

A novel green route for the synthesis of *N*-phenylacetamides, benzimidazoles and acridinediones using *Candida parapsilosis* ATCC 7330

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SUPPORTING INFORMATION

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General procedure for the synthesis of enaminones (4a-4e)¹

Equimolar mixture of cyclohexane-1,3-dione (112 mg, 1 mmol) was taken and mixed with the amine (1 equiv.) in a 50 ml RB flask. The unsealed RB flask containing the reaction mixture was kept in a beaker and irradiated with microwave radiation (domestic microwave oven of Power 300 W) for a specified period (6-20 min) to get the corresponding enaminones (75-89% yield). All the products were purified by column chromatography and characterized by spectral techniques.

Preparation of standard amides²

4-Methoxyaniline (0.7 mL, 6.1 mmol, and 0.5 equiv.), acetic anhydride (0.7 mL, 7.3 mmol and 0.6 equiv.) and dry DCM (18 mL) were added to a round-bottom flask and the reaction mixture was stirred at room temperature and was monitored by TLC at regular intervals of time. After the completion of reaction, the reaction mixture was washed with a saturated solution of sodium carbonate, the organic layers were dried over anhydrous Na₂SO₄ and the solvent was removed under reduced pressure. The reaction mixture was purified by column chromatography with hexane/ethyl acetate to get *N*-aryl amides in 50-68% yield.

General procedure for the synthesis of benzimidazoles using whole cells of *C. parapsilosis* ATCC 7330

2-phenylenediamine **1g** (0.67 mmol, 72 mg) dissolved in ethanol (1.5 mL) was added into a 150 mL Erlenmeyer flask containing the cells (18 g wet wt) in water (15 mL) and stirred on an orbital shaker at 200 rpm for 24 h at 35 °C. The reaction was performed in triplicates. The conversions were determined by HPLC using a C18 column with flow rate of 0.5 mL/min using acetonitrile: water (40:60) as eluent. After completion of the reaction, the reaction mixture was extracted by ethylacetate (3 X 10 mL) the organic layer was dried over anhydrous sodium sulphate and concentrated under high vacuum. The crude product was purified by column chromatography on silica gel (mesh size 100–200) using ethyl acetate and hexane mixture (80:20), to give the product in 84% yield. Similar procedure was followed for other diamines. Under identical conditions control experiments were done without whole cells. All the products were characterised by ¹H, ¹³C NMR and IR spectroscopy.

General procedure for the synthesis of acridinediones using whole cells of *C. parapsilosis* ATCC 7330

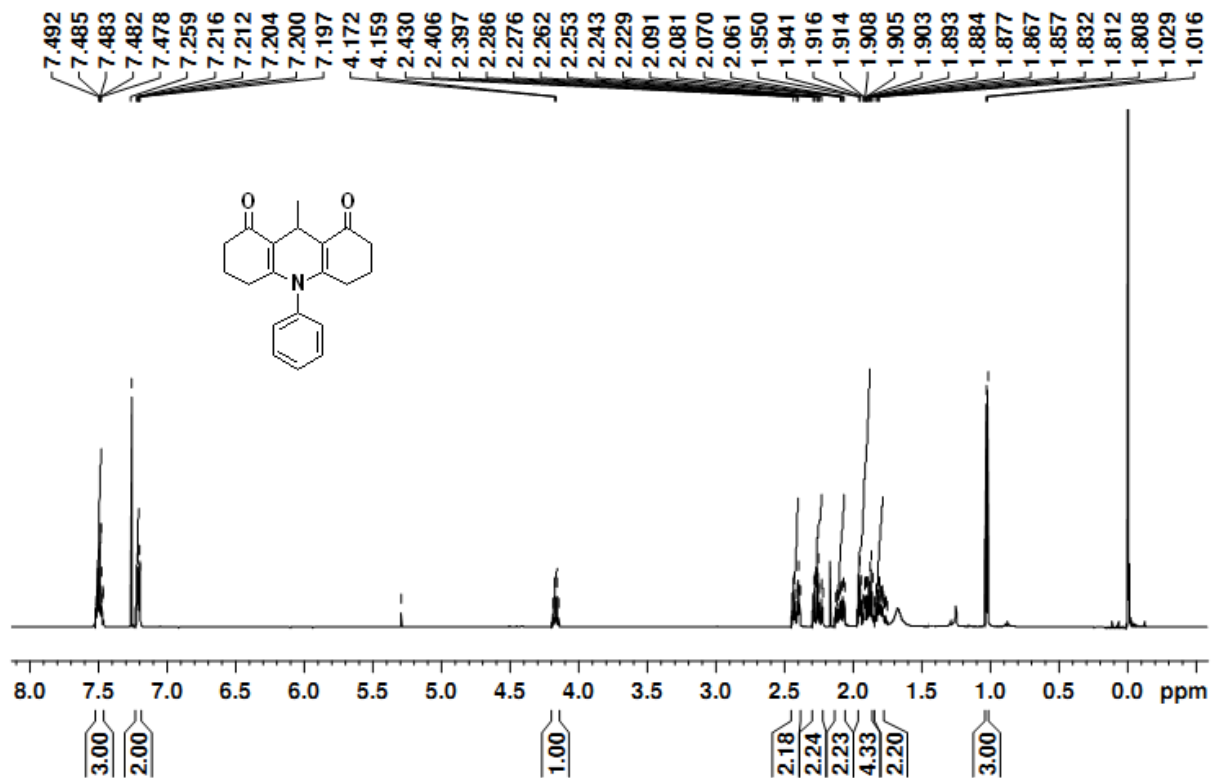
3-(phenylamino)cyclohex-2-enone **4a** (0.37 mmol, 72 mg) dissolved in ethanol (1.5 mL) was added into a 150 mL Erlenmeyer flask containing the cells (18 g wet wt) in water (15 mL) and stirred on an orbital shaker at 200 rpm for 24 h at 35 °C. The reaction was performed in triplicates. The conversions were determined by HPLC using a C18 column with flow rate of 0.5 mL/min using acetonitrile: water (85:15) as eluent. After completion of the reaction, the reaction mixture was extracted by ethylacetate (3 X 10 mL) the organic layer was dried over anhydrous sodium sulphate and concentrated under high vacuum. The crude product was purified by column chromatography on silica gel (mesh size 100–200) using dichloromethane and methanol mixture (99:01), to give the product in 48% yield. Similar procedure was followed for other diamines. Under identical conditions control experiments were done without whole cells. All the products were characterised by ¹H, ¹³C NMR and IR spectroscopy.

References

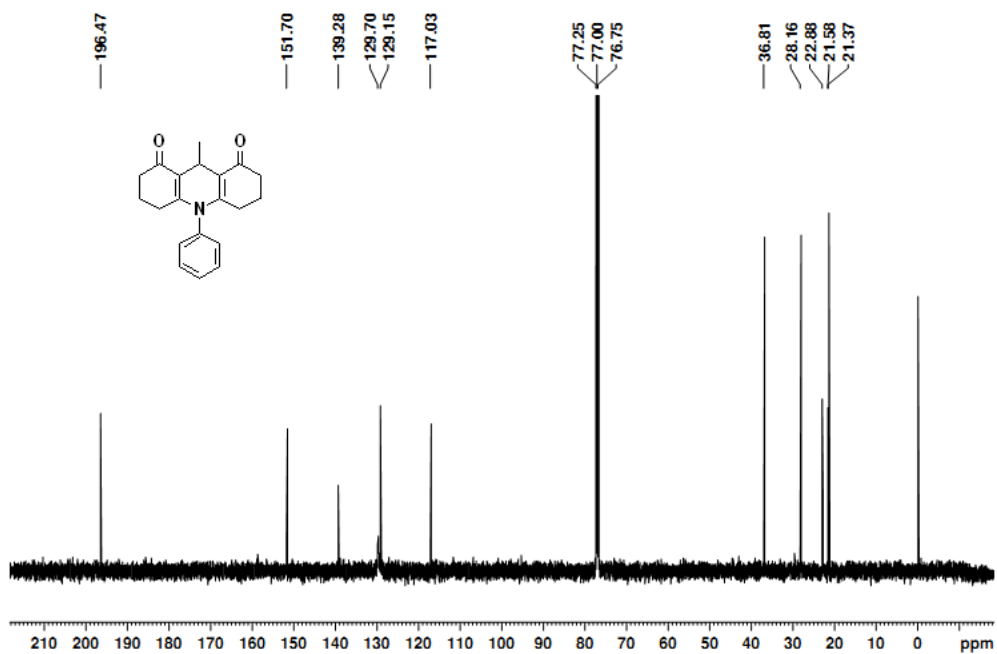
1. C. K. Z. Andrade, A. F. S. Barreto and W. A. Silva, *Arkivoc*, 2008 (xii), 226-232.
2. F. Zhou, X. Han, X. Lu, *Tetrahedron Lett.*, 2011, **52**, 4681-4685.

Spectral analysis of acridinediones

^1H NMR spectrum of 5a



^{13}C NMR spectrum of 5a



HRMS data for 5a

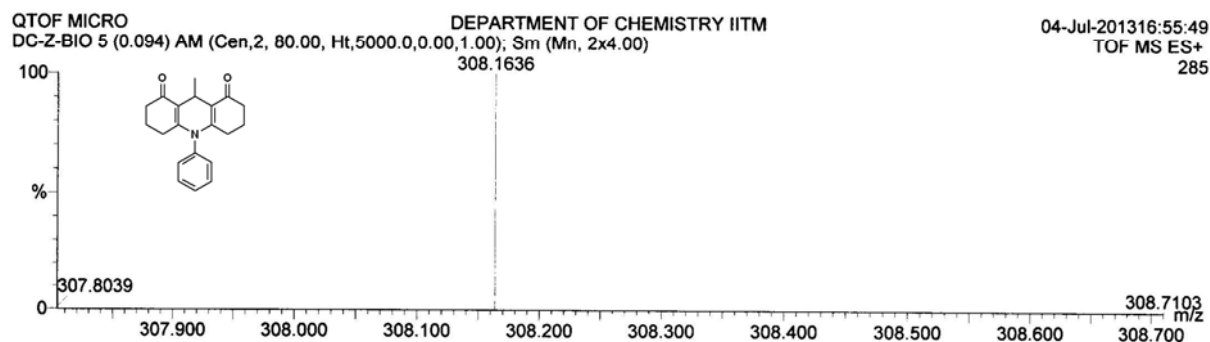
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Isotope cluster parameters: Separation = 1.0 Abundance = 1.0%

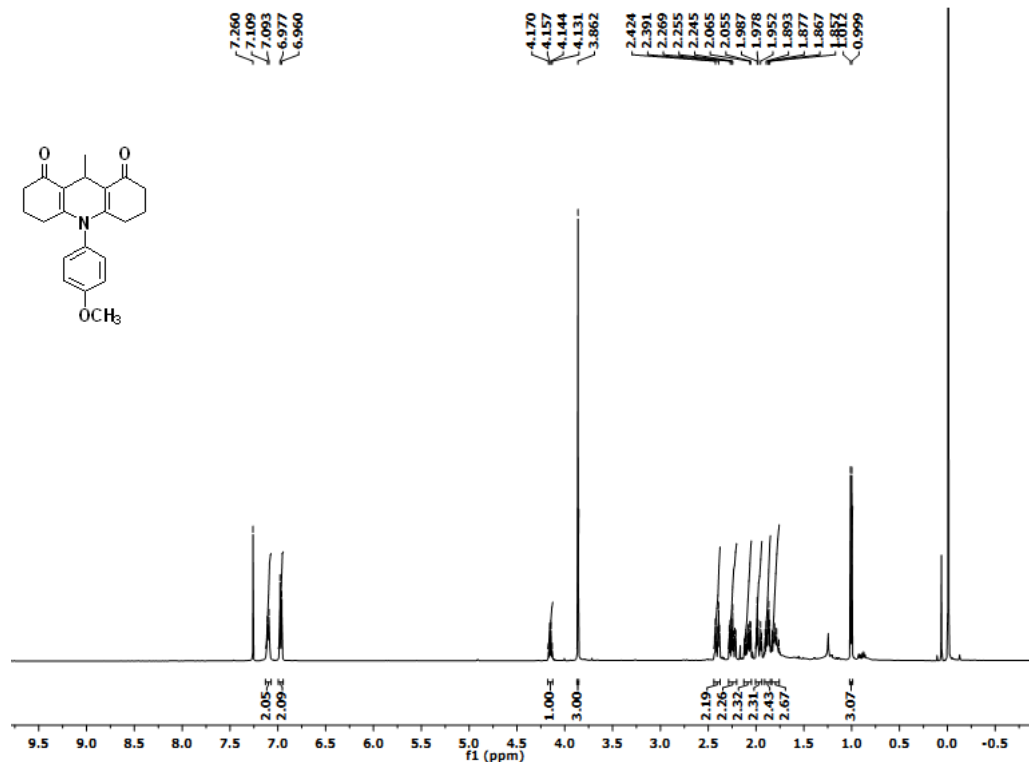
Monoisotopic Mass, Odd and Even Electron Ions

3 formula(e) evaluated with 1 results within limits (all results (up to 1000) for each mass)

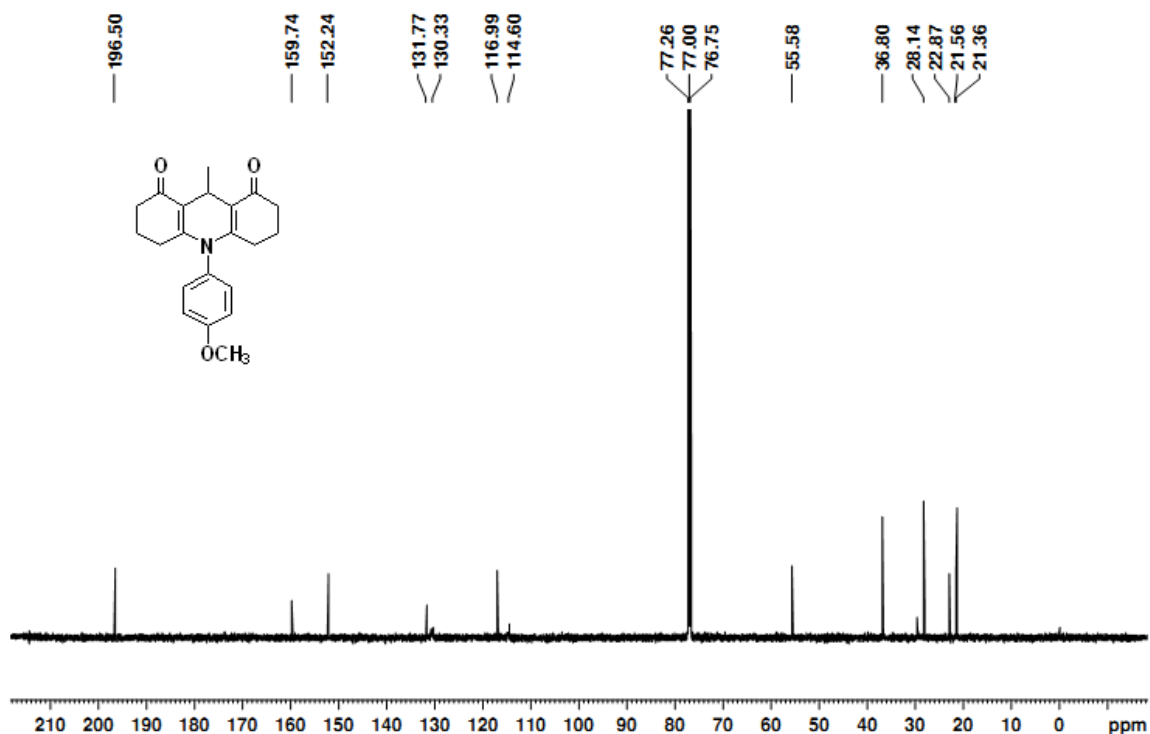


Minimum:							
Maximum:	200.0	5.0		-1.5			
				50.0			
Mass	Calc. Mass	mDa	PPM	DBE	Score	Formula	
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¹H NMR spectrum of 5b



¹³C NMR spectrum of 5b



HRMS data for 5b

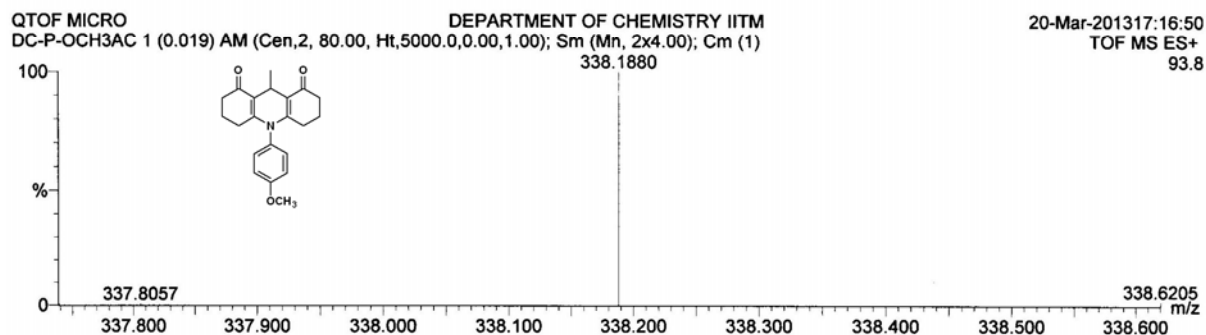
Single Mass Analysis

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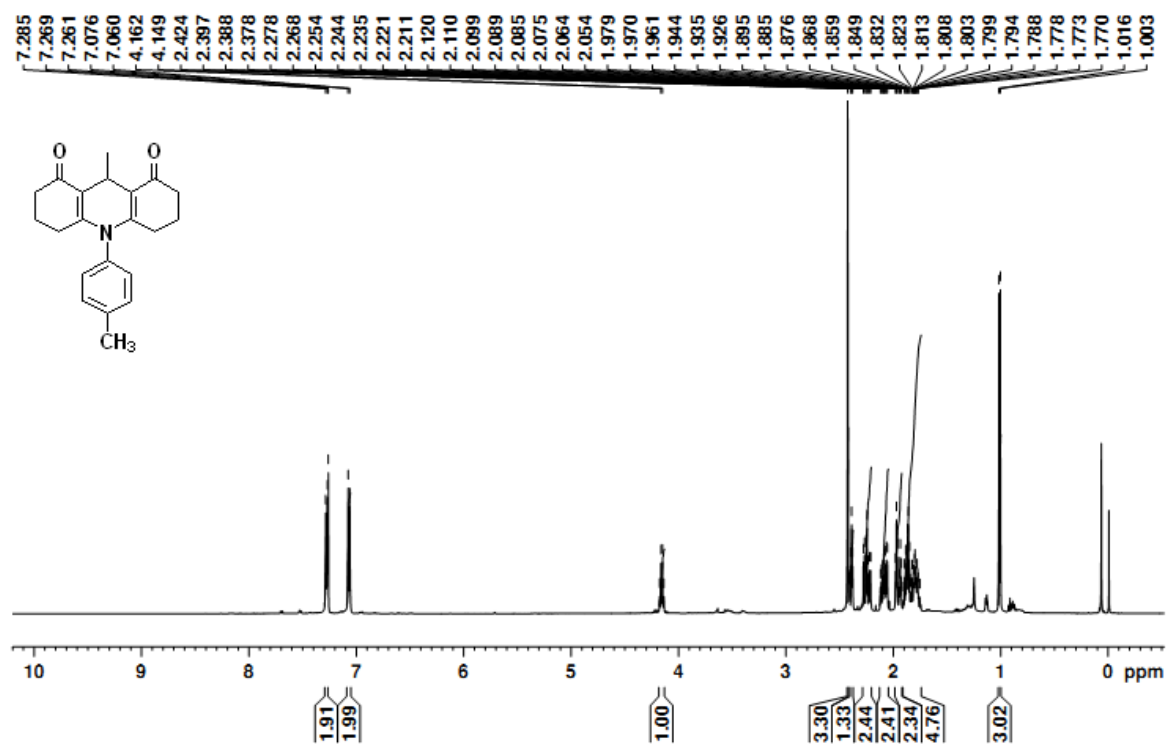
Monoisotopic Mass, Odd and Even Electron Ions

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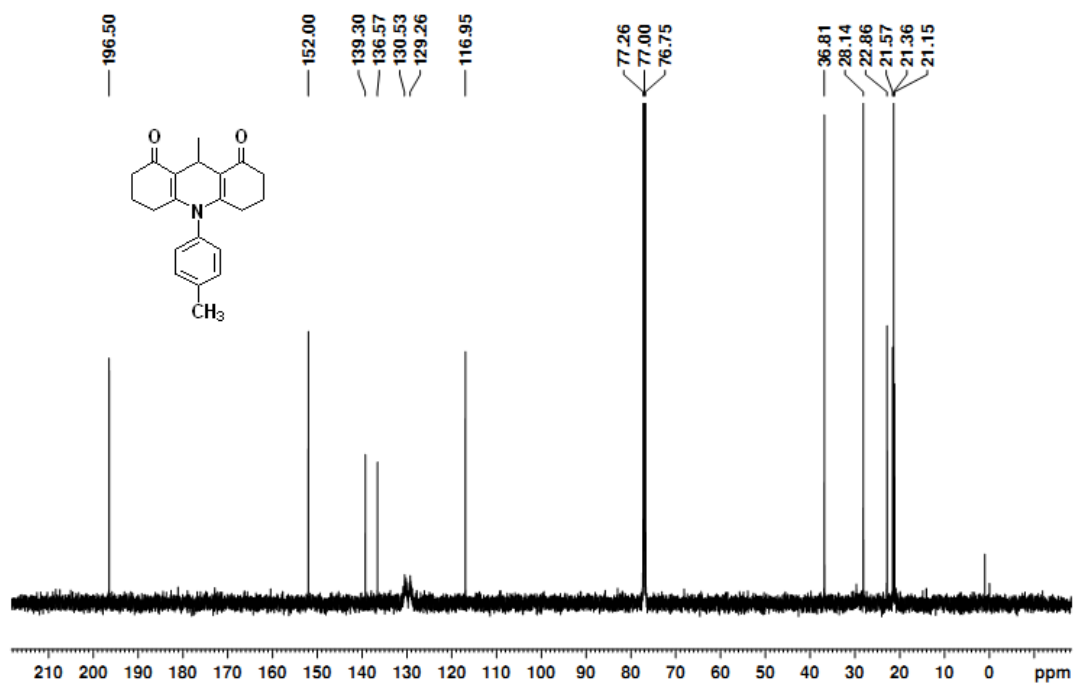


Mass	Calc. Mass	mDa	PPM	DBE	Score	Formula
338.1880	338.1882	-0.2	-0.7	10.0	1	C21 H24 N O3

¹H NMR spectrum of 5c



¹³C NMR spectrum of 5c



HRMS data for 5c

Single Mass Analysis

Tolerance = 200.0 mDa / DBE: min = -1.5, max = 50.0

Isotope cluster parameters: Separation = 1.0 Abundance = 1.0%

Monoisotopic Mass, Odd and Even Electron Ions

3 formula(e) evaluated with 1 results within limits (all results (up to 1000) for each mass)

QTOF MICRO

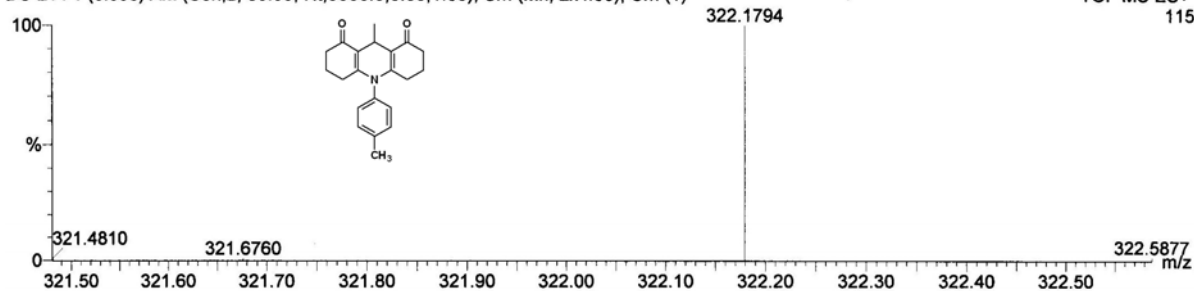
DC-214 1 (0.038) AM (Cen,2, 80.00, Ht,5000.0,0.00,1.00); Sm (Mn, 2x4.00); Cm (1)

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16-Apr-2013 12:15:20

TOF MS ES+

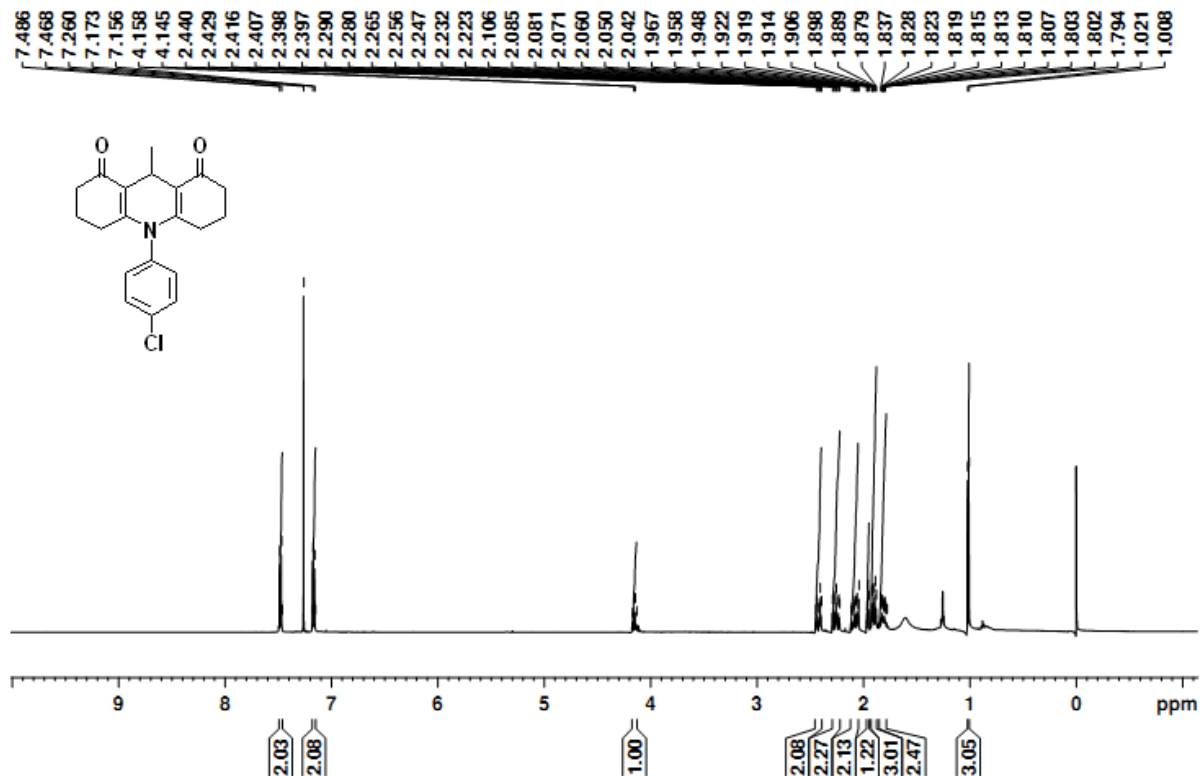
115



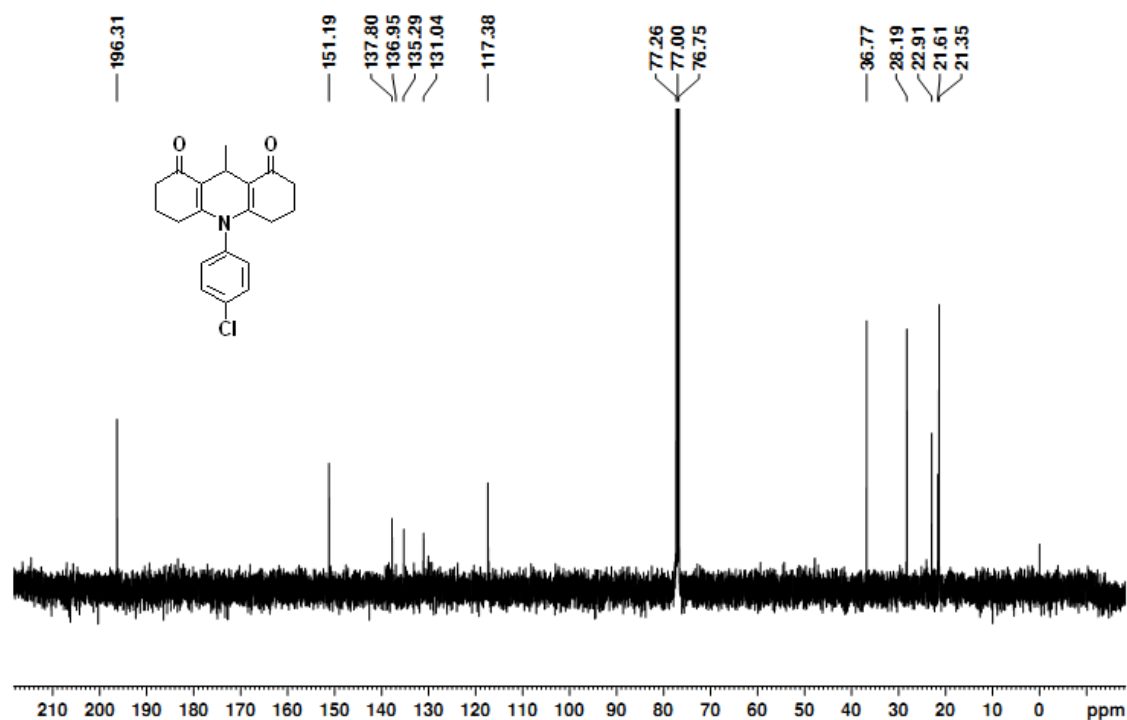
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Maximum: 200.0 5.0 50.0

Mass	Calc. Mass	mDa	PPM	DBE	Score	Formula
322.1794	322.1807	-1.3	-4.0	10.5	1	C21 H24 N O2

¹H NMR spectrum of 5d



¹³C NMR spectrum of 5d



HRMS data for 5d

Single Mass Analysis

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Isotope cluster parameters: Separation = 1.0 Abundance = 1.0%

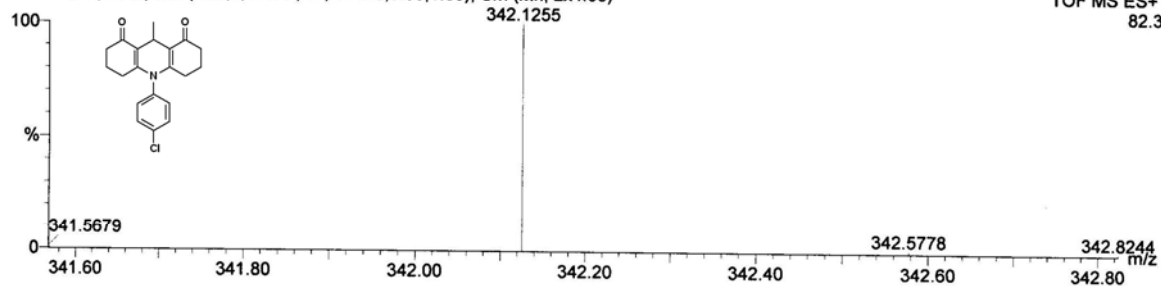
Monoisotopic Mass, Odd and Even Electron Ions

9 formula(e) evaluated with 1 results within limits (all results (up to 1000) for each mass)

QTOF MICRO

DEPARTMENT OF CHEMISTRY IITM
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20-Mar-2013 16:44:11
 TOF MS ES+
 82.3



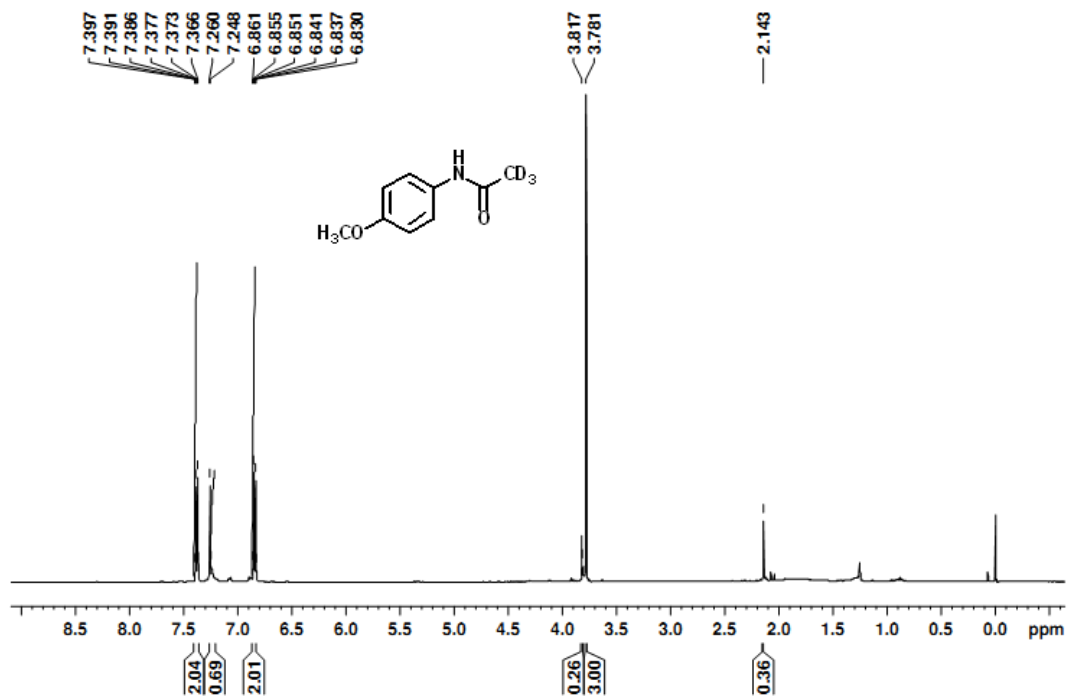
Minimum:

Maximum: 200.0 5.0 -1.5 50.0

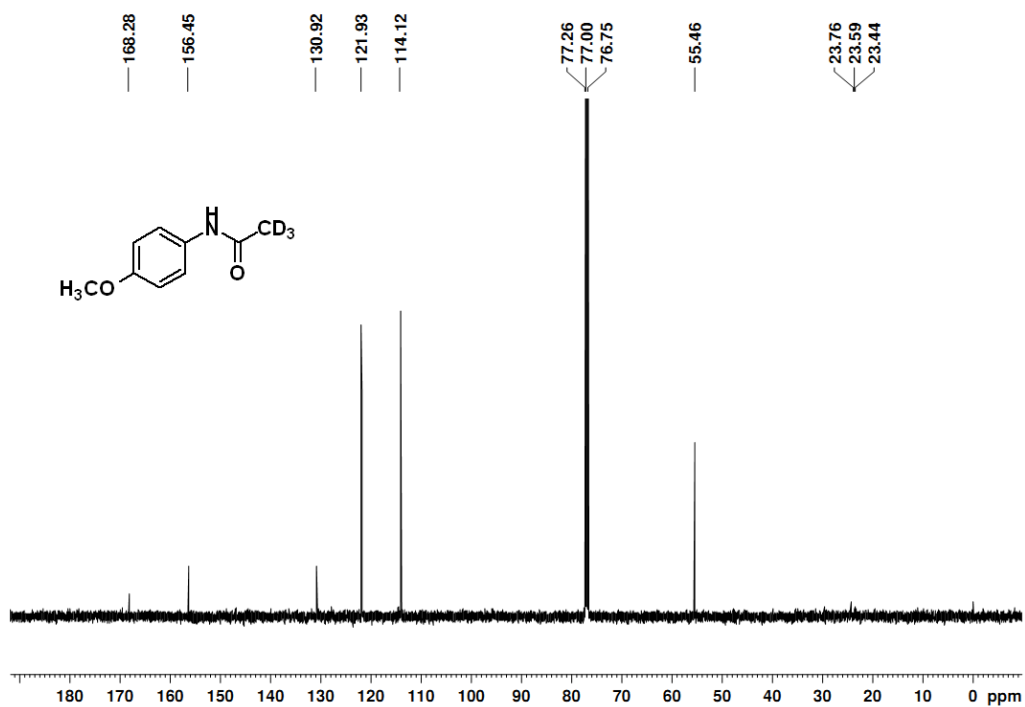
Mass	Calc. Mass	mDa	PPM	DBE	Score	Formula
342.1255	342.1261	-0.6	-1.8	10.5	1	C ₂₀ H ₂₁ N O ₂ Cl

NMR spectra of deuterated and undeuterated *N*-(4-methoxyphenyl) acetamide

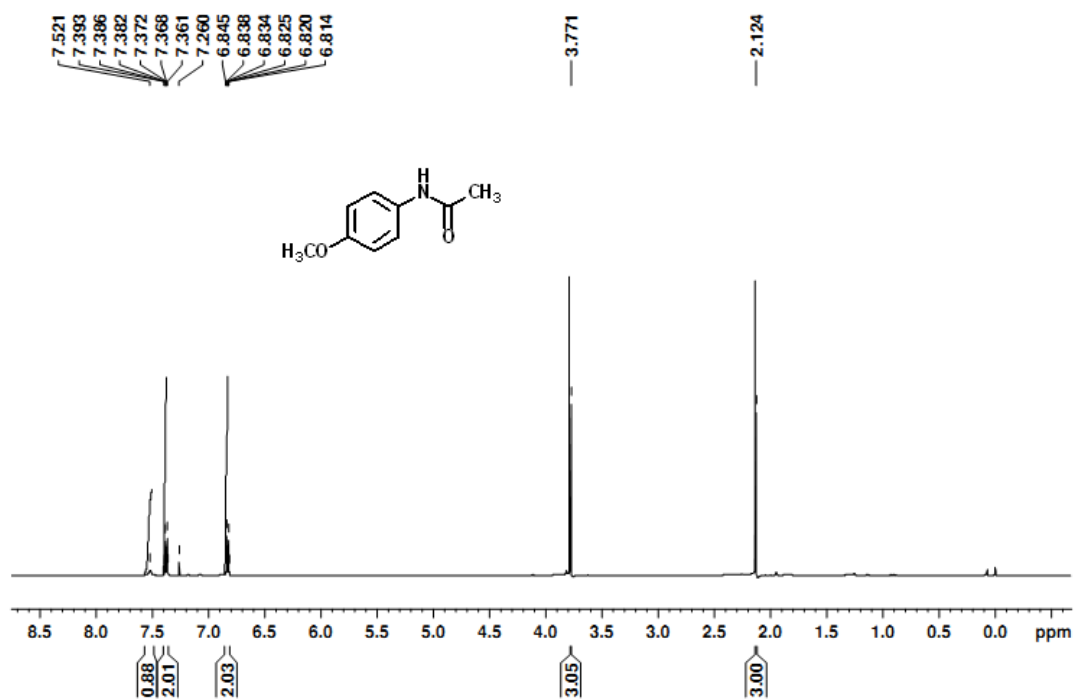
¹H NMR spectrum of 3a



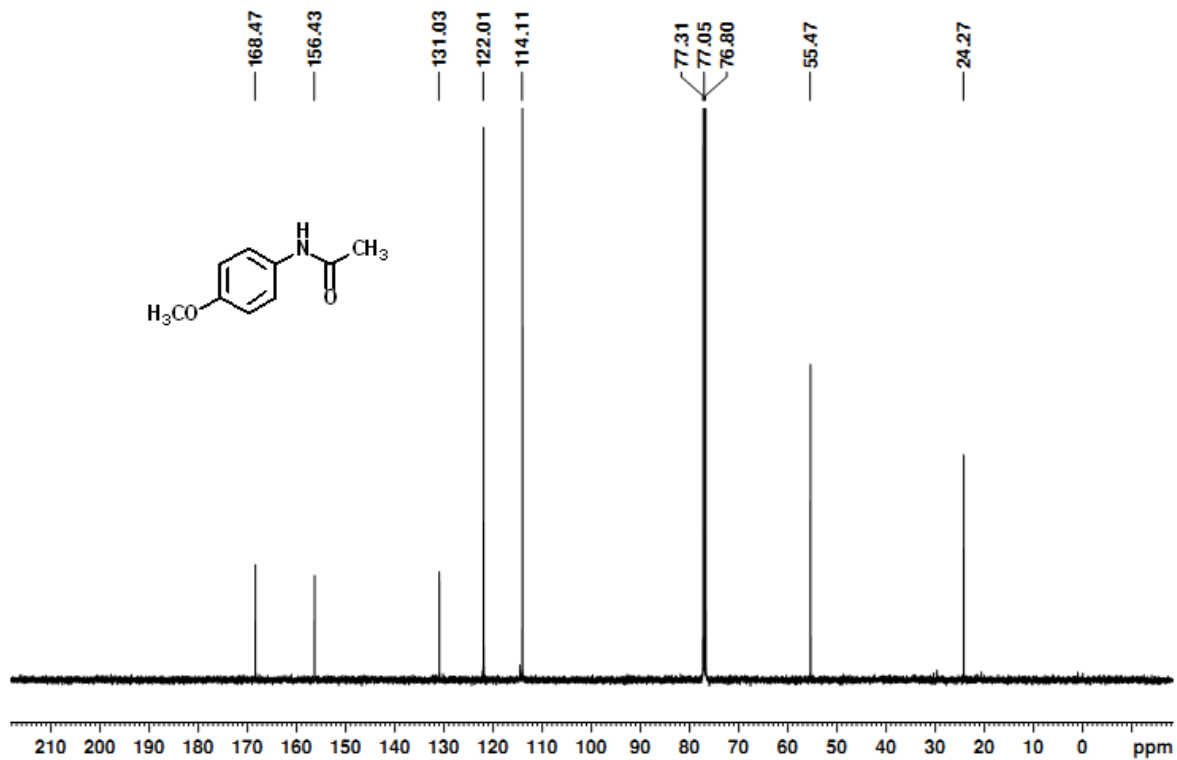
¹³C NMR spectrum of 3a



¹H NMR spectrum of 2b

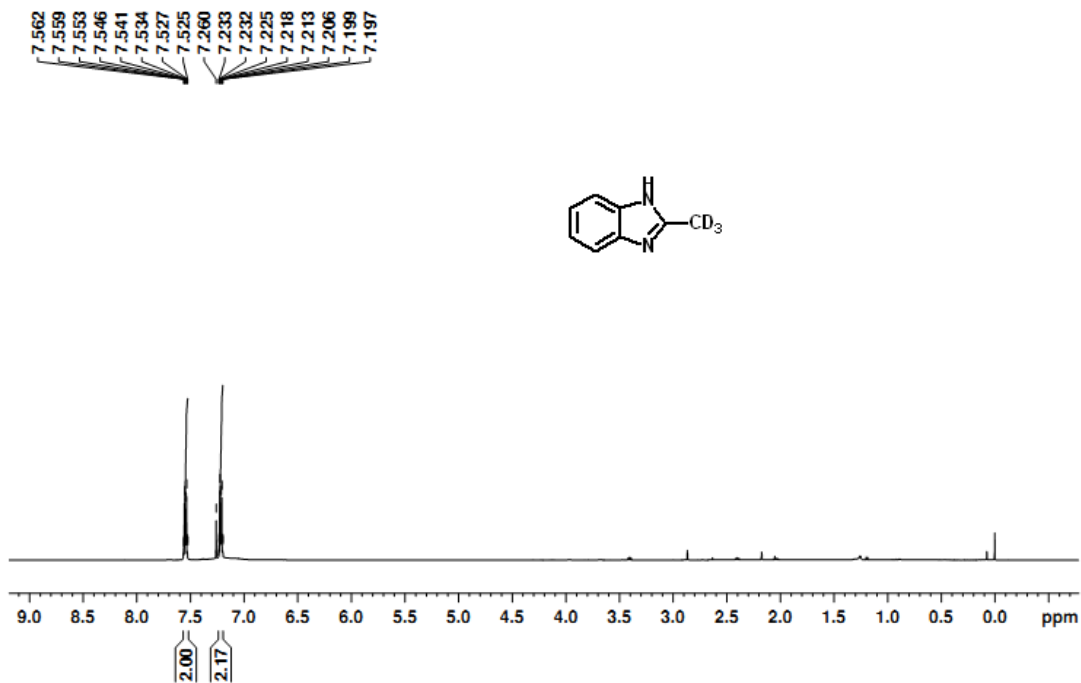


¹³C NMR spectrum of 2b

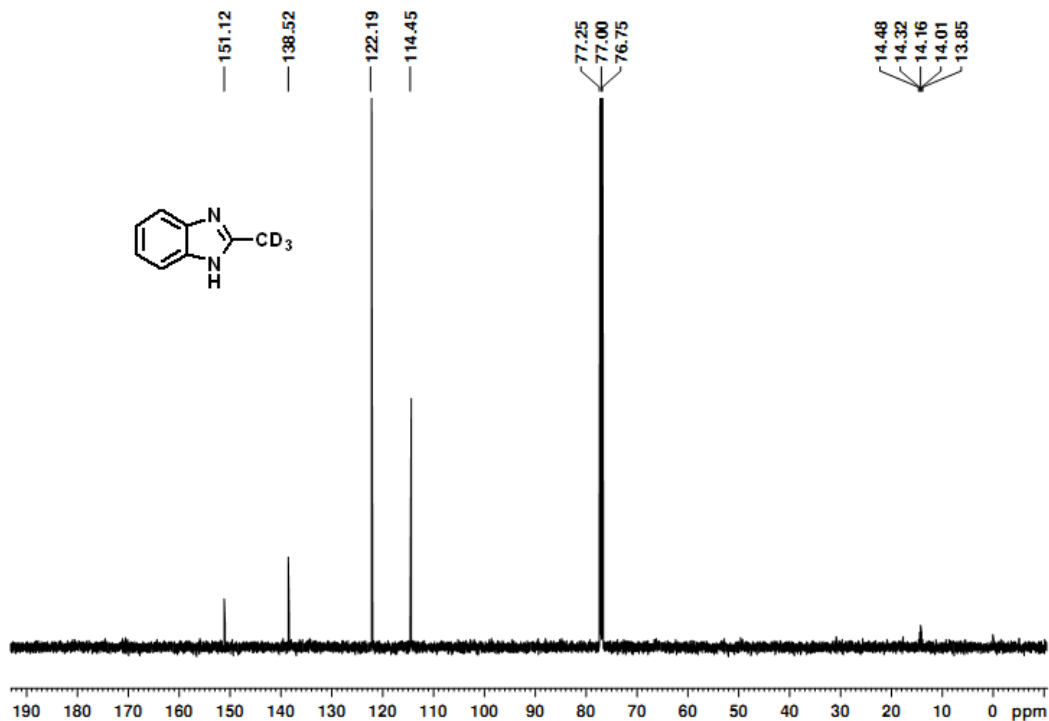


NMR spectra of deuterated and undeuterated 2-methylbenzimidazole

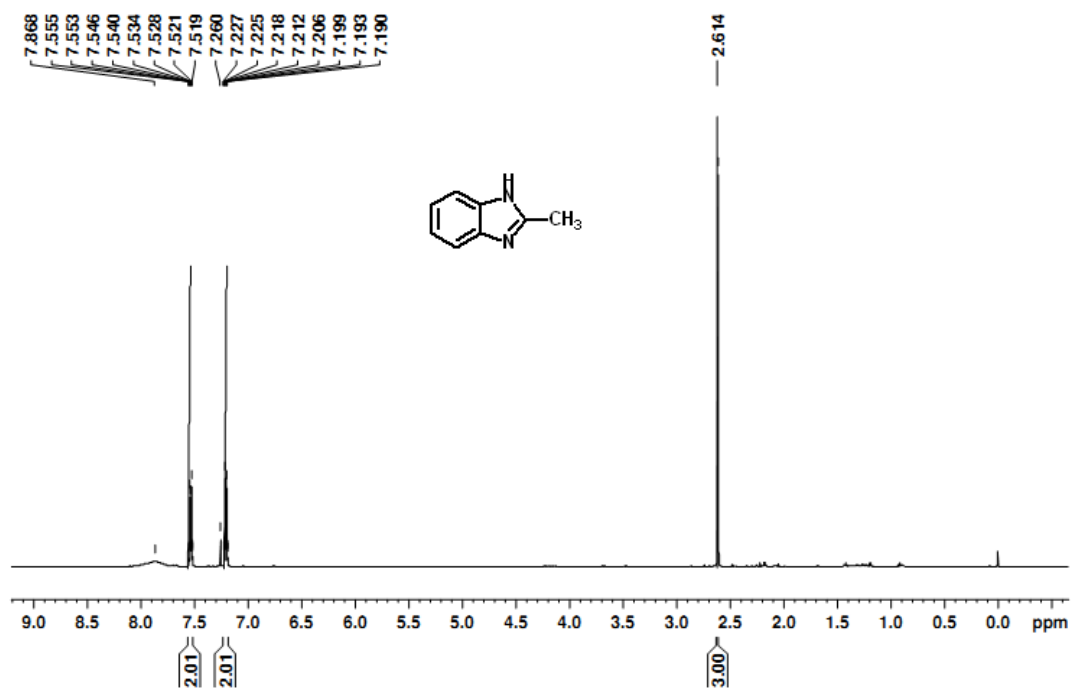
¹H NMR spectrum of 3b



¹³C NMR spectrum of 3b



^1H NMR spectrum of 2g



^{13}C NMR spectrum of 2g

