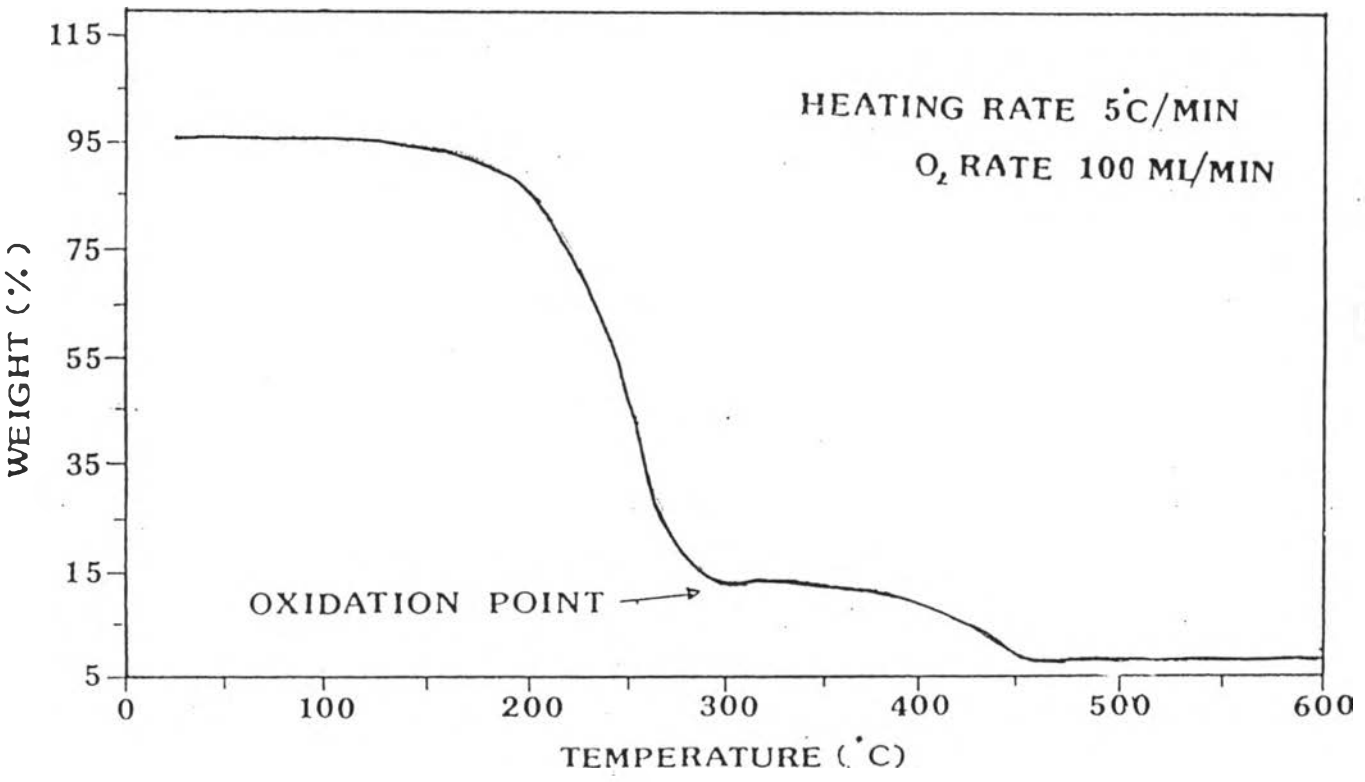


Figure A3 Thermooxidation stability curve of acid-clay treated oil

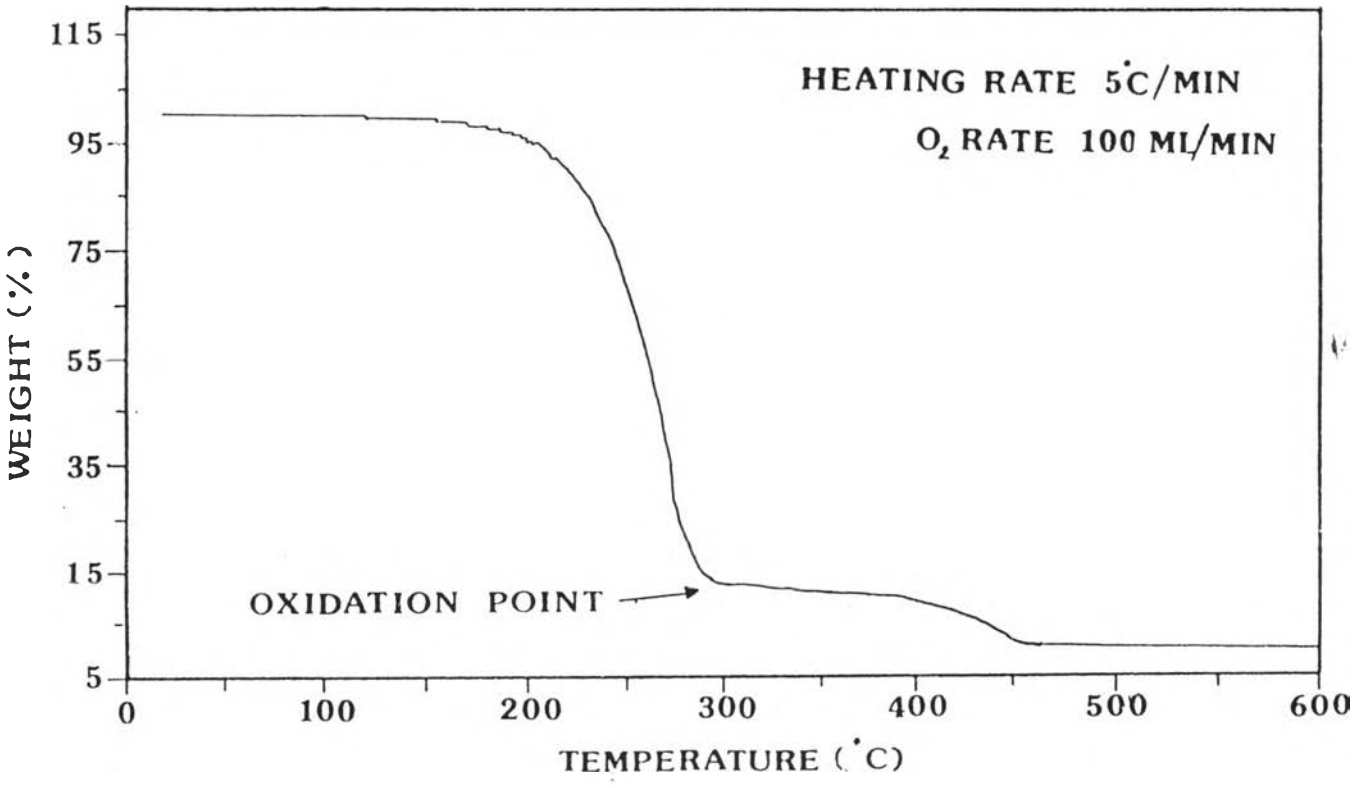


Figure A4 Thermooxidation stability curve of hydrotreated oil

# VITA

Miss Sasiwimol Boonthrong was born on August 3, 1968 in Bangkok. She received a Degree of Bachelor of Science in Chemistry from Kasetsart University in 1990. She has been a graduate student studying Petrochemistry in Chulalongkorn University since 1990.