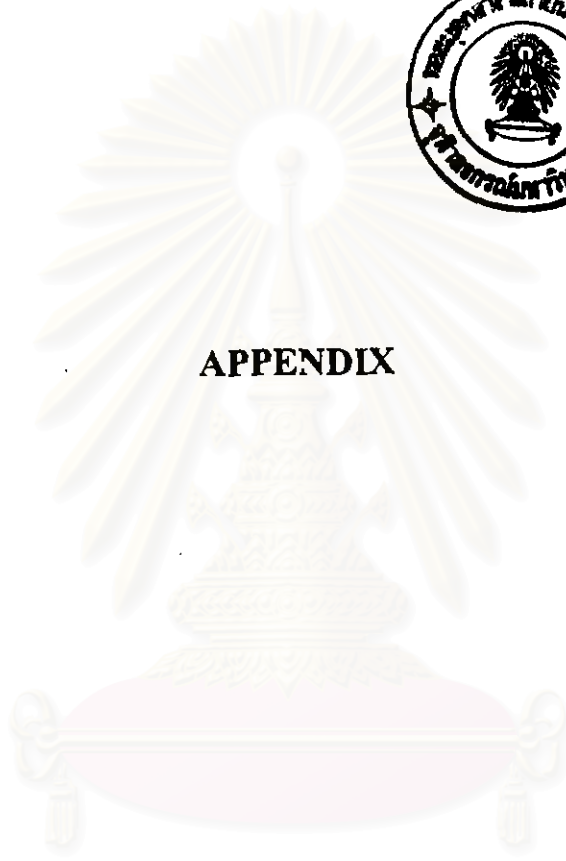


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APPENDIX



สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

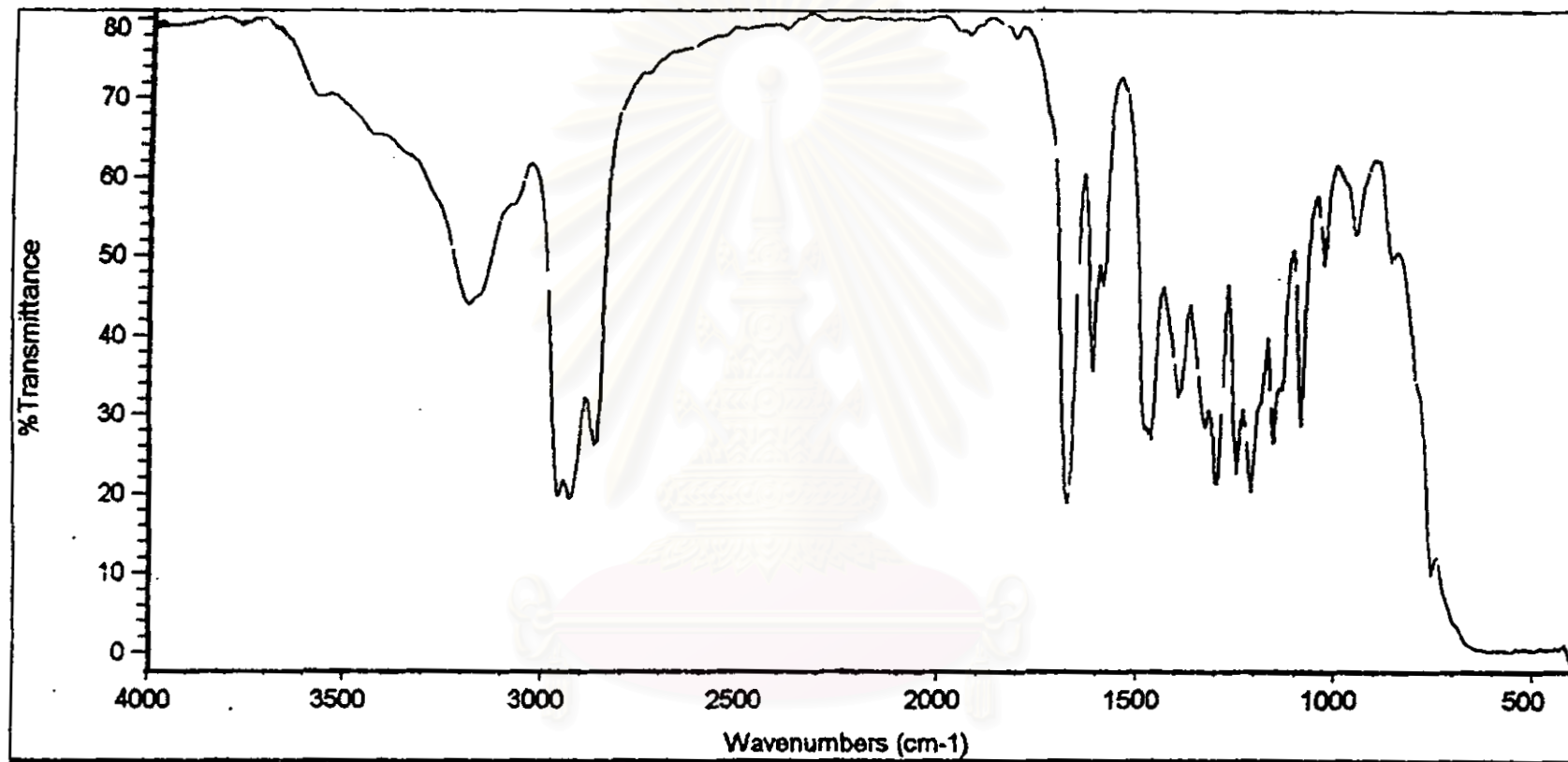


Figure 1-1: The FT-IR spectrum of 2-ethyl-1-hexyl salicylate

จุฬาลงกรณ์มหาวิทยาลัย

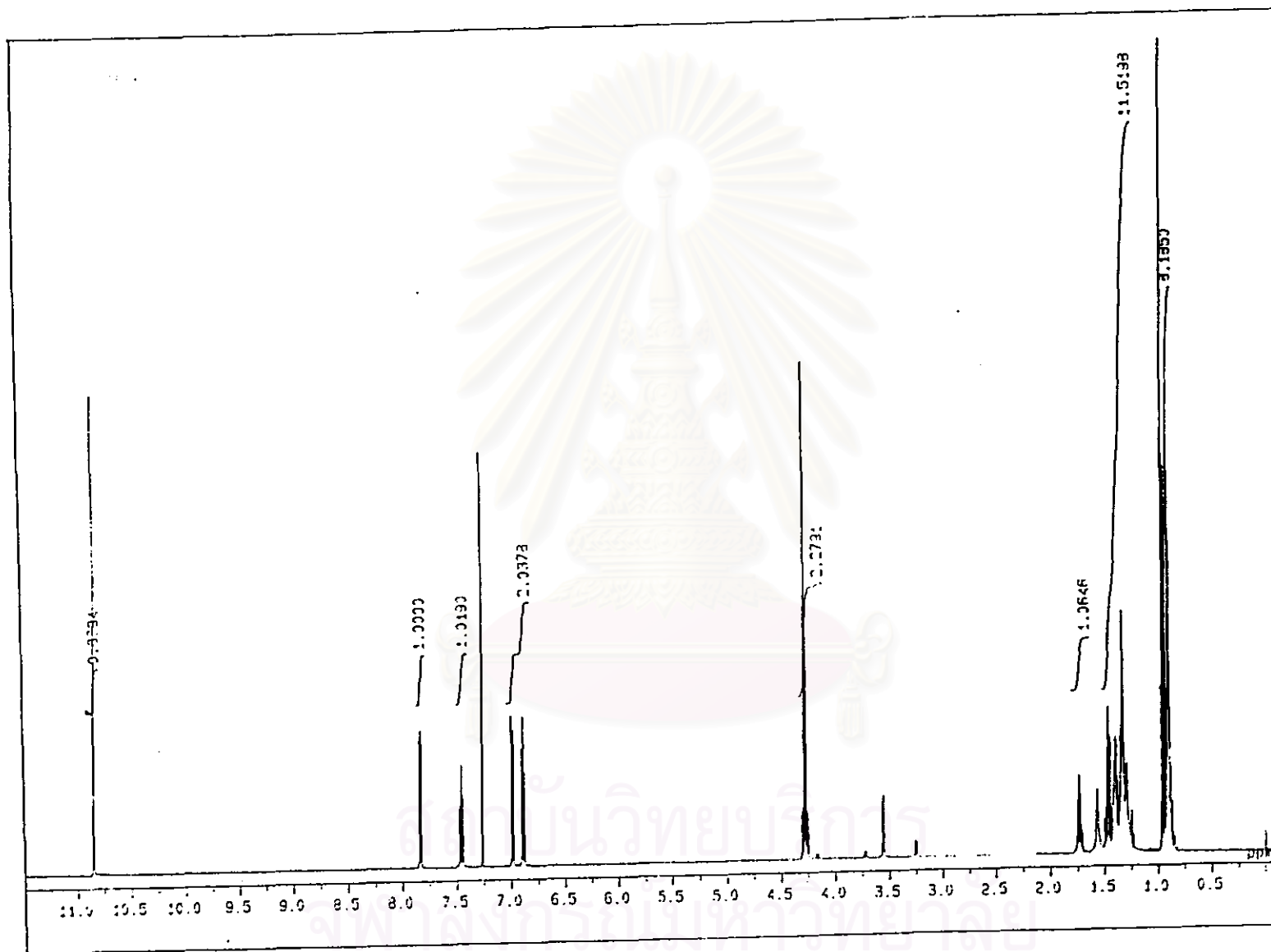


Figure 1-2: The $^1\text{H-NMR}$ spectrum of 2-ethyl-1-hexyl salicylate

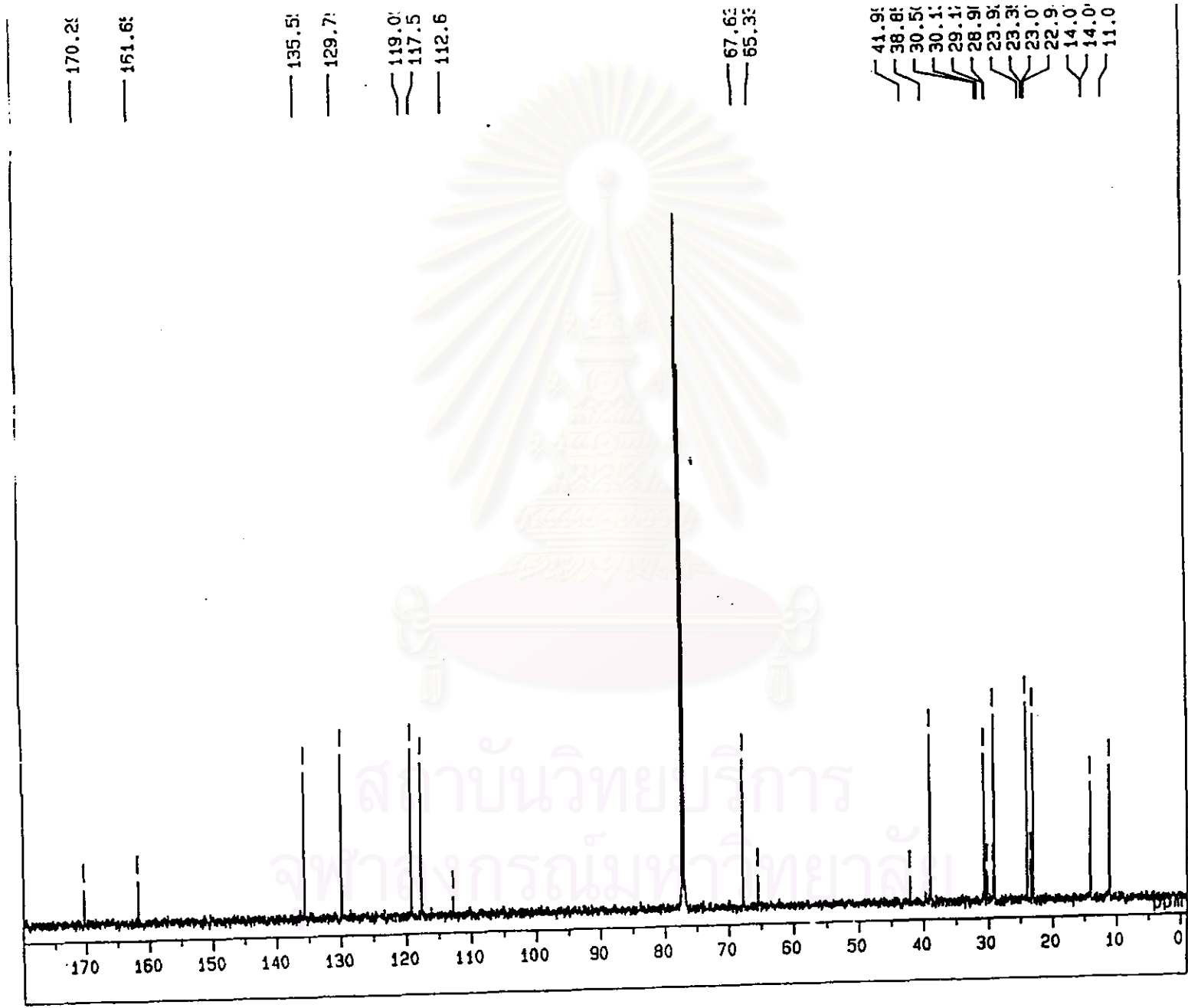


Fig. ¹³C NMR spectrum of 2-ethyl-1-hexyl salicylate

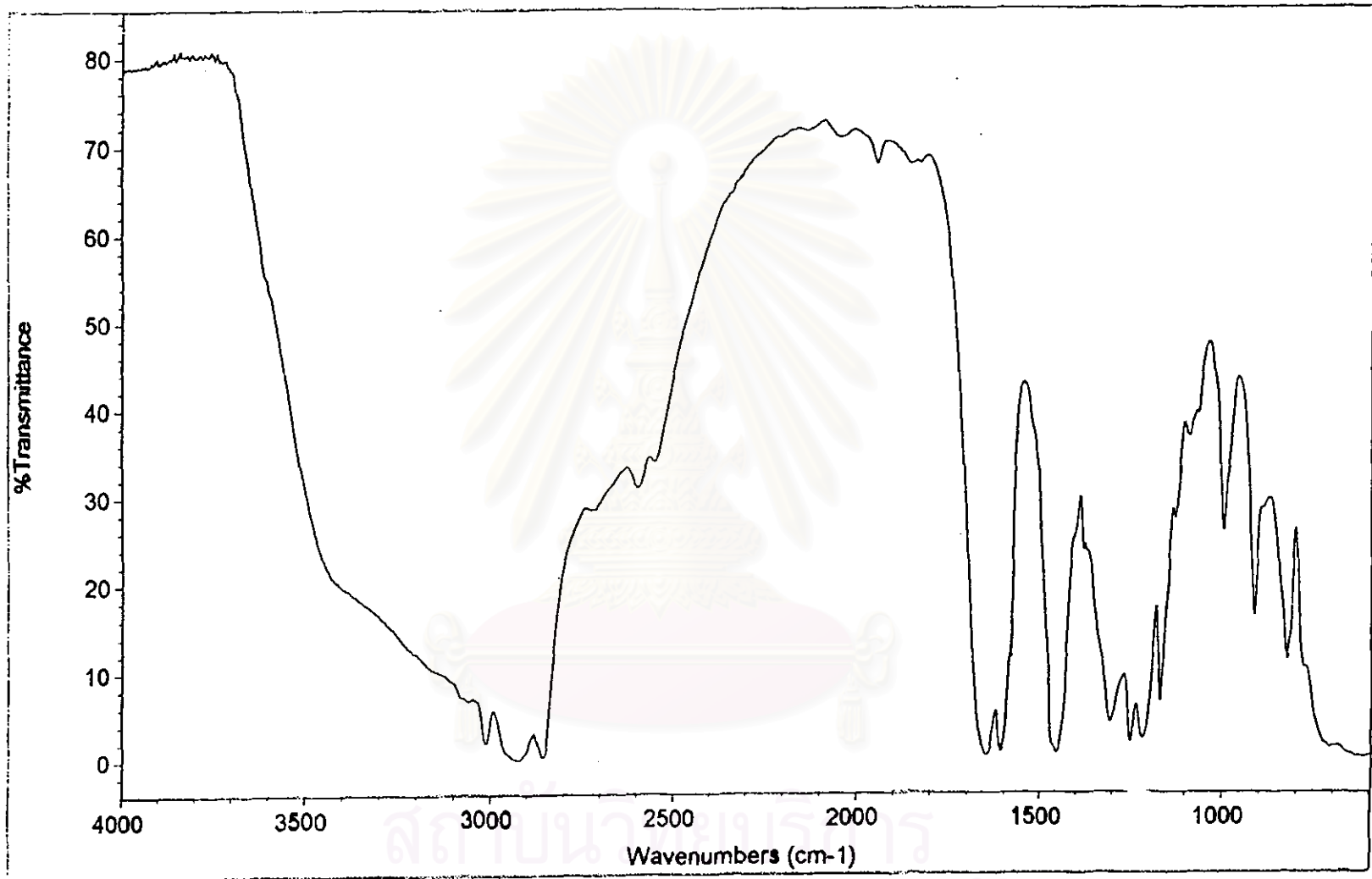


Figure 2-1: The FT-IR spectrum of CNSL

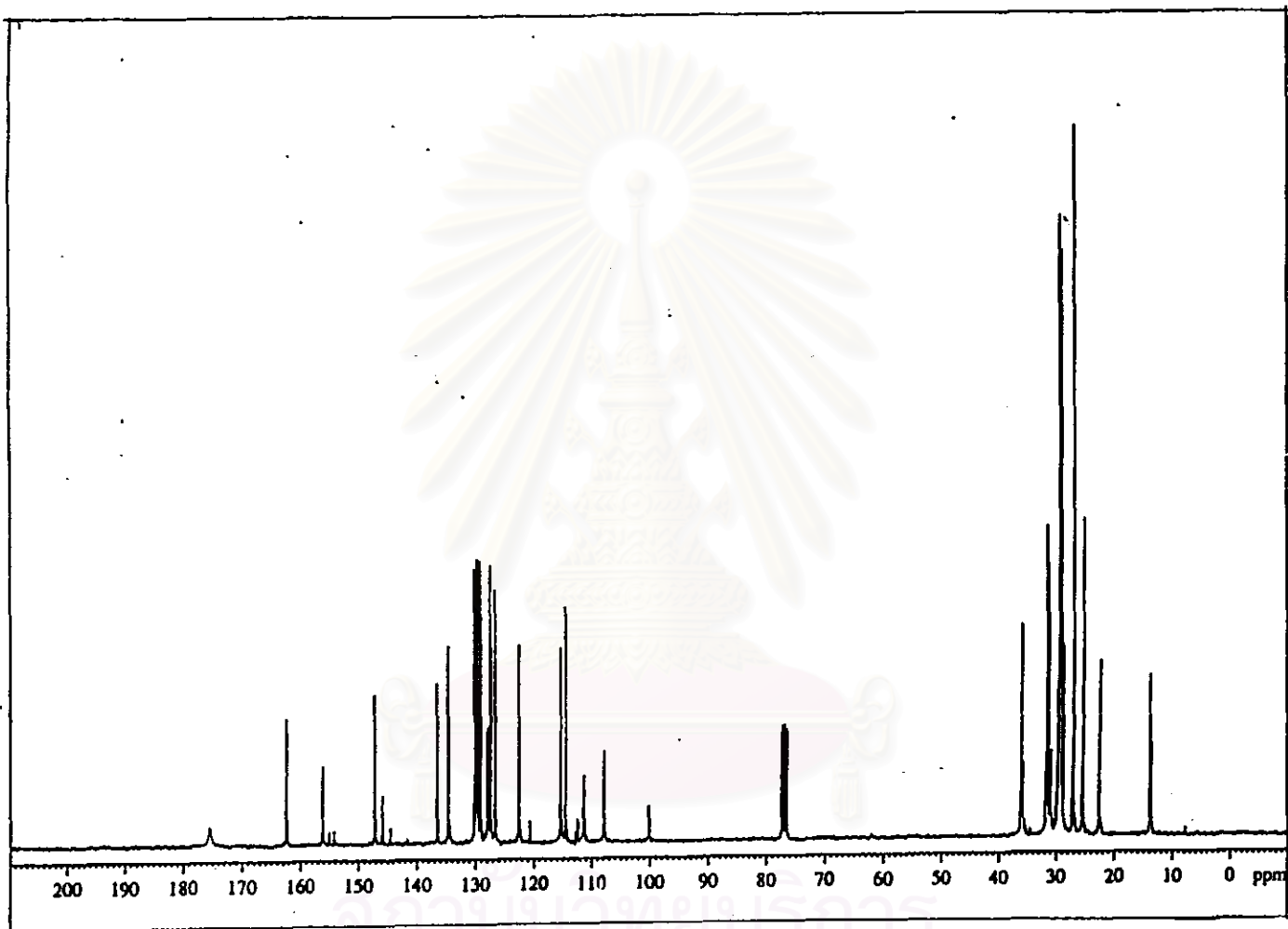


Figure 2-2: The ^{13}C -NMR spectrum of CNSL

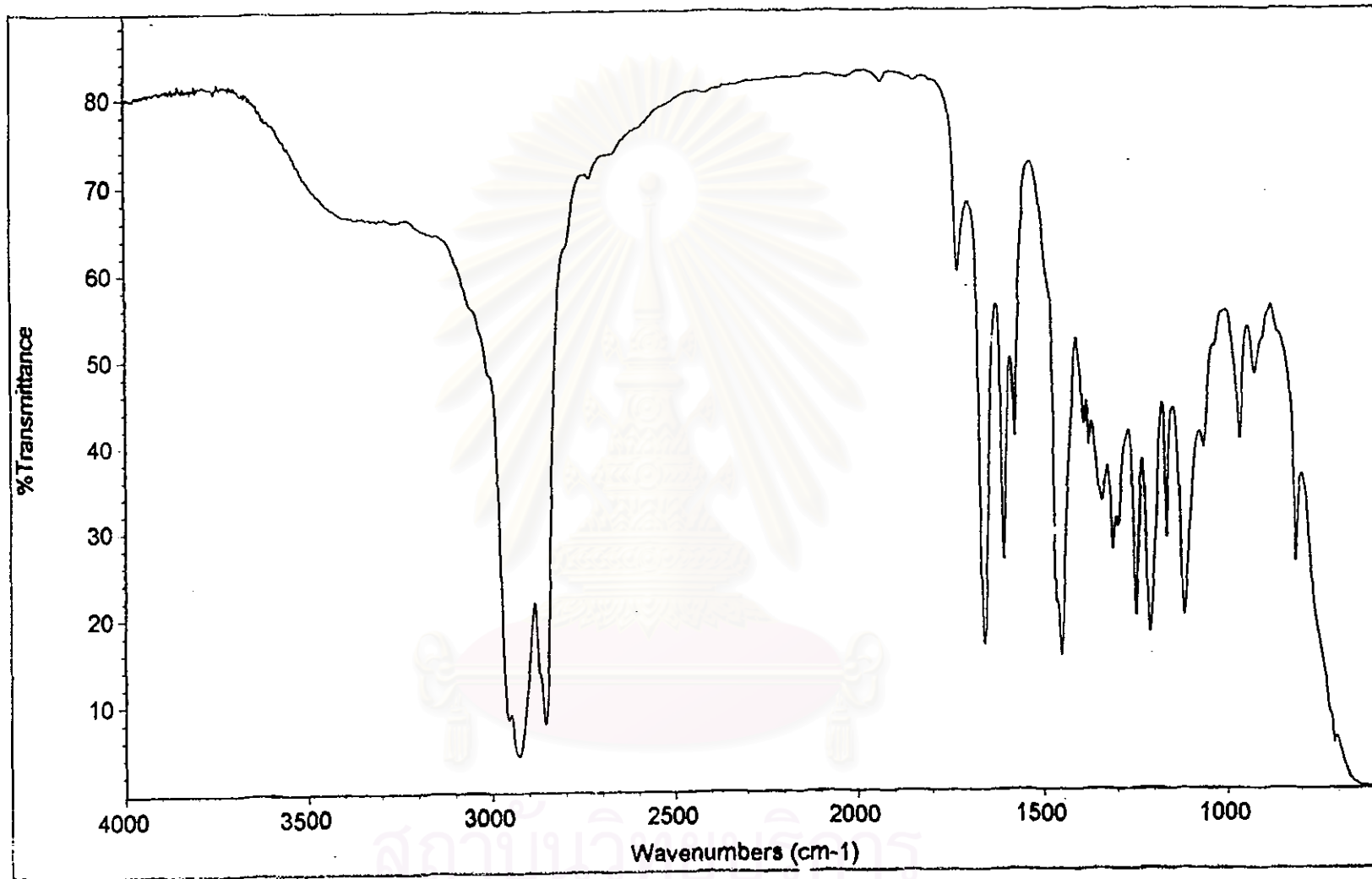


Figure 3-1: The FT-IR spectrum of esterified-CNSL

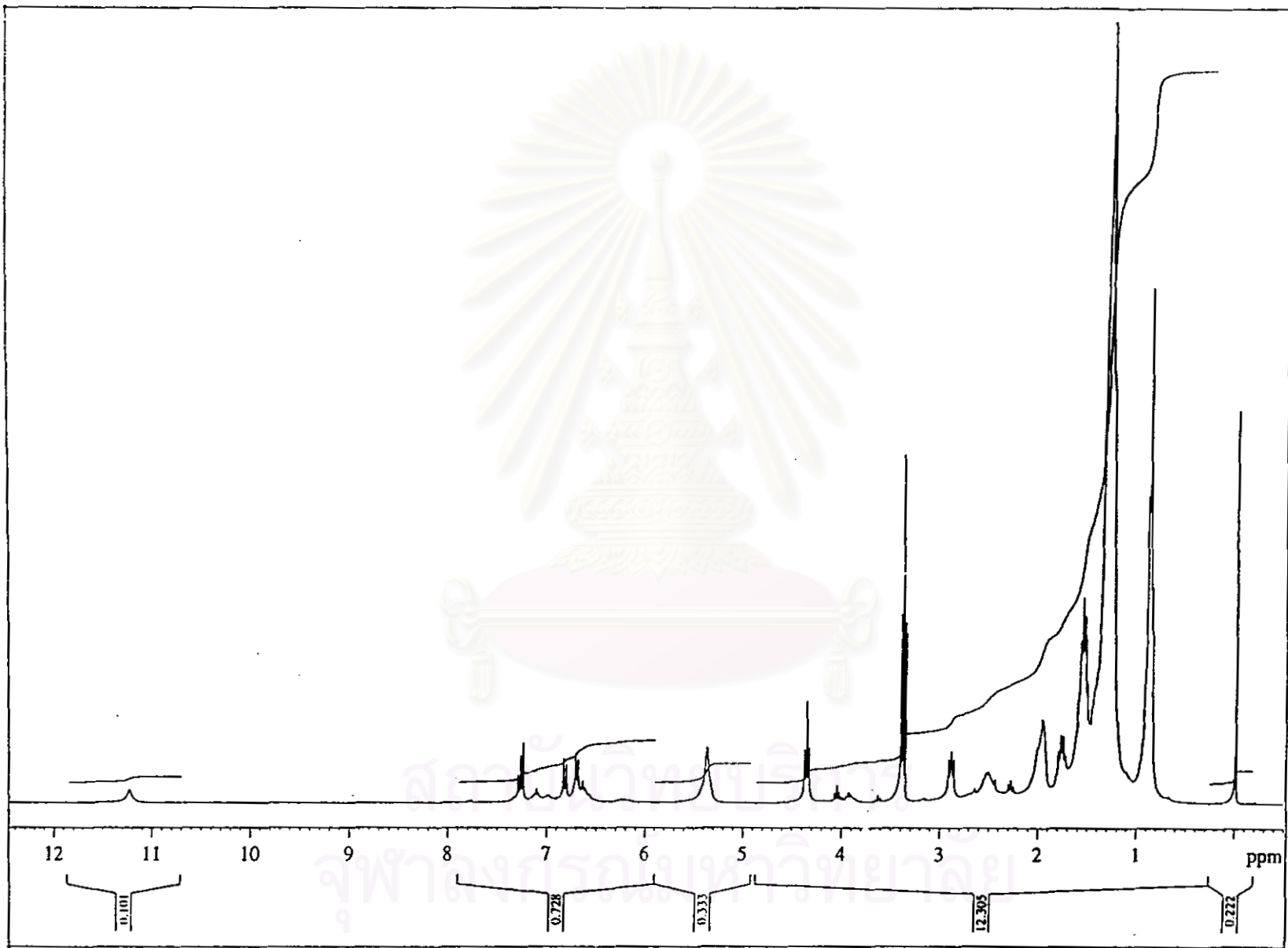


Figure 3-2: The $^1\text{H-NMR}$ spectrum of esterified-CNSL

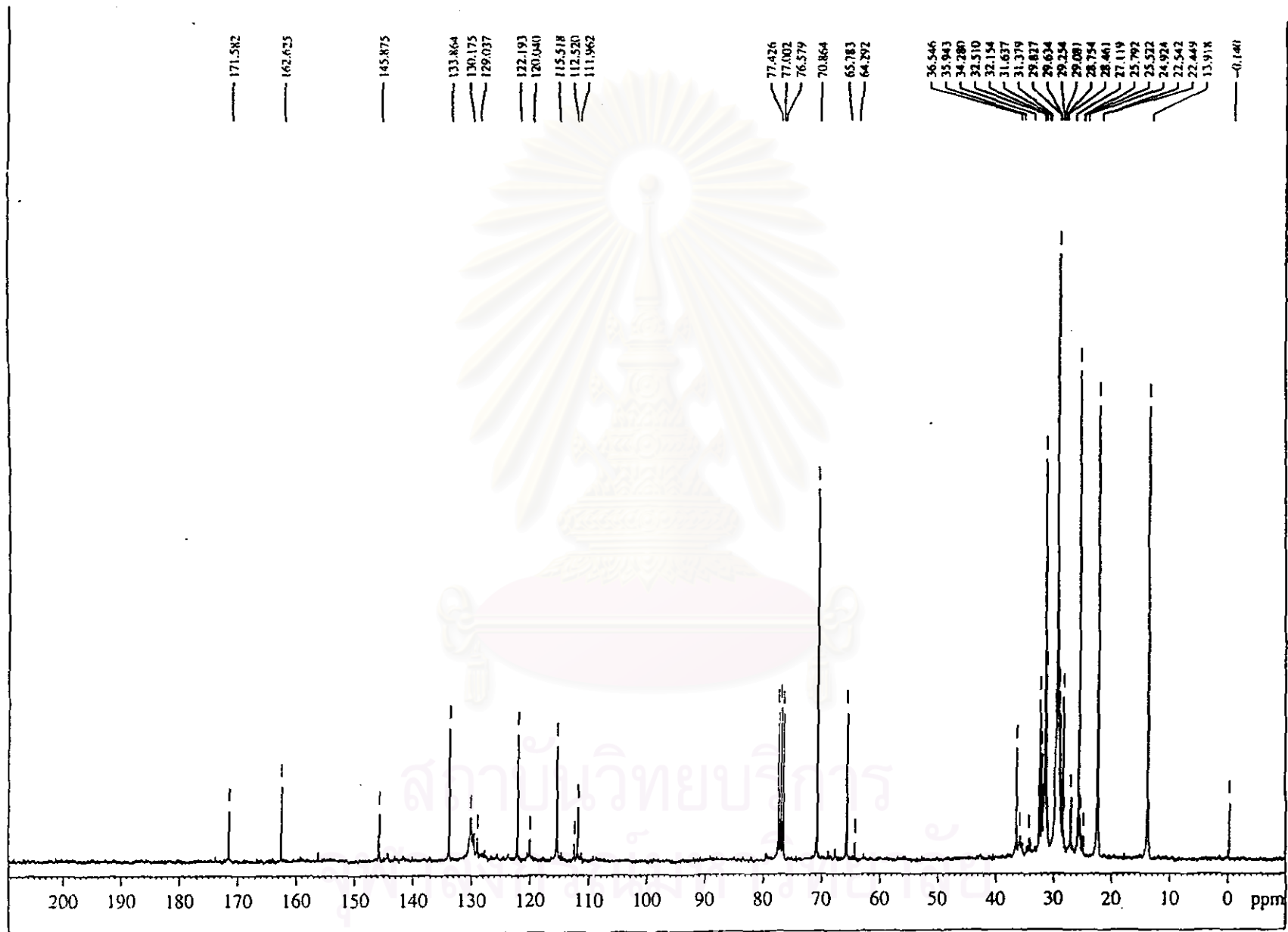


Figure 3-3: The ^{13}C -NMR spectrum of esterified-CNSL

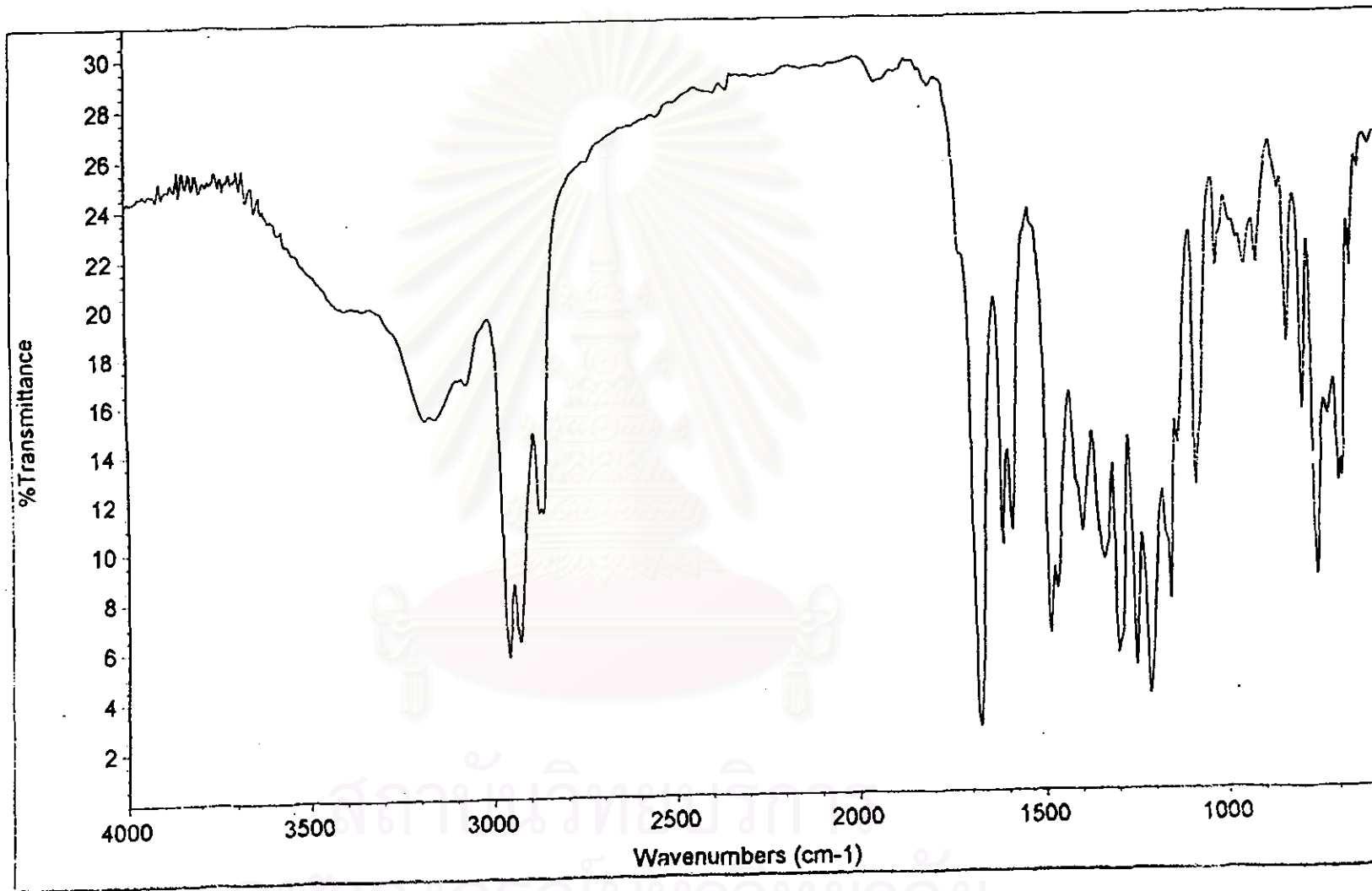


Figure 4-1: The FT-IR spectrum of marker dye 1

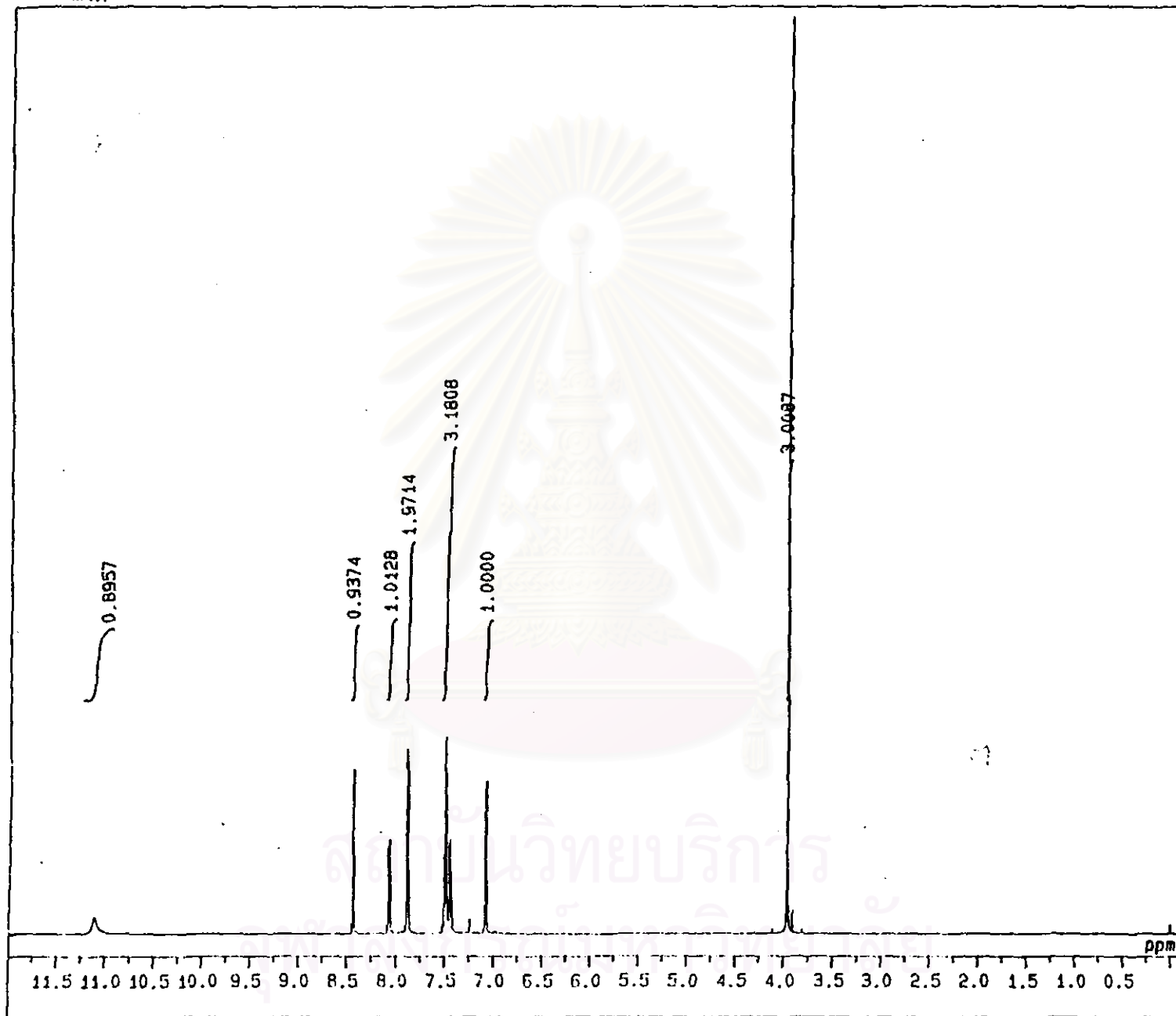


Figure 4-2: The $^1\text{H-NMR}$ spectrum of marker dye 1

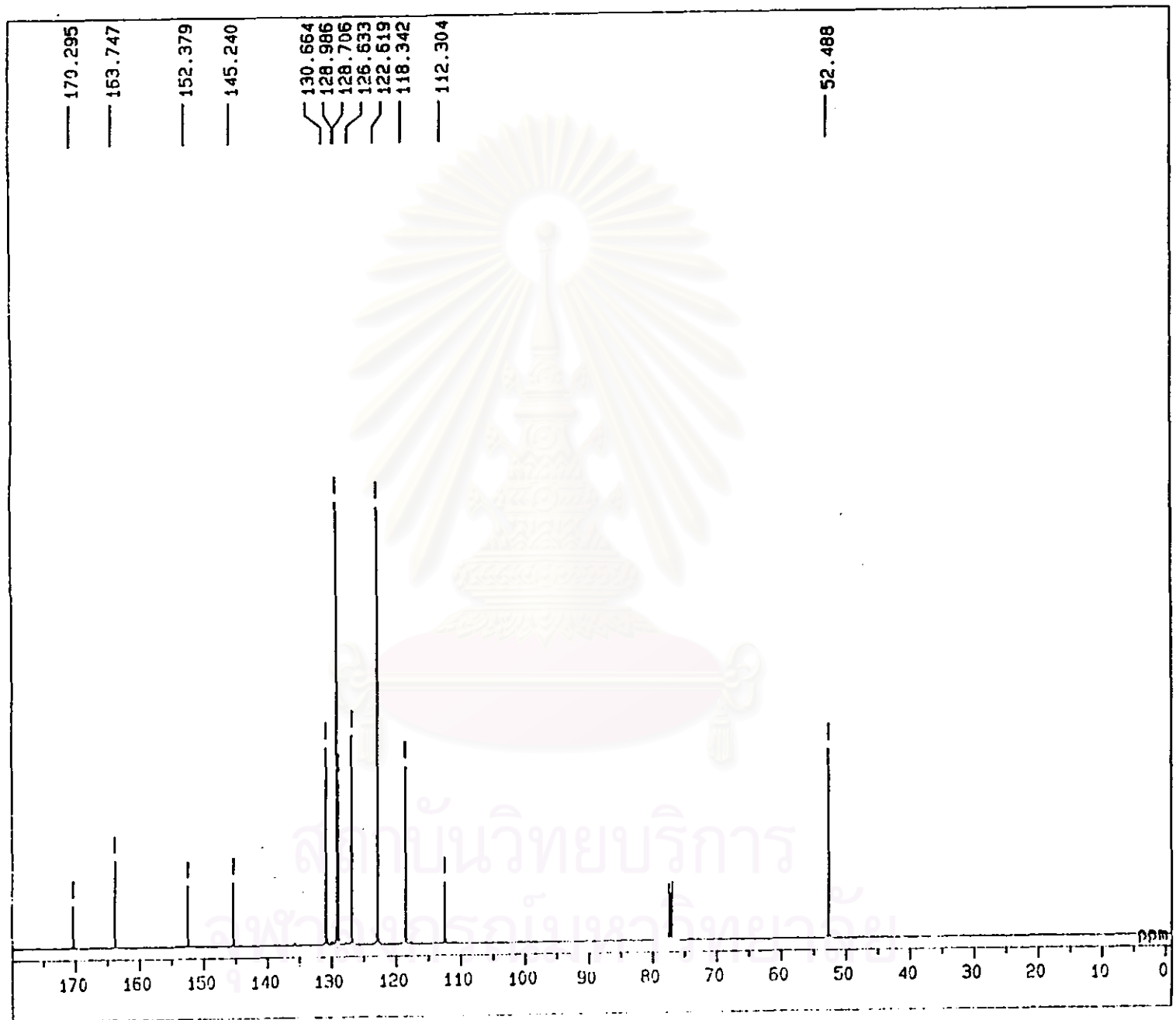


Figure 4-3: The ^{13}C -NMR spectrum of marker dye 1

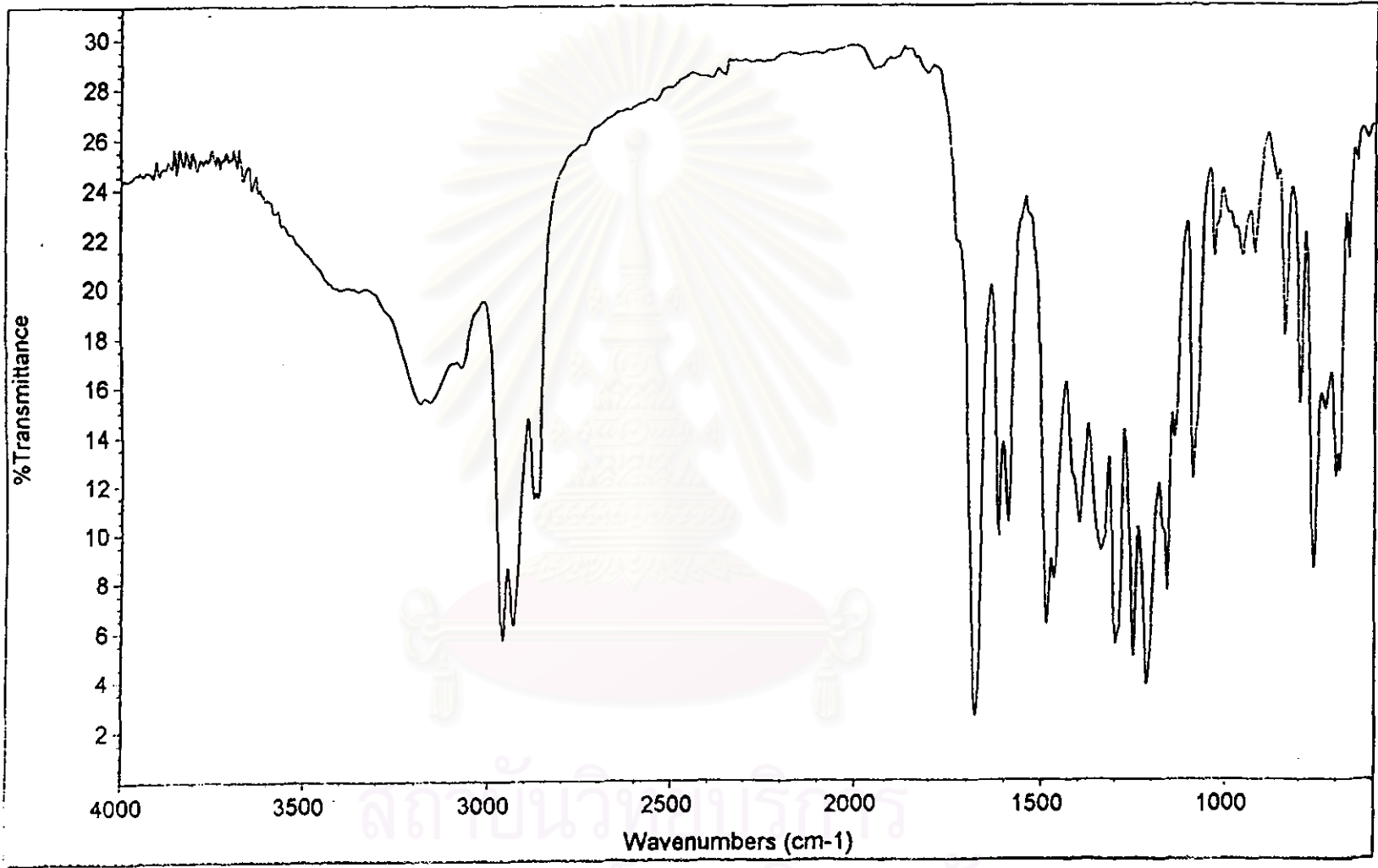


Figure 5-1: The FT-IR spectrum of marker dye 2

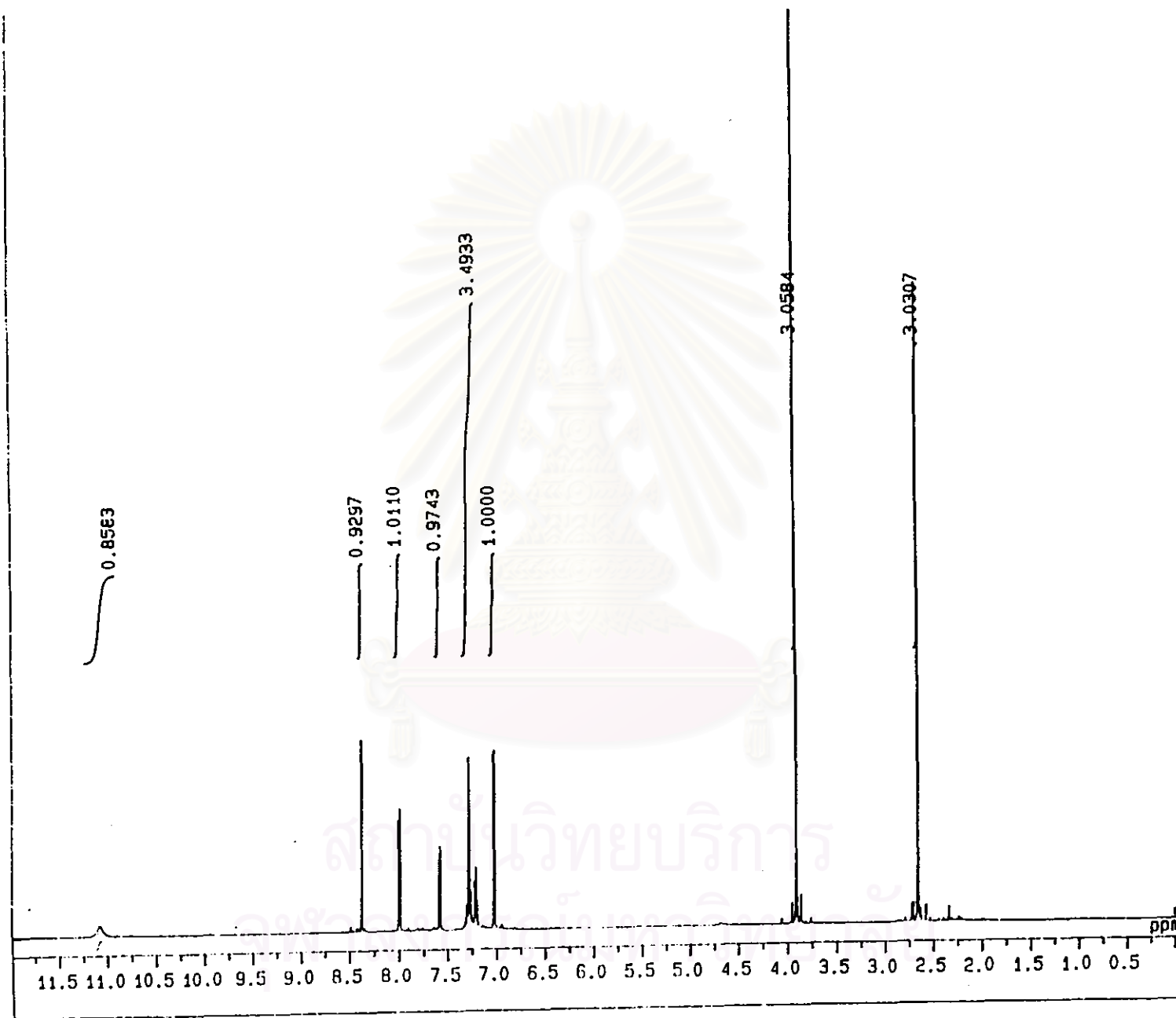


Figure 5-2: The $^1\text{H-NMR}$ spectrum of marker dye 2

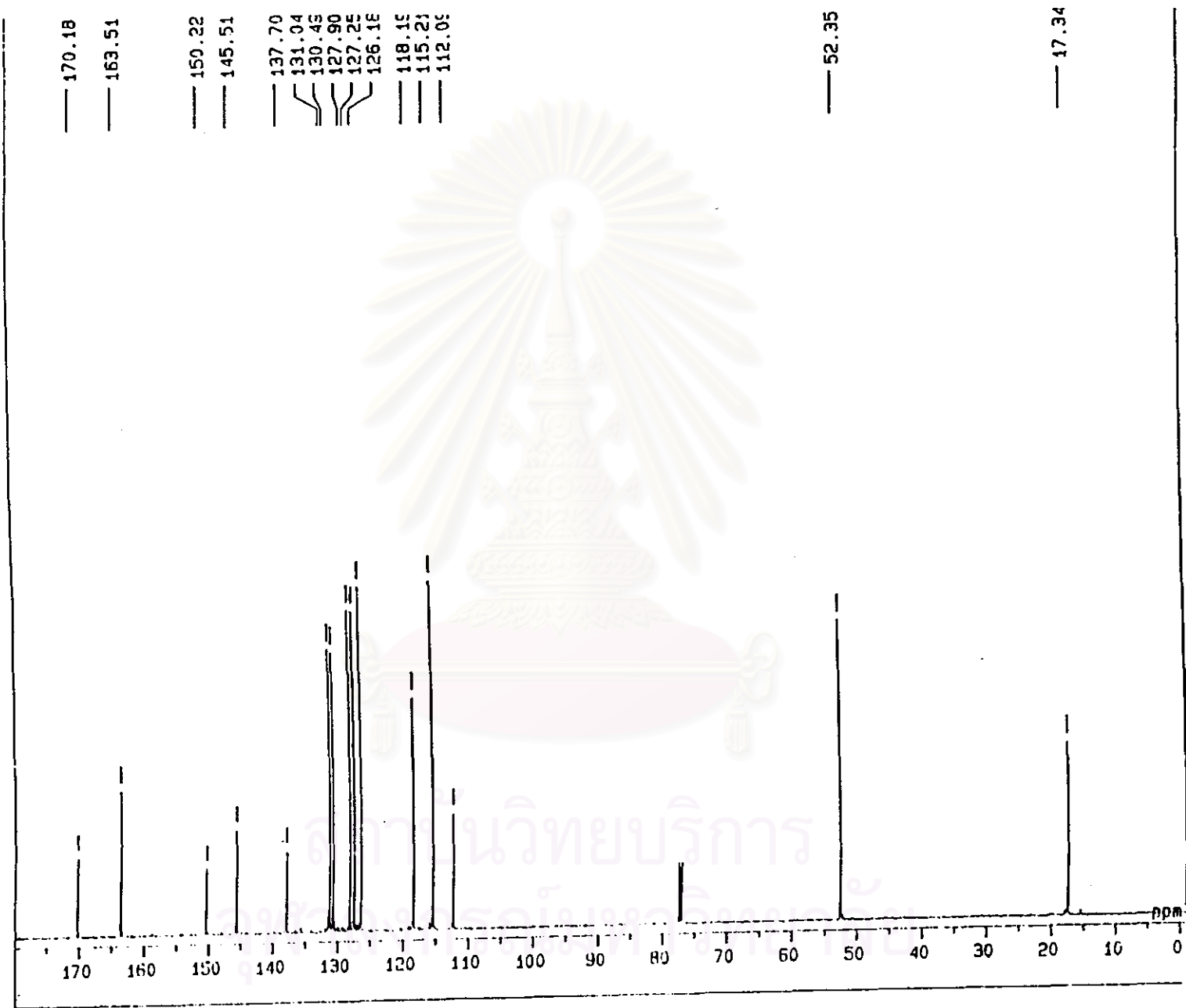


Figure 5-3: The ^{13}C -NMR spectrum of marker dye 2

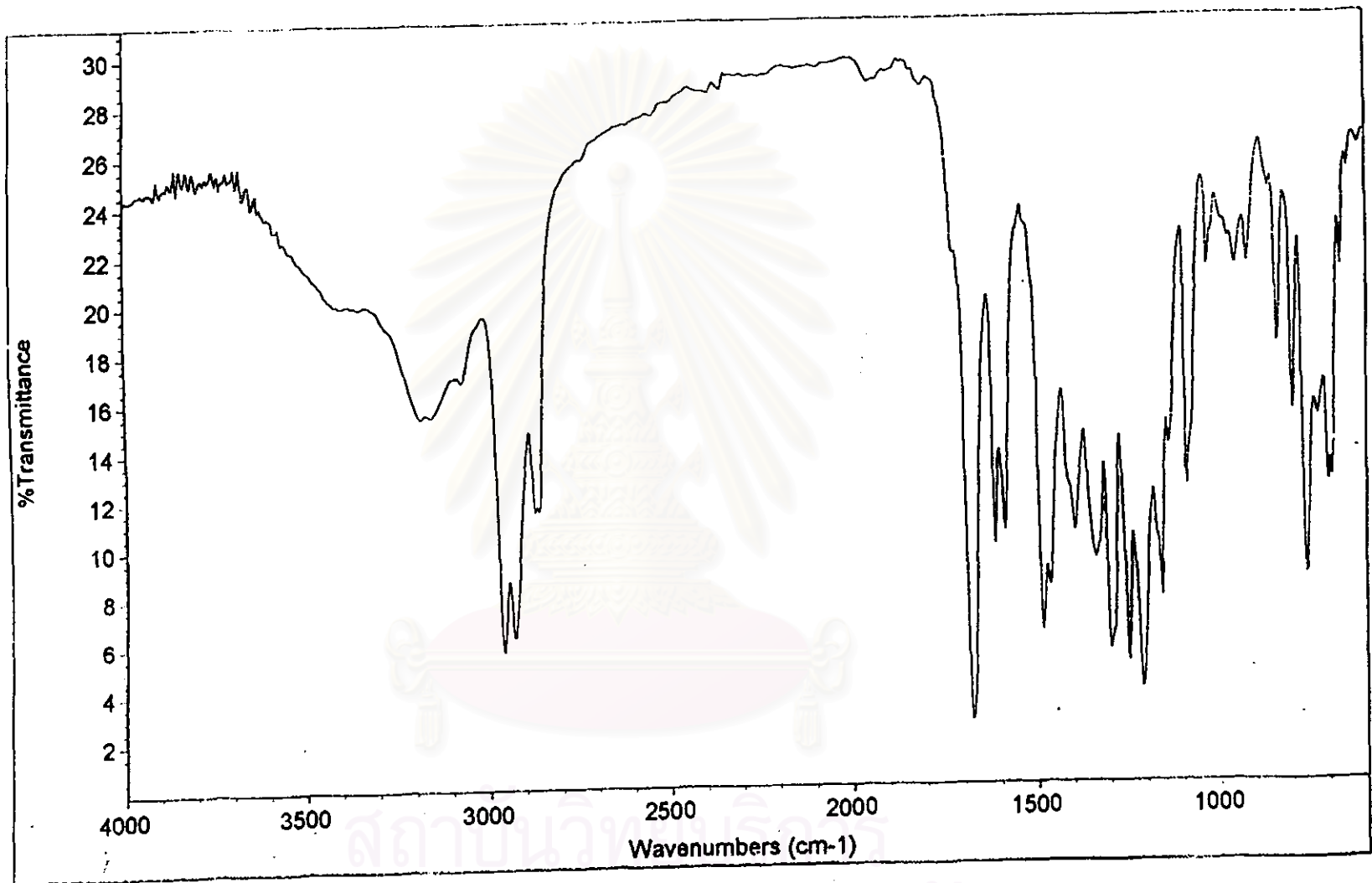


Figure 6-1: The FT-IR spectrum of marker dye 3

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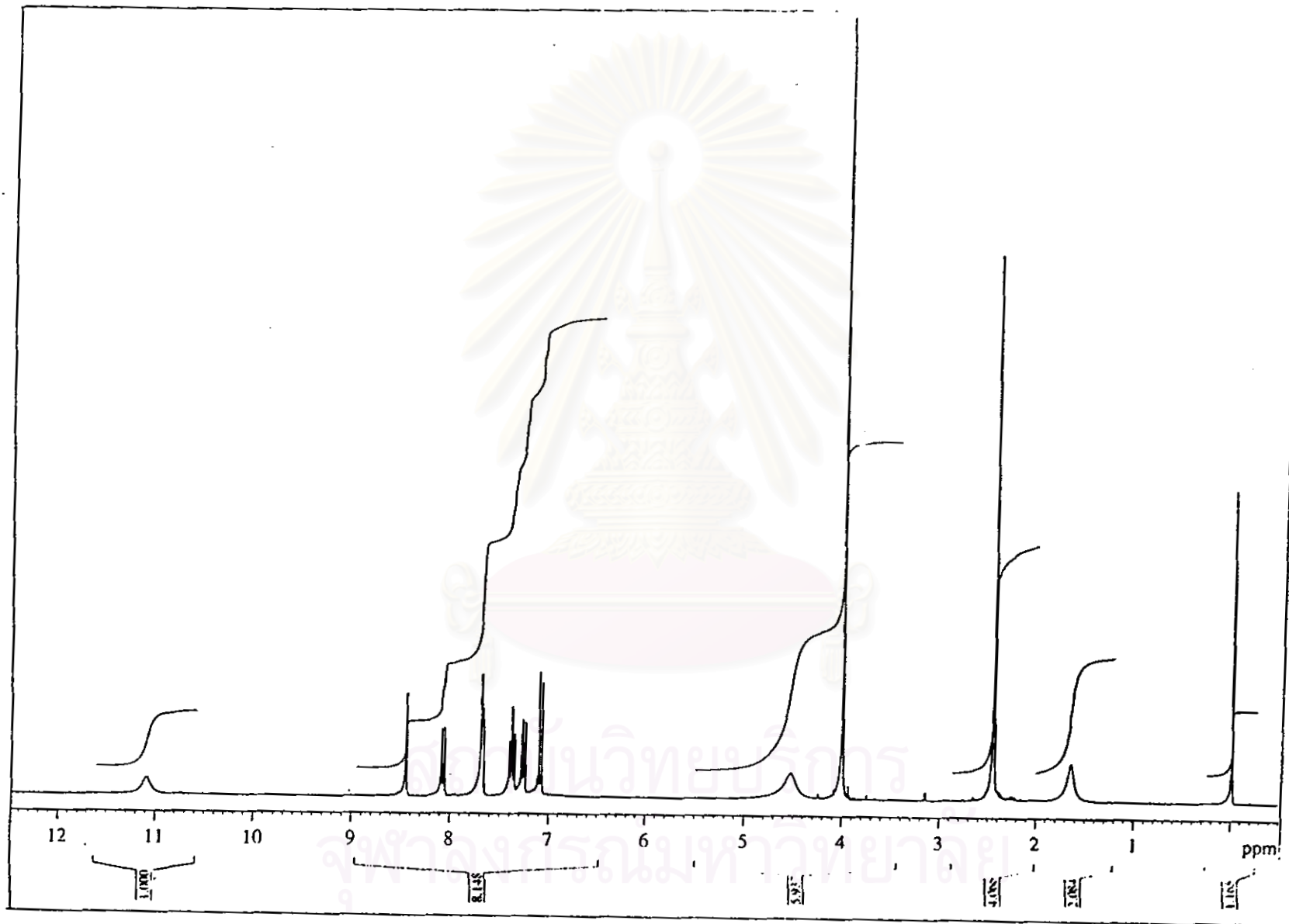


Figure 6-2: The $^1\text{H-NMR}$ spectrum of marker dye 3

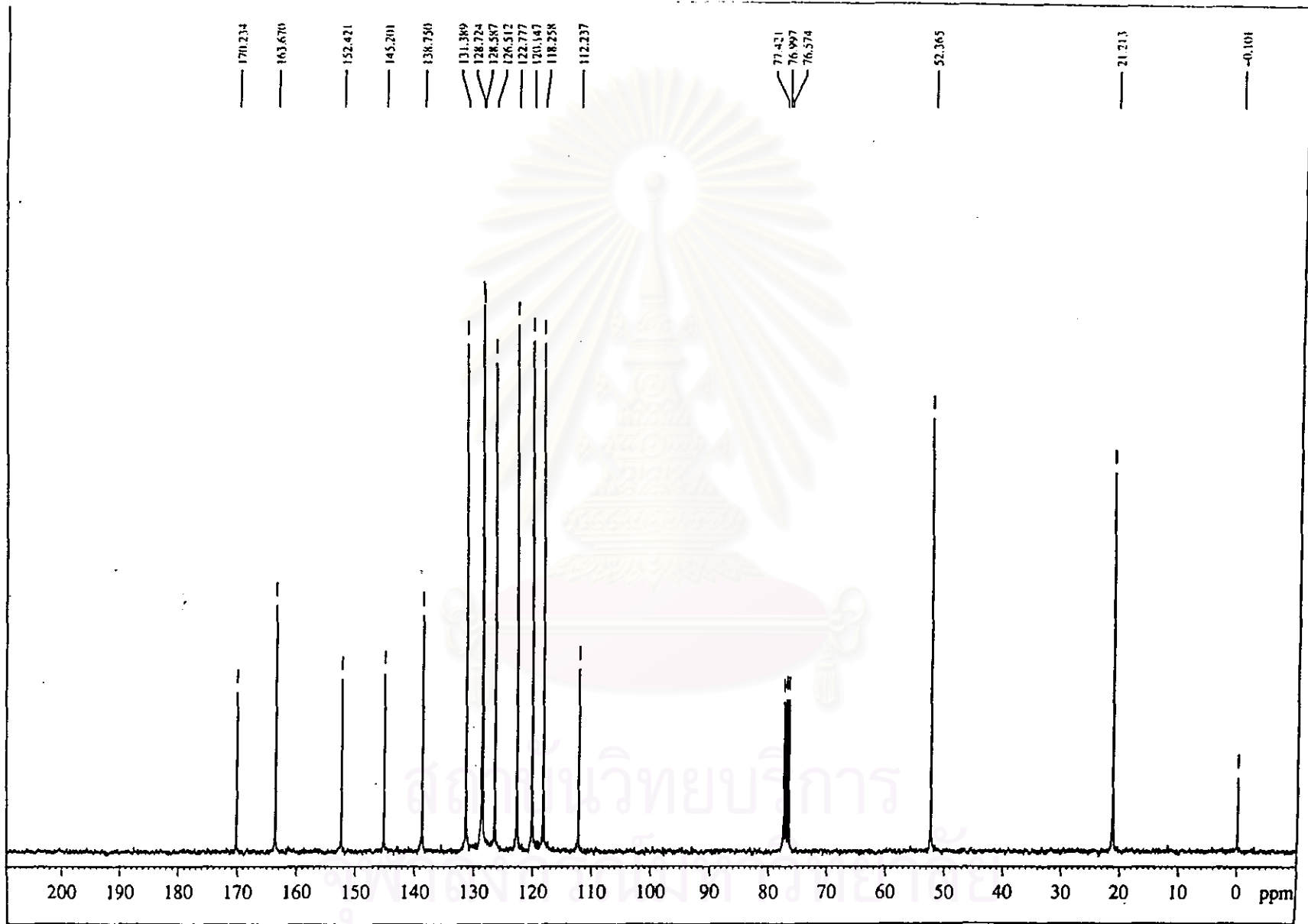


Figure 6-3: The ^{13}C -NMR spectrum of marker dye 3

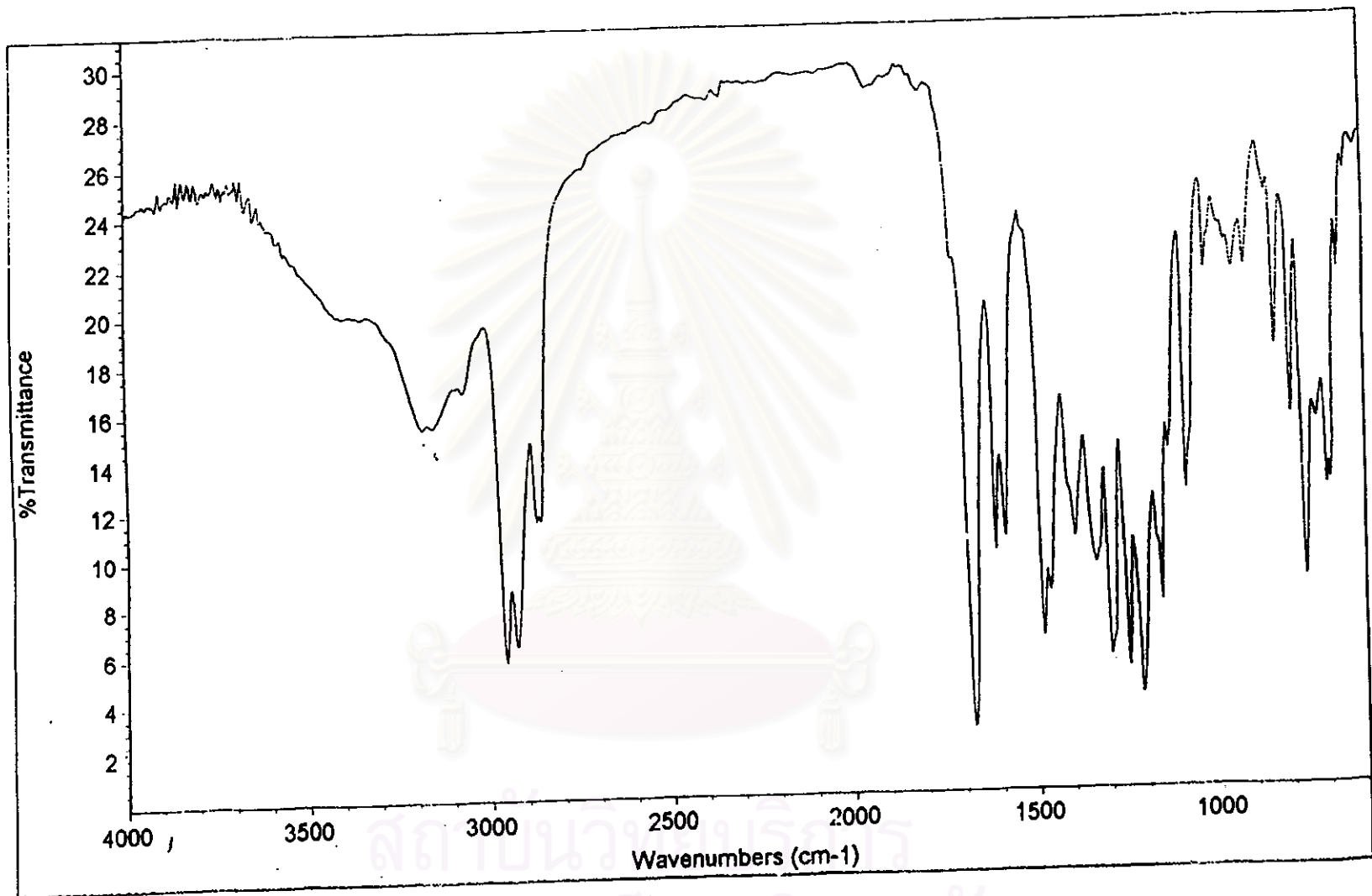


Figure 7-1: The FT-IR spectrum of marker dye 4

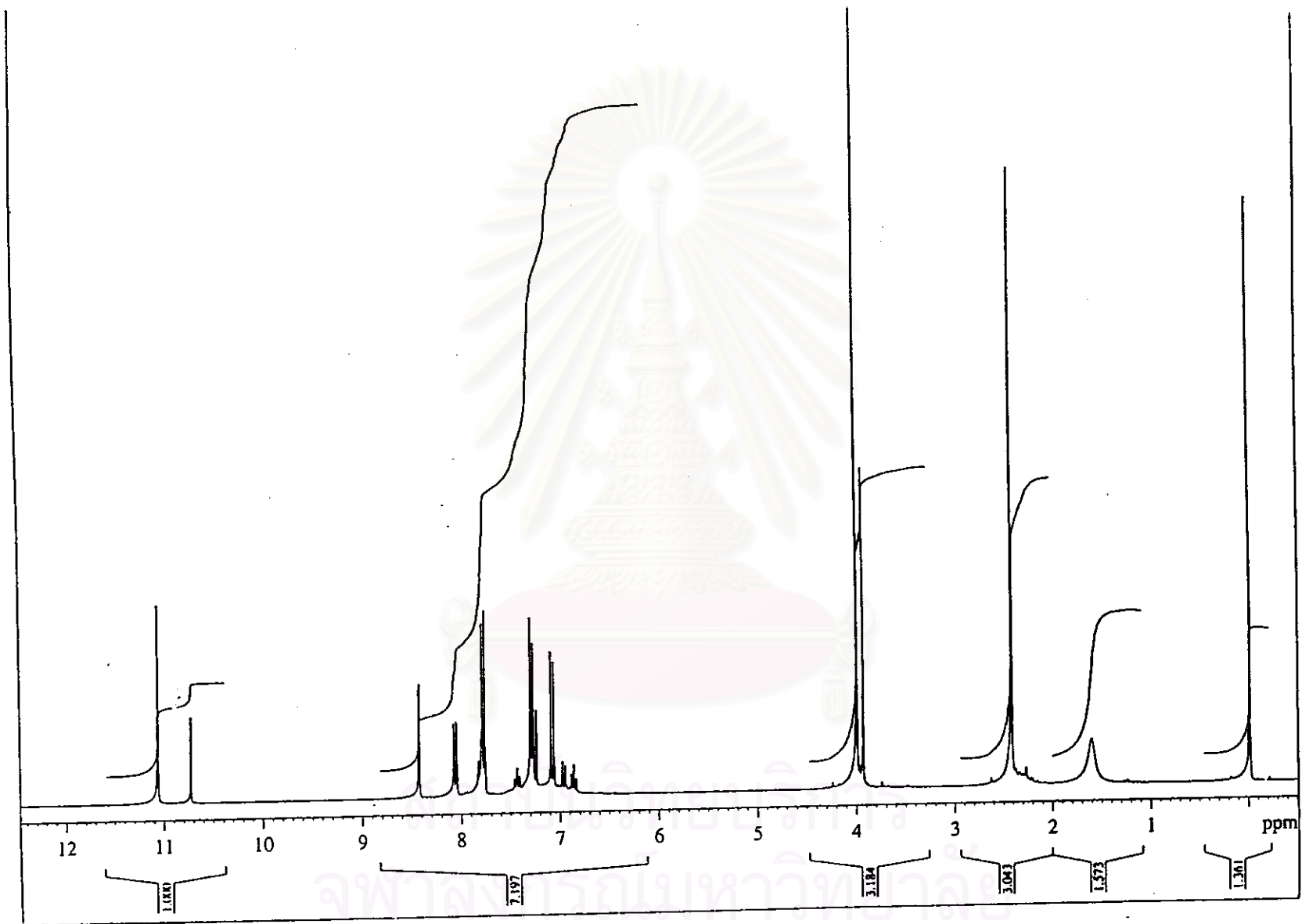


Figure 7-2: The $^1\text{H-NMR}$ spectrum of marker dye 4

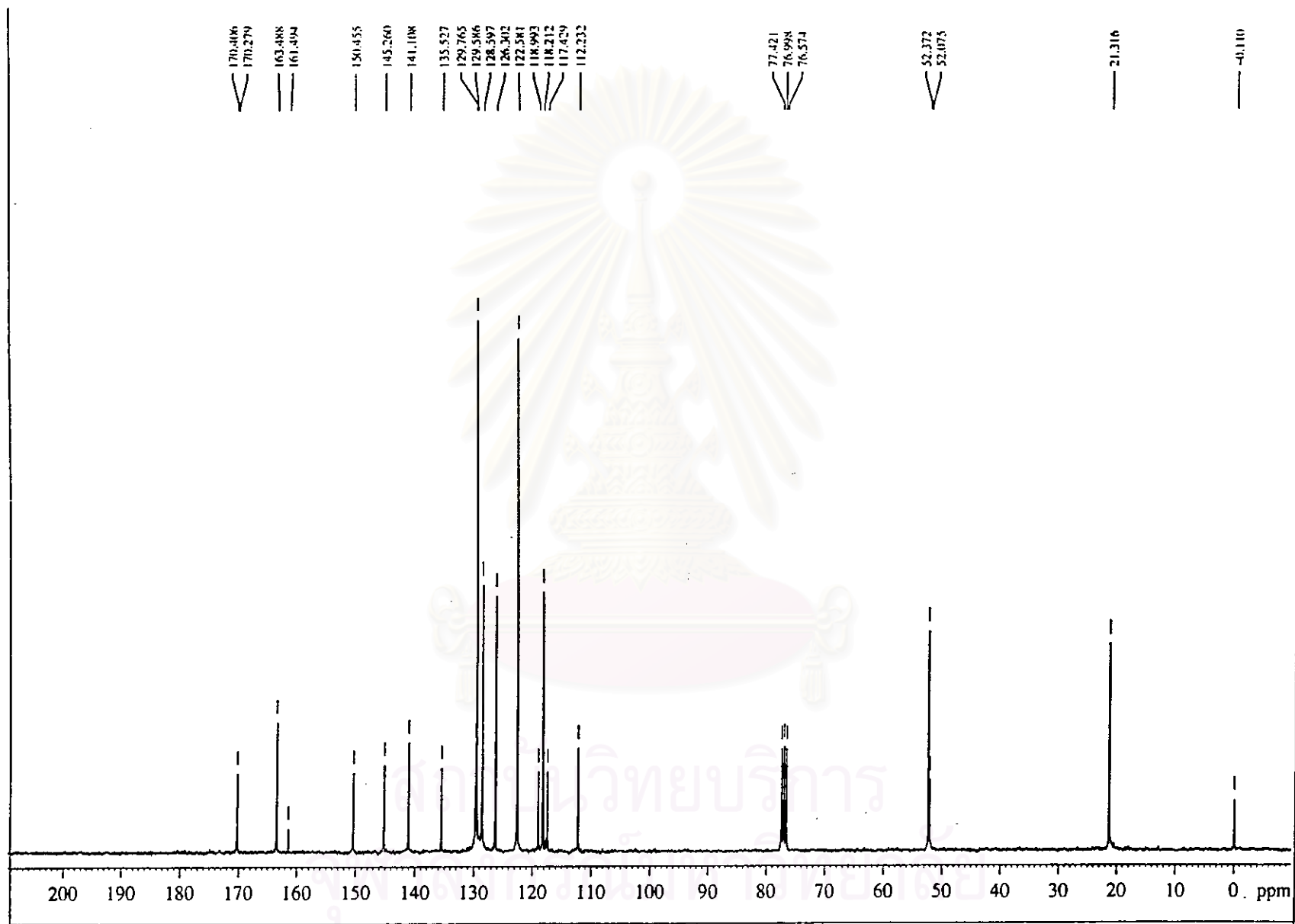


Figure 7-3: The ^{13}C -NMR spectrum of marker dye 4

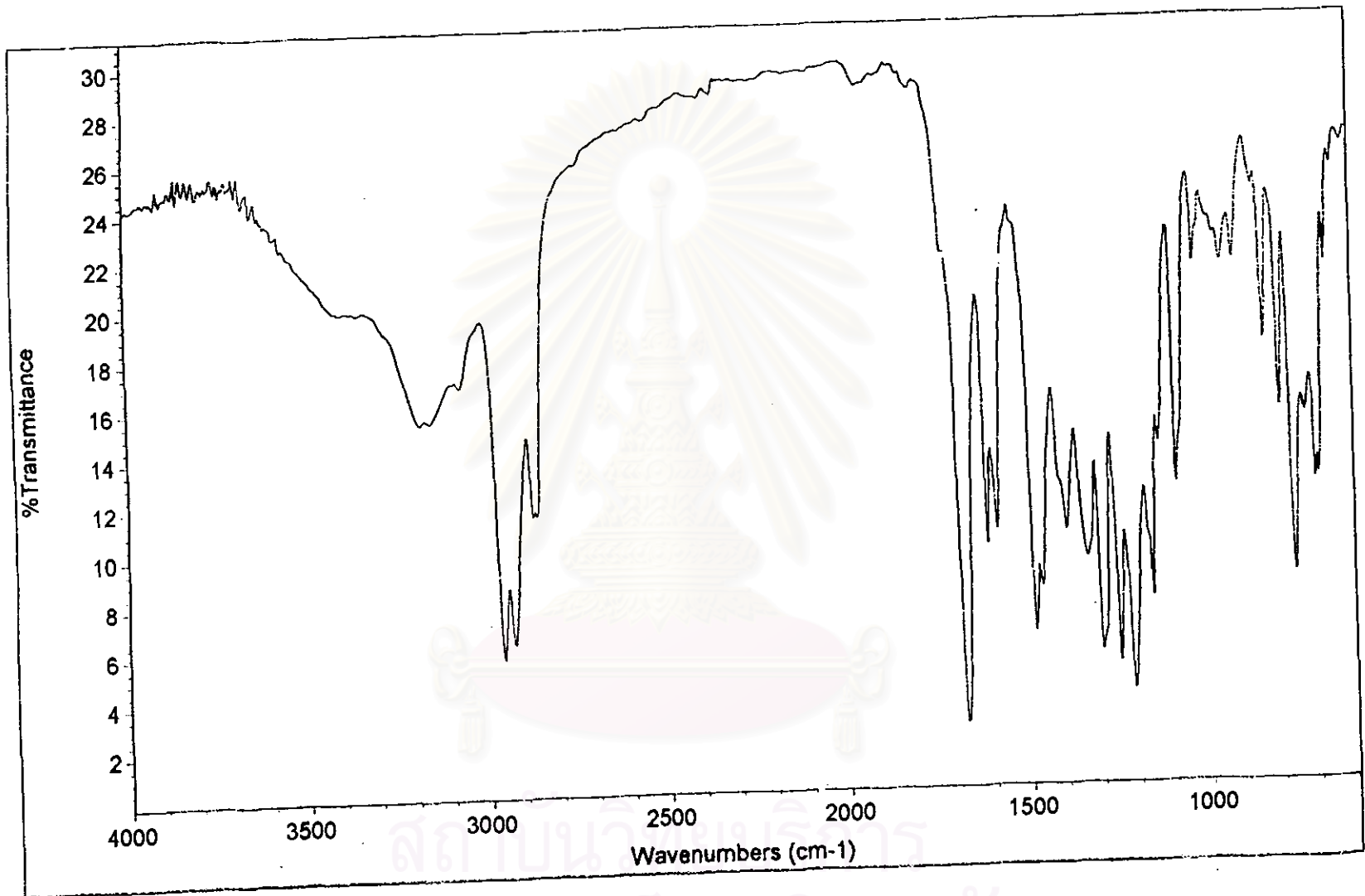


Figure 8-1: The FT-IR spectrum of marker dye 5

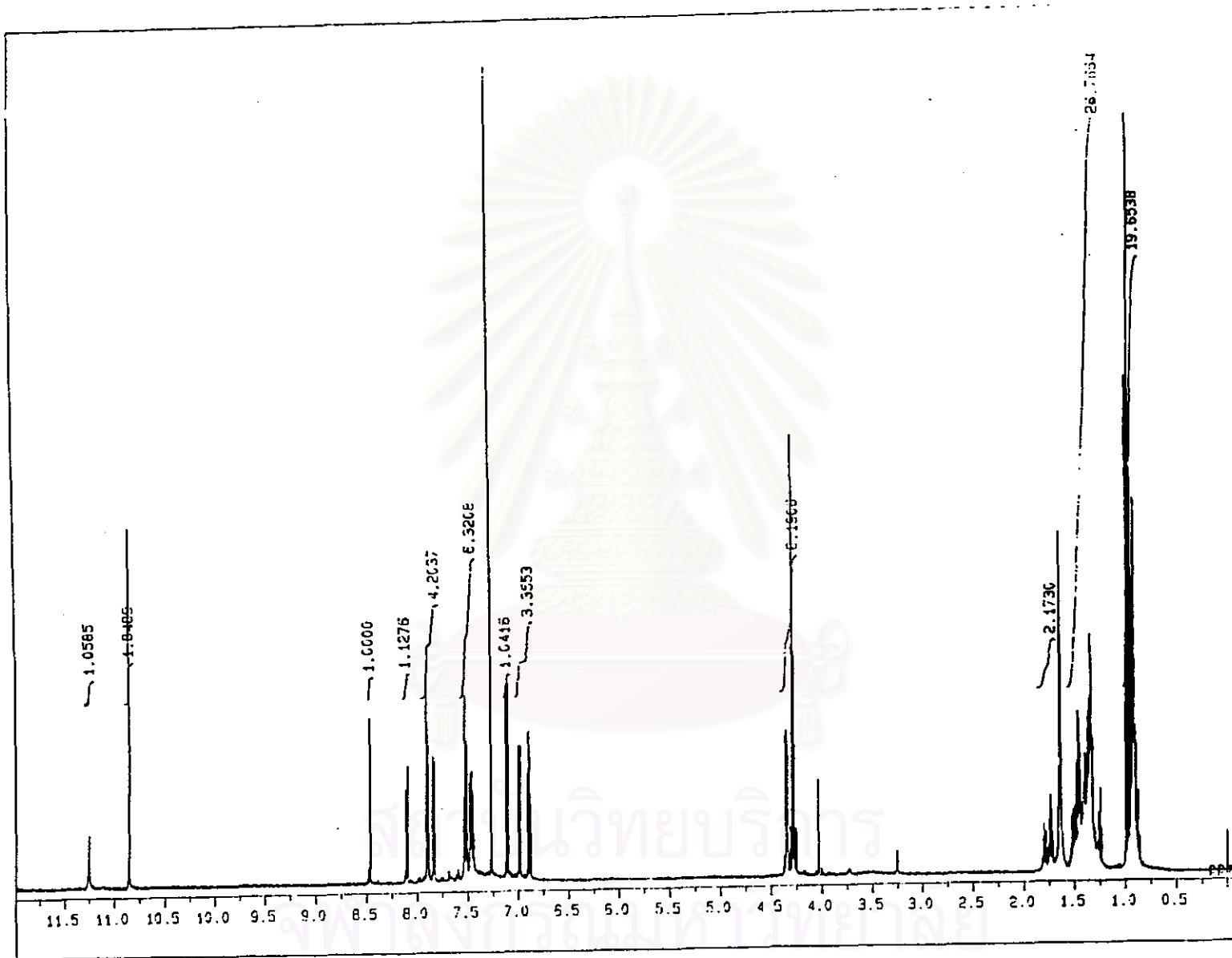


Figure 8-2: The $^1\text{H-NMR}$ spectrum of marker dye 5

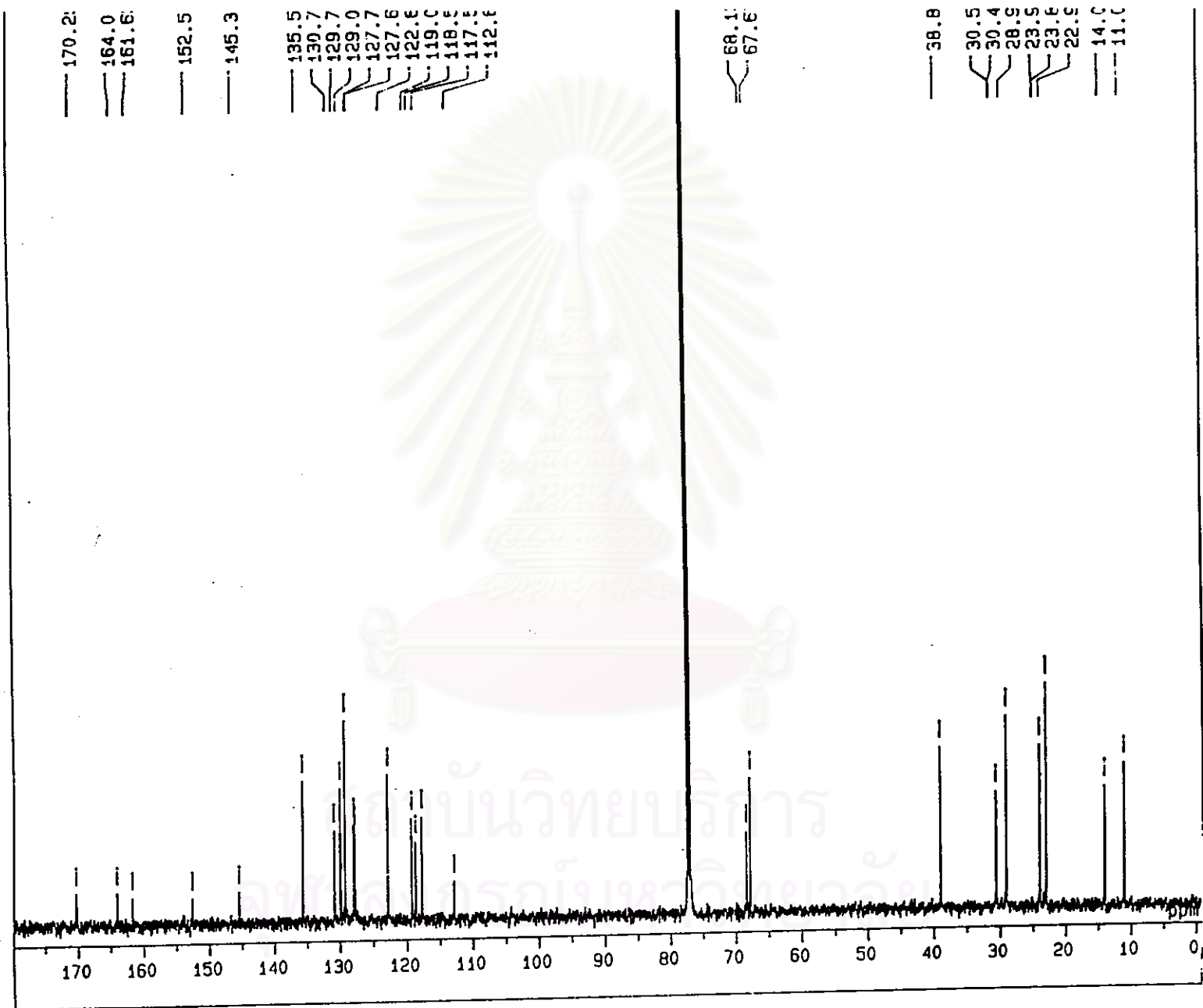


Figure 8-3: The ^{13}C -NMR spectrum of marker dye 5

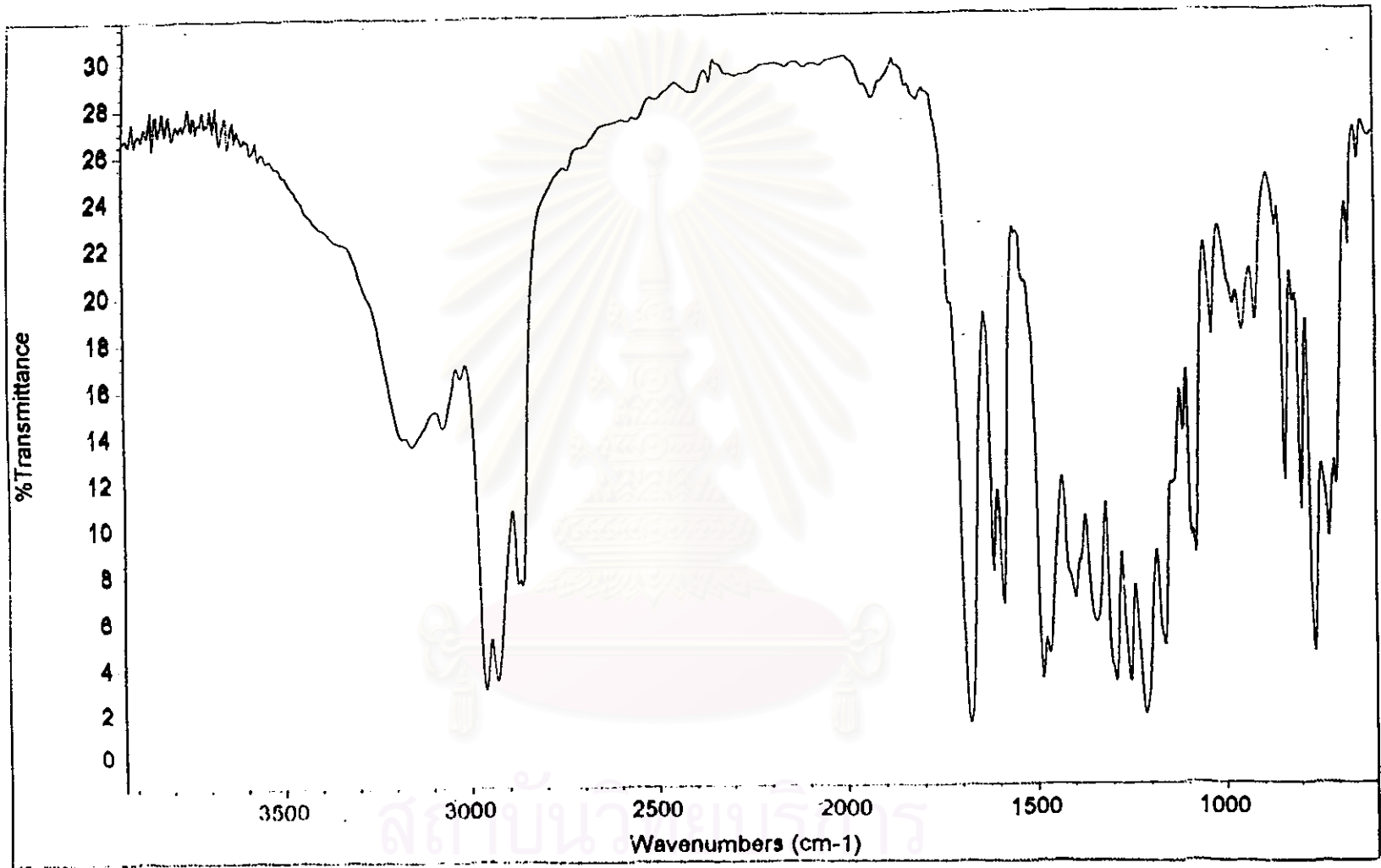


Figure 9-1: The FT-IR spectrum of marker dye 6

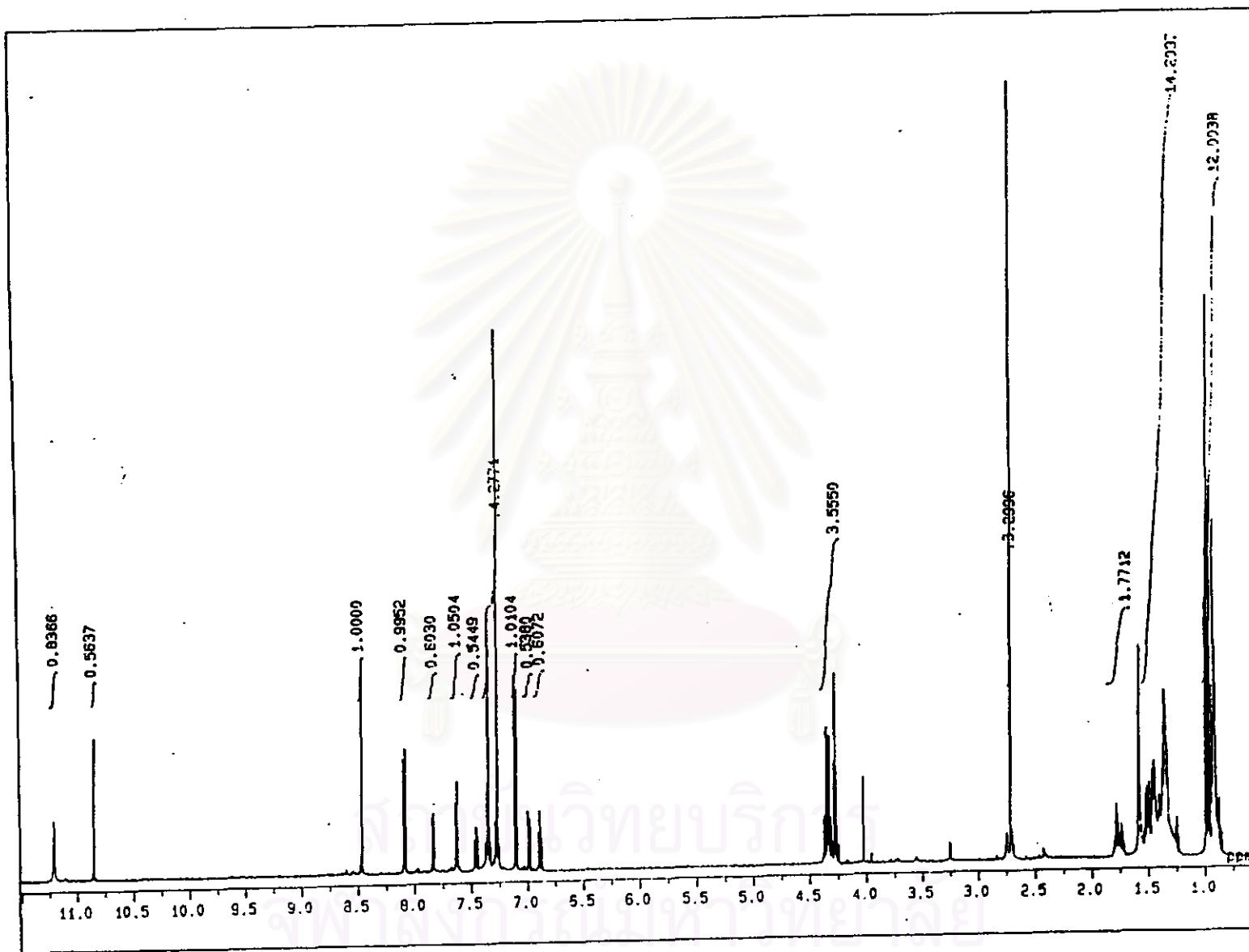


Figure 9-2: The $^1\text{H-NMR}$ spectrum of marker dye 6

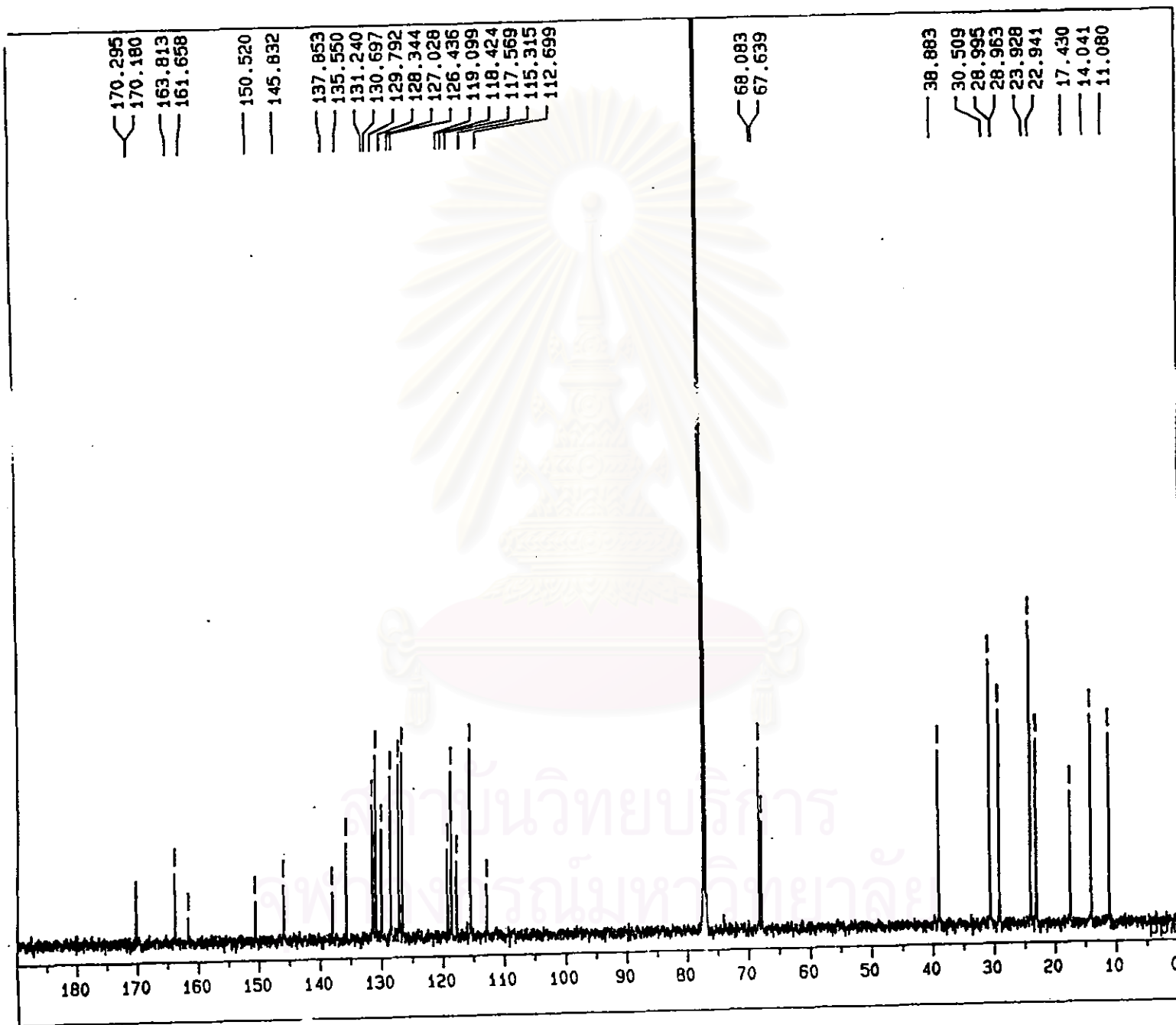


Figure 9-3: The ^{13}C -NMR spectrum of marker dye 6

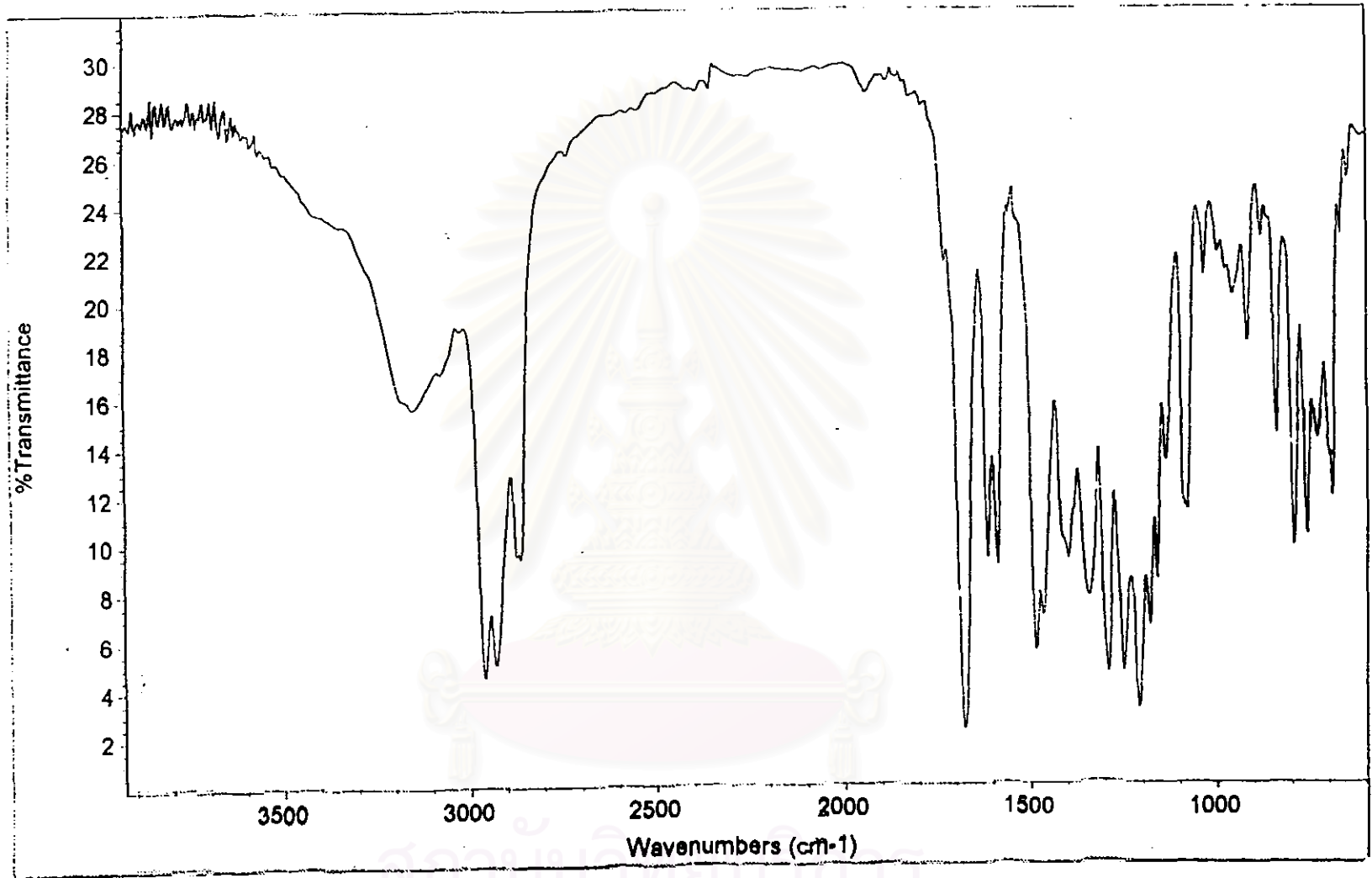


Figure 10-1: The FT-IR spectrum of marker dye 7

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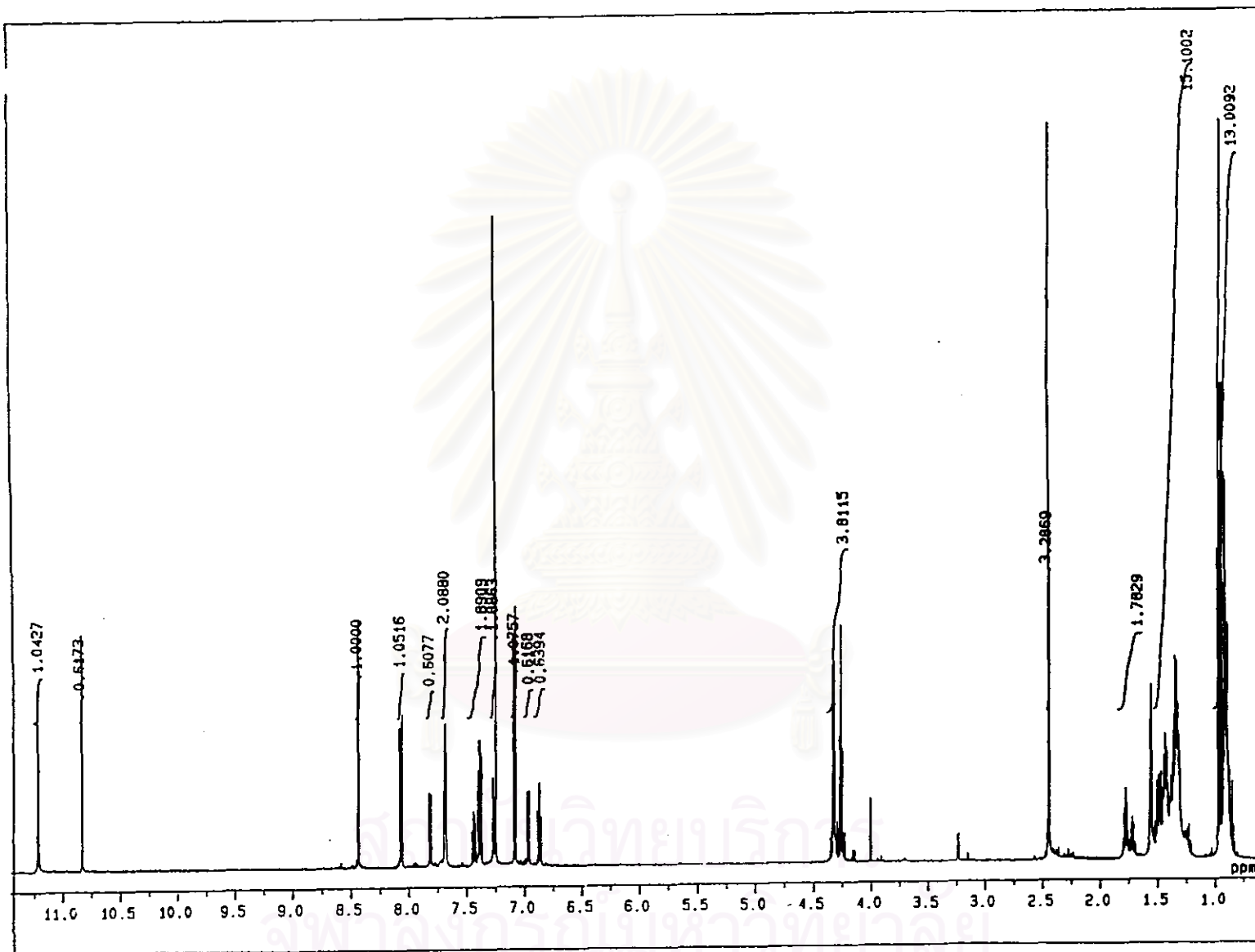
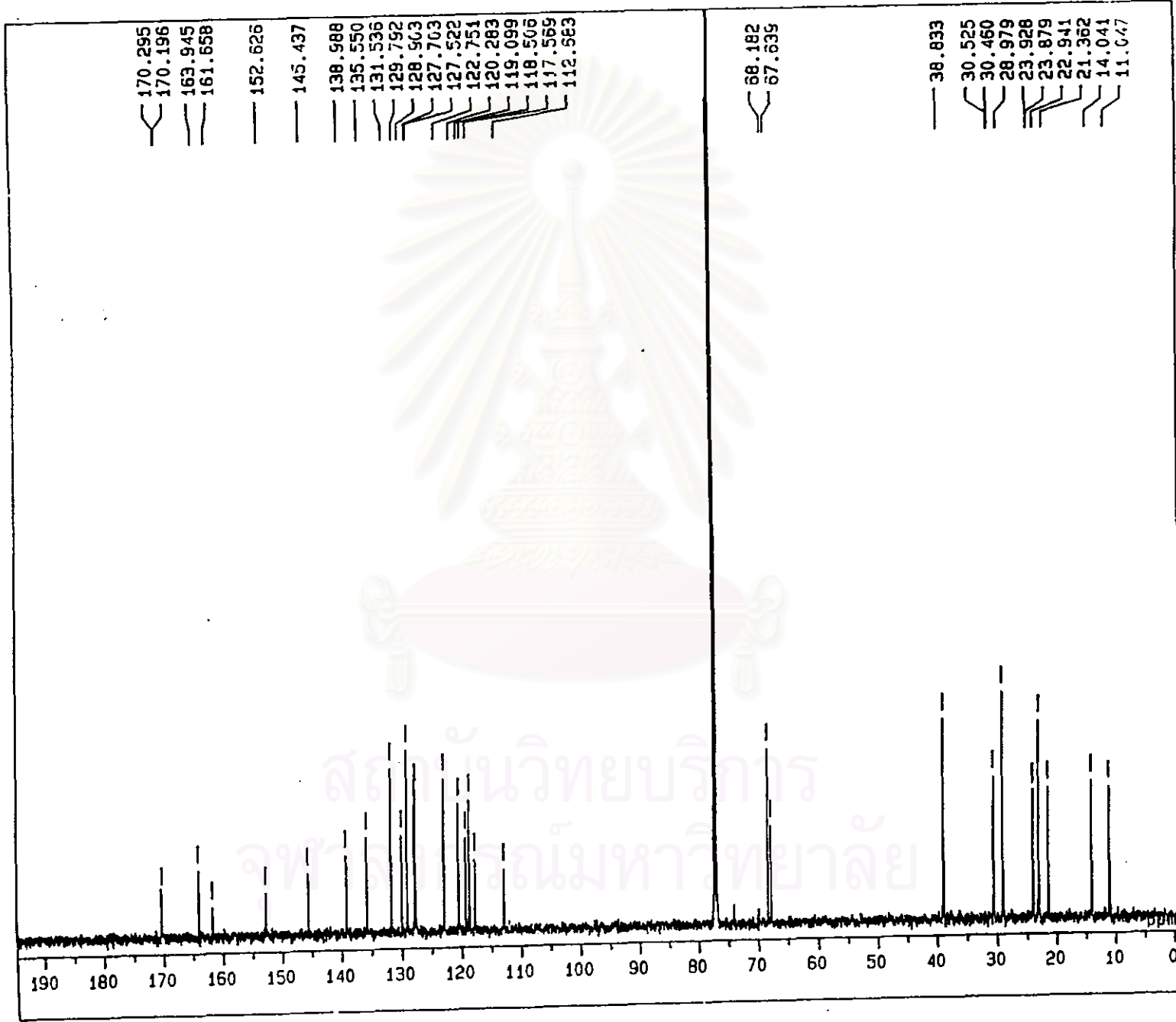


Figure 10-2: The $^1\text{H-NMR}$ spectrum of marker dye 7



13C NMR spectrum of marker dye 7

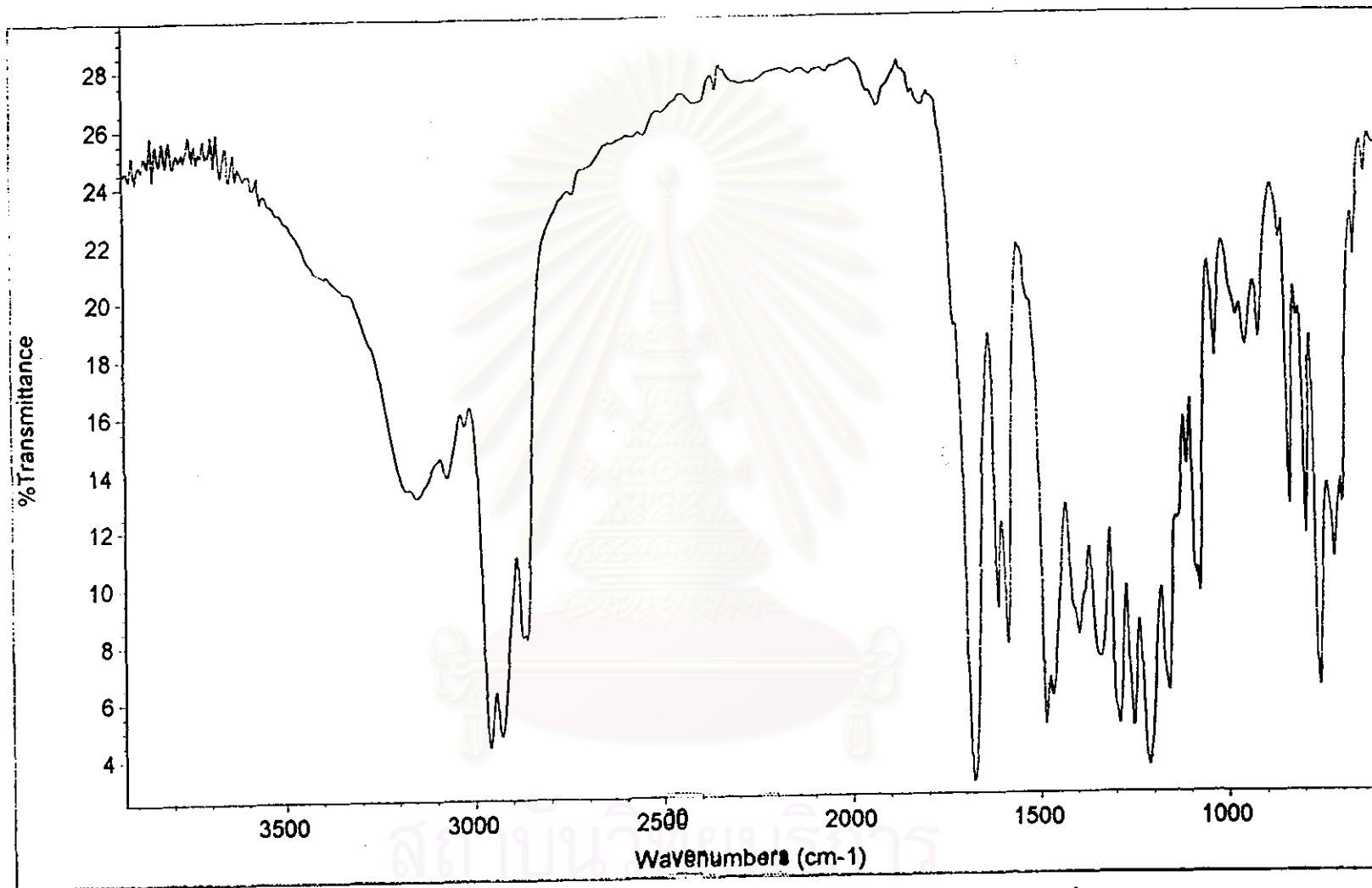


Figure 11-1: The FT-IR spectrum of marker dye 8

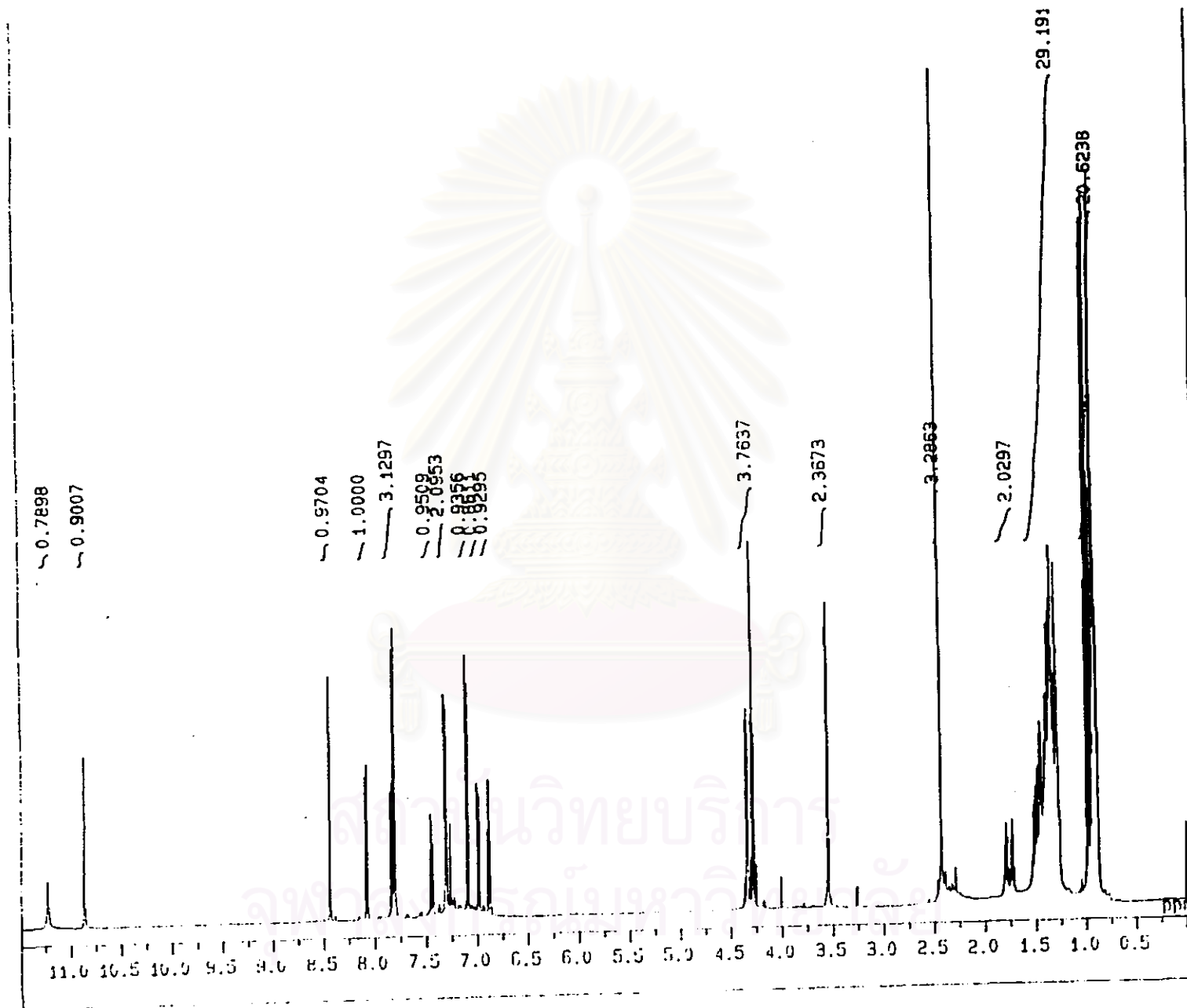


Figure 11-2: The $^1\text{H-NMR}$ spectrum of marker dye 8

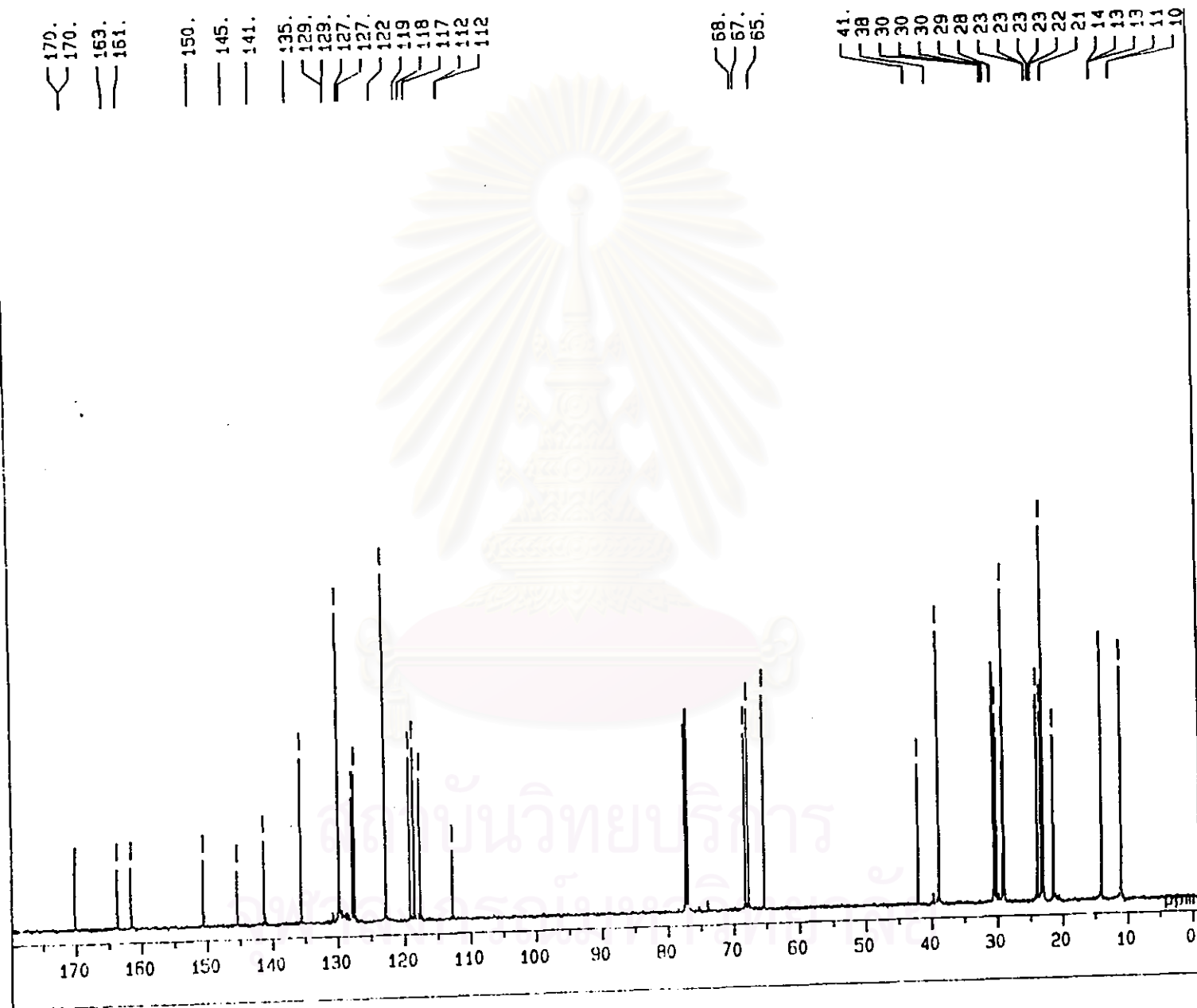


Figure 11-3: The ^{13}C -NMR spectrum of marker dye 8

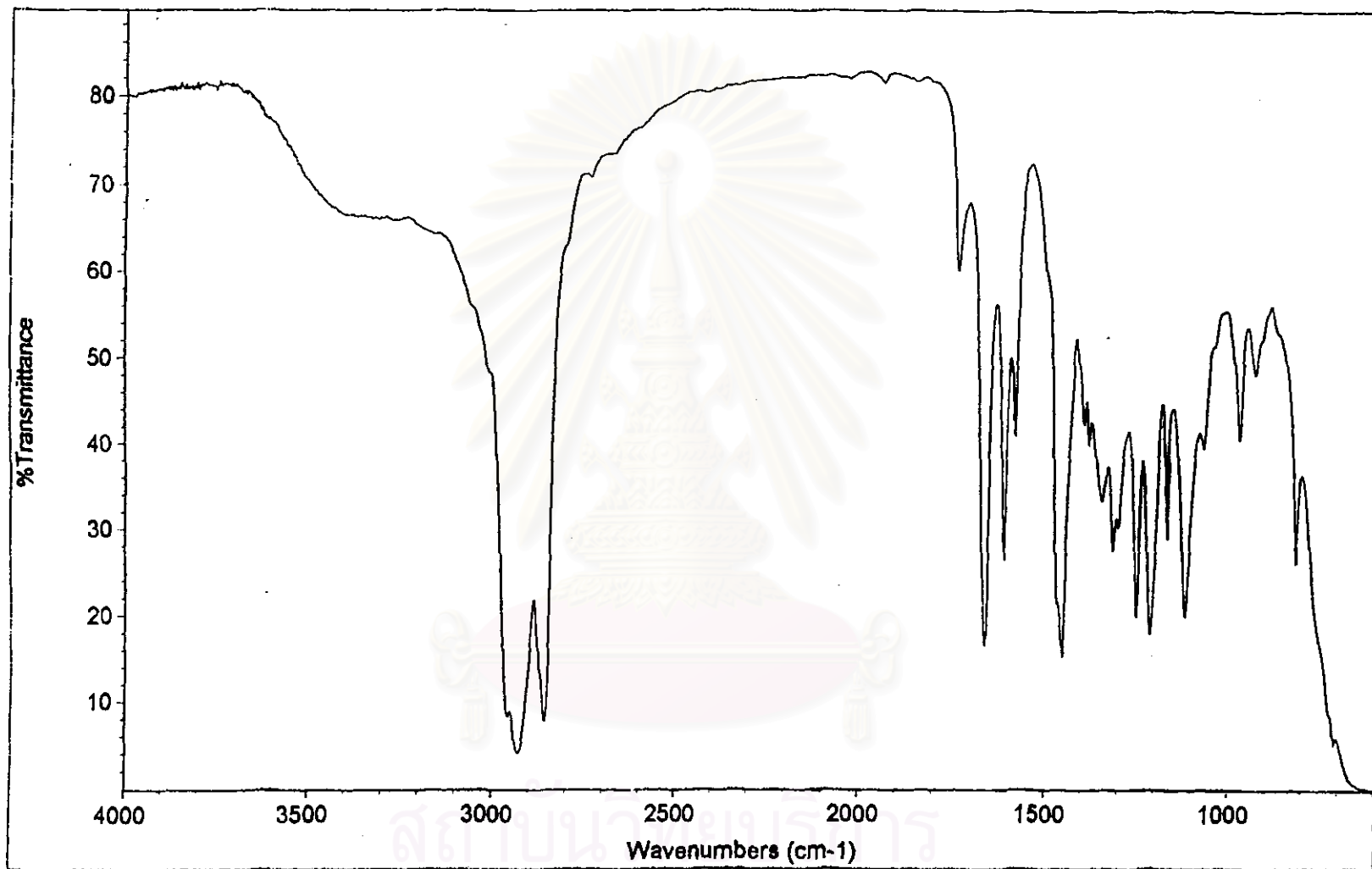


Figure 12-1: The FT-IR spectrum of marker dye 9

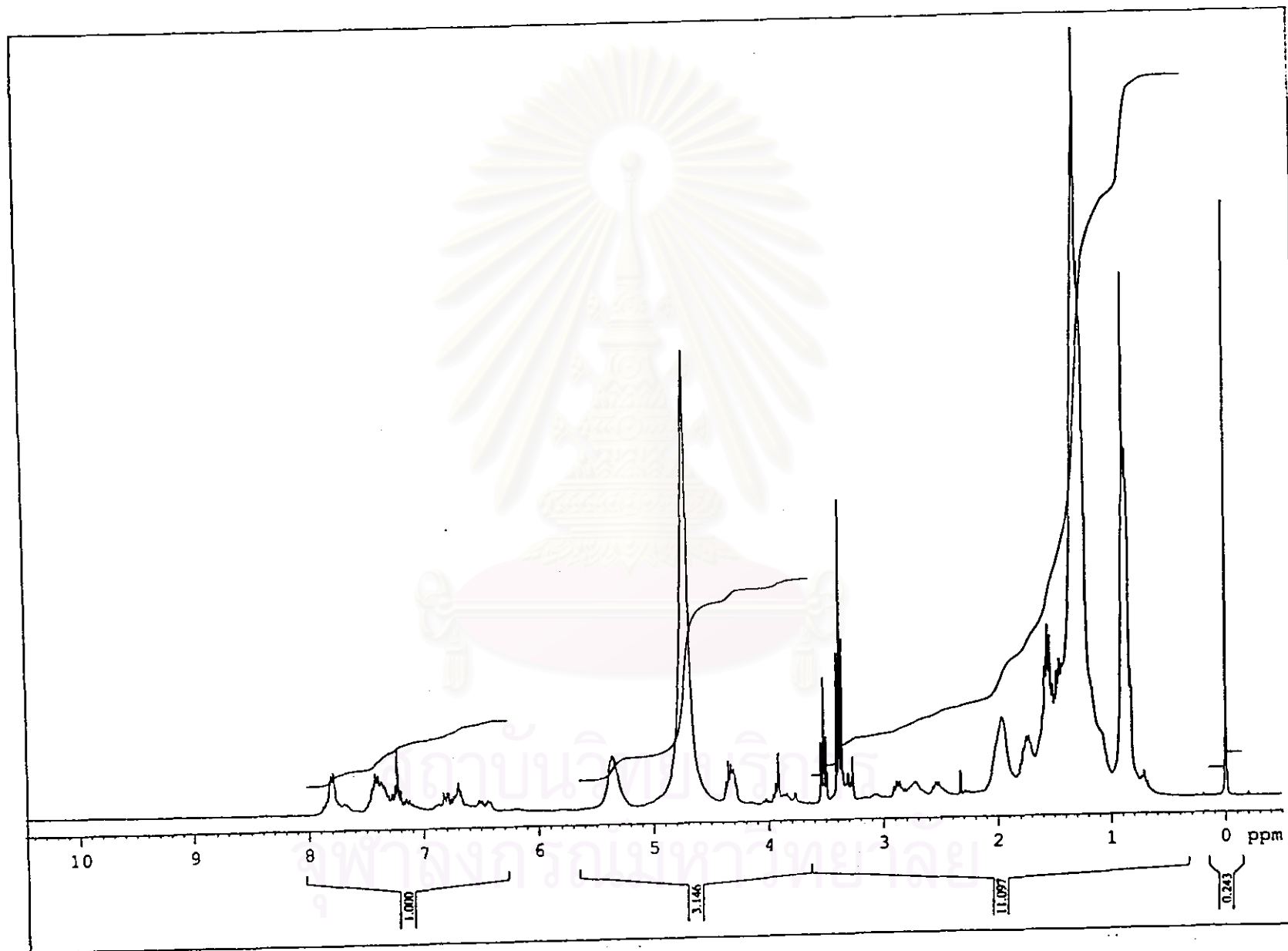


Figure 12-2: The $^1\text{H-NMR}$ spectrum of marker dye 9

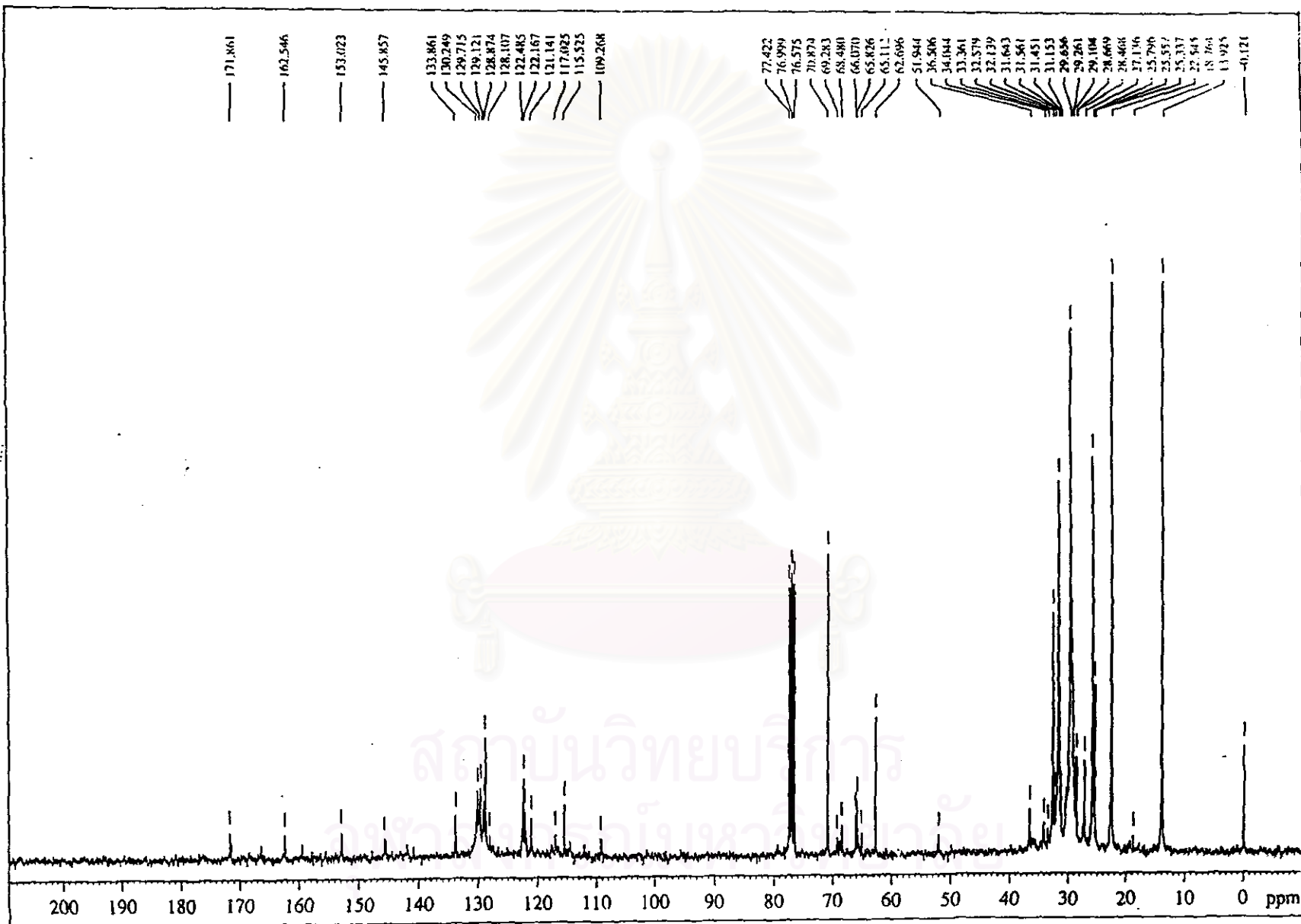


Figure 12-3: The ^{13}C -NMR spectrum of marker dye 9

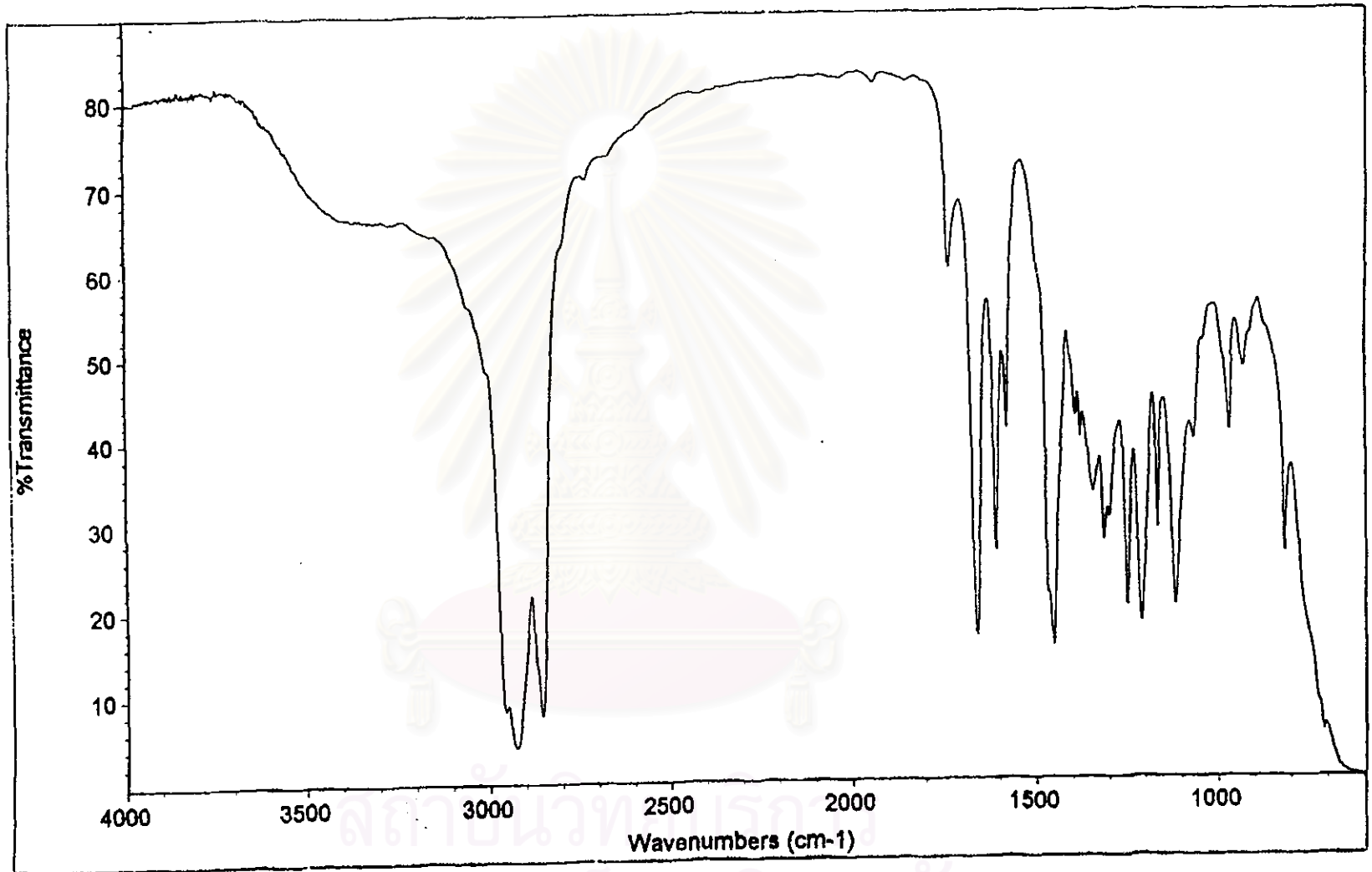


Figure 13-1: The FT-IR spectrum of marker dye 10

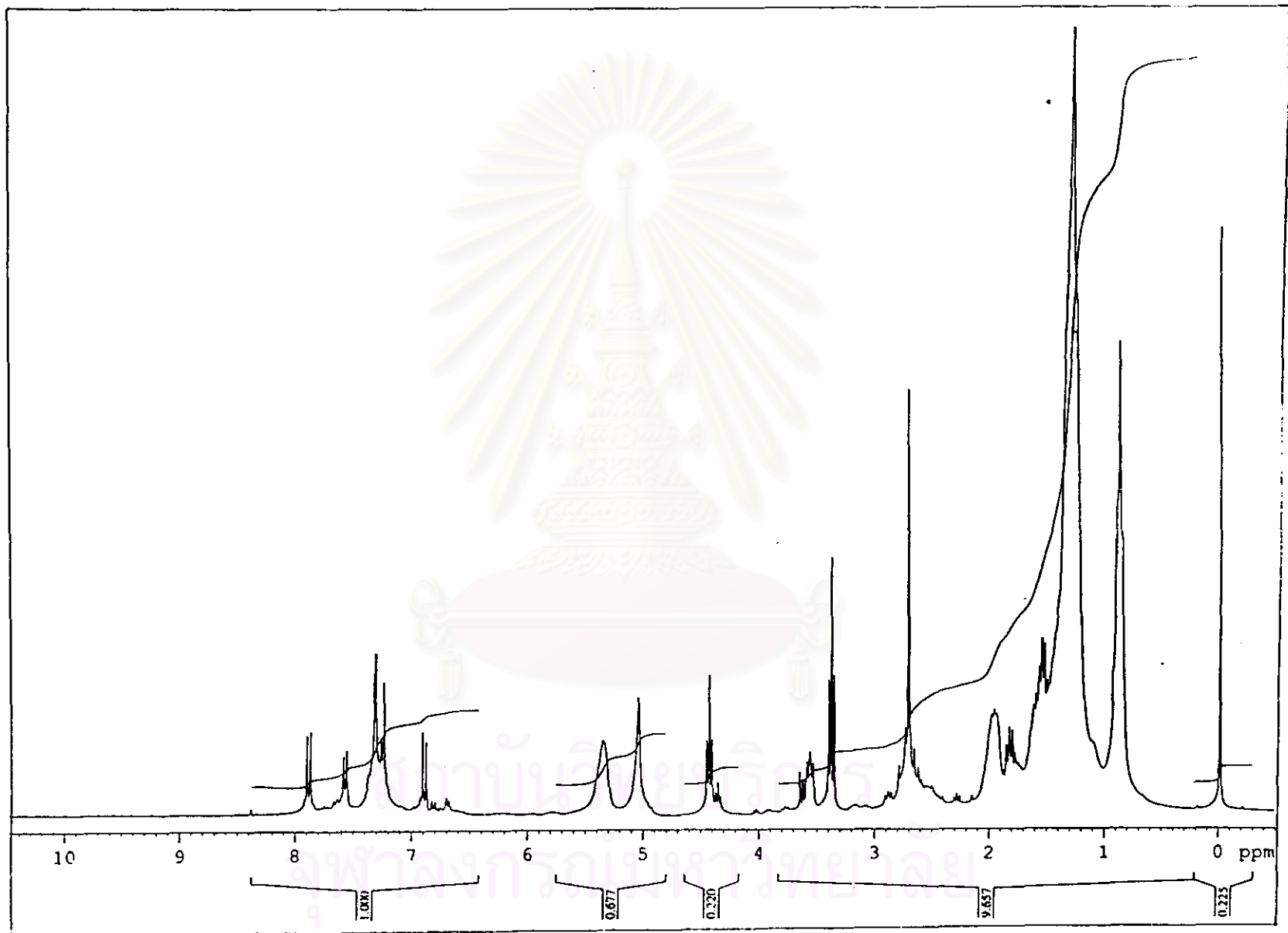


Figure 13-2: The $^1\text{H-NMR}$ spectrum of marker dye 10

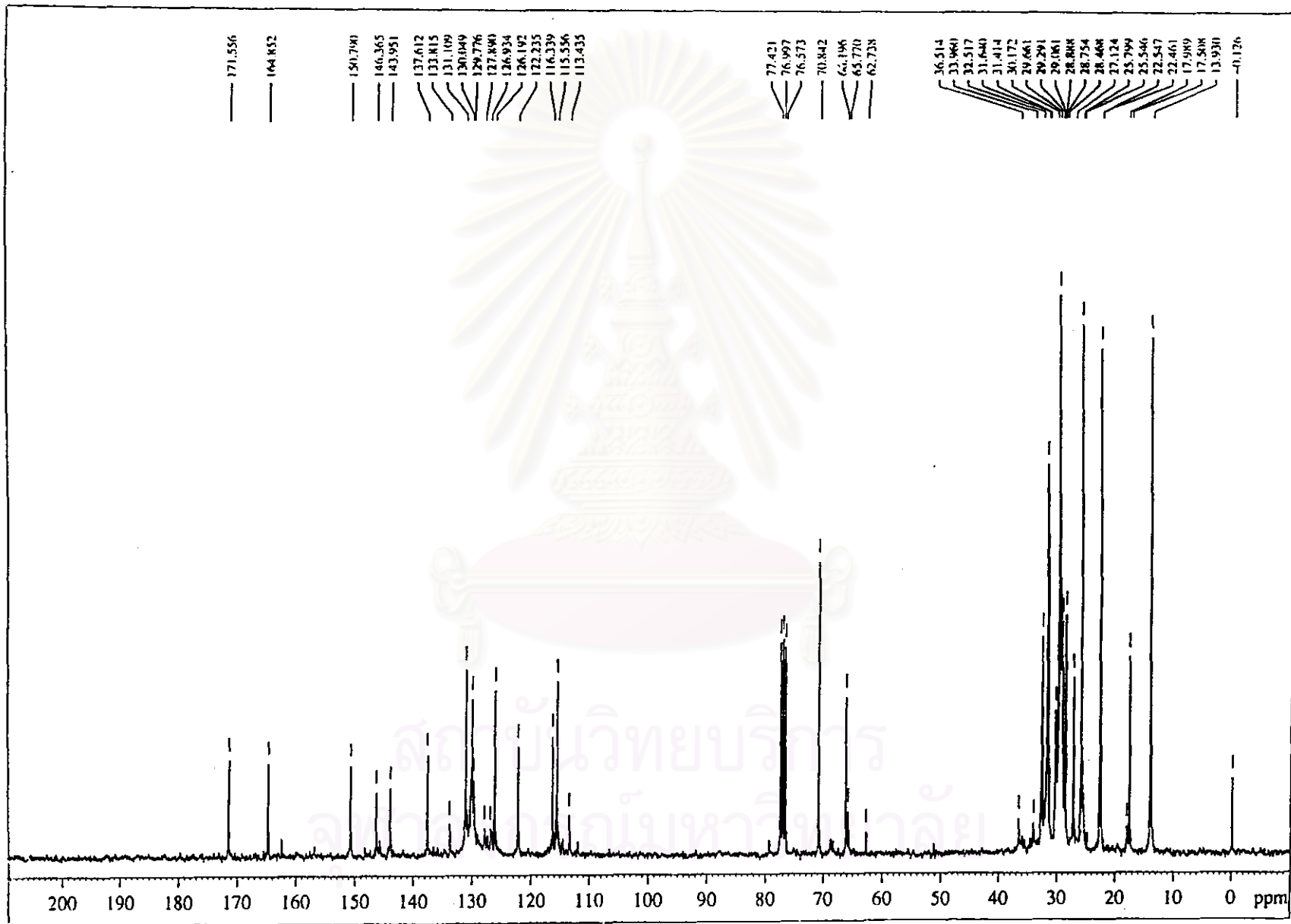


Figure 13-3: The ^{13}C -NMR spectrum of marker dye 10

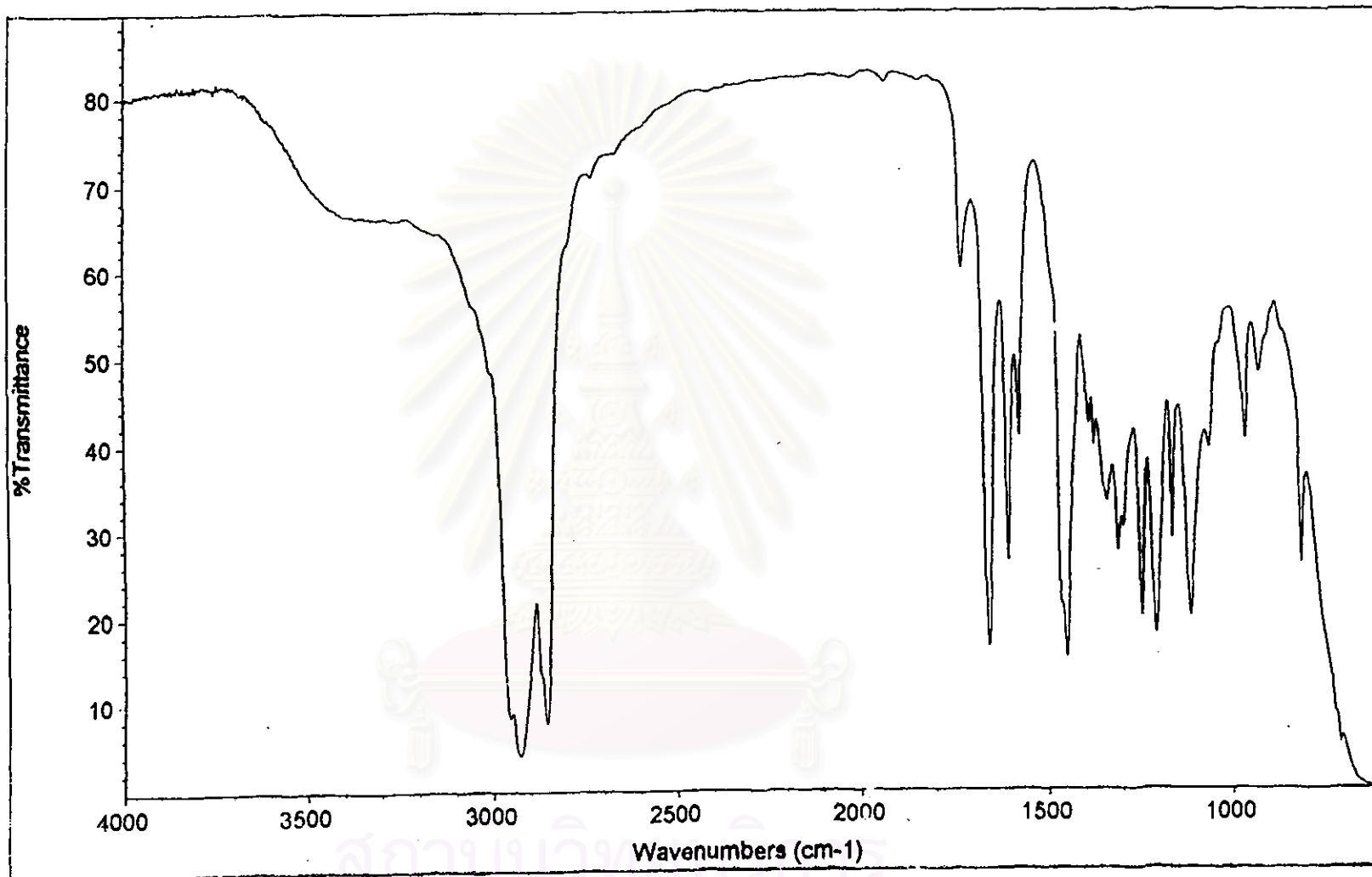


Figure 14-1: The FT-IR spectrum of marker dye 11

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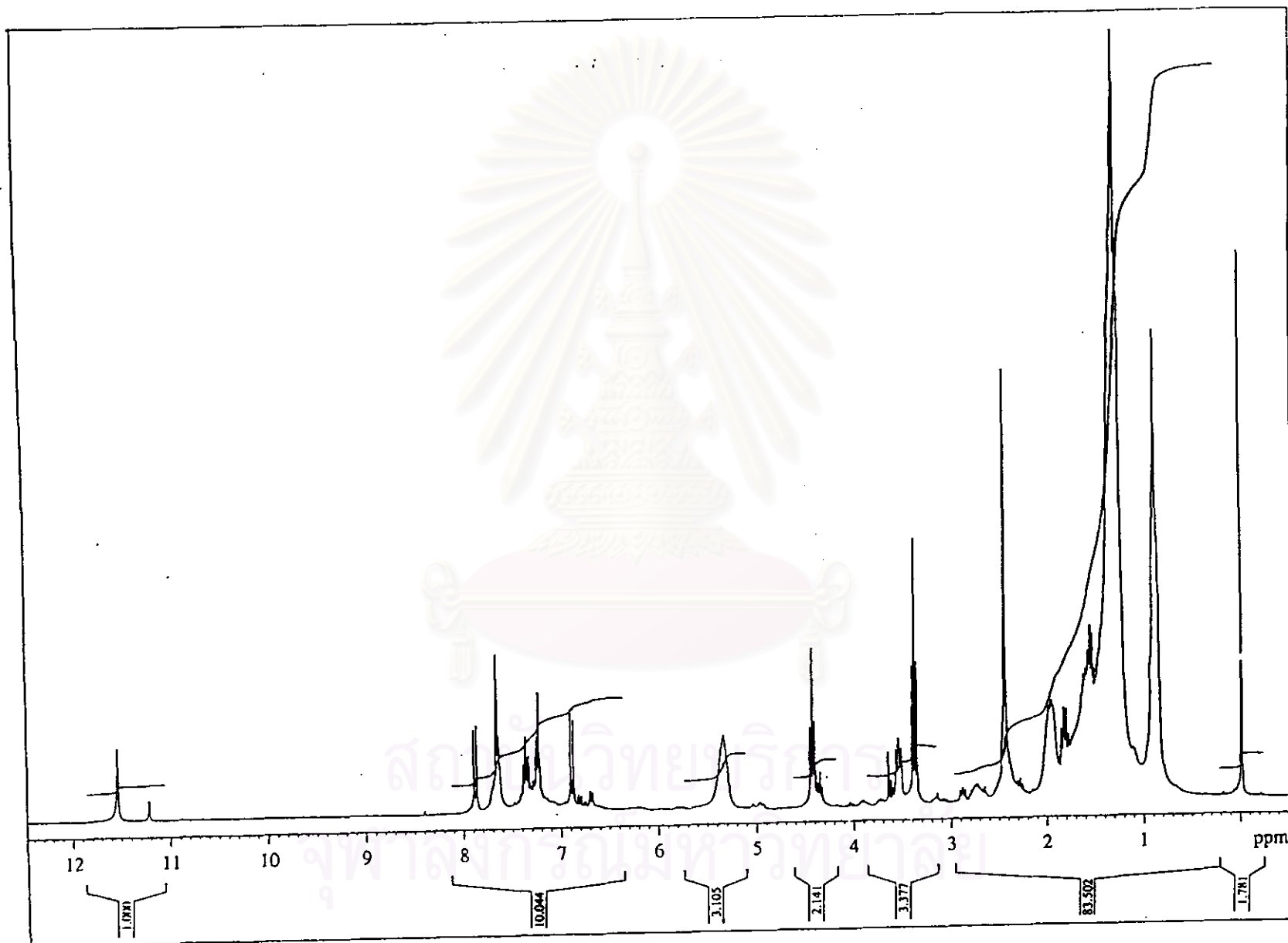


Figure 14-2: The $^1\text{H-NMR}$ spectrum of marker dye 11

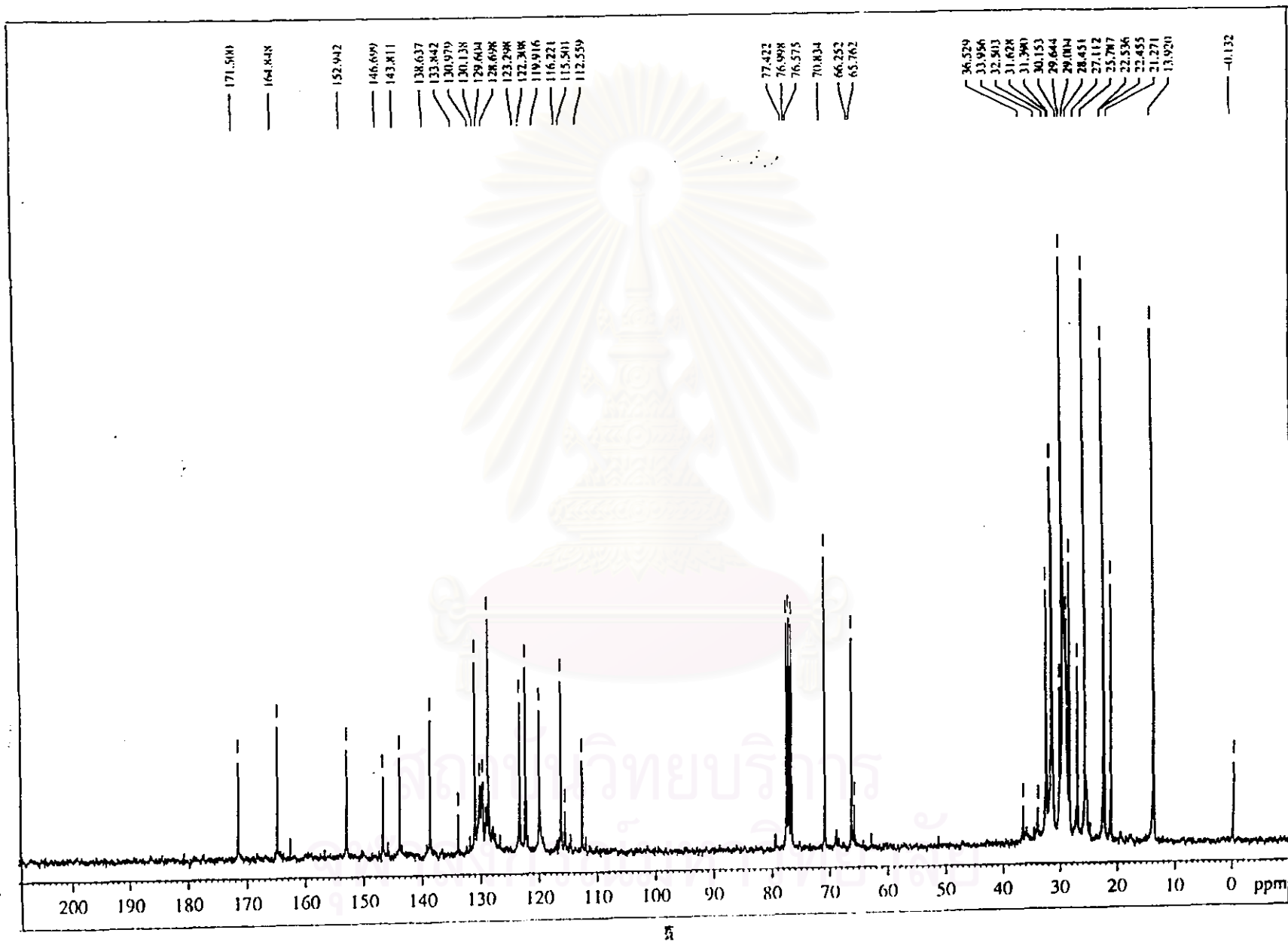


Figure 14-3: The ^{13}C -NMR spectrum of marker dye 11

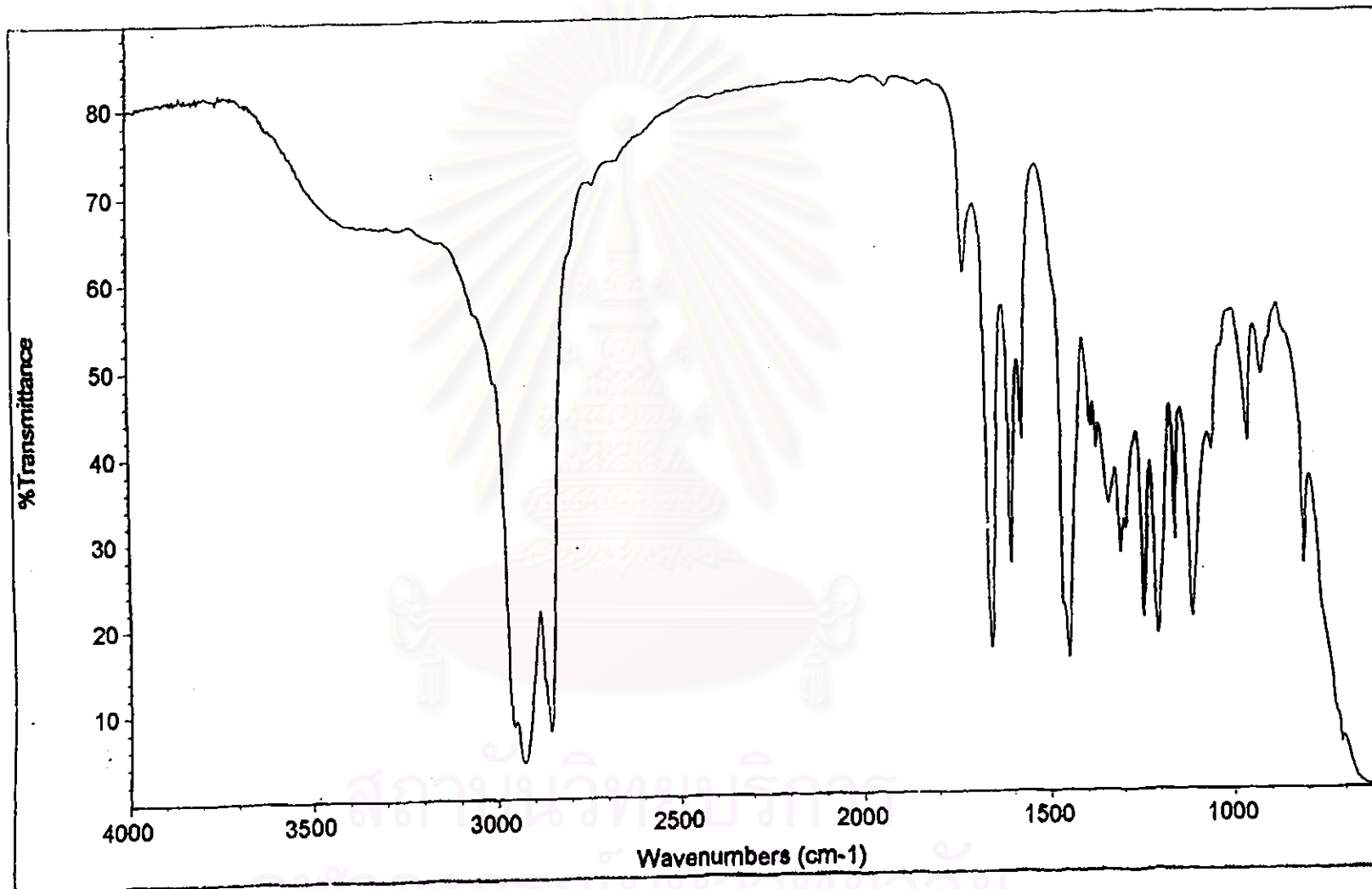


Figure 15-1: The FT-IR spectrum of marker dye 12

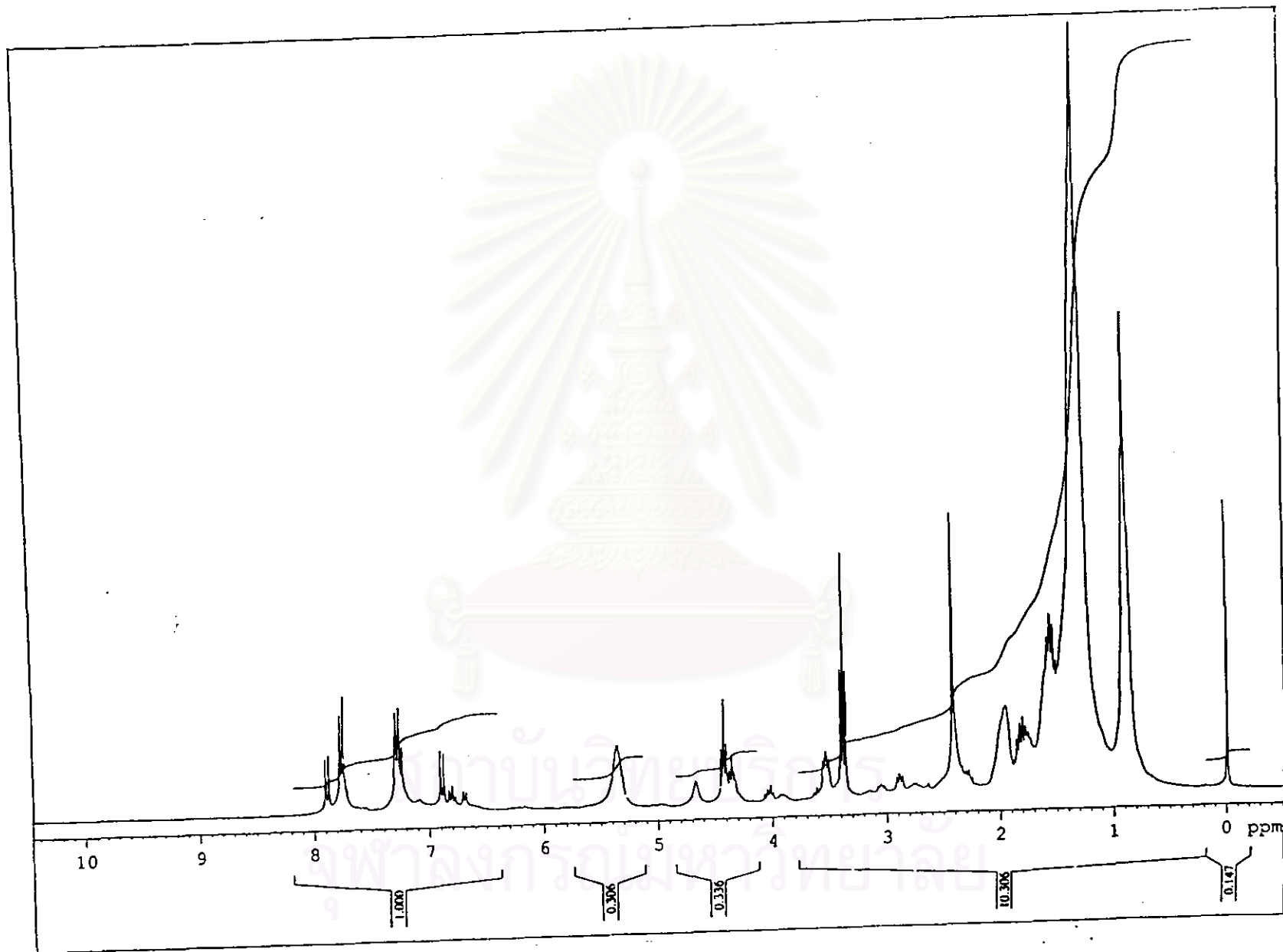


Figure 15-2: The $^1\text{H-NMR}$ spectrum of marker dye 12.

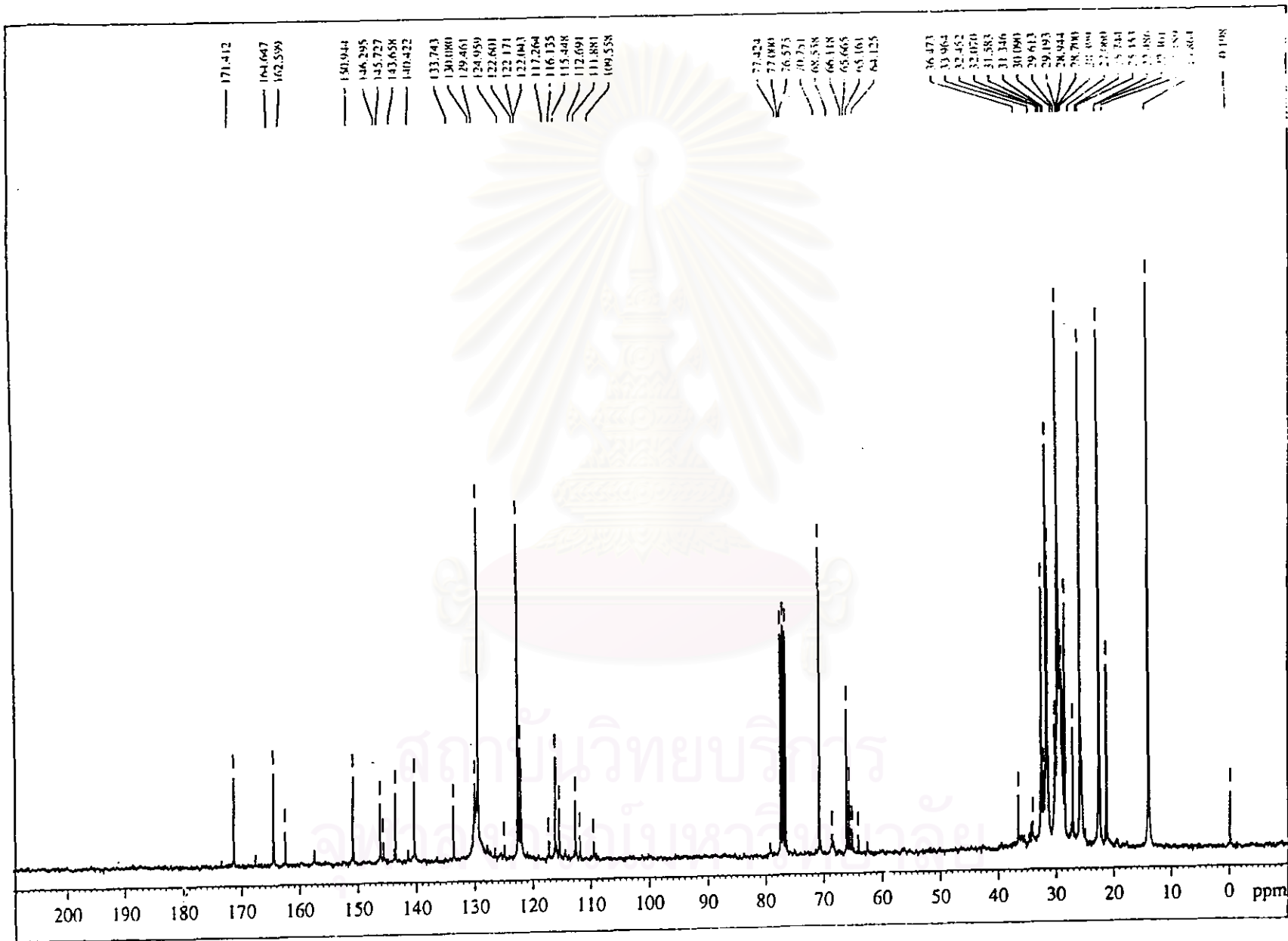
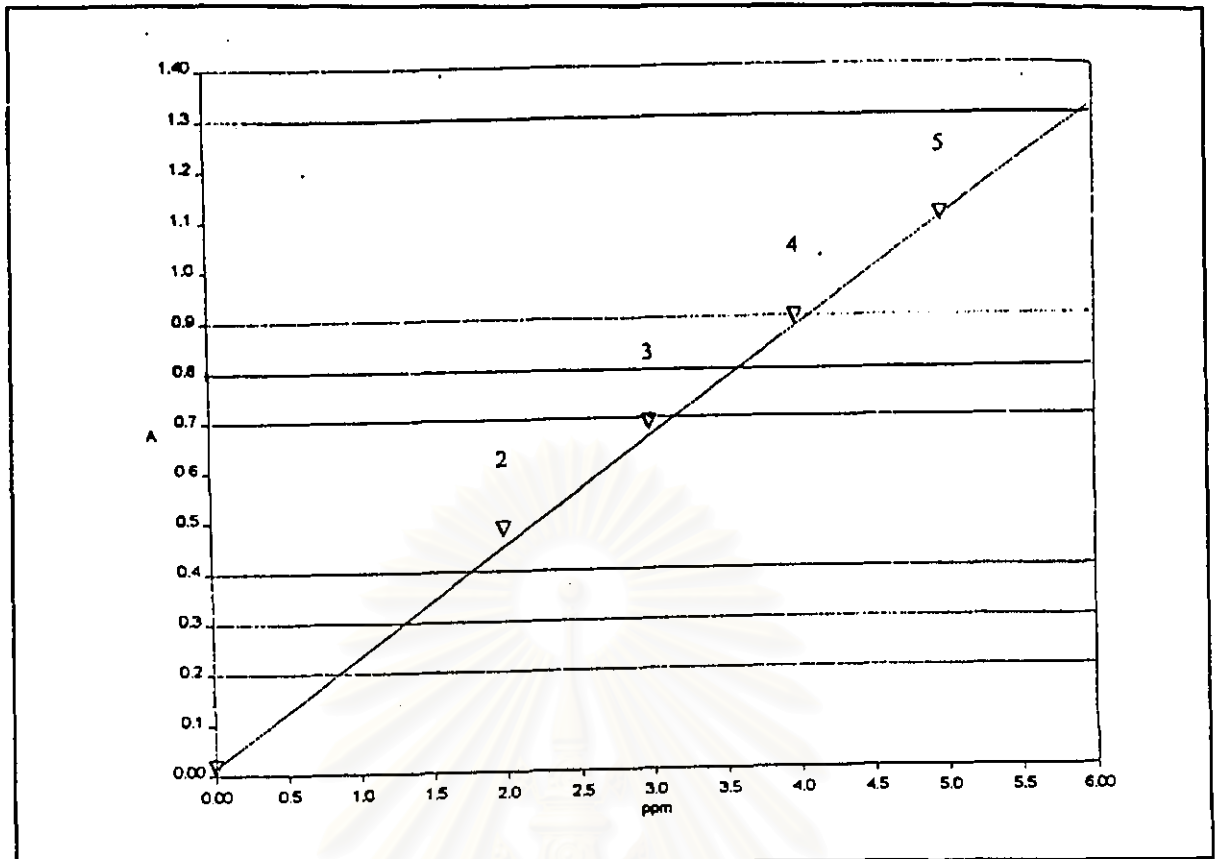
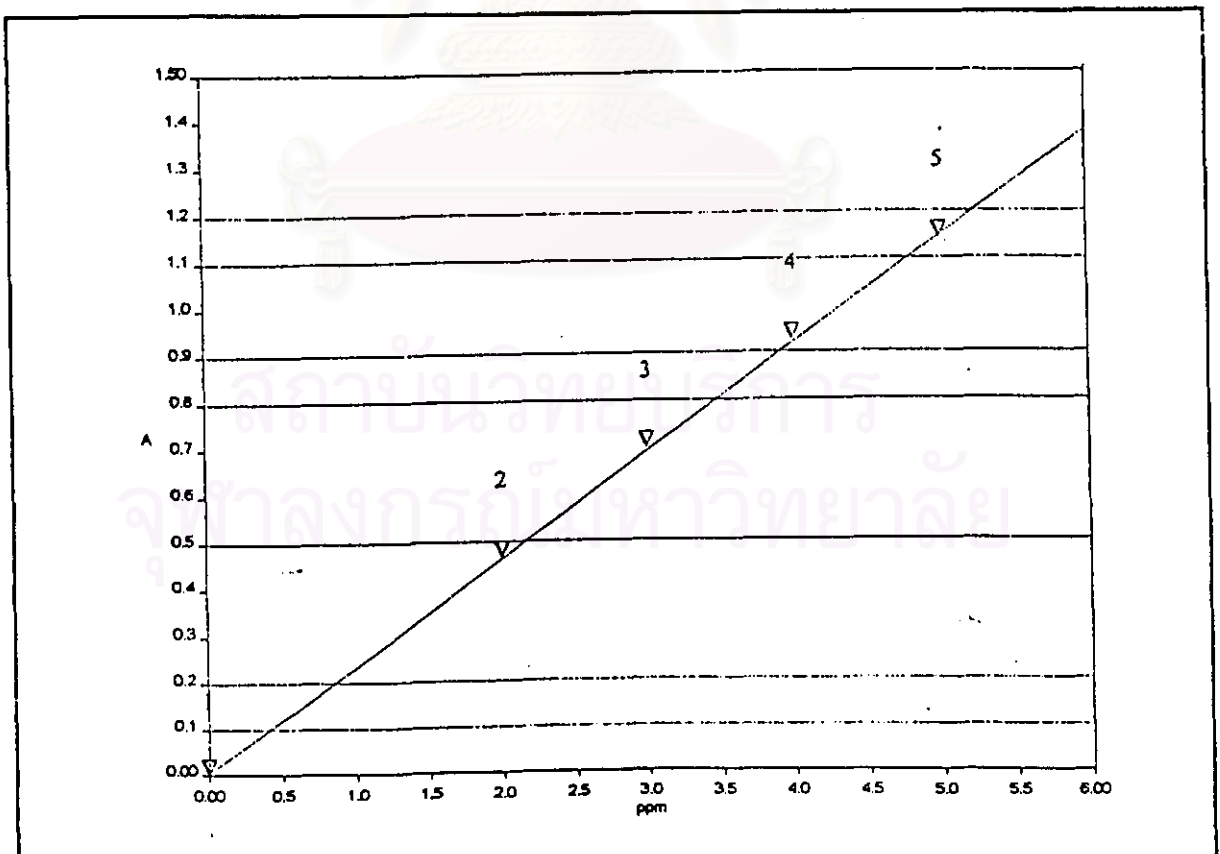


Figure 15-3: The ^{13}C -NMR spectrum of marker dye 12



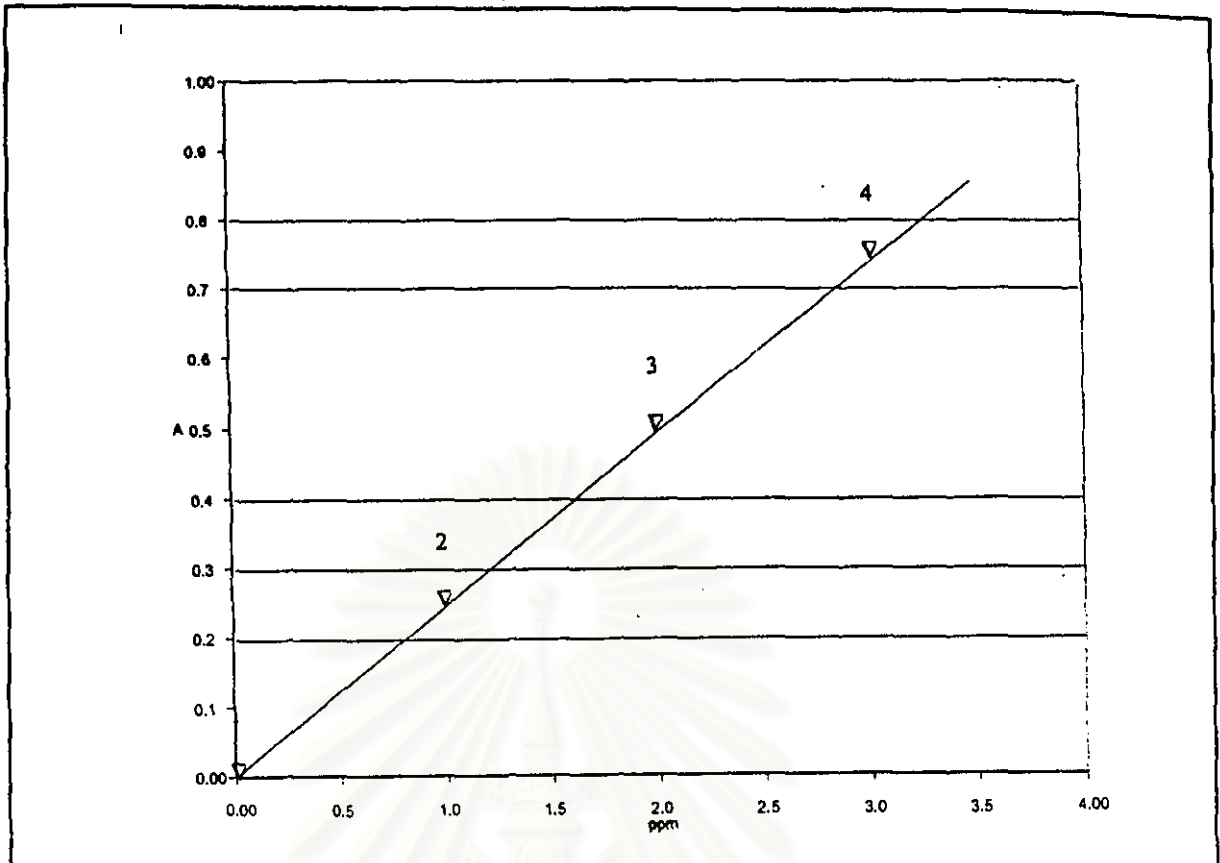
Description : $Y = 3.3330e-04 + 2.4450e-01 * X$

Figure 16-1 Calibration curve of solvent 1 of marker dye 5 in high-speed diesel oil.



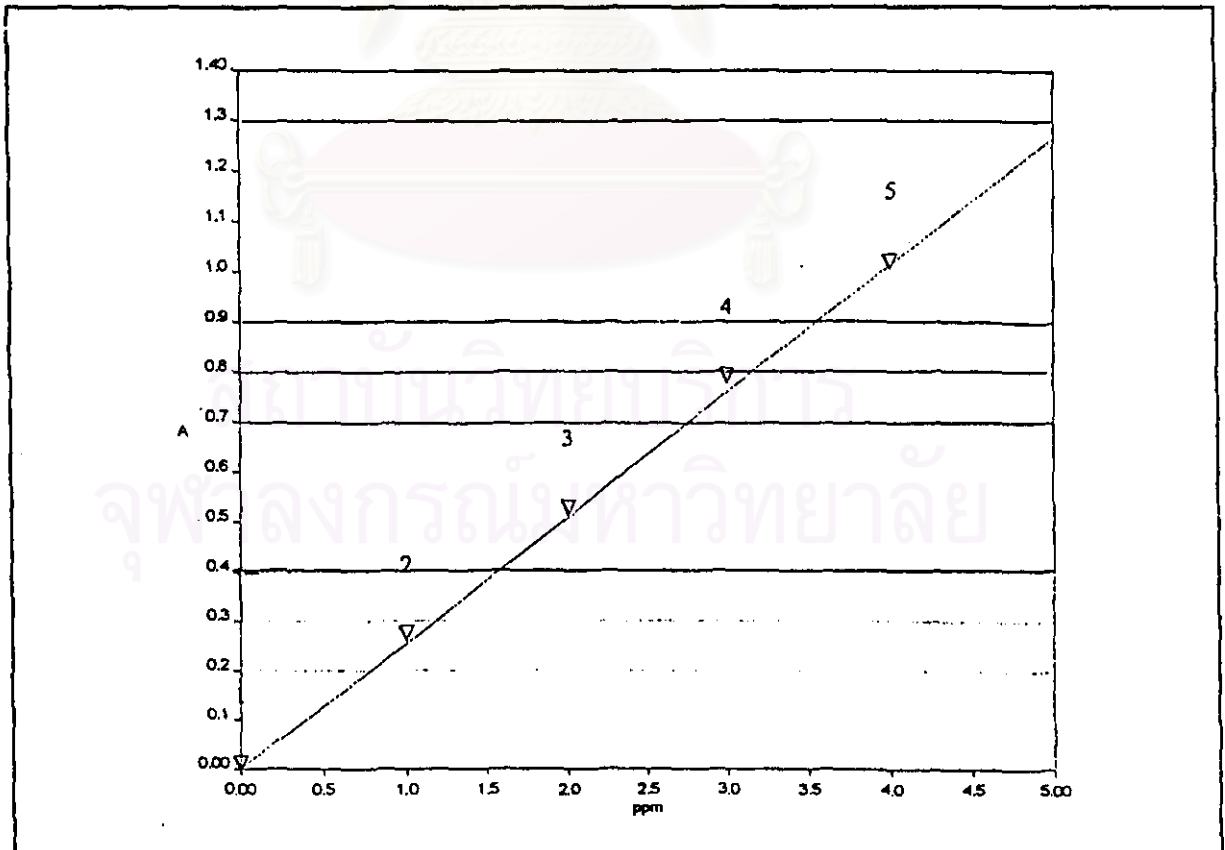
Description : $Y = -2.012000e-03 + 2.529580e-01 * X$

Figure 16-2 Calibration curve of solvent 2 of marker dye 5 in high-speed diesel oil.



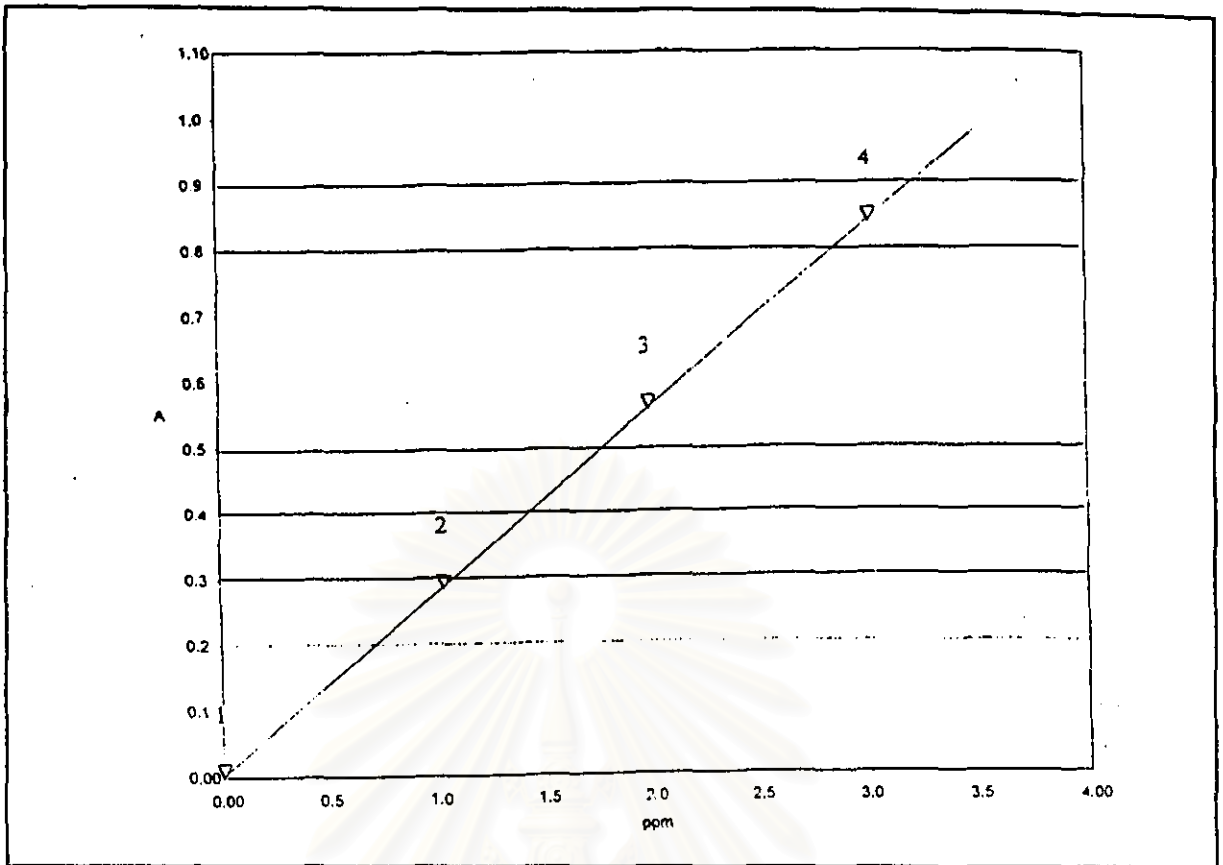
Description : $Y = 1.565541e-02 + 2.162088e-01 * X$

Figure 16-3 Calibration curve of solvent 3 of marker dye 5 in high-speed diesel oil.



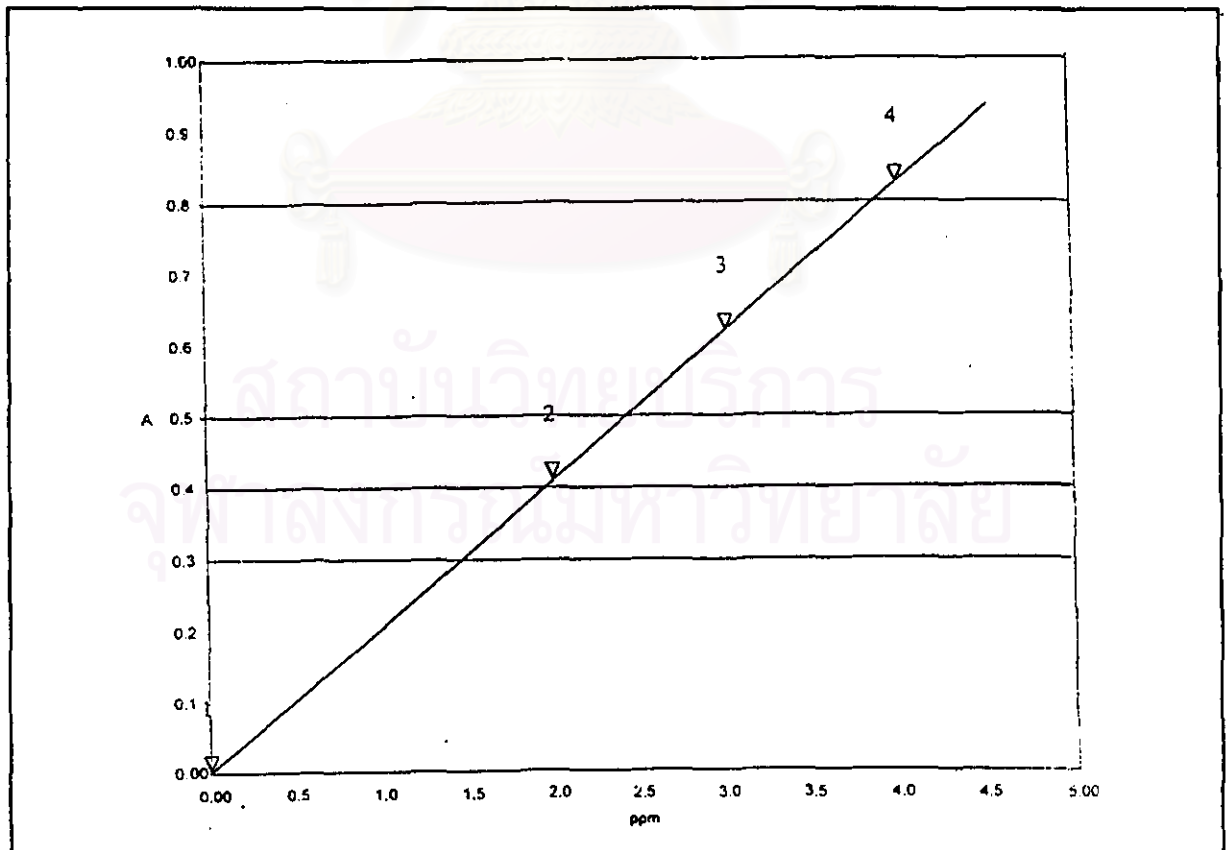
Description : $Y = 4.631351e-03 + 2.290659e-01 * X$

Figure 16-4 Calibration curve of solvent 4 of marker dye 5 in high-speed diesel oil.



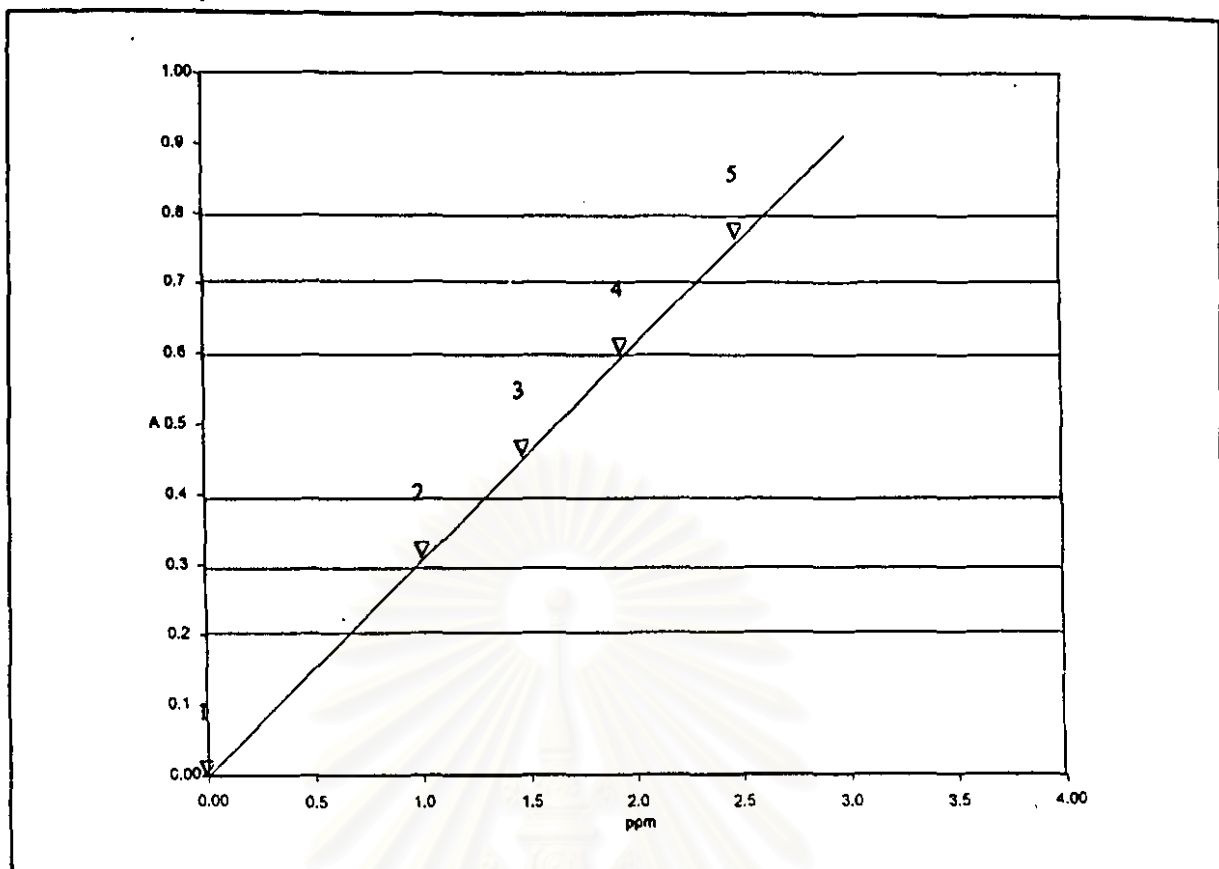
Description : $Y = 1.6667e-03 + 2.7950e-01 * X$

Figure 17-1 Calibration curve of solvent 1 of marker dye 6 in high-speed diesel oil.



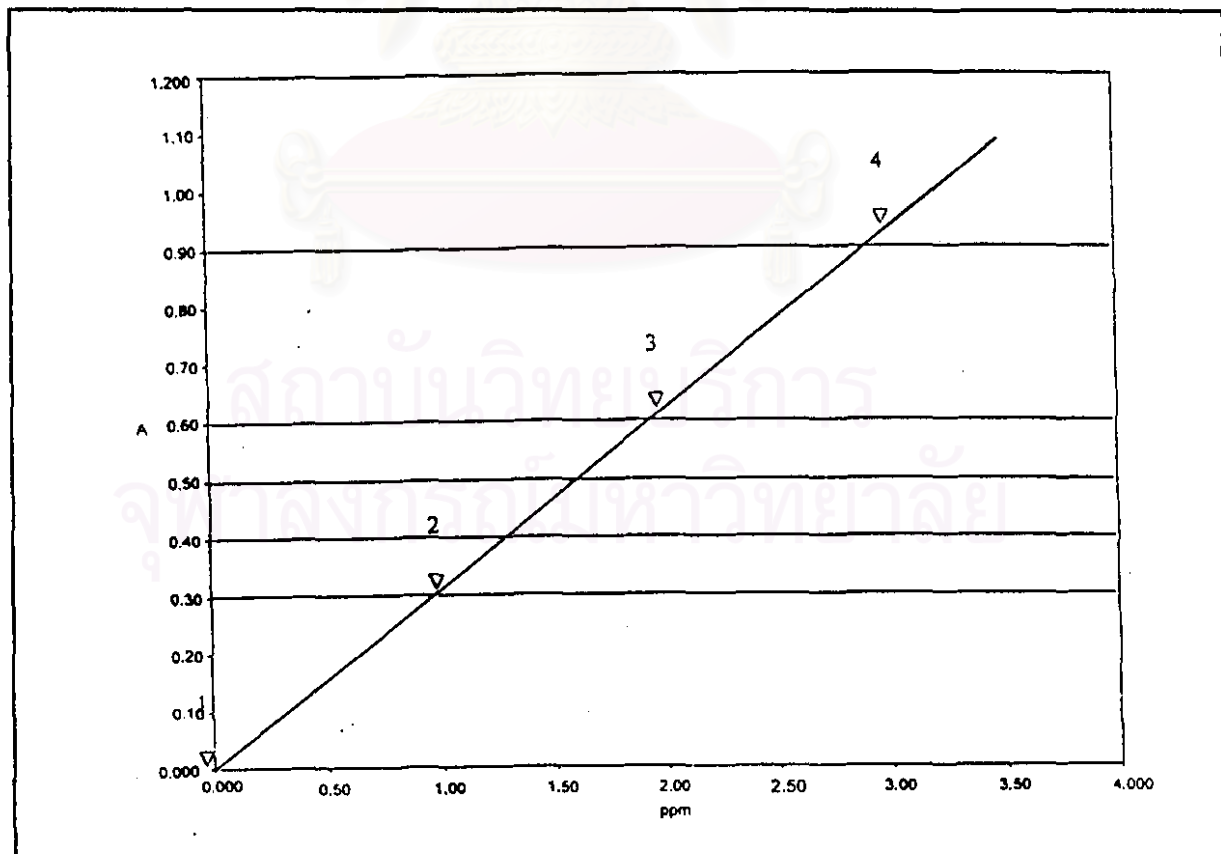
Description : $Y = 1.0000e-03 + 2.0600e-01 * X$

Figure 17-2 Calibration curve of solvent 2 of marker dye 6 in high-speed diesel oil.



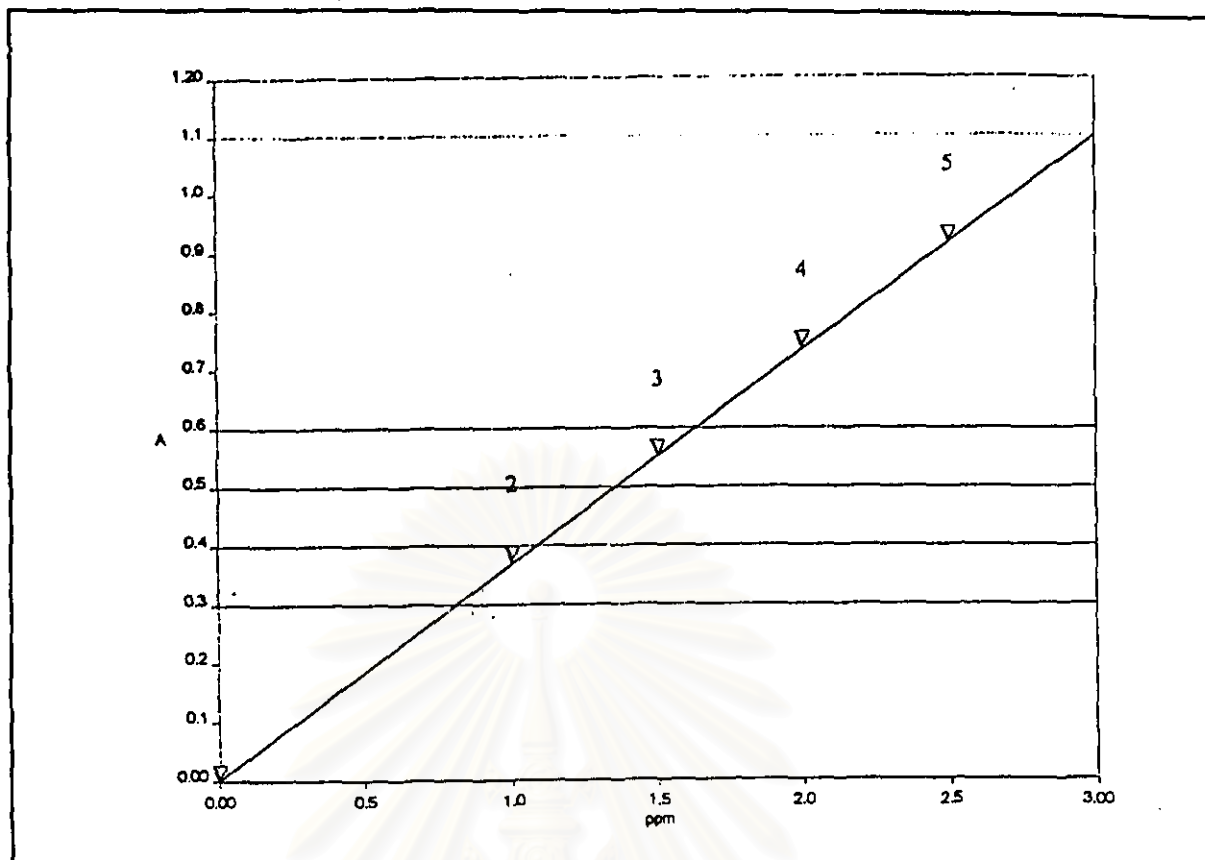
Description : $Y = -8.000e-02 + 3.0460e-01 * X$

Figure 17-3 Calibration curve of solvent 3 of marker dye 6 in high-speed diesel oil.



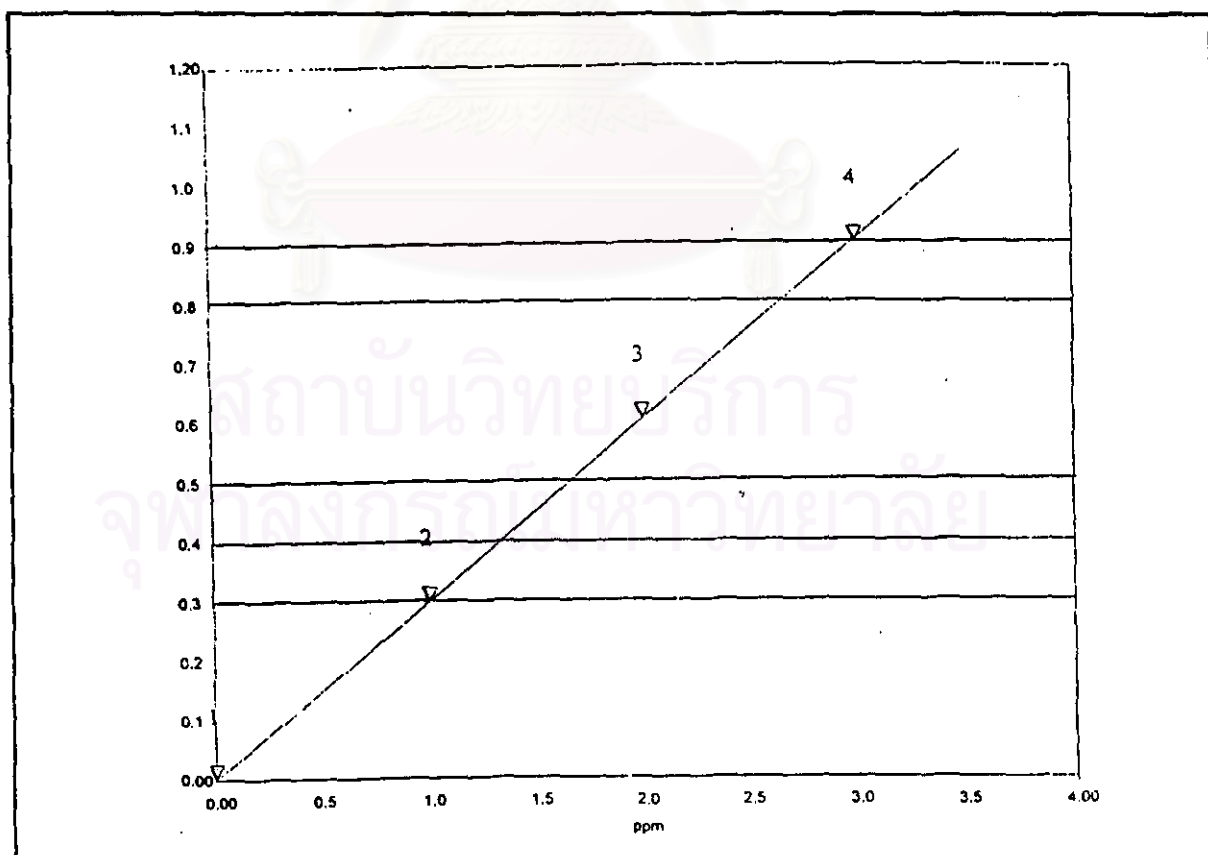
Description : $Y = -3.333333e-04 + 3.105000e-01 * X$

Figure 17-4 Calibration curve of solvent 4 of marker dye 6 in high-speed diesel oil.



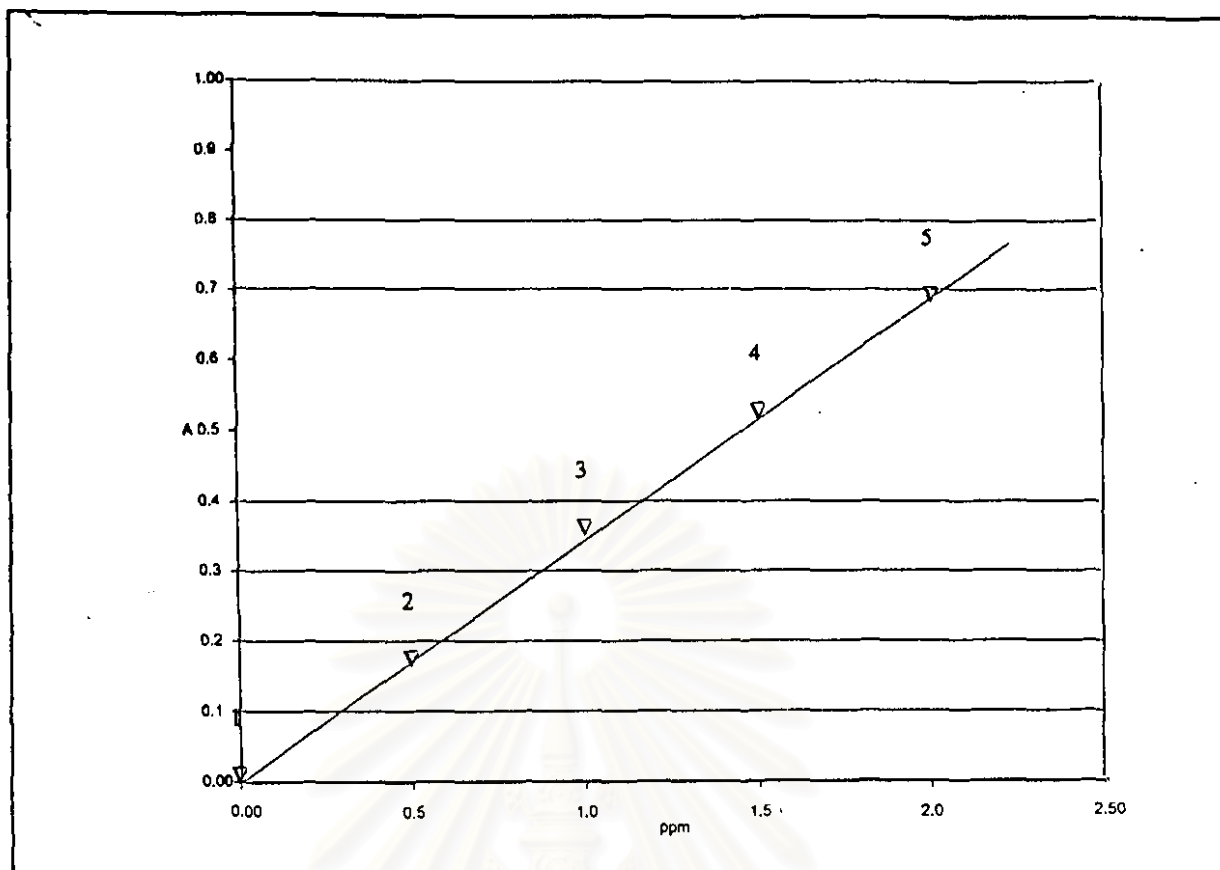
Description : $Y = 1.897838e-04 + 3.667530e-01 * X$

Figure 18-1 Calibration curve of solvent 1 of marker dye 7 in high-speed diesel oil.



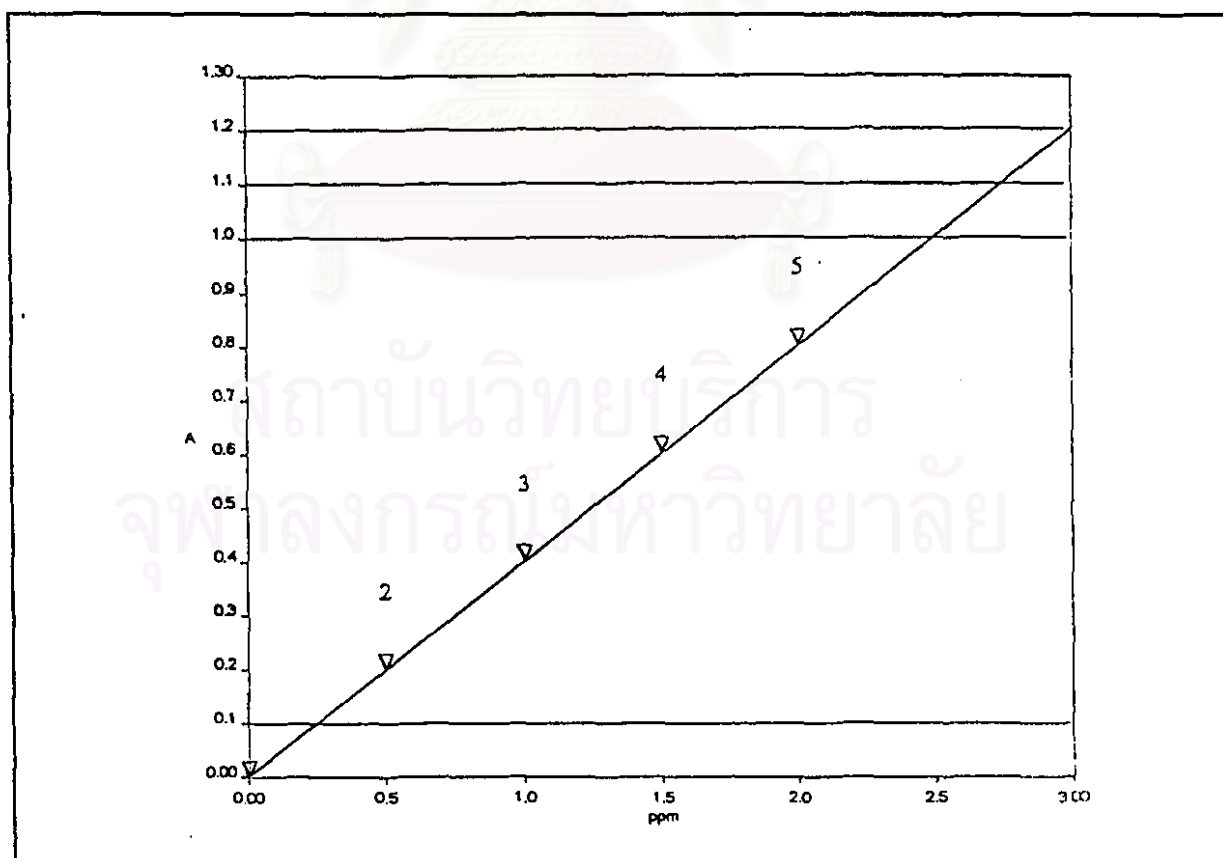
Description : $Y = -5.92120e-04 + 3.01000e-01 * X$

Figure 18-2 Calibration curve of solvent 2 of marker dye 7 in high-speed diesel oil.



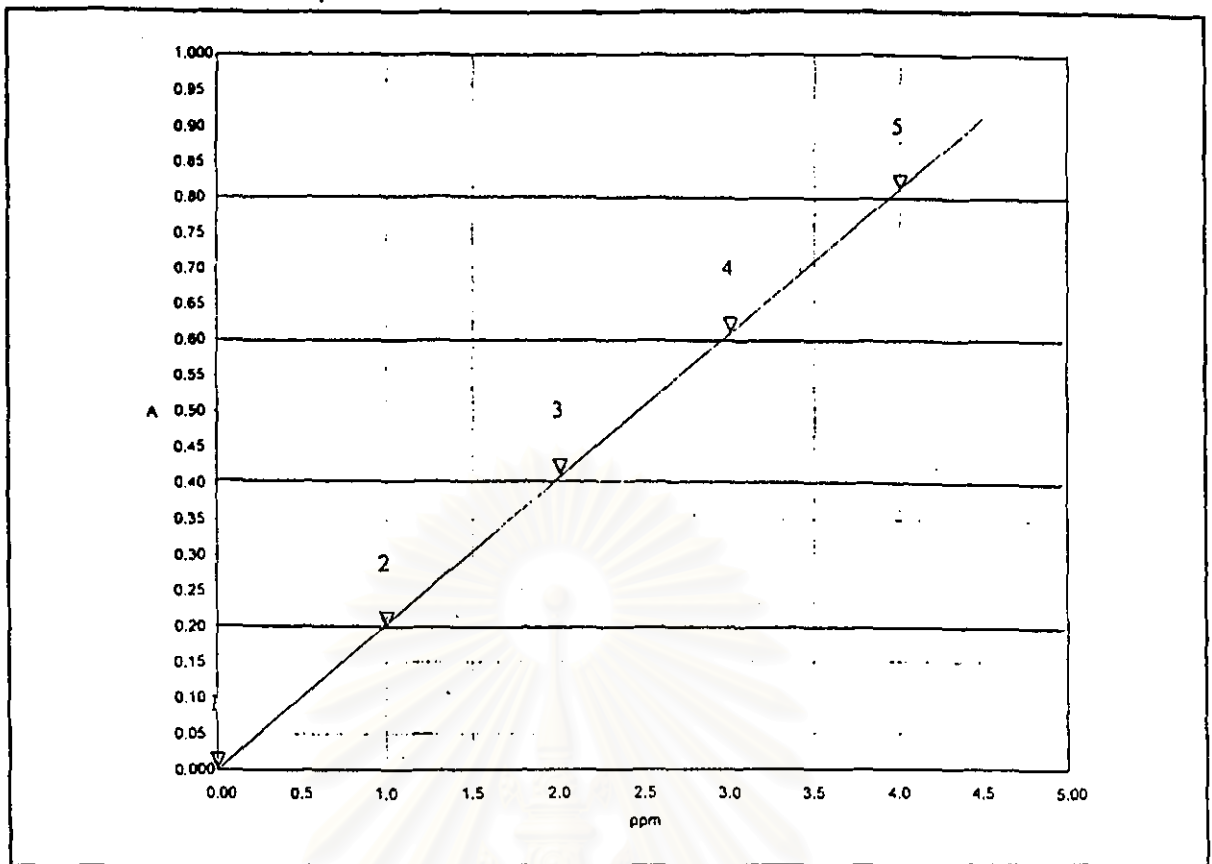
Description : $Y = -3.5530e-04 + 3.4140e-01 * X$

Figure 18-3 Calibration curve of solvent 3 of marker dye 7 in high-speed diesel oil.



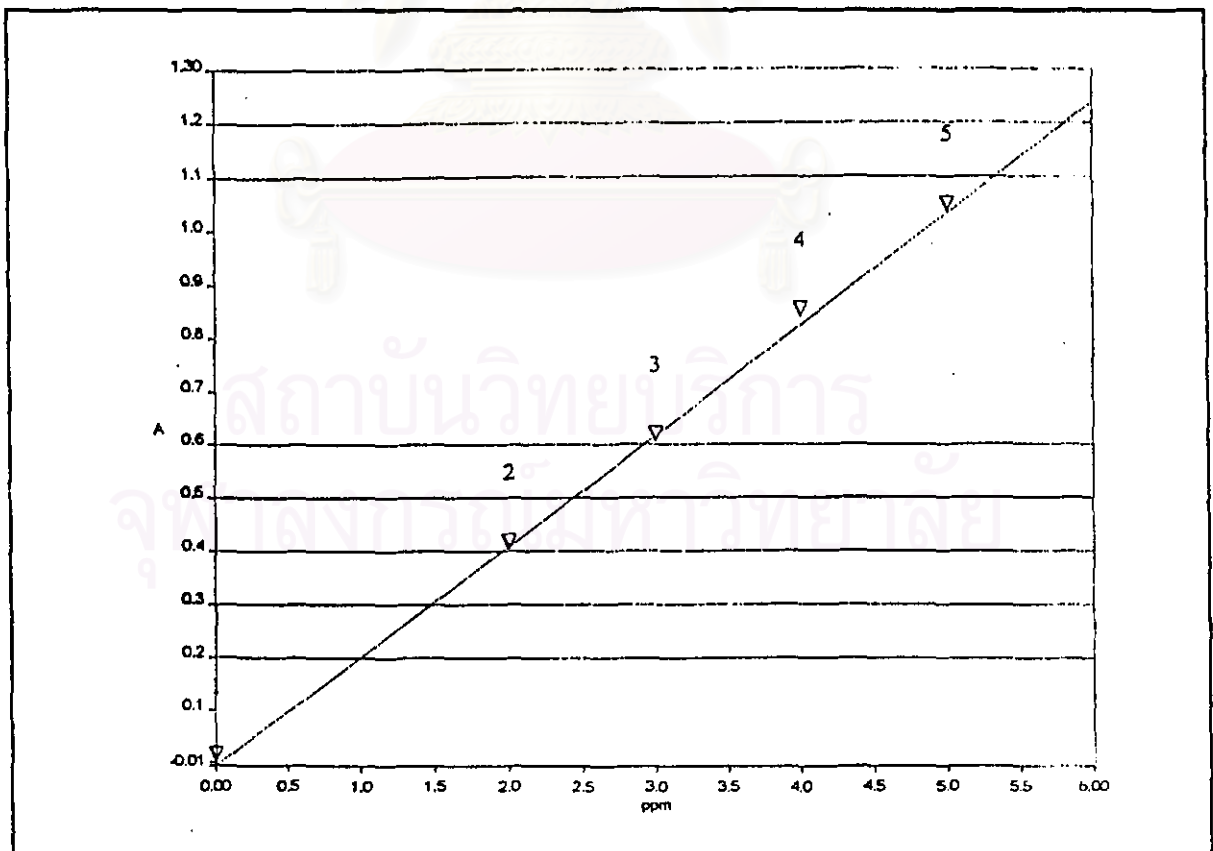
Description : $Y = -1.308000e-03 + 4.014120e-01 * X$

Figure 18-4 Calibration curve of solvent 4 of marker dye 7 in high-speed diesel oil.



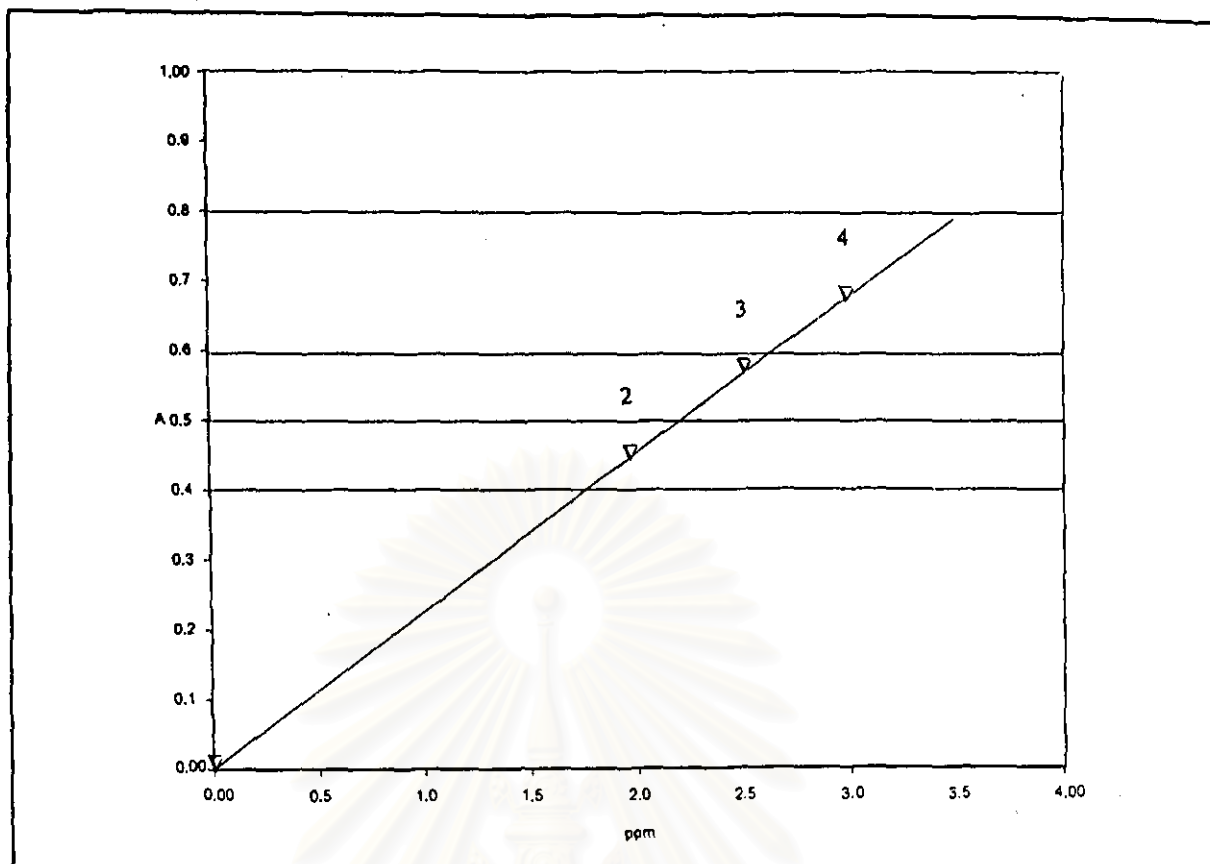
Description : $Y = -3.55270e-04 + 2.03100e-01 * X$

Figure 19-1 Calibration curve of solvent 1 of marker dye 8 in high-speed diesel oil.



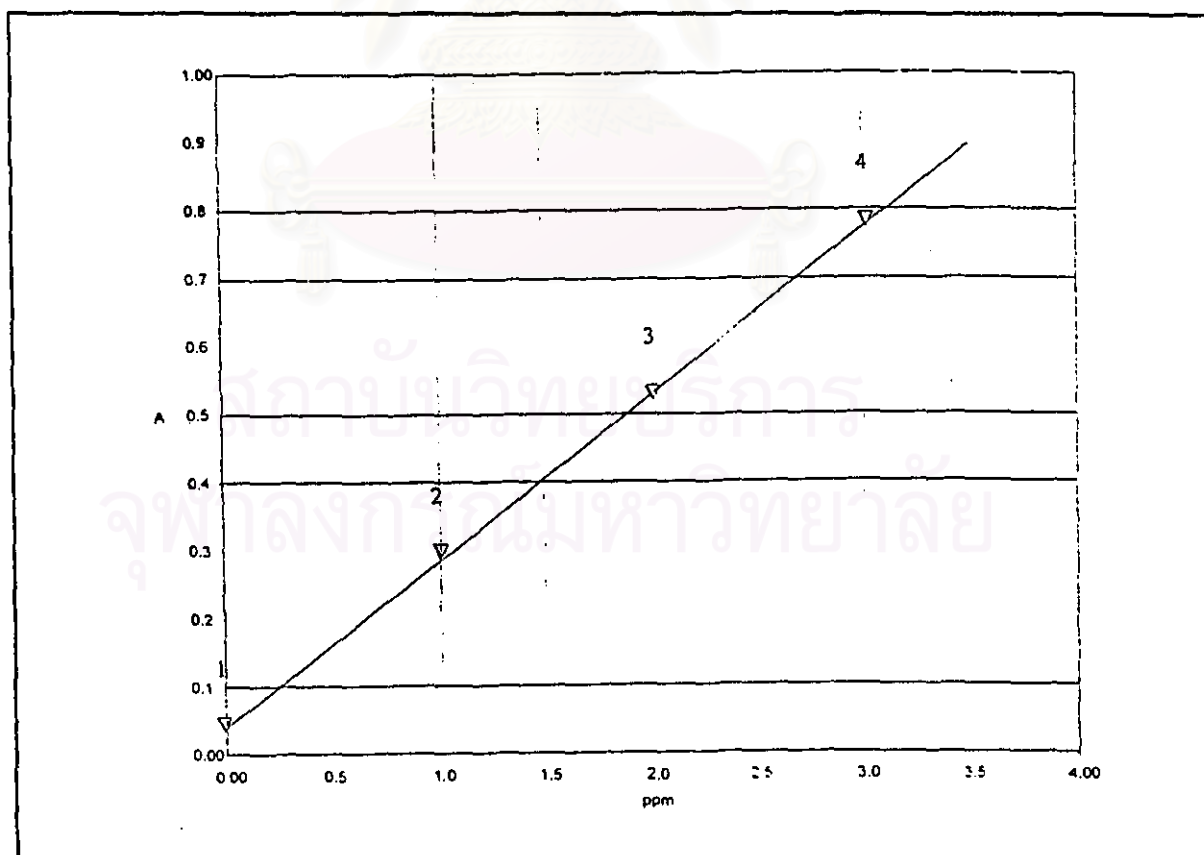
Description : $Y = -6.253784e-03 + 2.077464e-01 * X$

Figure 19-2 Calibration curve of solvent 2 of marker dye 8 in high-speed diesel oil.



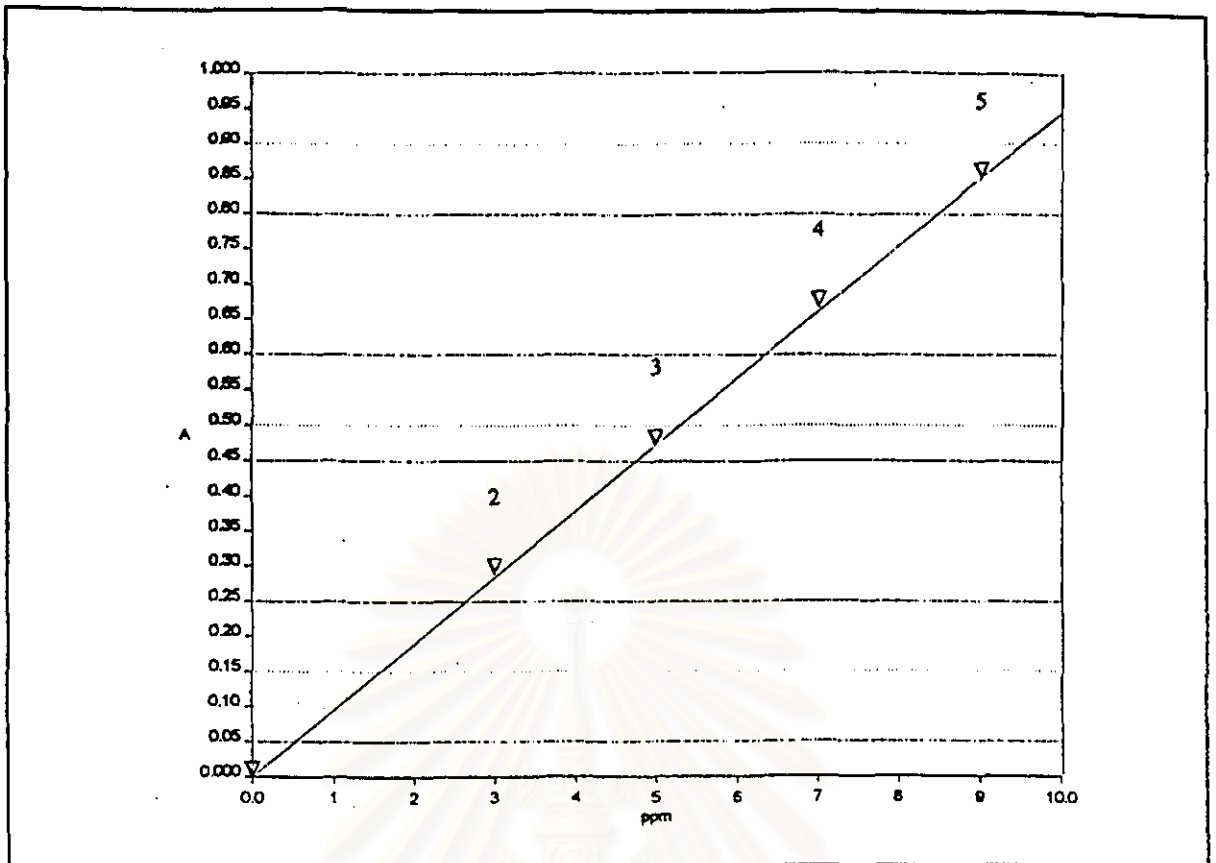
Description : $Y = -4.7370e-04 + 2.2600e-01 * X$

Figure 19-3 Calibration curve of solvent 3 of marker dye 8 in high-speed diesel oil.



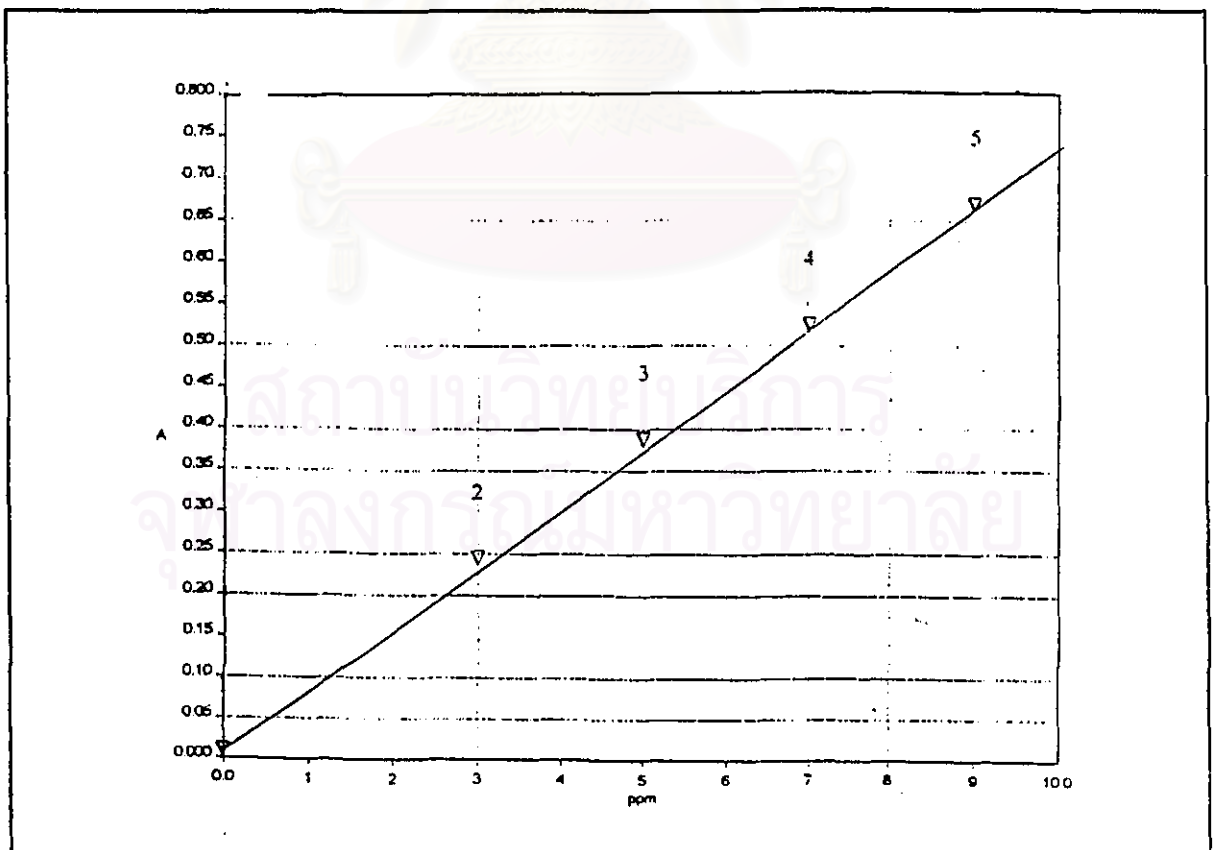
Description : $Y = 3.933333e-03 + 2.4450e-01 * X$

Figure 19-4 Calibration curve of solvent 4 of marker dye 8 in high-speed diesel oil.



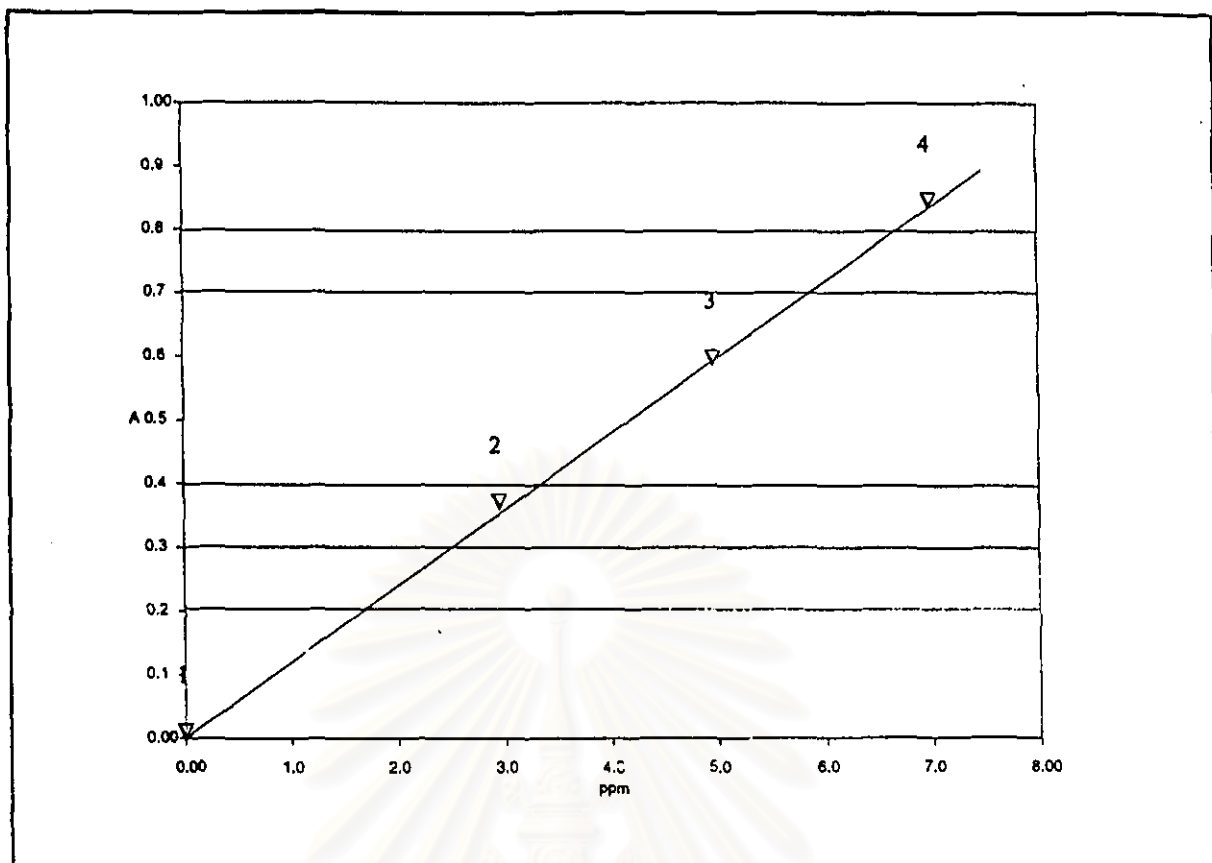
Description : $Y = 5.3590e-04 + 9.468377e-02 * X$

Figure 20-1 Calibration curve of solvent 1 of marker dye 9 in high-speed diesel oil.



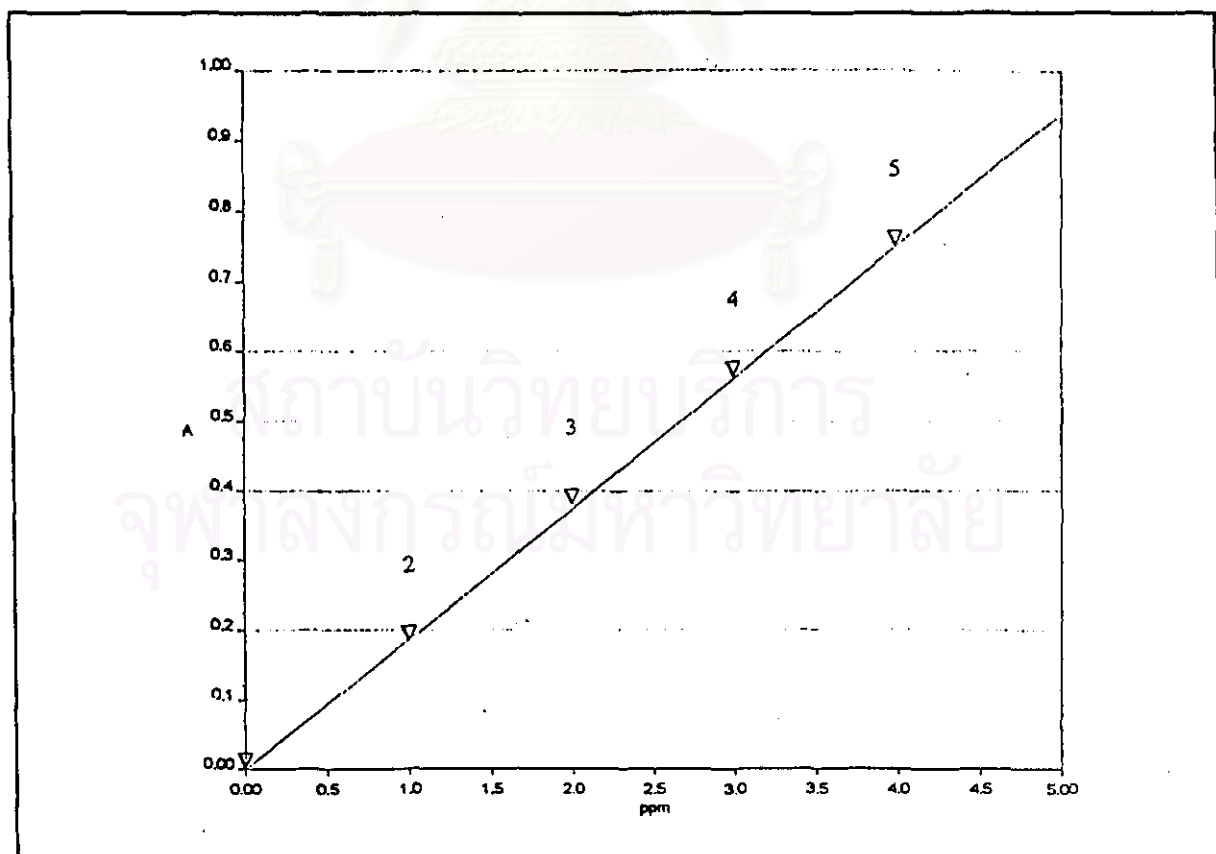
Description : $Y = 7.945902e-03 + 7.293377e-02 * X$

Figure 20-2 Calibration curve of solvent 2 of marker dye 9 in high-speed diesel oil.



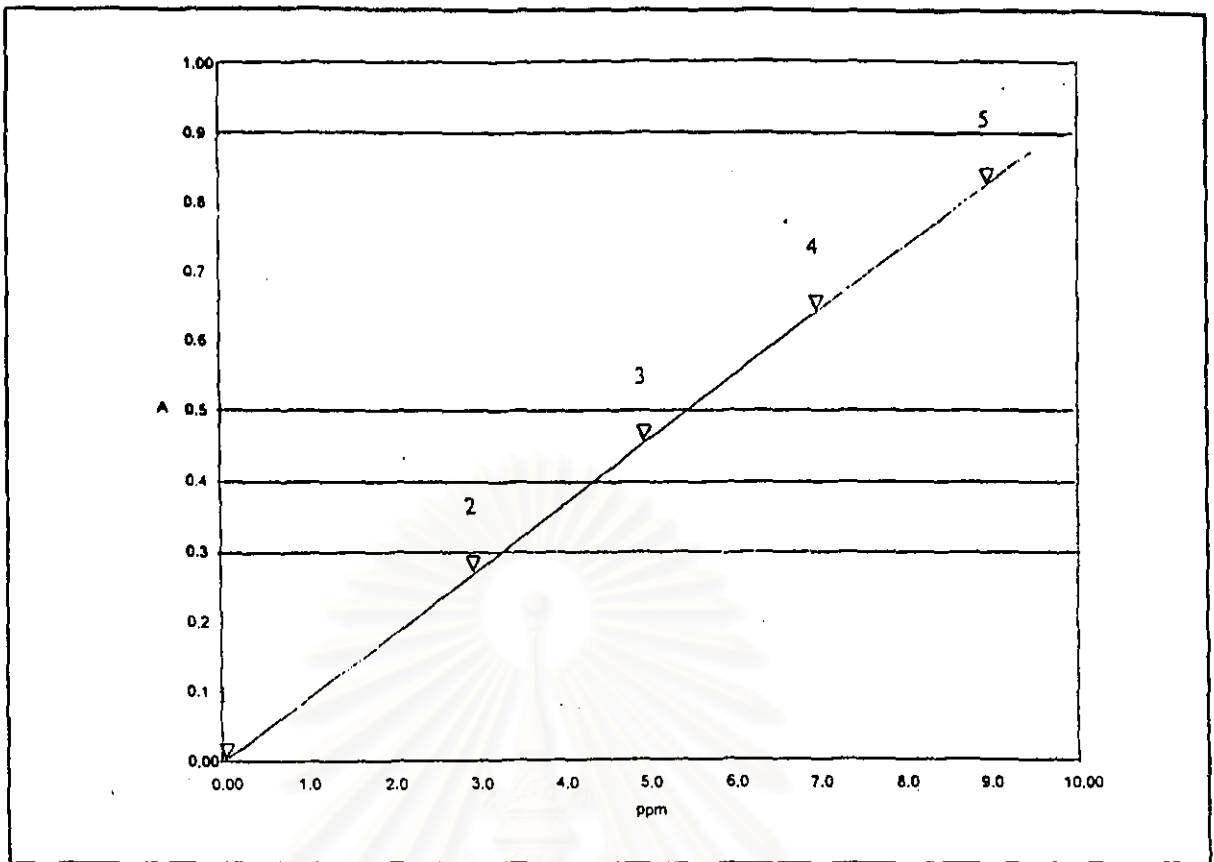
Description : $Y = 1.667e-04 + 1.1940e-01 * X$

Figure 20-3 Calibration curve of solvent 3 of marker dye 9 in high-speed diesel oil.



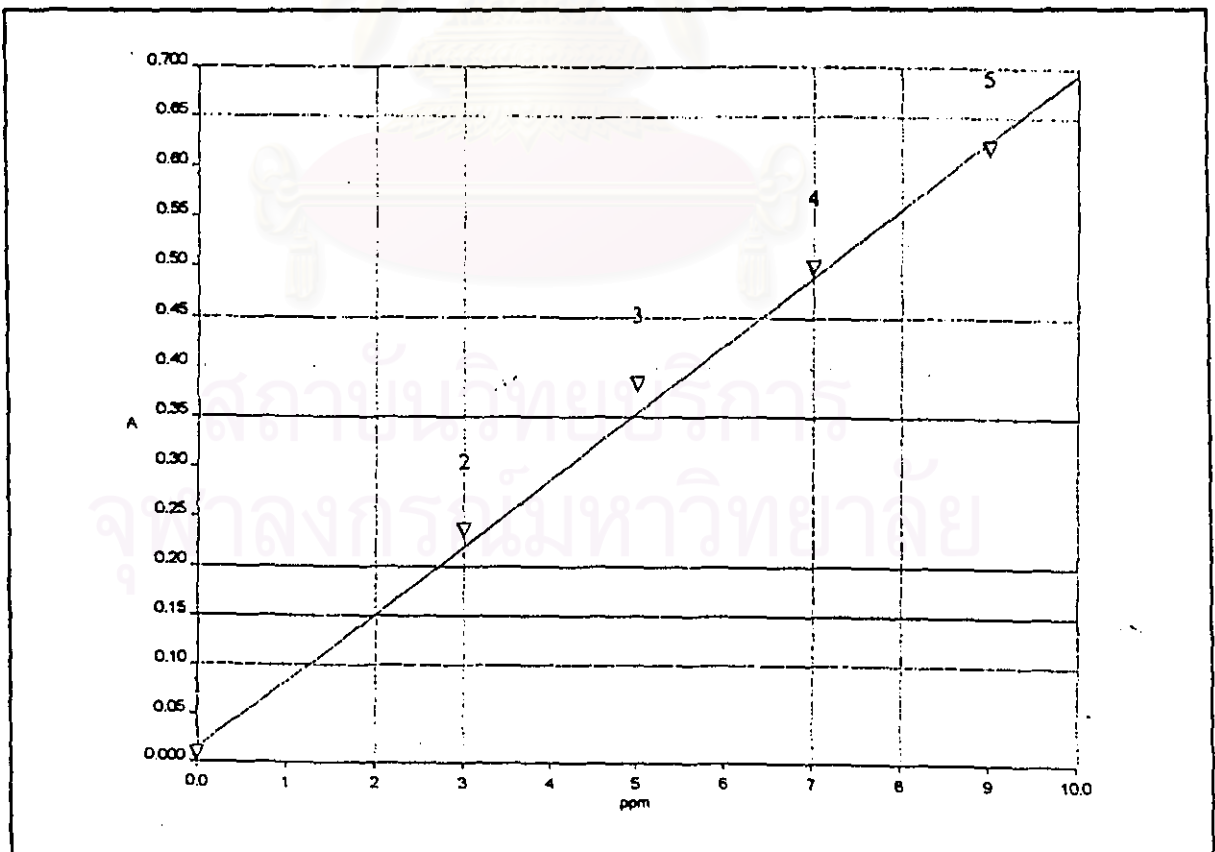
Description : $Y = -8.000000e-04 + 1.875350e-01 * X$

Figure 20-4 Calibration curve of solvent 4 of marker dye 9 in high-speed diesel oil.



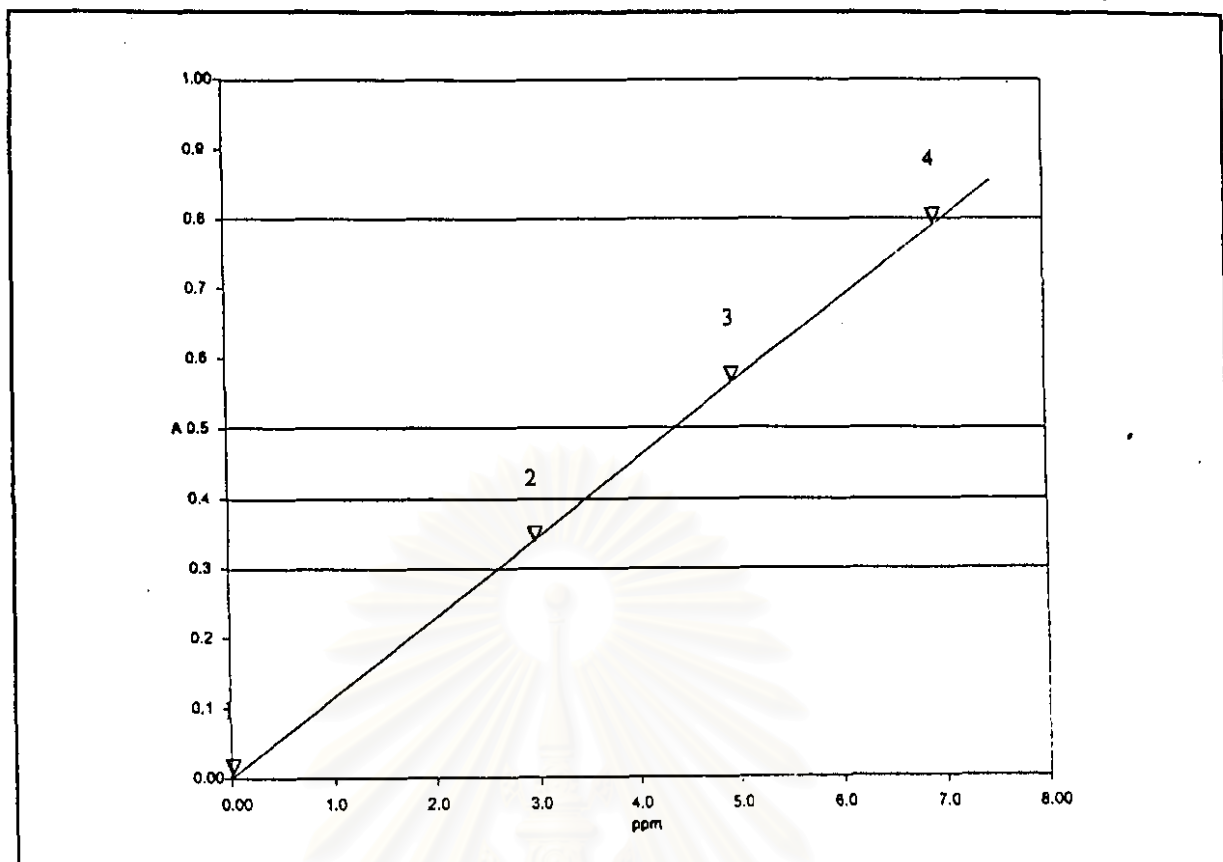
Description : $Y = -2.3000e-03 + 9.230e-01 * X$

Figure 21-1 Calibration curve of solvent 1 of marker dye 10 in high-speed diesel oil.



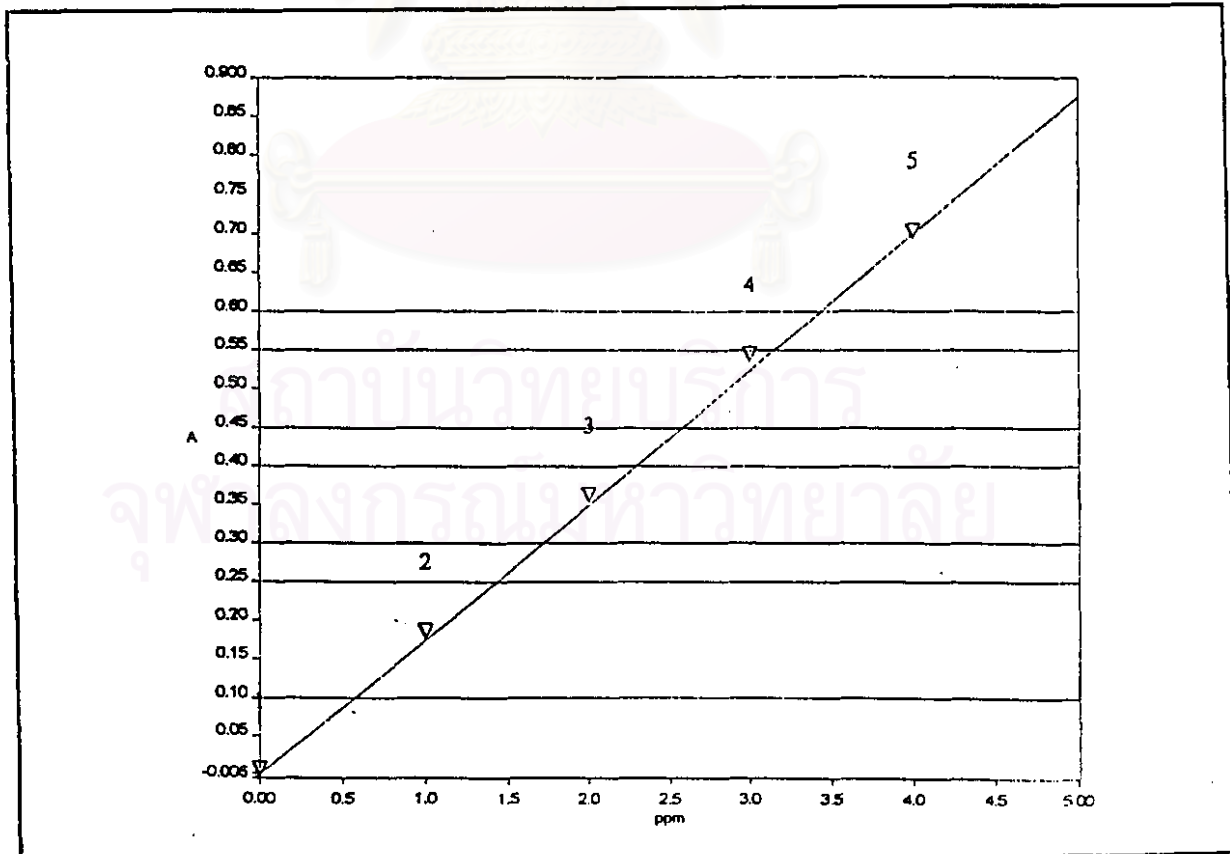
Description : $Y = 1.486738e-02 + 6.800221e-02 * X$

Figure 21-2 Calibration curve of solvent 2 of marker dye 10 in high-speed diesel oil.



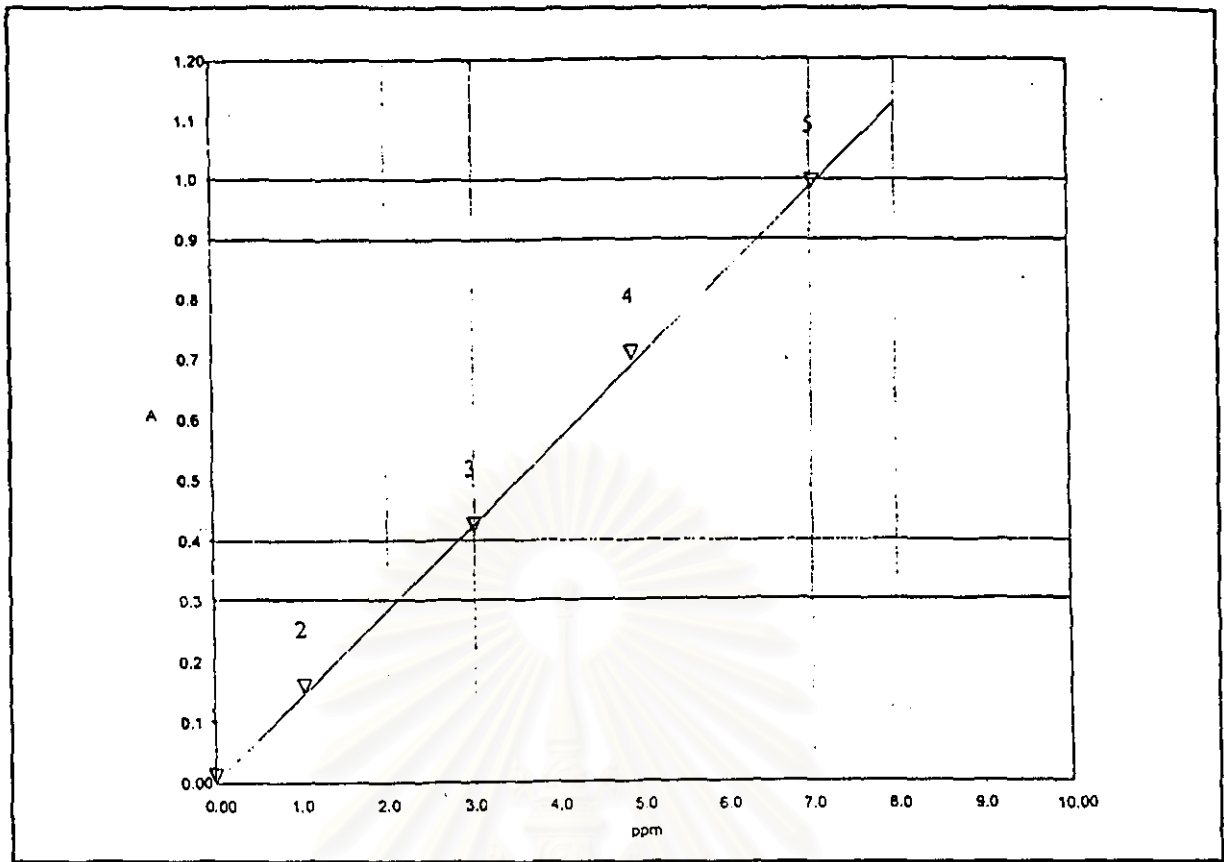
Description : $Y = 1.000e-03 + 1.1400e-01 * X$

Figure 21-3 Calibration curve of solvent 3 of marker dye 10 in high-speed diesel oil.



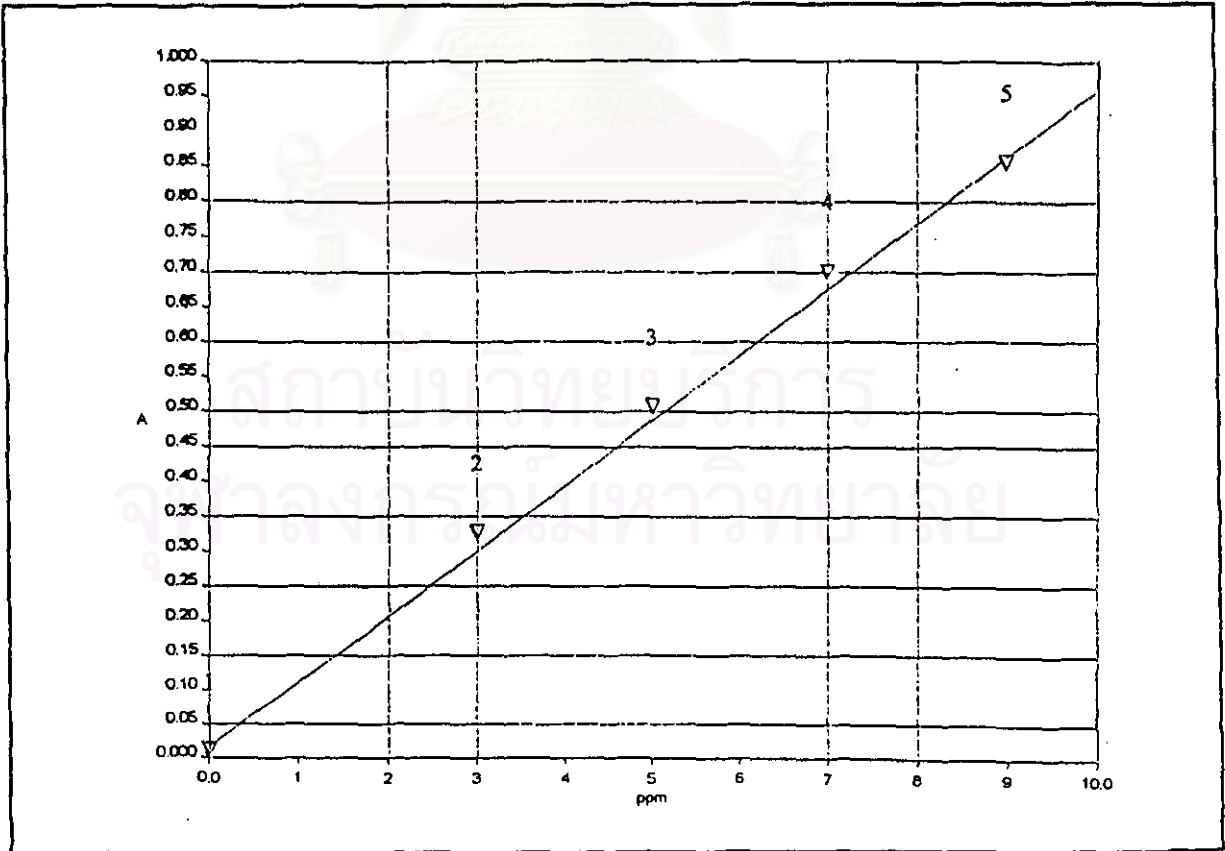
Description : $Y = -9.060000e-04 + 1.752810e-01 * X$

Figure 21-4 Calibration curve of solvent 4 of marker dye 10 in high-speed diesel oil.



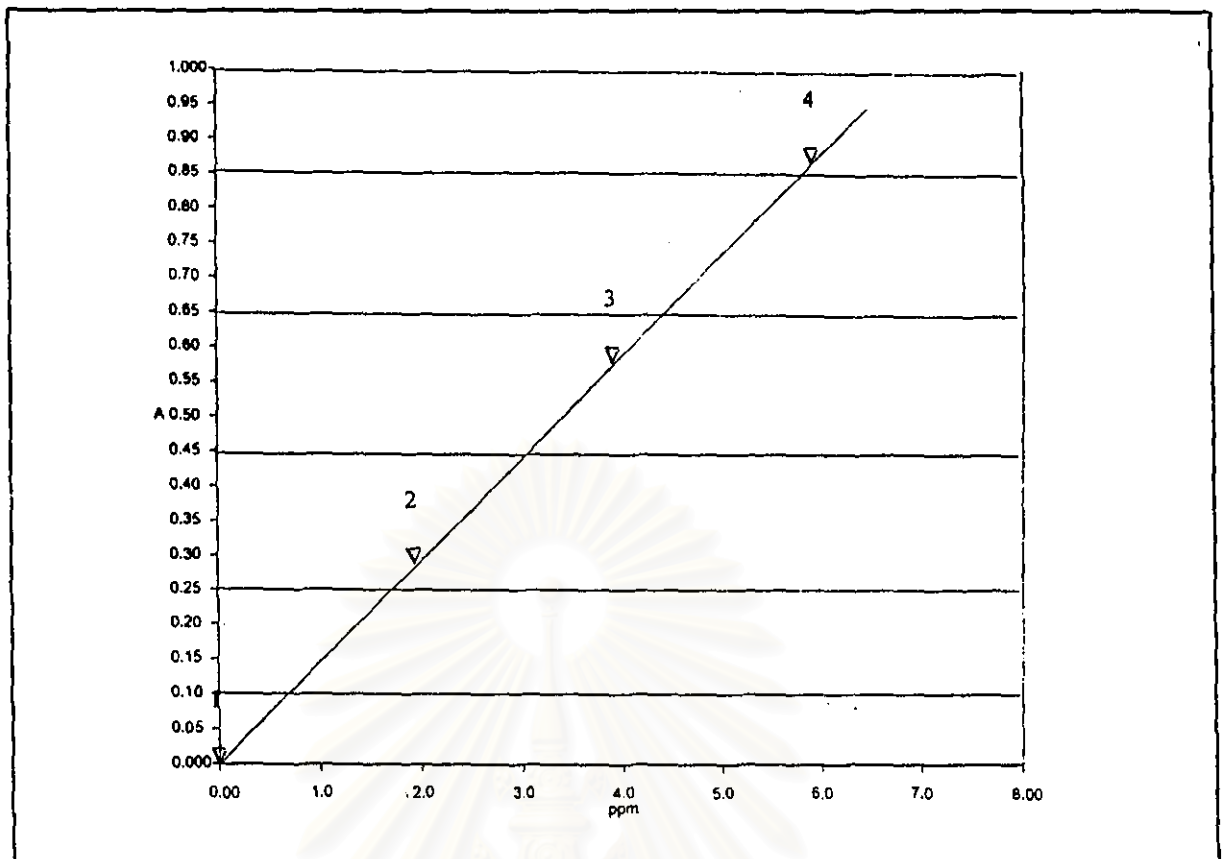
Description : $Y = 7.6500e-04 + 1.4100e-01 * X$

Figure 22-1 Calibration curve of solvent 1 of marker dye 11 in high-speed diesel oil.



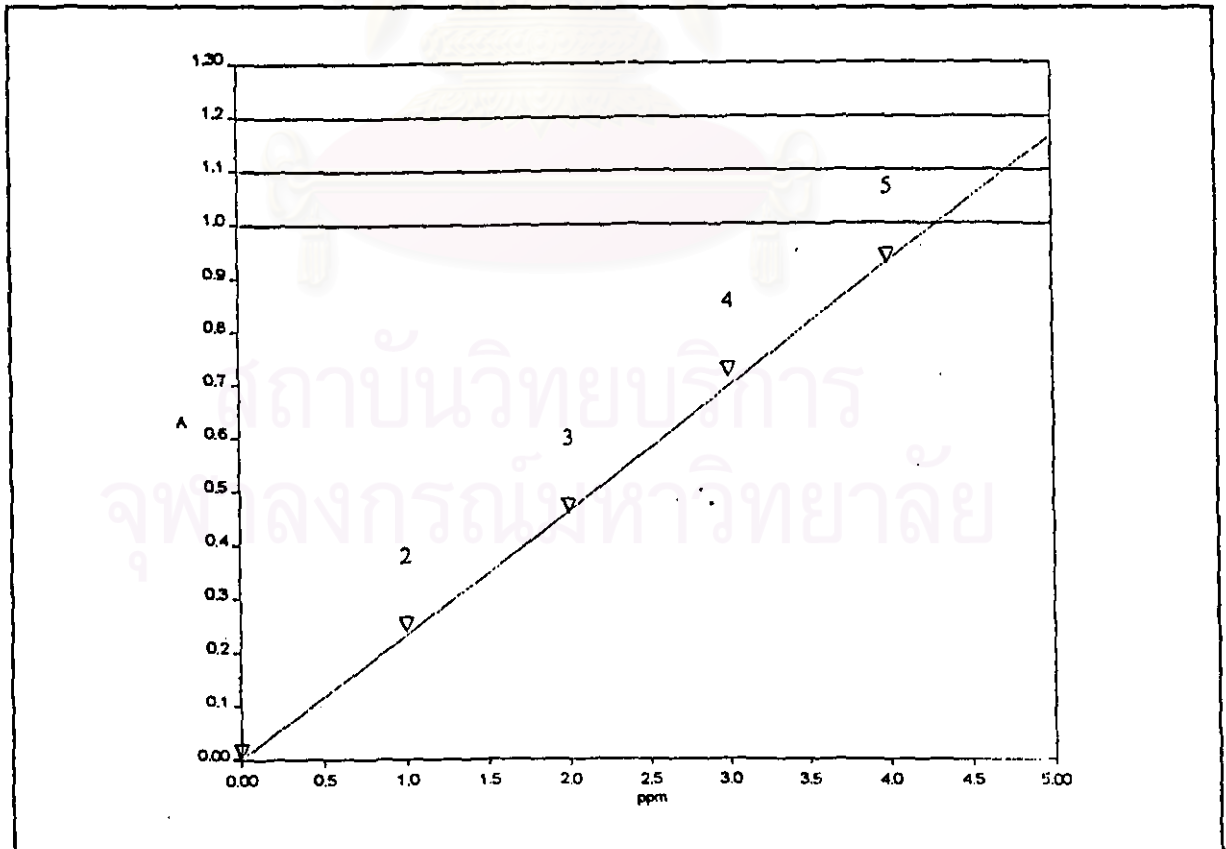
Description : $Y = 1.689164e-02 + 9.421549e-02 * X$

Figure 22-2 Calibration curve of solvent 2 of marker dye 11 in high-speed diesel oil.



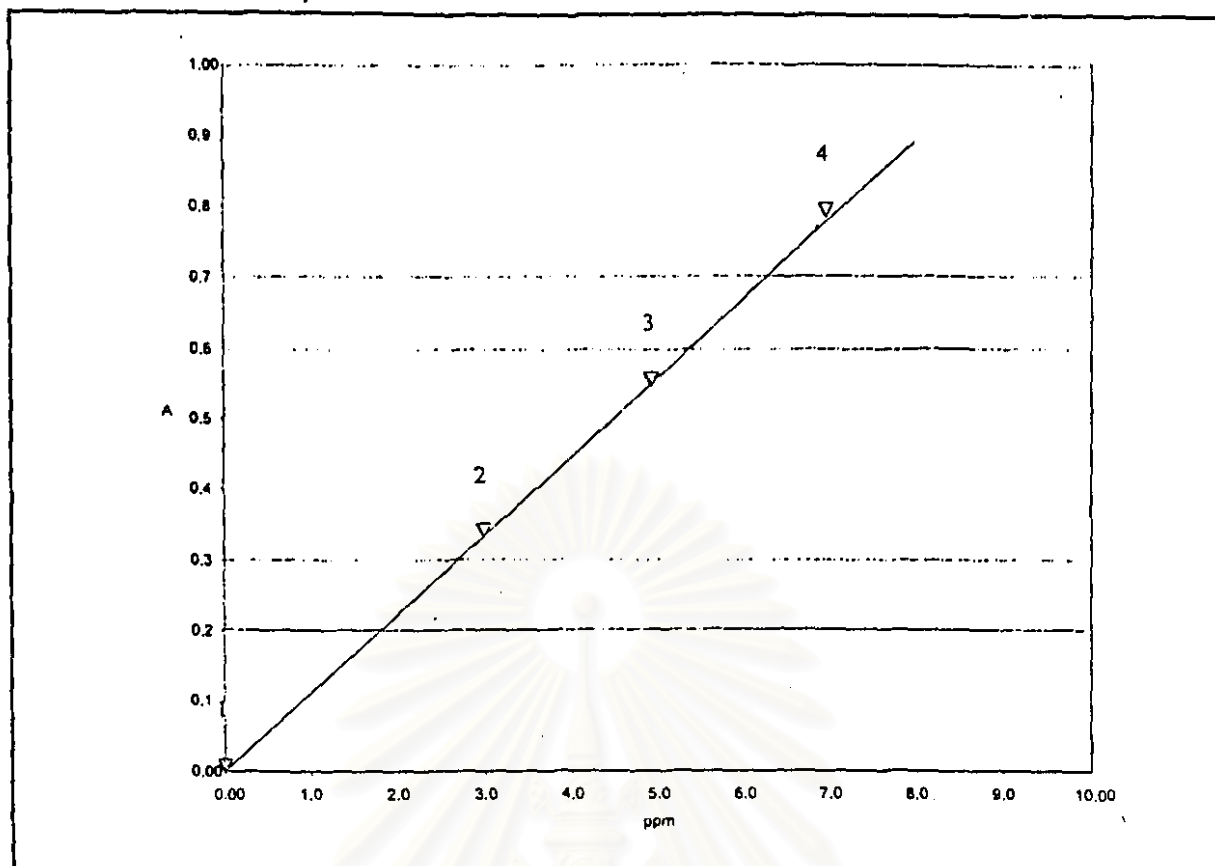
Description : $Y = -3.333e-04 + 1.46300e-01 * X$

Figure 22-3 Calibration curve of solvent 3 of marker dye 11 in high-speed diesel oil.



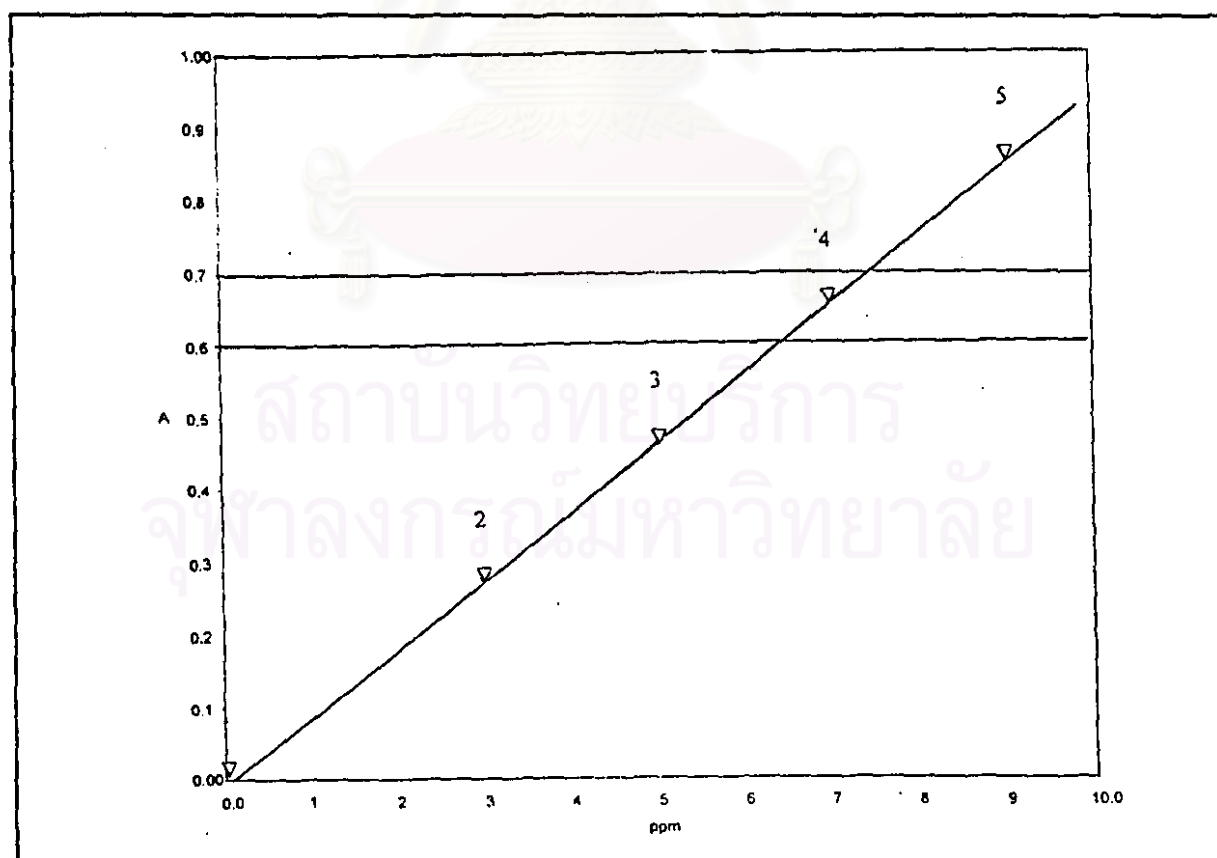
Description : $Y = -1.760000e-04 + 2.328760e-01 * X$

Figure 22-4 Calibration curve of solvent 4 of marker dye 11 in high-speed diesel oil.



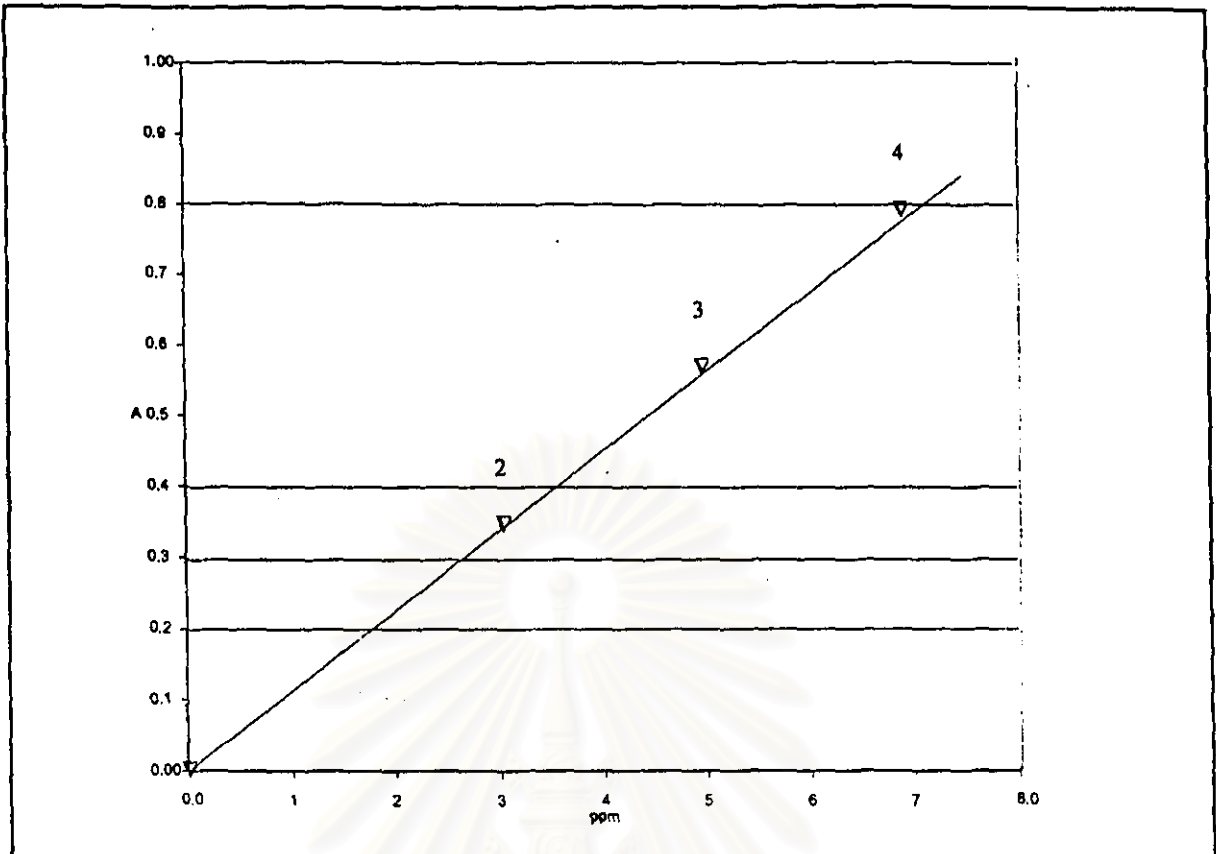
Description : $Y = -5.000e-04 + 1.1150e-01 * X$

Figure 23-1 Calibration curve of solvent 1 of marker dye 12 in high-speed diesel oil.



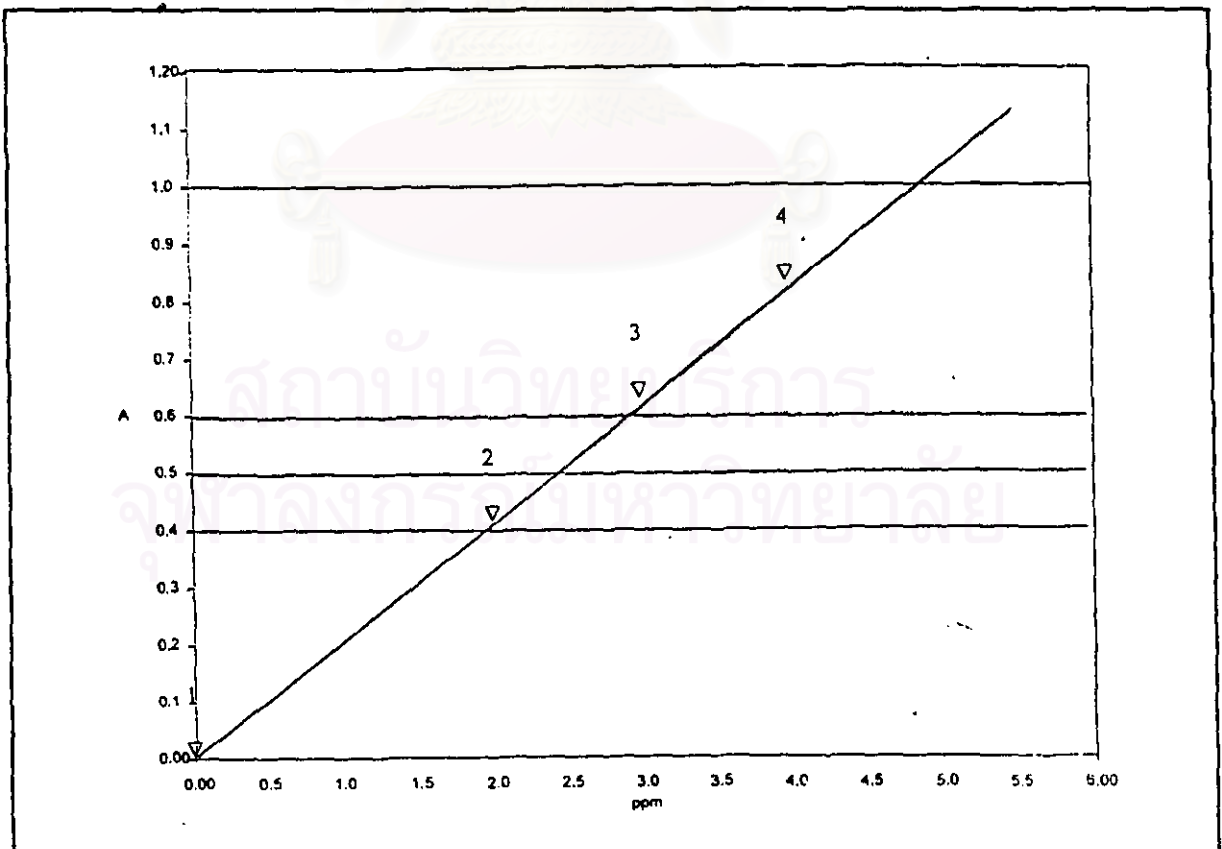
Description : $Y = -1.01000e-02 + 9.5100e-02 * X$

Figure 23-2 Calibration curve of solvent 2 of marker dye 12 in high-speed diesel oil.



Description : $Y = -5.000e-04 + 1.12500e-01 * X$

Figure 23-3 Calibration curve of solvent 3 of marker dye 12 in high-speed diesel oil.



Description : $Y = 1.833333e-03 + 2.055000e-01 * X$

Figure 23-4 Calibration curve of solvent 4 of marker dye 12 in high-speed diesel oil.

VITA

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