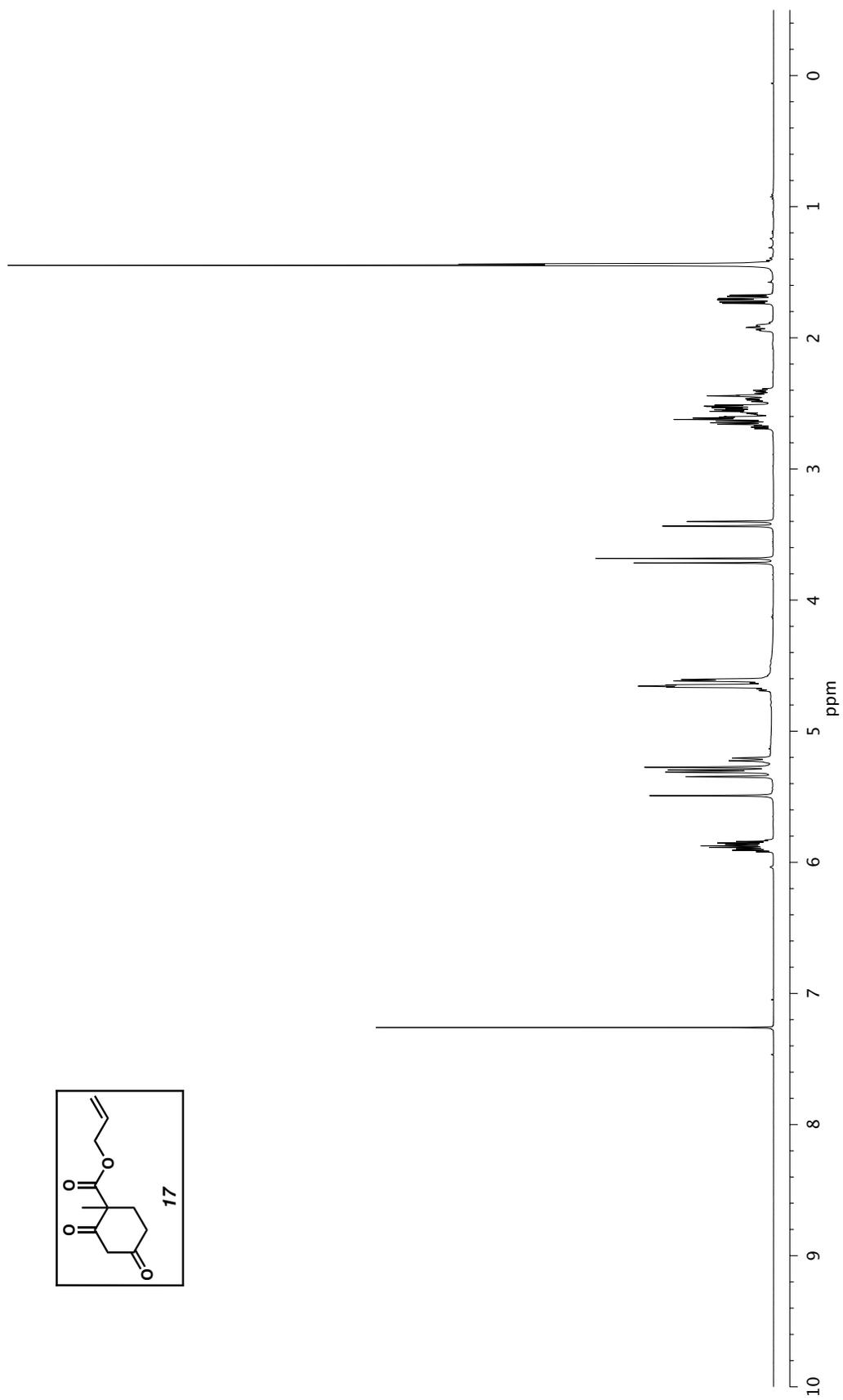


APPENDIX 1

Spectra Relevant to Chapter 1:

*Expanding Insight into the Asymmetric Palladium-Catalyzed
Allylic Alkylation of N-Heterocyclic Molecules and Cyclic Ketones*

Figure A1.1.1. ^1H NMR (500 MHz, CDCl_3) of compound 17.

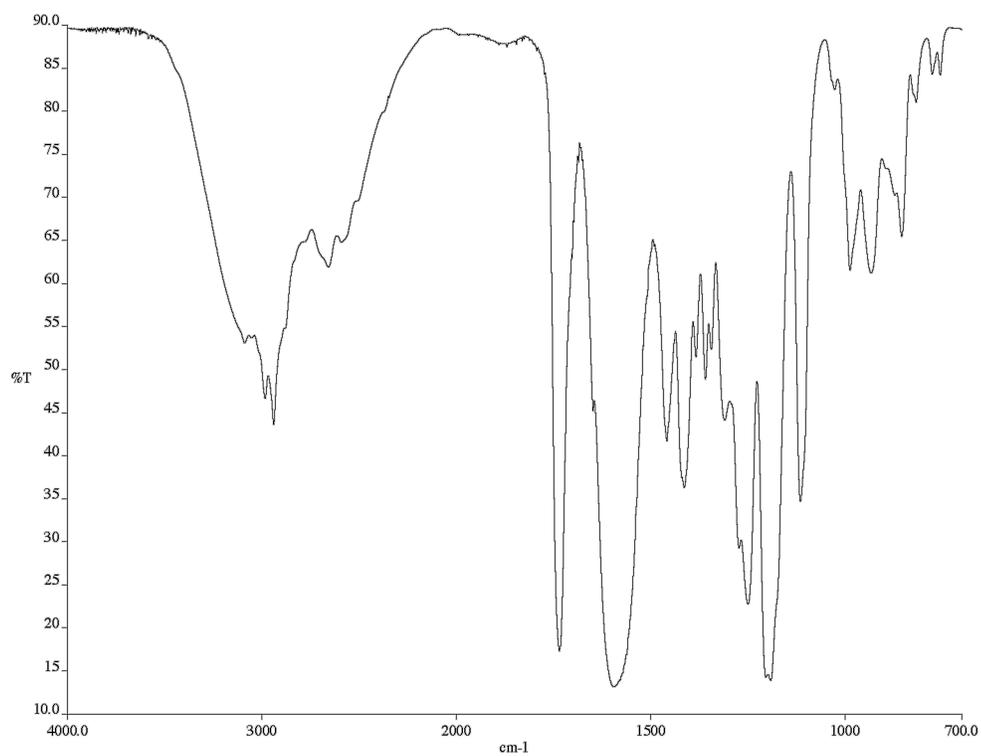


Figure A1.1.2. Infrared spectrum (thin film/NaCl) of compound 17.

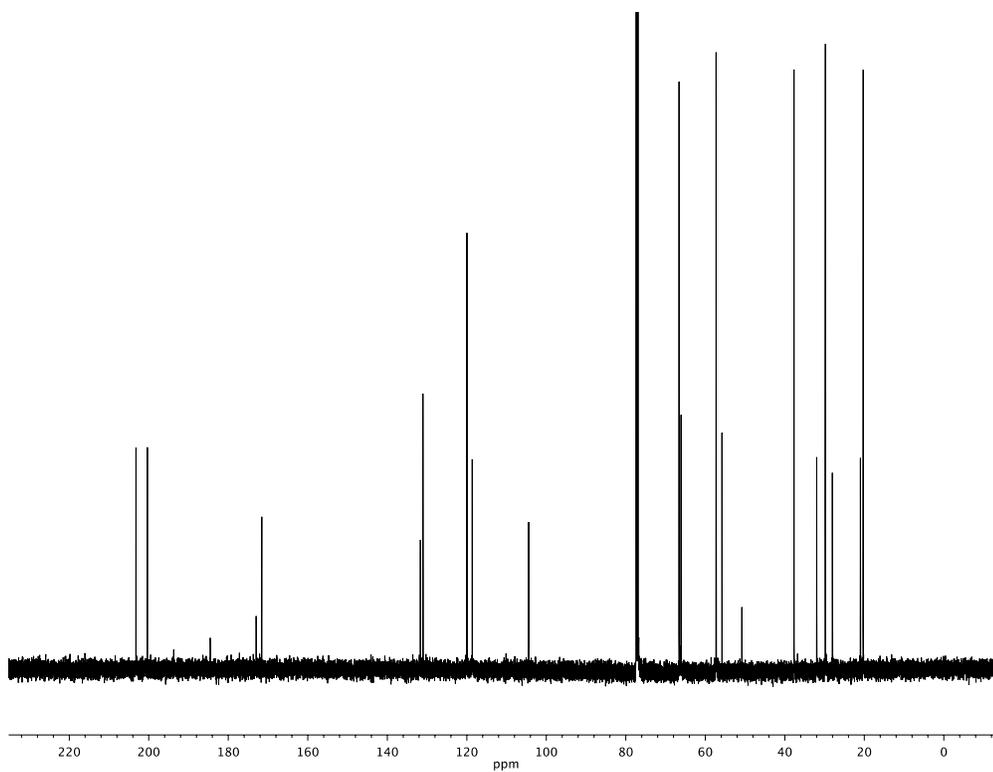
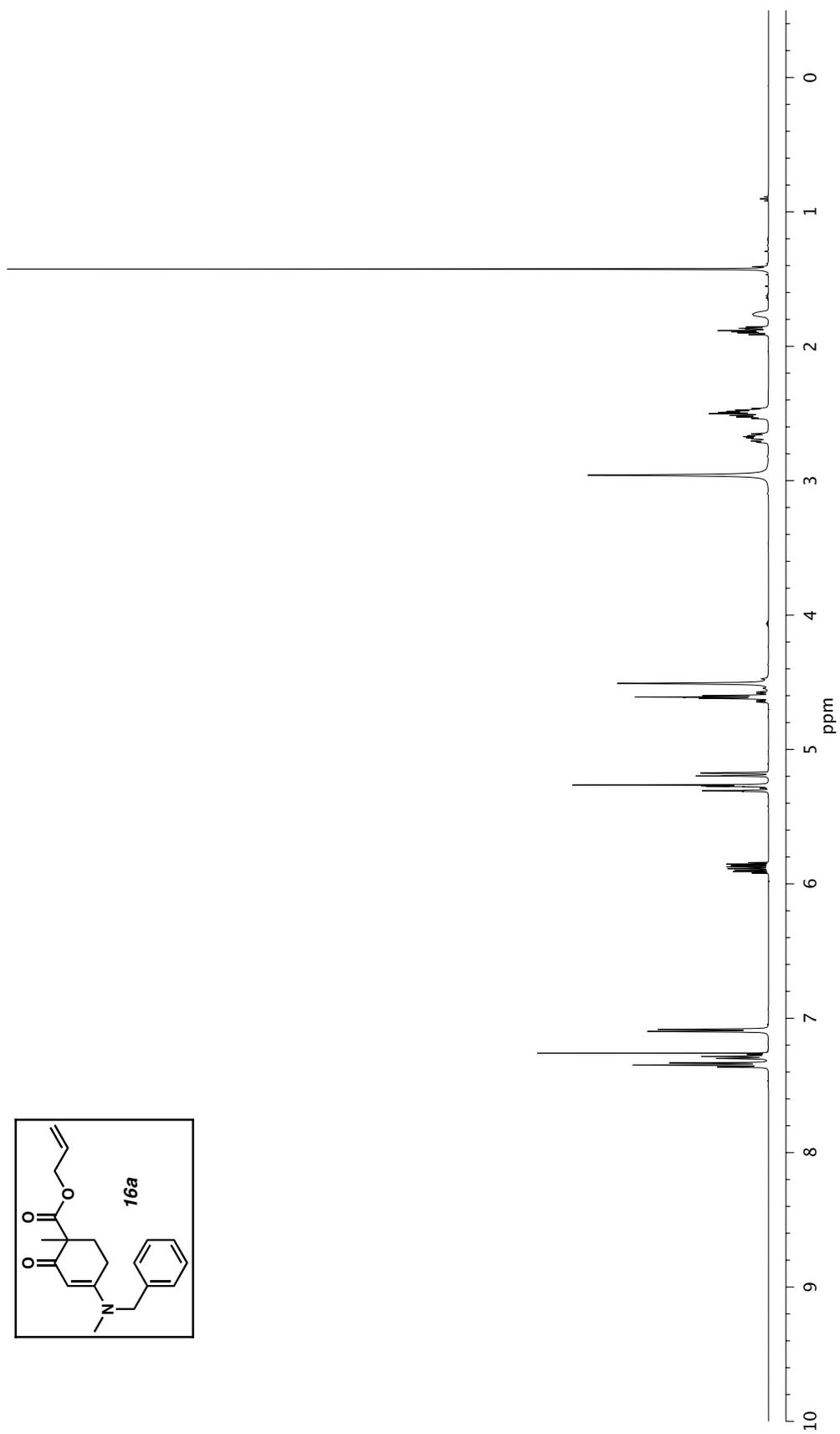
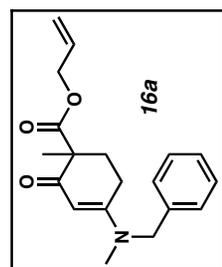


Figure A1.1.3. ¹³C NMR (125 MHz, CDCl₃) of compound 17.

Figure A1.2.1. ¹H NMR (500 MHz, CDCl₃) of compound **16a**.

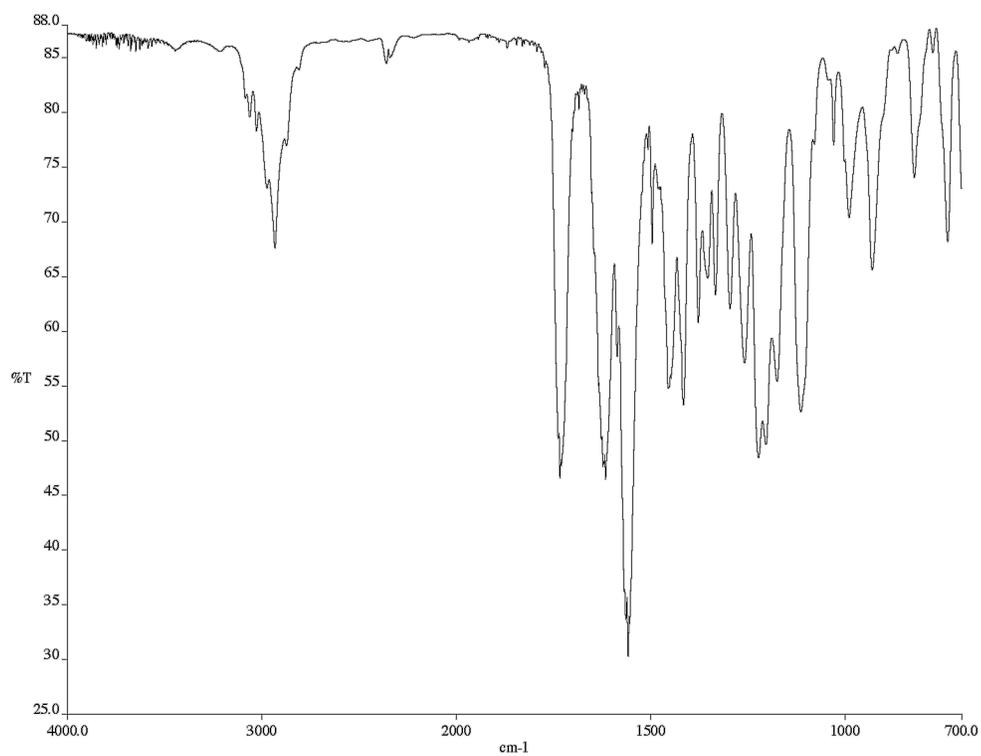


Figure A1.2.2. Infrared spectrum (thin film/NaCl) of compound **16a**.

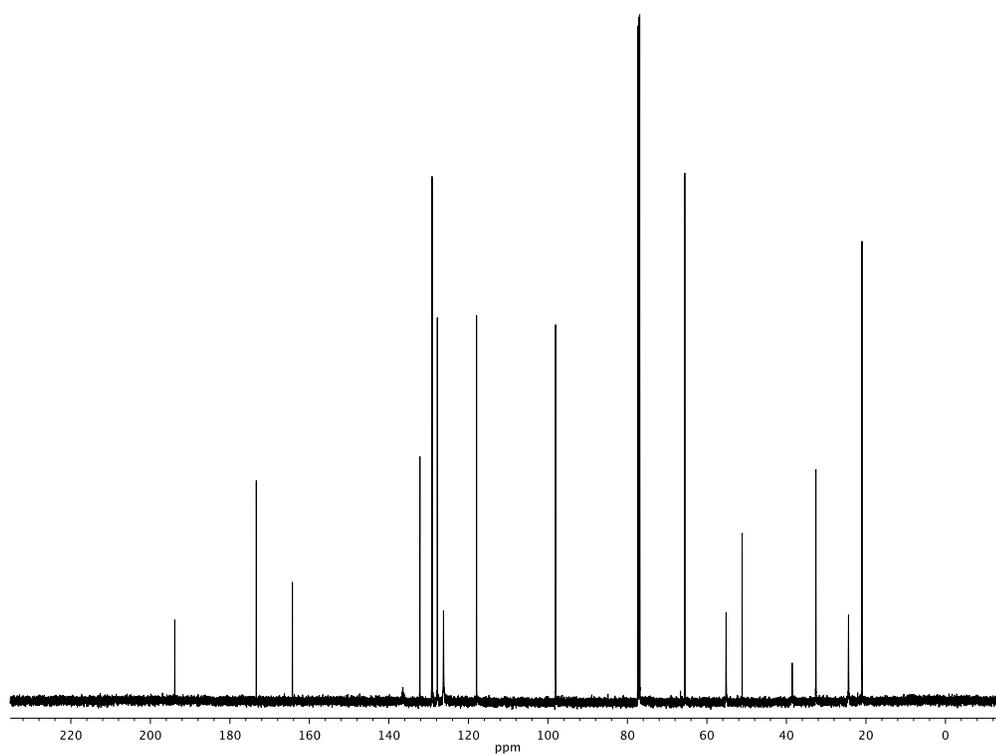
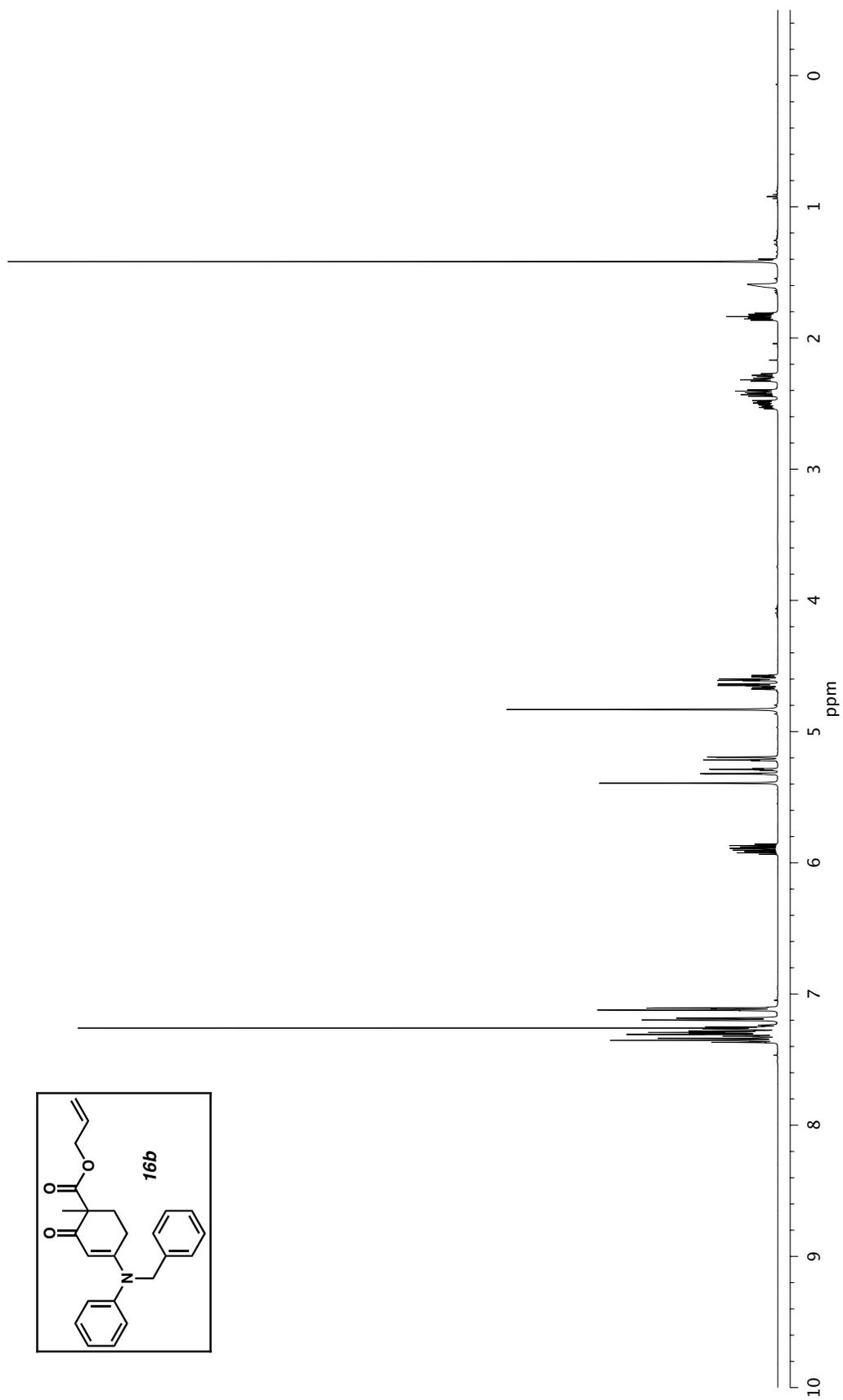


Figure A1.2.3. ¹³C NMR (125 MHz, CDCl₃) of compound **16a**.

Figure A1.3.1. ^1H NMR (500 MHz, CDCl_3) of compound **16b**.

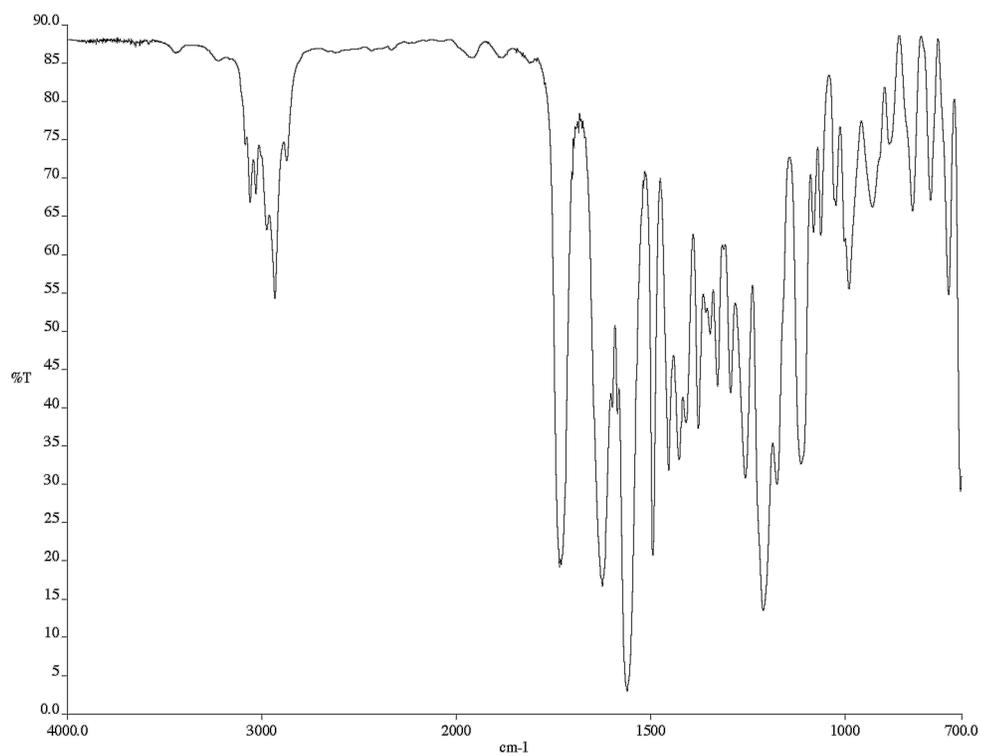


Figure A1.3.2. Infrared spectrum (thin film/NaCl) of compound **16b**.

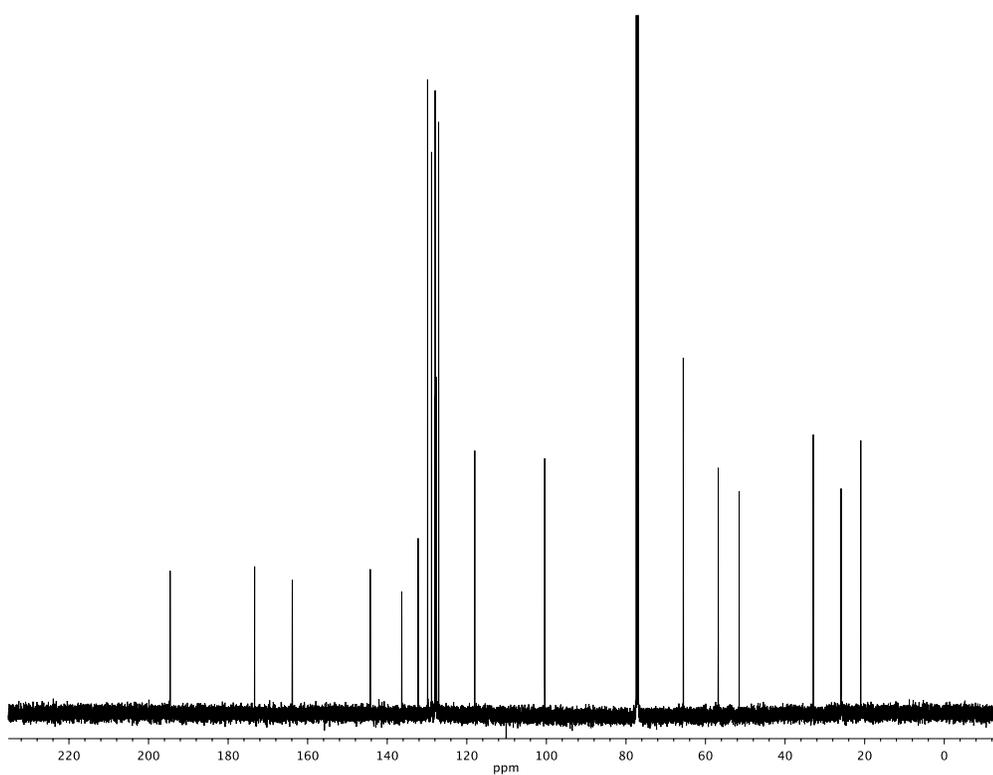
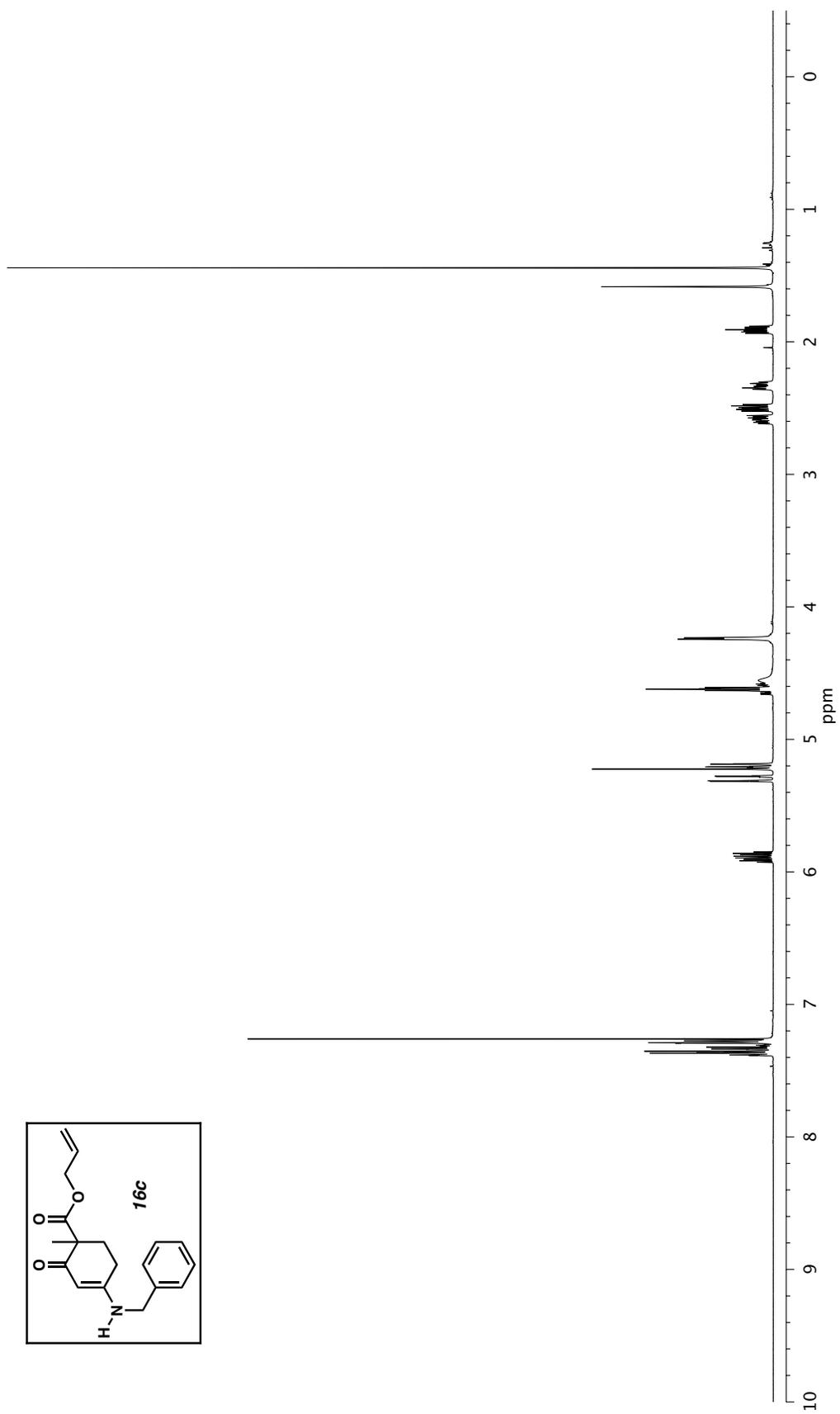


Figure A1.3.3. ^{13}C NMR (125 MHz, CDCl_3) of compound **16b**.

Figure A1.4.1. ¹H NMR (500 MHz, CDCl₃) of compound **16c**.

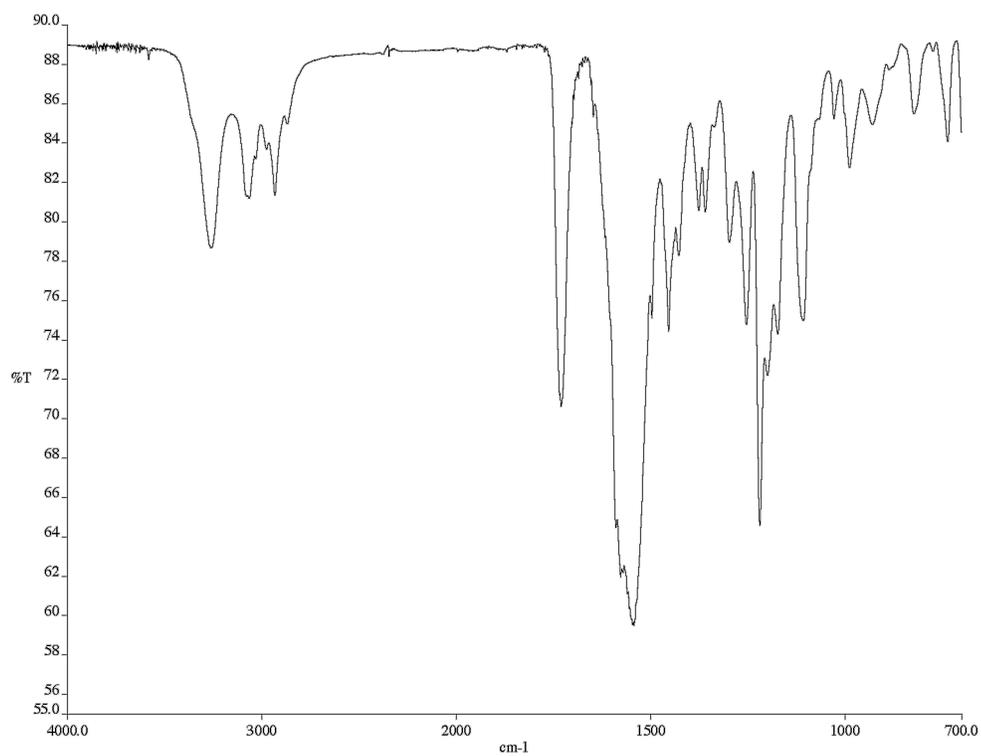


Figure A1.4.2. Infrared spectrum (thin film/NaCl) of compound **16c**.

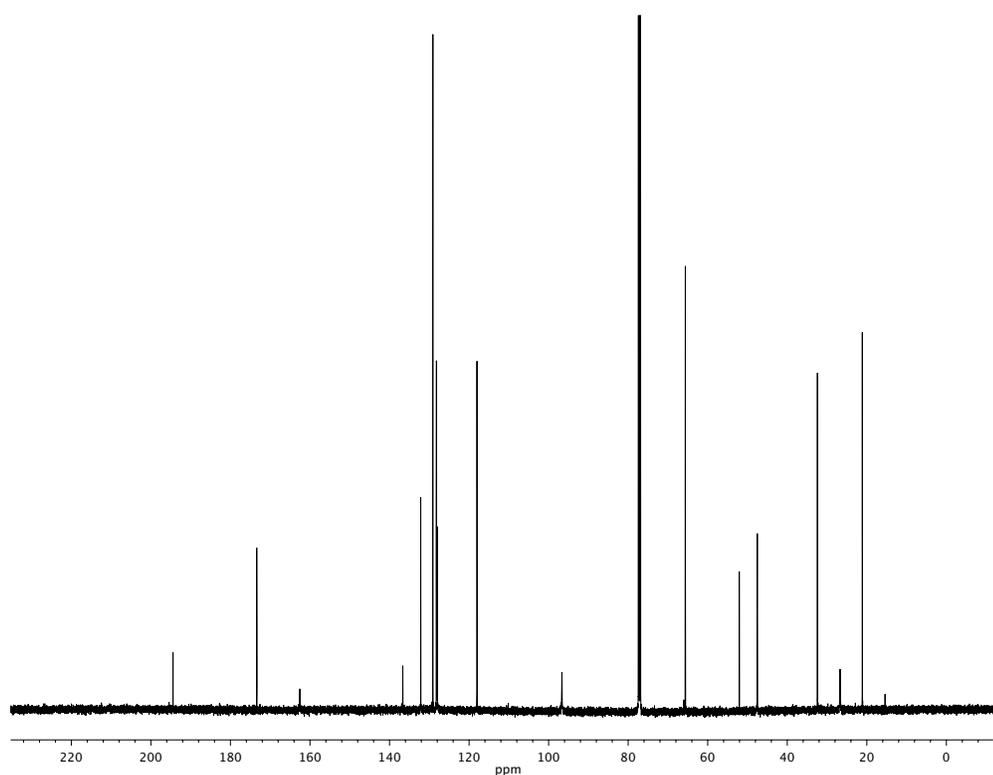


Figure A1.4.3. ¹³C NMR (125 MHz, CDCl₃) of compound **16c**.

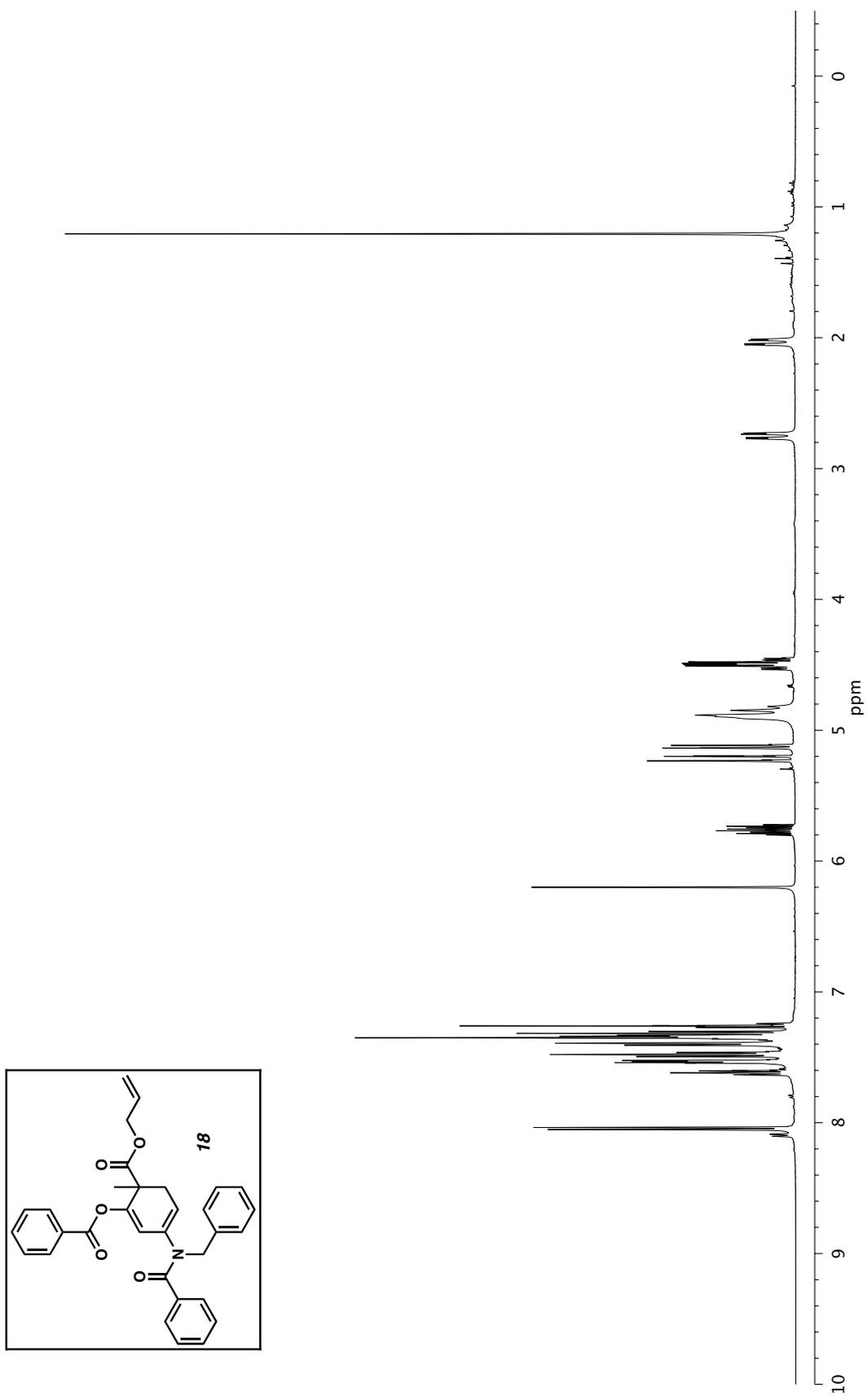


Figure A1.5.1. ^1H NMR (500 MHz, CDCl_3) of compound **18**.

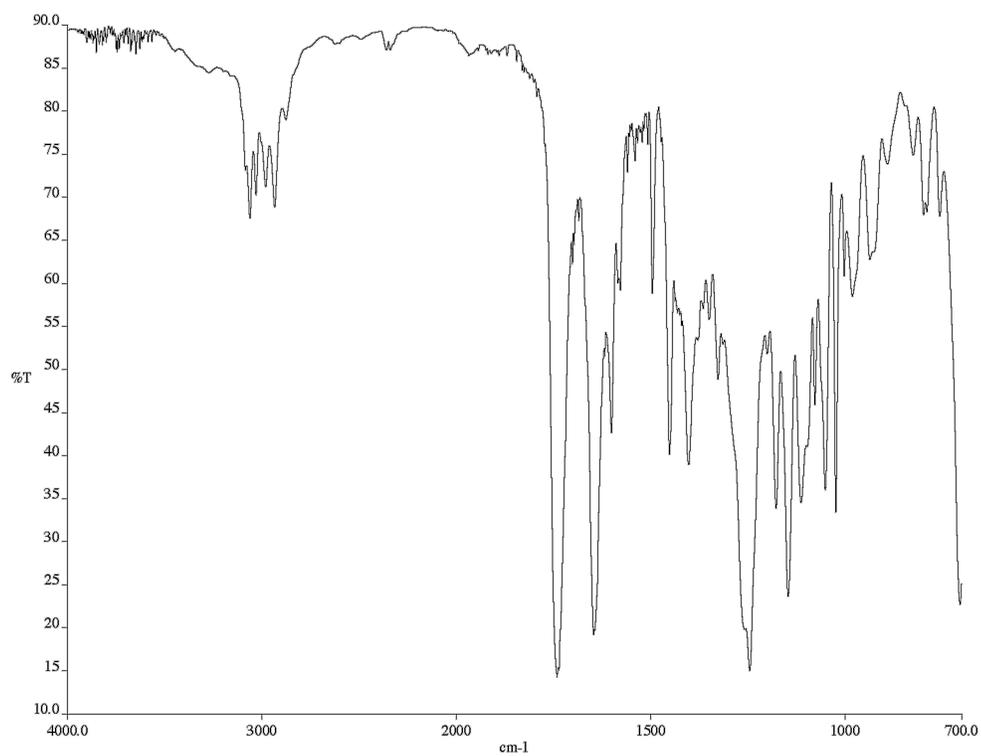


Figure A1.5.2. Infrared spectrum (thin film/NaCl) of compound **18**.

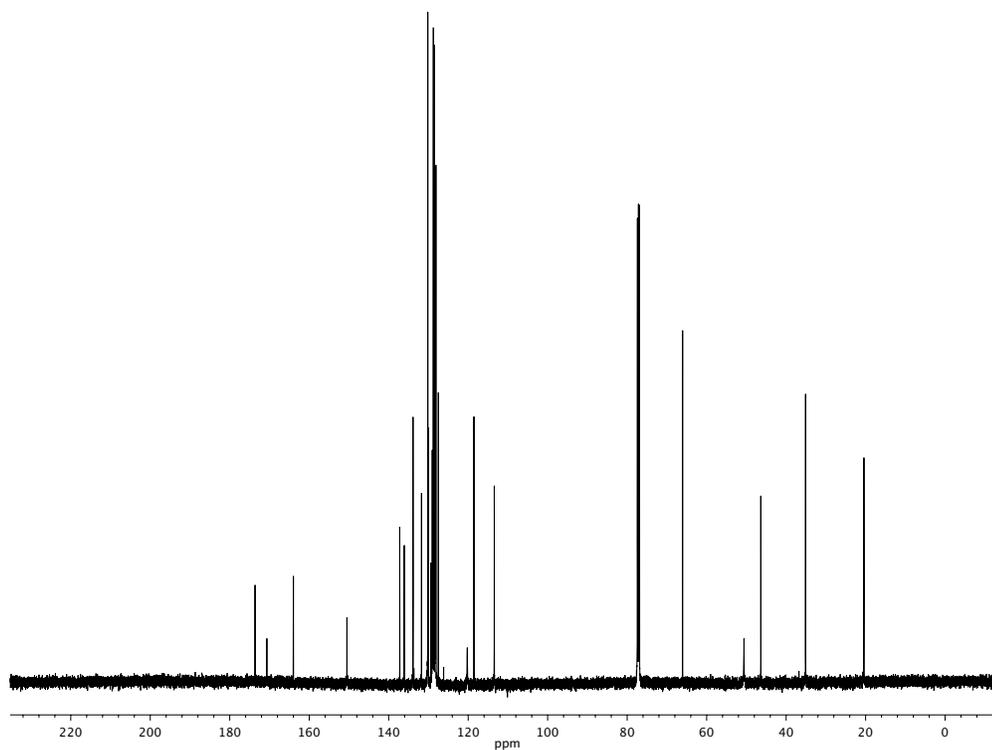


Figure A1.5.3. ^{13}C NMR (125 MHz, CDCl_3) of compound **18**.

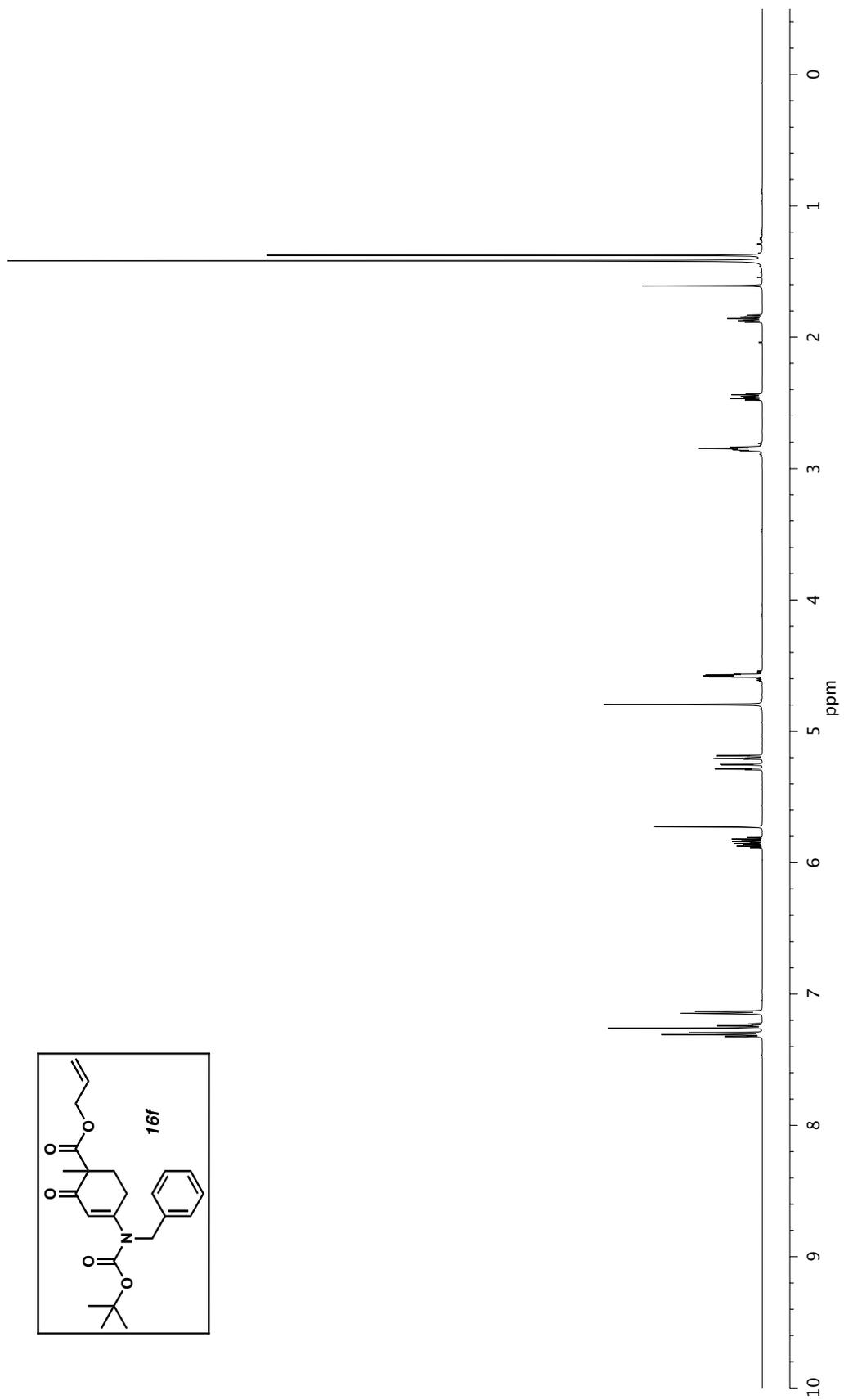


Figure A1.6.1. ¹H NMR (500 MHz, CDCl₃) of compound **16f**.

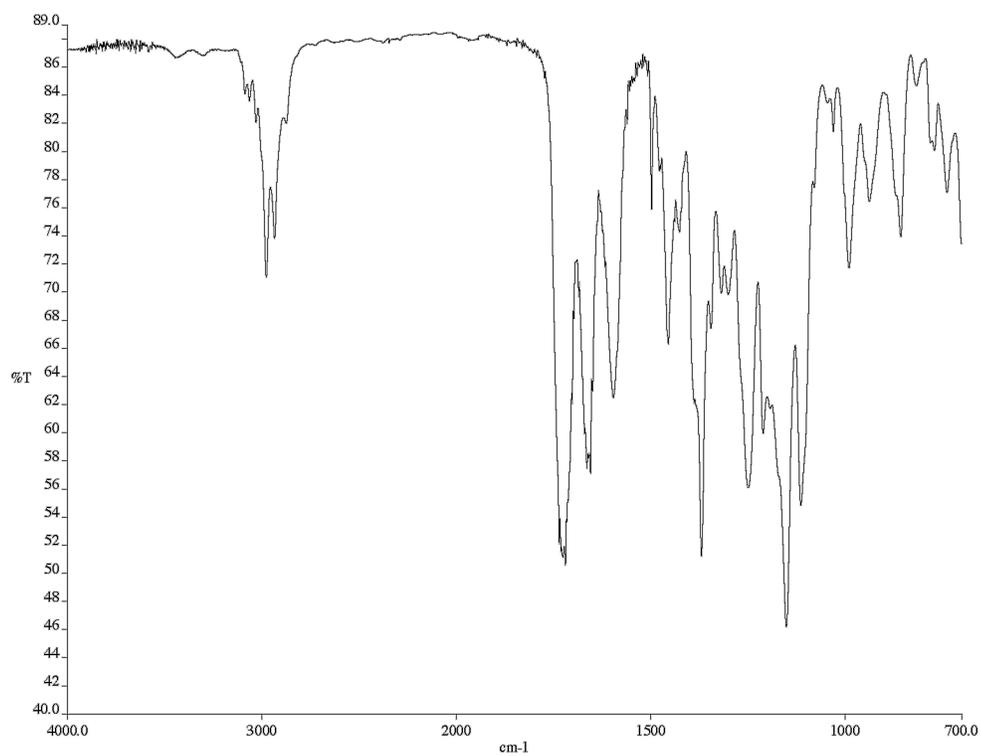


Figure A1.6.2. Infrared spectrum (thin film/NaCl) of compound **16f**.

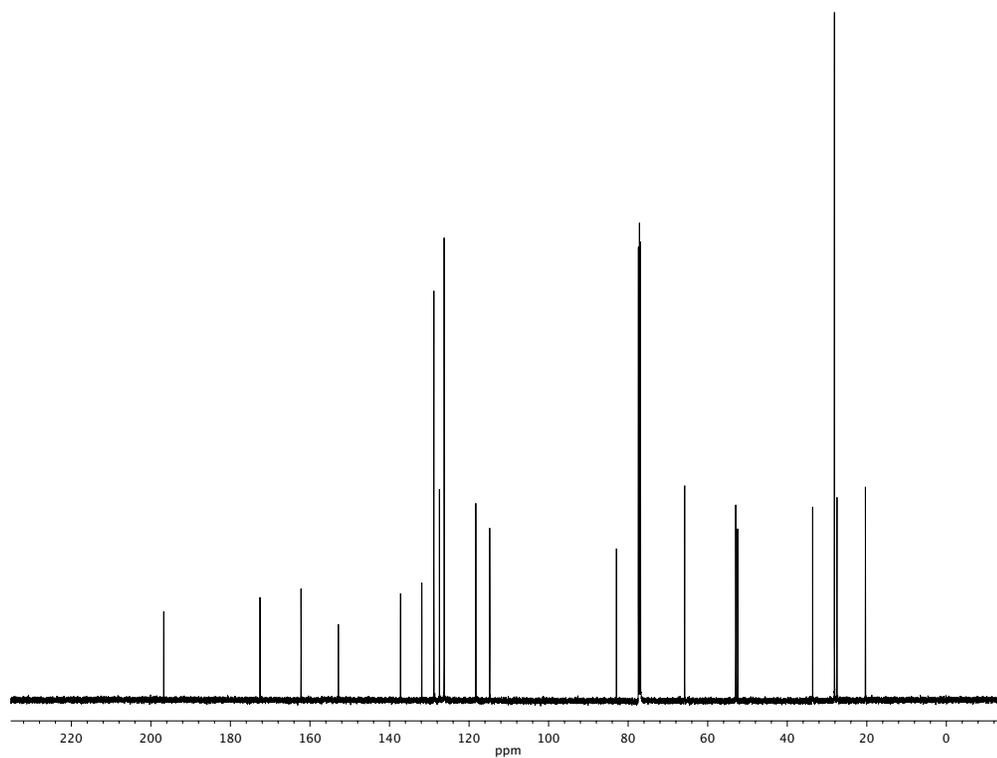
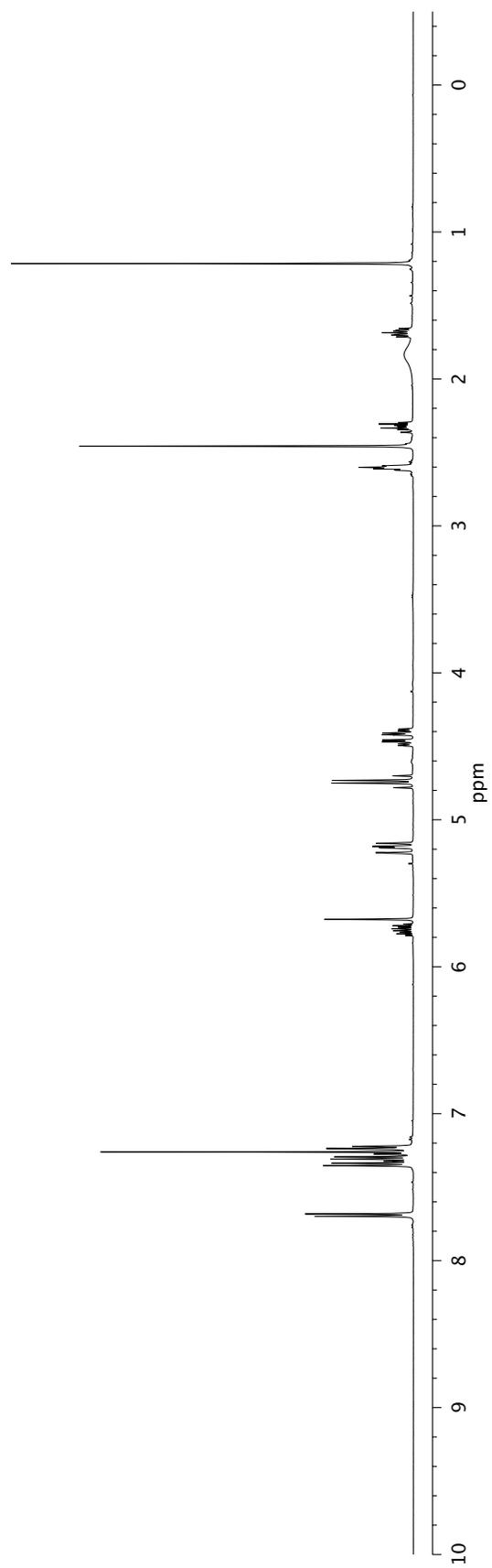
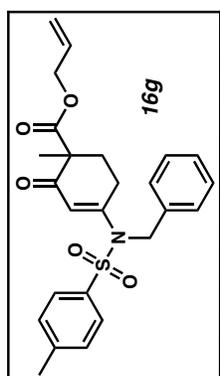


Figure A1.6.3. ¹³C NMR (125 MHz, CDCl₃) of compound **16f**.

Figure A1.7.1. ¹H NMR (500 MHz, CDCl₃) of compound **16g**.

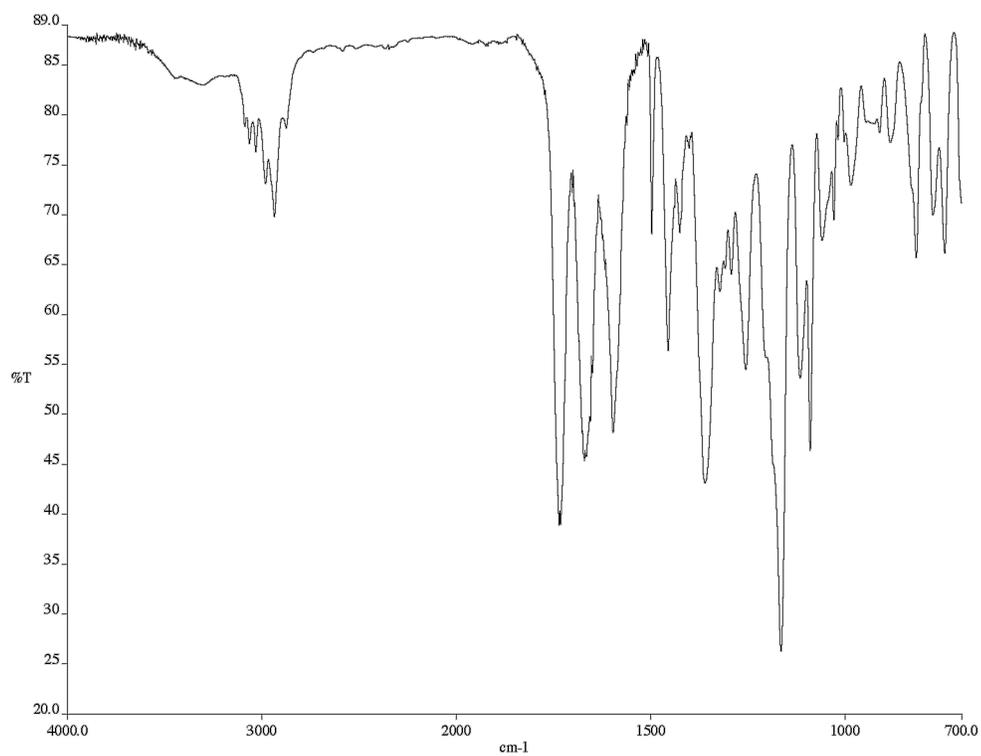


Figure A1.7.2. Infrared spectrum (thin film/NaCl) of compound **16g**.

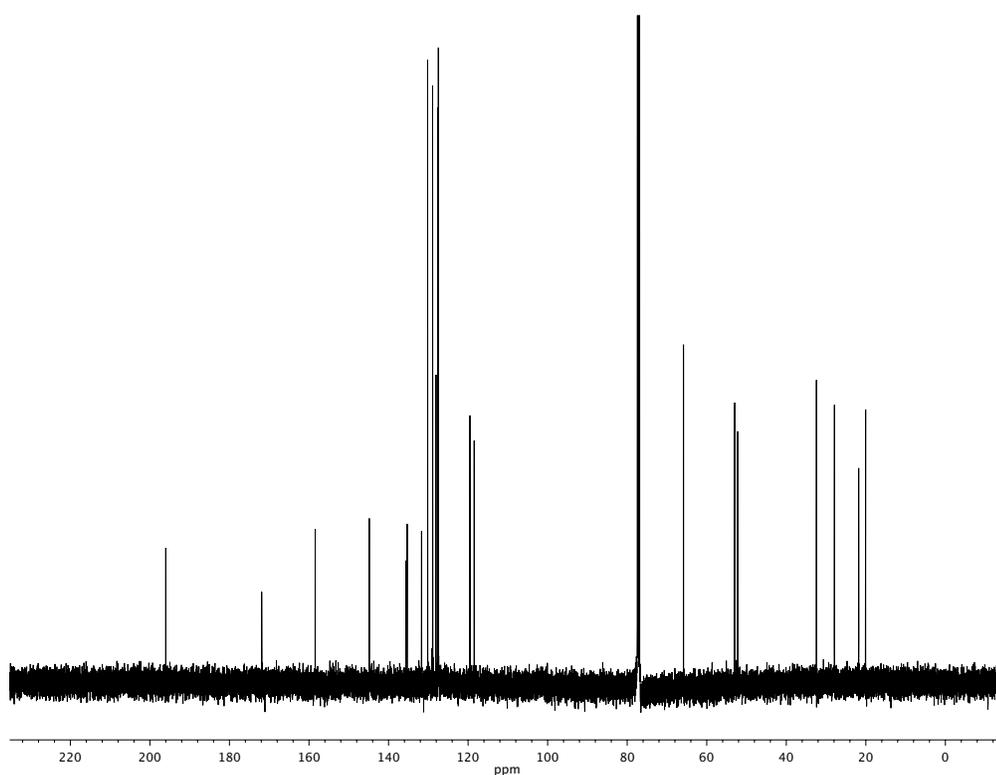


Figure A1.7.3. ¹³C NMR (125 MHz, CDCl₃) of compound **16g**.

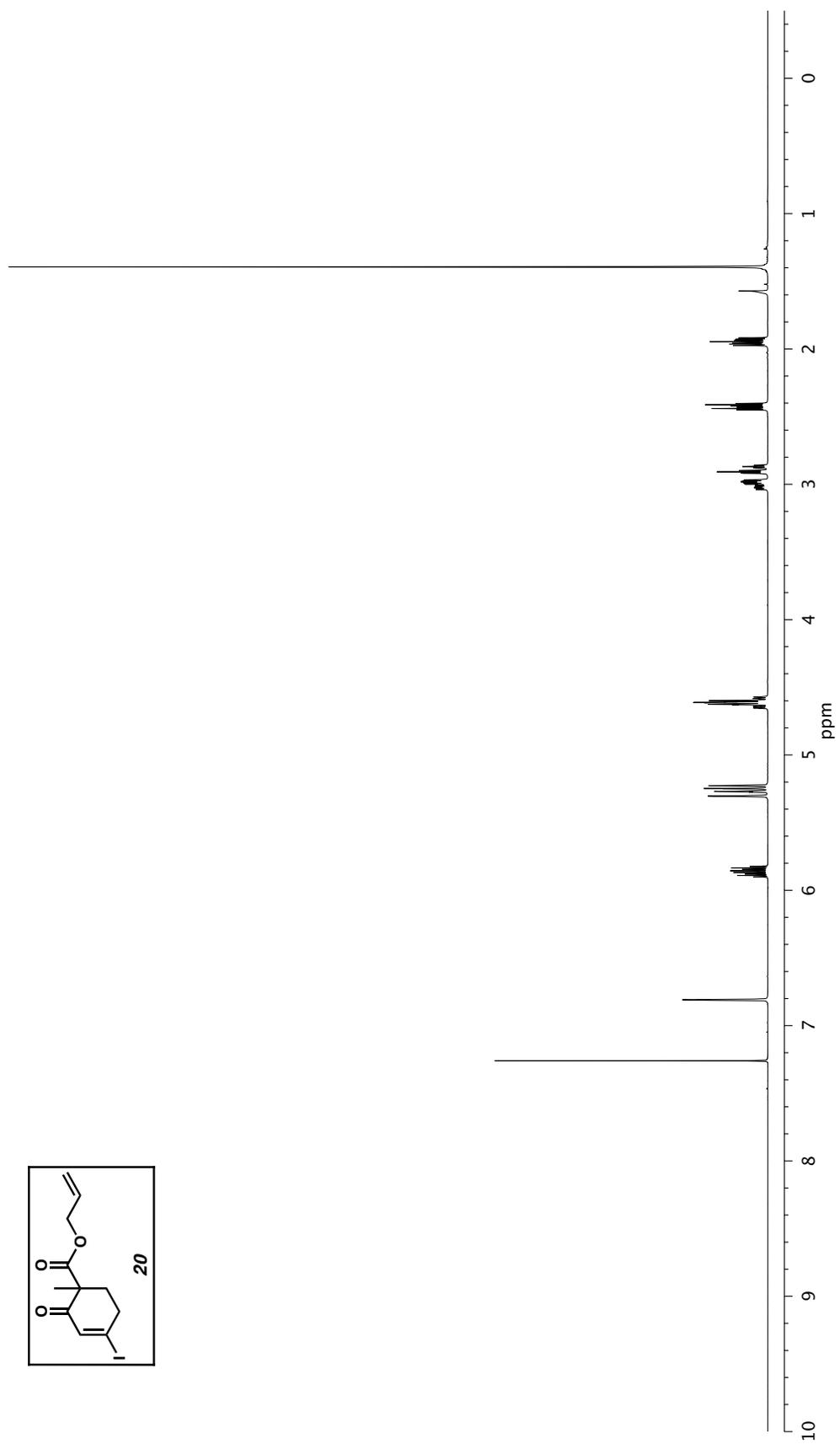


Figure A1.8.1. ^1H NMR (500 MHz, CDCl_3) of compound **20**.

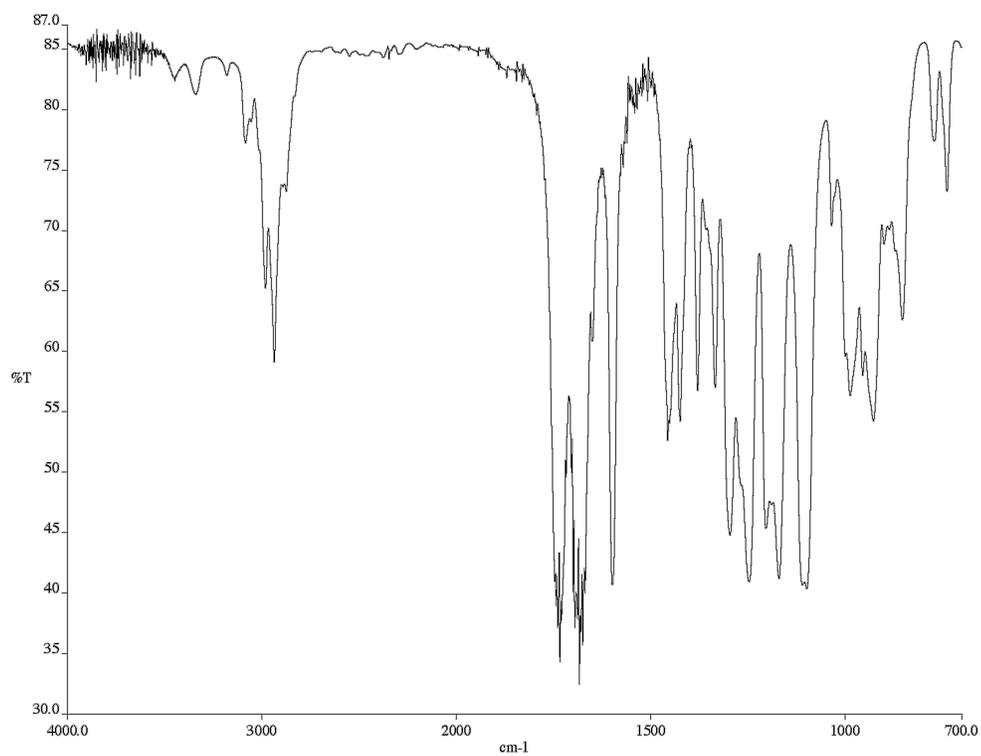


Figure A1.8.2. Infrared spectrum (thin film/NaCl) of compound 20.

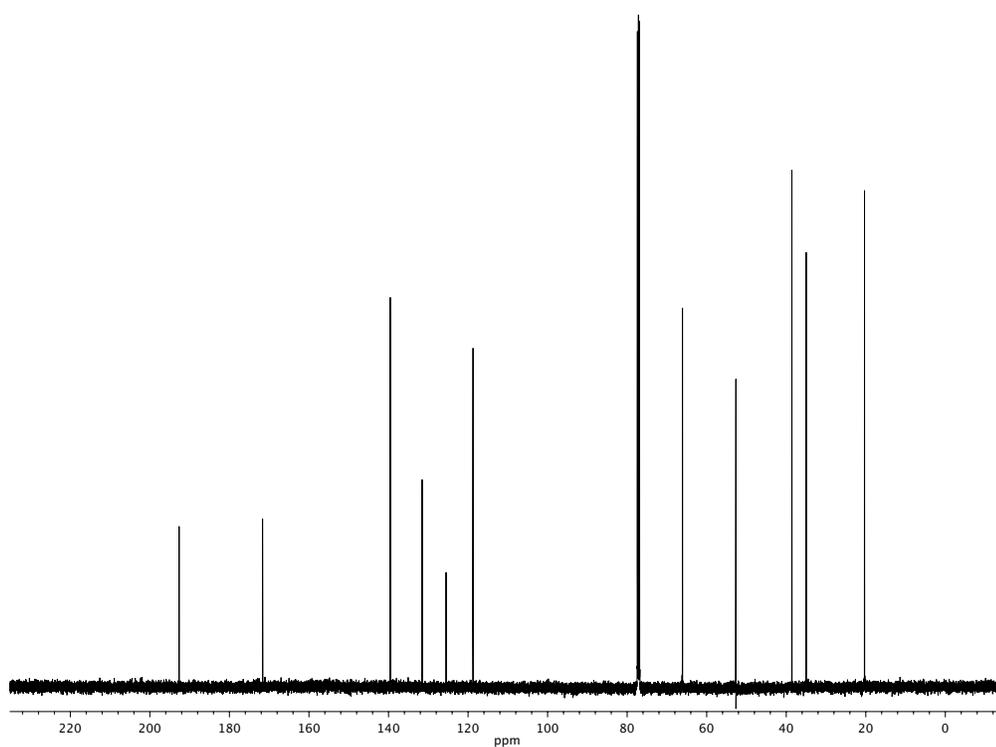
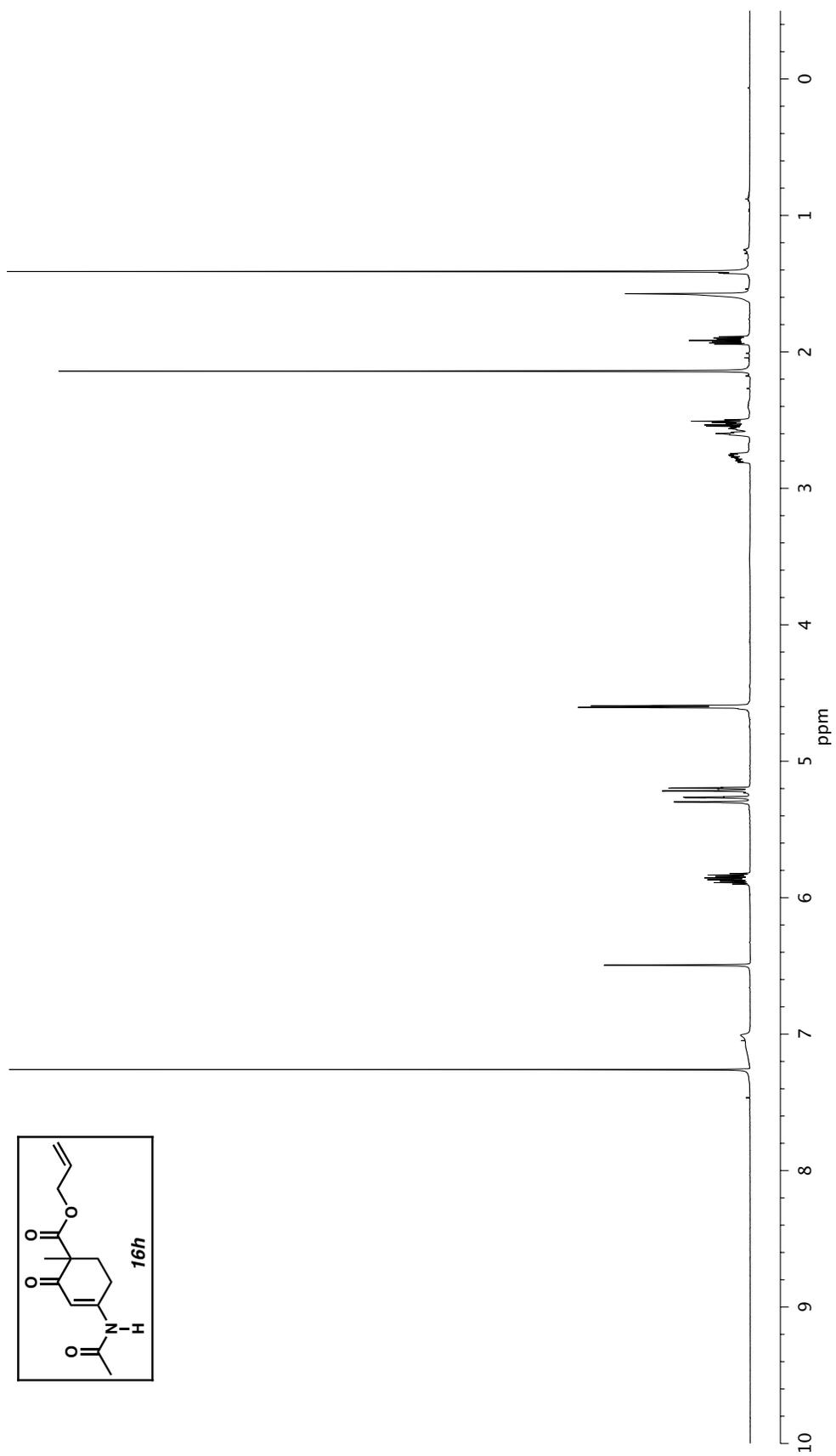


Figure A1.8.3. ¹³C NMR (125 MHz, CDCl₃) of compound 20.

Figure A1.9.1. ^1H NMR (500 MHz, CDCl_3) of compound **16h**.

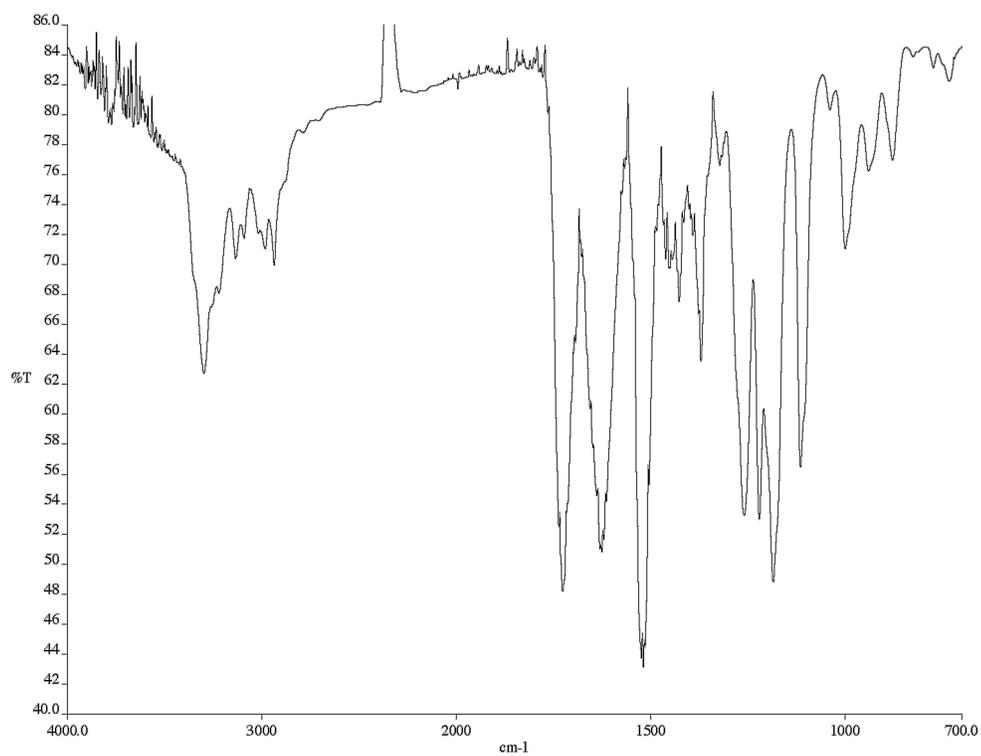


Figure A1.9.2. Infrared spectrum (thin film/NaCl) of compound **16h**.

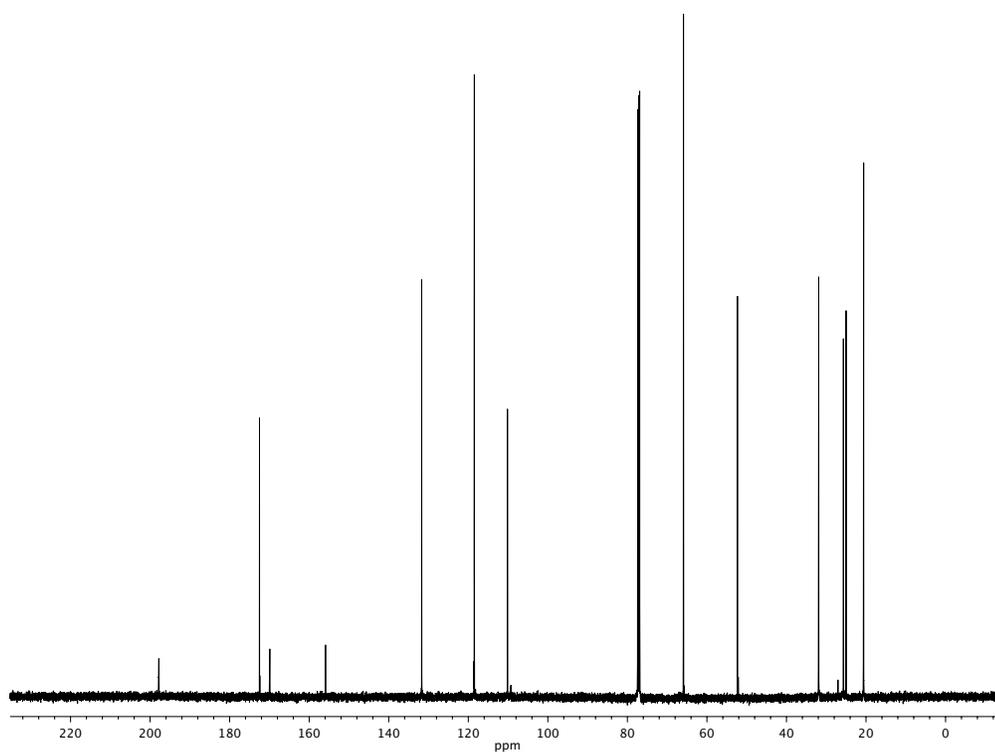
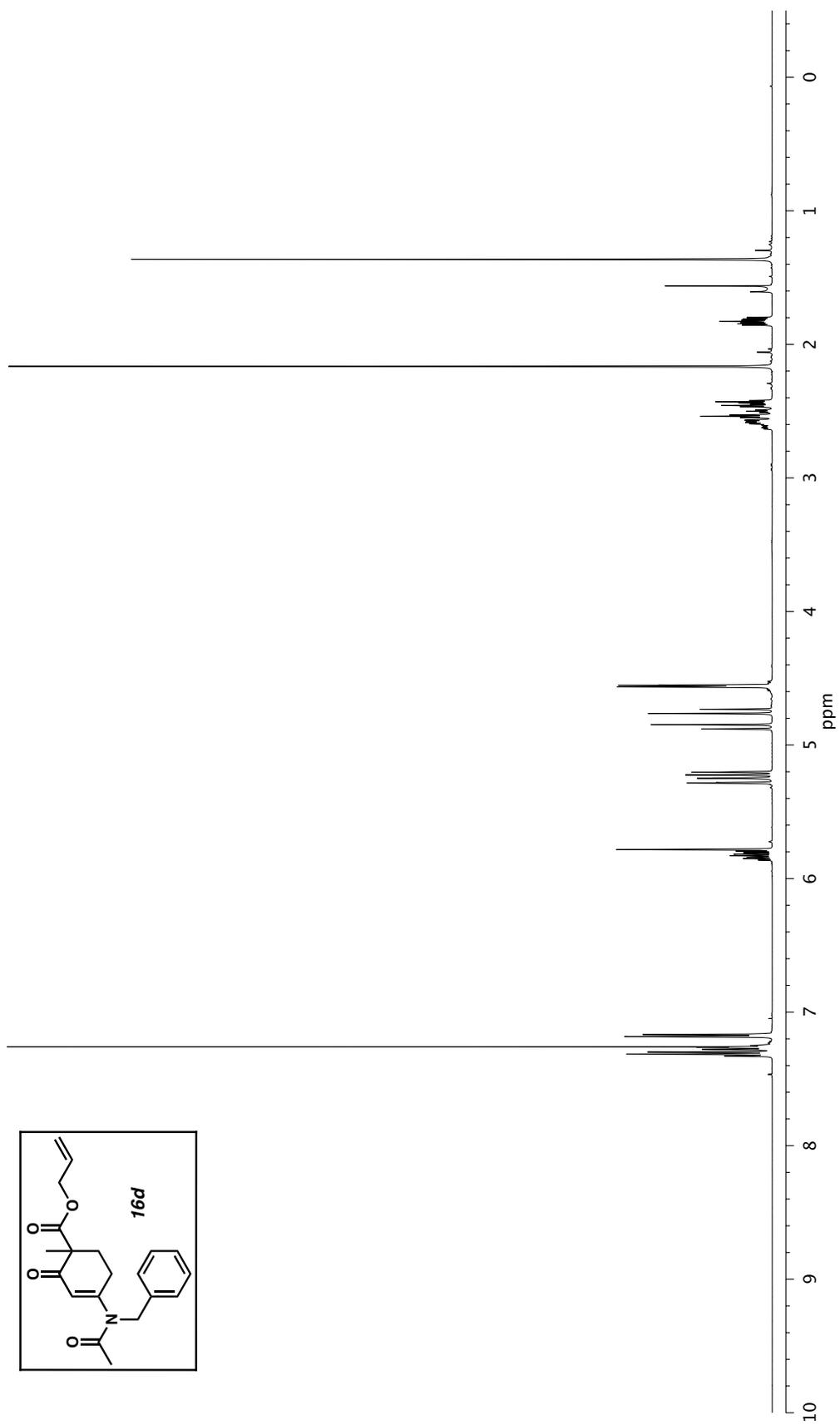


Figure A1.9.3. ¹³C NMR (125 MHz, CDCl₃) of compound **16h**.

Figure A1.10.1. ^1H NMR (500 MHz, CDCl_3) of compound **16d**.

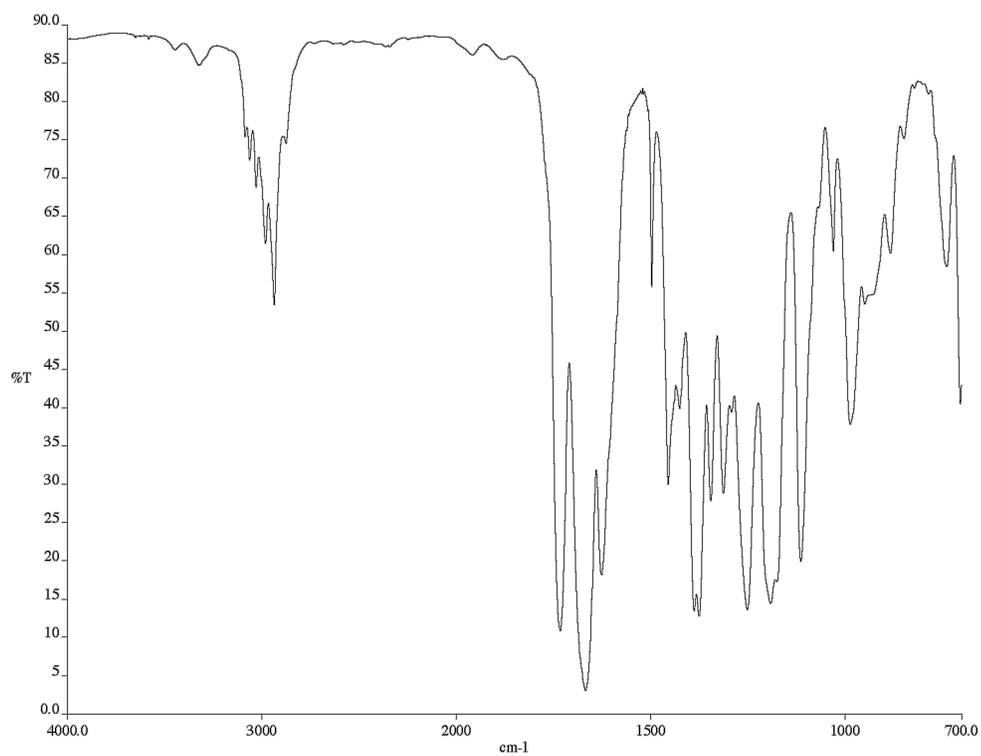


Figure A1.10.2. Infrared spectrum (thin film/NaCl) of compound **16d**.

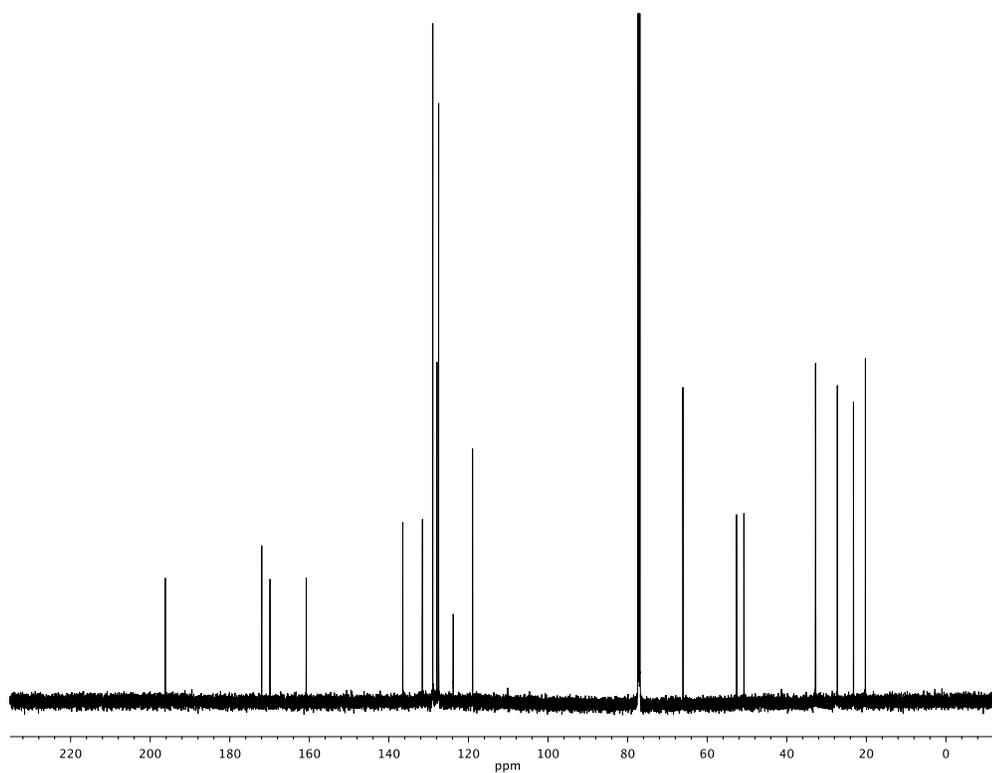
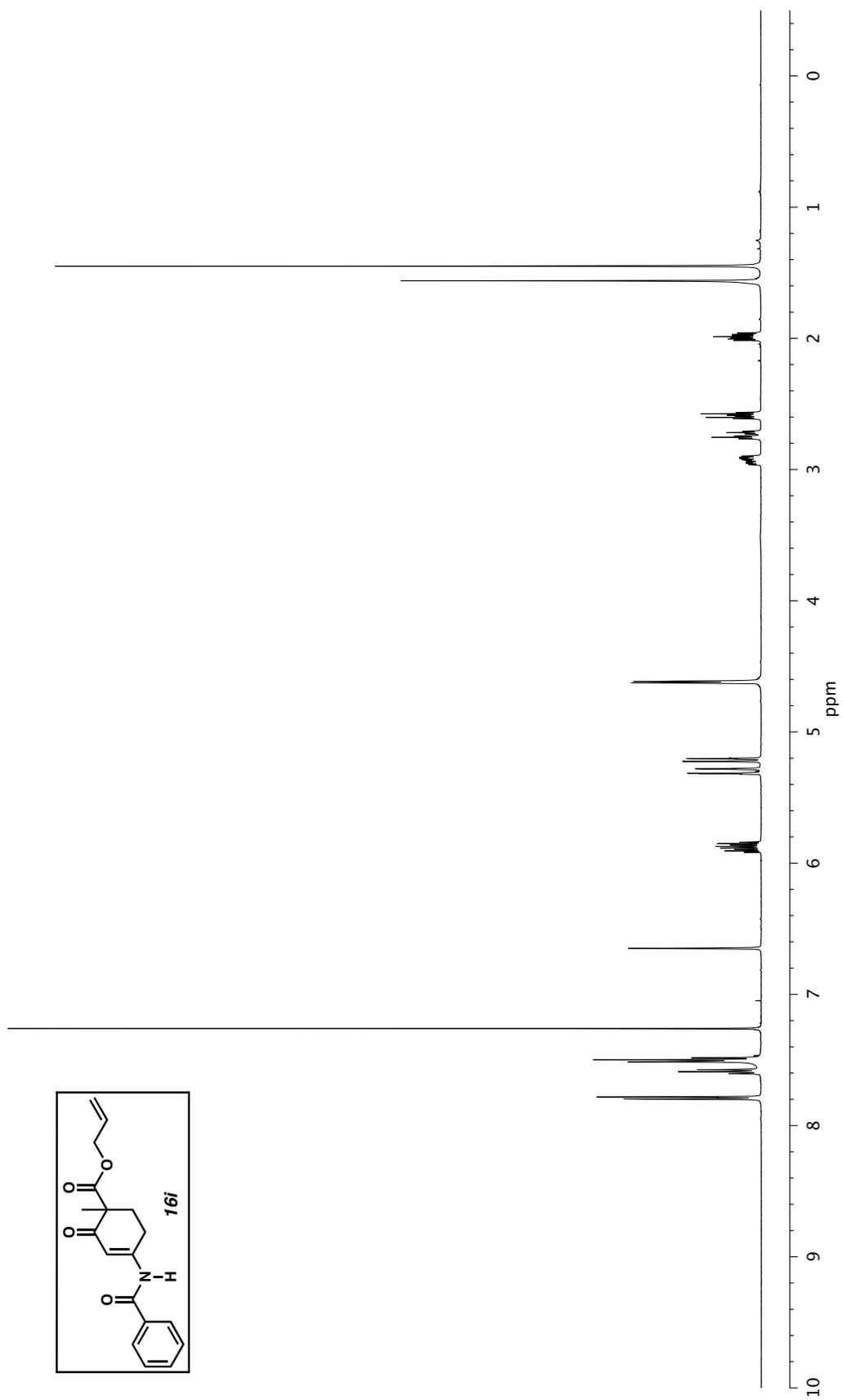


Figure A1.10.3. ¹³C NMR (125 MHz, CDCl₃) of compound **16d**.

Figure A1.11.1. ^1H NMR (500 MHz, CDCl_3) of compound **16i**.

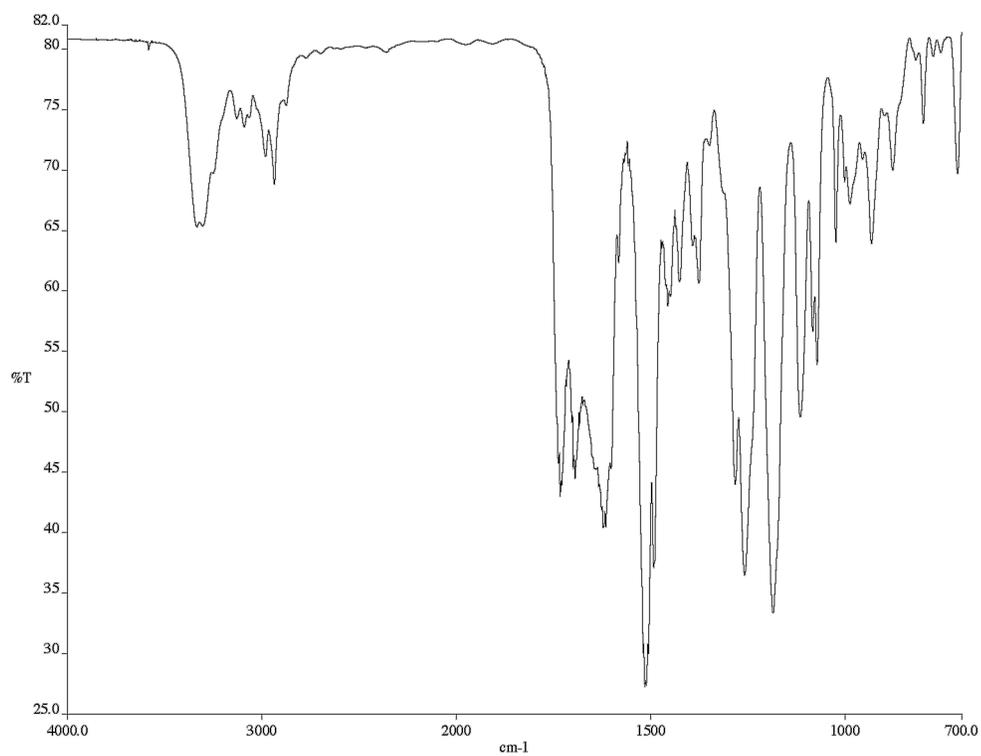


Figure A1.11.2. Infrared spectrum (thin film/NaCl) of compound **16i**.

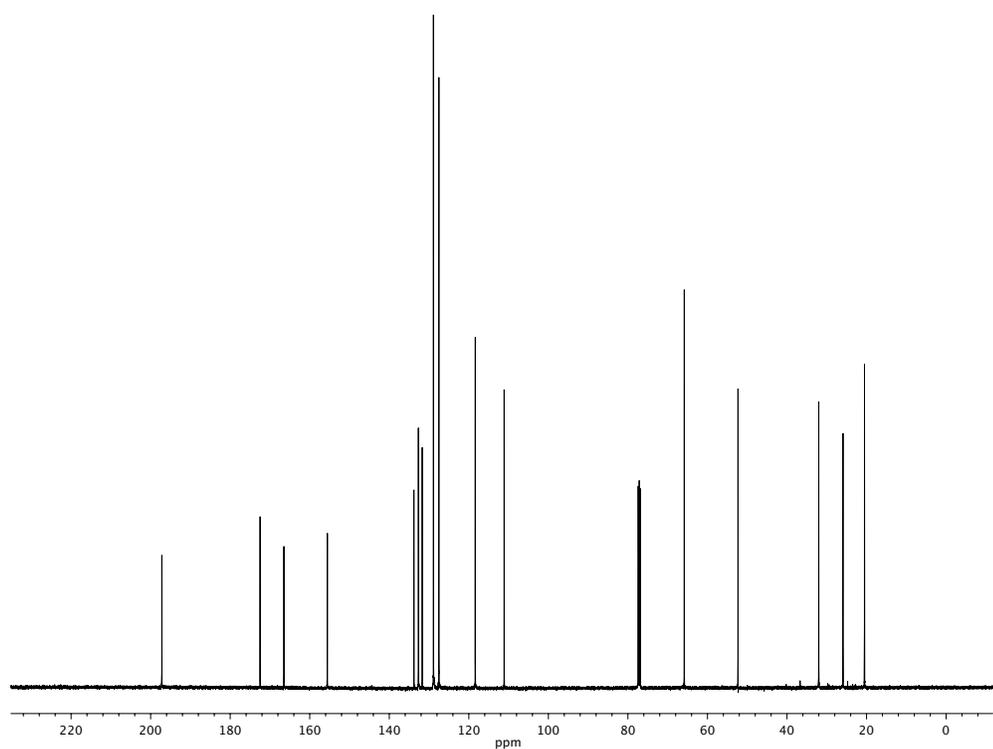
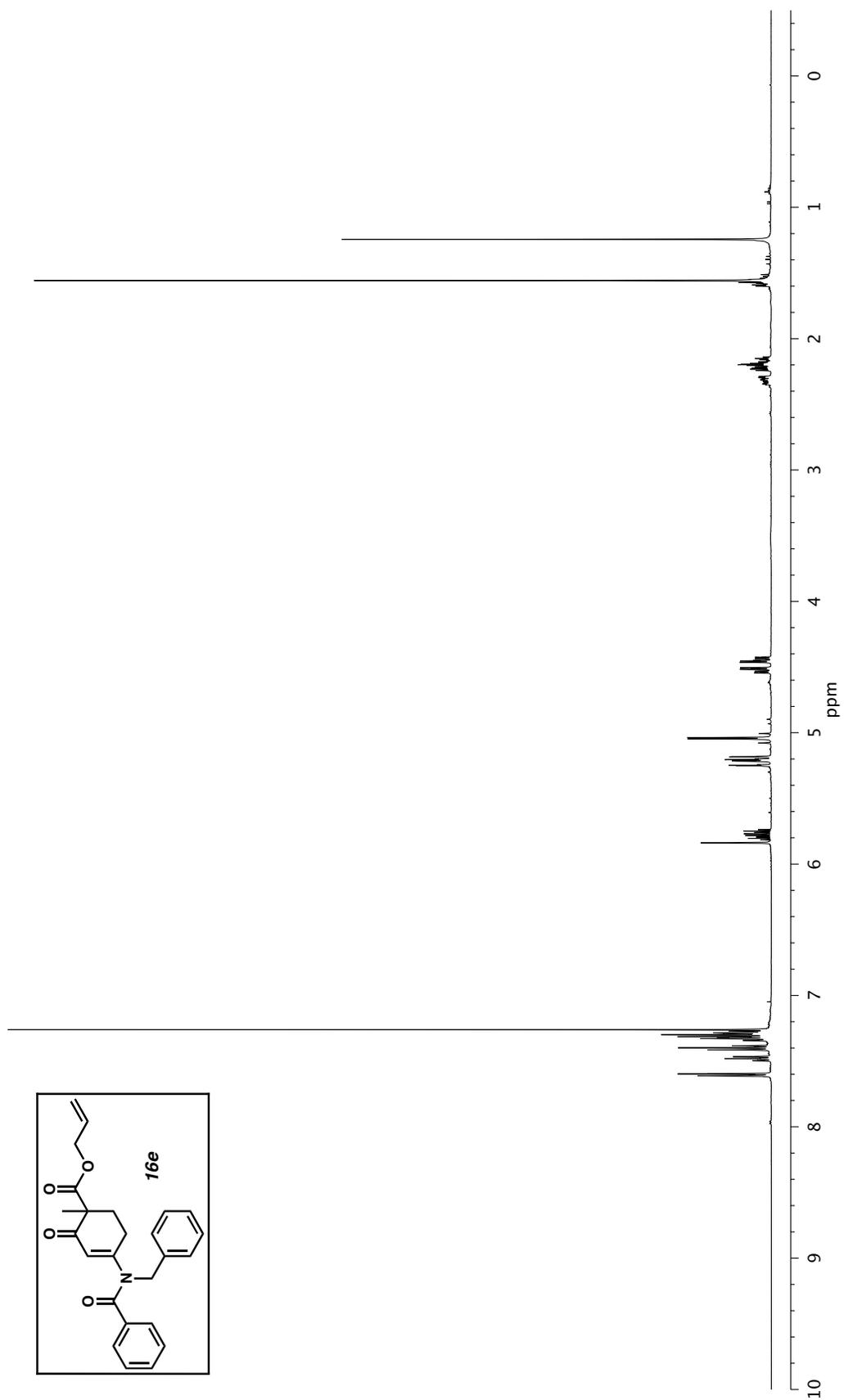


Figure A1.11.3. ¹³C NMR (125 MHz, CDCl₃) of compound **16i**.

Figure A1.12.1. ^1H NMR (500 MHz, CDCl_3) of compound **16e**.

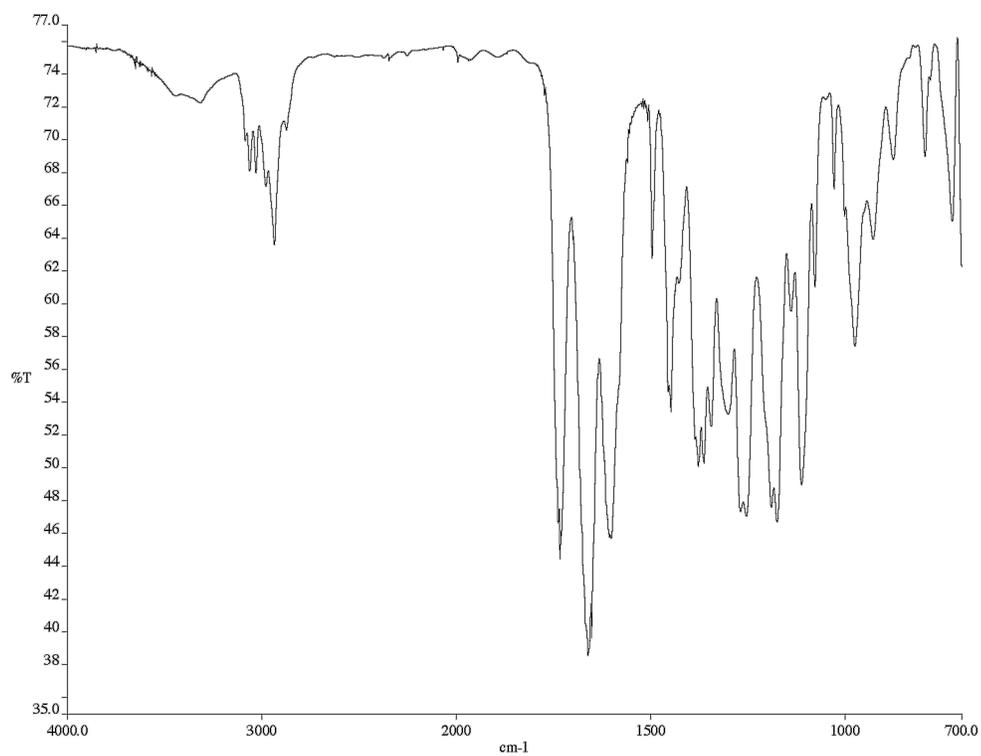


Figure A1.12.2. Infrared spectrum (thin film/NaCl) of compound **16e**.

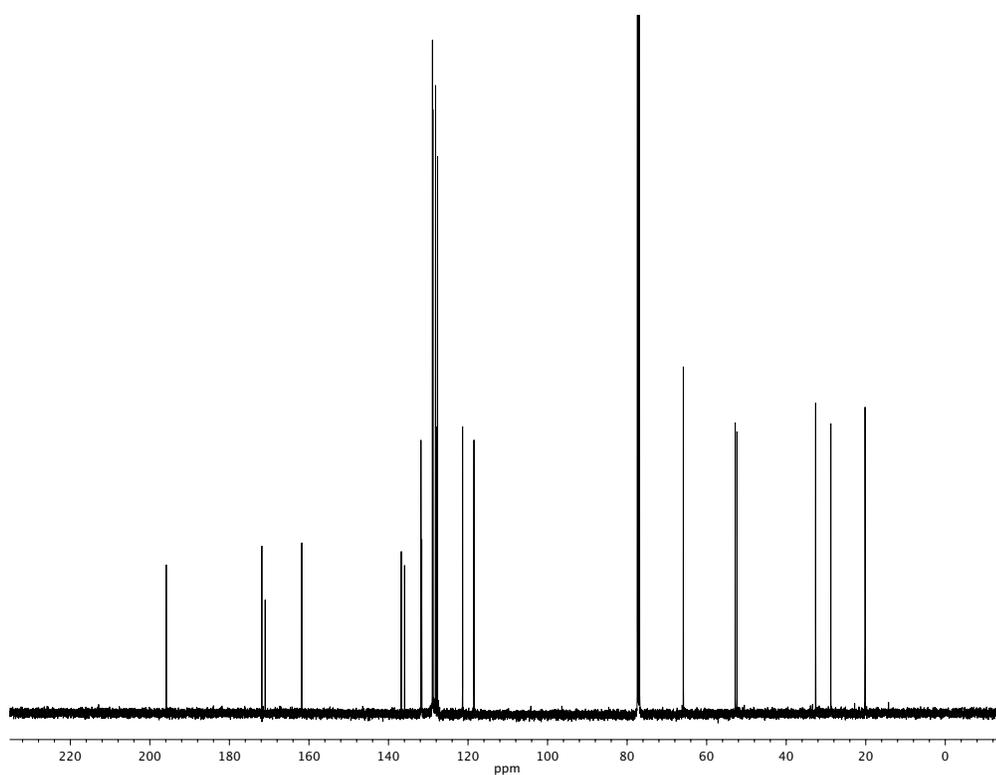
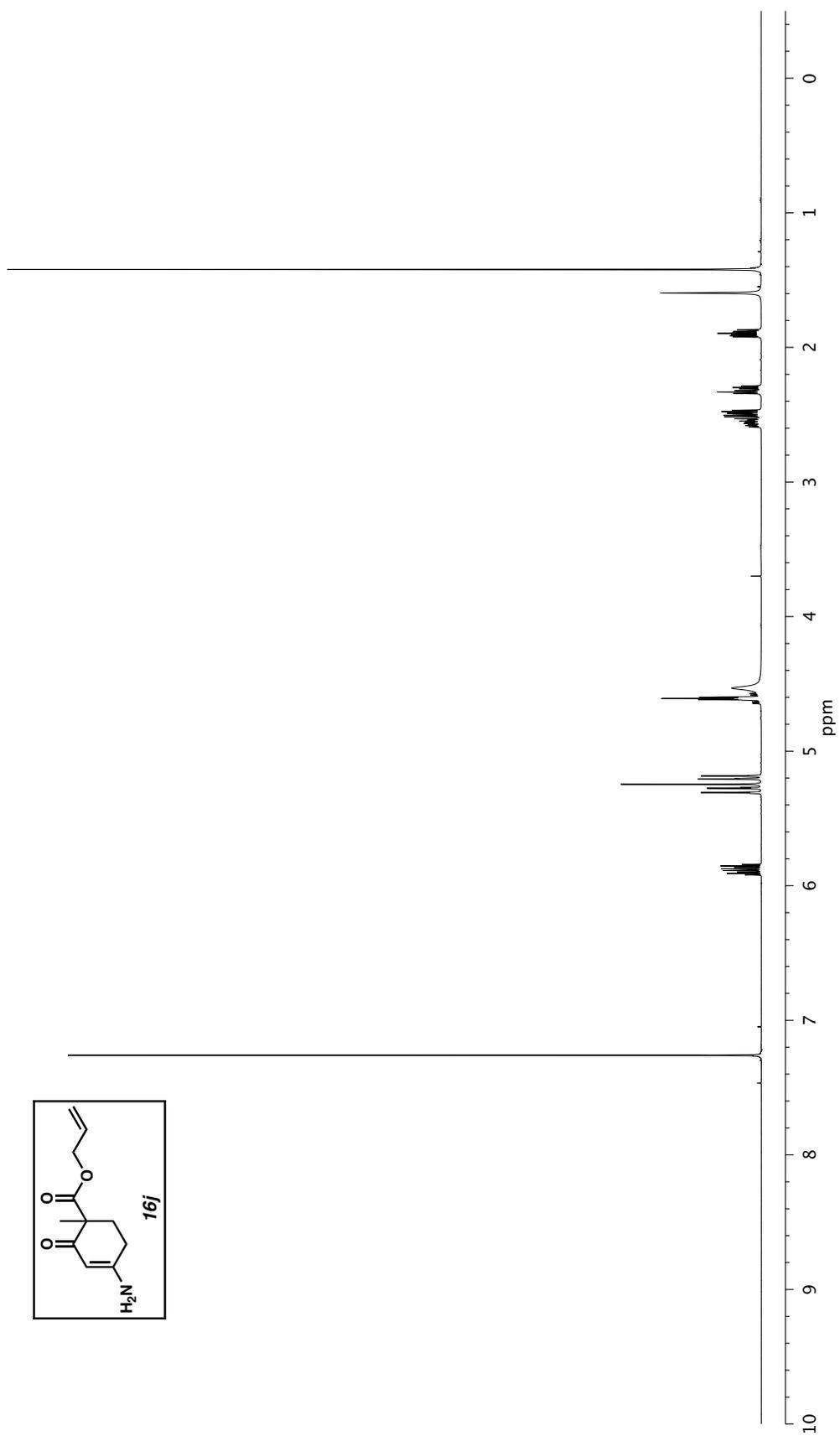


Figure A1.12.3. ¹³C NMR (125 MHz, CDCl₃) of compound **16e**.

Figure A1.13.1. ^1H NMR (500 MHz, CDCl_3) of compound **16j**.

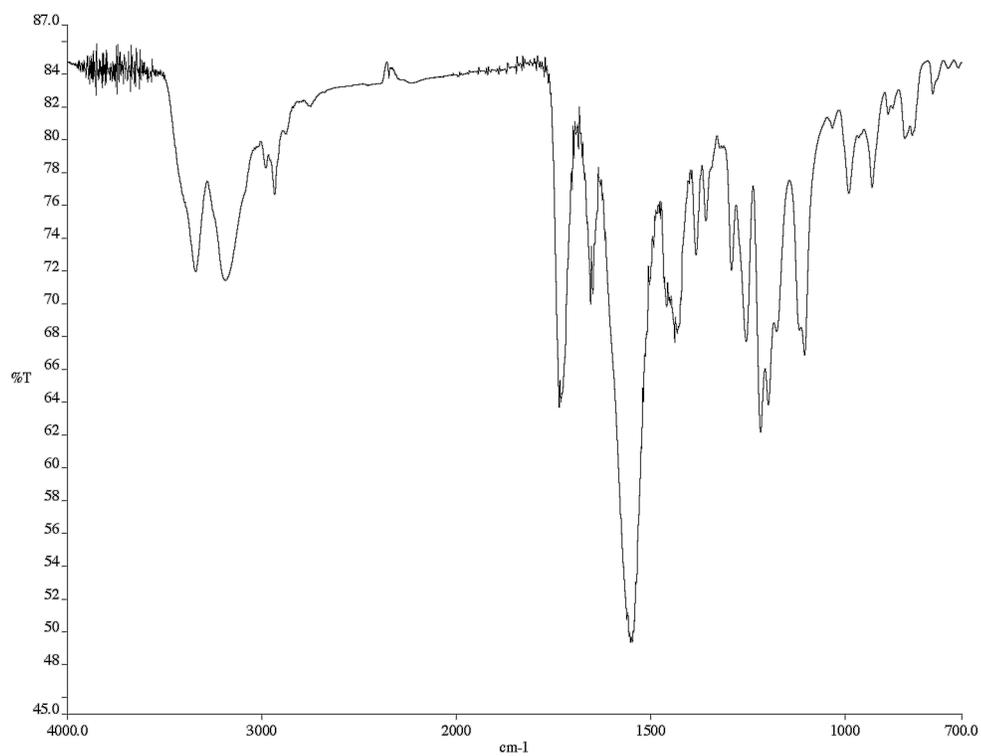


Figure A1.13.2. Infrared spectrum (thin film/NaCl) of compound **16j**.

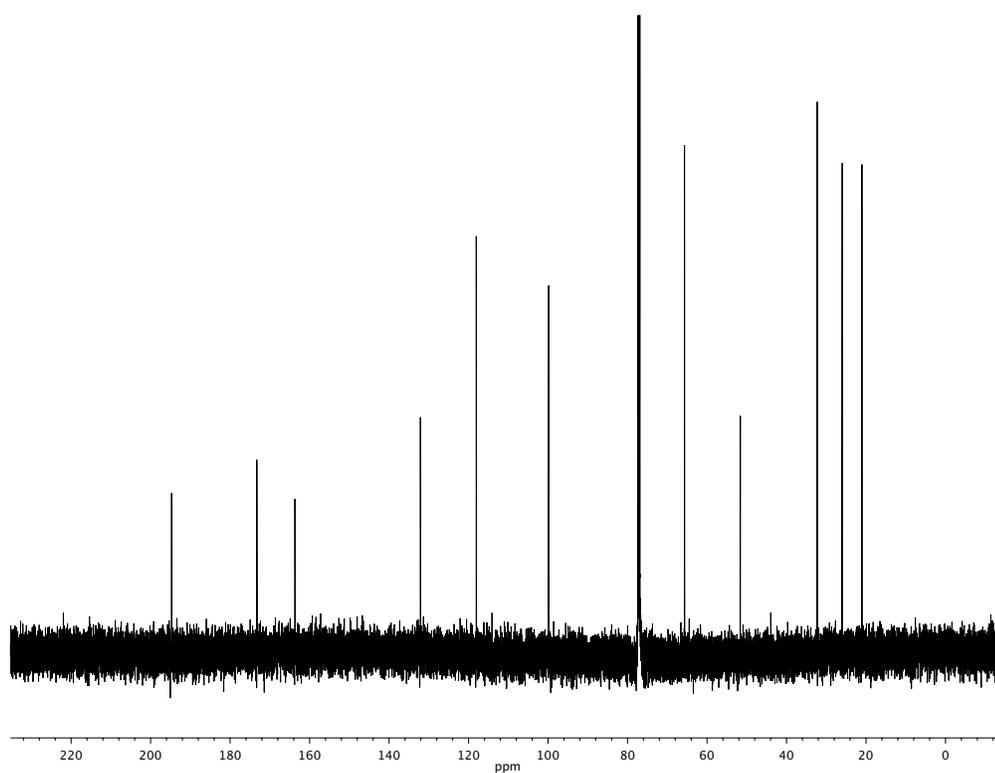
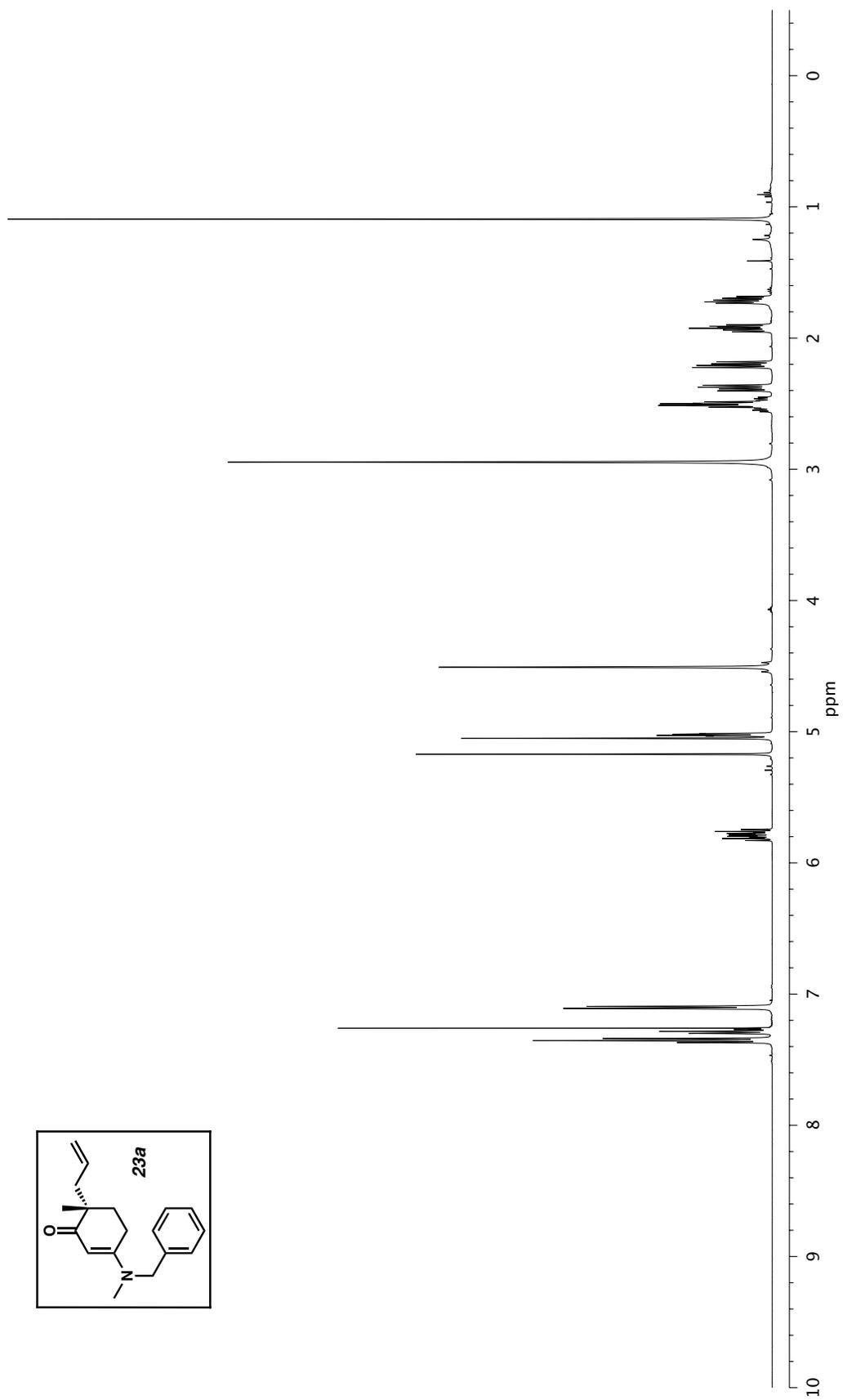


Figure A1.13.3. ¹³C NMR (125 MHz, CDCl₃) of compound **16j**.

Figure A1.14.1. ^1H NMR (500 MHz, CDCl_3) of compound **23a**.

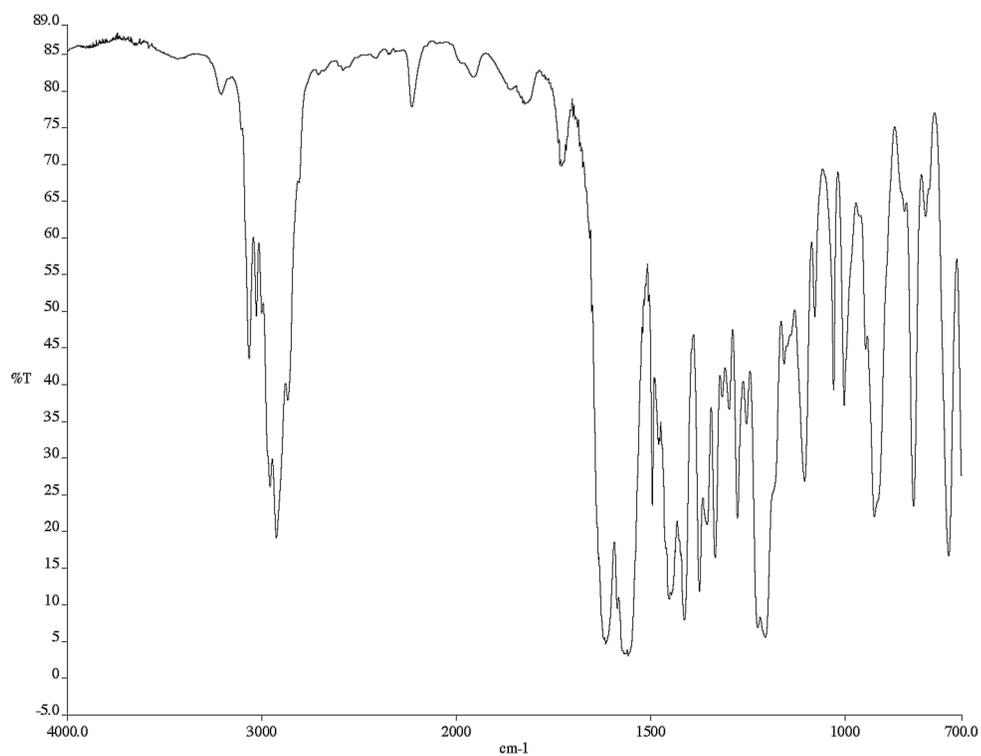


Figure A1.14.2. Infrared spectrum (thin film/NaCl) of compound **23a**.

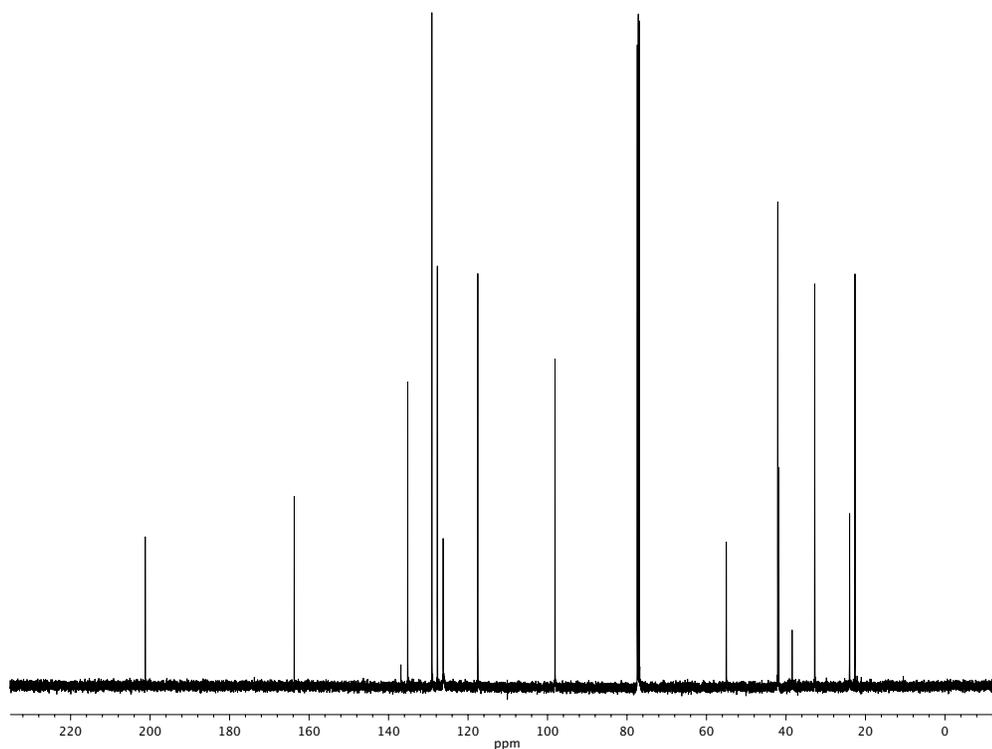
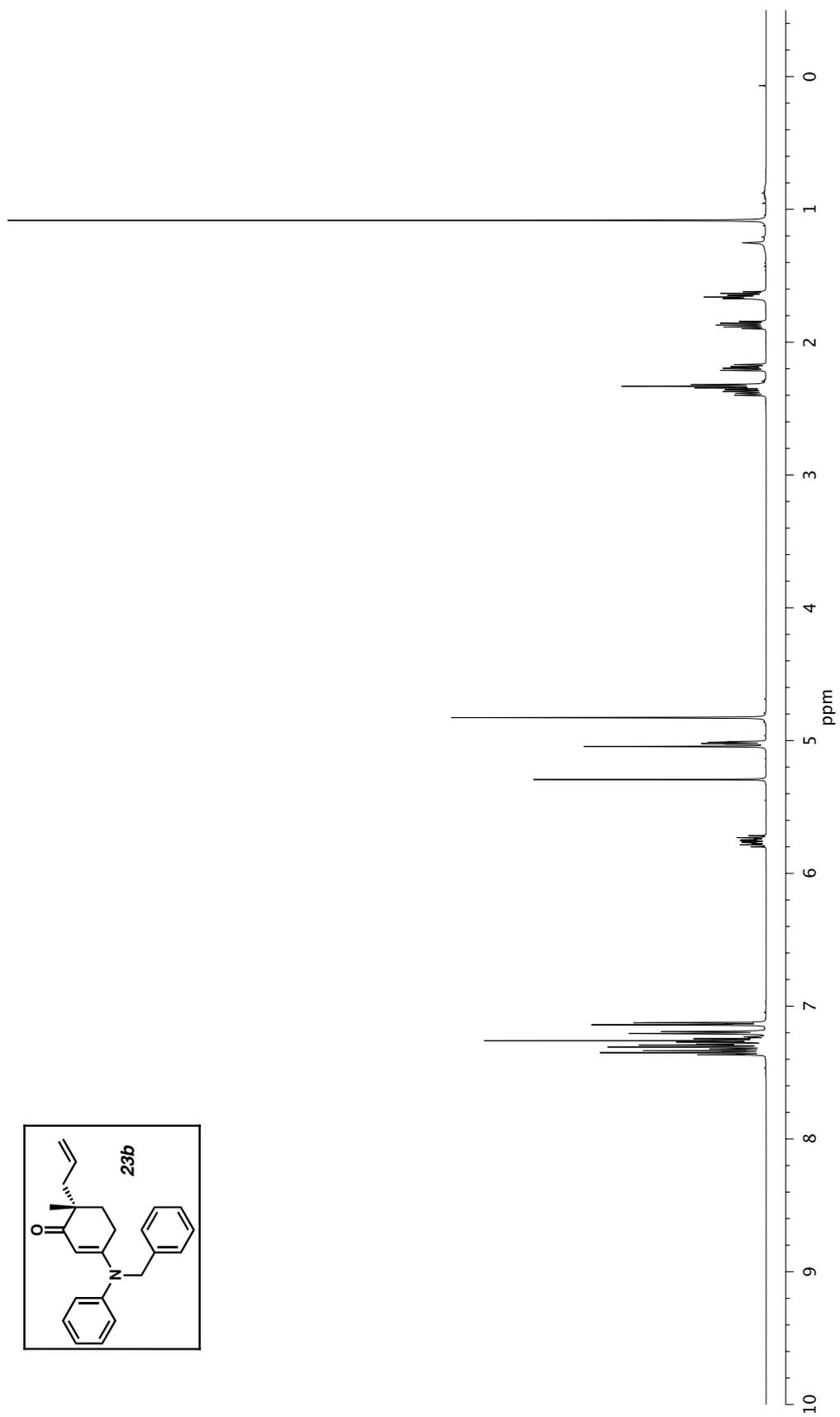


Figure A1.14.3. ¹³C NMR (125 MHz, CDCl₃) of compound **23a**.

Figure A1.15.1. ^1H NMR (500 MHz, CDCl_3) of compound **23b**.

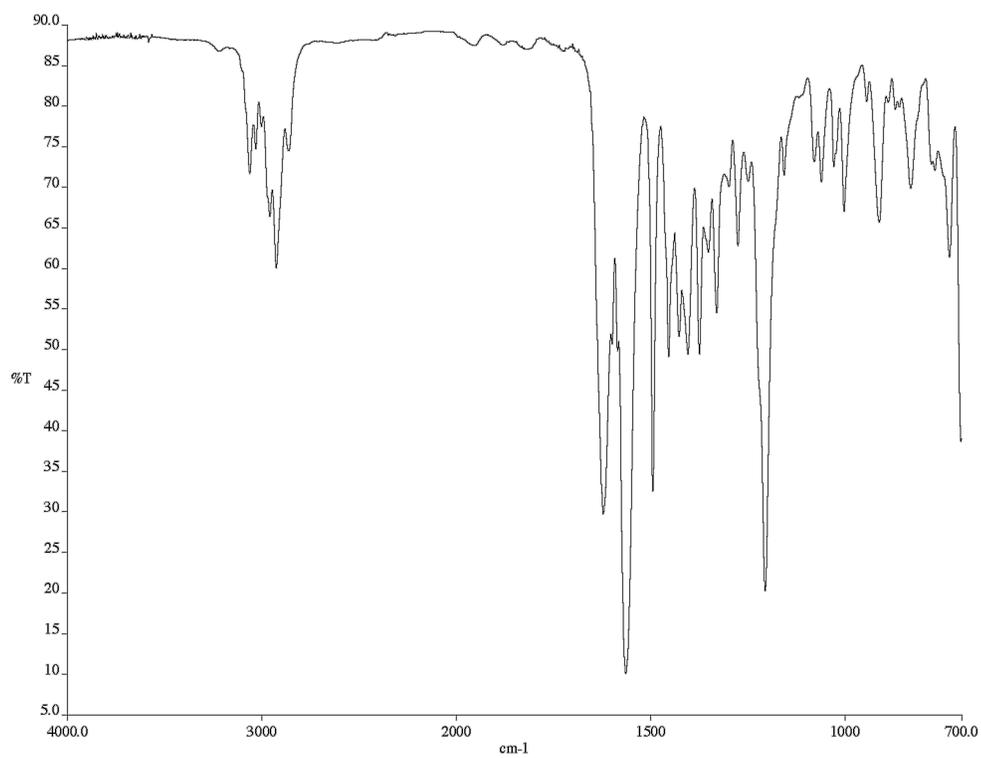


Figure A1.15.2. Infrared spectrum (thin film/NaCl) of compound **23b**.

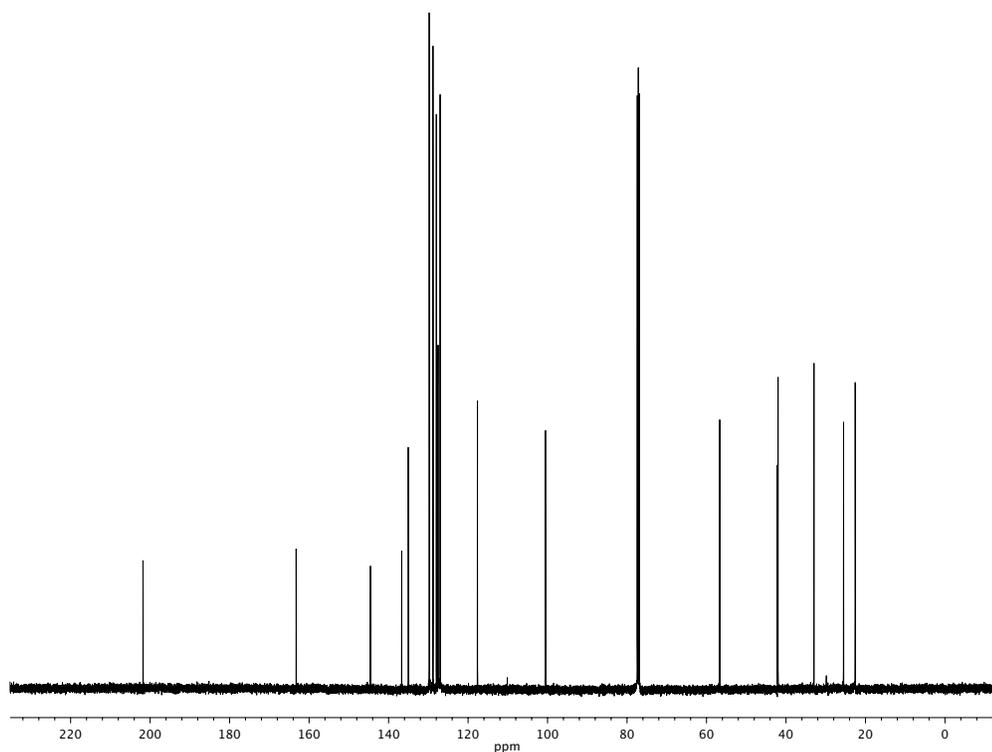
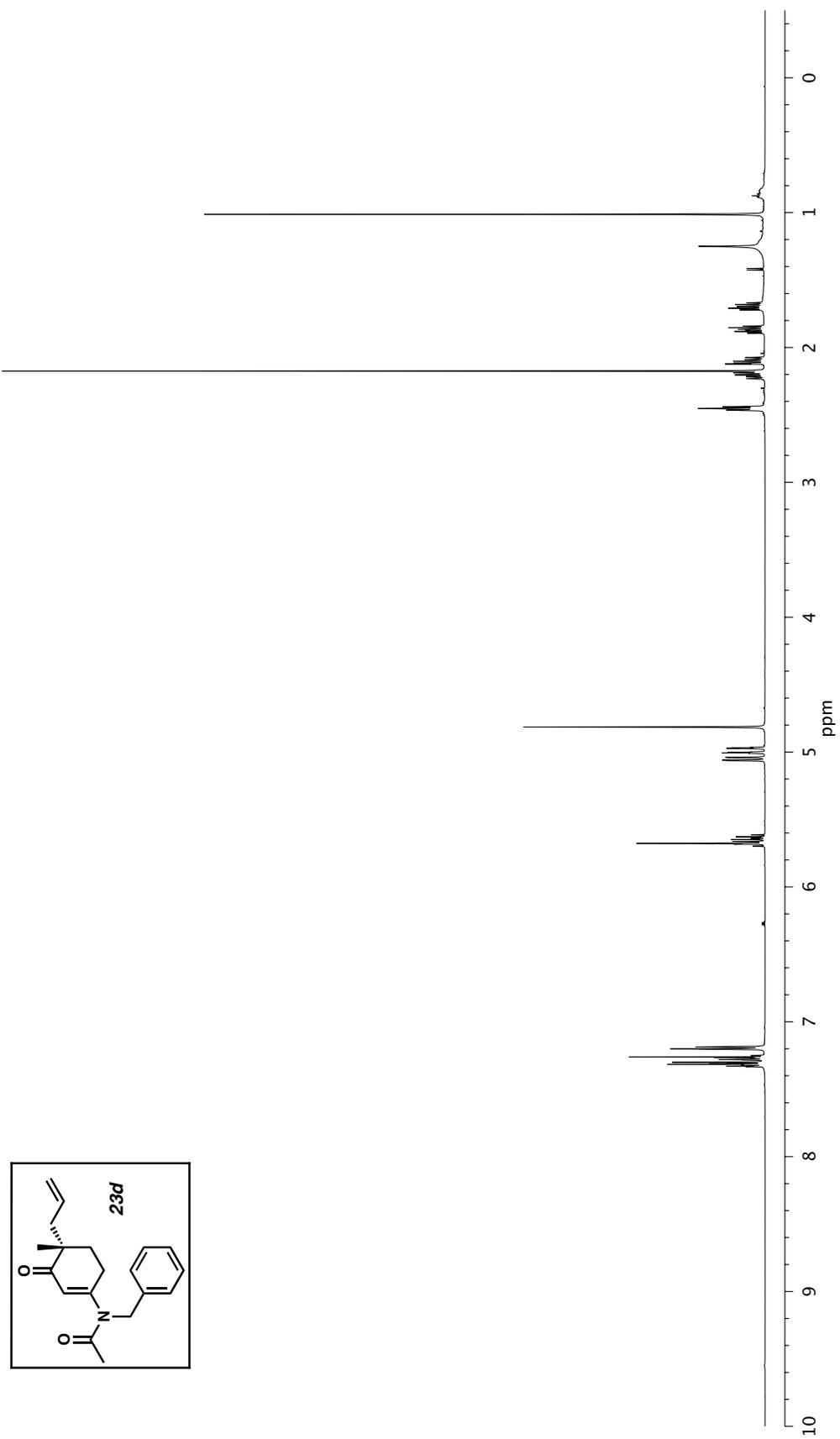


Figure A1.15.3. ¹³C NMR (125 MHz, CDCl₃) of compound **23b**.

Figure A1.16.1. ^1H NMR (500 MHz, CDCl_3) of compound **23d**.

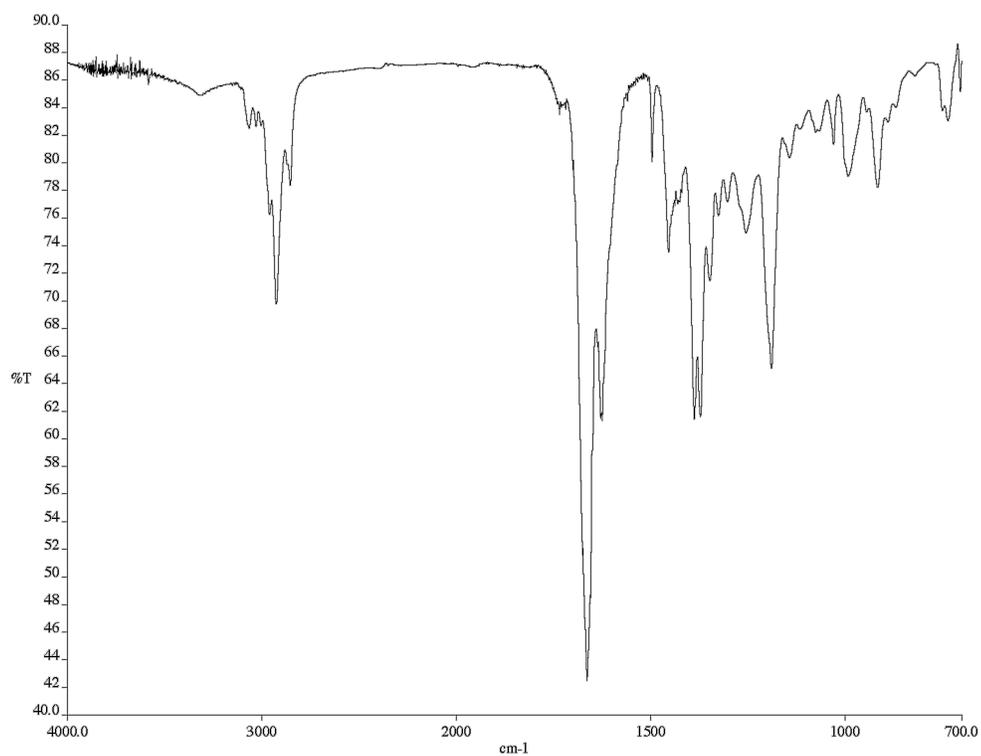


Figure A1.16.2. Infrared spectrum (thin film/NaCl) of compound **23d**.

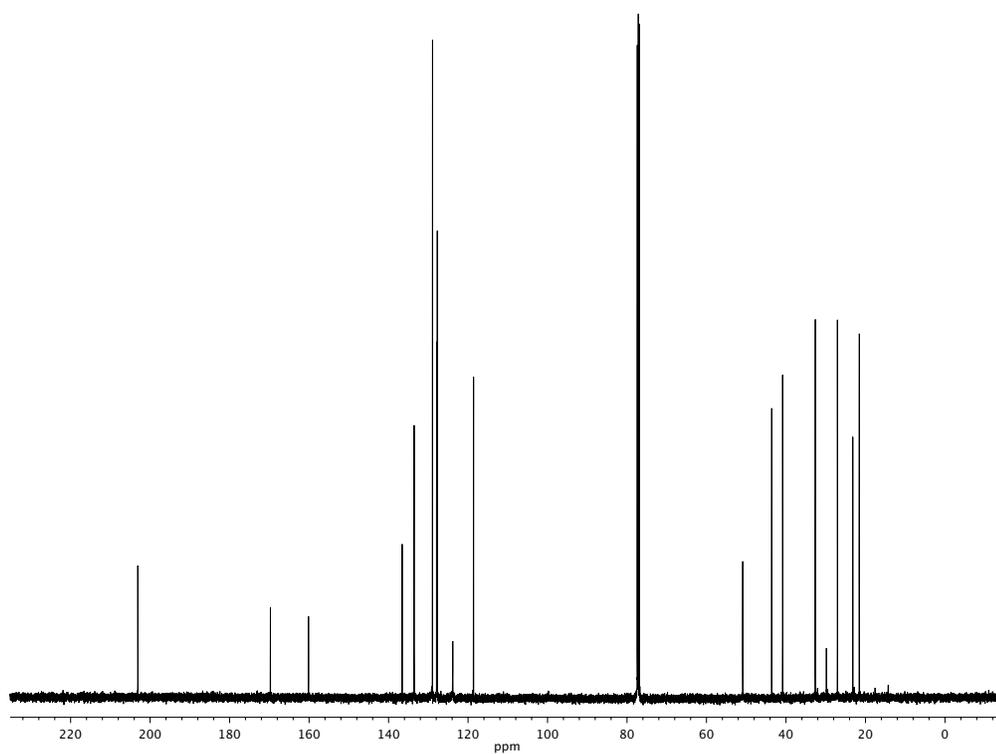
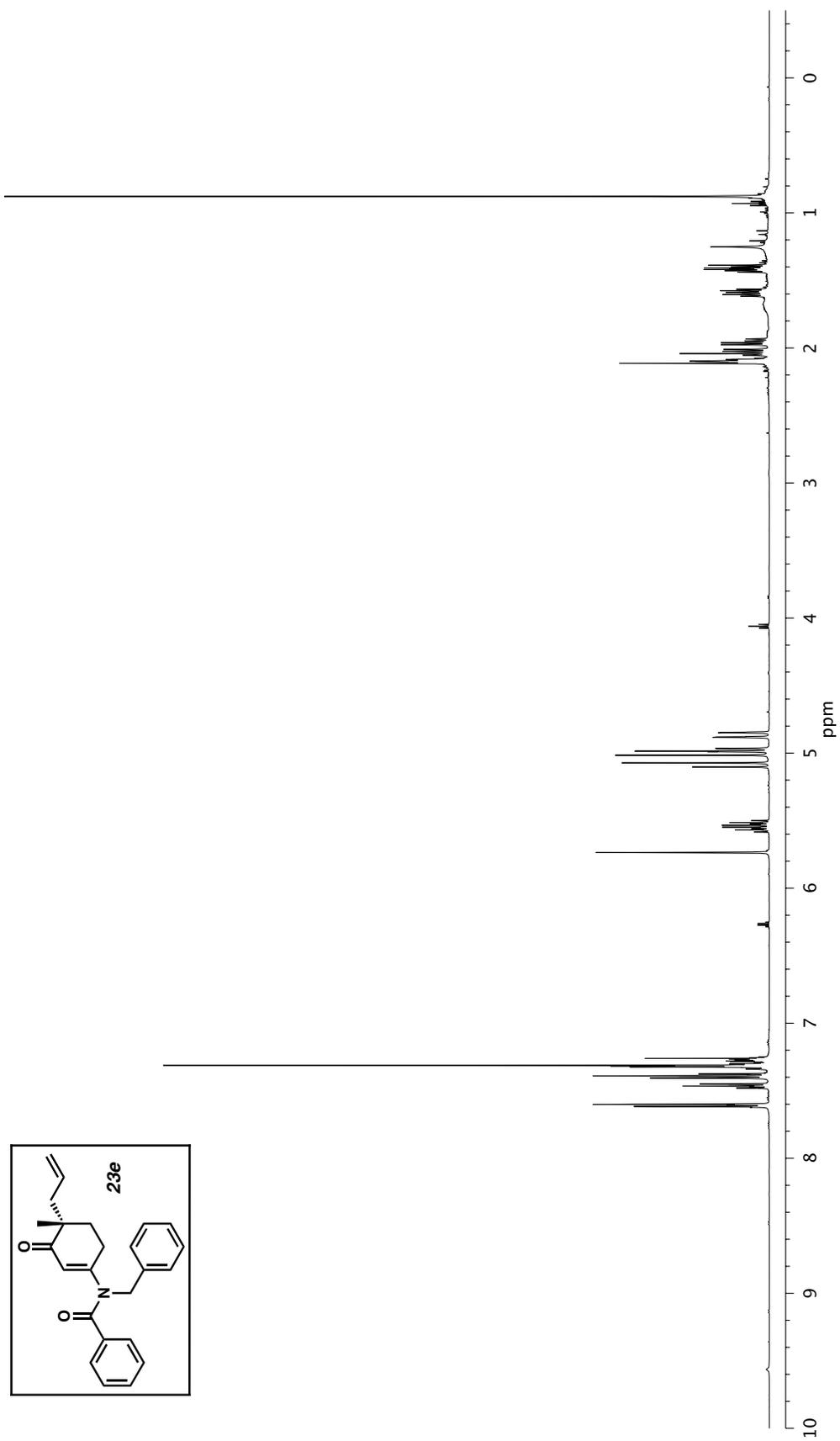


Figure A1.16.3. ¹³C NMR (125 MHz, CDCl₃) of compound **23d**.

Figure A1.17.1. ^1H NMR (500 MHz, CDCl_3) of compound **23e**.

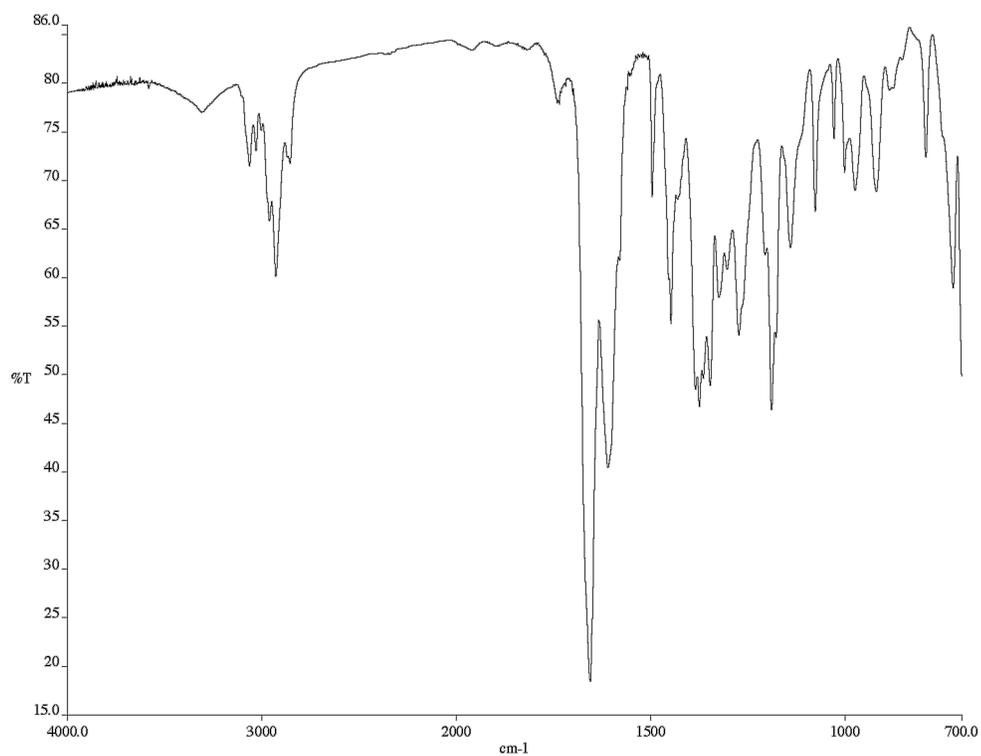


Figure A1.17.2. Infrared spectrum (thin film/NaCl) of compound **23e**.

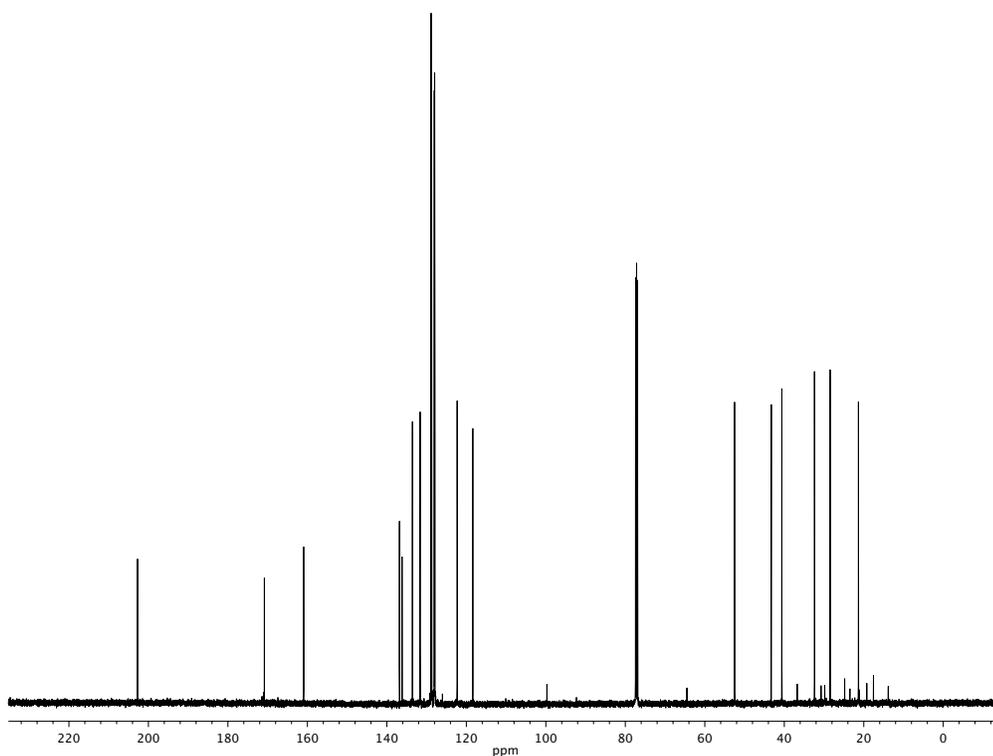
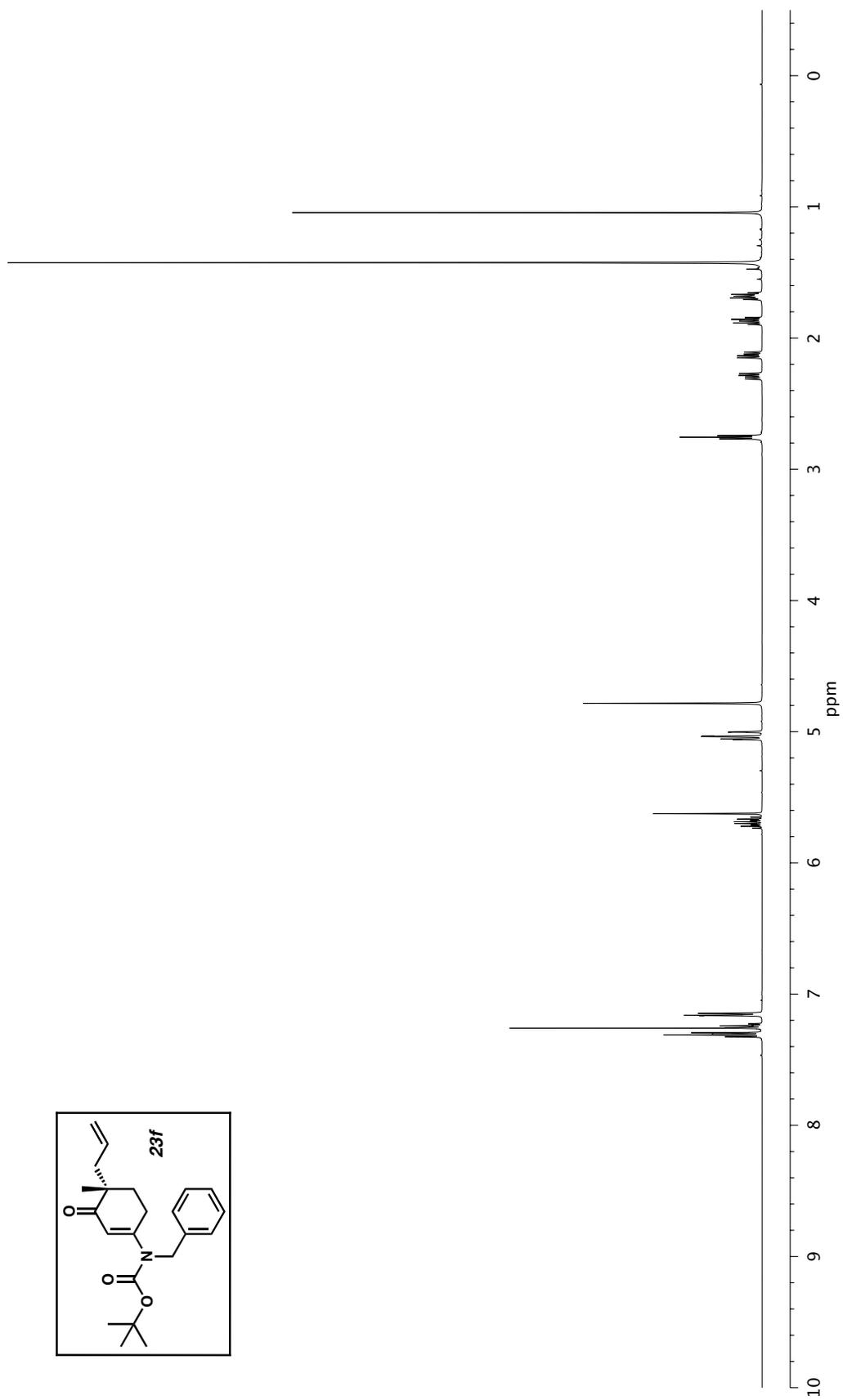


Figure A1.17.3. ¹³C NMR (125 MHz, CDCl₃) of compound **23e**.

Figure A1.18.1. ^1H NMR (500 MHz, CDCl_3) of compound **23f**.

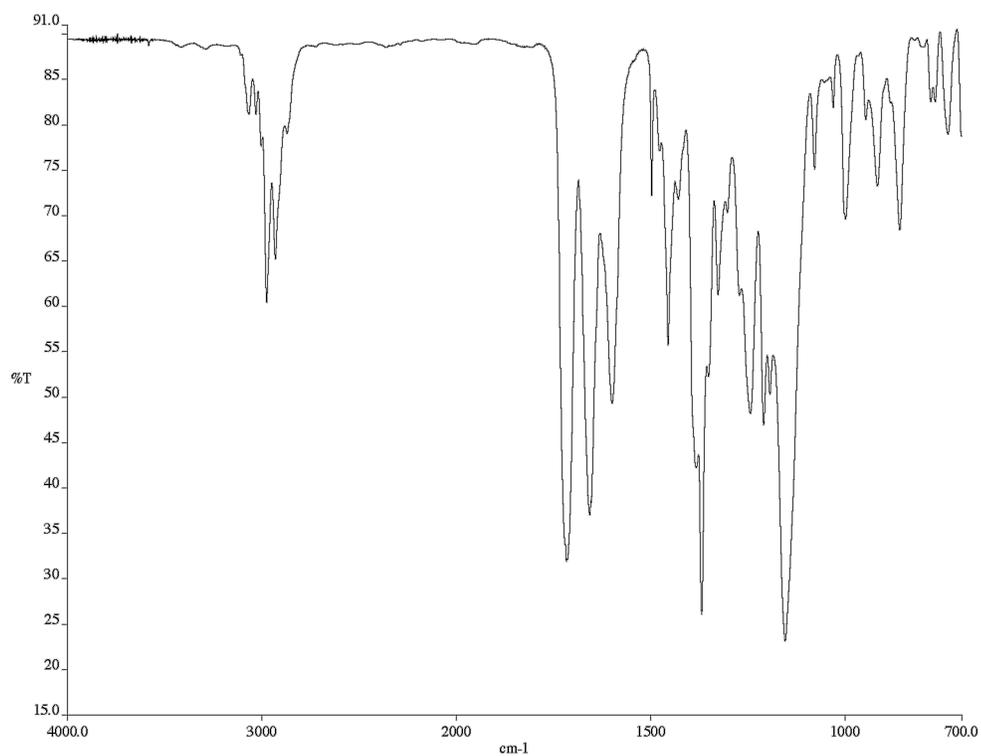


Figure A1.18.2. Infrared spectrum (thin film/NaCl) of compound **23f**.

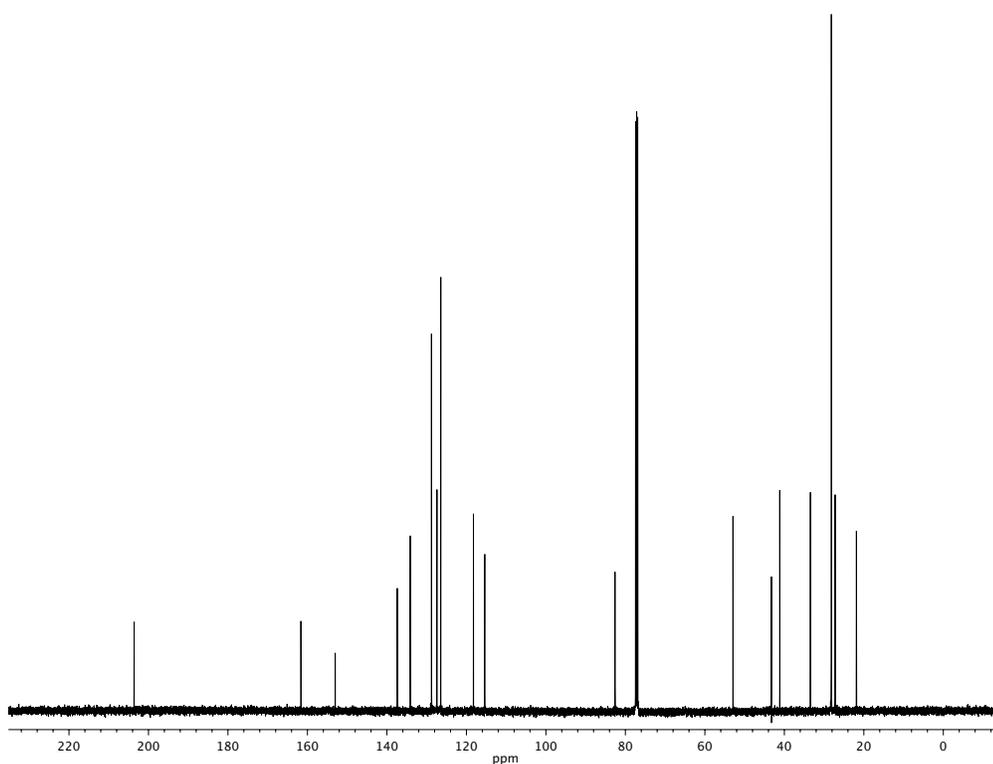
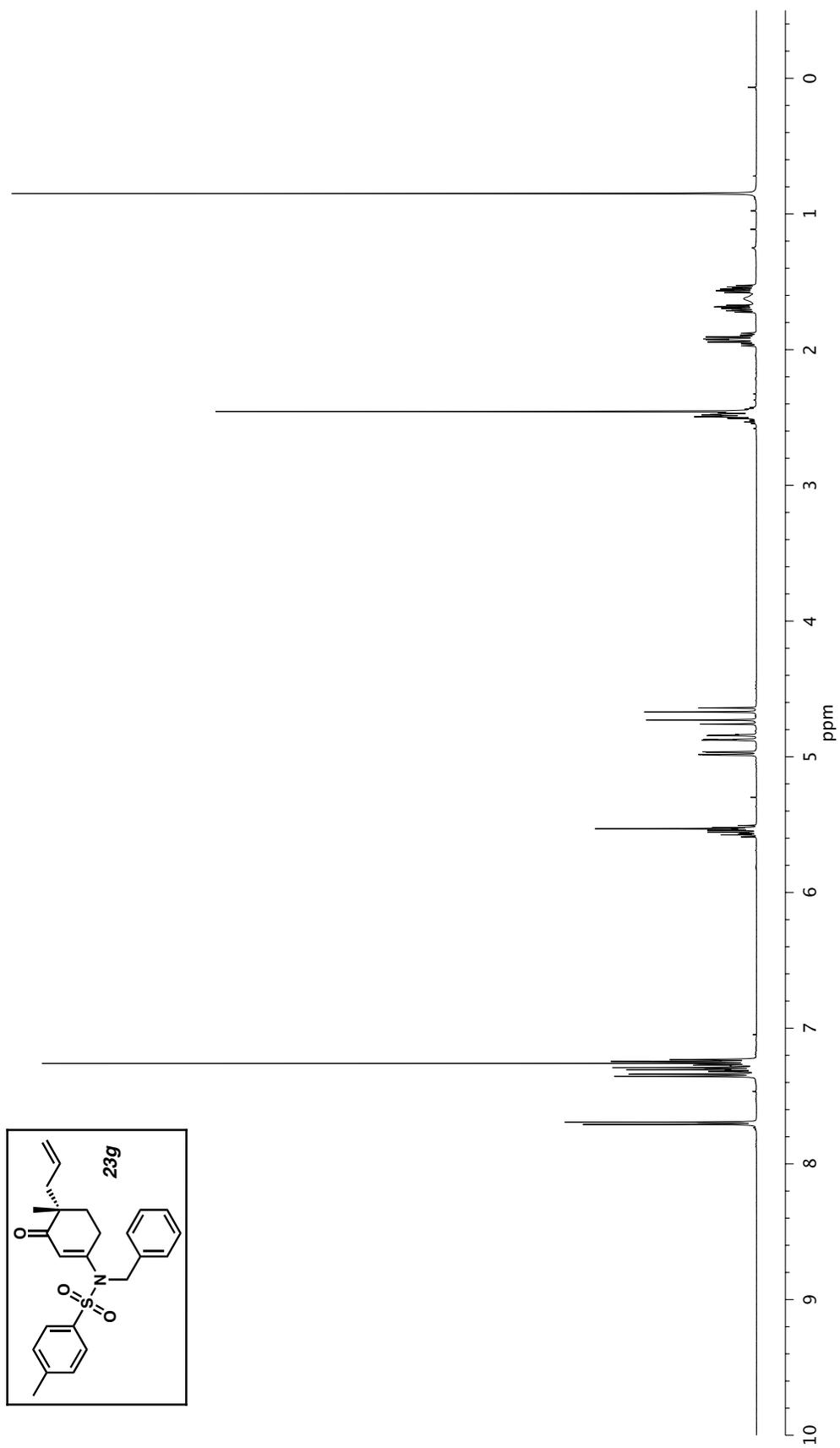


Figure A1.18.3. ¹³C NMR (125 MHz, CDCl₃) of compound **23f**.

Figure A1.19.1. ^1H NMR (500 MHz, CDCl_3) of compound **23g**.

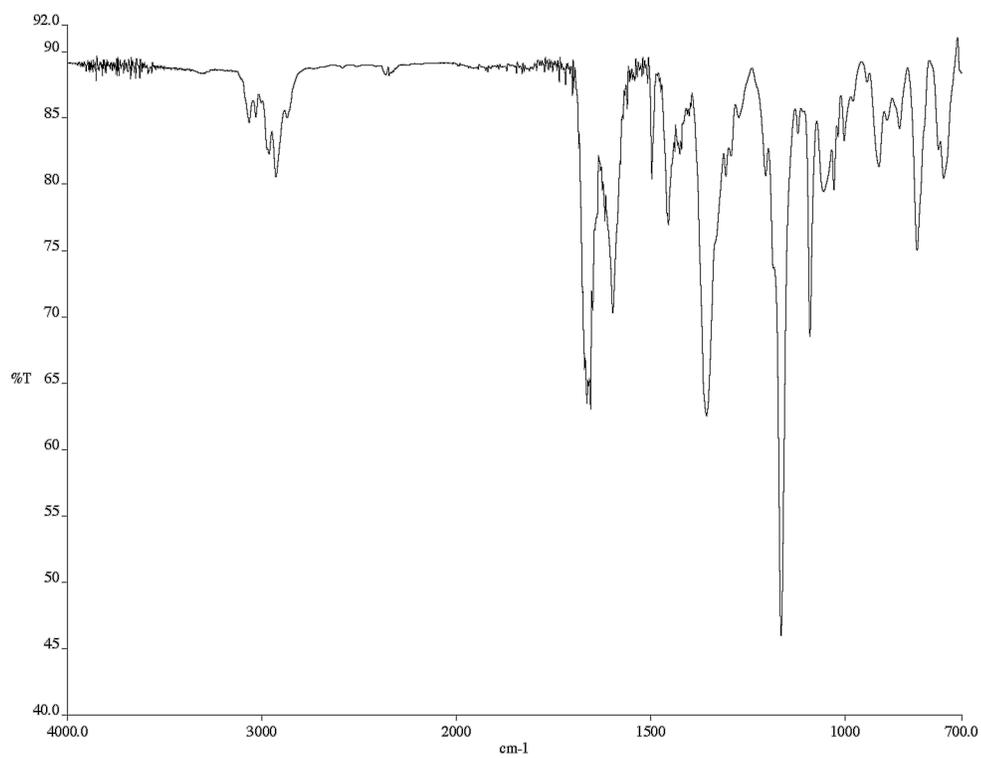


Figure A1.19.2. Infrared spectrum (thin film/NaCl) of compound **23g**.

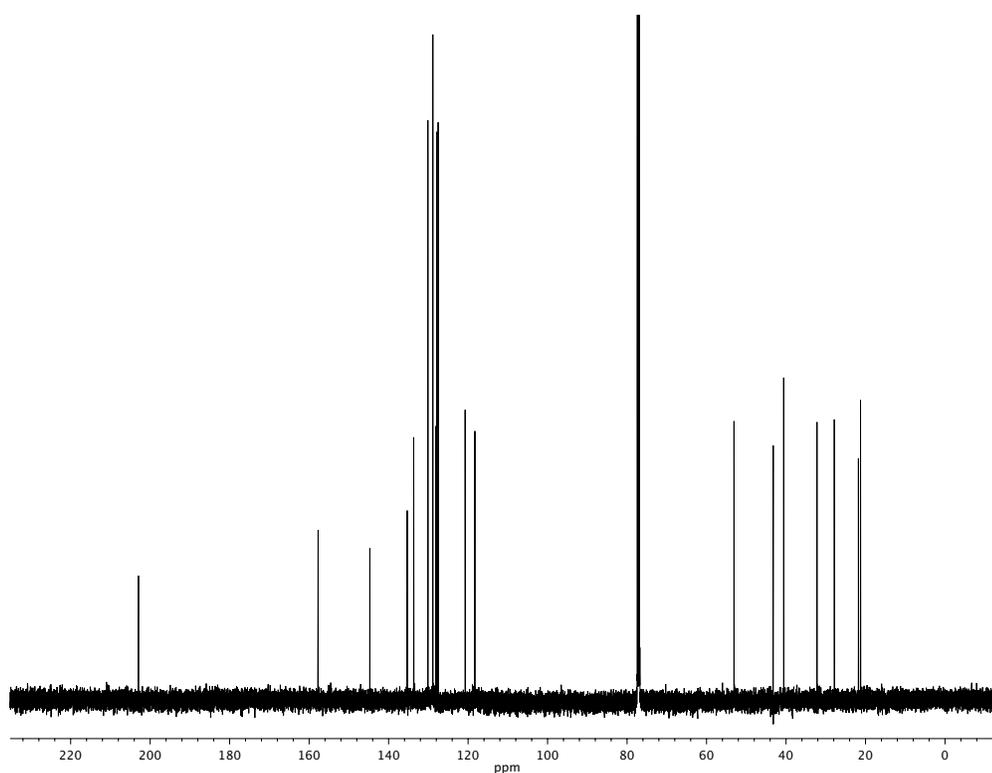
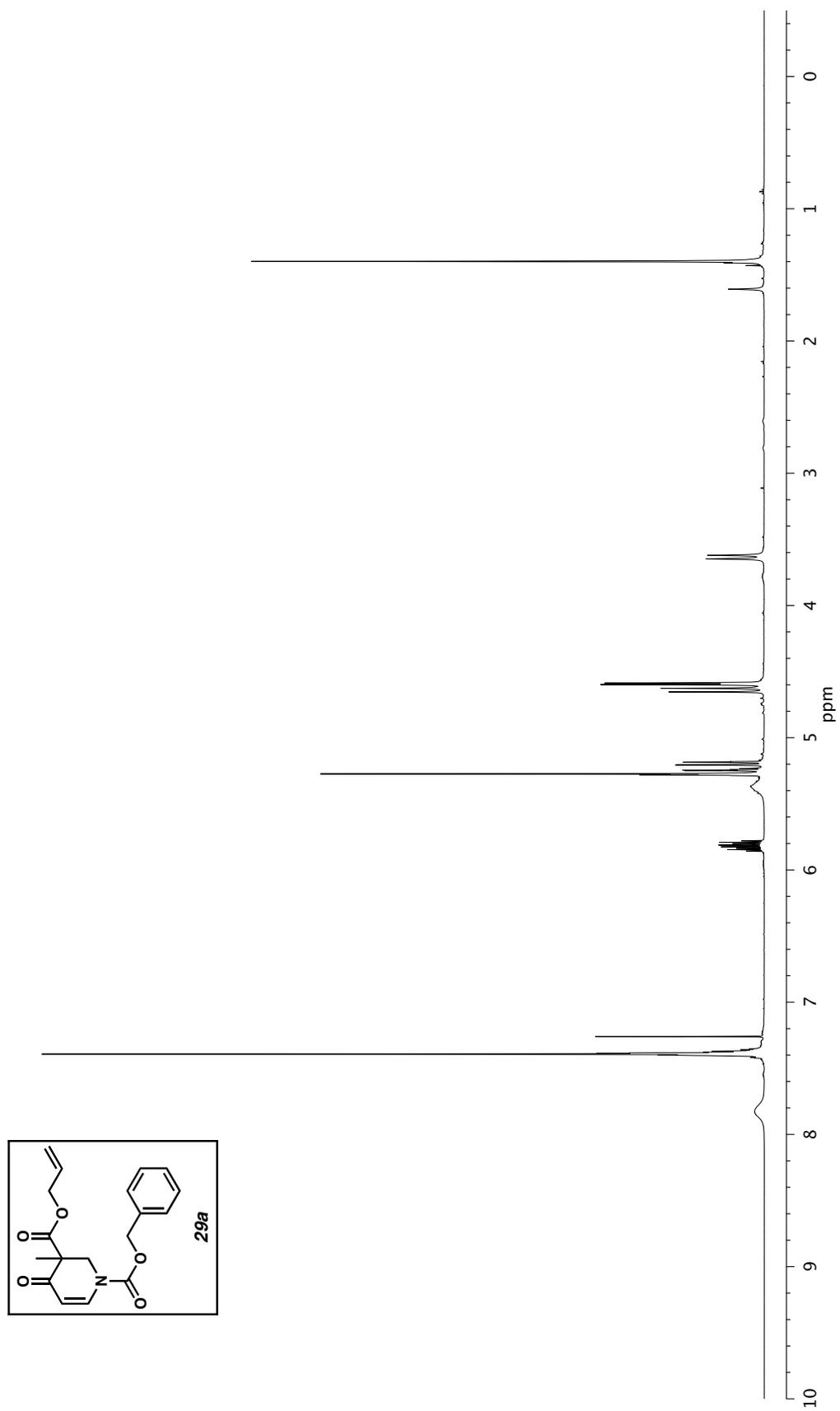


Figure A1.19.3. ¹³C NMR (125 MHz, CDCl₃) of compound **23g**.

Figure A1.20.1. ^1H NMR (500 MHz, CDCl_3) of compound **29a**.

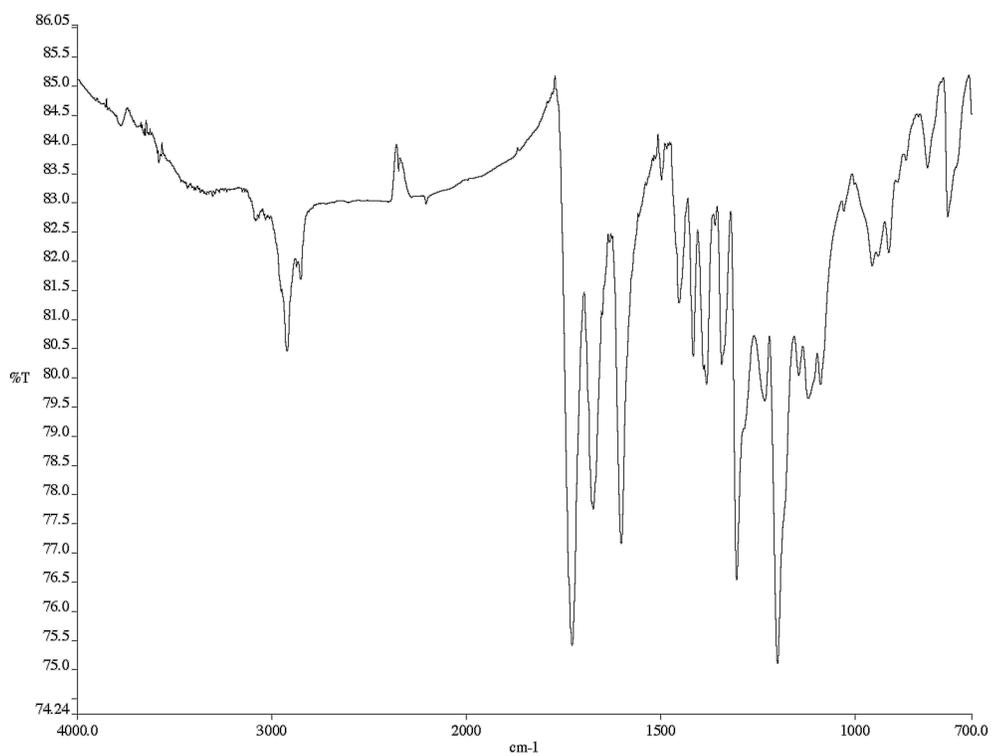


Figure A1.20.2. Infrared spectrum (thin film/NaCl) of compound **29a**.

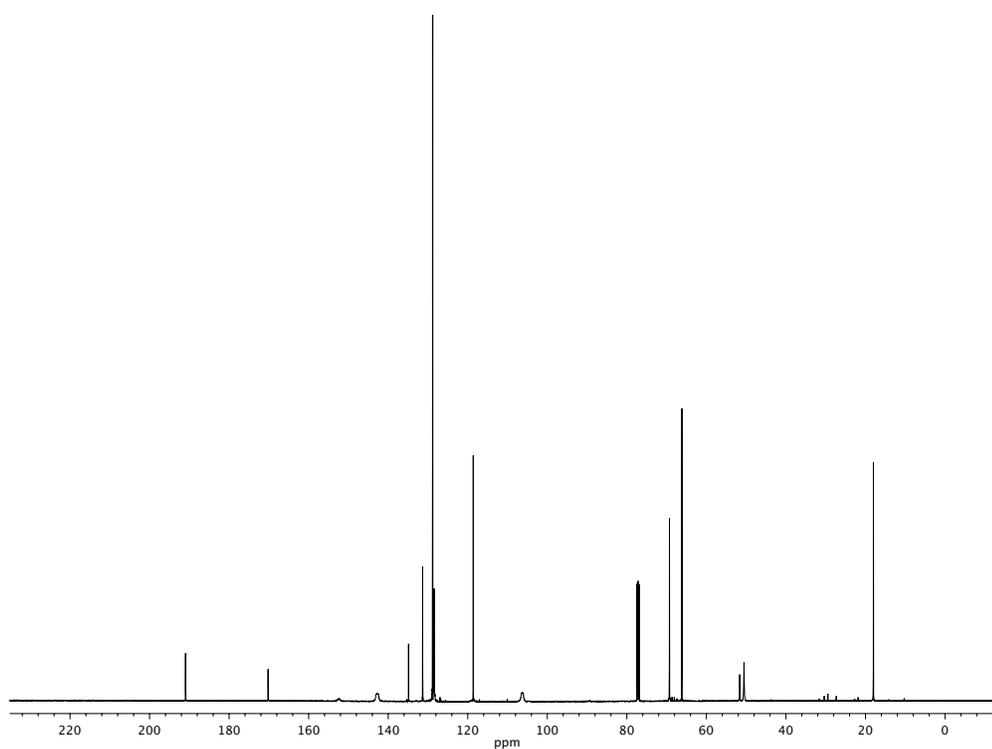
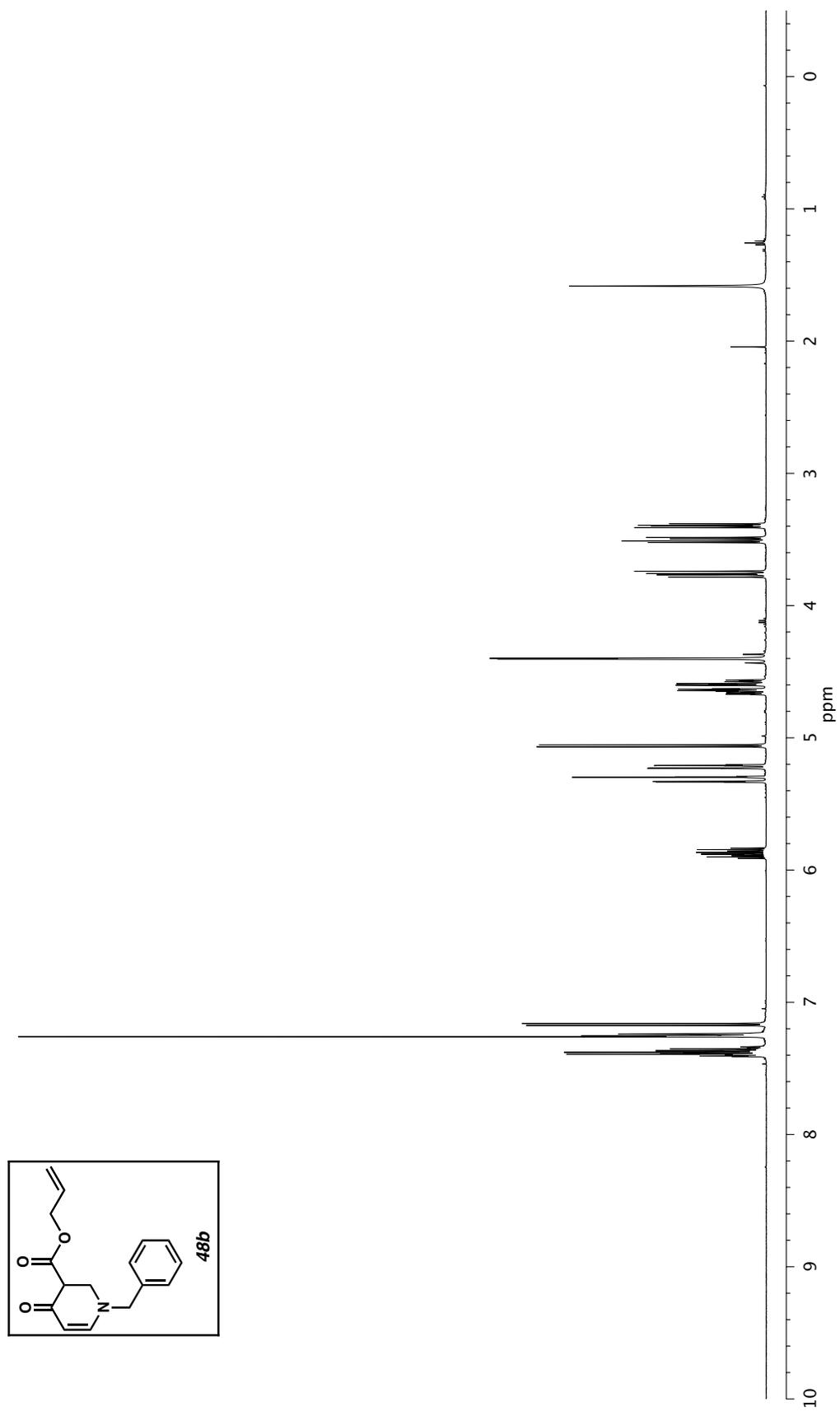


Figure A1.20.3. ¹³C NMR (125 MHz, CDCl₃) of compound **29a**.

Figure A1.21.1. ^1H NMR (500 MHz, CDCl_3) of compound **48b**.

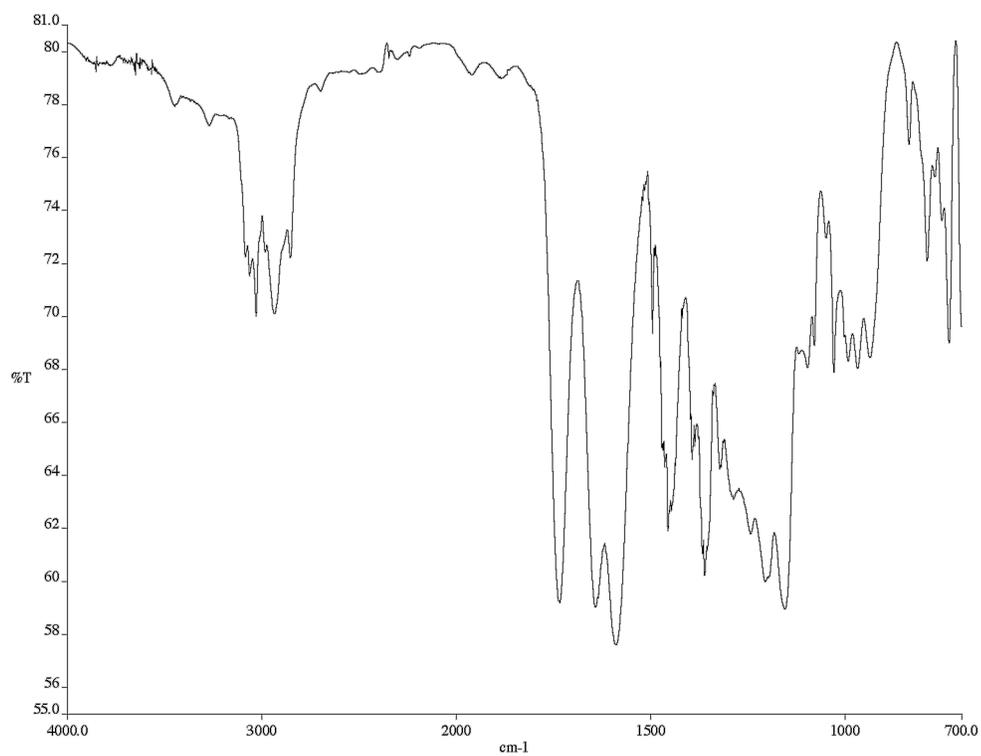


Figure A1.21.2. Infrared spectrum (thin film/NaCl) of compound **48b**.

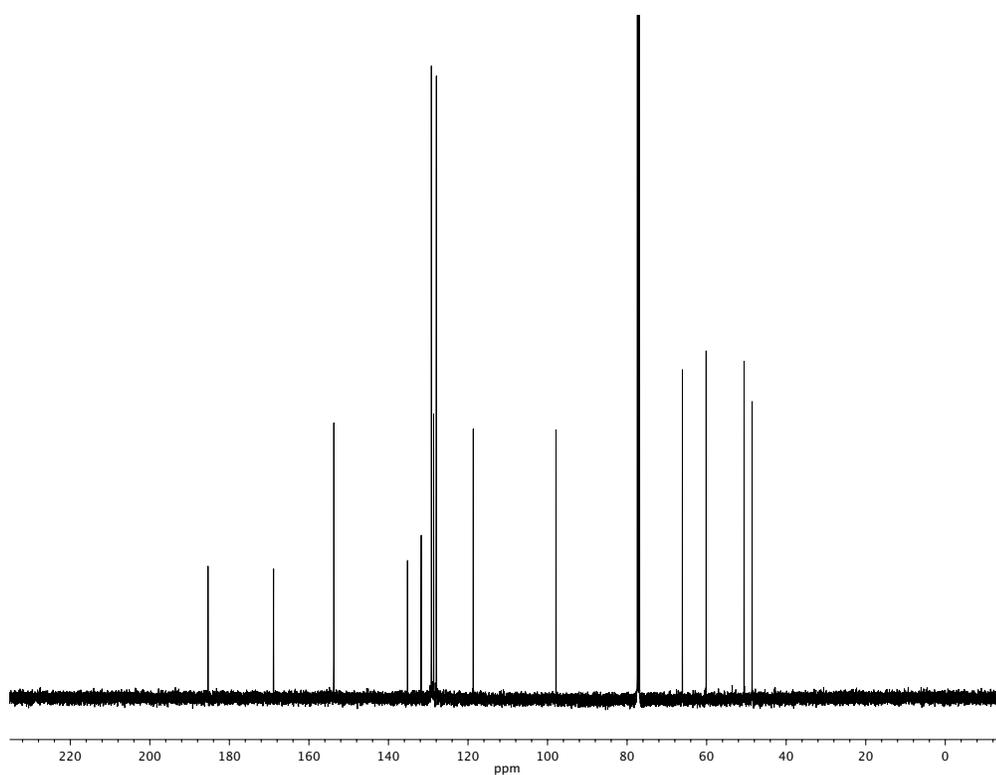
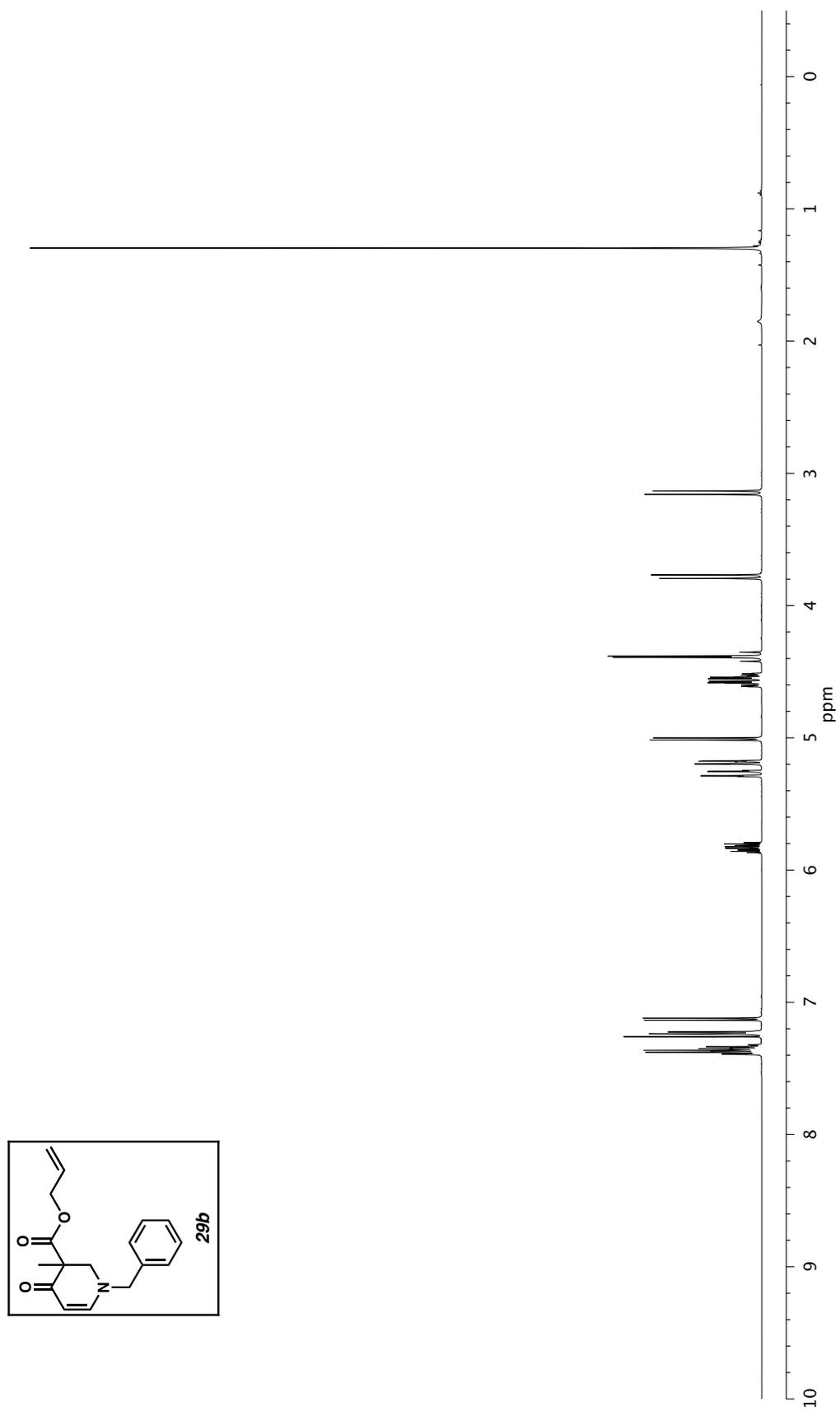


Figure A1.21.3. ^{13}C NMR (125 MHz, CDCl_3) of compound **48b**.

Figure A1.22.1. ^1H NMR (500 MHz, CDCl_3) of compound **29b**.

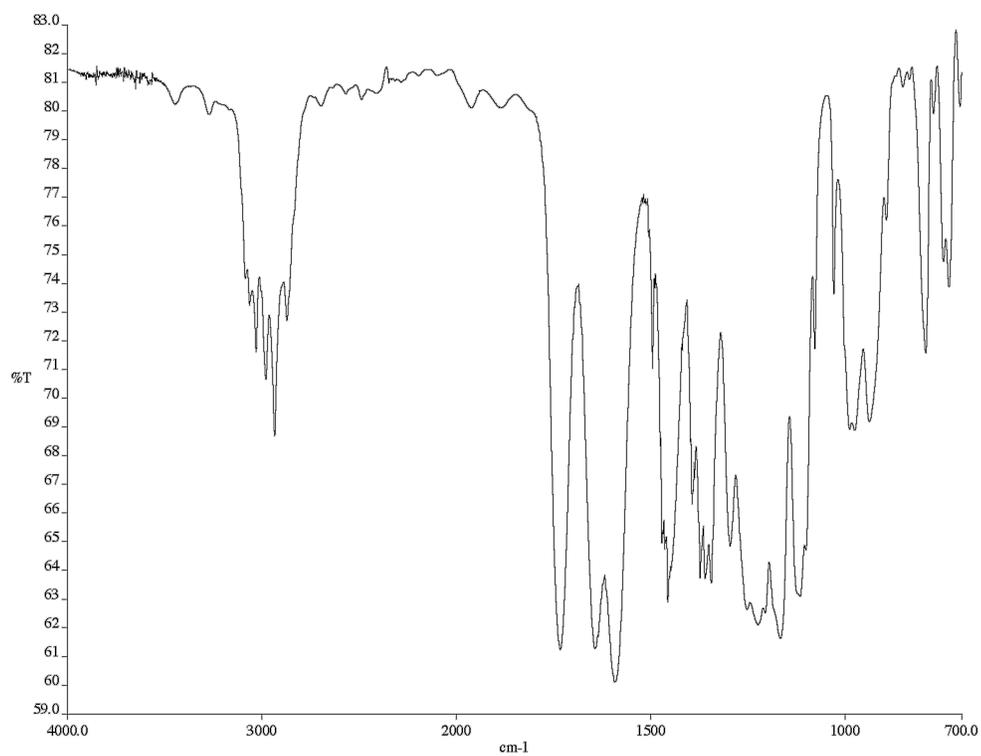


Figure A1.22.2. Infrared spectrum (thin film/NaCl) of compound **29b**.

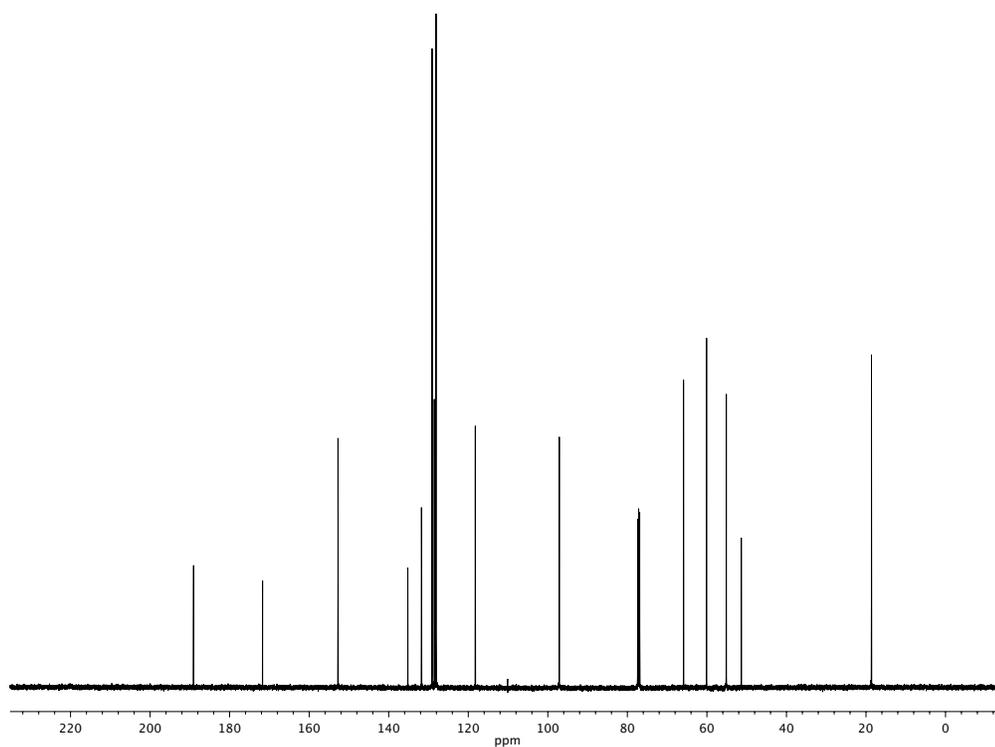


Figure A1.22.3. ¹³C NMR (125 MHz, CDCl₃) of compound **29b**.

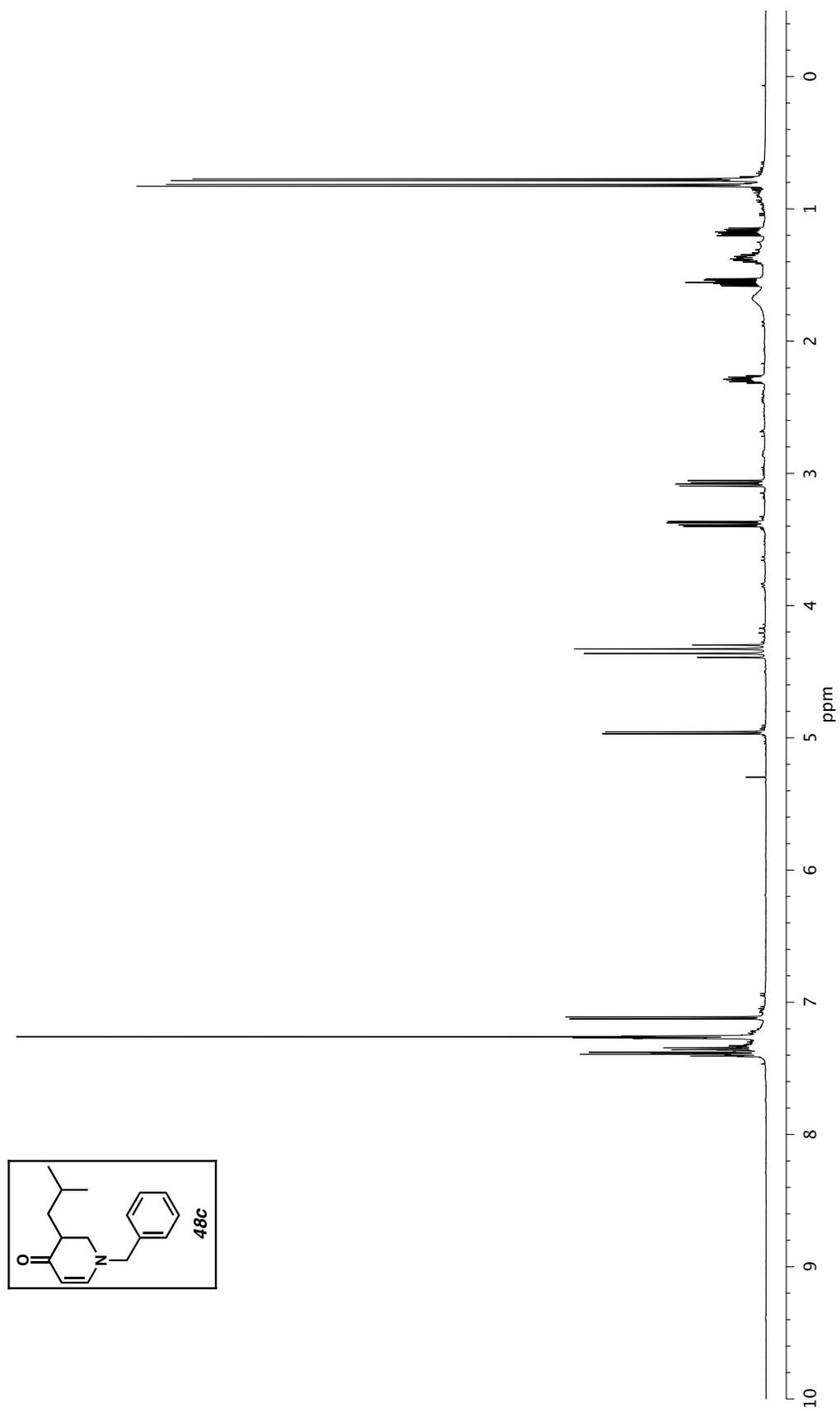


Figure A1.23.1. ^1H NMR (500 MHz, CDCl_3) of compound **48c**.

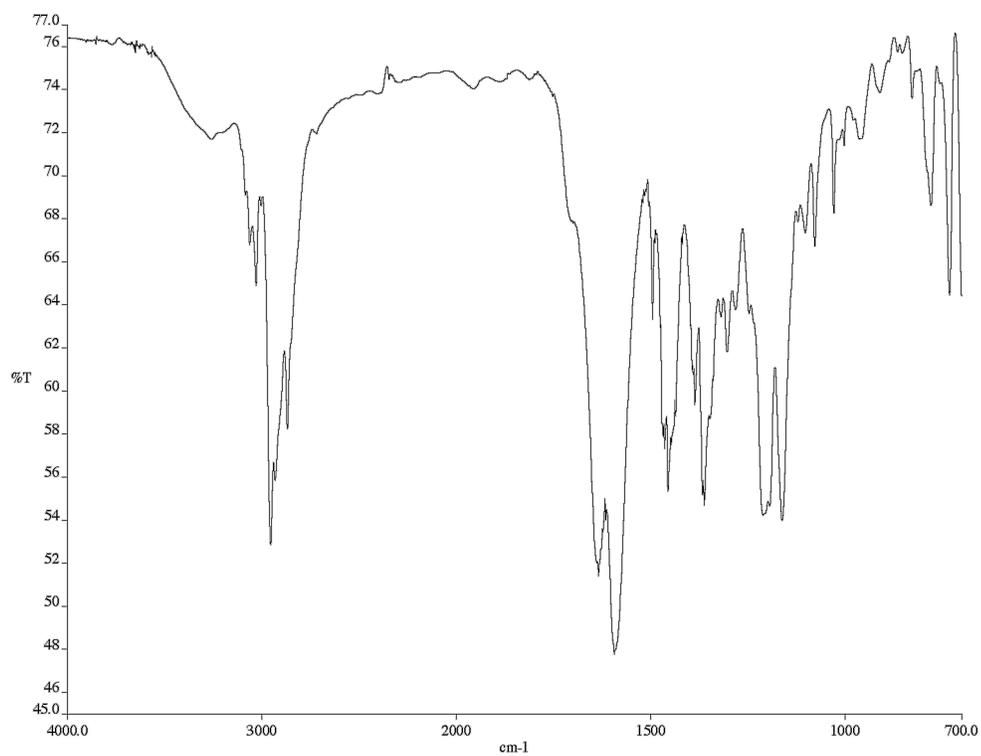


Figure A1.23.2. Infrared spectrum (thin film/NaCl) of compound **48c**.

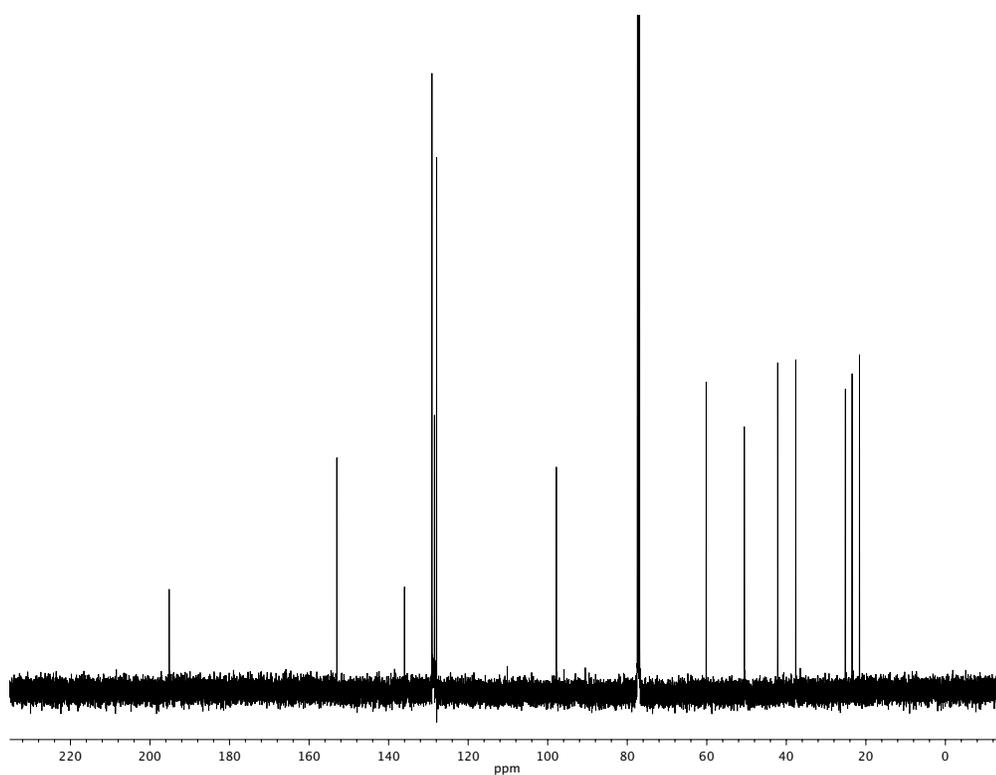
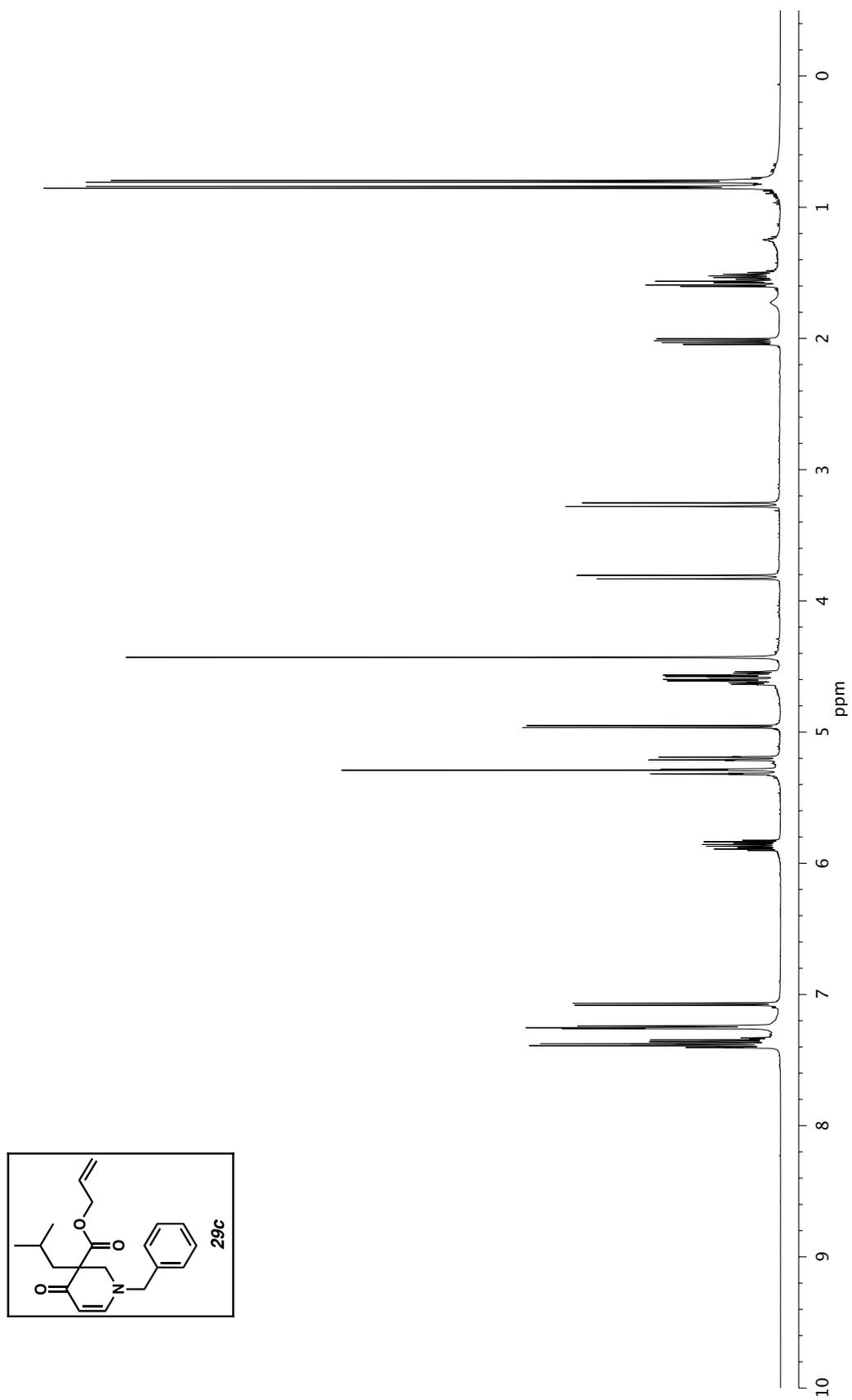


Figure A1.23.3. ¹³C NMR (125 MHz, CDCl₃) of compound **48c**.

Figure A1.24.1. ^1H NMR (500 MHz, CDCl_3) of compound **29c**.

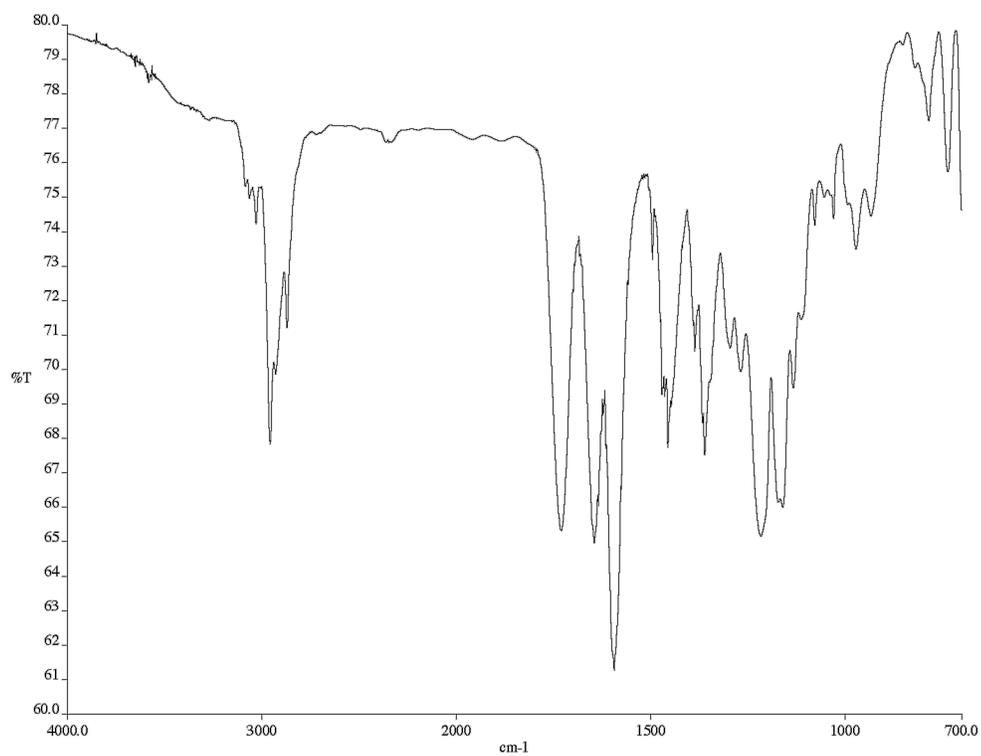


Figure A1.24.2. Infrared spectrum (thin film/NaCl) of compound **29c**.

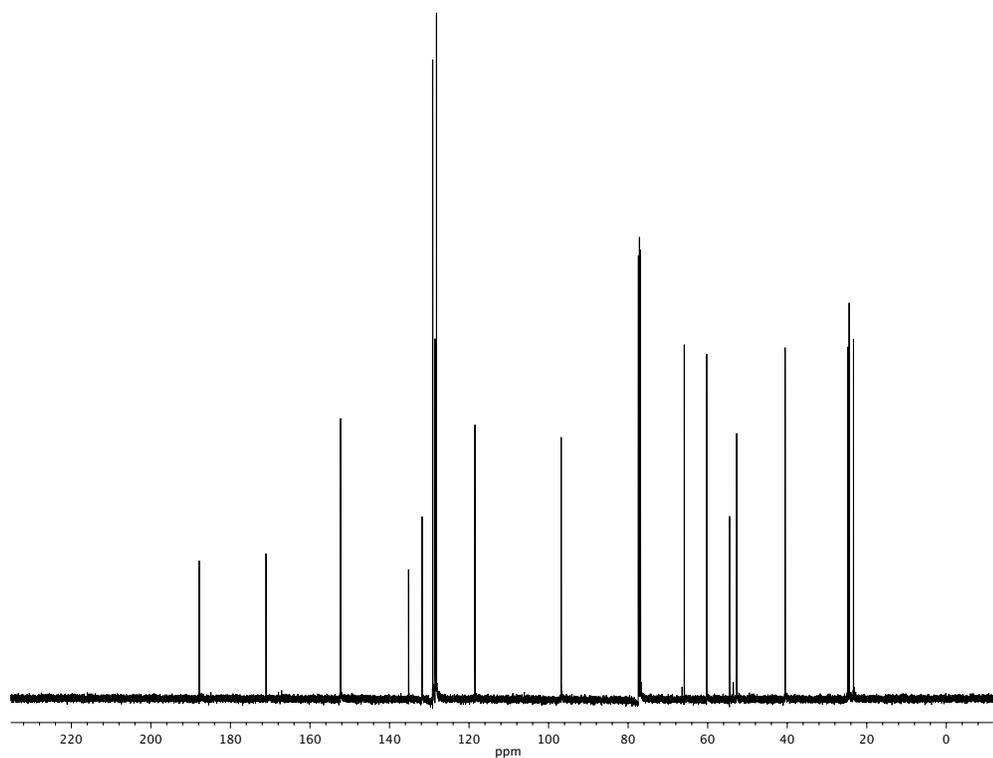


Figure A1.24.3. ¹³C NMR (125 MHz, CDCl₃) of compound **29c**.

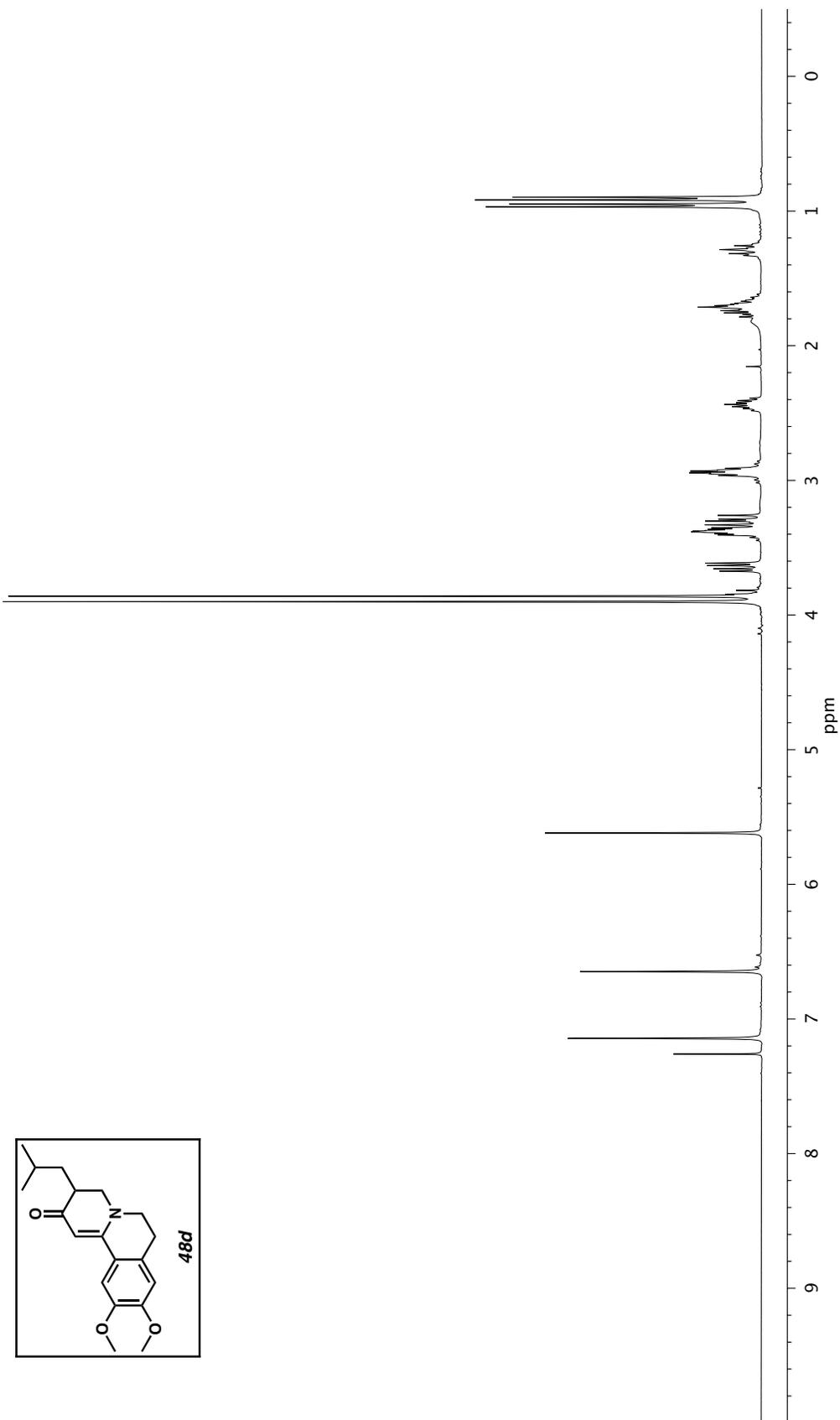


Figure A1.25.1. ^1H NMR (500 MHz, CDCl_3) of compound **48d**.

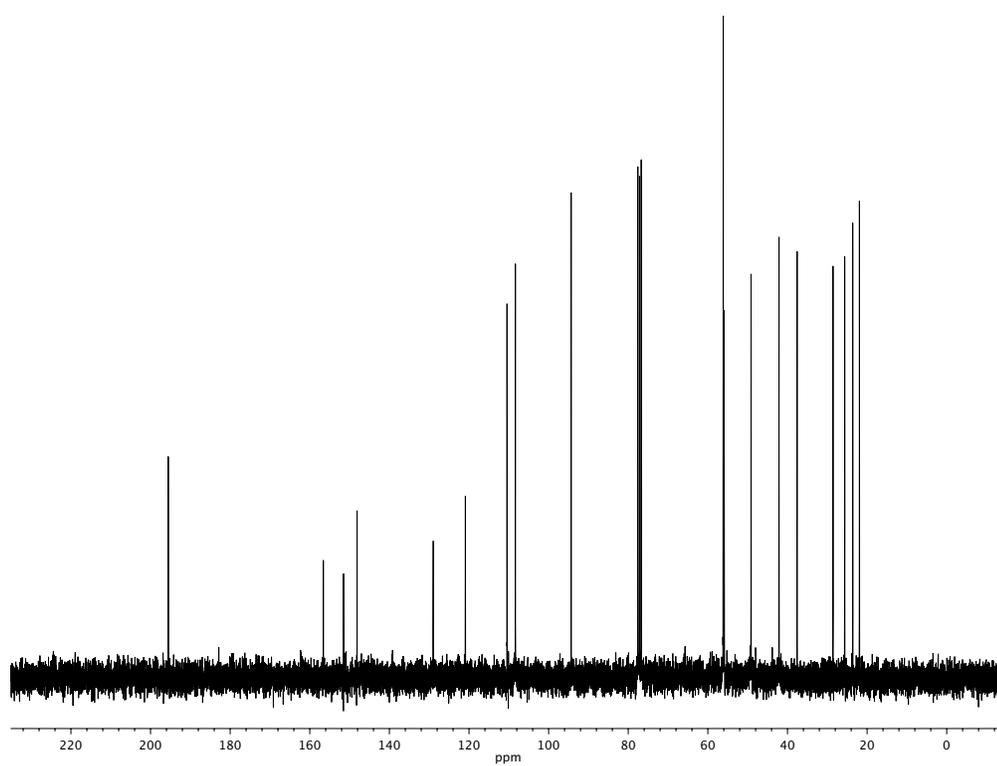


Figure A1.25.2. ^{13}C NMR (125 MHz, CDCl_3) of compound **48d**.

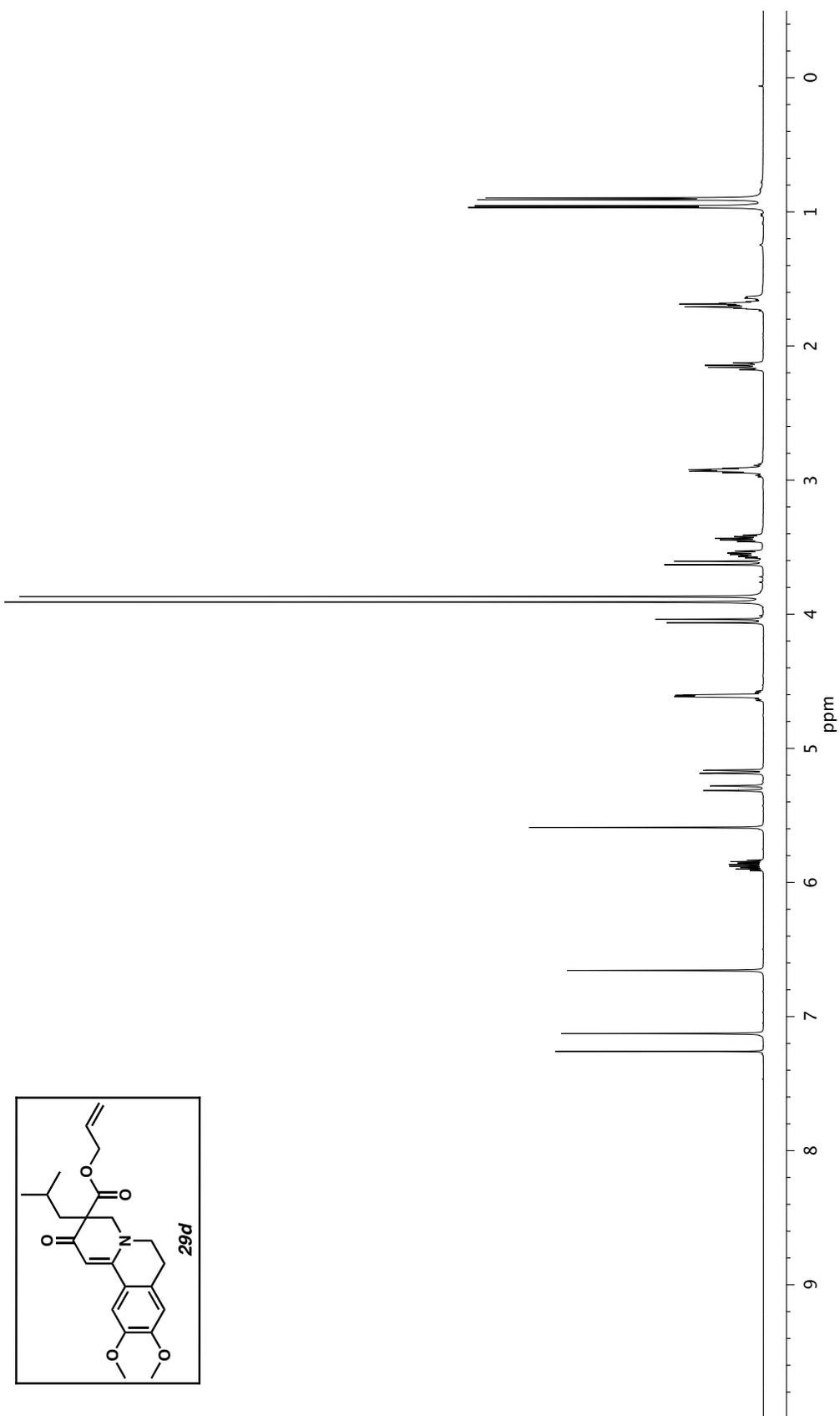


Figure A1.26.1. ^1H NMR (500 MHz, CDCl_3) of compound **29d**.

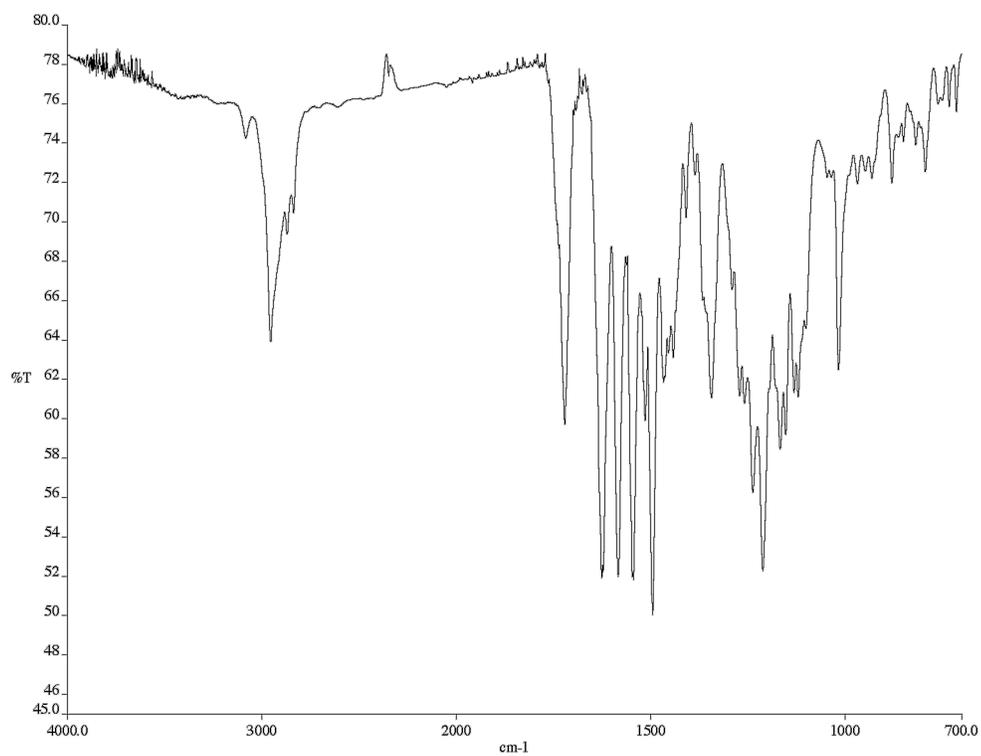


Figure A1.26.2. Infrared spectrum (thin film/NaCl) of compound **29d**.

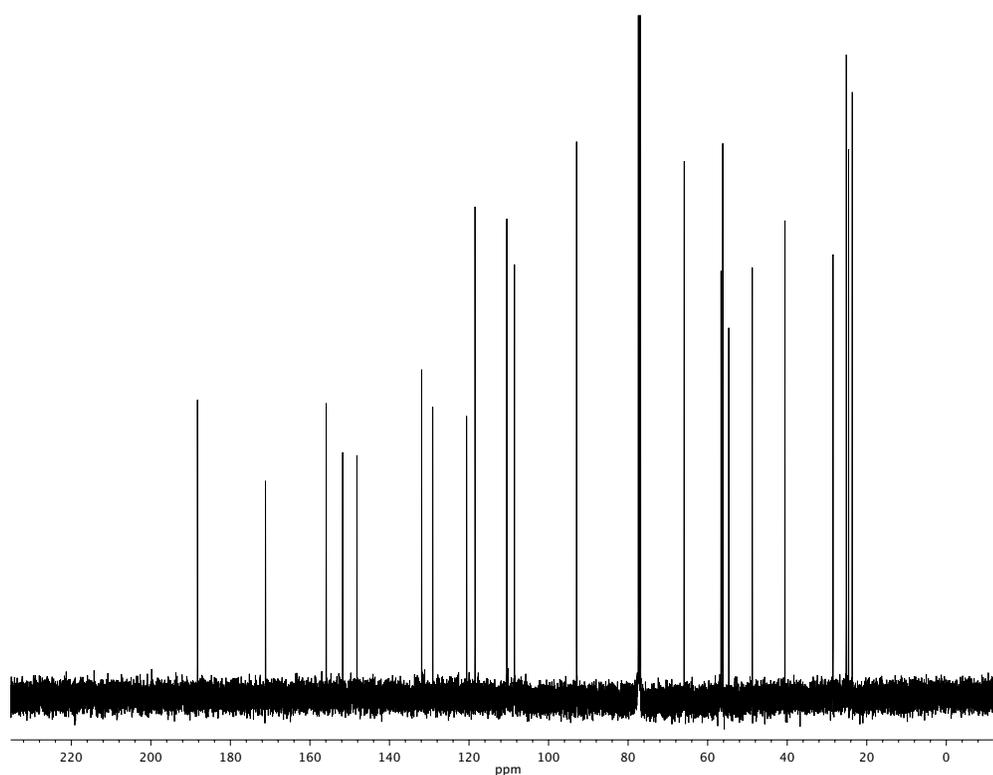
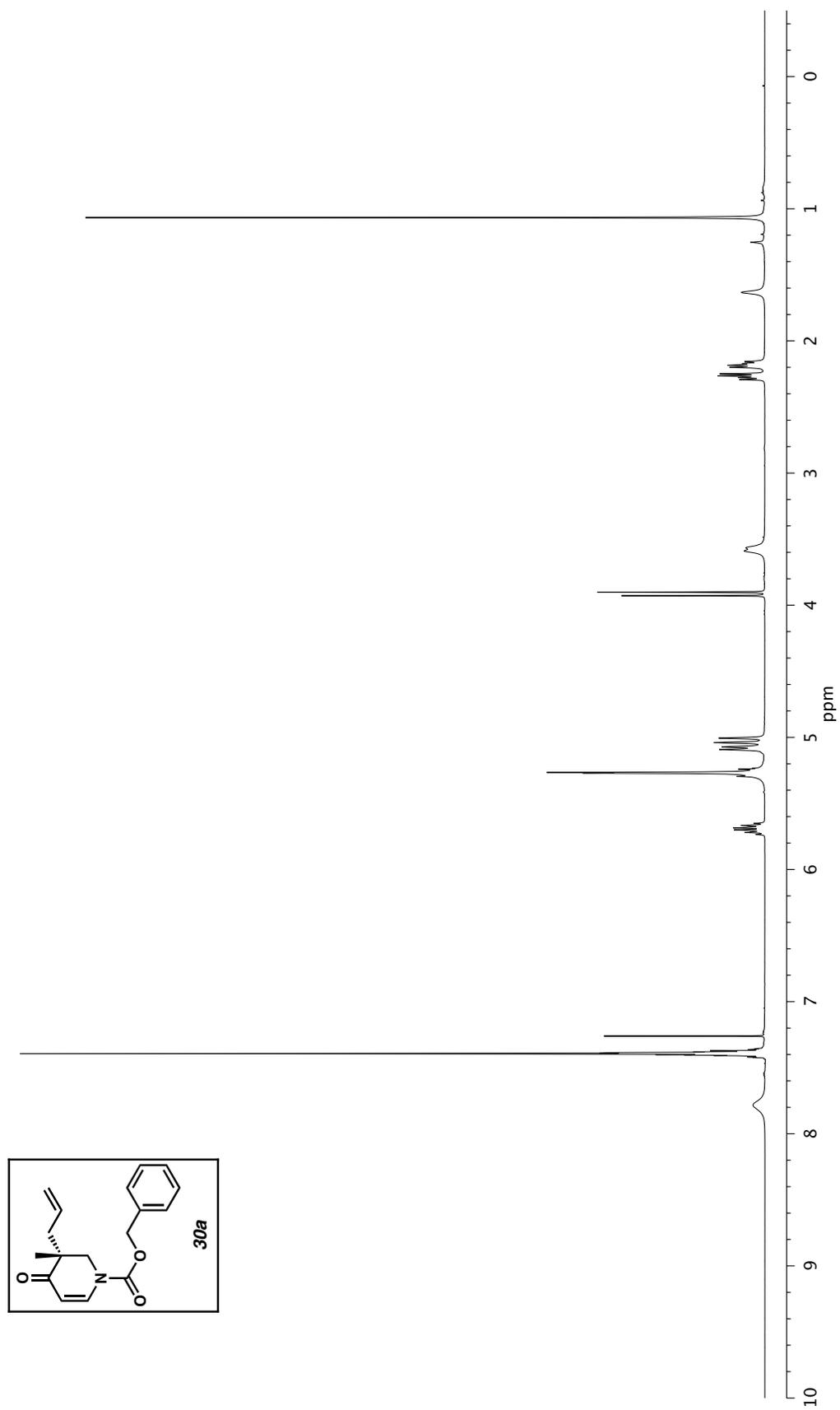


Figure A1.26.3. ¹³C NMR (125 MHz, CDCl₃) of compound **29d**.

Figure A1.27.1. ^1H NMR (500 MHz, CDCl_3) of compound **30a**.

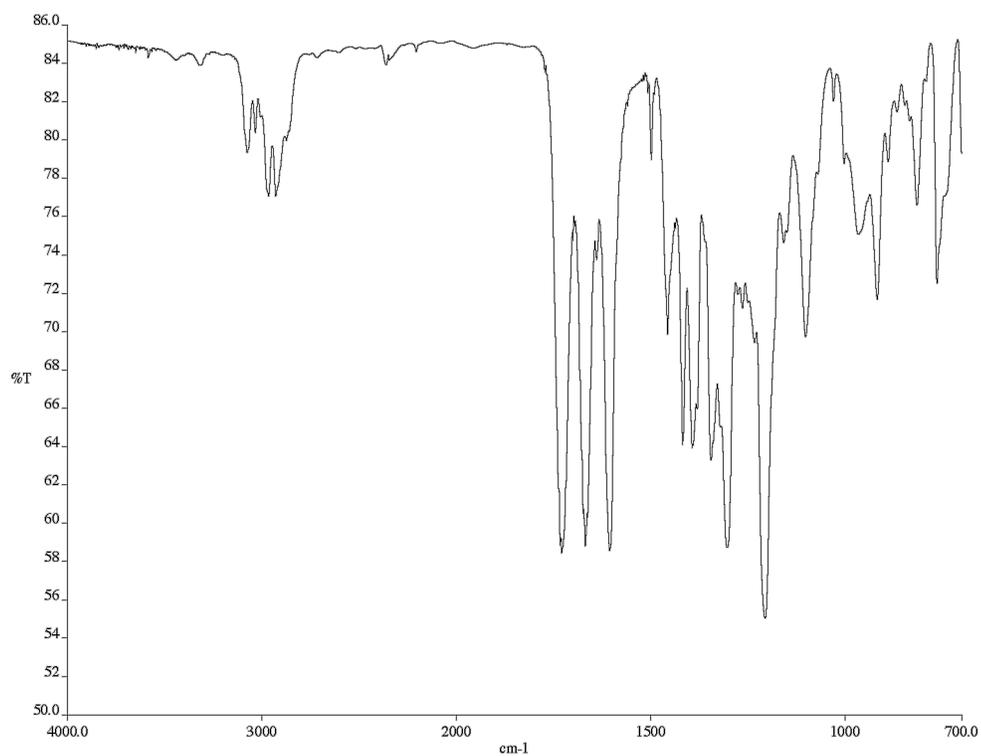


Figure A1.27.2. Infrared spectrum (thin film/NaCl) of compound **30a**.

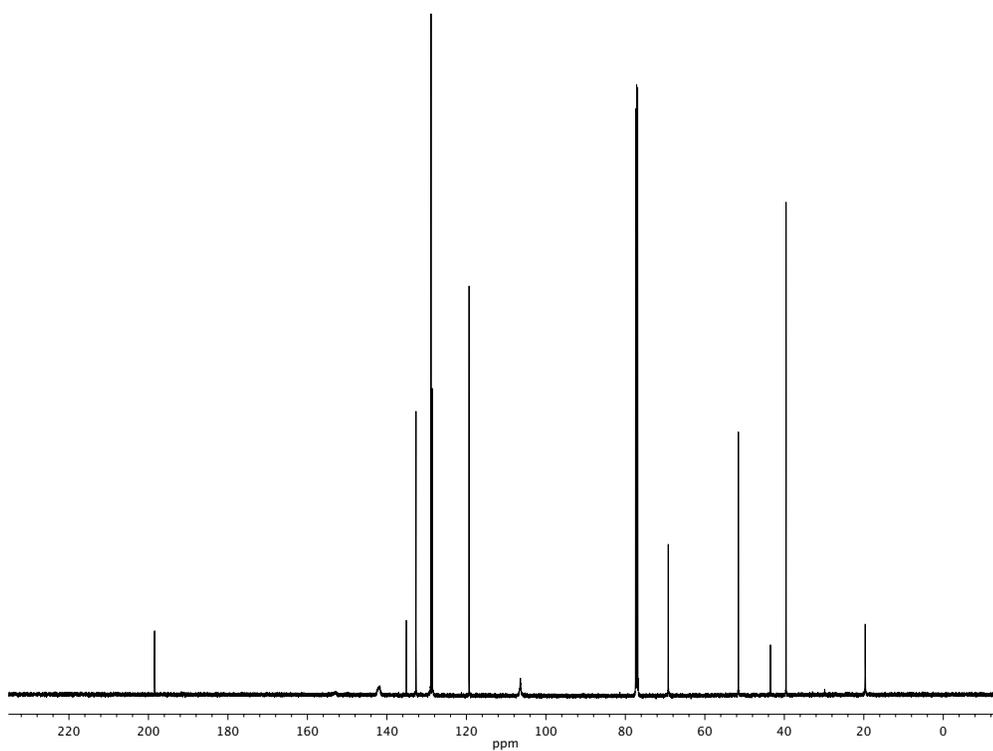
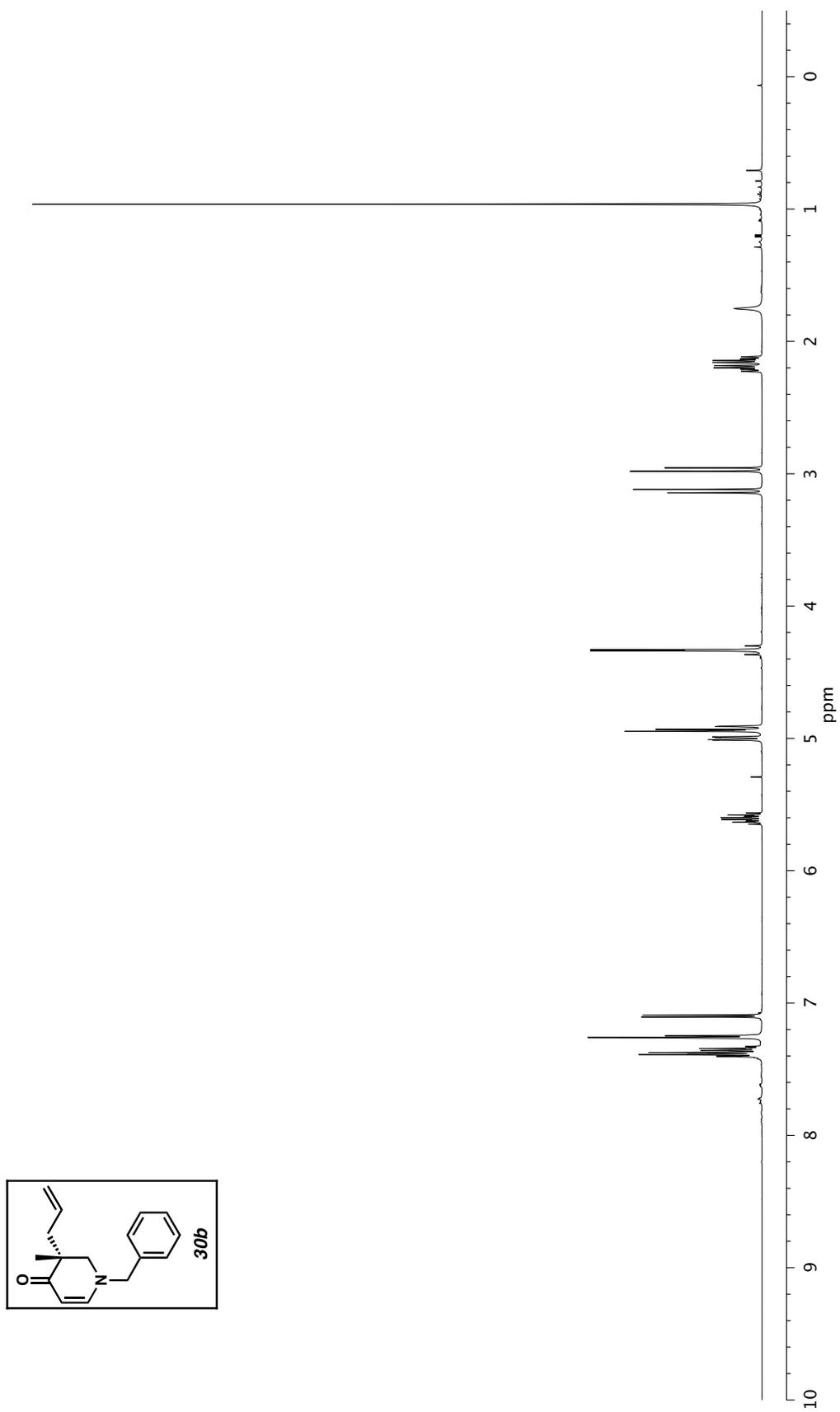


Figure A1.27.3. ¹³C NMR (125 MHz, CDCl₃) of compound **30a**.

Figure A1.28.1. ^1H NMR (500 MHz, CDCl_3) of compound **30b**.

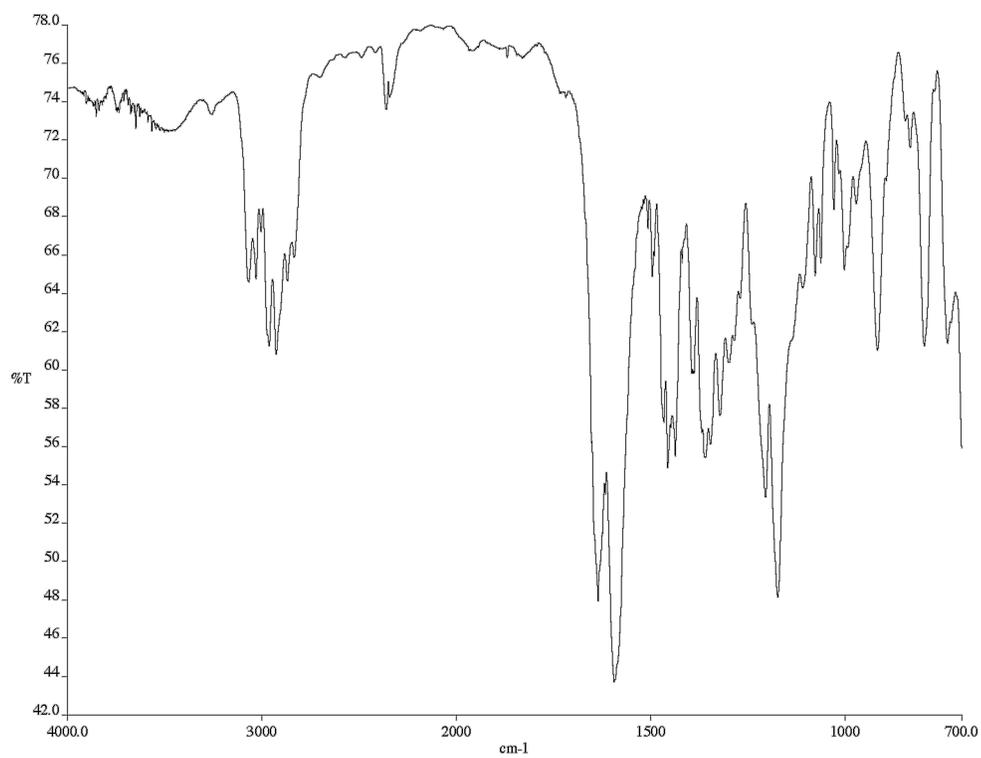


Figure A1.28.2. Infrared spectrum (thin film/NaCl) of compound **30b**.

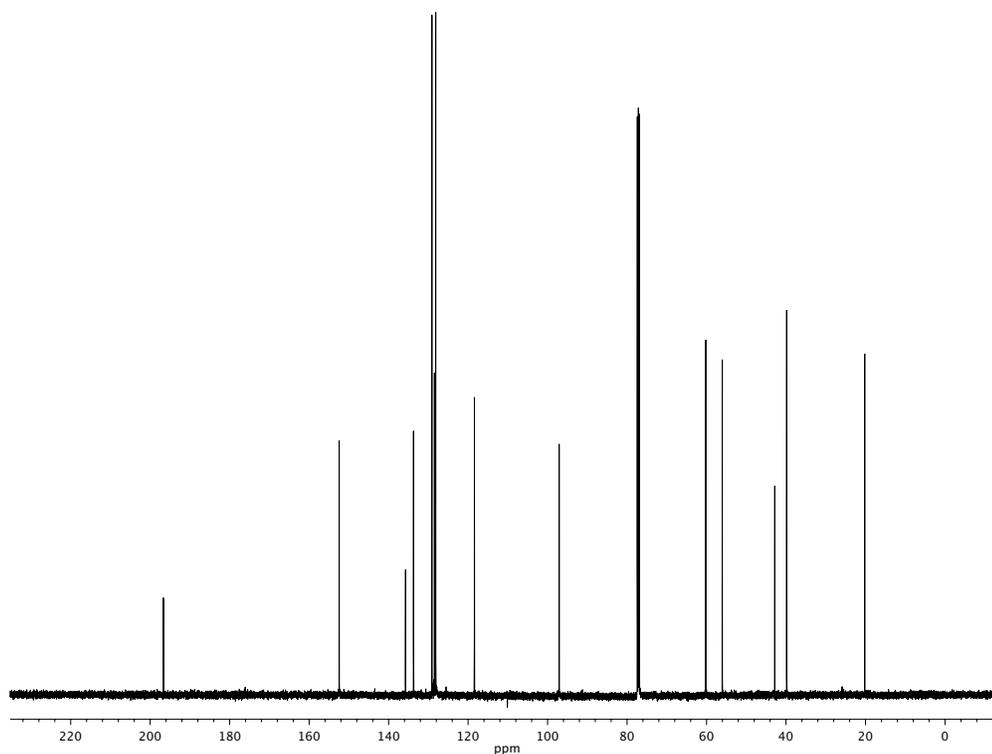
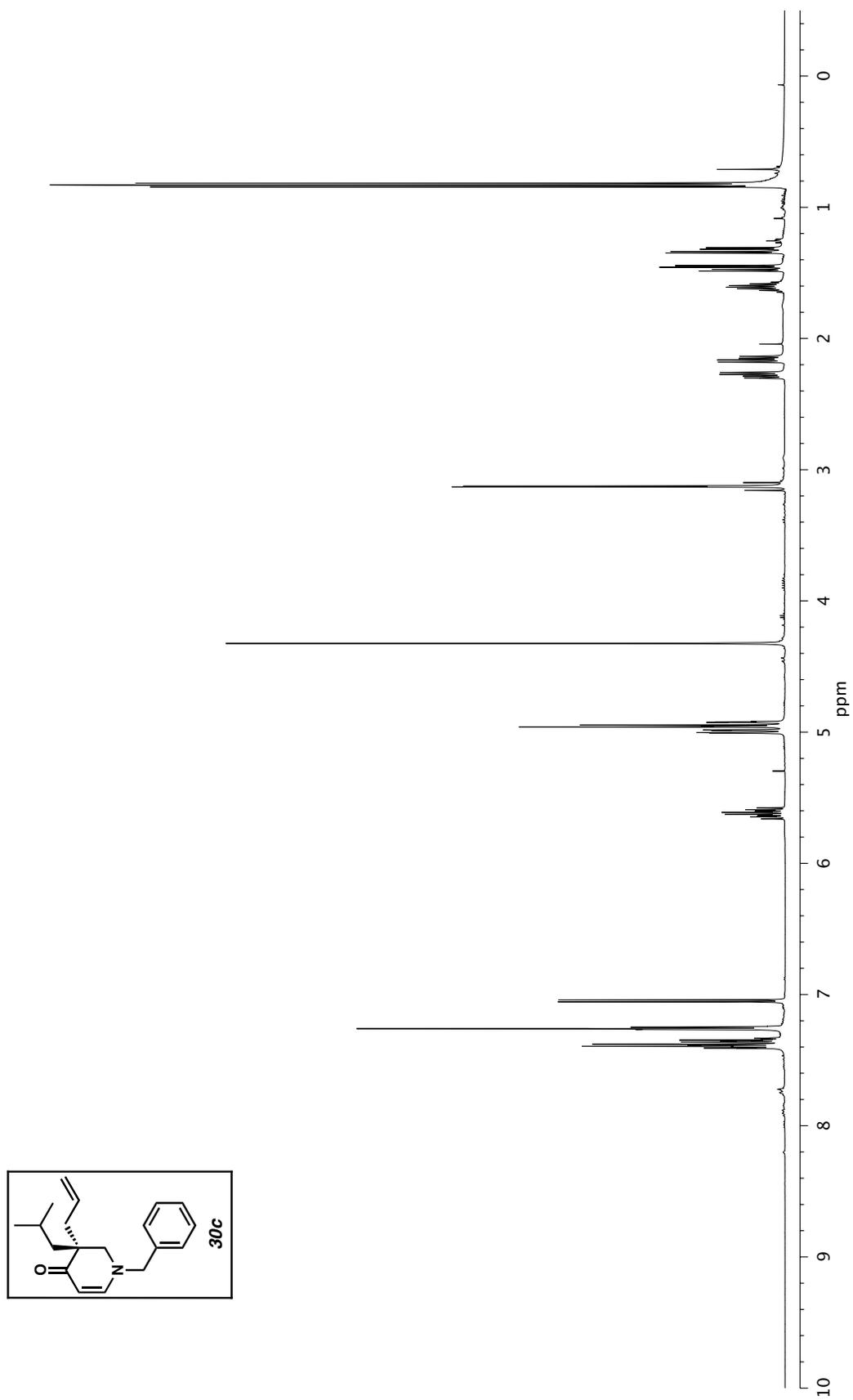


Figure A1.28.3. ¹³C NMR (125 MHz, CDCl₃) of compound **30b**.

Figure A1.29.1. ^1H NMR (500 MHz, CDCl_3) of compound **30c**.

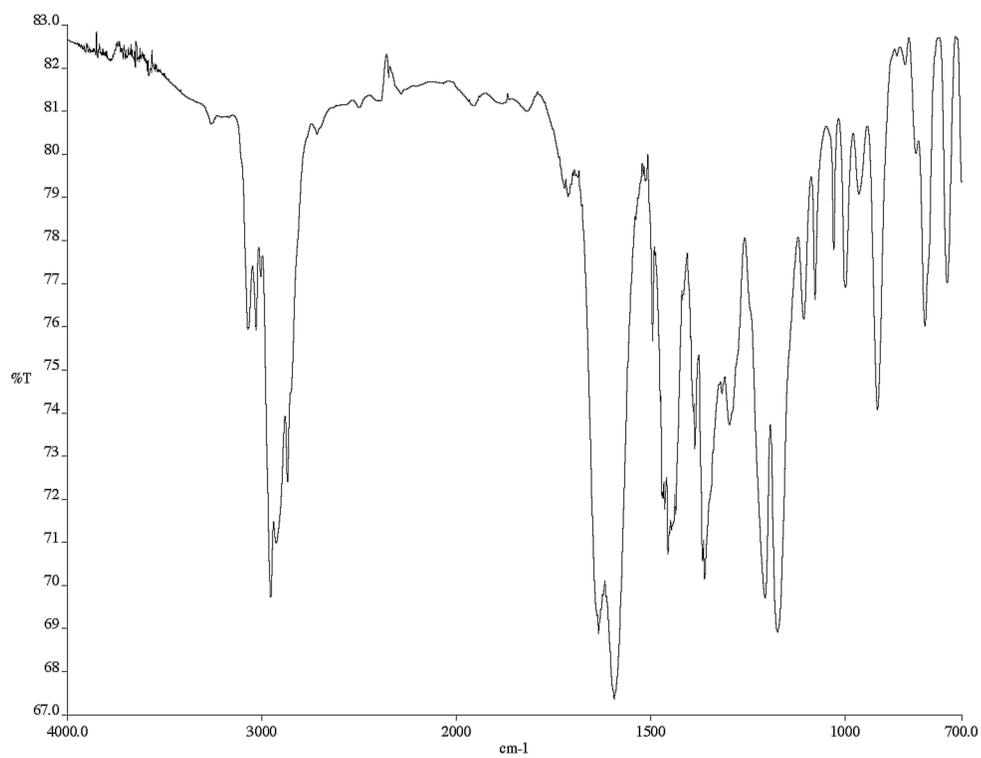


Figure A1.29.2. Infrared spectrum (thin film/NaCl) of compound **30c**.

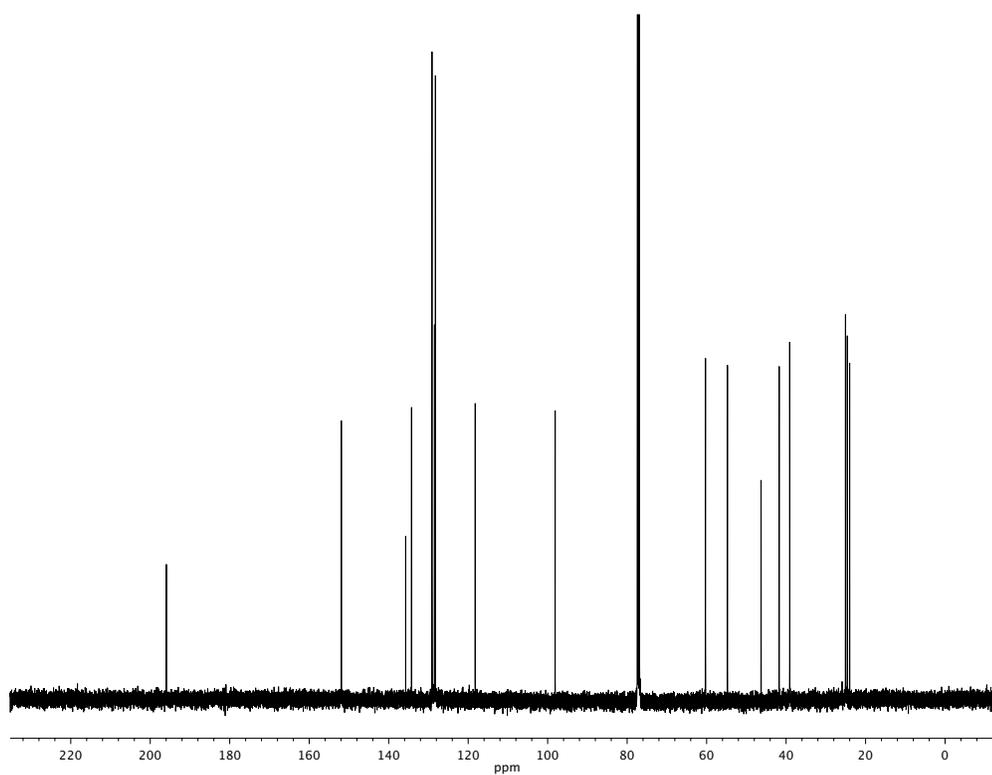


Figure A1.29.3. ¹³C NMR (125 MHz, CDCl₃) of compound **30c**.

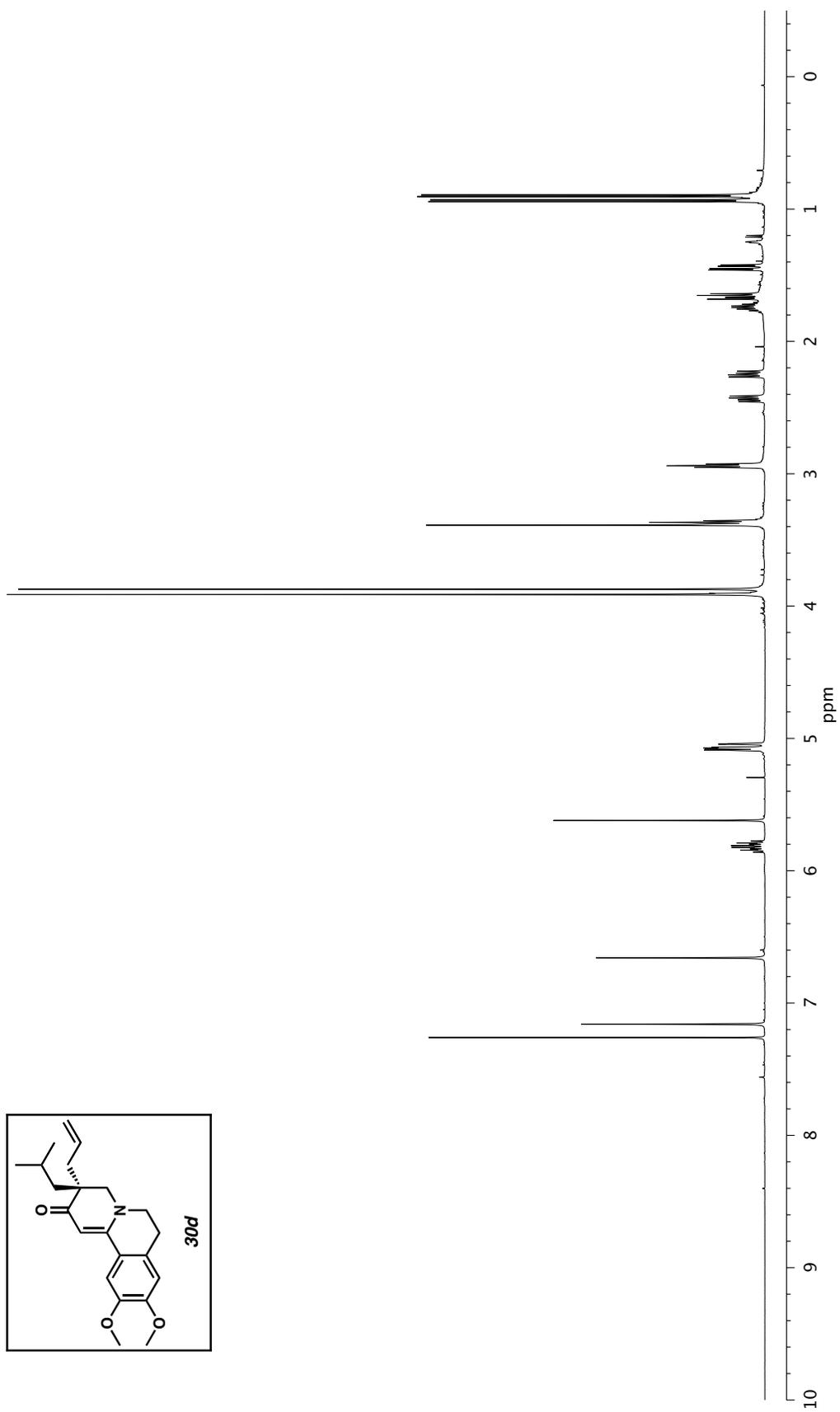


Figure A1.30.1. ¹H NMR (500 MHz, CDCl₃) of compound **30d**.

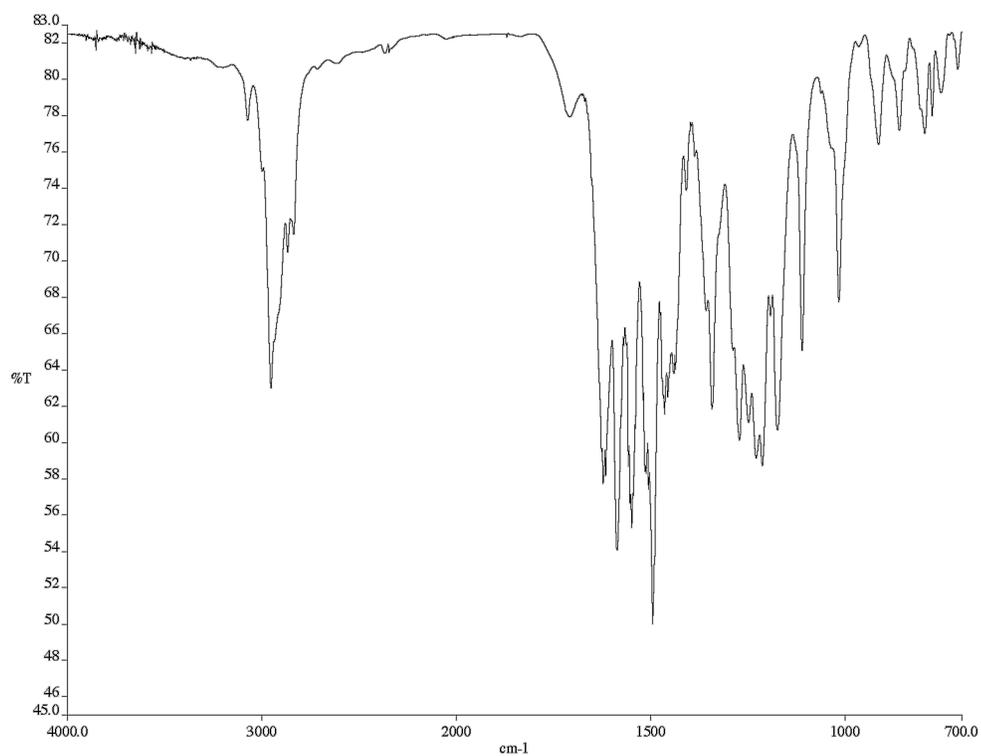


Figure A1.30.2. Infrared spectrum (thin film/NaCl) of compound **30d**.

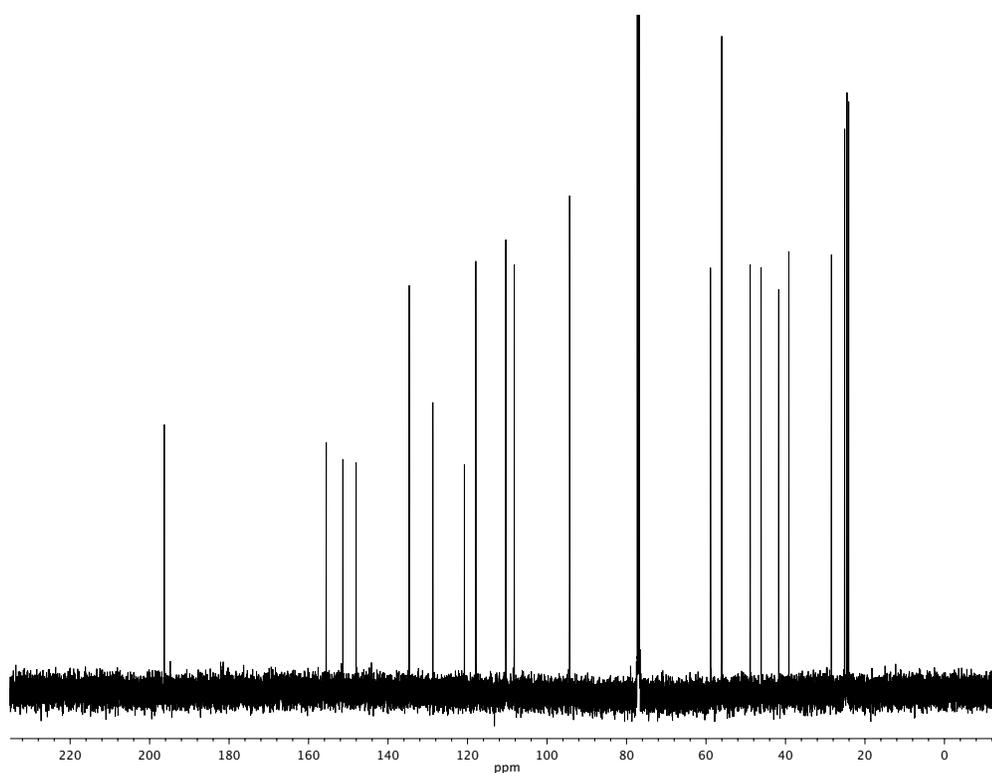
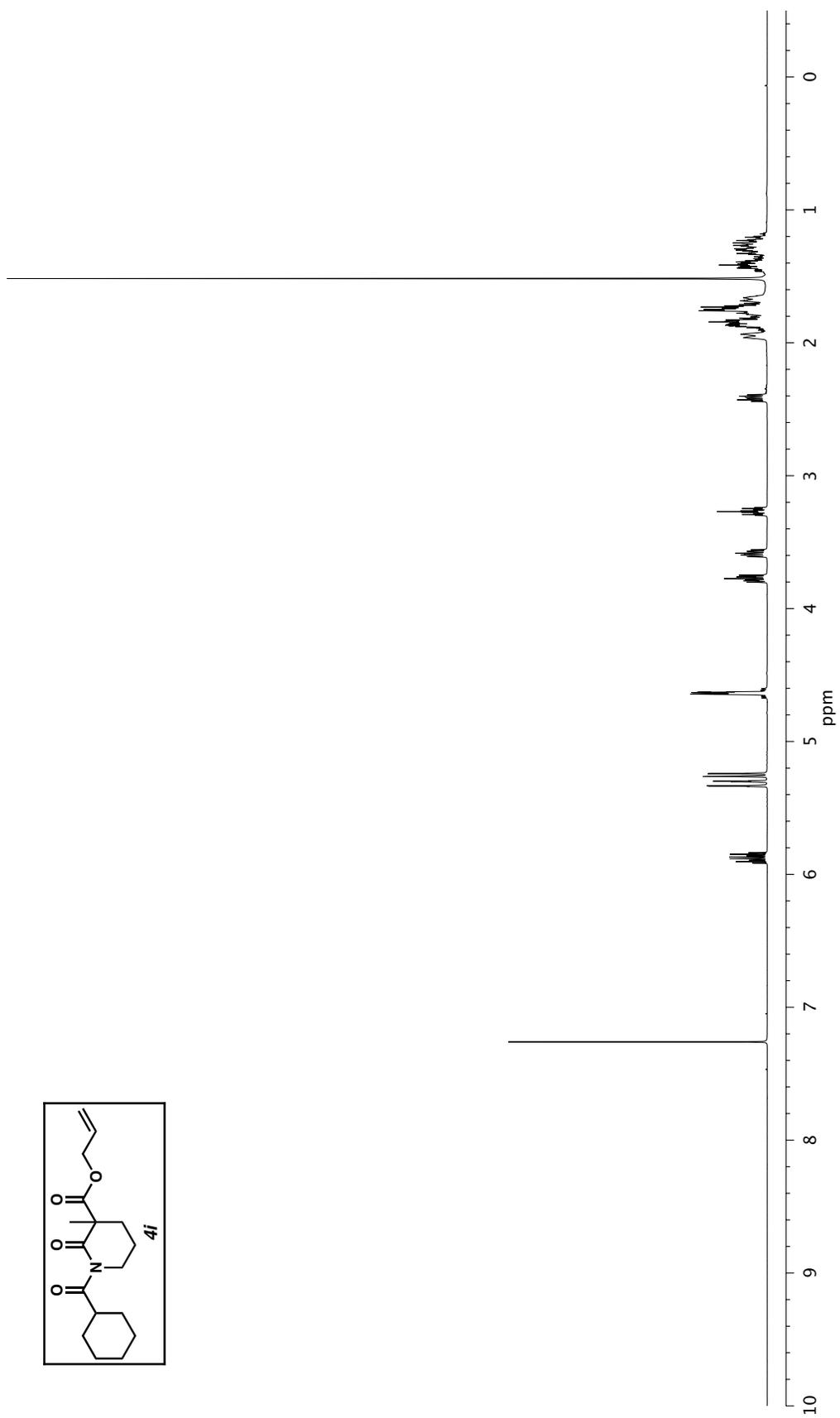


Figure A1.30.3. ¹³C NMR (125 MHz, CDCl₃) of compound **30d**.

Figure A1.31.1. ^1H NMR (500 MHz, CDCl_3) of compound **4i**.

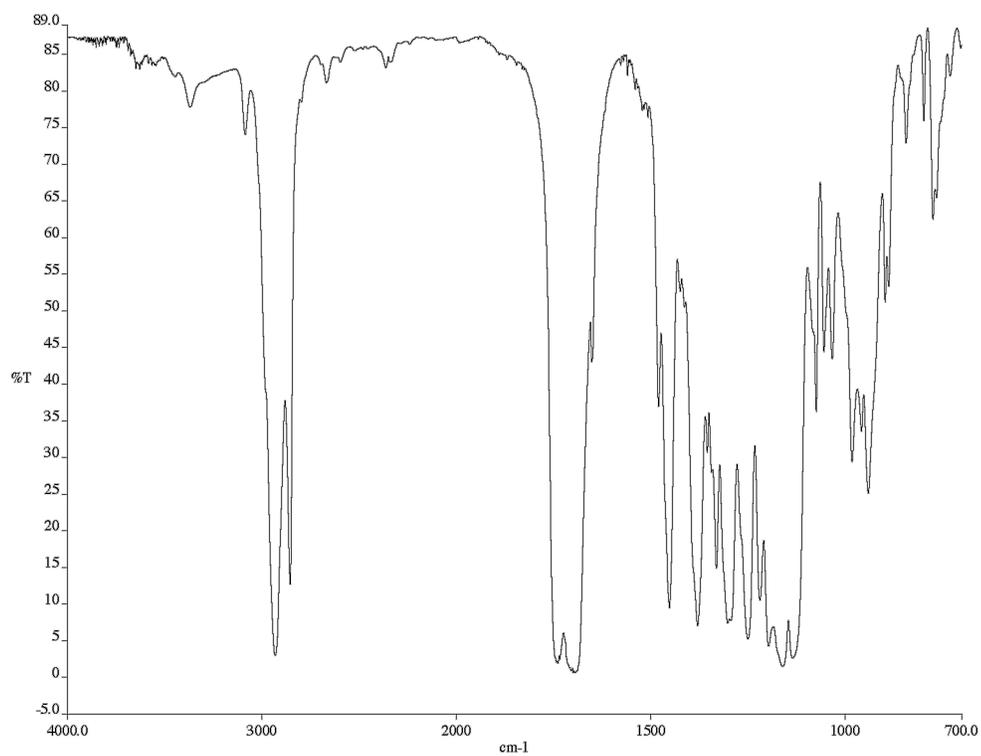


Figure A1.31.2. Infrared spectrum (thin film/NaCl) of compound **4i**.

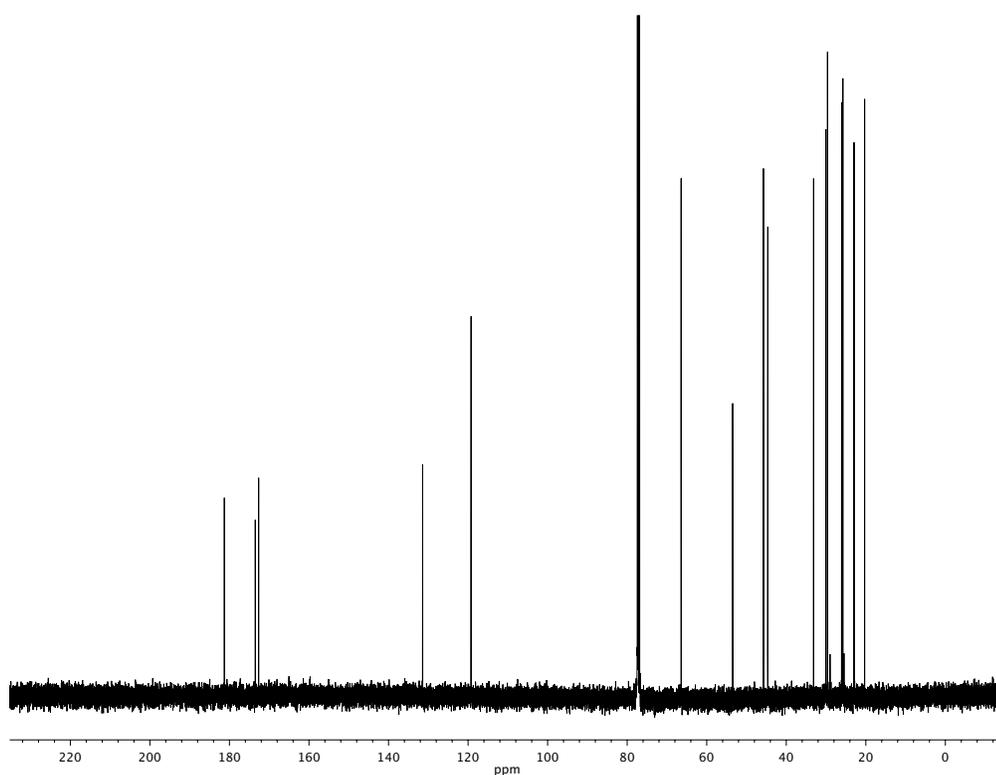
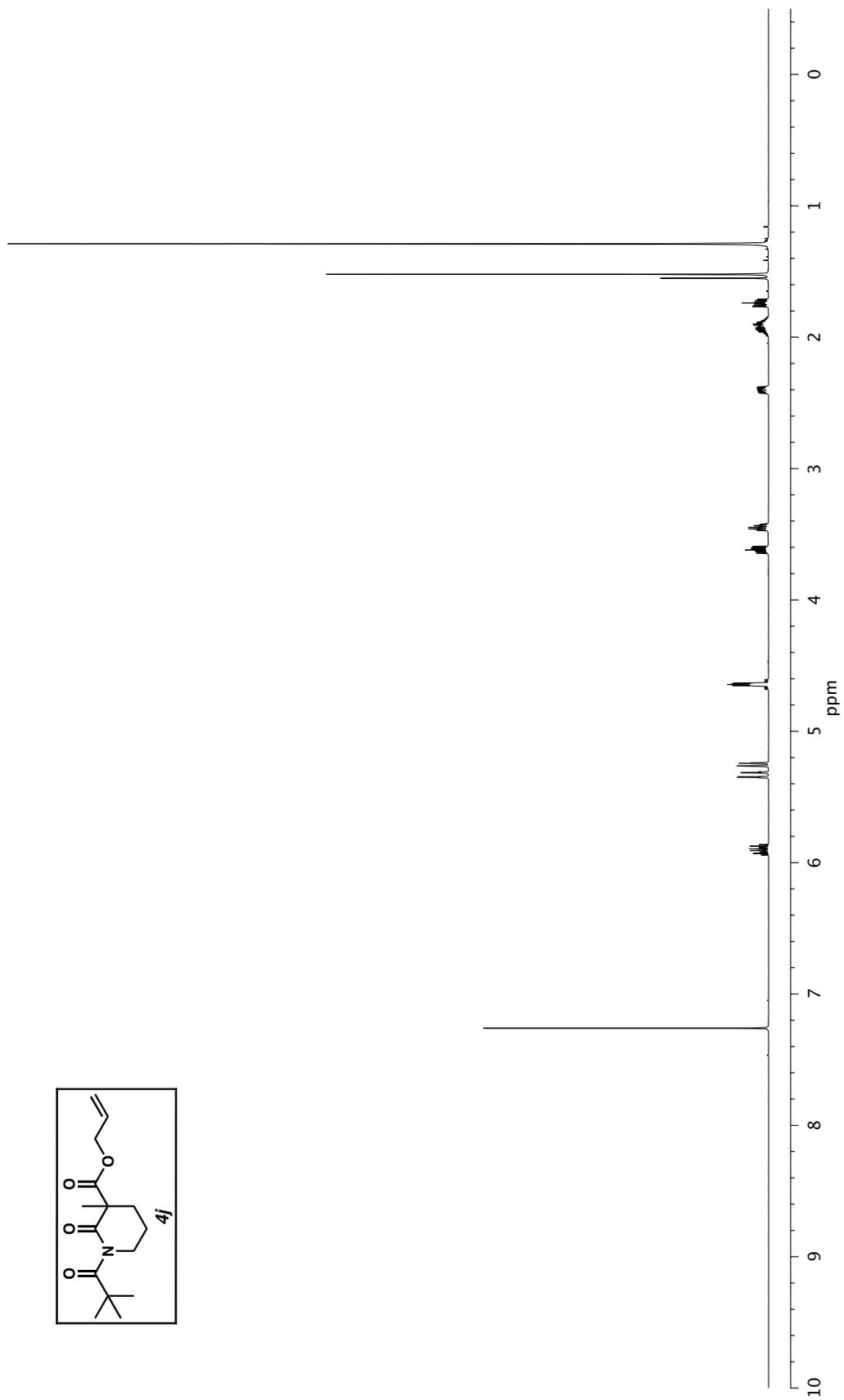


Figure A1.31.3. ¹³C NMR (125 MHz, CDCl₃) of compound **4i**.

Figure A1.32.1. ^1H NMR (500 MHz, CDCl_3) of compound **4j**.

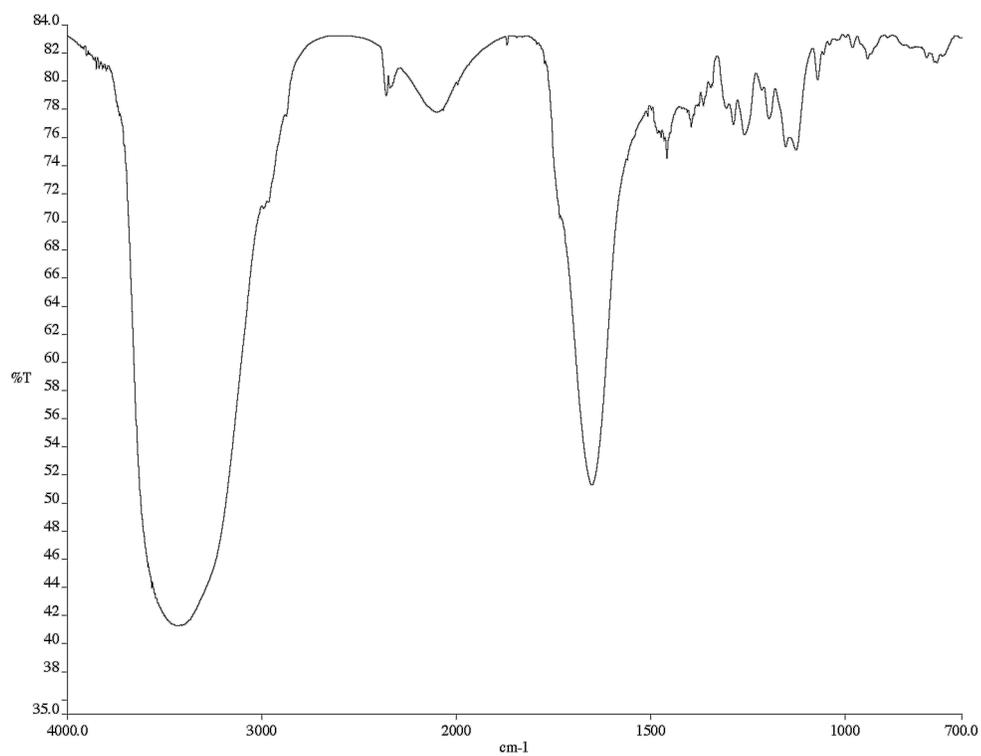


Figure A1.32.2. Infrared spectrum (thin film/NaCl) of compound **4j**.

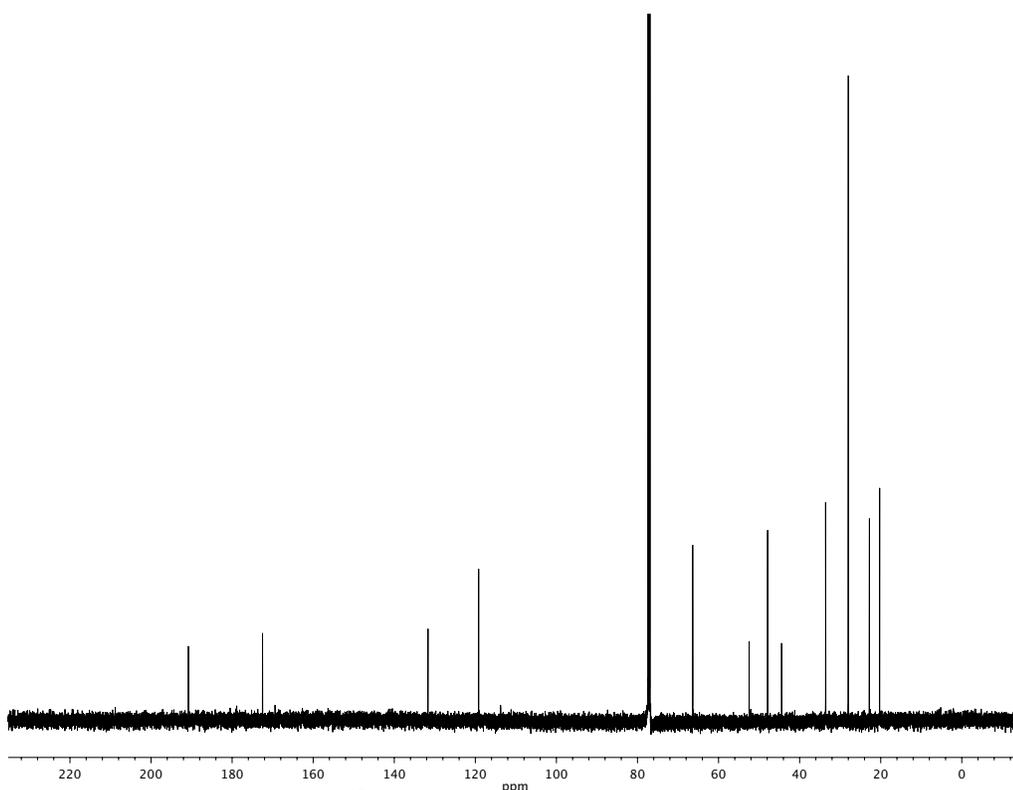


Figure A1.32.3. ¹³C NMR (125 MHz, CDCl₃) of compound **4j**.

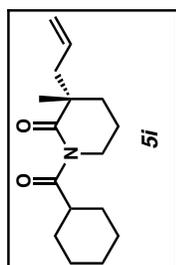
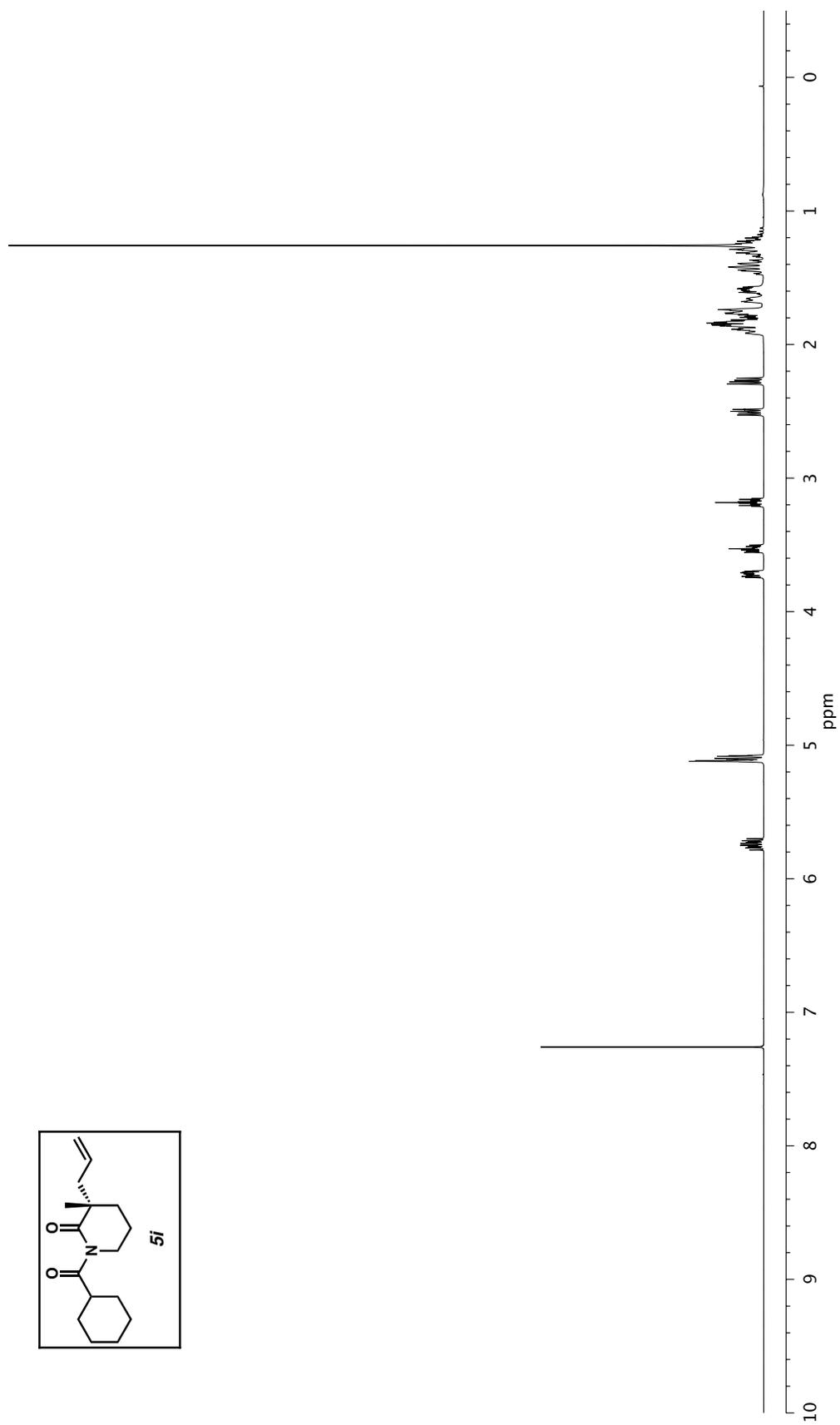


Figure A1.33.1. ¹H NMR (500 MHz, CDCl₃) of compound **5i**.

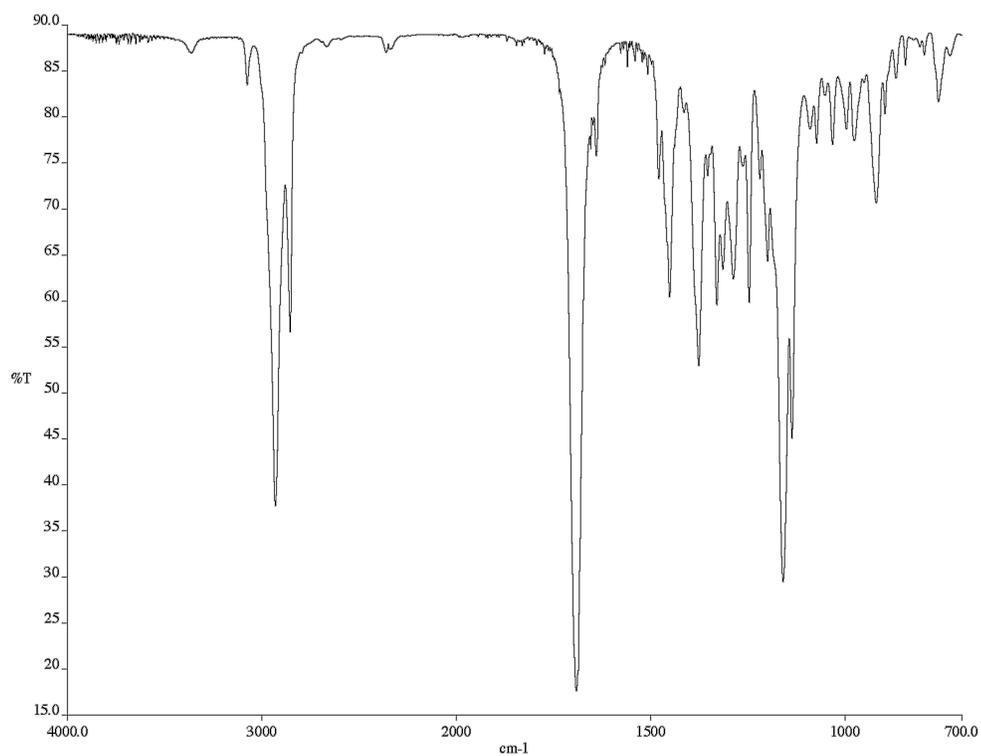


Figure A1.33.2. Infrared spectrum (thin film/NaCl) of compound **5i**.

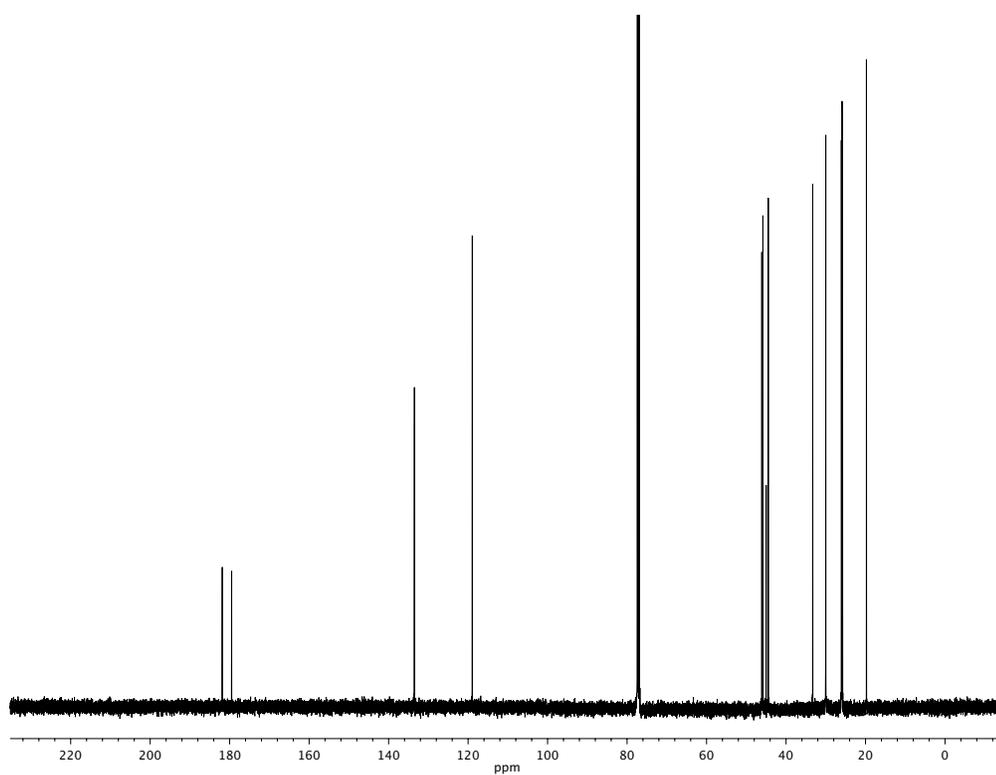


Figure A1.33.3. ¹³C NMR (125 MHz, CDCl₃) of compound **5i**.

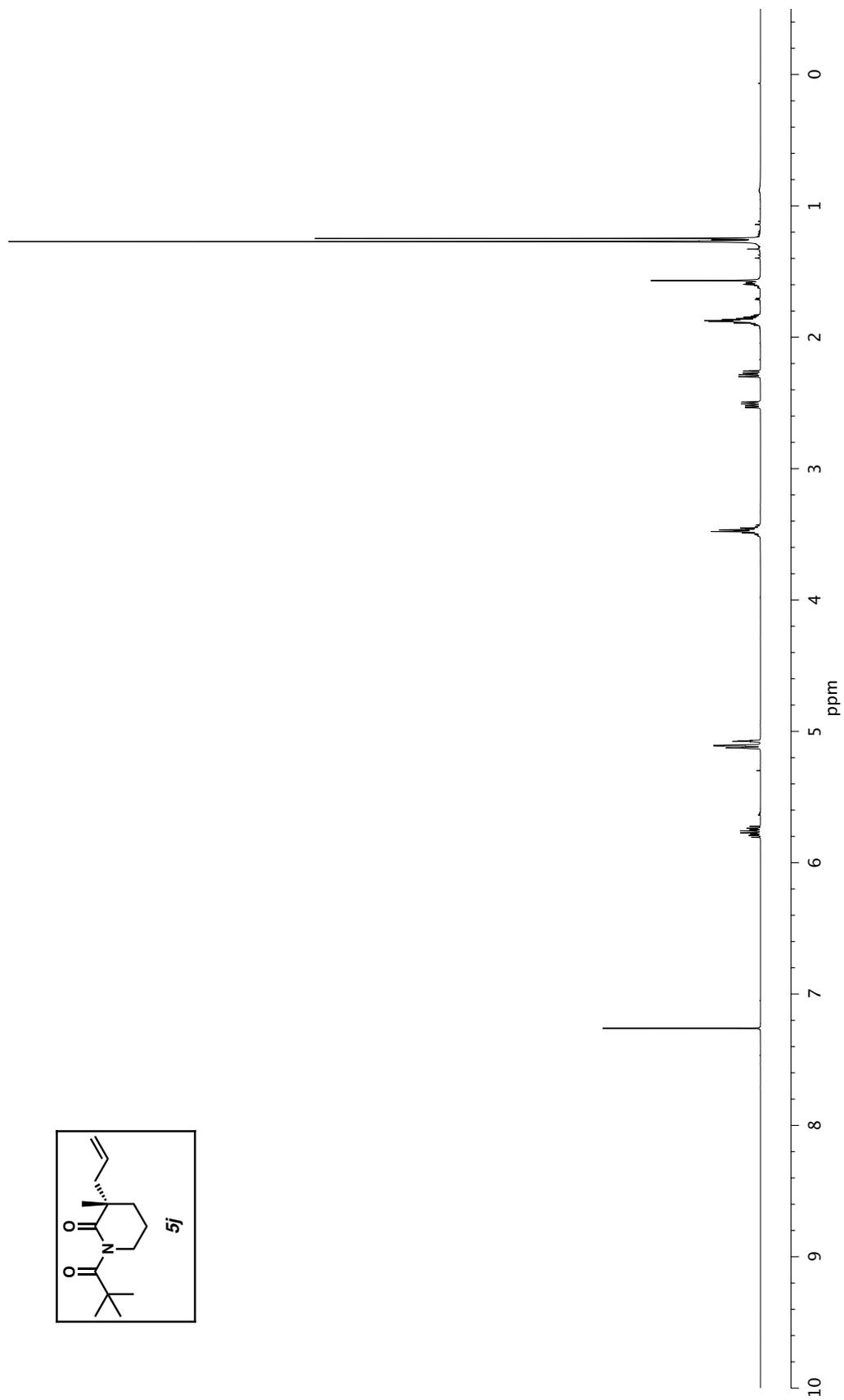


Figure A1.34.1. ¹H NMR (500 MHz, CDCl₃) of compound **5j**.

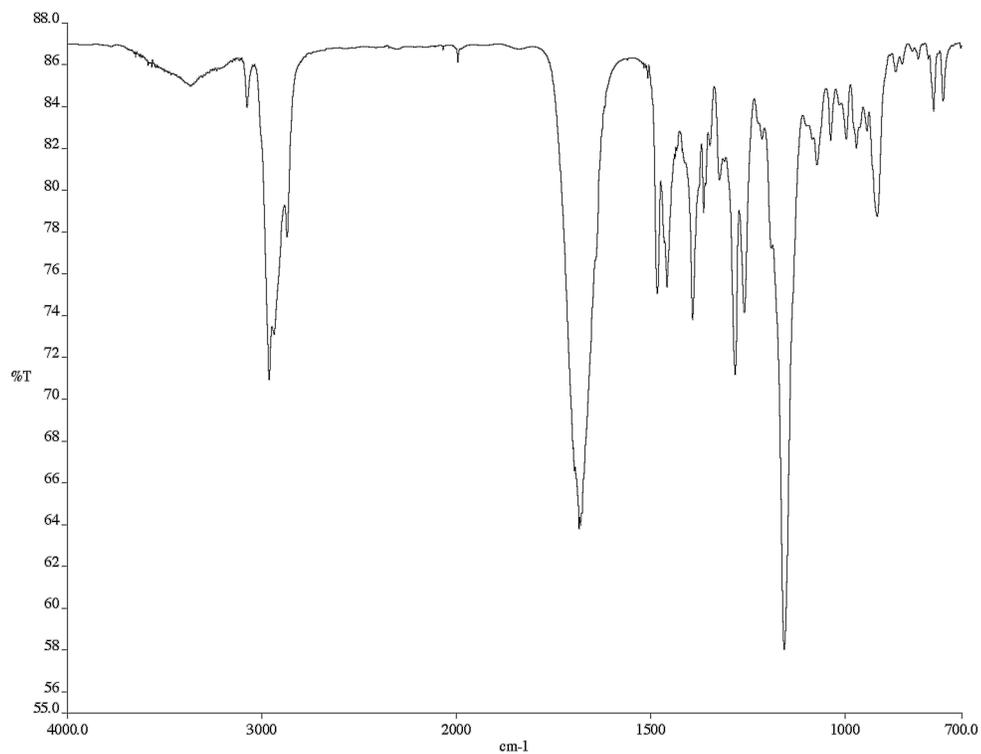


Figure A1.34.2. Infrared spectrum (thin film/NaCl) of compound **5j**.

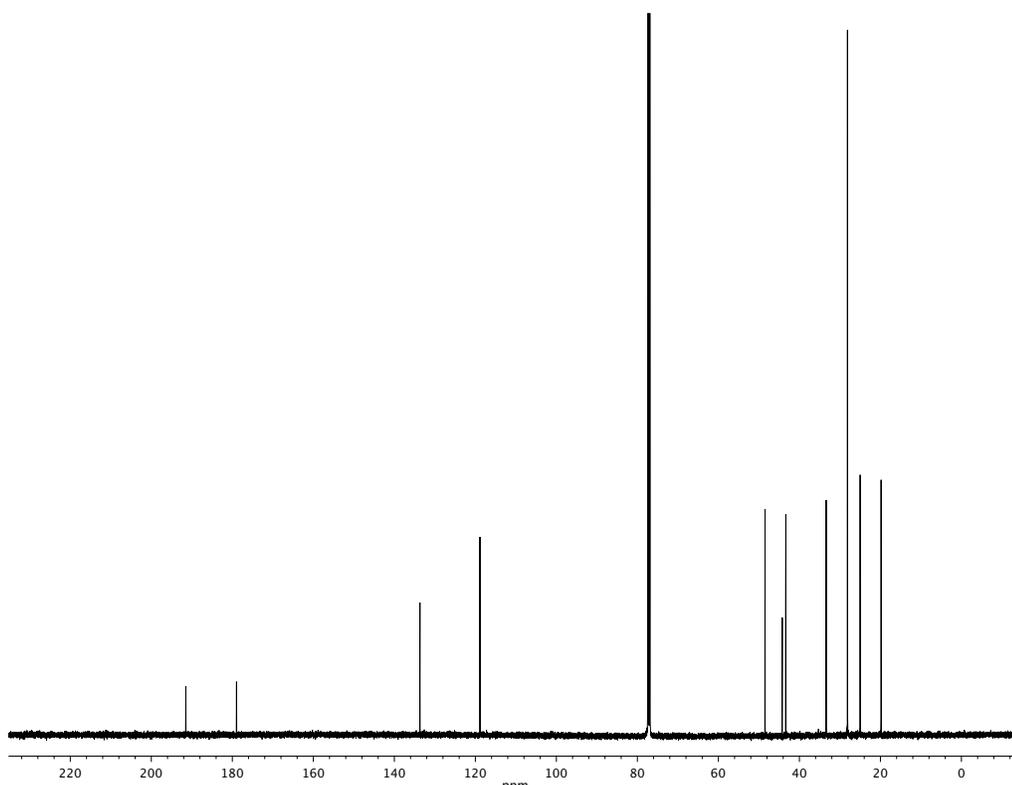
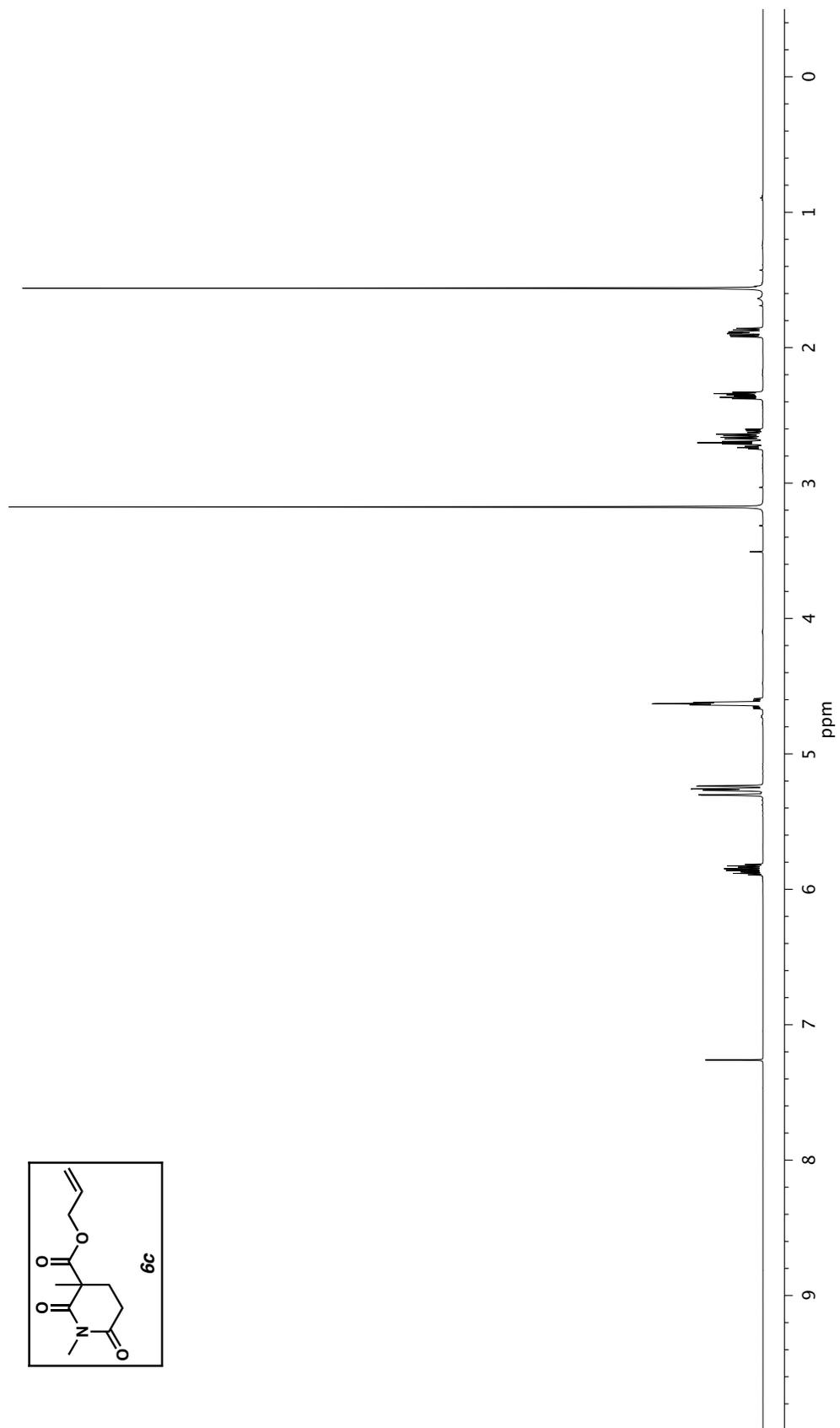


Figure A1.34.3. ¹³C NMR (125 MHz, CDCl₃) of compound **5j**.

Figure A1.35.1. ^1H NMR (500 MHz, CDCl_3) of compound **6c**.

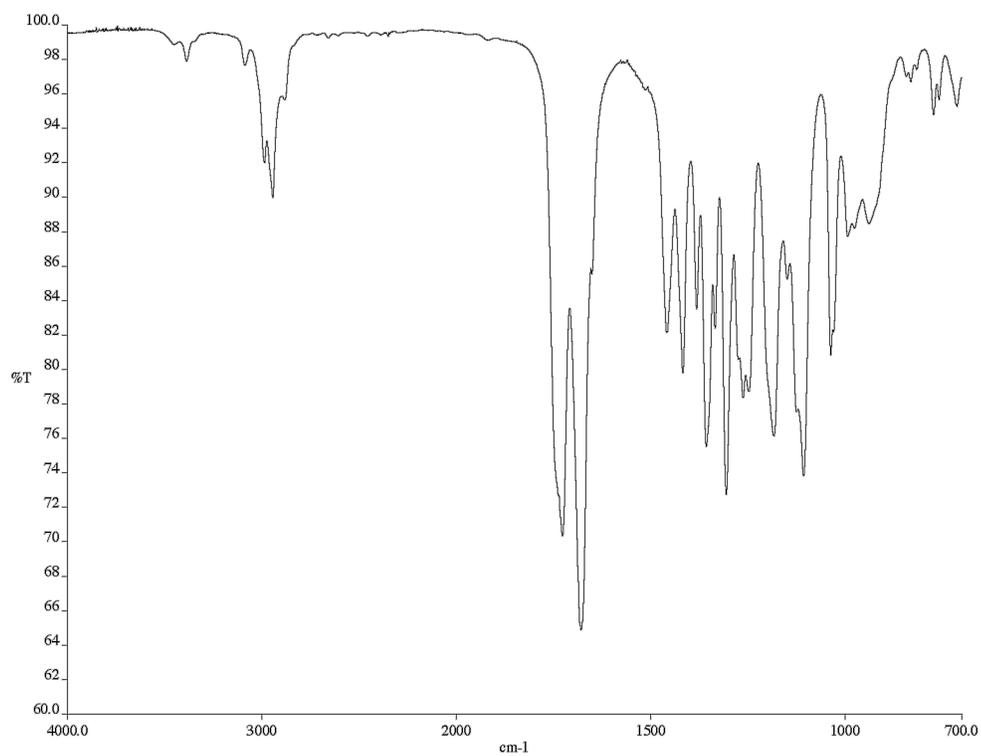


Figure A1.35.2. Infrared spectrum (thin film/NaCl) of compound **6c**.

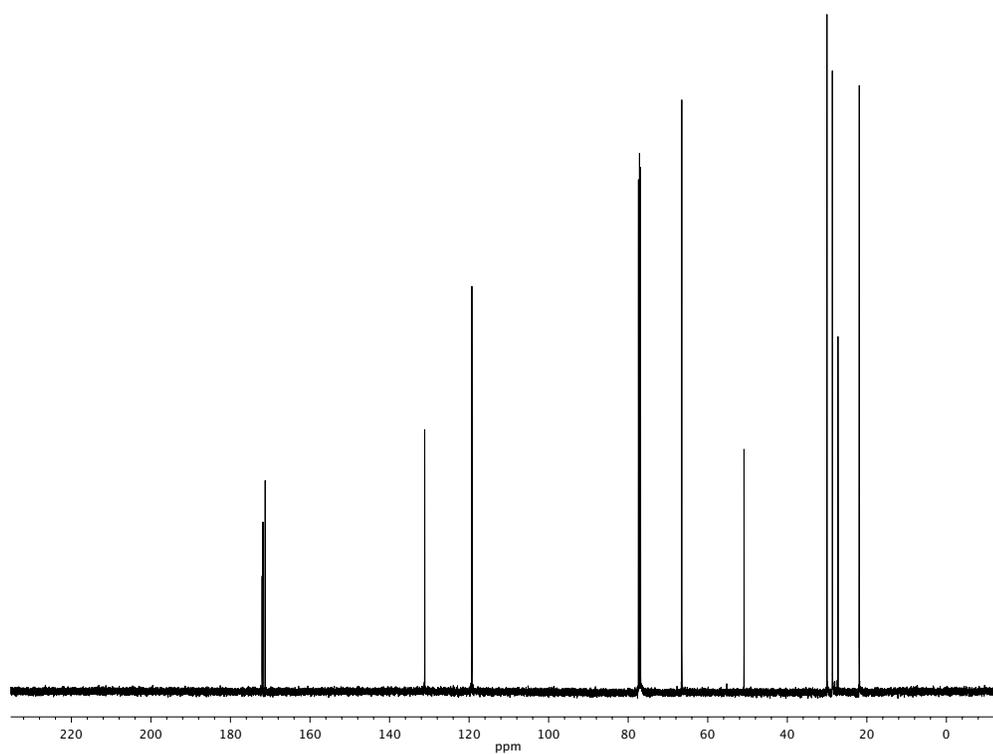
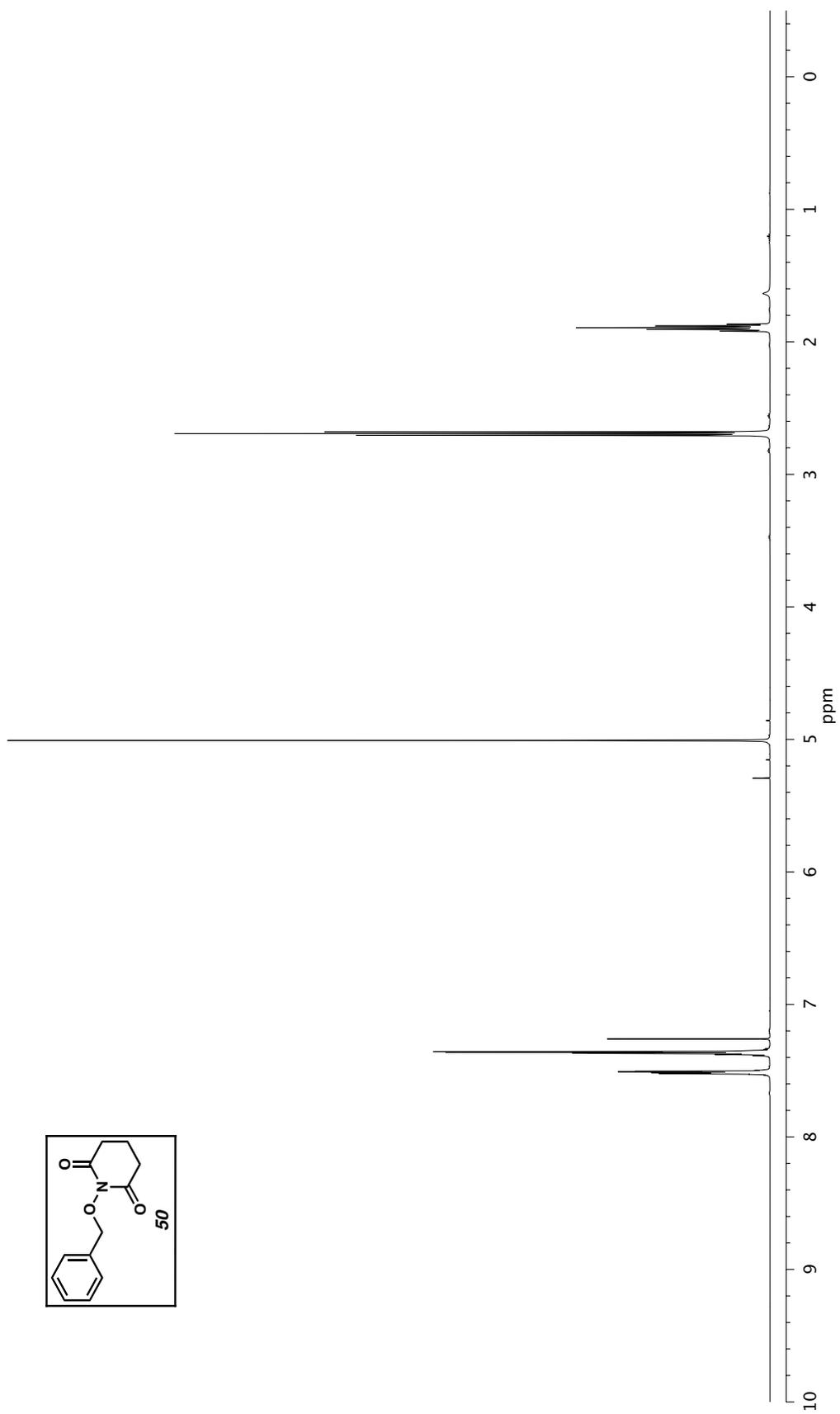


Figure A1.35.3. ¹³C NMR (125 MHz, CDCl₃) of compound **6c**.

Figure A1.36.1. ^1H NMR (500 MHz, CDCl_3) of compound **50**.

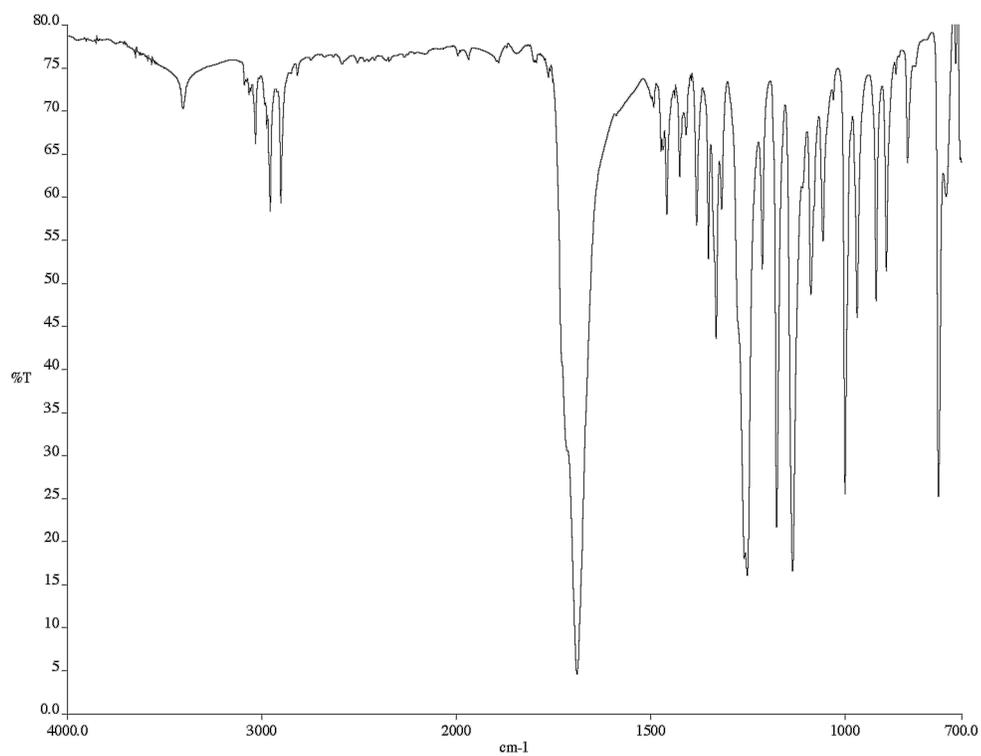


Figure A1.36.2. Infrared spectrum (thin film/NaCl) of compound **50**.

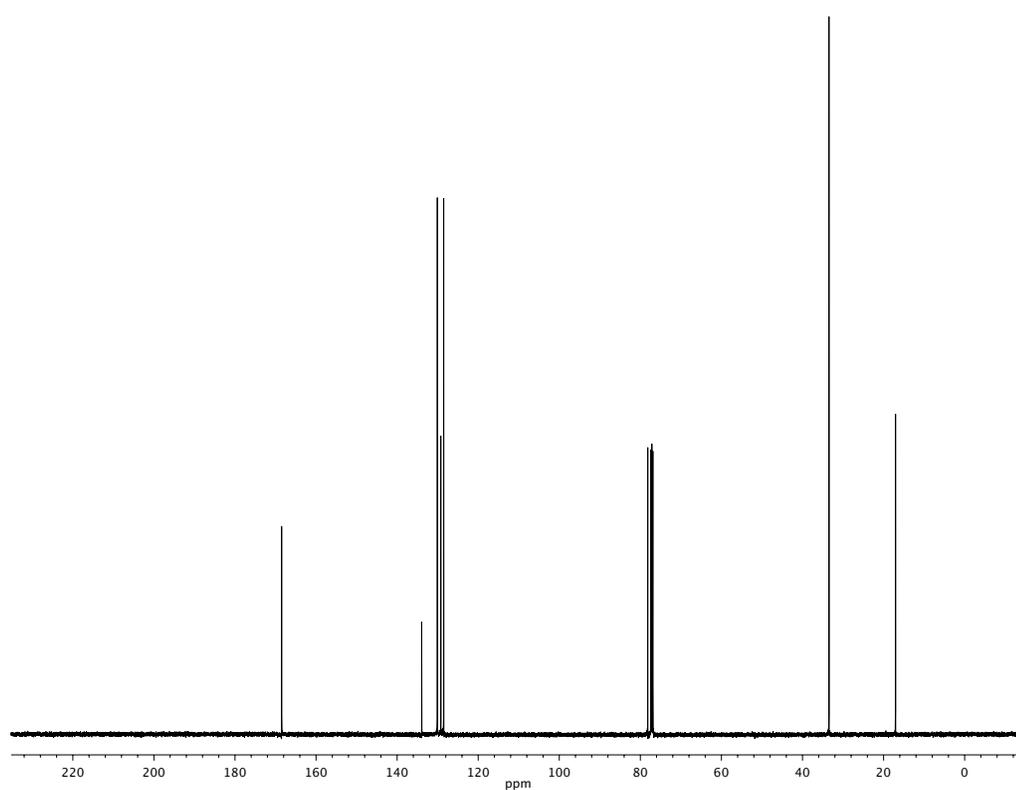
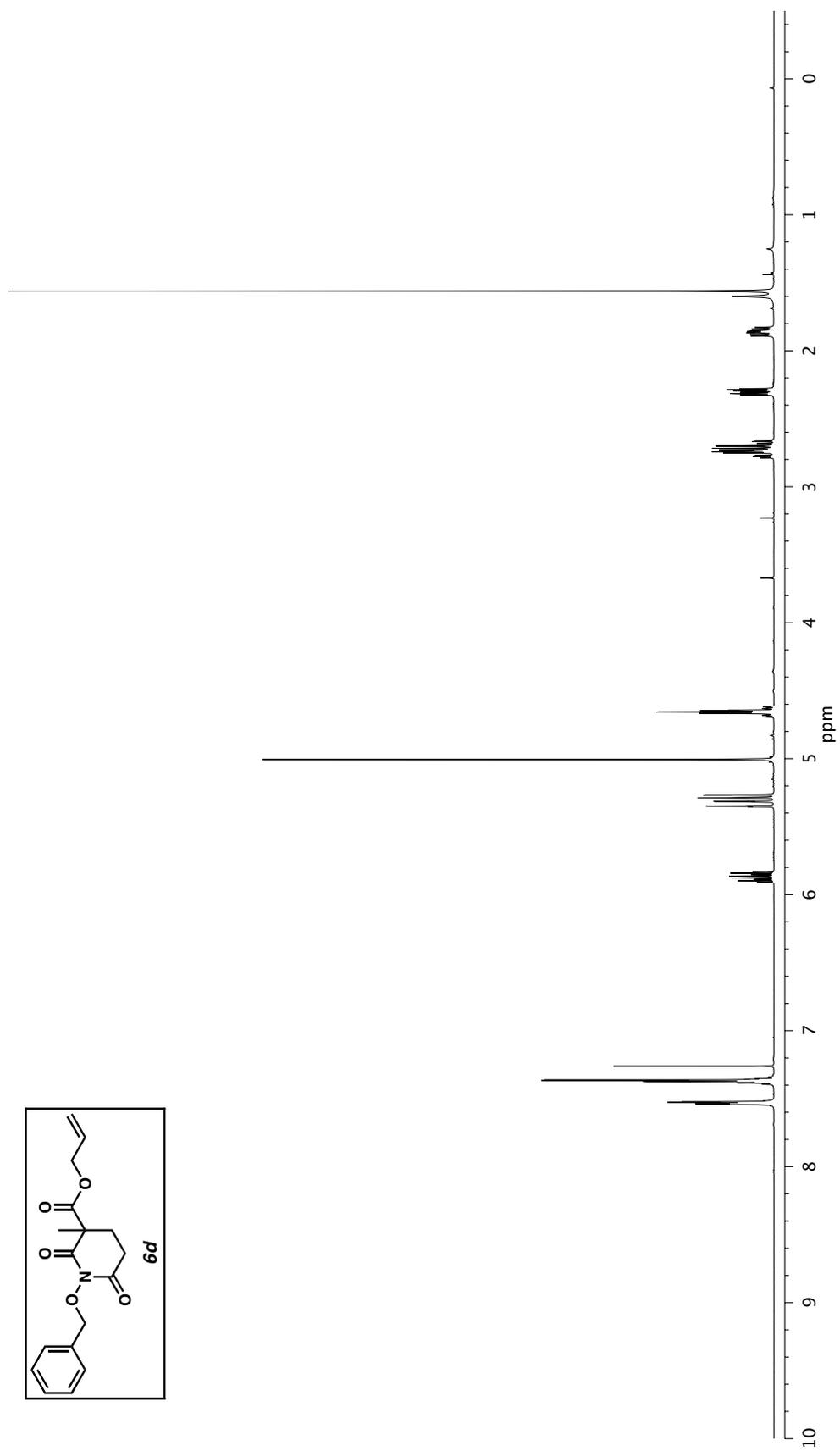


Figure A1.36.3. ¹³C NMR (125 MHz, CDCl₃) of compound **50**.

Figure A1.37.1. ¹H NMR (500 MHz, CDCl₃) of compound **6d**.

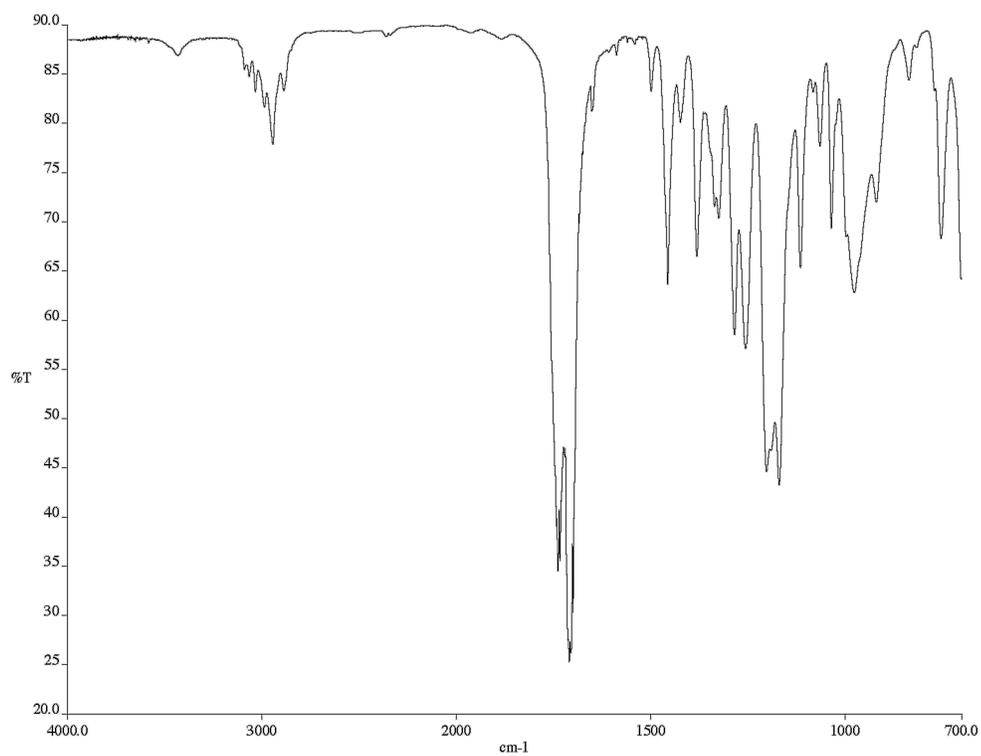


Figure A1.37.2. Infrared spectrum (thin film/NaCl) of compound **6d**.

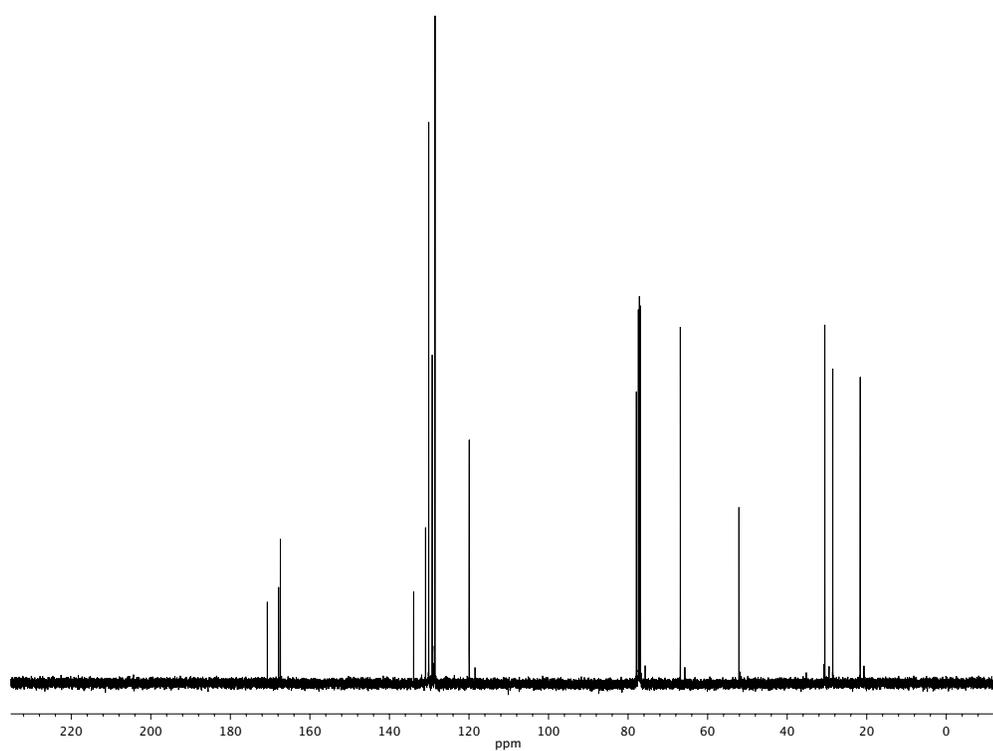
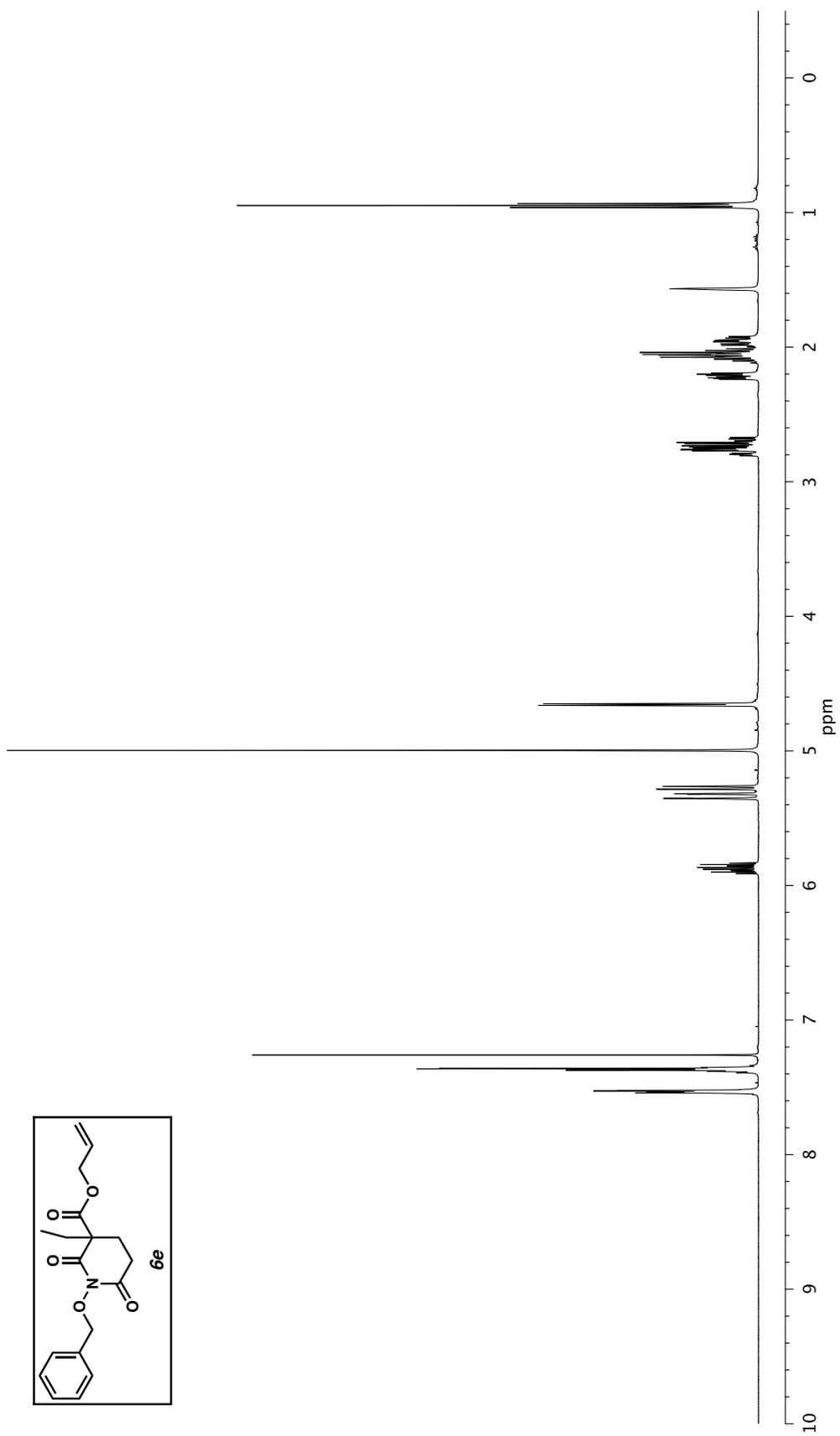


Figure A1.37.3. ¹³C NMR (125 MHz, CDCl₃) of compound **6d**.

Figure A1.38.1. ^1H NMR (500 MHz, CDCl_3) of compound **6e**.

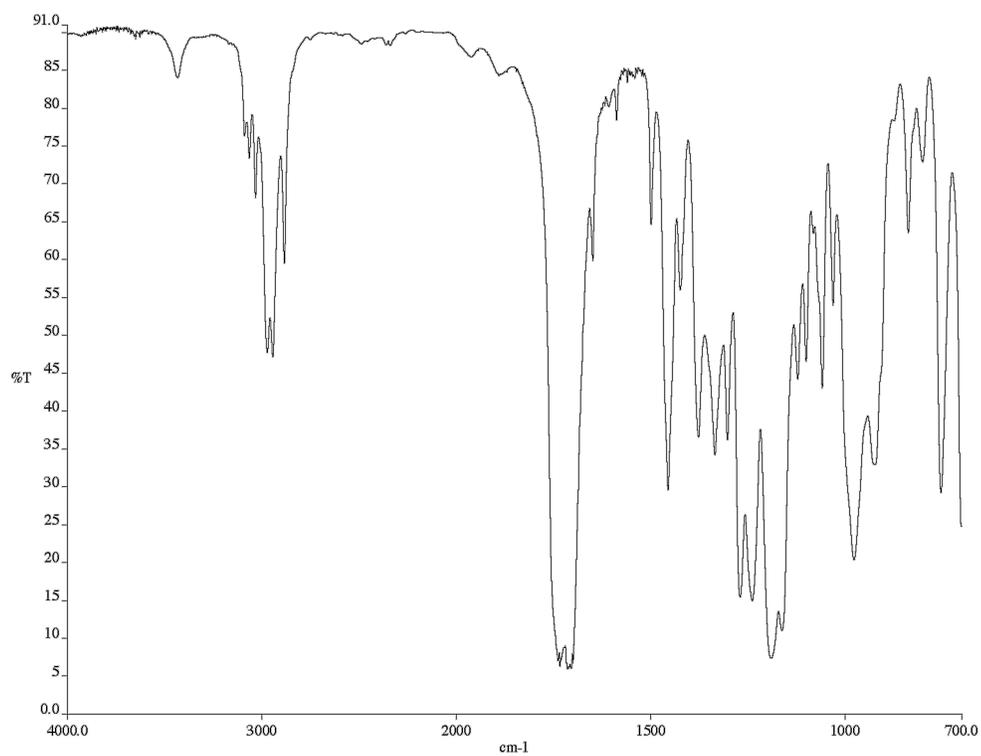


Figure A1.38.2. Infrared spectrum (thin film/NaCl) of compound **6e**.

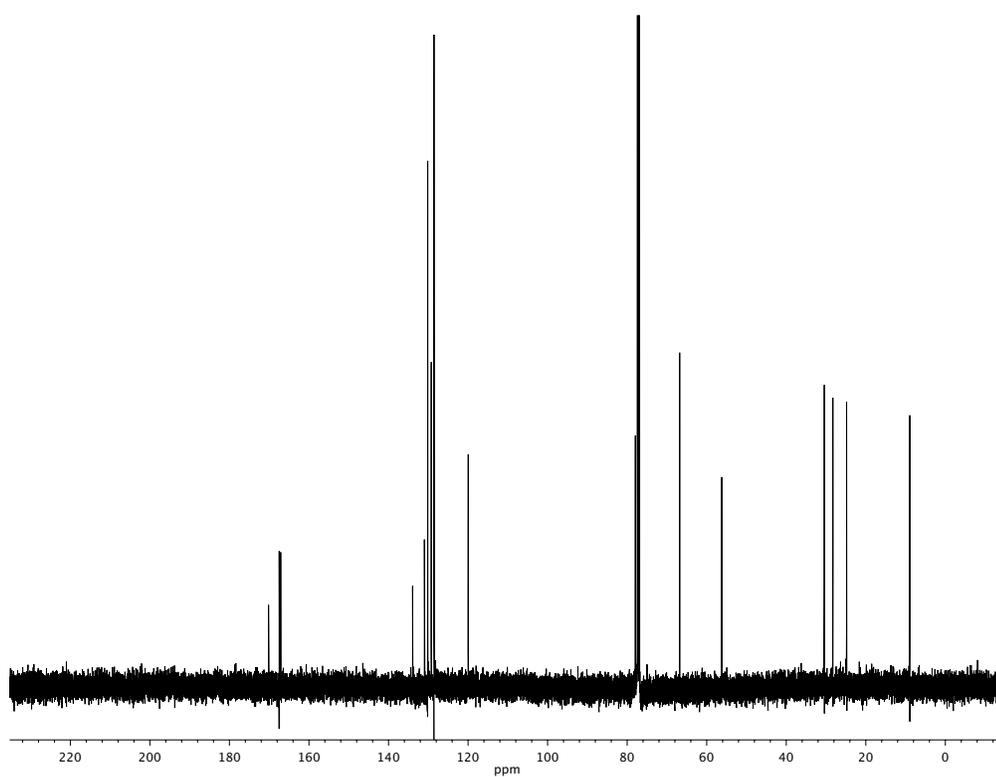
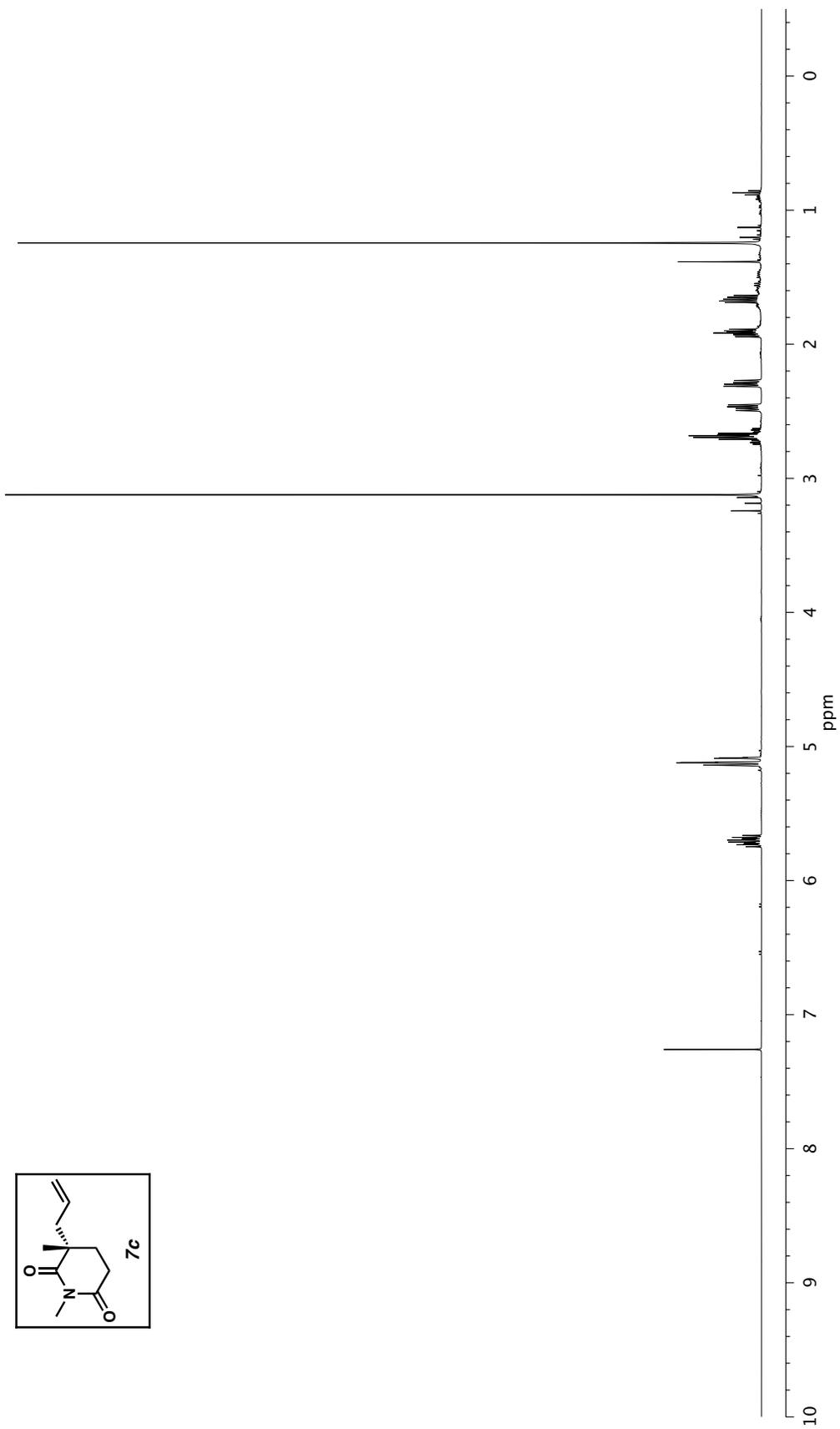


Figure A1.38.3. ¹³C NMR (125 MHz, CDCl₃) of compound **6e**.

Figure A1.39.1. ^1H NMR (500 MHz, CDCl_3) of compound **7c**.

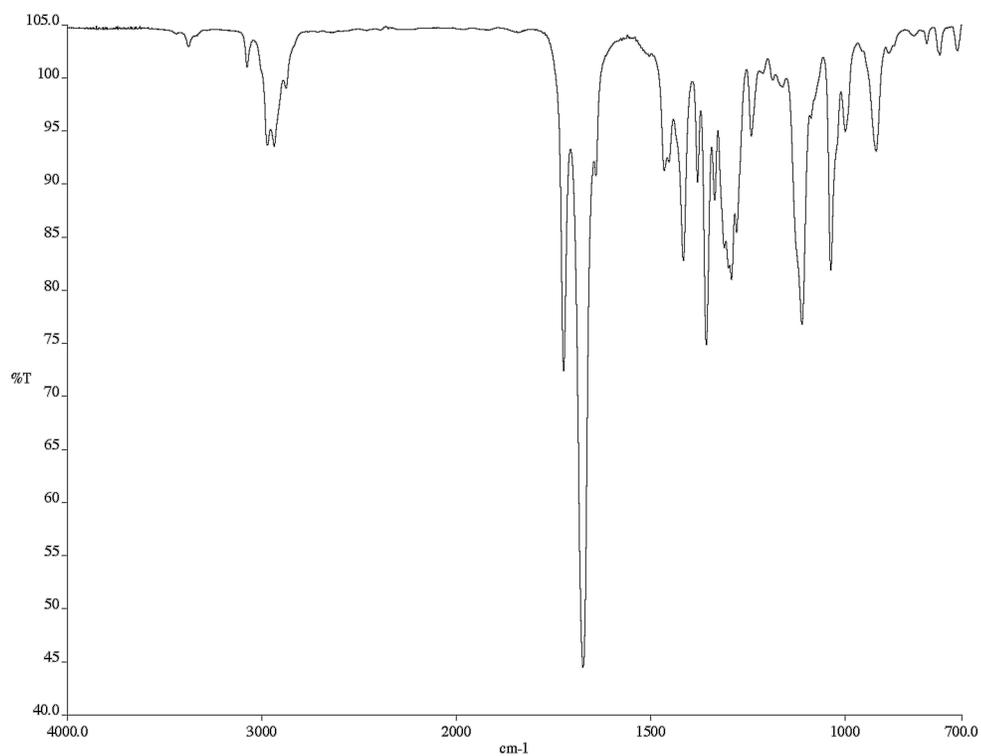


Figure A1.39.2. Infrared spectrum (thin film/NaCl) of compound **7c**.

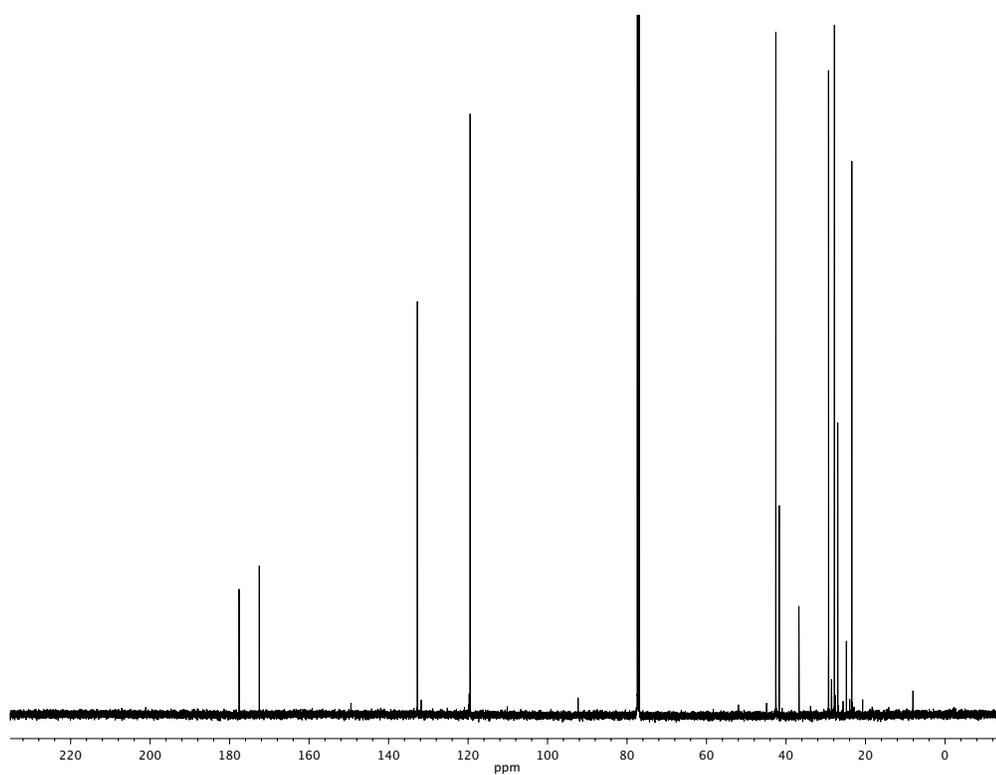


Figure A1.39.3. ¹³C NMR (125 MHz, CDCl₃) of compound **7c**.

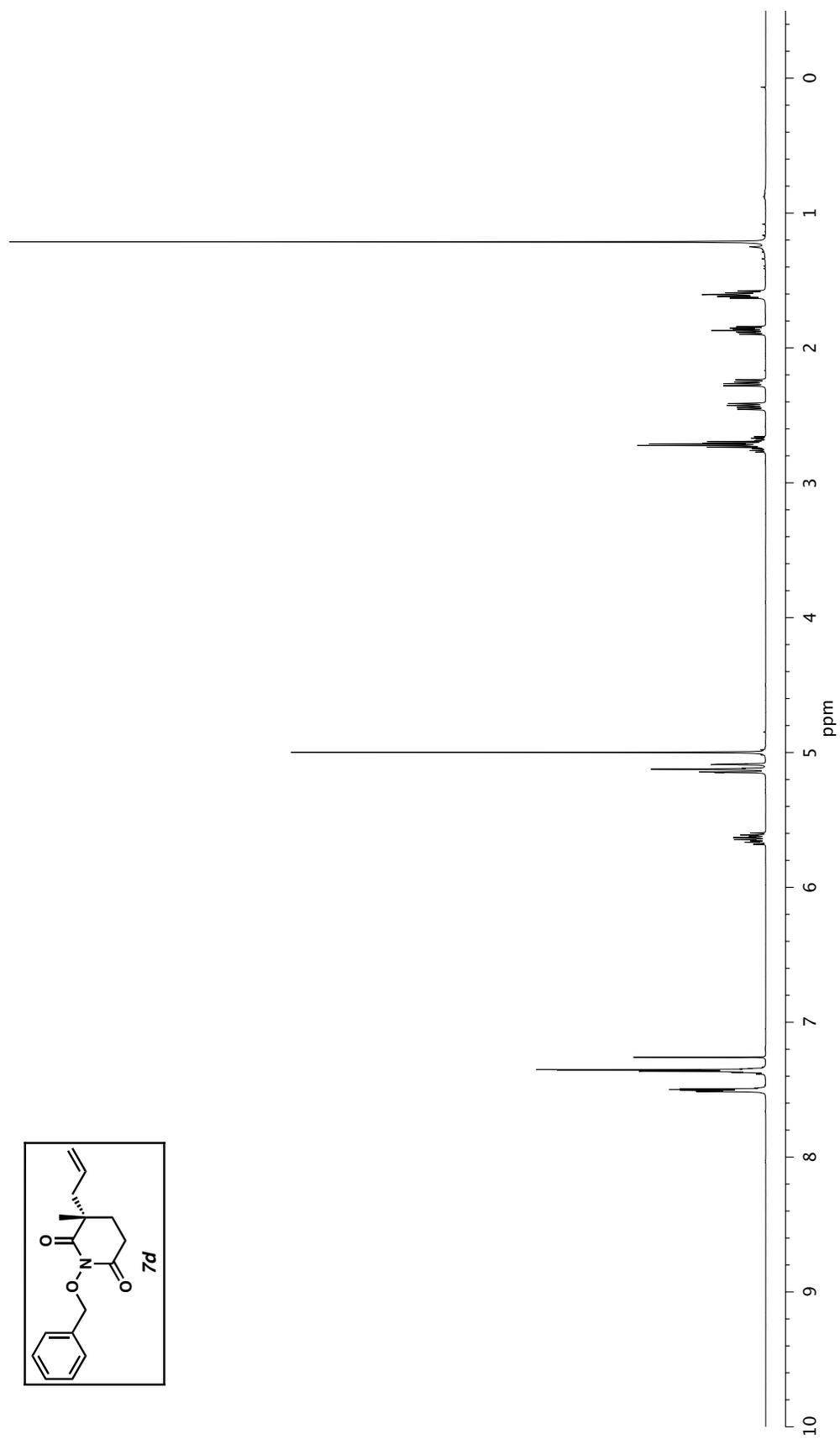


Figure A1.40.1. ^1H NMR (500 MHz, CDCl_3) of compound **7d**.

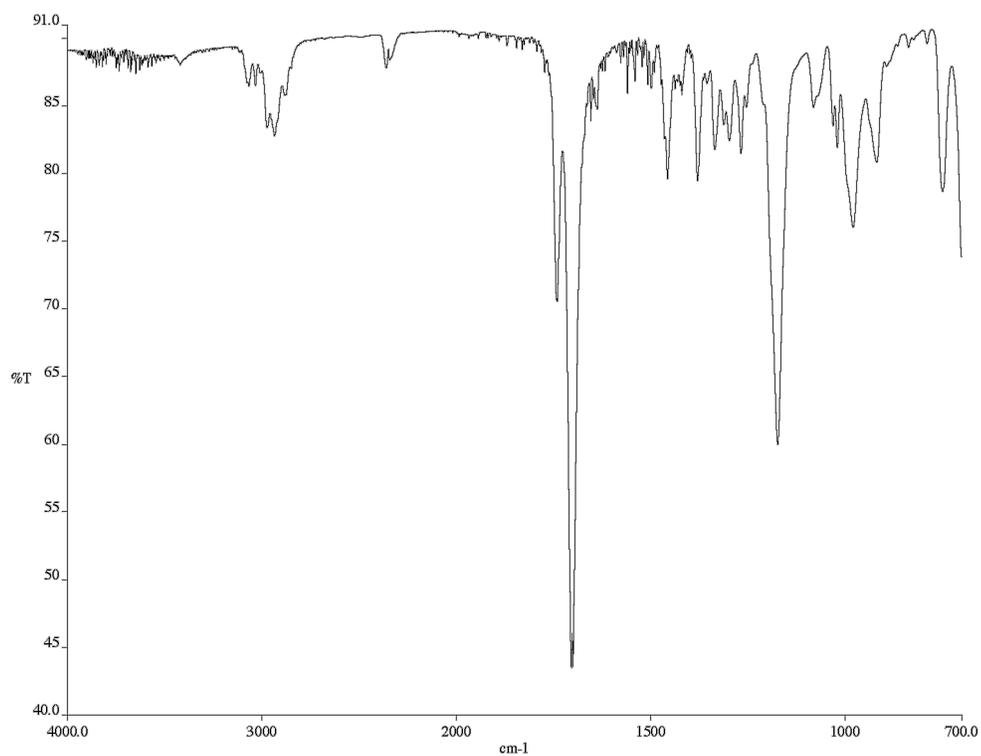


Figure A1.40.2. Infrared spectrum (thin film/NaCl) of compound **7d**.

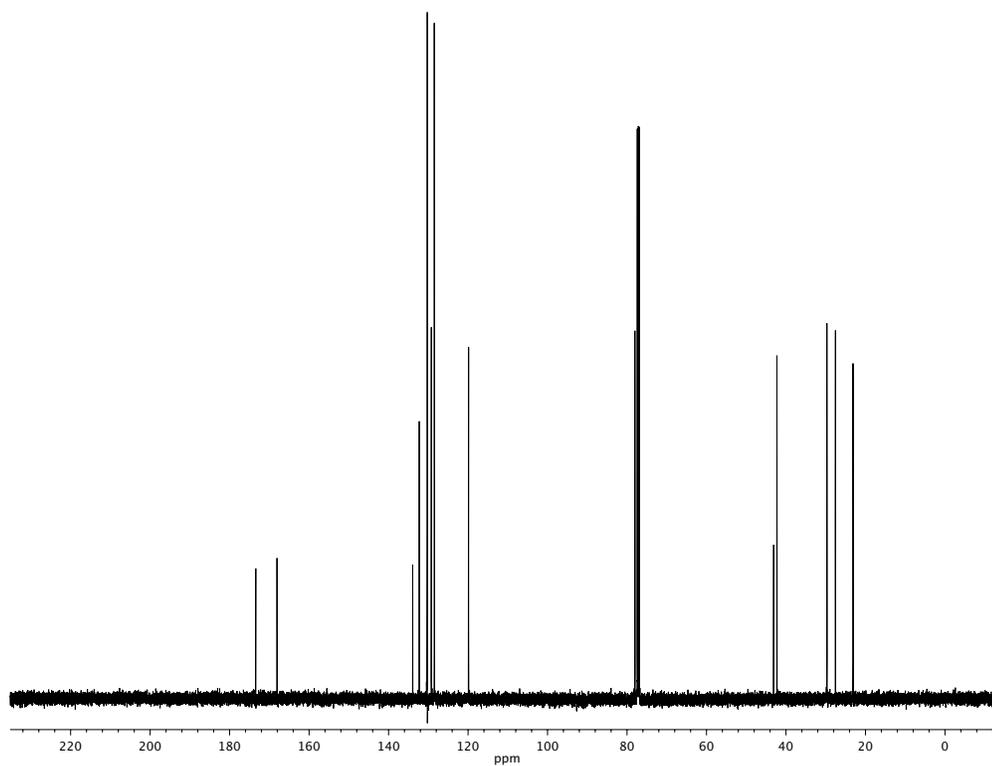


Figure A1.40.3. ¹³C NMR (125 MHz, CDCl₃) of compound **7d**.

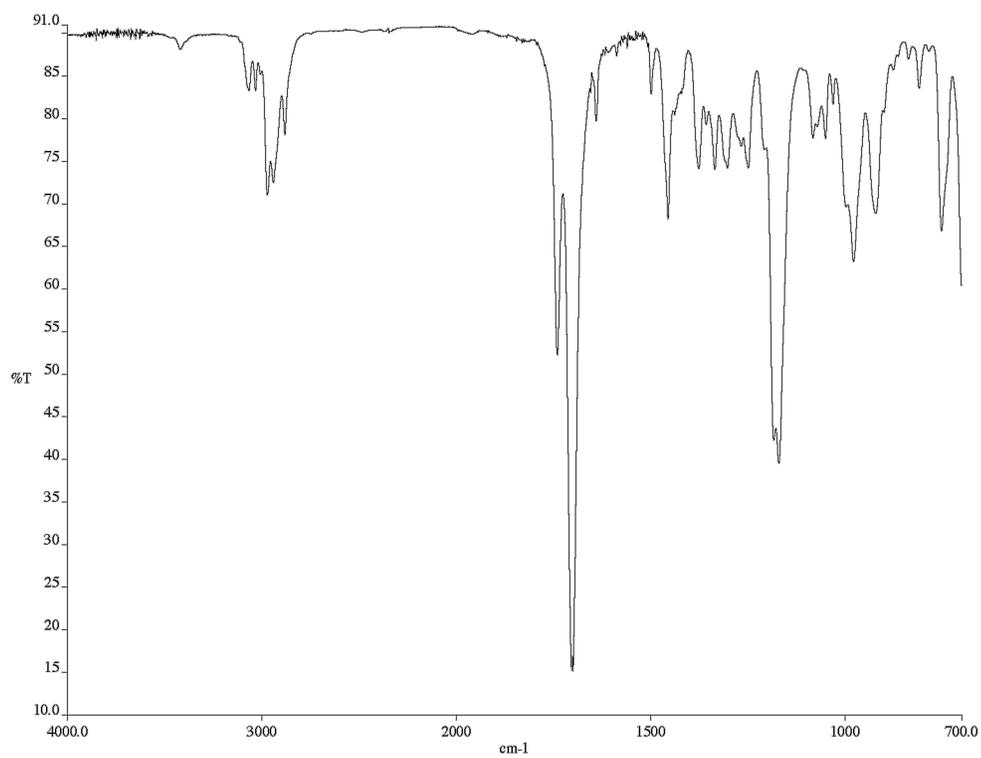


Figure A1.41.2. Infrared spectrum (thin film/NaCl) of compound 7e.

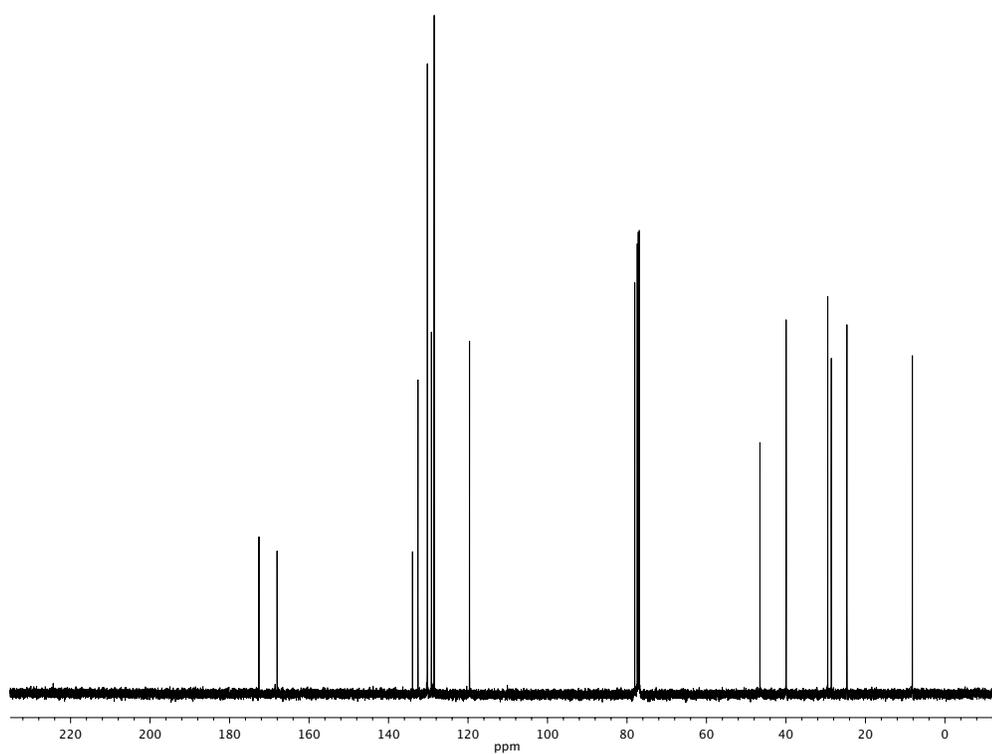


Figure A1.41.3. ¹³C NMR (125 MHz, CDCl₃) of compound 7e.

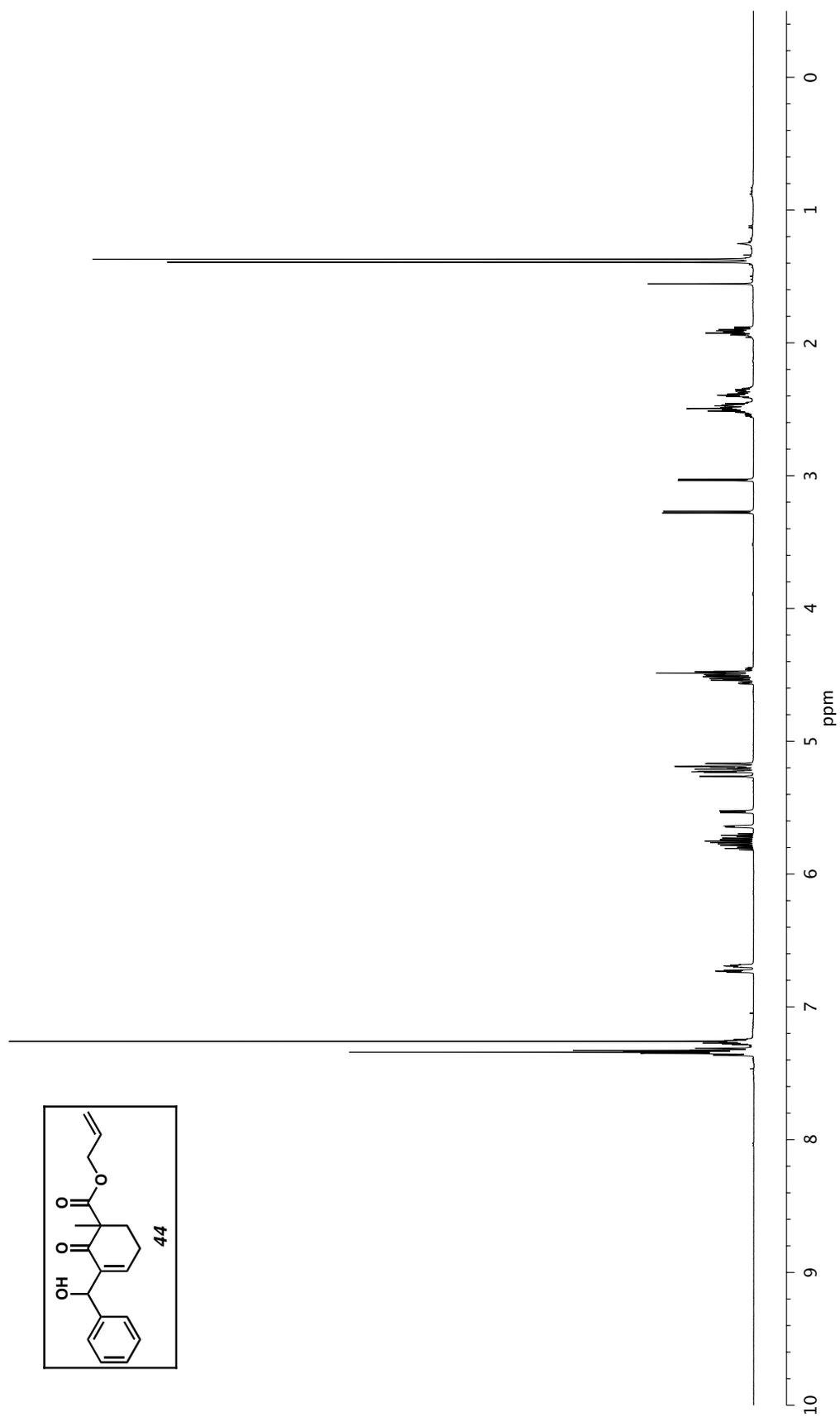


Figure A1.42.1. ^1H NMR (500 MHz, CDCl_3) of compound **44**.

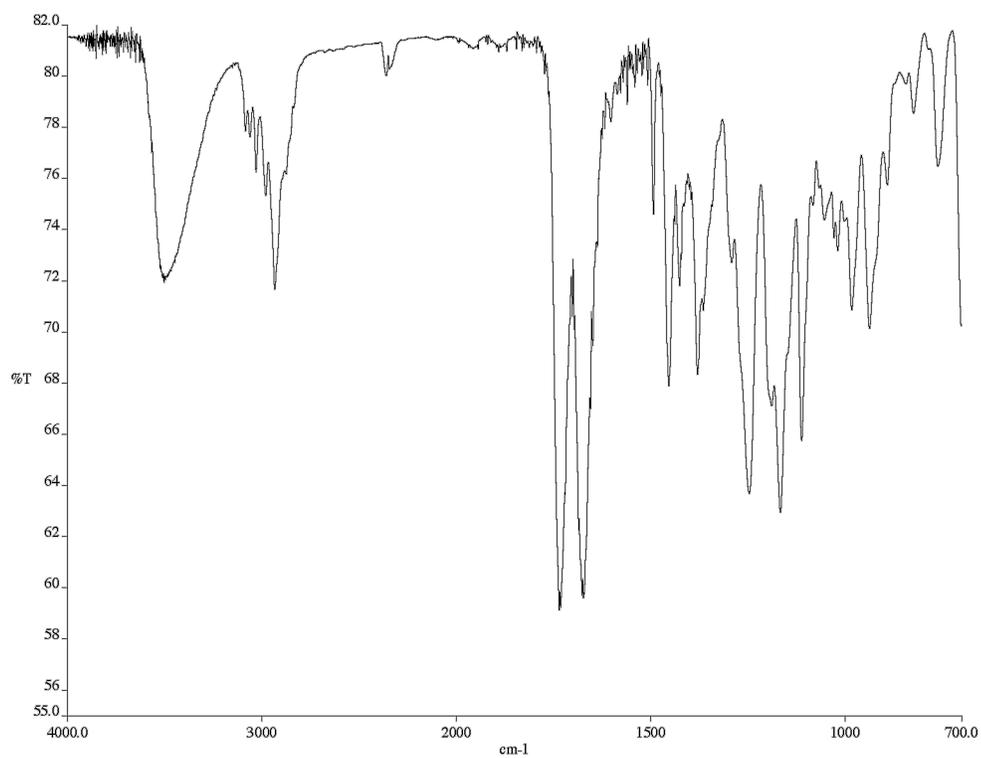
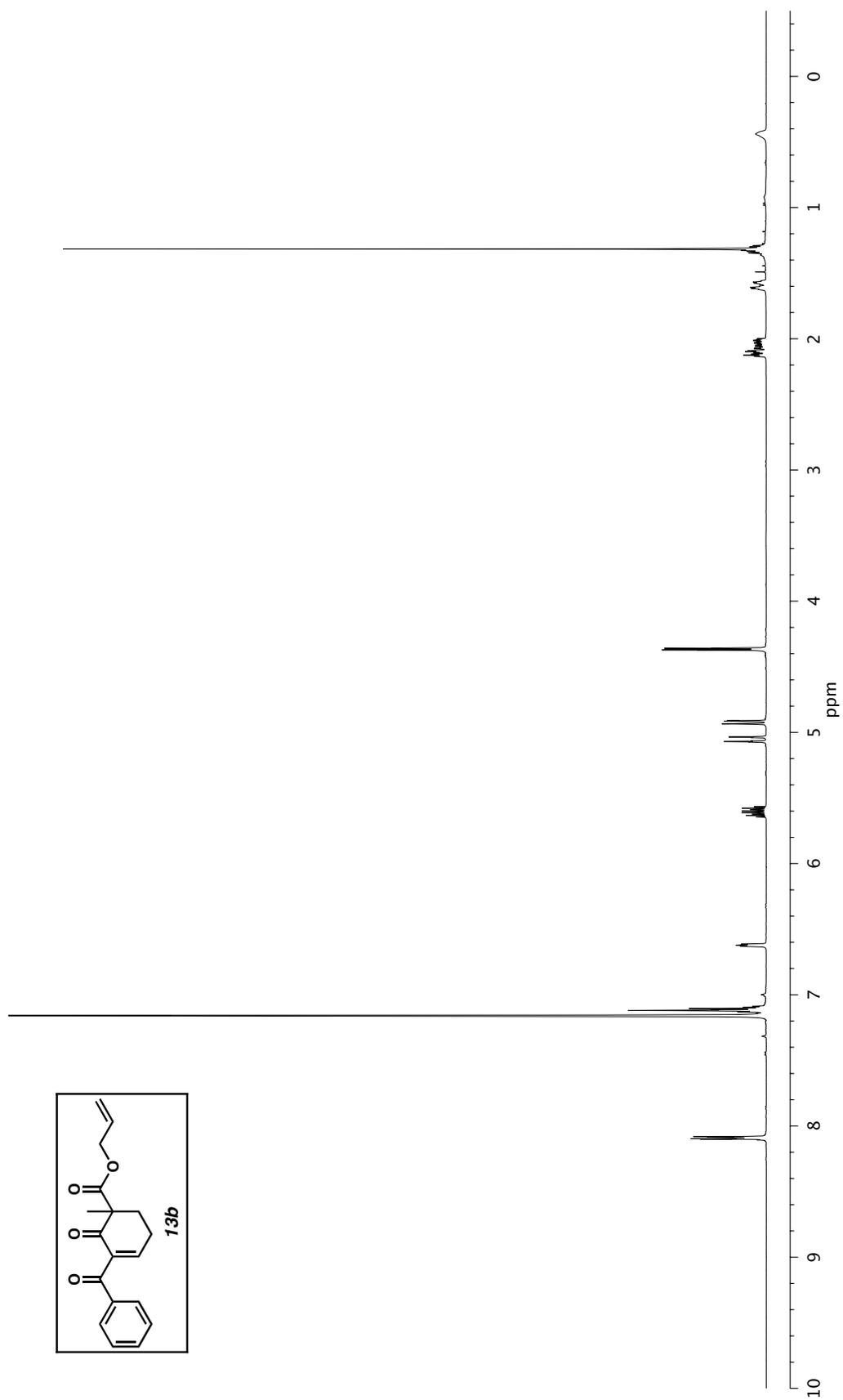


Figure A1.42.2. Infrared spectrum (thin film/NaCl) of compound **44**.

Figure A1.43.1. ^1H NMR (500 MHz, $\text{C}_6\text{D}_6\text{O}$) of compound **13b**.

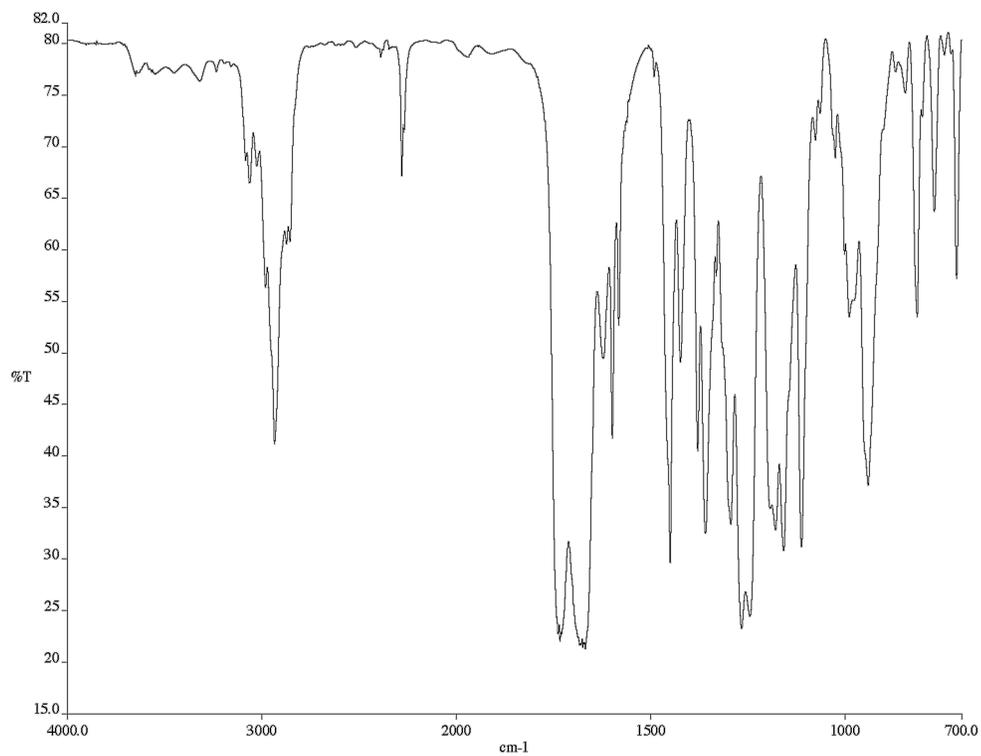


Figure A1.43.2. Infrared spectrum (thin film/NaCl) of compound **13b**.

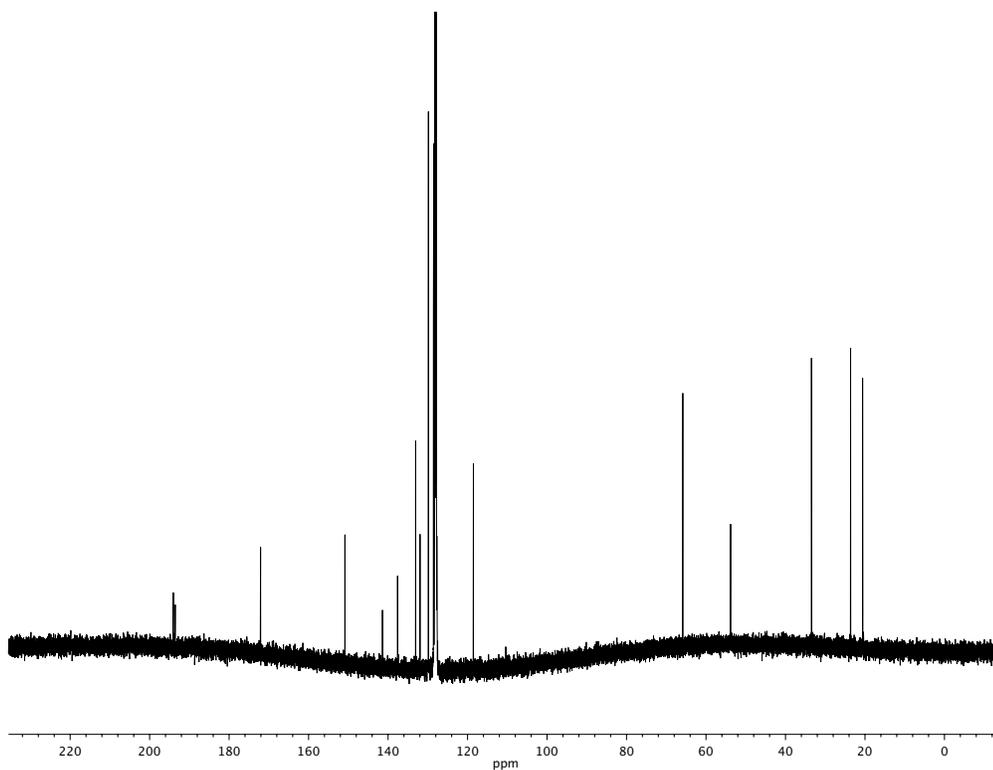
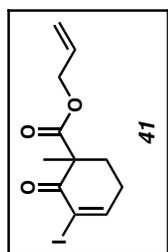
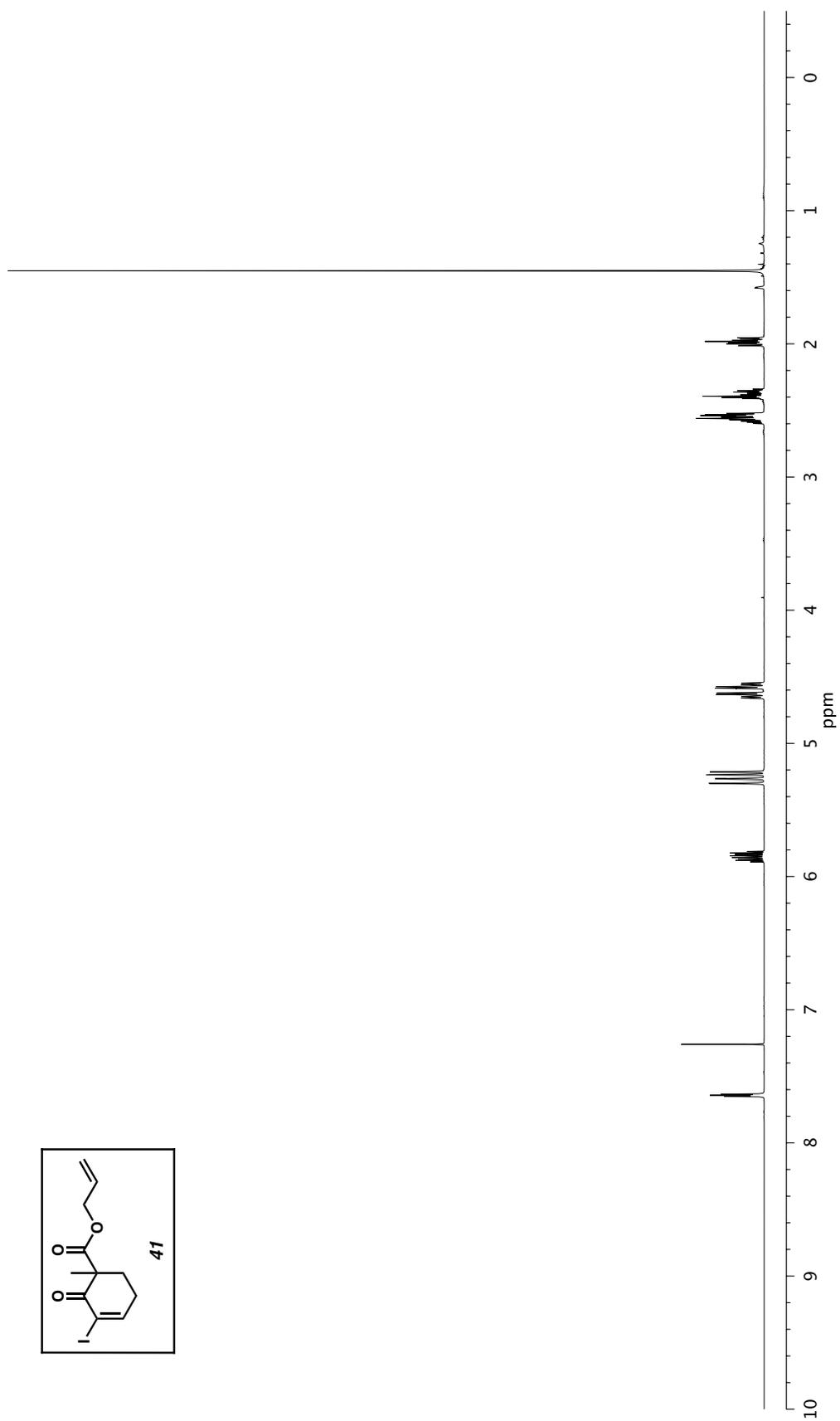


Figure A1.43.3. ¹³C NMR (125 MHz, C₆D₆) of compound **13b**.

Figure A1.44.1. ^1H NMR (500 MHz, CDCl_3) of compound **41**.

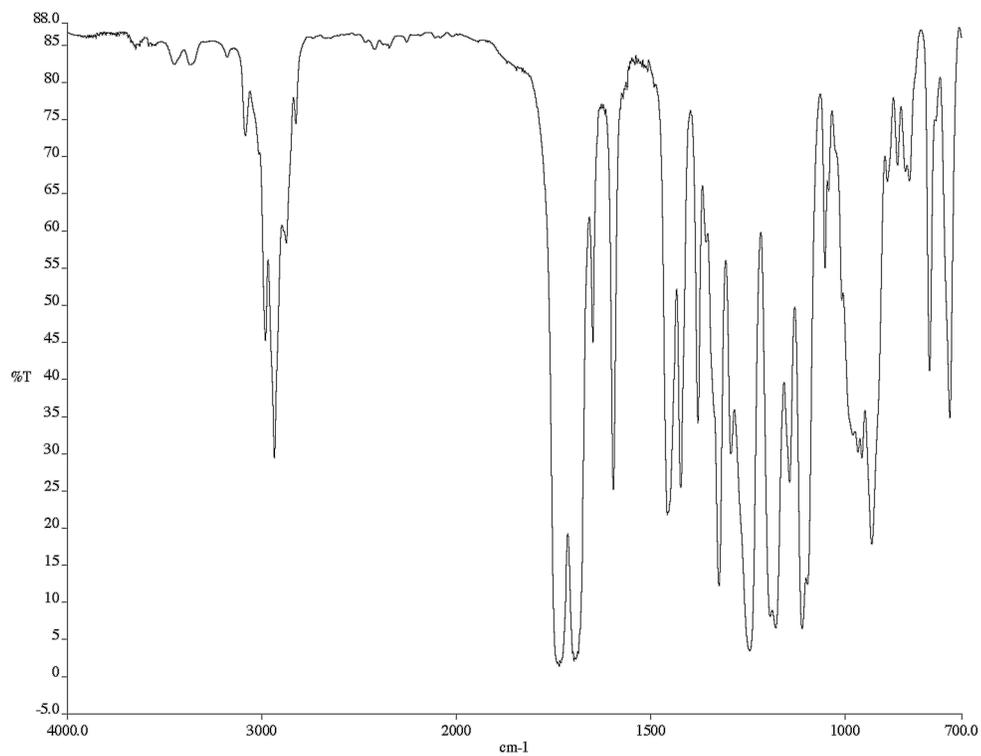


Figure A1.44.2. Infrared spectrum (thin film/NaCl) of compound **41**.

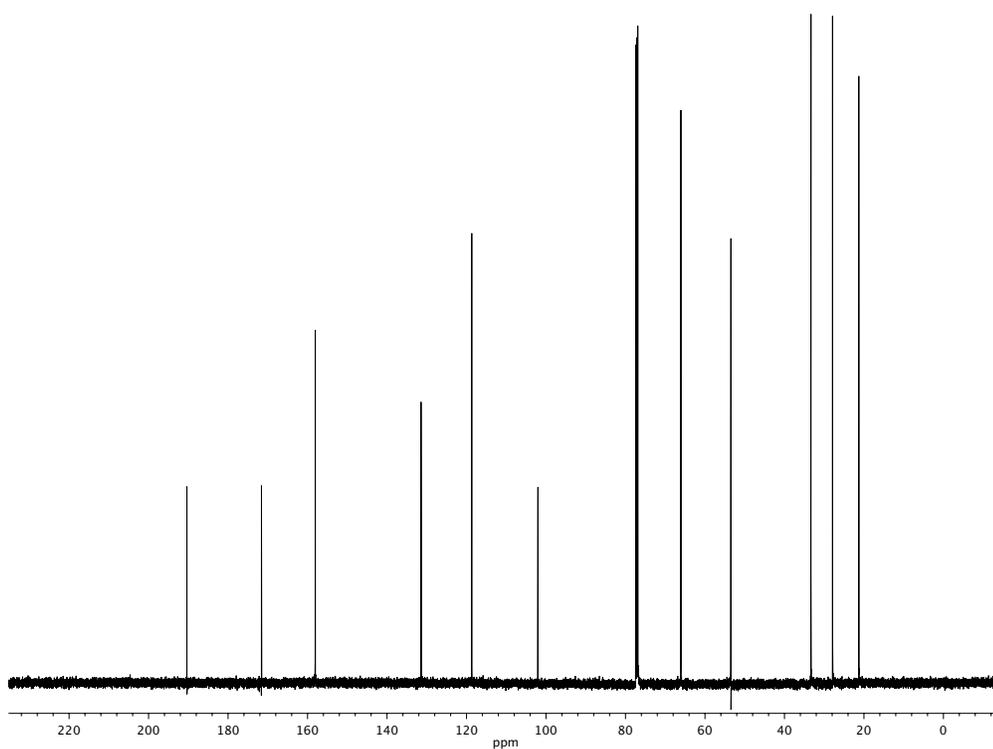
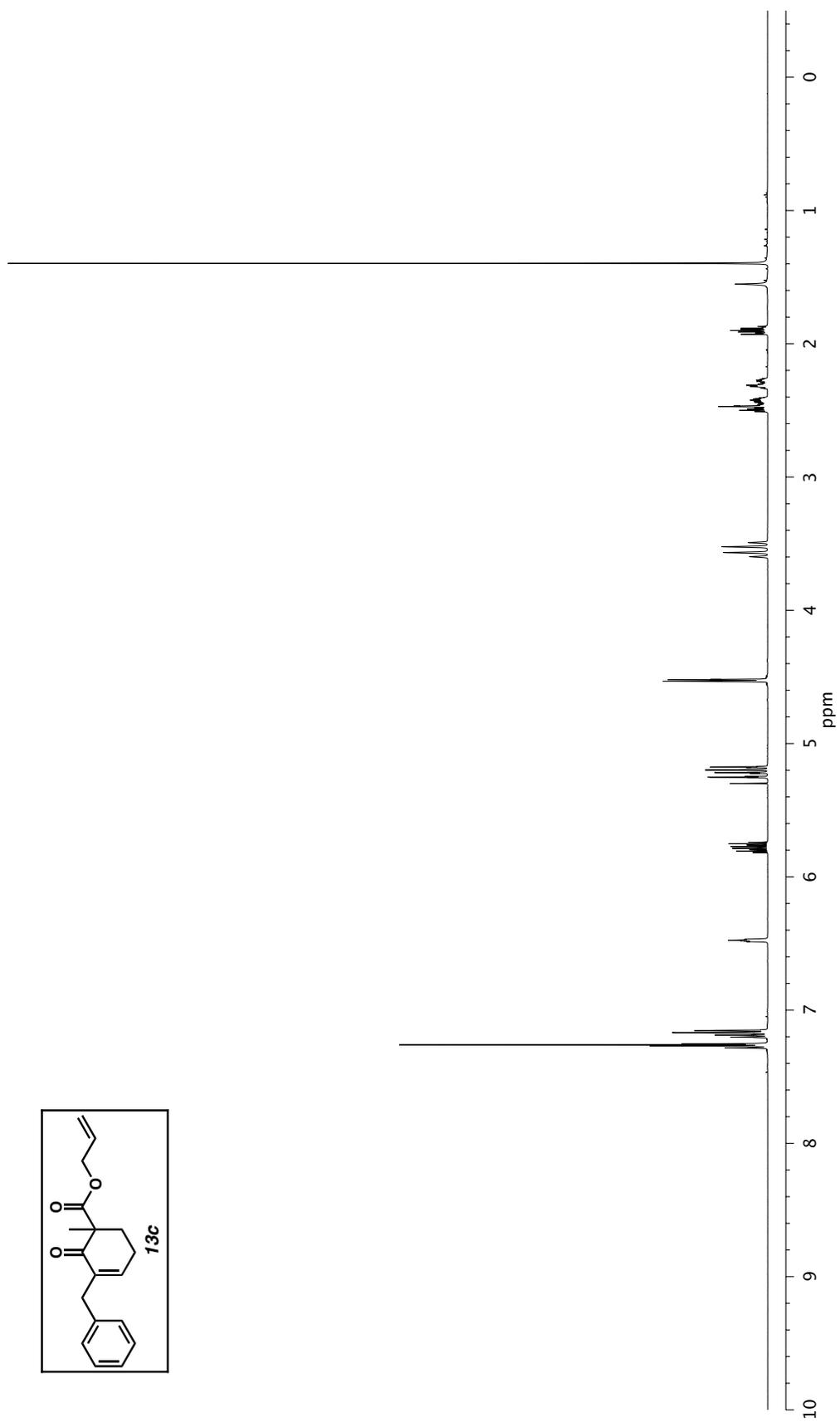


Figure A1.44.3. ¹³C NMR (125 MHz, CDCl₃) of compound **41**.

Figure A1.45.1. ^1H NMR (500 MHz, CDCl_3) of compound **13c**.

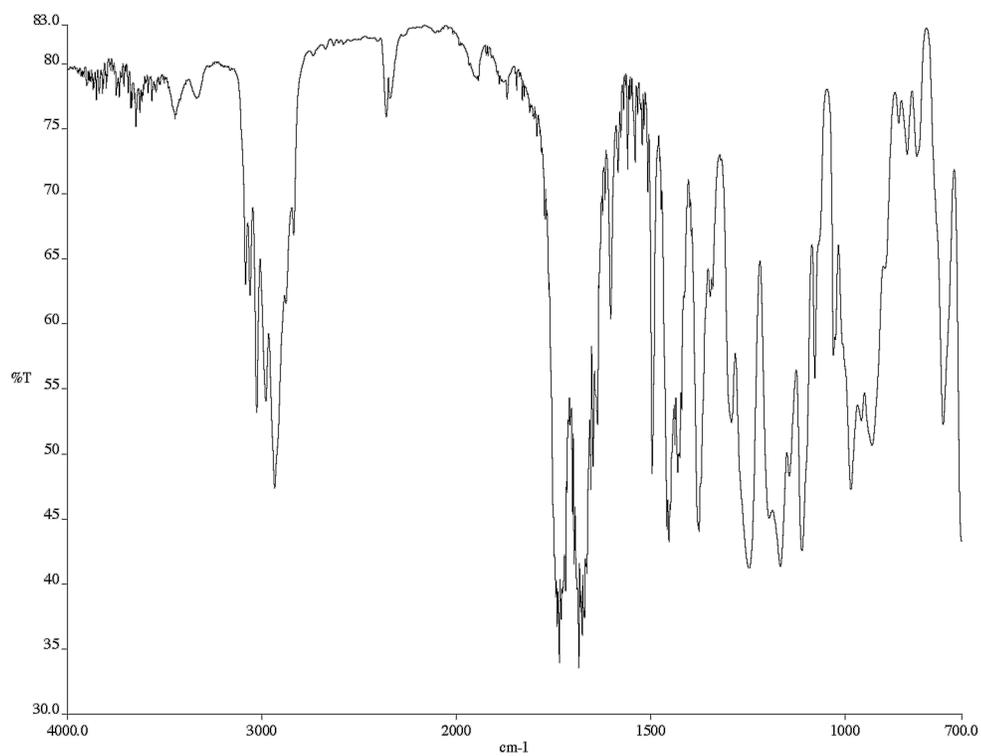


Figure A1.45.2. Infrared spectrum (thin film/NaCl) of compound **13c**.

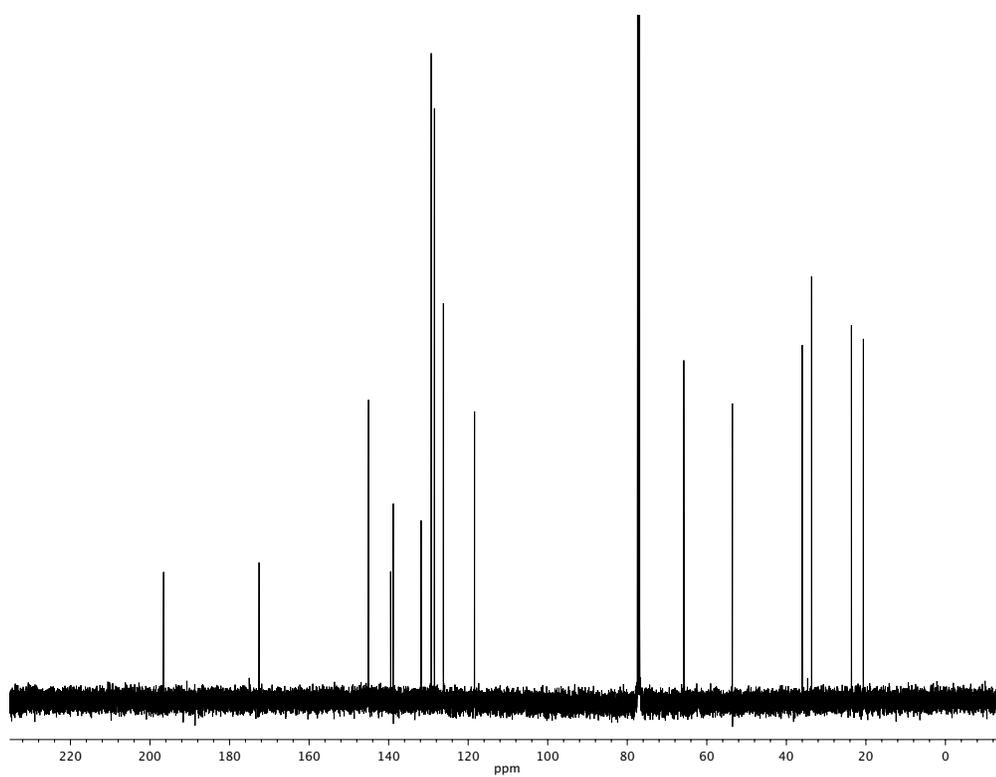


Figure A1.45.3. ¹³C NMR (125 MHz, CDCl₃) of compound **13c**.

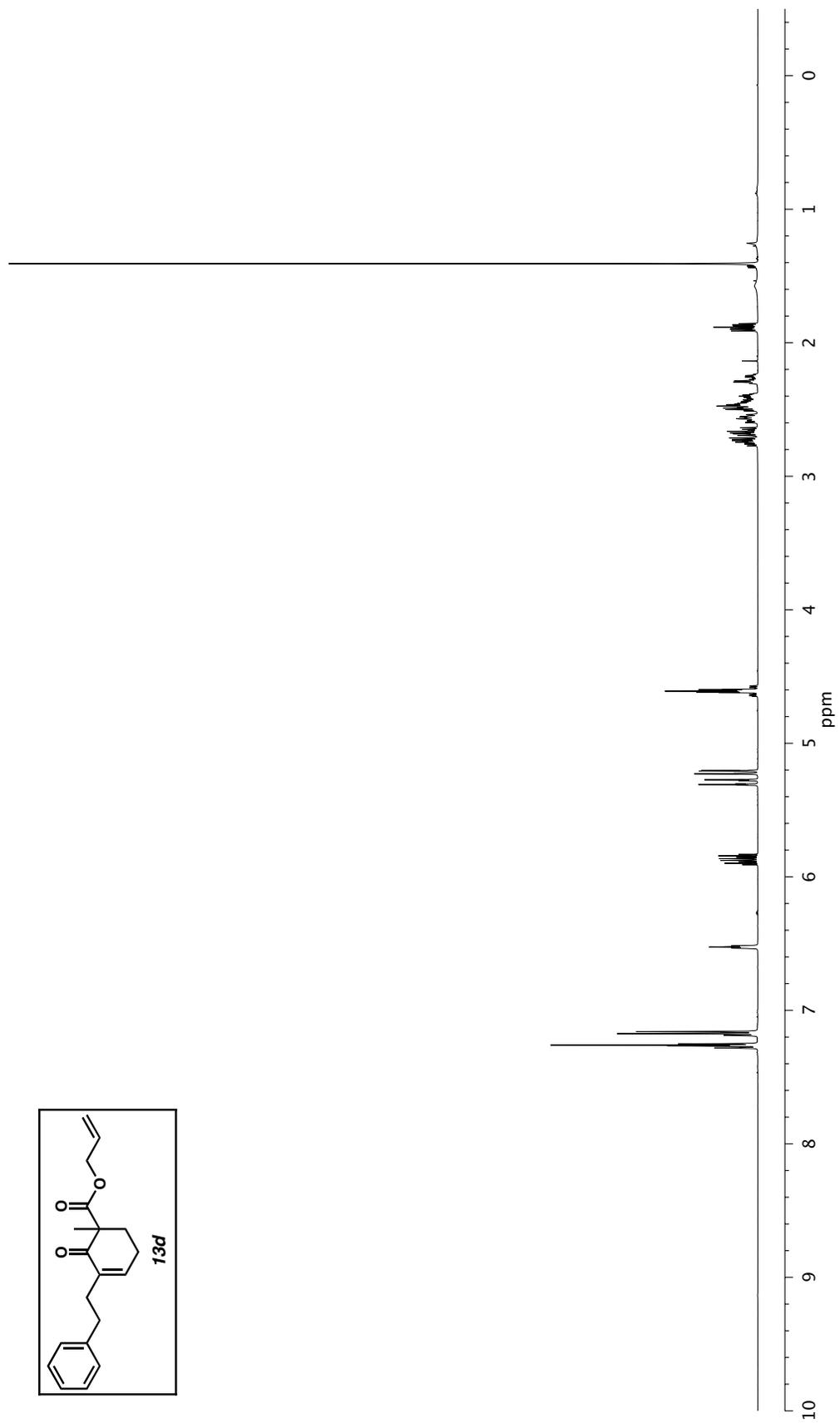


Figure A1.46.1. ^1H NMR (500 MHz, CDCl_3) of compound **13d**.

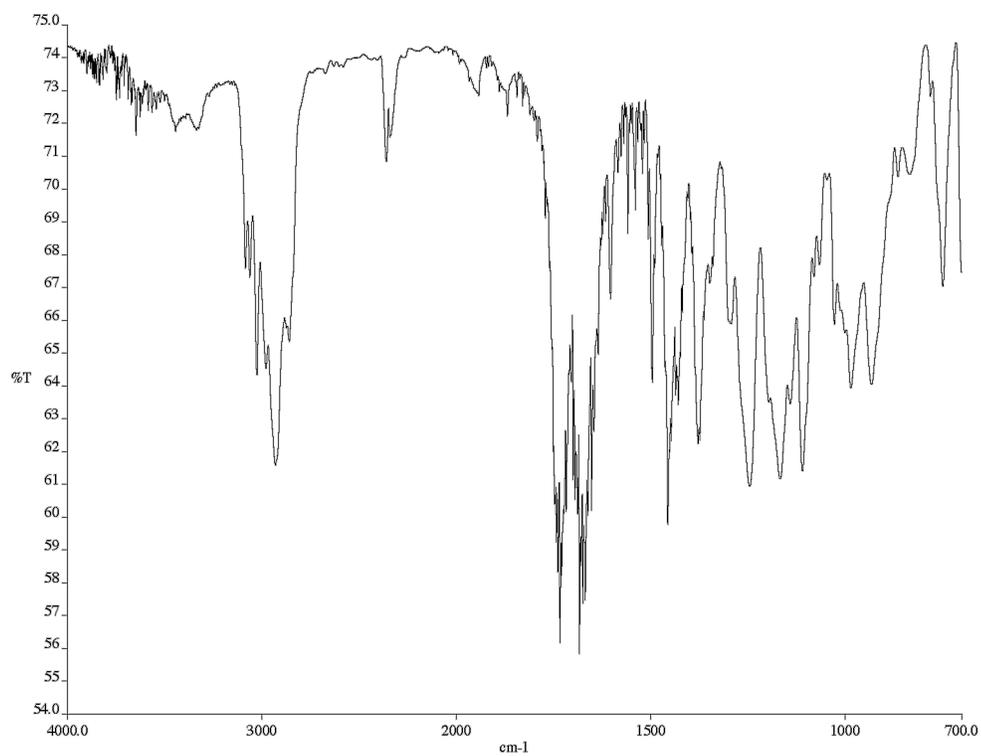


Figure A1.46.2. Infrared spectrum (thin film/NaCl) of compound **13d**.

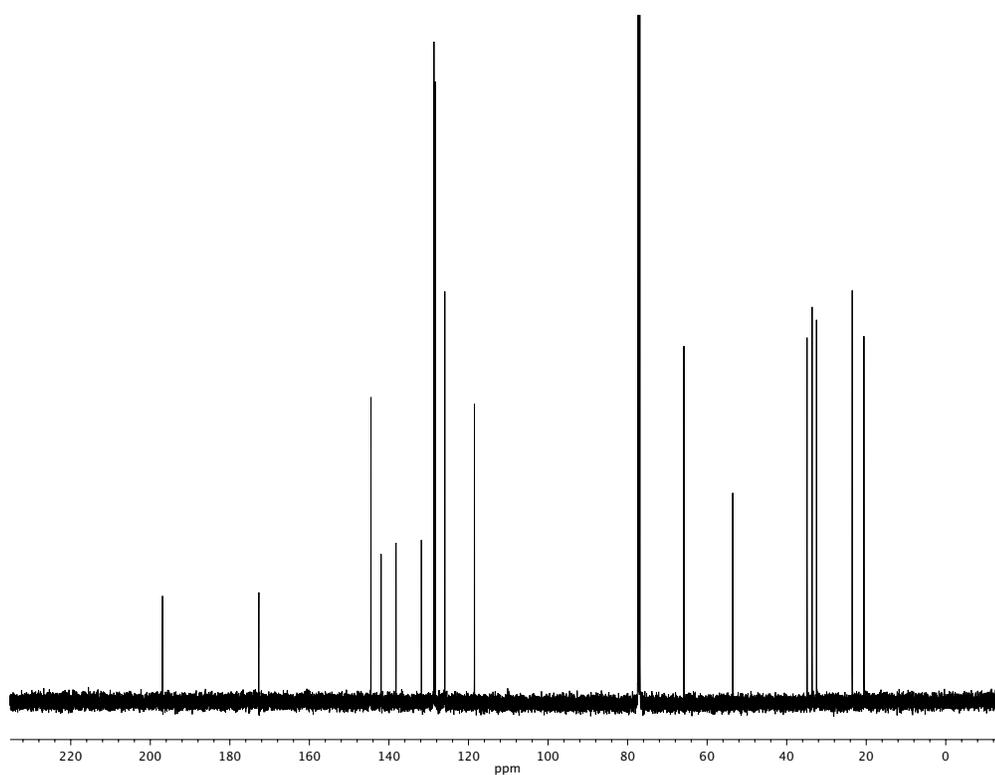
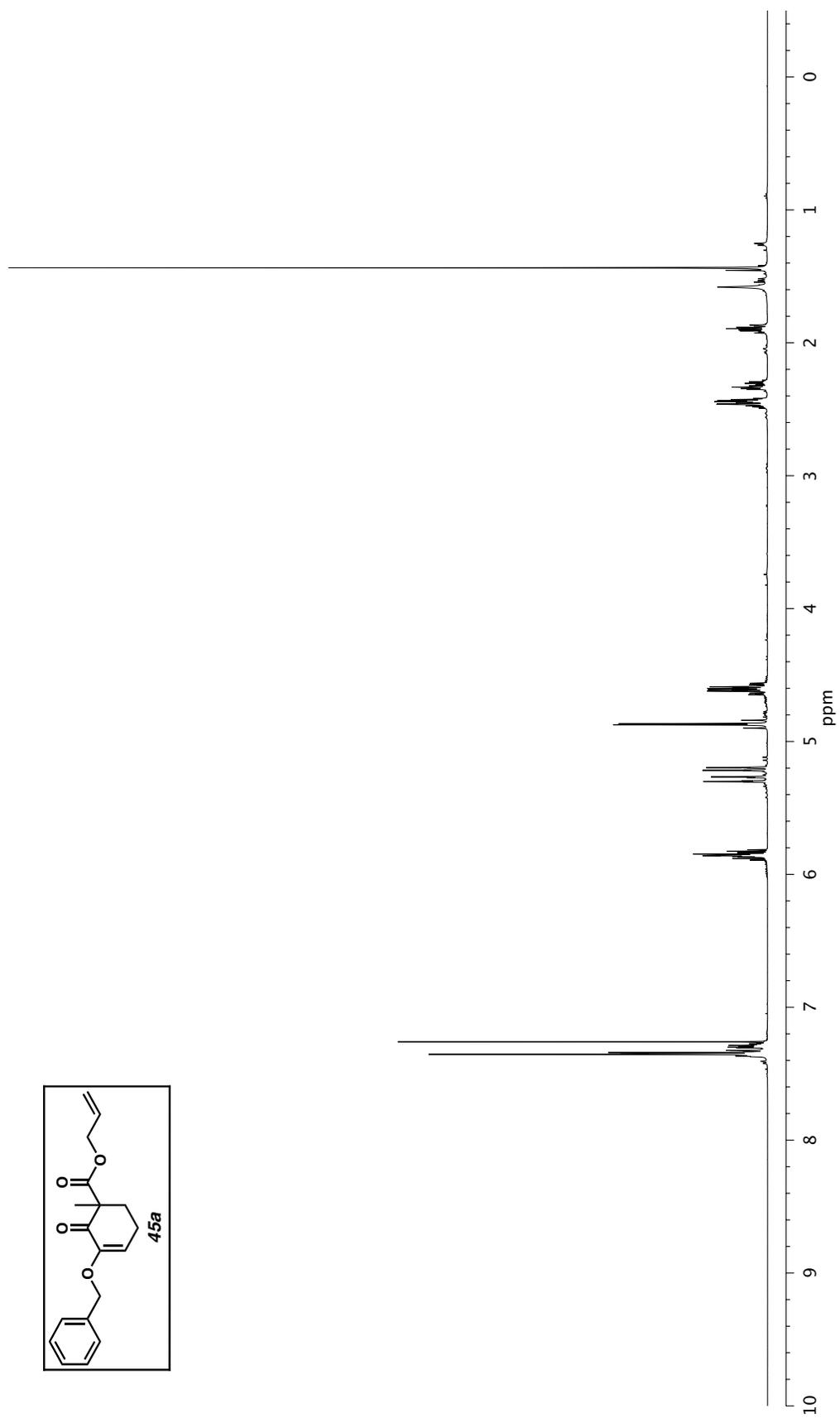


Figure A1.46.3. ¹³C NMR (125 MHz, CDCl₃) of compound **13d**.

Figure A1.47.1. ^1H NMR (500 MHz, CDCl_3) of compound **45a**.

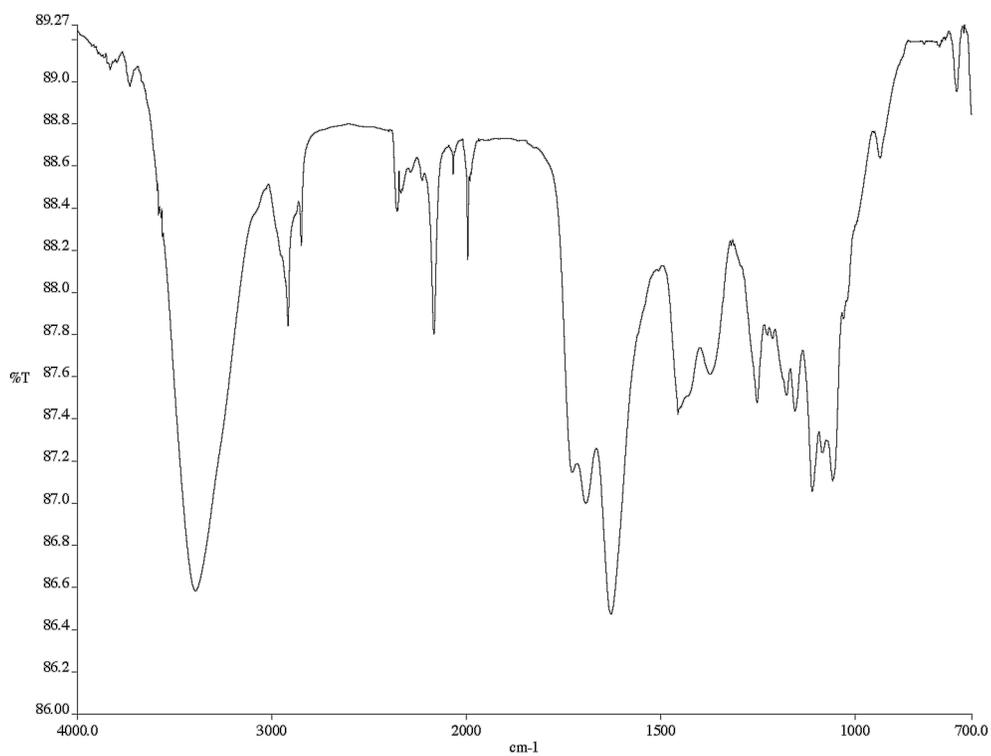


Figure A1.47.2. Infrared spectrum (thin film/NaCl) of compound **45a**.

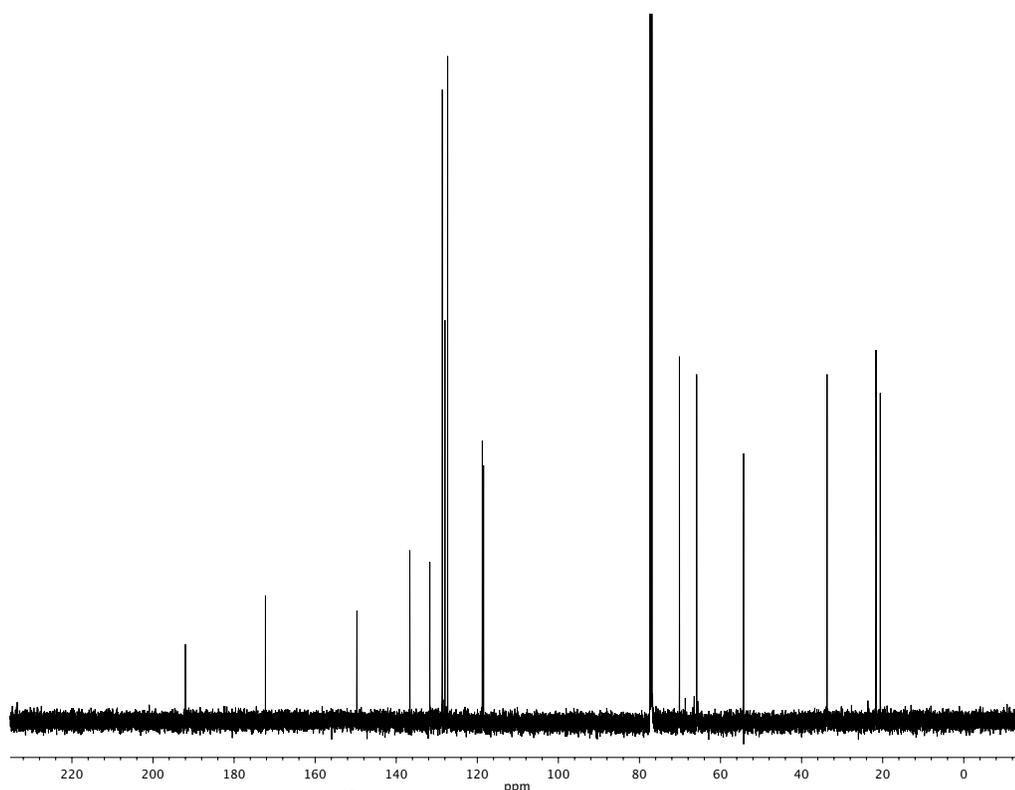
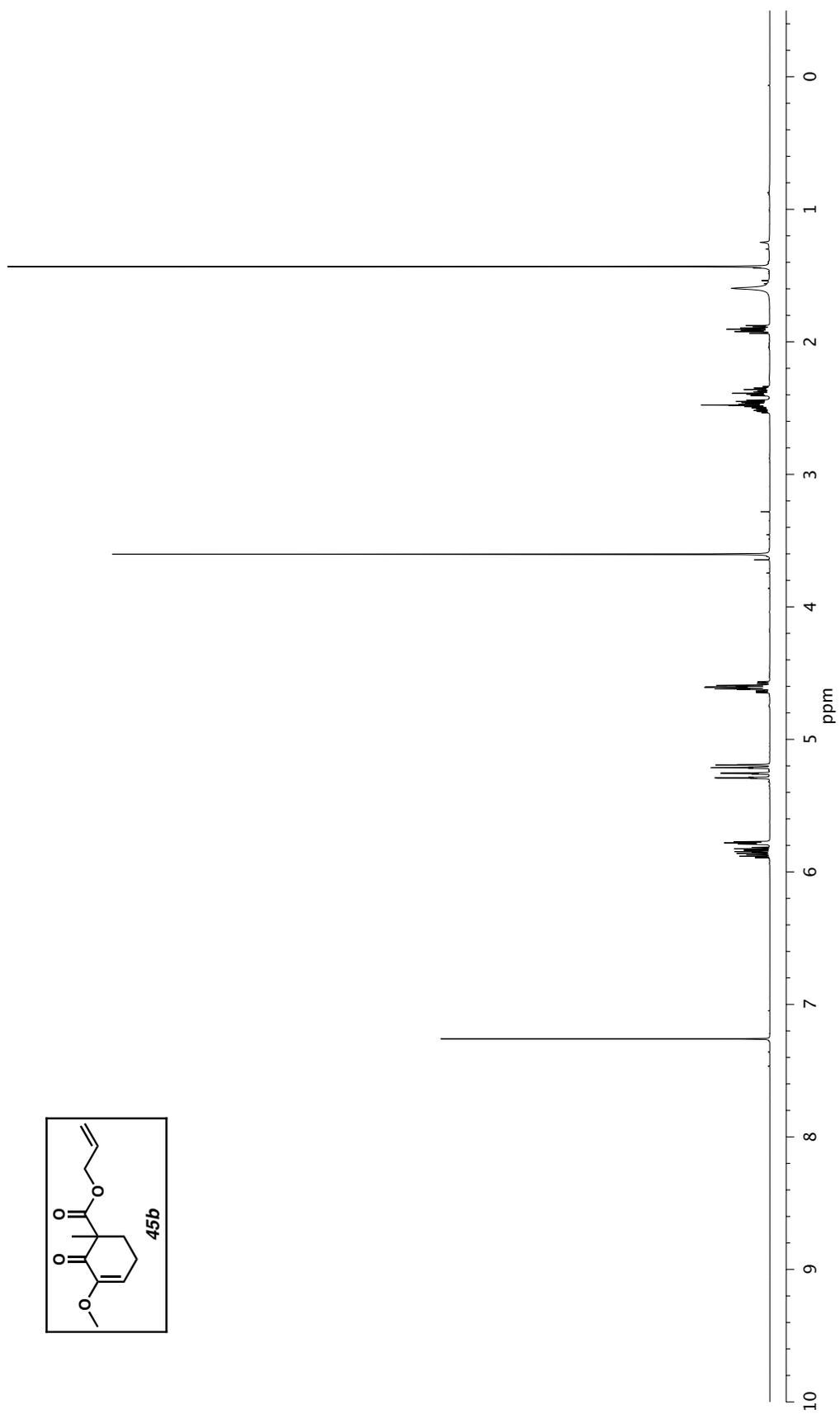


Figure A1.47.3. ^{13}C NMR (125 MHz, CDCl_3) of compound **45a**.

Figure A1.48.1. ^1H NMR (500 MHz, CDCl_3) of compound **45b**.

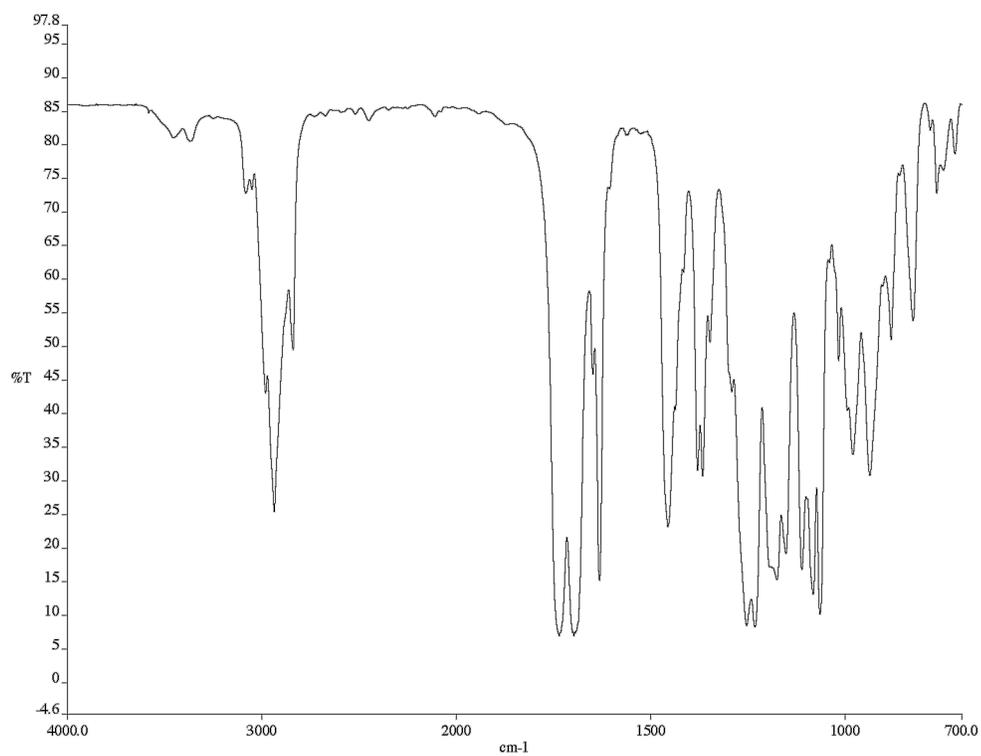


Figure A1.48.2. Infrared spectrum (thin film/NaCl) of compound **45b**.

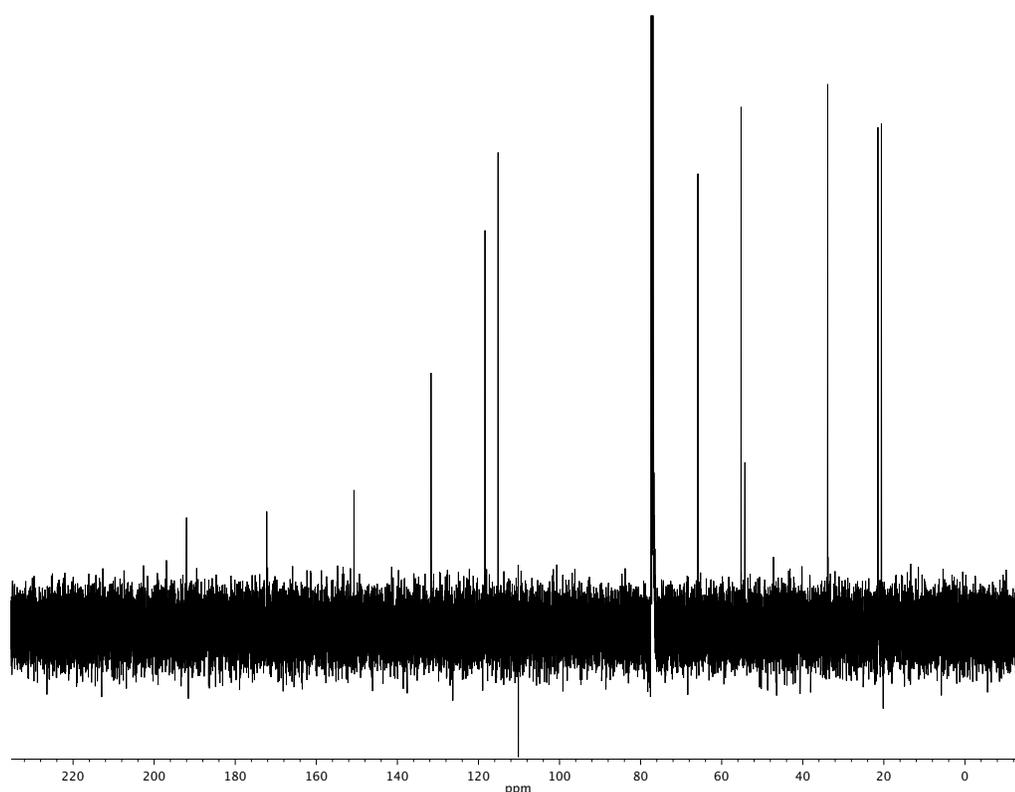
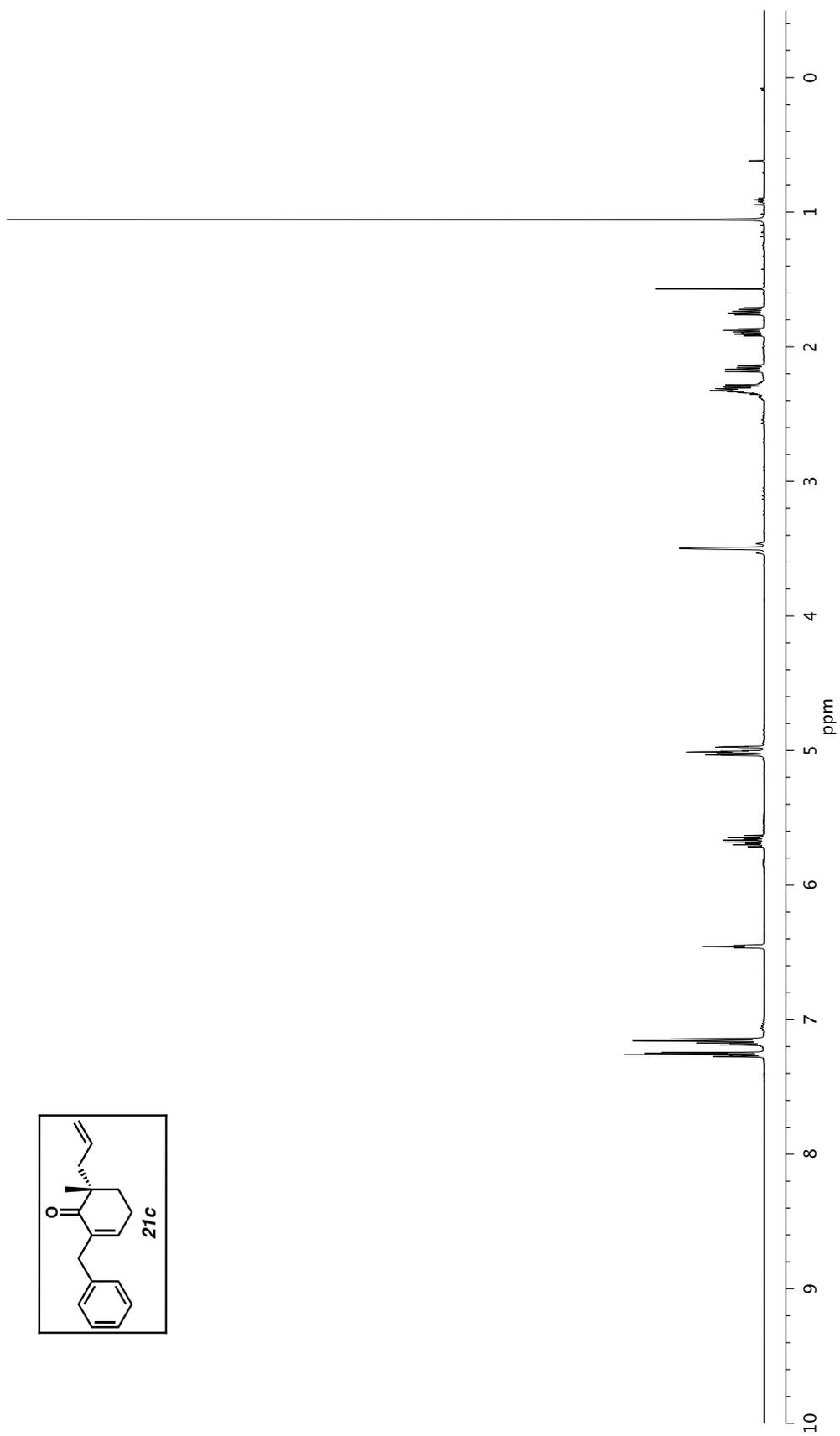


Figure A1.48.3. ¹³C NMR (125 MHz, CDCl₃) of compound **45b**.

Figure A1.49.1. ^1H NMR (500 MHz, CDCl_3) of compound **21c**.

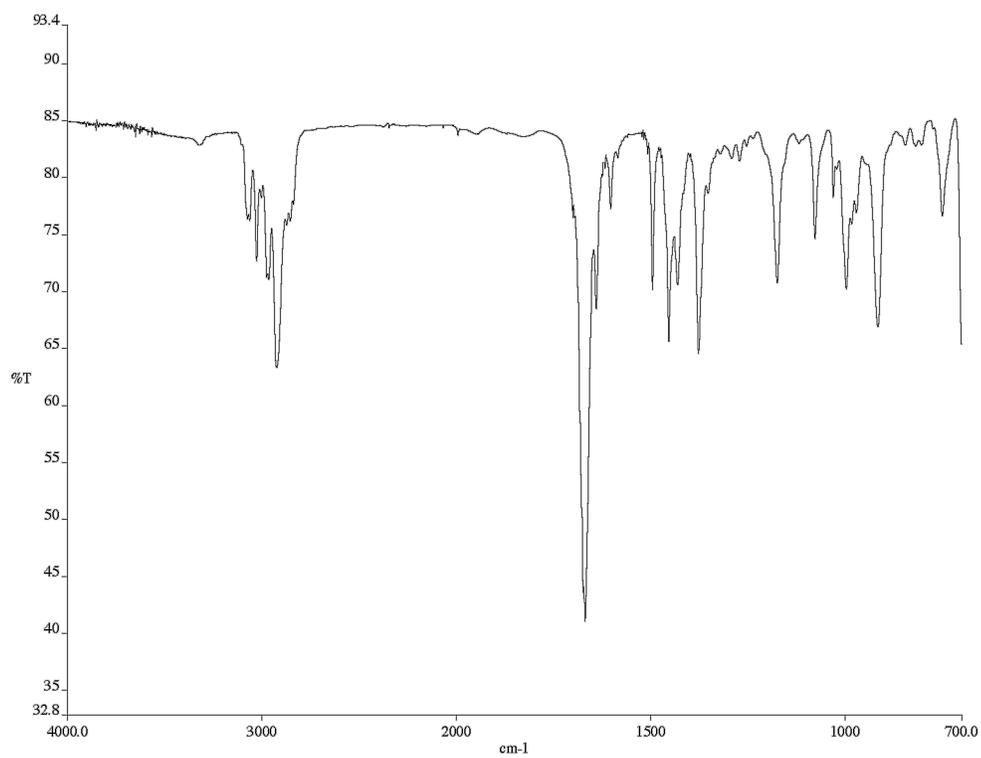


Figure A1.49.2. Infrared spectrum (thin film/NaCl) of compound **21c**.

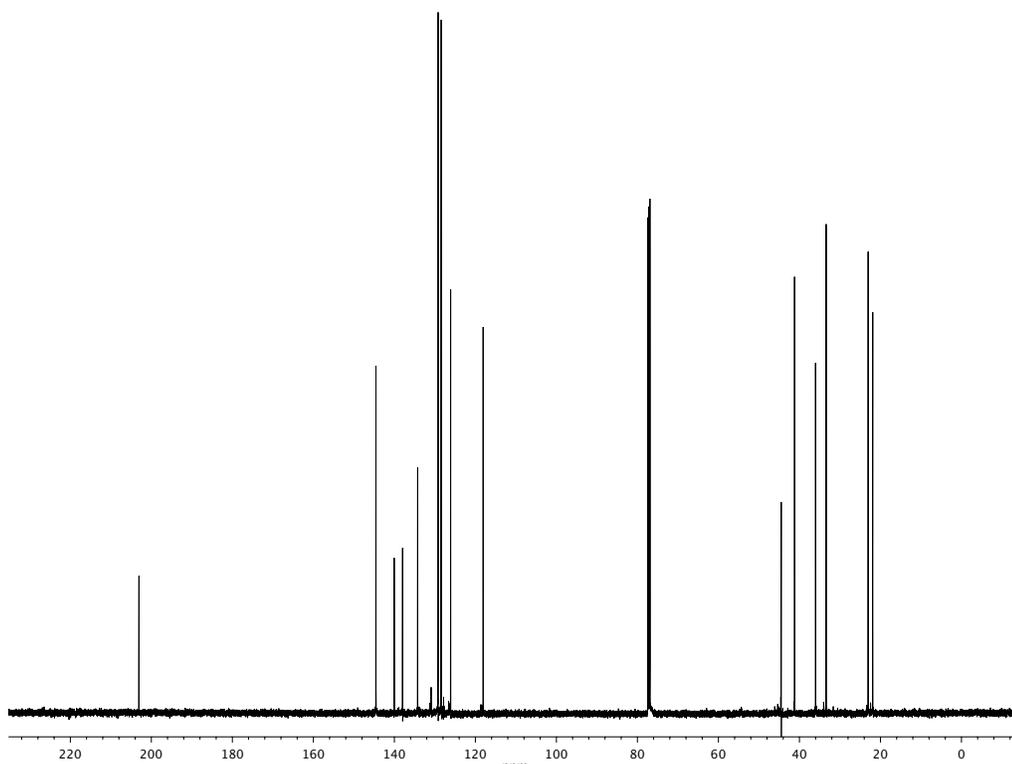
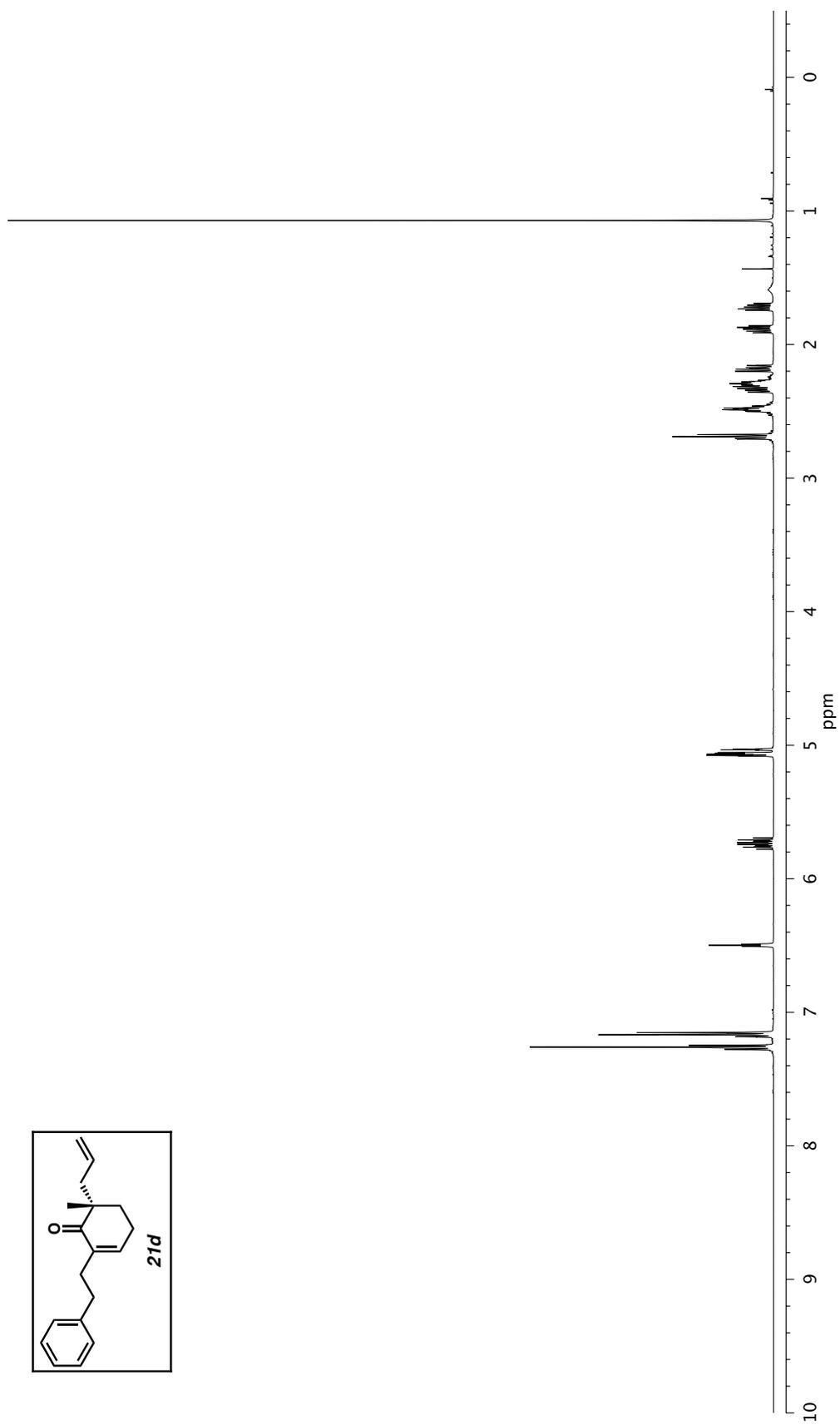


Figure A1.49.3. ¹³C NMR (125 MHz, CDCl₃) of compound **21c**.

Figure A1.50.1. ^1H NMR (500 MHz, CDCl_3) of compound **21d**.

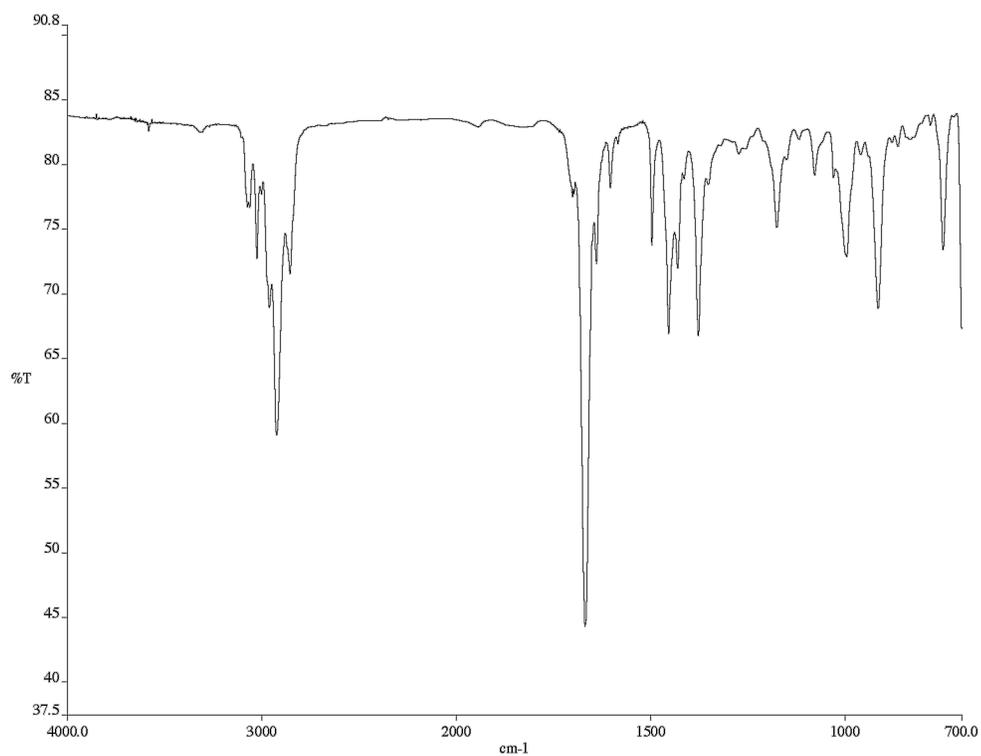


Figure A1.50.2. Infrared spectrum (thin film/NaCl) of compound **21d**.

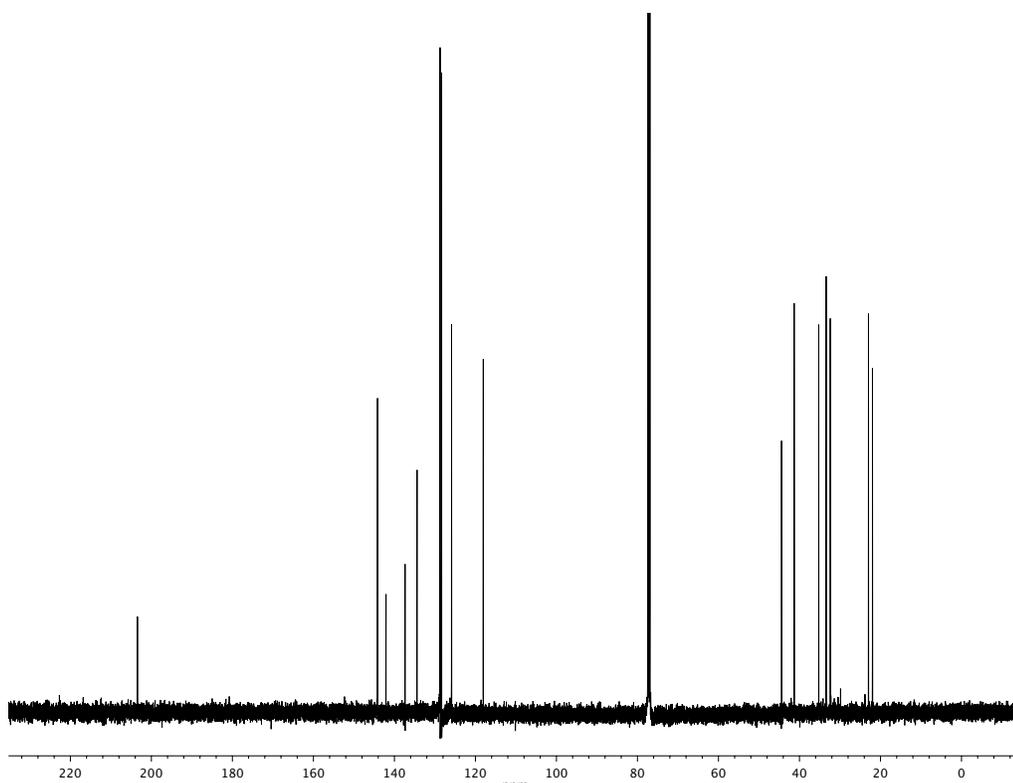
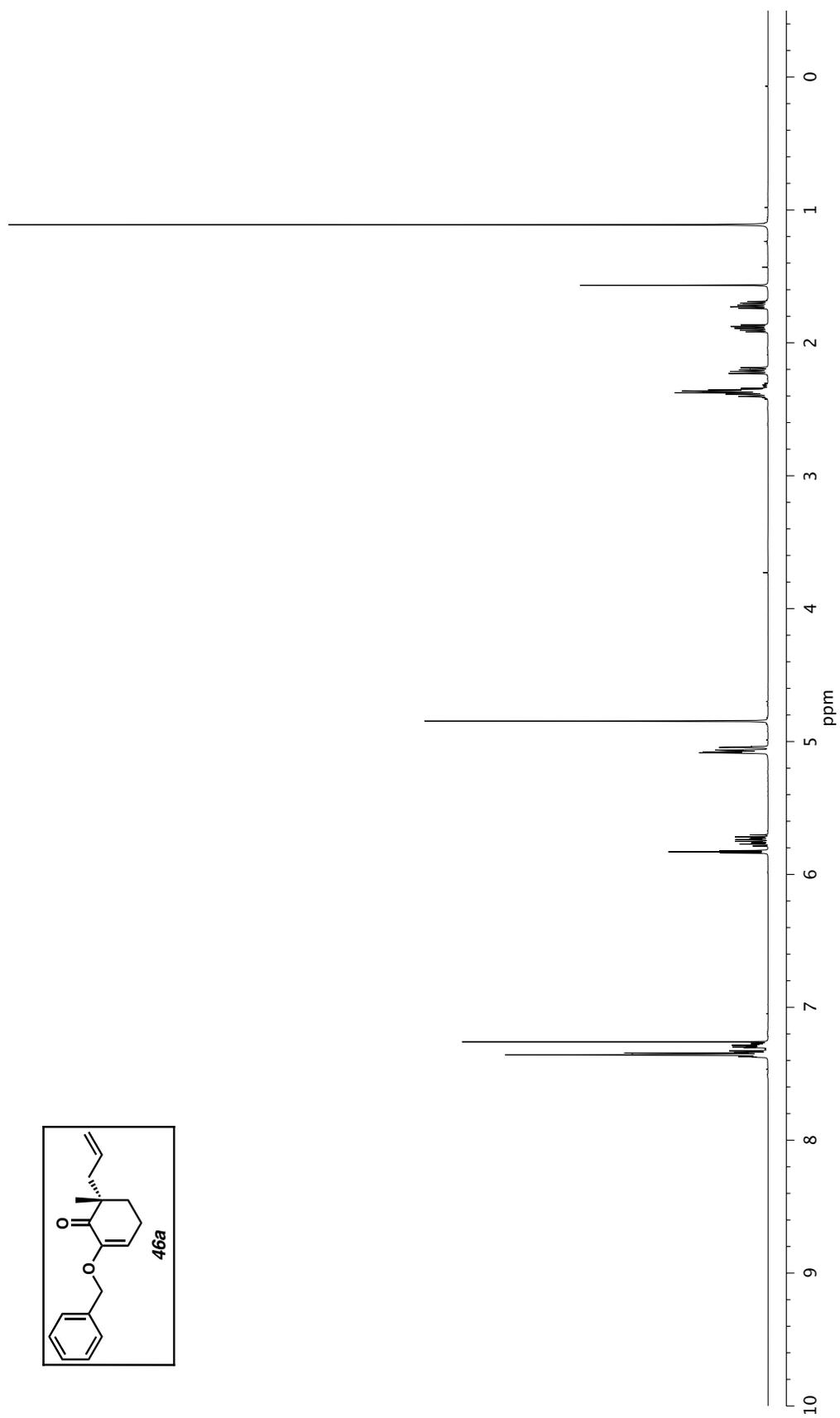


Figure A1.50.3. ¹³C NMR (125 MHz, CDCl₃) of compound **21d**.

Figure A1.51.1. ^1H NMR (500 MHz, CDCl_3) of compound **46a**.

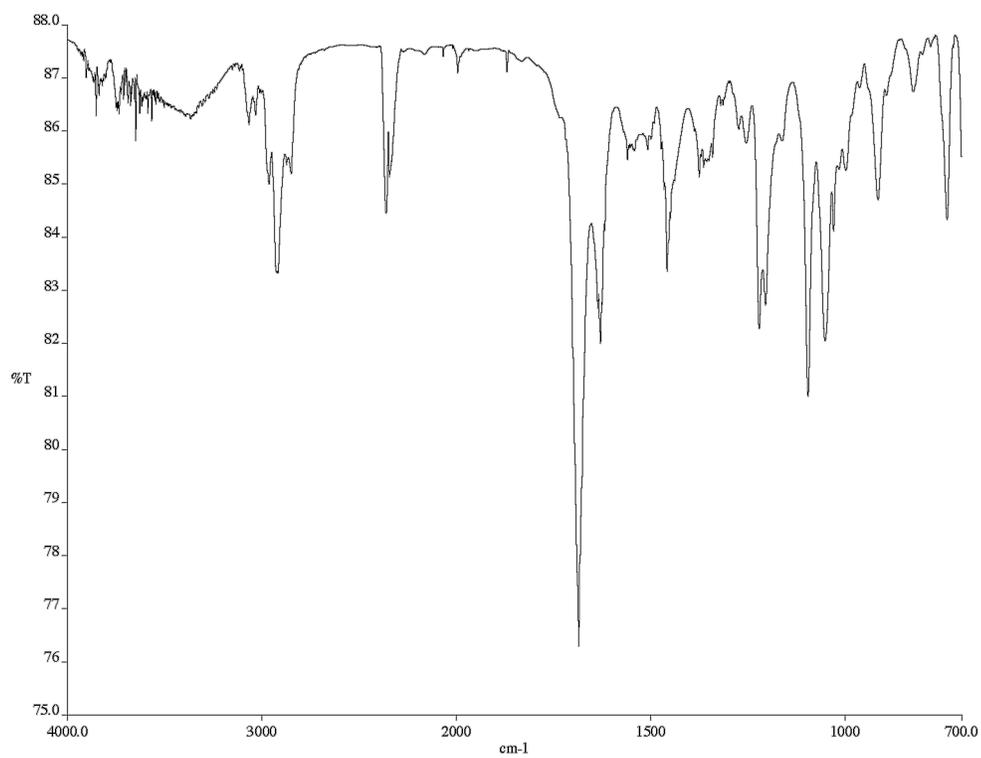


Figure A1.51.2. Infrared spectrum (thin film/NaCl) of compound **46a**.

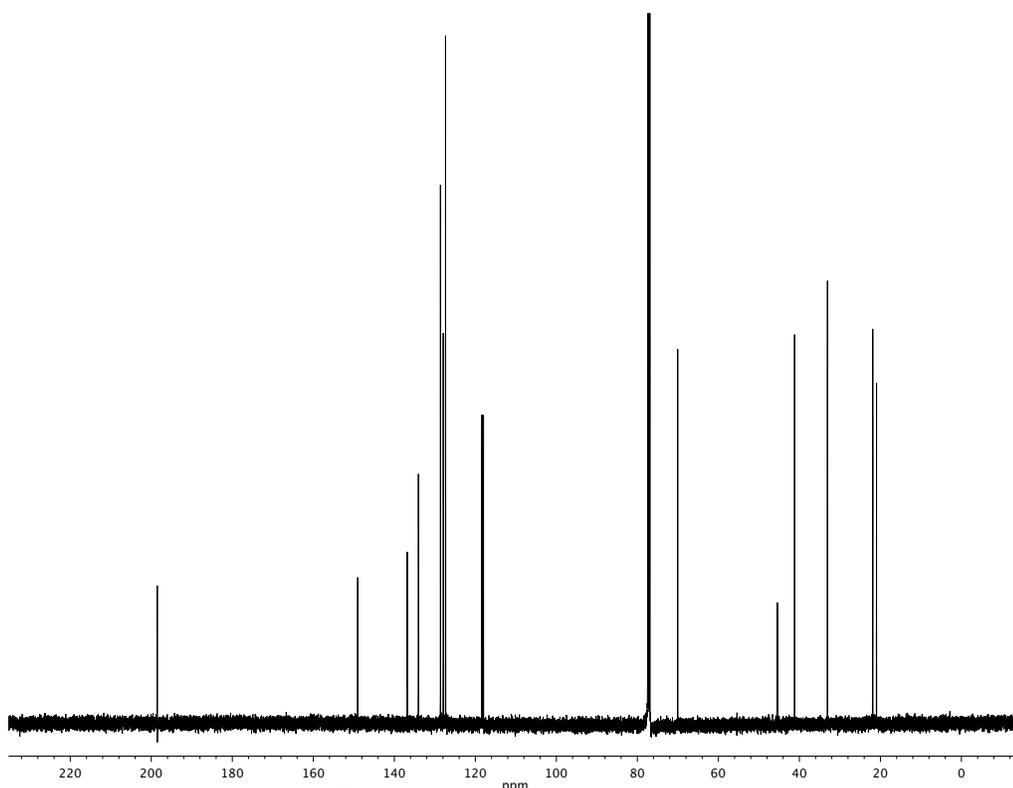


Figure A1.51.3. ¹³C NMR (125 MHz, CDCl₃) of compound **46a**.

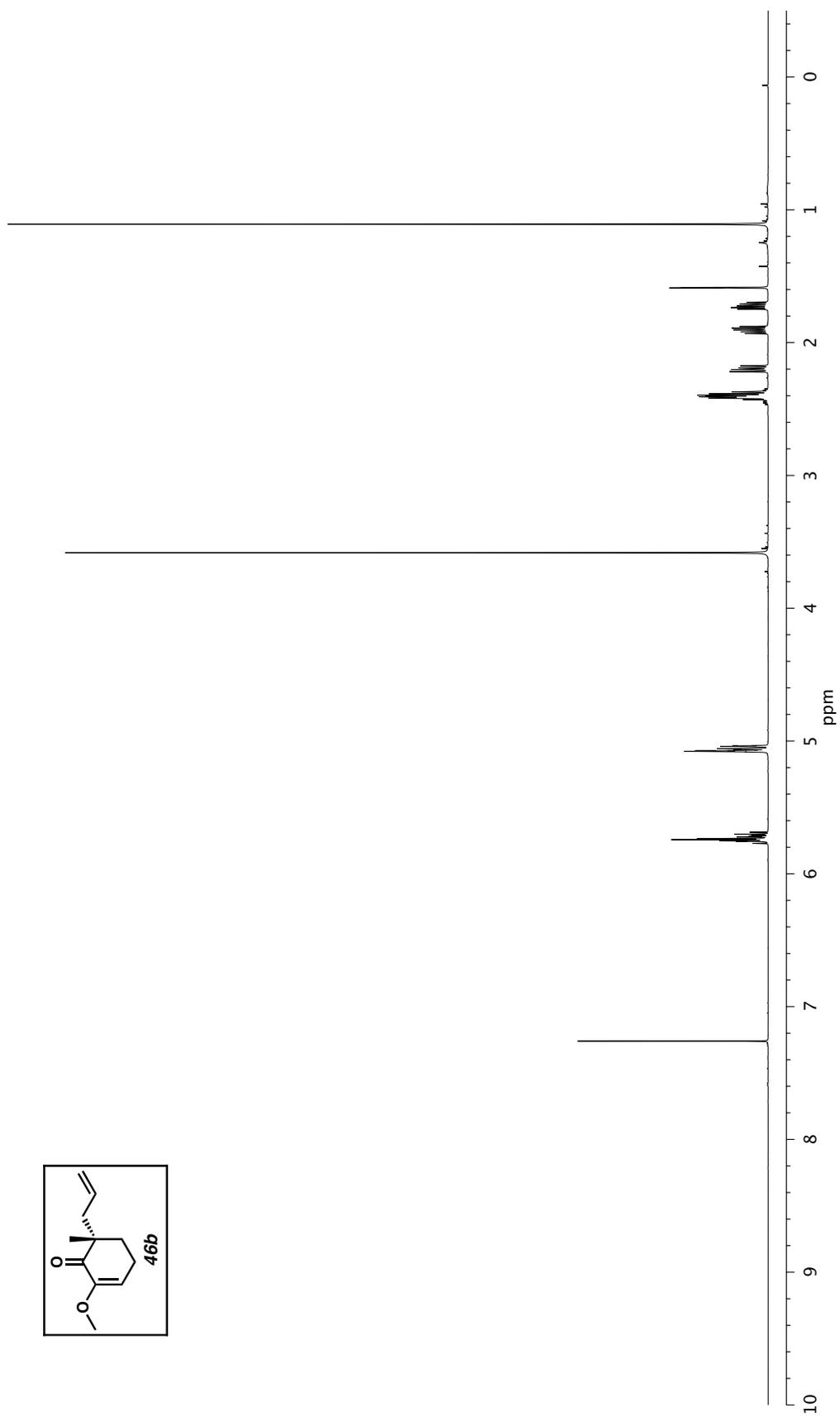


Figure A1.52.1. ^1H NMR (500 MHz, CDCl_3) of compound **46b**.

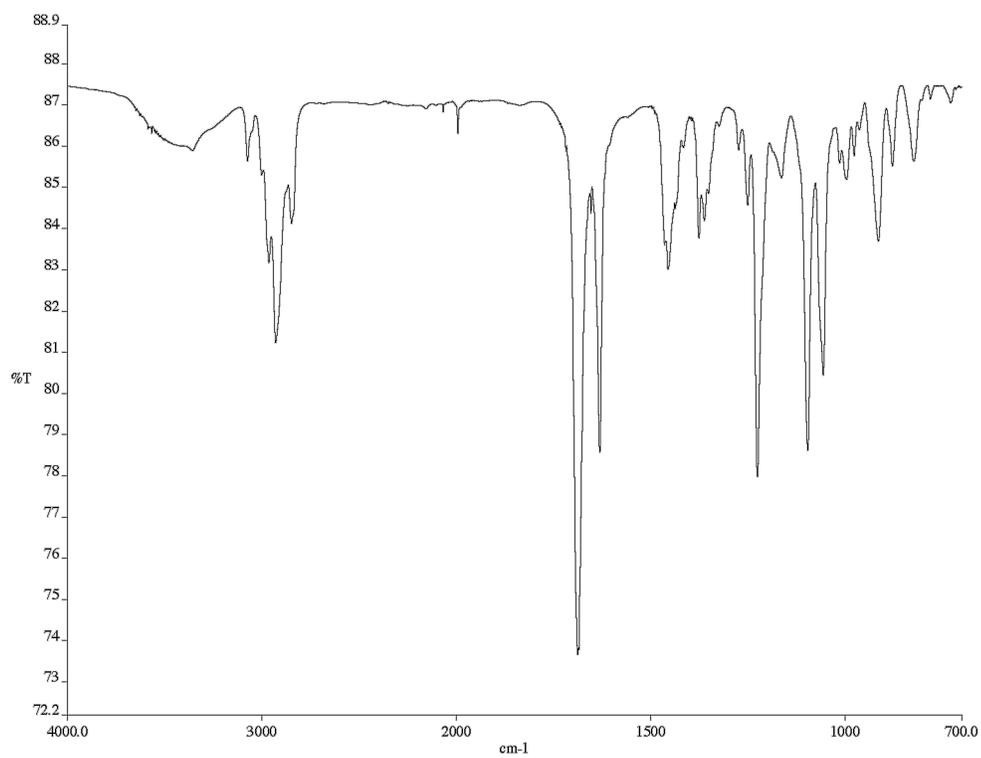


Figure A1.52.2. Infrared spectrum (thin film/NaCl) of compound **46b**.

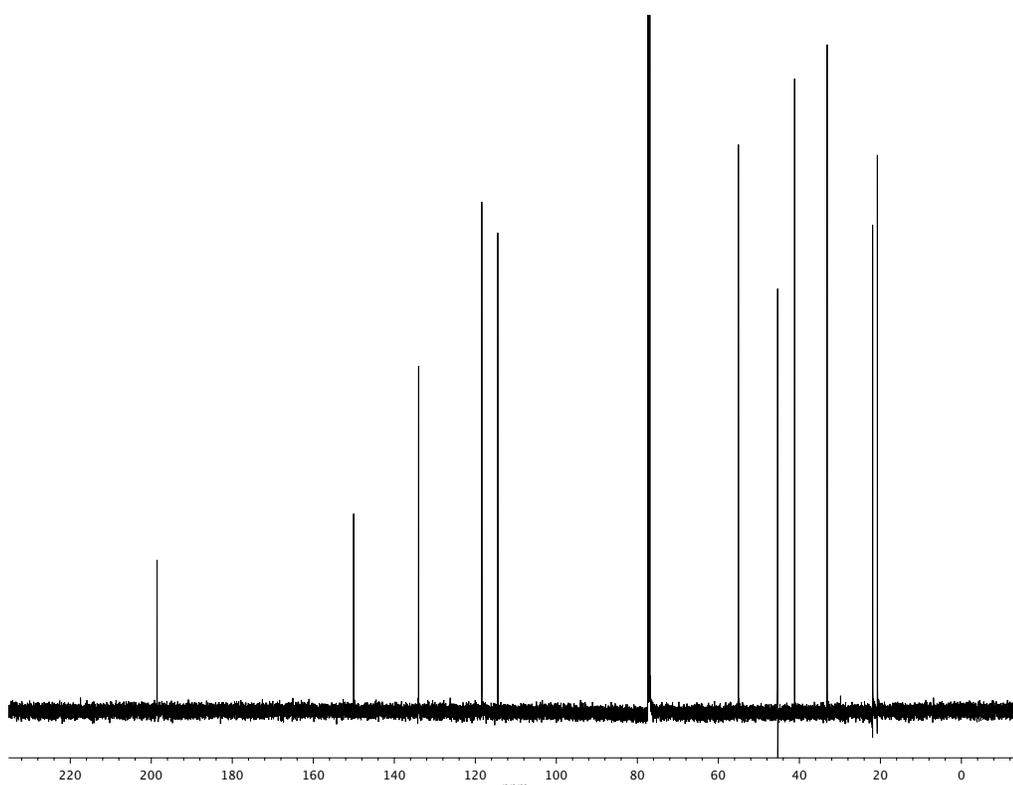


Figure A1.52.3. ¹³C NMR (125 MHz, CDCl₃) of compound **46b**.