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Supplementary material

Ohmic heating as a new efficient process for organic synthesis in water

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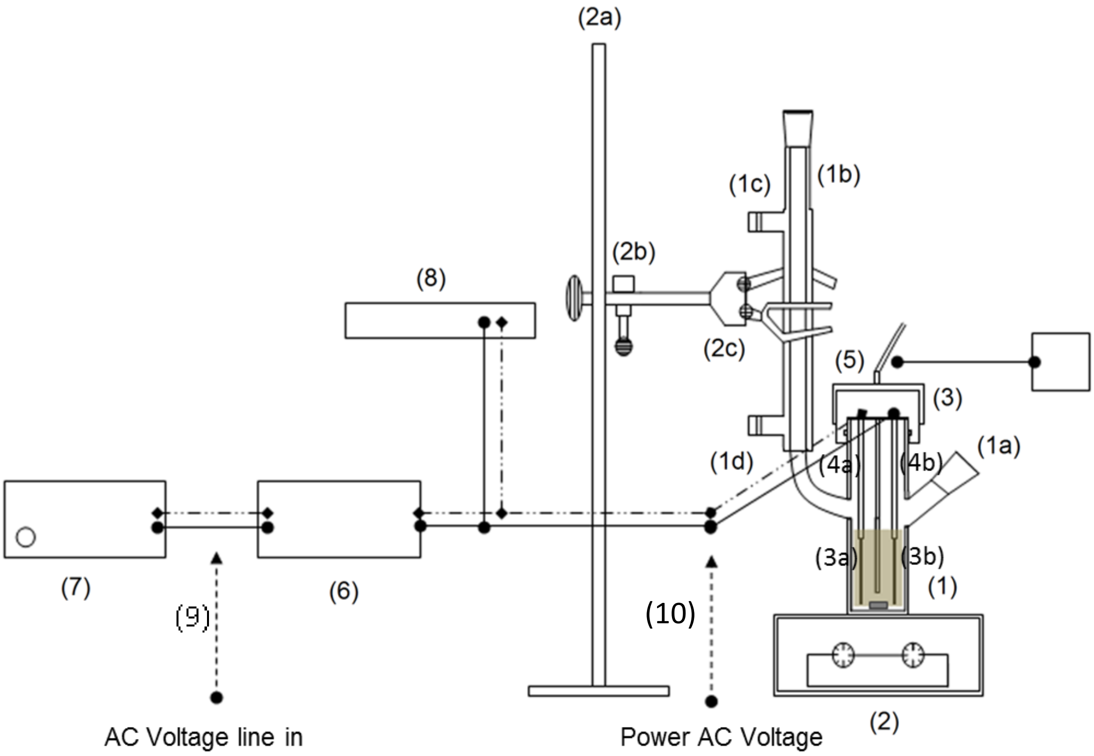
1. Ohmic heating reactor



1- Glass vessel reactor (1a, side arm for addition of reagents; 1b, condenser; 1c thread for water outlet pipe; 1d, thread for water inlet pipe).

2- Magnetic stirring plate and cylindrical magnetic stirrer (10 mm length) and 2a, 2b, 2c: supporters.

3-Reactor cover (PEEK, Polyether ether ketone).

3a,3b,4a,4b- Stainless steel (316) rectangular electrodes (dimensions: 40 mm length x 25 mm wide; 1 mm thickness); distance between the electrodes: 23 mm).

5- Type J glass sheathed thermocouple, (glass tube with 6mm external diameter, 4mm internal diameter and thickness 1 mm, conical at the bottom)

6- MOSFET Power amplifier (Velleman model QUBIC VPA21300MB, 2600 Watts Max, bridged mode).

7- Signal function generator (Topward function generator 8110)

8- Agilent 34972A LXI Data Acquisition / Data Logger and Switch Unit (Data acquisition of temperature, voltage, frequency, electric current and power in the reactor is done using a software application developed in Agilent VEE).

Figure S1 – Schematic representation of the ohmic heating reactor apparatus.

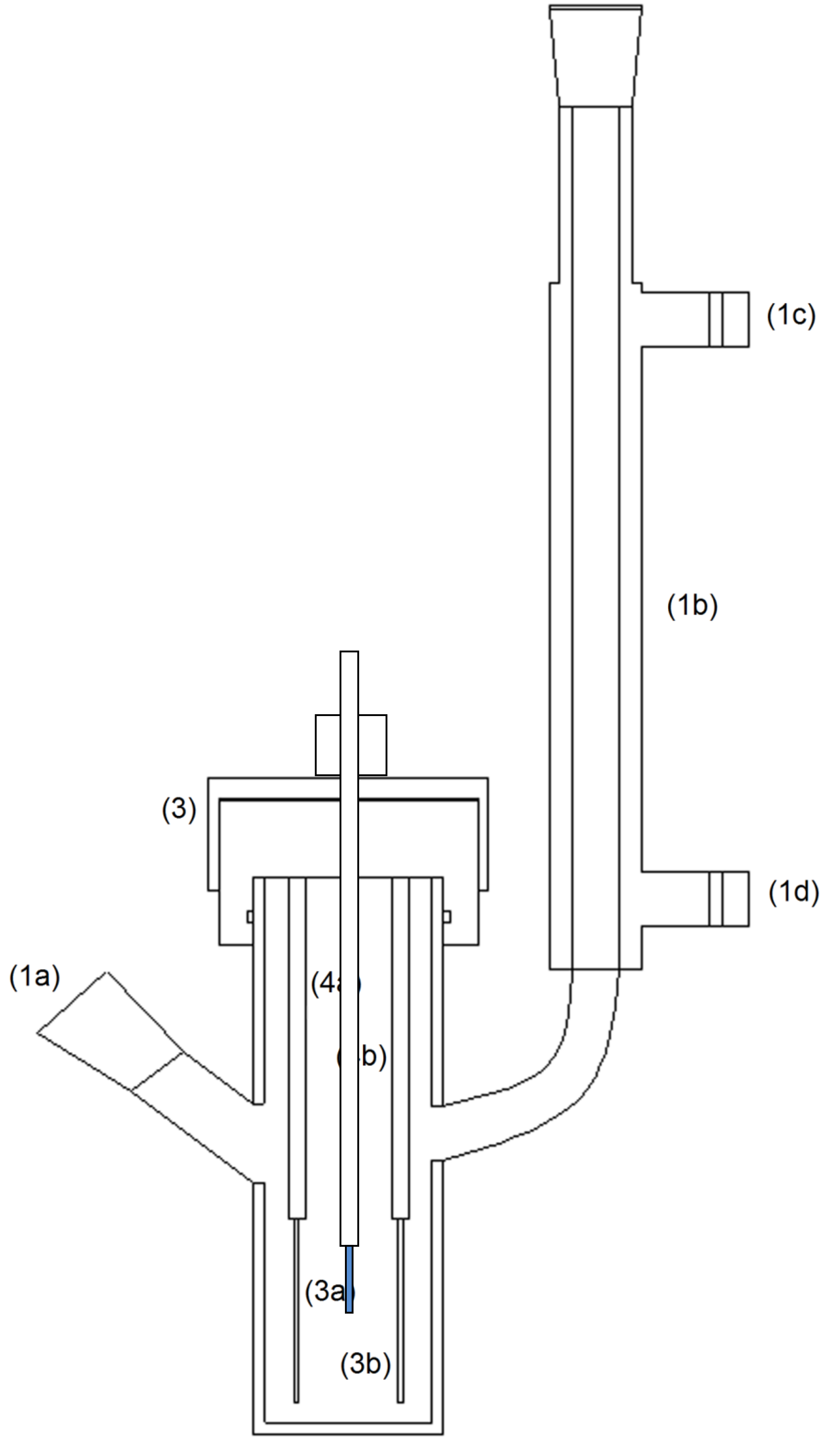
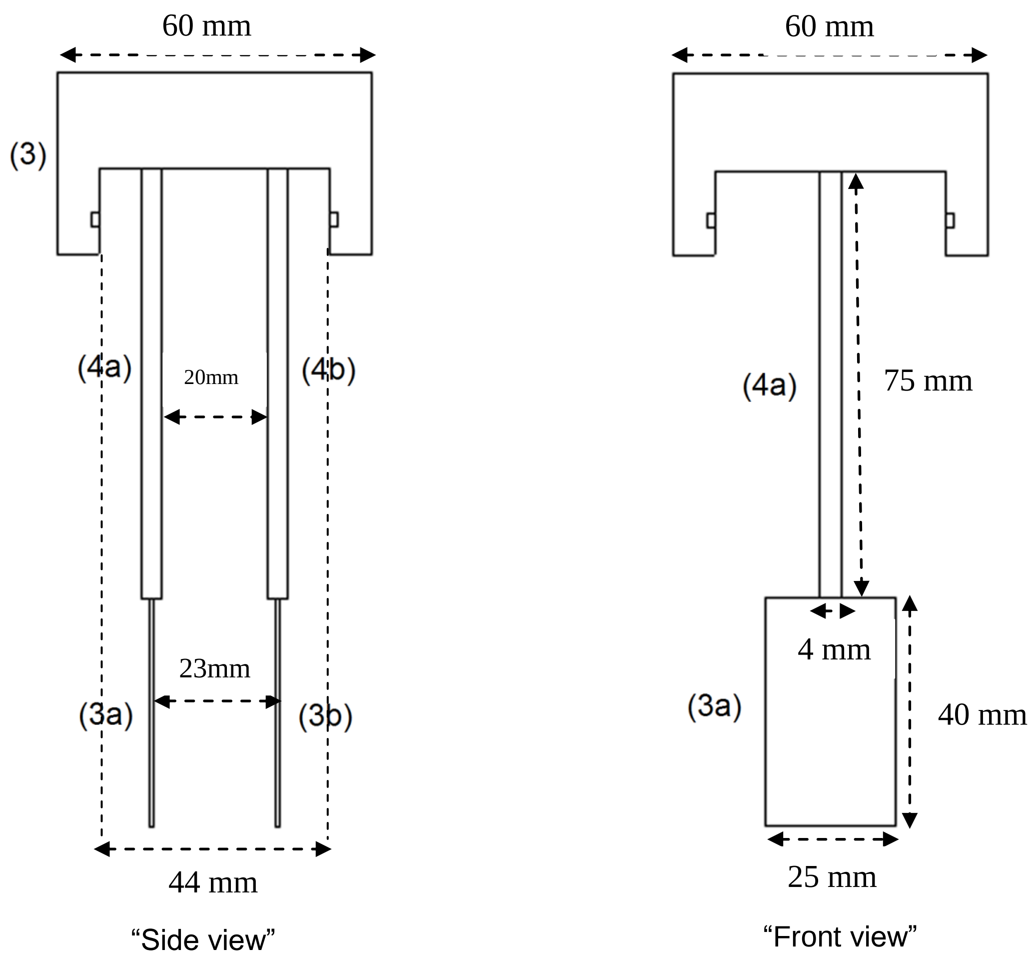


Figure S2 – Detailed representation of the ohmic heating 50 mL glass vessel reactor. The temperature sensor is located between the heating electrodes.



3- Reactor cover (PEEK, Polyether ether ketone).

3a,3b- Stainless steel (316) rectangular electrodes (dimensions: 40 mm length x 25 mm wide; 1 mm thickness) (for a volume of 25 mL the length of the electrode inside the solution/ reaction media is 20 mm).

4a,4b- Stainless steel rod with the electrodes.

Figure S3 – Detailed representation of the ohmic heating electrodes and their dimensions.

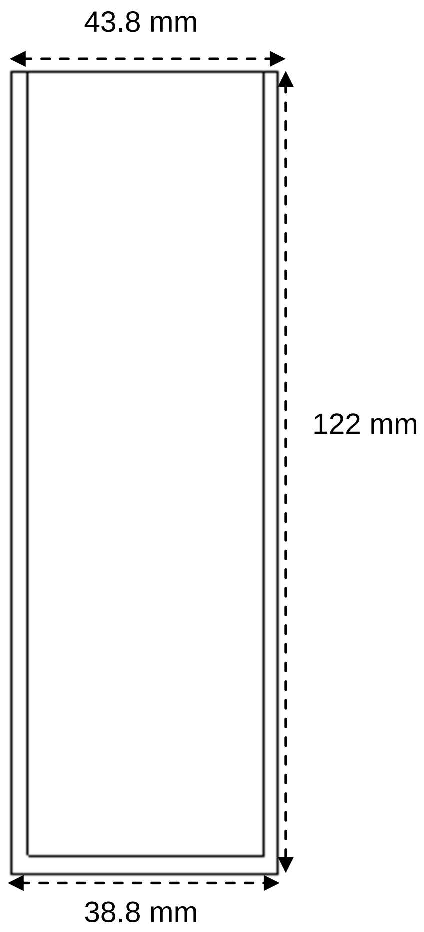


Figure S4 – 50 mL Glass Vessel Reactor.

2. Results of monitoring the heating power (Temperature, Power, AC Current and AC Voltage) along the reaction heating time using the ohmic heating apparatus /methodology

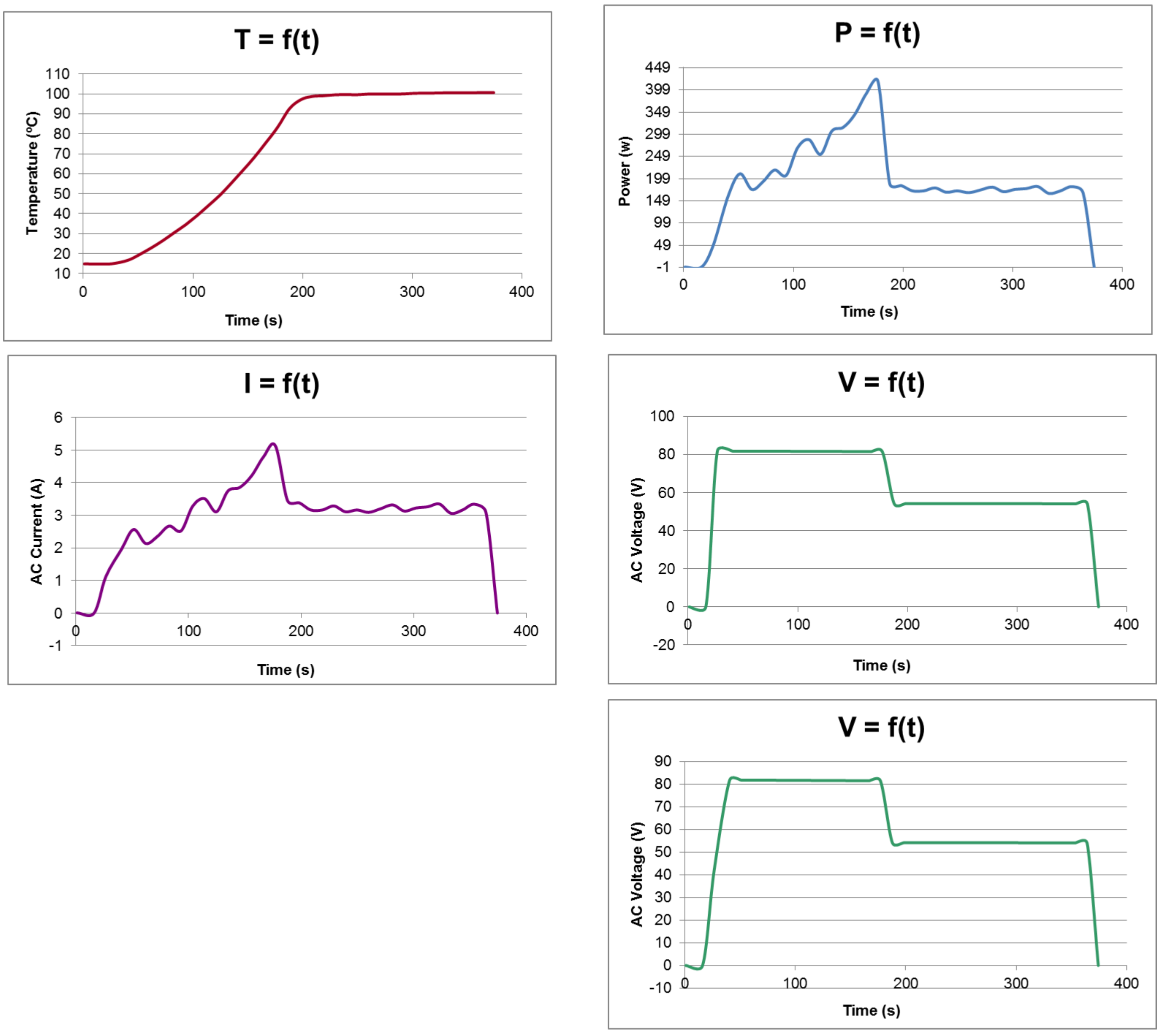


Figure S5- Results of monitoring the heating power (Temperature, Power, AC Current and AC Voltage) along the reaction heating time: heating of a solution of 30 mg NaCl in 25 mL of water (c=0.02 moldm^{-3}).

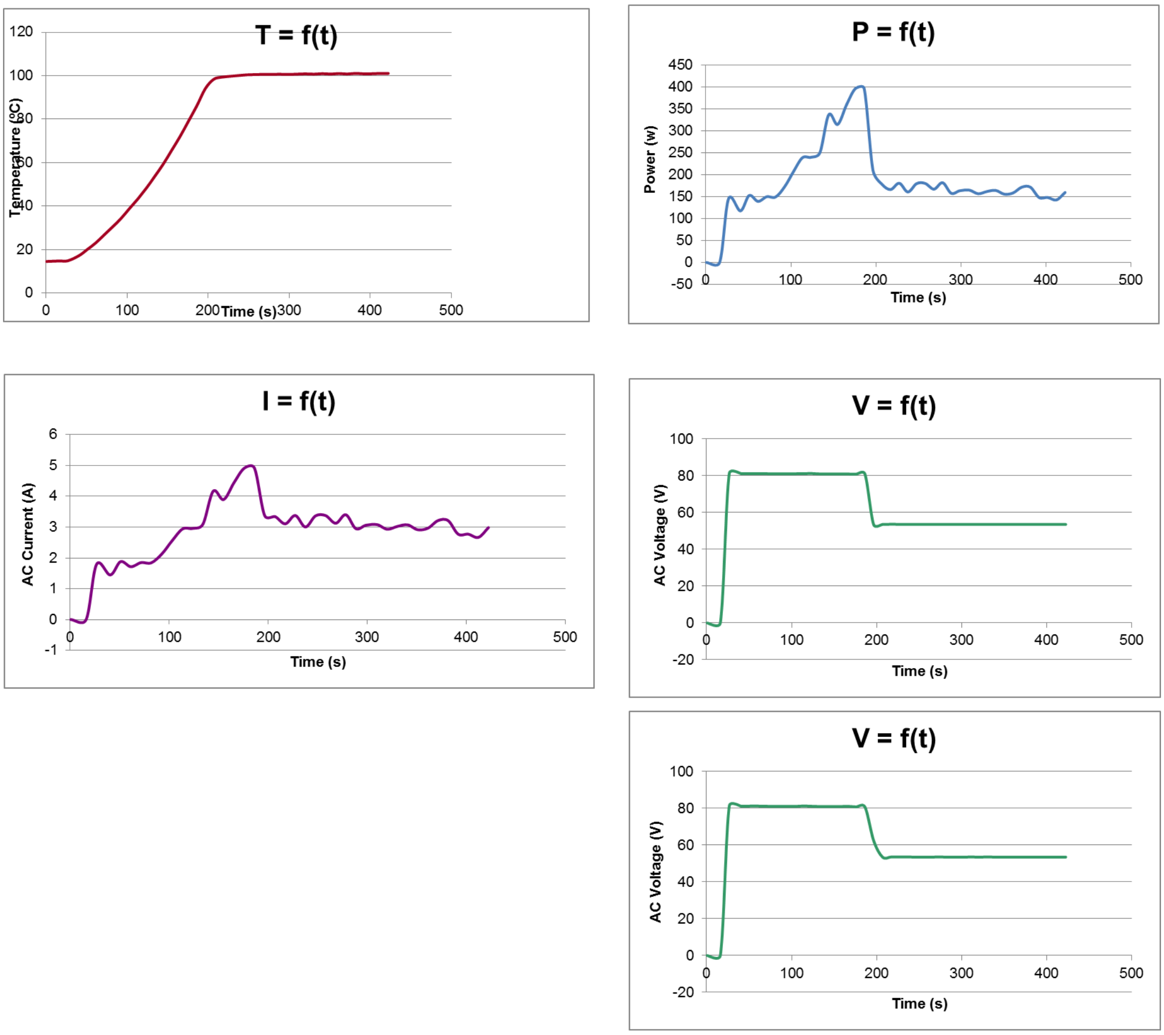


Figure S6- Typical results of monitoring the heating power (Temperature, Power, AC Current and AC Voltage) of the Diels-Alder reaction.

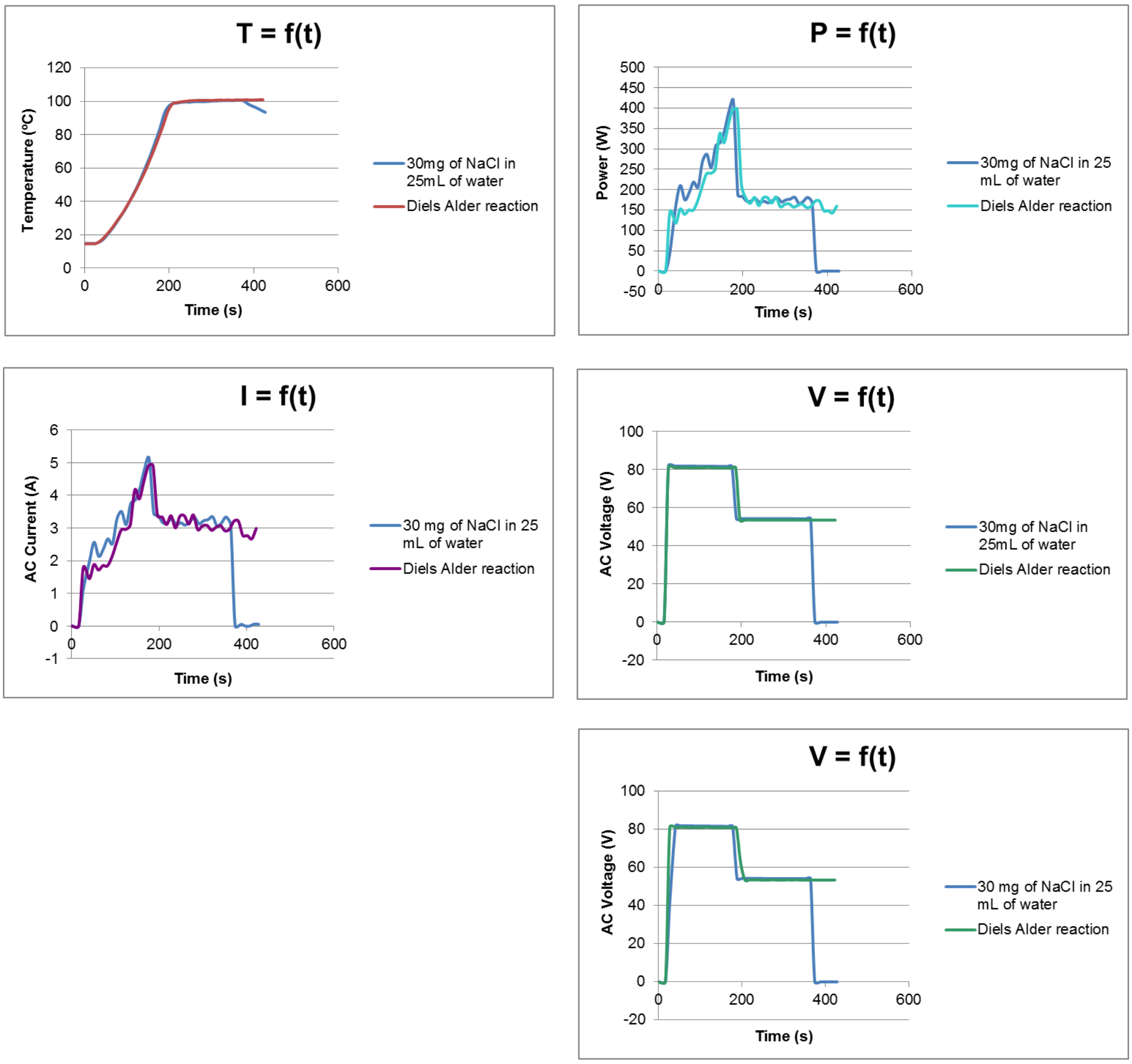


Figure S7 – Results of monitoring the heating power (Temperature, Power, AC Current and AC Voltage): comparison between the results obtained for the NaCl solution (c= 0.02 moldm^{-3}) and those obtained for the Diels-Alder reaction.

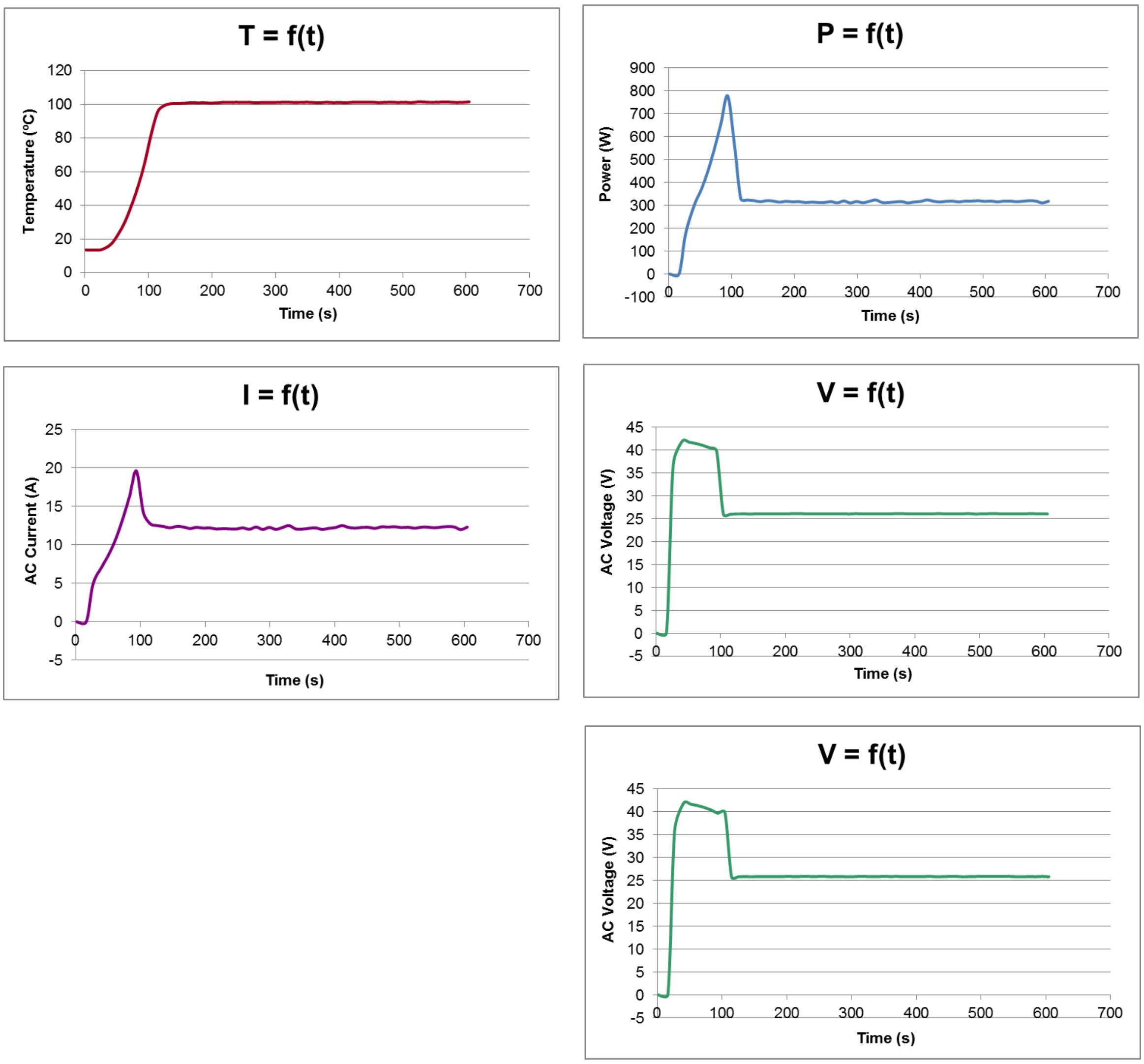


Figure S8- Results of monitoring the heating power (Temperature, Power, AC Current and AC Voltage): heating of a solution of 403 mg Na_2CO_3 in 25 mL of water (c=0.15 $moldm^{-3}$).

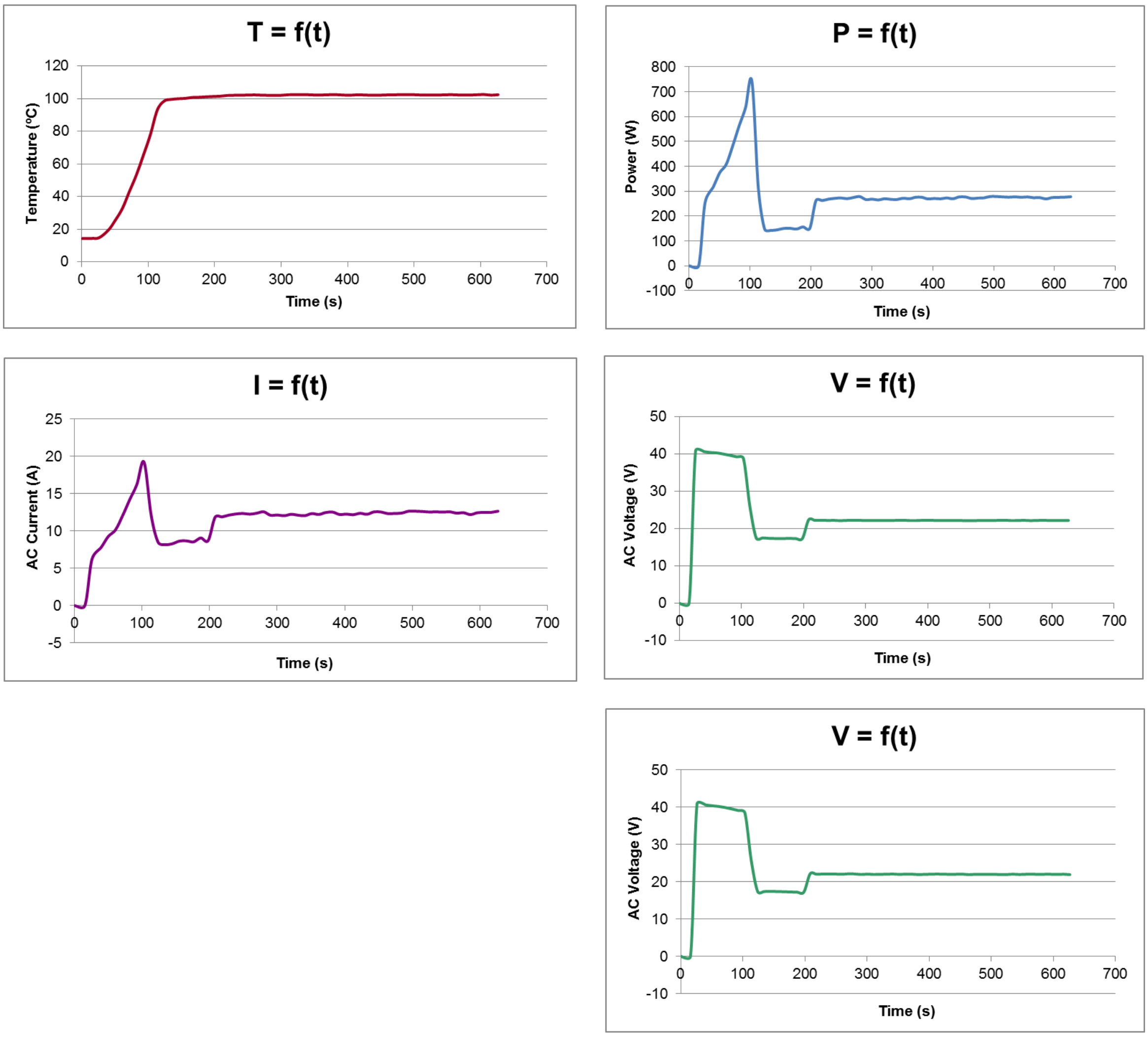


Figure S9- Typical results of monitoring the heating power (Temperature, Power, AC Current and AC Voltage) of the Suzuki reaction.

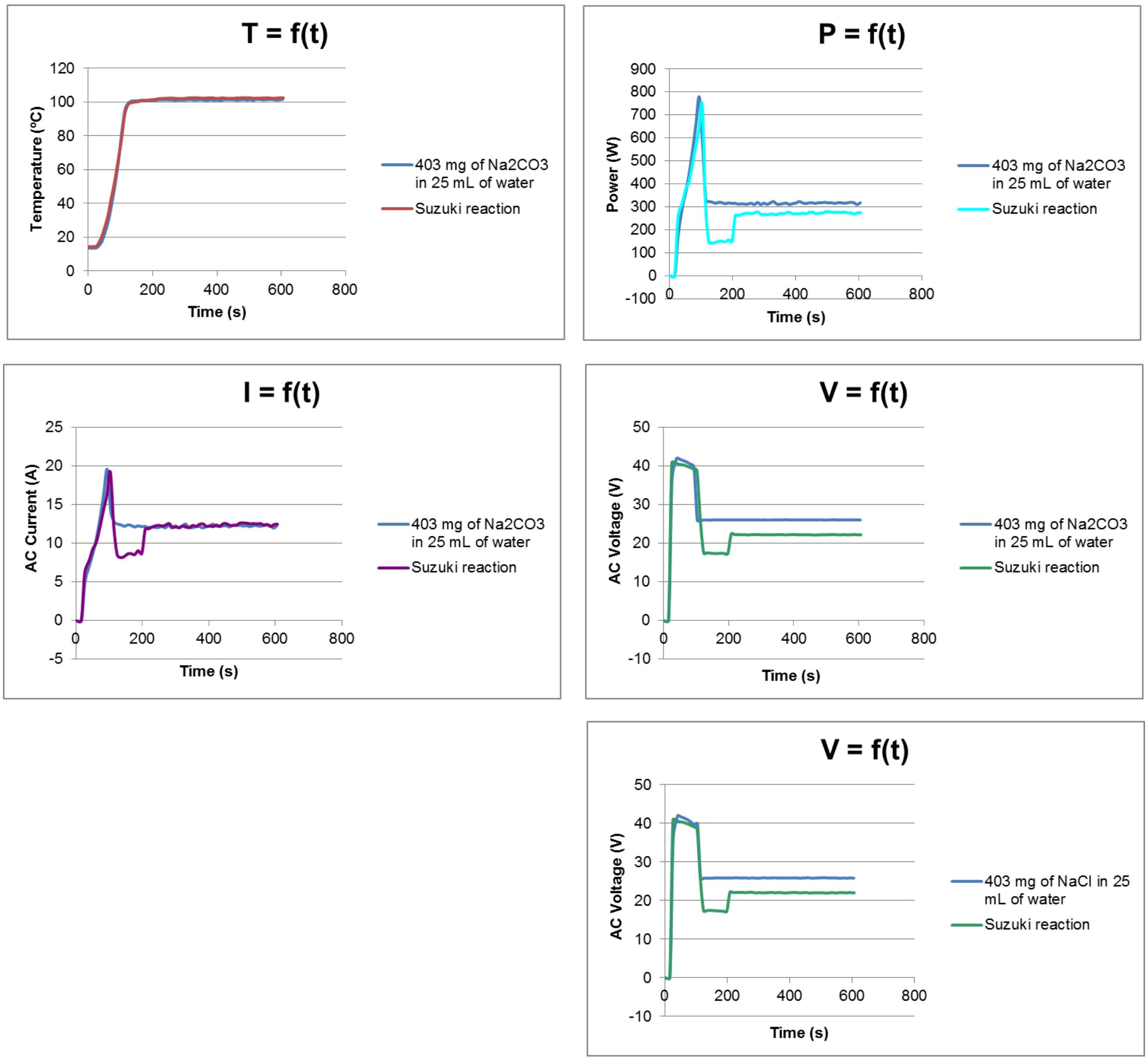


Figure S10 –Results of monitoring the heating power (Temperature, Power, AC Current and AC Voltage): comparison between the results of the Na_2CO_3 solution (c=0.15 moldm^{-3}) and those of the Suzuki reaction.

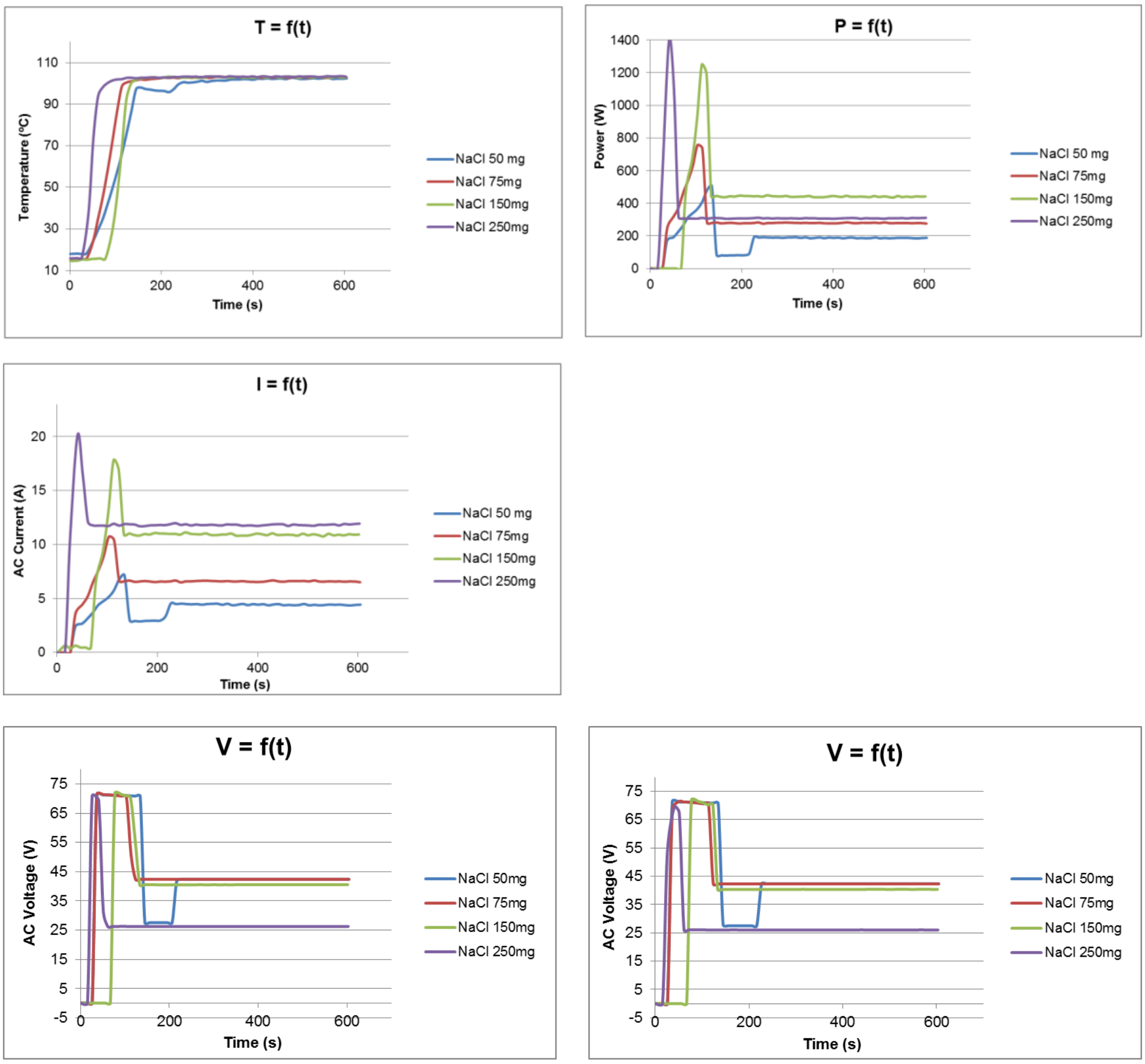


Figure S11 – Results of monitoring the heating power (Temperature, Power, AC Current and AC Voltage): ohmic heating of NaCl solutions with different concentrations (volume of water: 25 mL; position 10 on the power amplifier to reach the reflux, then the power was reduced manually to maintain the reflux).

3. NMR Spectra

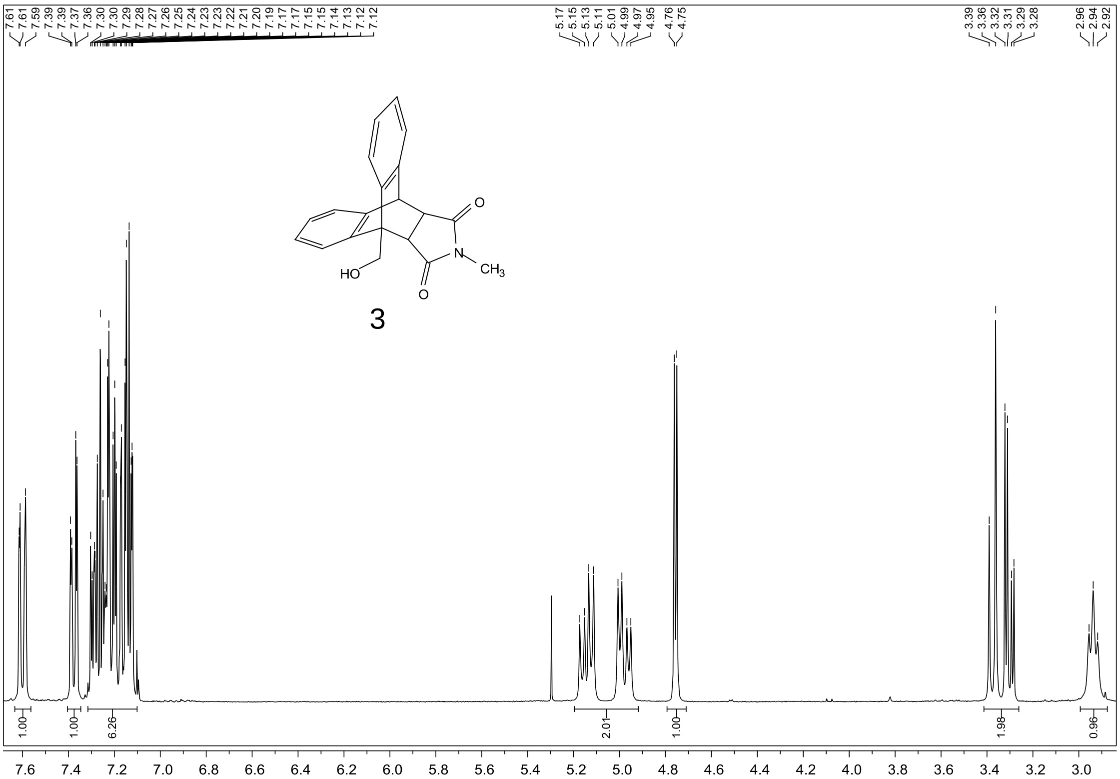


Figure S12. ^{1}H NMR spectrum of compound **3** ($CDCl_3$; 300.13 MHz).

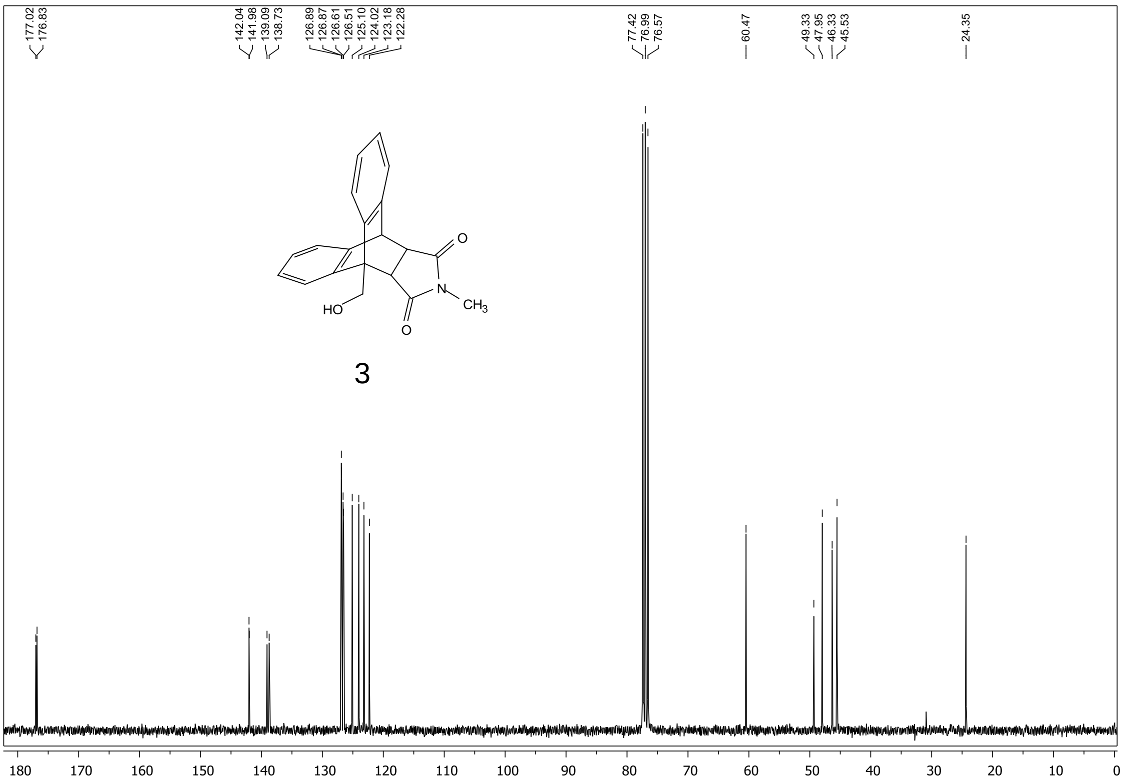
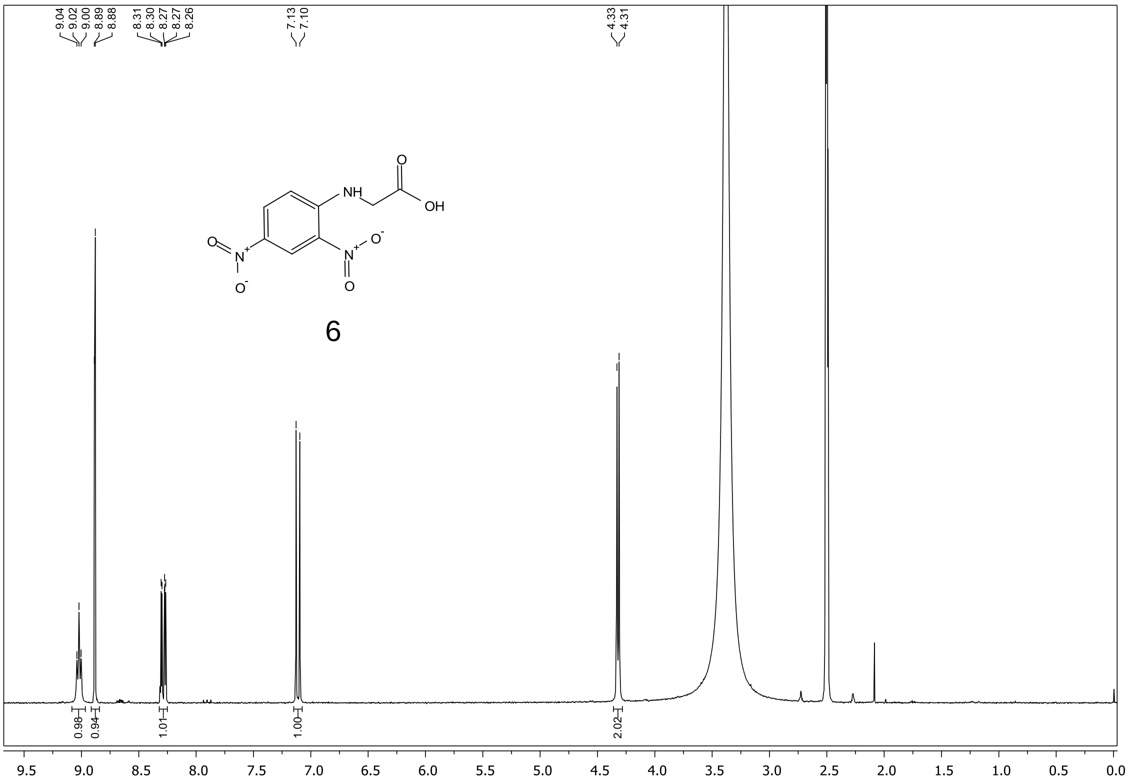


Figure S13. ^{13}C NMR spectrum of compound **3** ($CDCl_3$; 75.47 MHz).



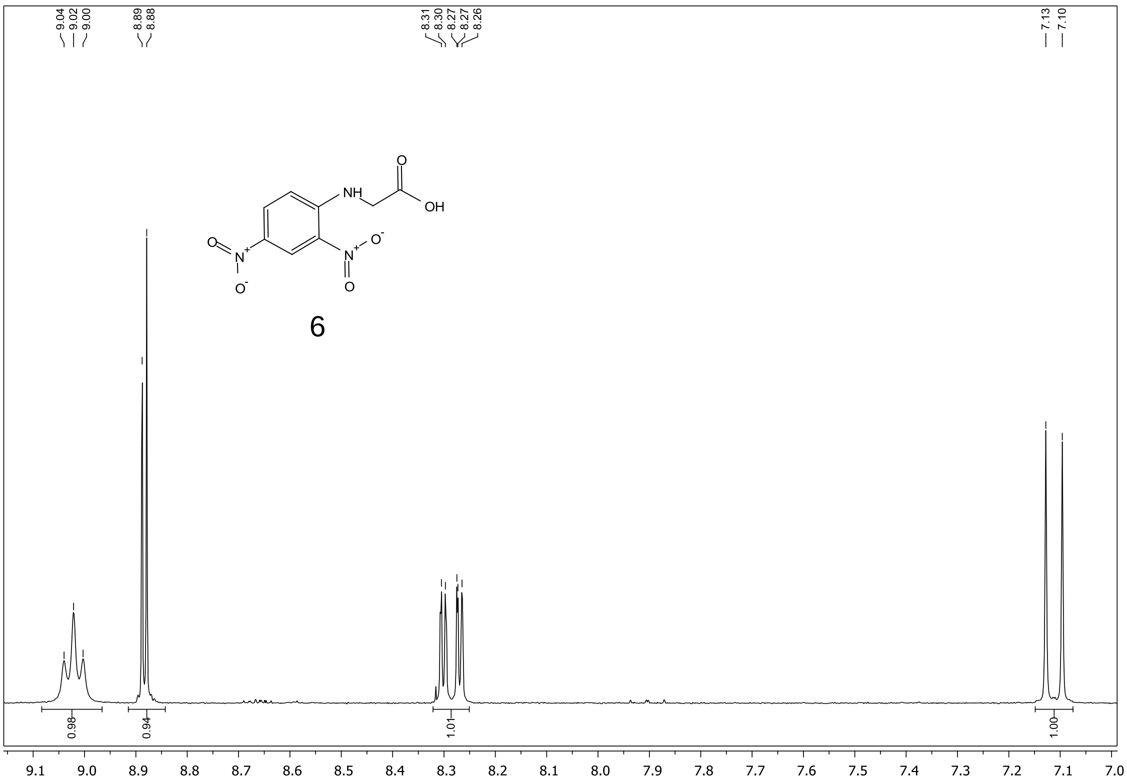


Figure S14. ^{1}H NMR spectra of compound **6** (DMSO-d_6; 300.13 MHz).

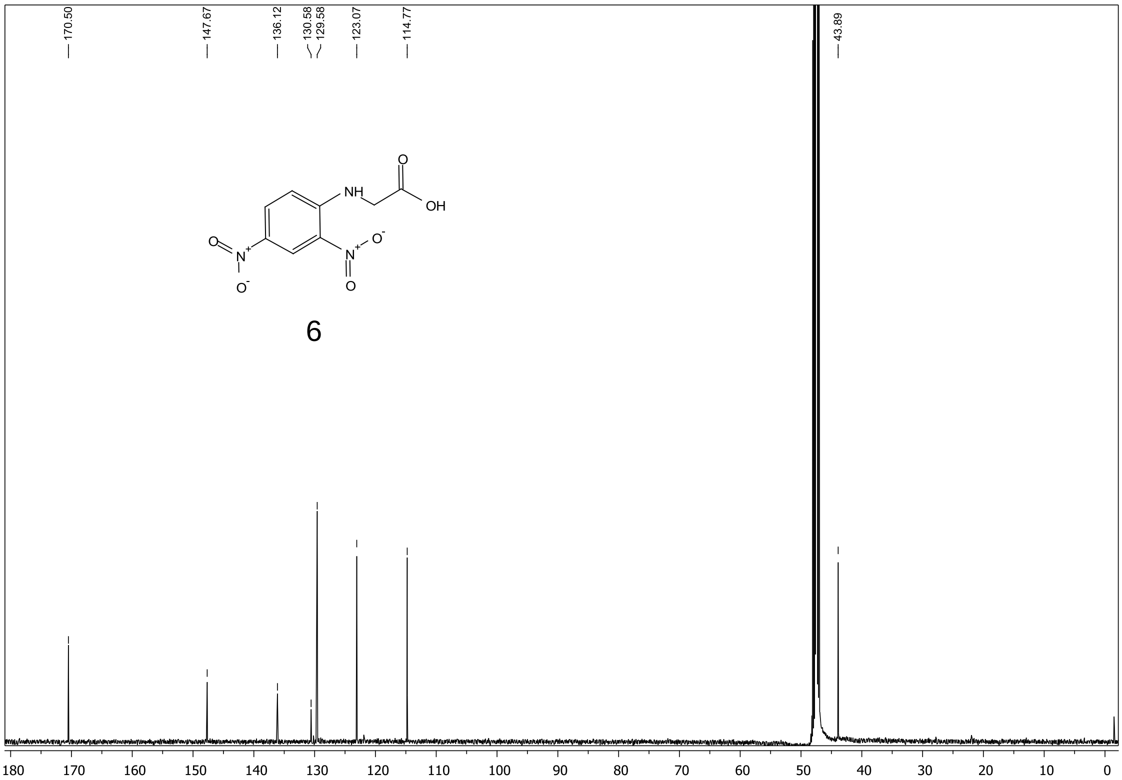


Figure S15. ^{13}C NMR spectrum of compound **6** (DMSO-d_6; 125.27 MHz).

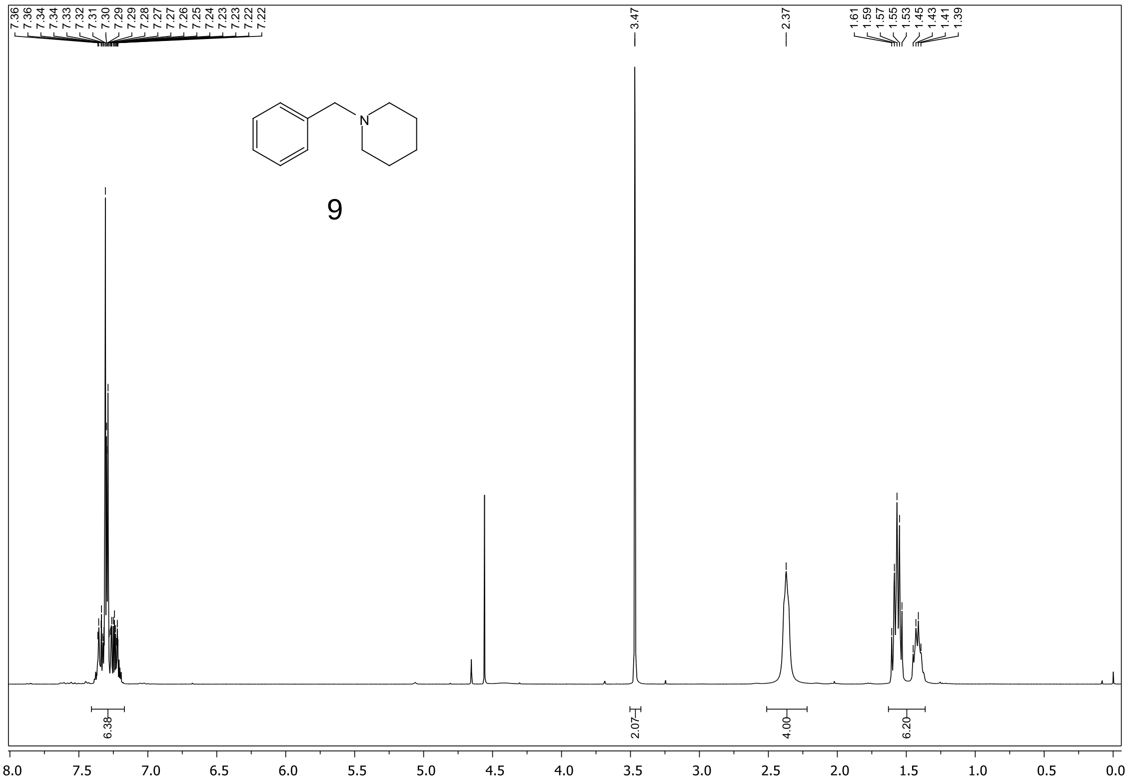


Figure S16. ^{1}H NMR spectrum of compound **9** ($CDCl_3$; 300.13 MHz)

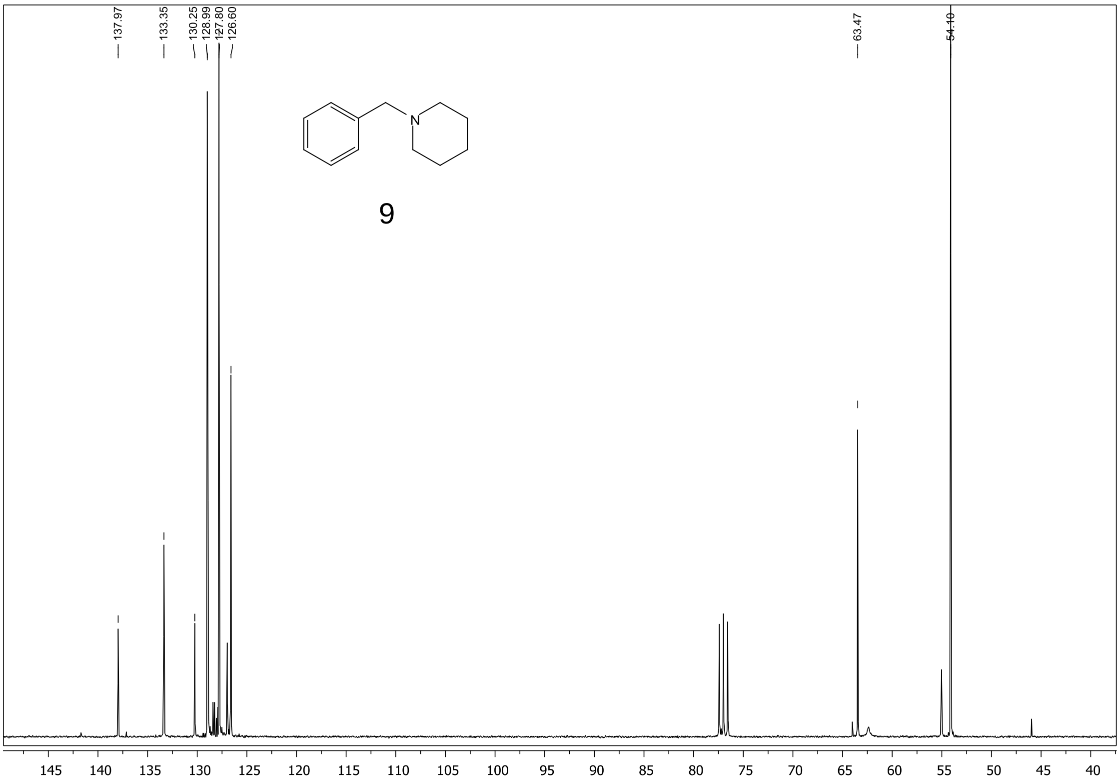
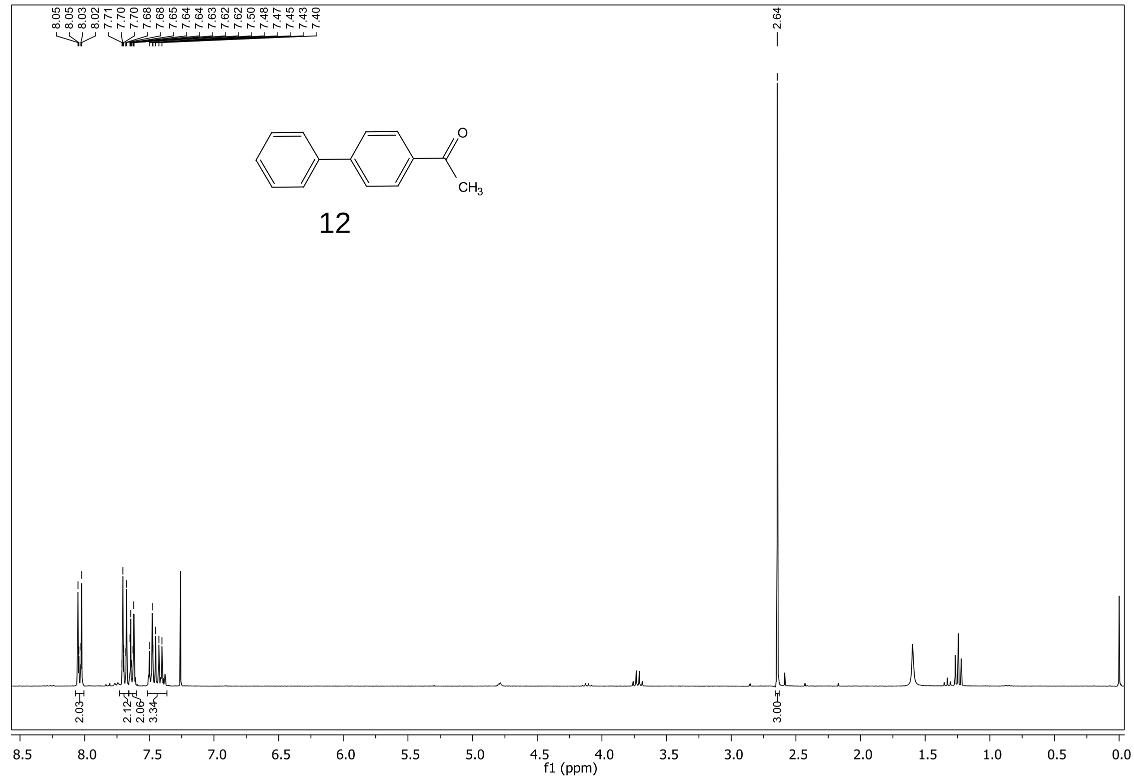


Figure S17. ^{13}C NMR spectrum of compound **9** ($CDCl_3$; 75.47 MHz).



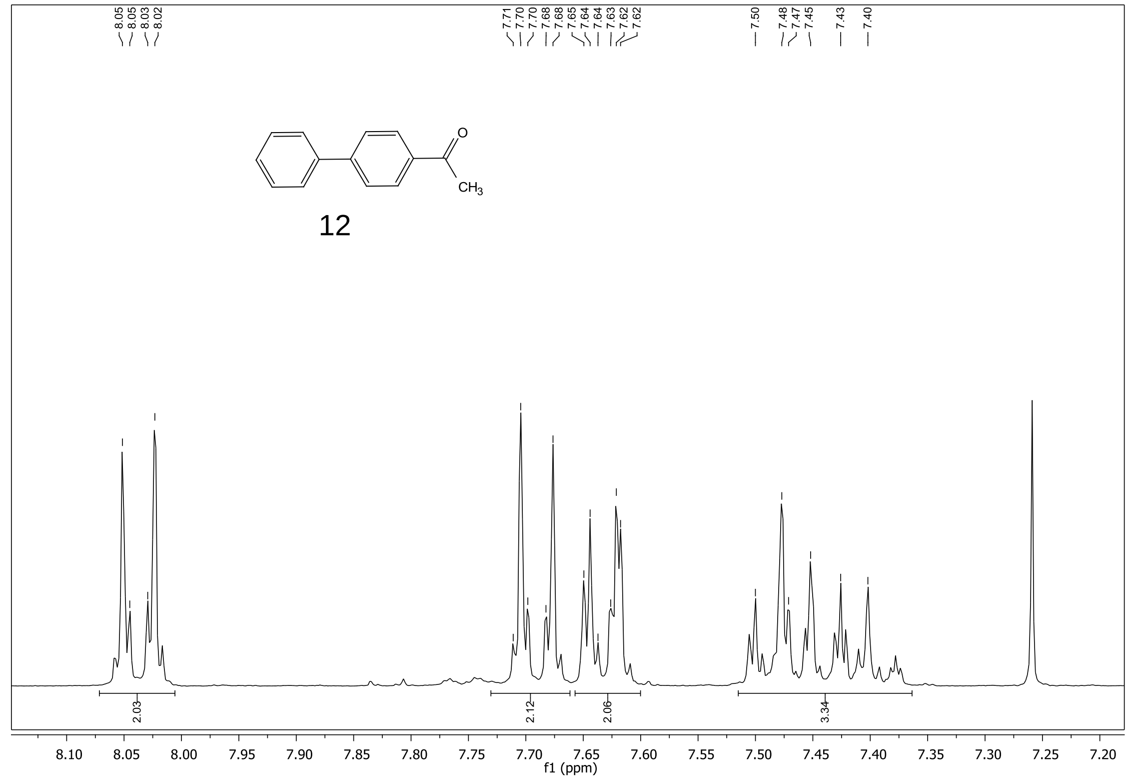


Figure S18. ^{1}H NMR spectra of compound **12** ($CDCl_3$; 300.13 MHz).

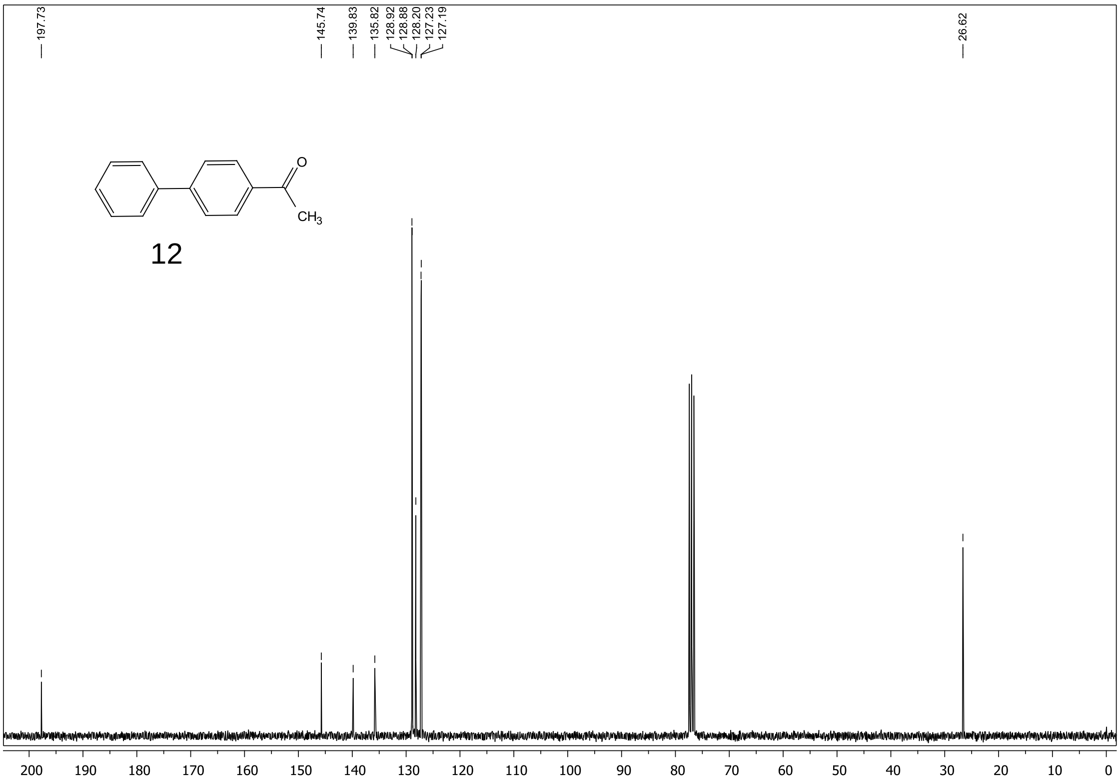


Figure S19. ^{13}C NMR spectrum of compound **12** ($CDCl_3$; 75.47 MHz).