

## SUPPORTING INFORMATION

**Name of Journal: New Journal of Chemistry**

### **Biomass Waste-Derived Recyclable Heterogeneous Catalyst for Aqueous Aldol Reaction and Depolymerization of PET Waste**

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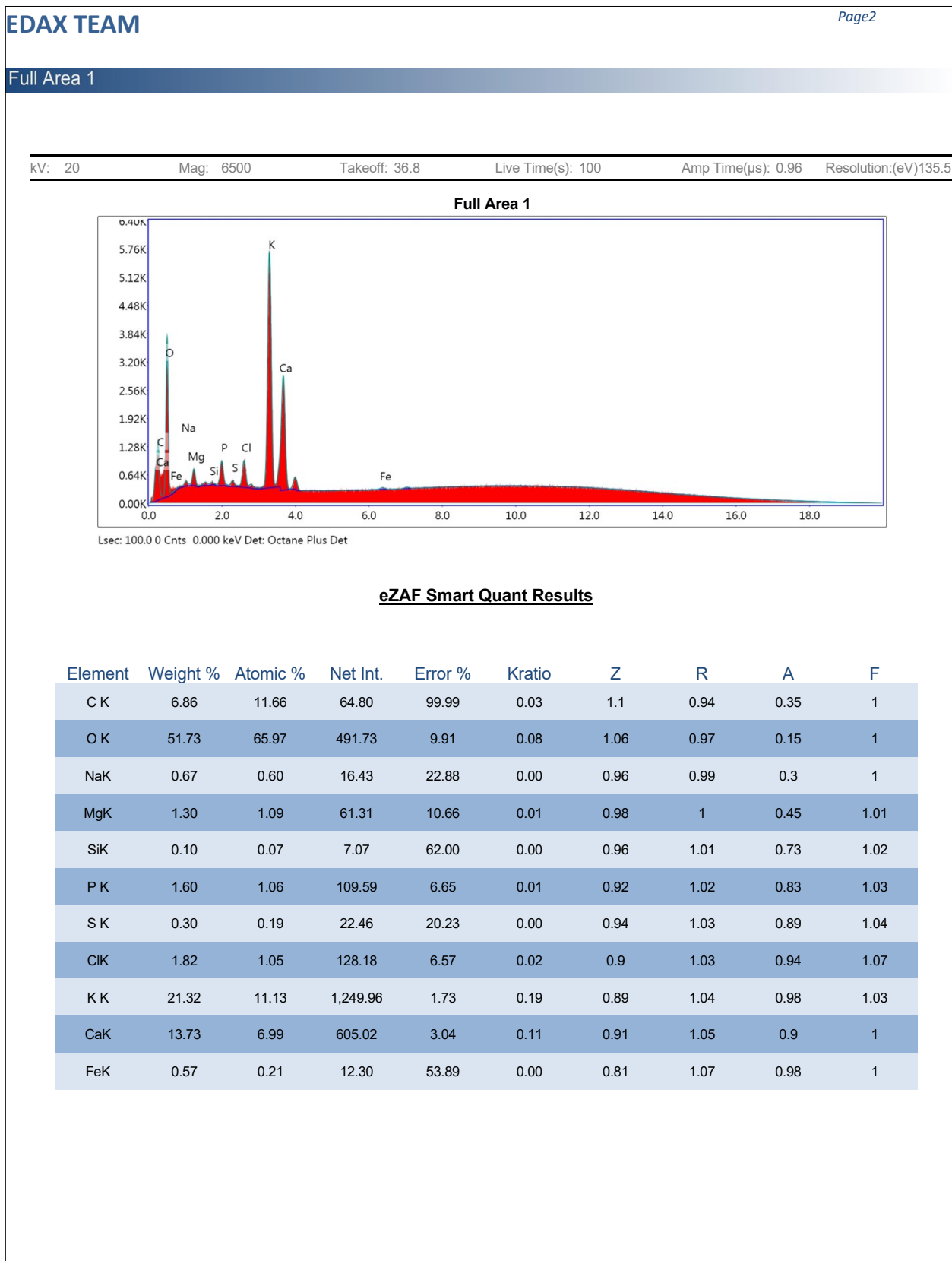
\* Corresponding author: [mapuiakhiangte@gmail.com](mailto:mapuiakhiangte@gmail.com)

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**Table S1:** XRF Analysis of OPA Catalyst.

Sl. No	Metal oxides	Concentration (%)
1	CaO	31.322
2	K <sub>2</sub> O	29.38
3	SO <sub>3</sub>	15.792
4	MgO	7.037
5	P <sub>2</sub> O <sub>5</sub>	5.188
6	Fe <sub>2</sub> O <sub>3</sub>	2.152
7	SiO <sub>2</sub>	1.115
8	MnO	0.268
9	CuO	0.201
10	Cr <sub>2</sub> O <sub>3</sub>	0.129
11	Al <sub>2</sub> O <sub>3</sub>	0.123
12	Na <sub>2</sub> O	0.108

**Figure S1: EDX data of fresh OPA**



Filename: ...m-Dept-PU-C-Samson-SM-02-2021USAVE.ttd  
 Operator ID: SICART  
 Sample ID: Heterogeneous Catalyst (SM-02)  
 Sample Weight: 11.317 mg  
 Comment: samson talhmanqalizuqala /Dr.K.Vanlalidipua, Dept of Chem,pachhunga Uni College, Aizawal  
 ID No-352/2020-21

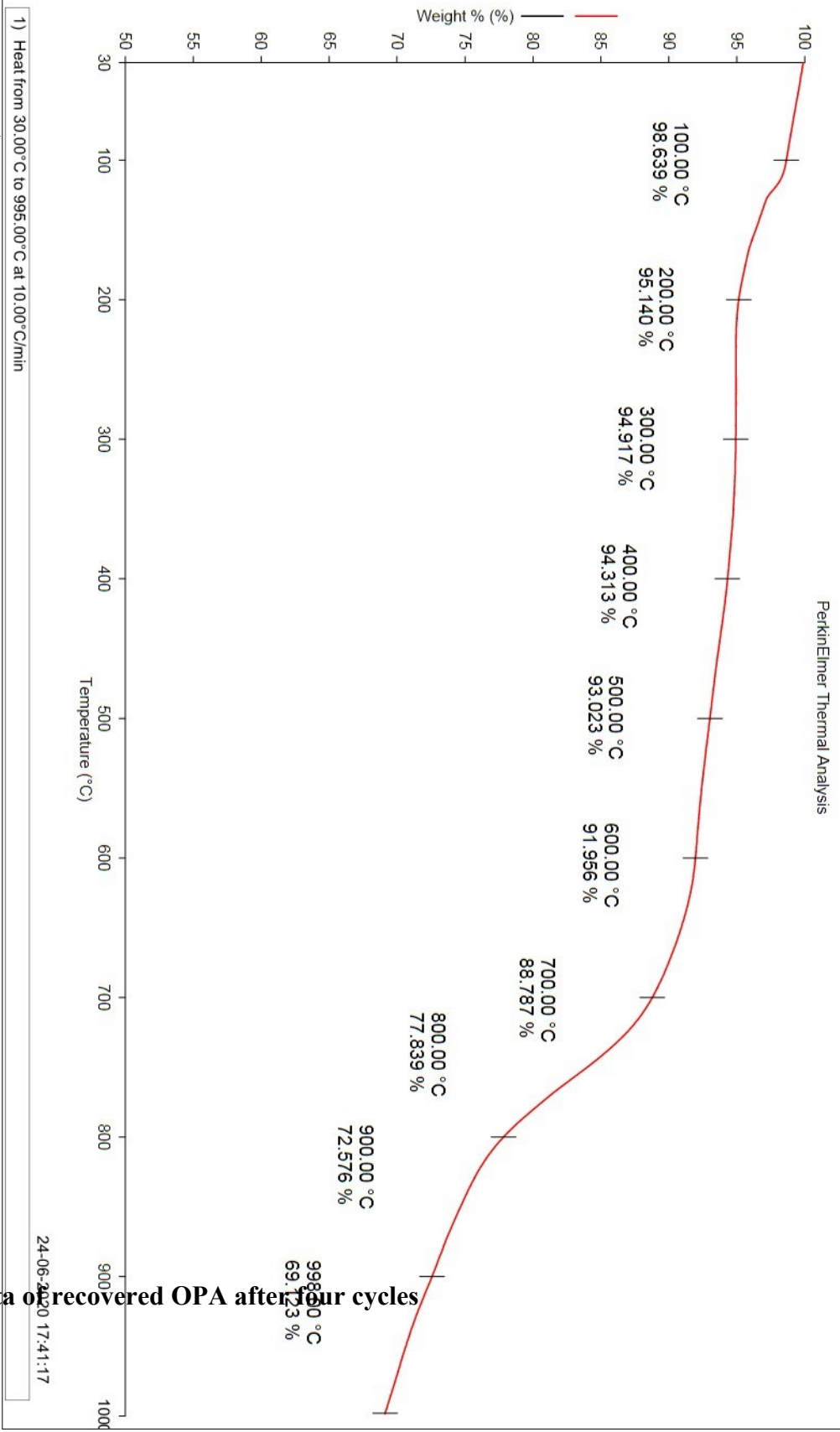
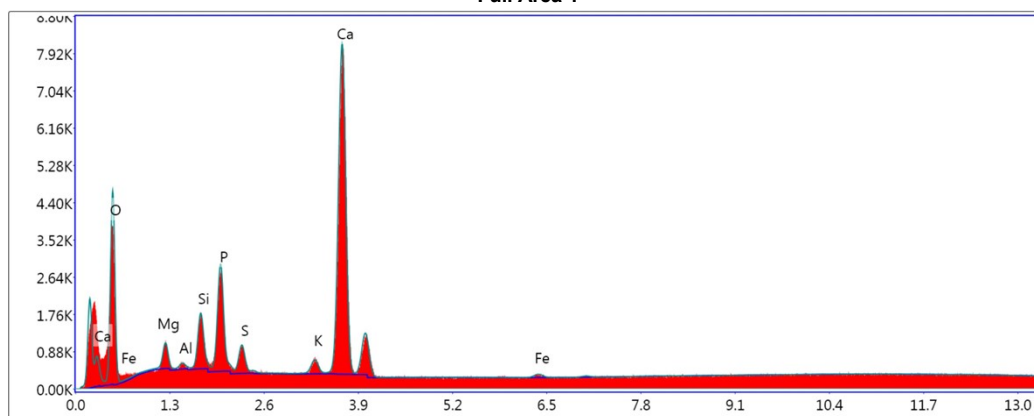


Figure S2: Thermal

Figure S3: EDX data on recovered OPA after four cycles

kV: 20      Mag: 1000      Takeoff: 36.4      Live Time(s): 30      Amp Time(μs): 0.96      Resolution:(eV)135.5

#### Full Area 1

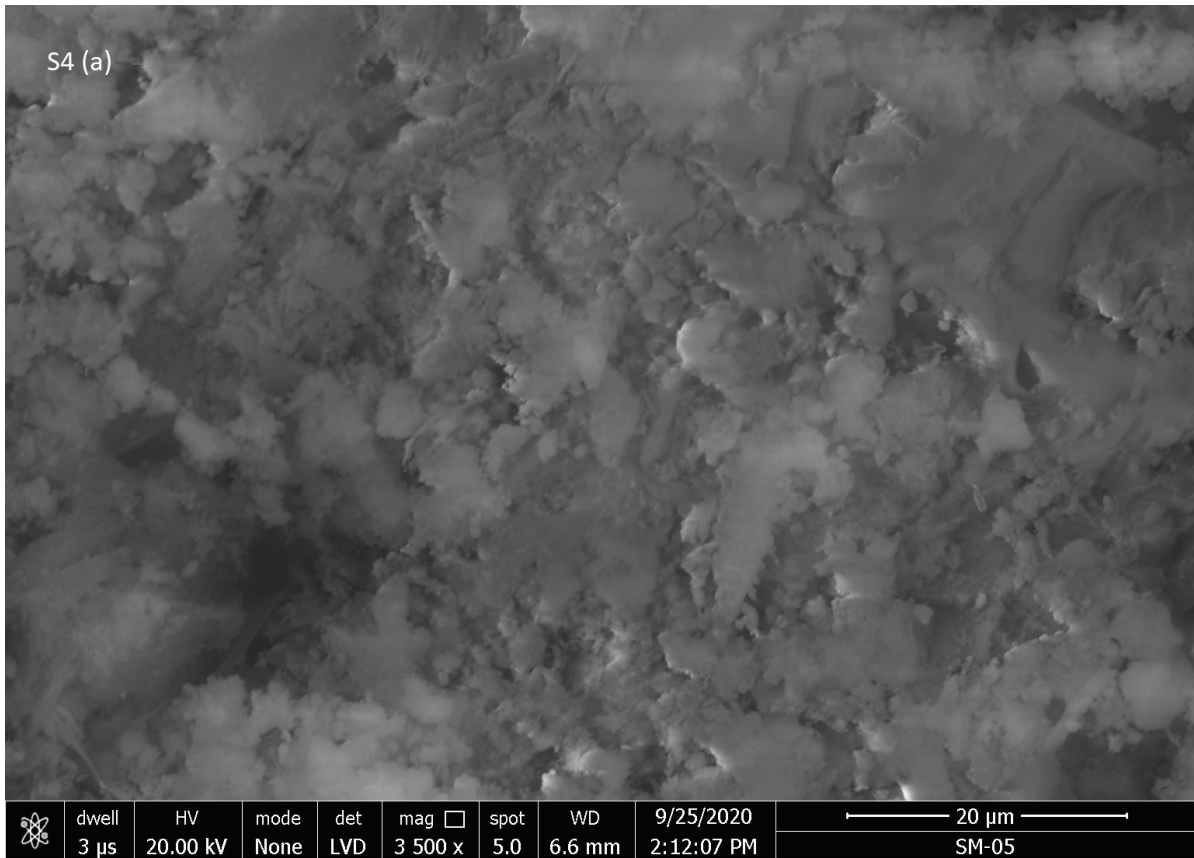


Lsec: 30.0 0 Cnts 0.000 keV Det: Octane Plus Det

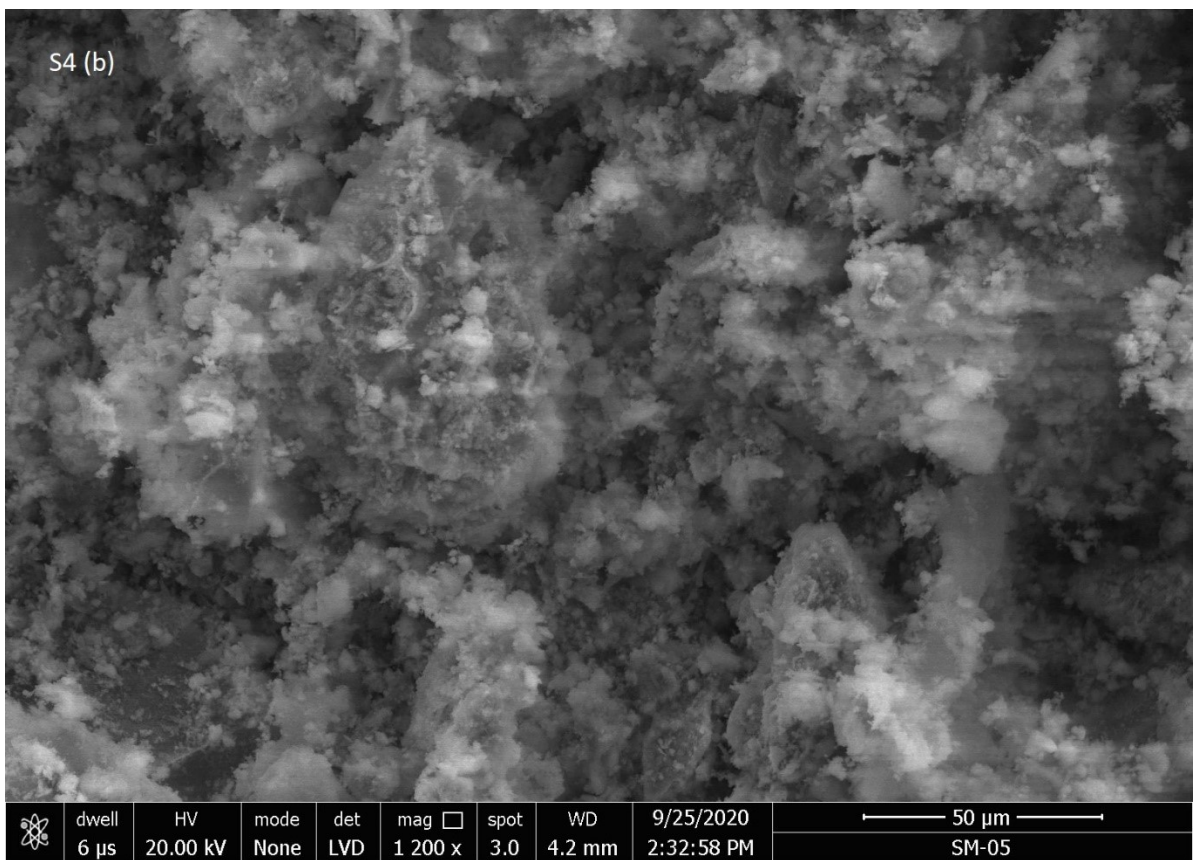
#### eZAF Smart Quant Results

Element	Weight %	Atomic %	Net Int.	Error %	Kratio	Z	R	A	F
O K	53.13	72.16	2,109.72	9.80	0.09	1.06	0.96	0.16	1
MgK	1.85	1.65	349.86	9.34	0.01	0.98	1	0.45	1.01
AlK	0.27	0.22	65.20	25.30	0.00	0.95	1	0.58	1.01
SiK	2.71	2.10	802.50	5.46	0.02	0.97	1.01	0.71	1.02
P K	6.18	4.34	1,628.71	3.97	0.05	0.93	1.02	0.79	1.02
S K	1.53	1.04	421.28	7.52	0.01	0.95	1.02	0.82	1.03
K K	0.98	0.54	244.49	8.95	0.01	0.9	1.04	0.96	1.12
CaK	32.51	17.62	6,262.06	1.69	0.29	0.92	1.04	0.97	1
FeK	0.84	0.33	73.68	30.81	0.01	0.82	1.07	0.98	1

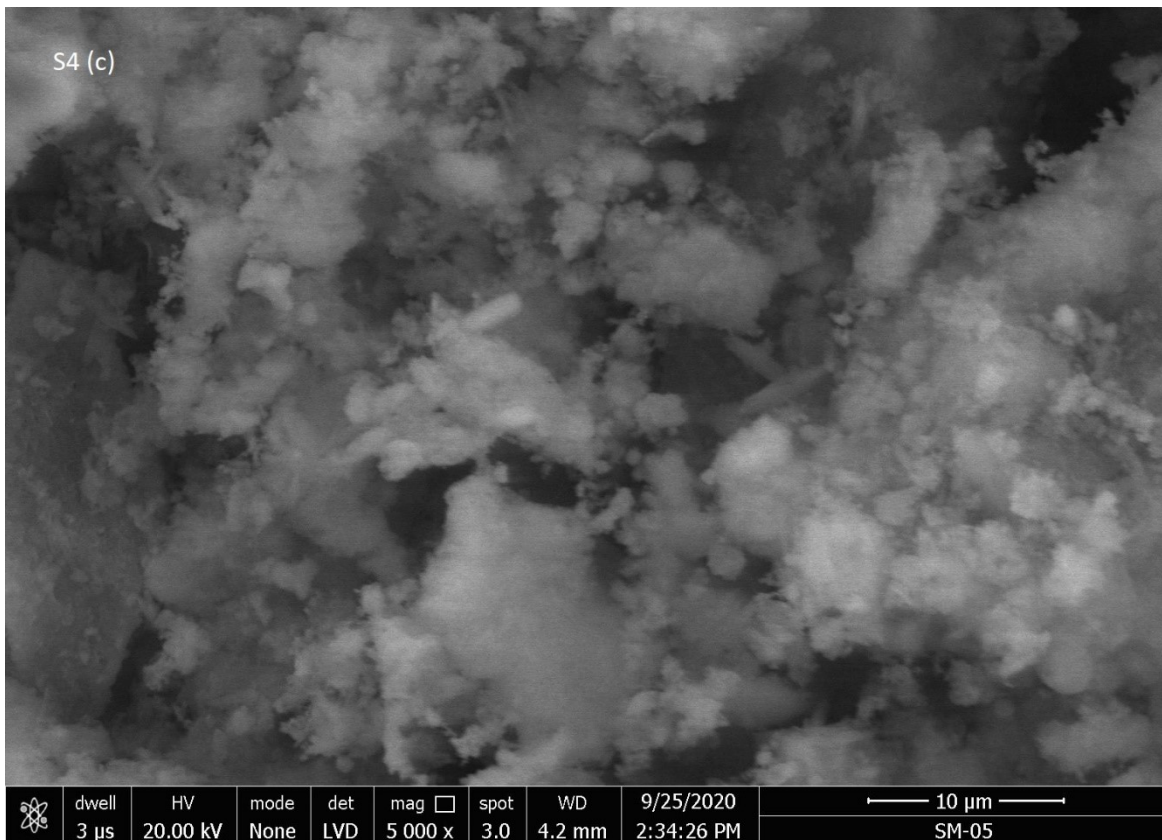
Figure S4 (a): SEM image of the recovered OPA



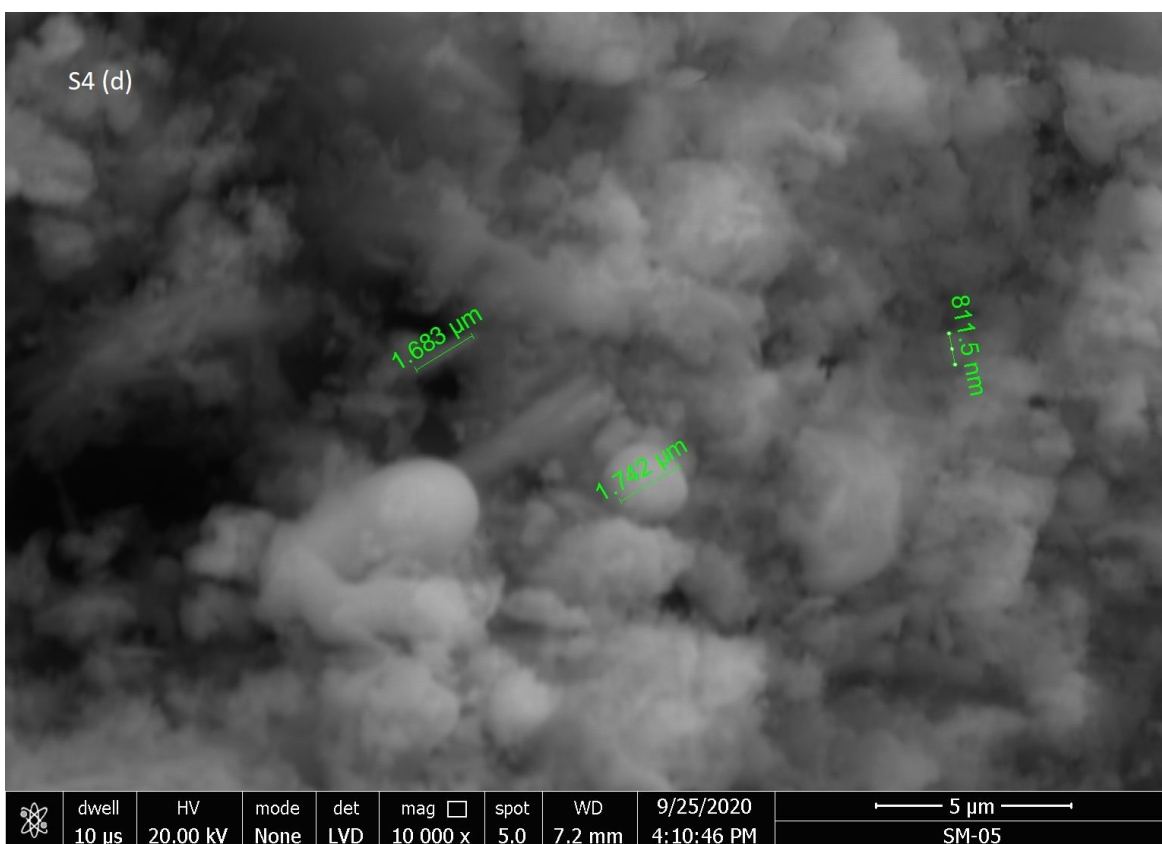
**Figure S4 (b): SEM image of the recovered OPA**



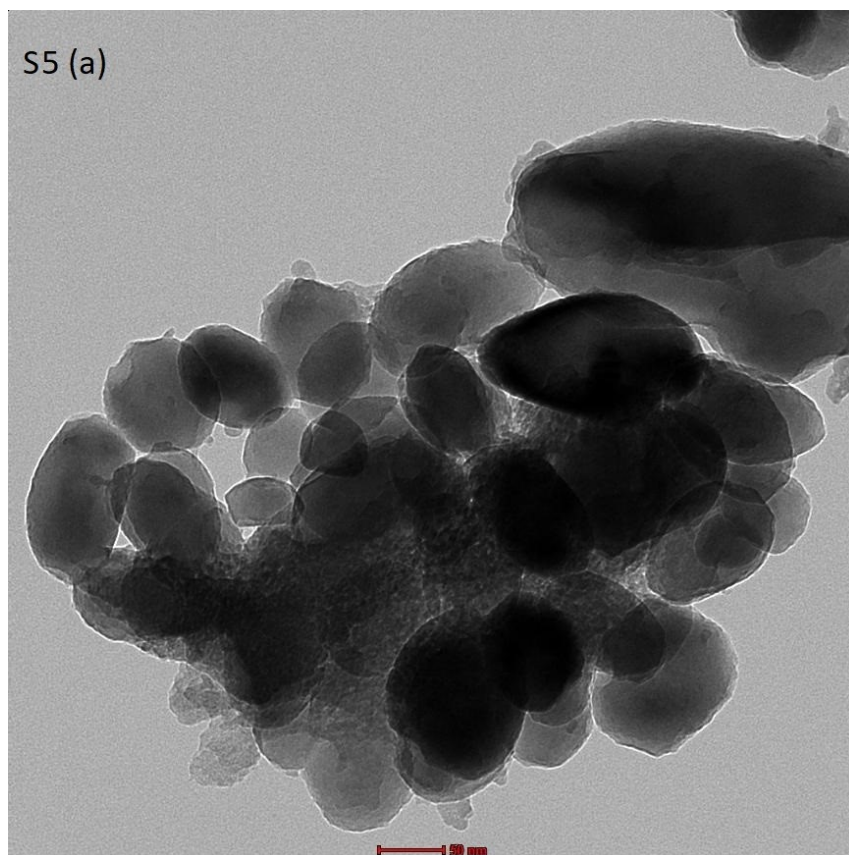
**Figure S4 (c): SEM image of the recovered OPA**



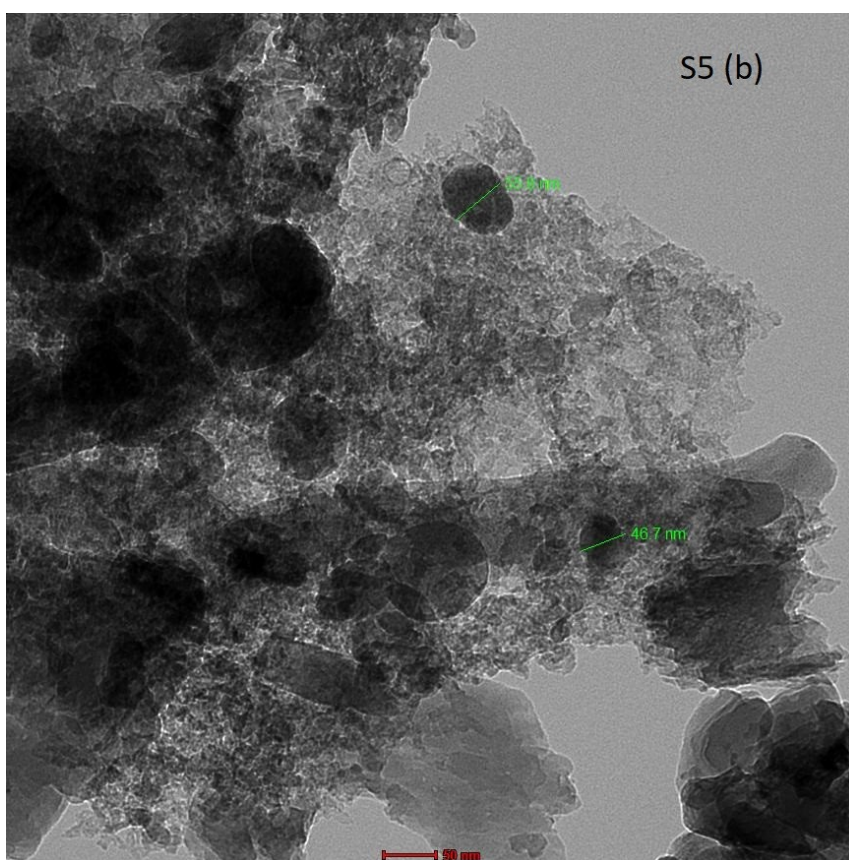
**Figure S4 (d): SEM image of the recovered OPA**



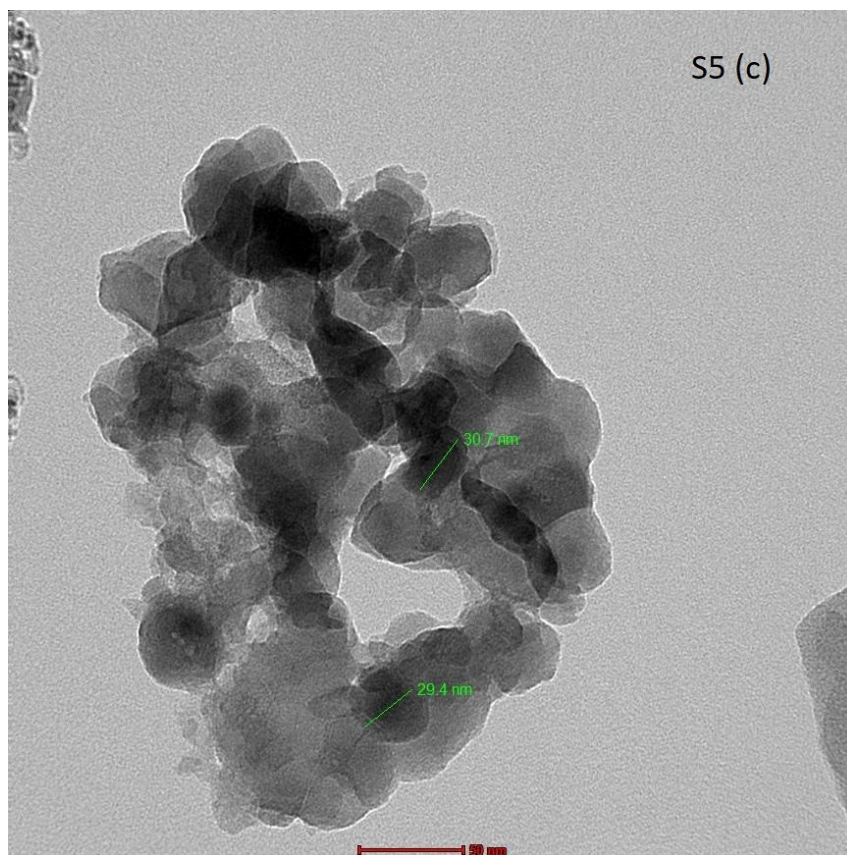
**Figure S5 (a): TEM image of the recovered OPA**



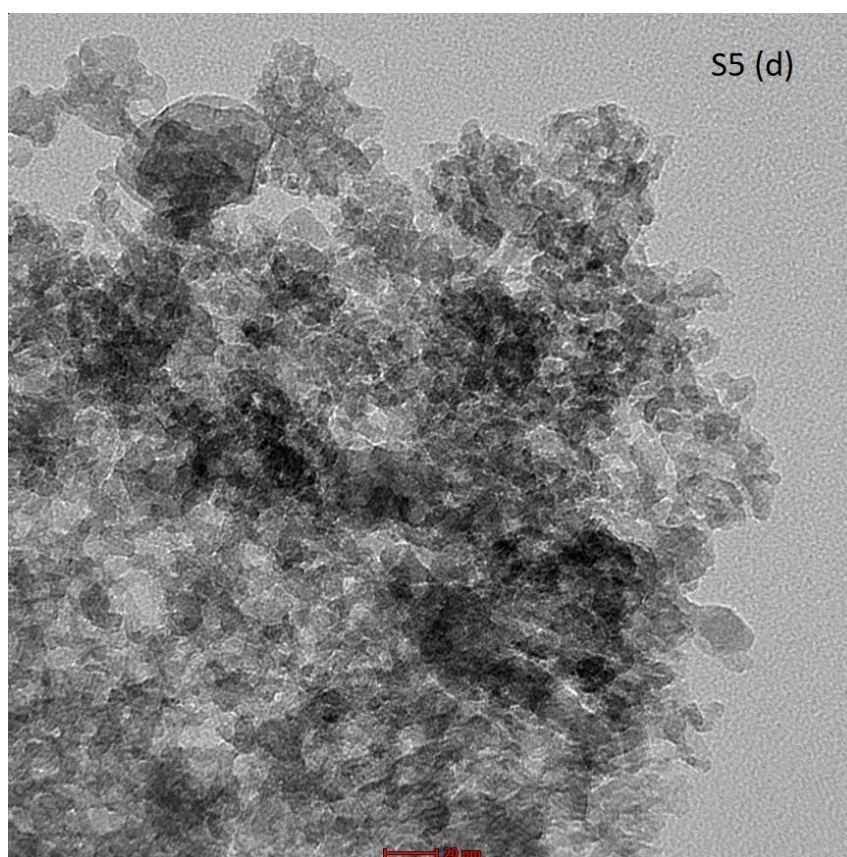
**Figure S5 (b): TEM image of the recovered OPA**



**Figure S5 (c): TEM image of the recovered OPA**



**Figure S5 (d): TEM image of the recovered OPA**

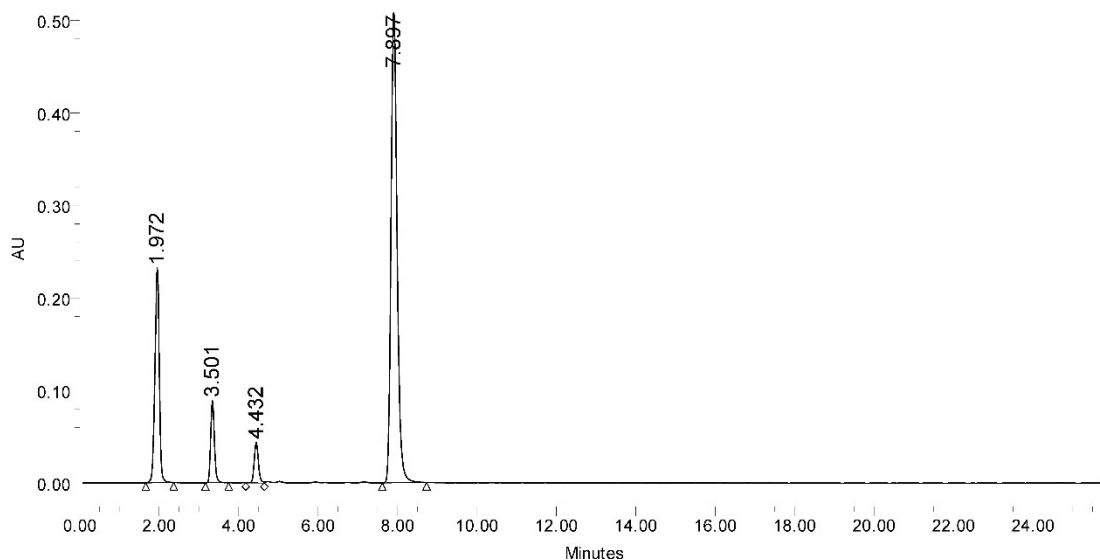


**Figure S6: HPLC data of the crude product**



### SAMPLE INFORMATION

Sample Name: DMT Crude	Acquired By: Breeze
Sample Type: Unknown	Date Acquired: 11-05-2020 13:05:48 IST
Vial: 1	Acq. Method: DMT
Injection #: 4	Date Processed: 13-05-2021 10:00:32 IST
Injection Volume: 20.00 ul	Channel Name: W2489 ChA
Run Time: 30.00 Minutes	Sample Set Name:

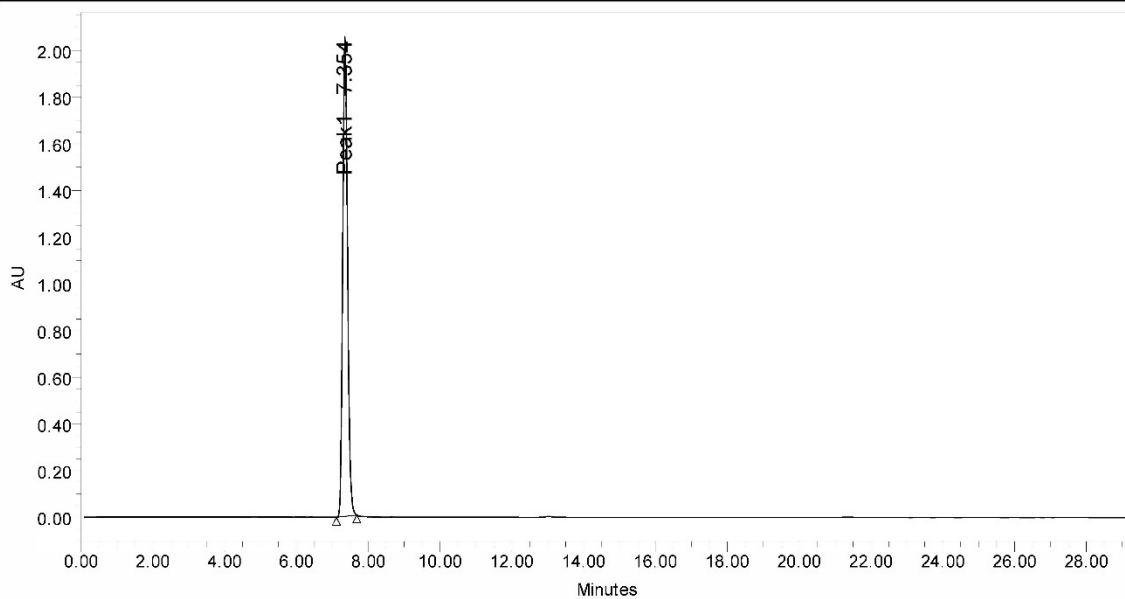


	RT (min)	Area (μV*sec)	% Area	Height (μV)	% Height
1	1.972	1673874	22.54	242345	26.56
2	3.501	578765	6.67	88975	9.87
3	4.432	215797	4.38	44325	3.64
4	7.897	5653864	63.29	521321	58.12

**Figure S7: HPLC data of the recrystallized DMT**

SAMPLE INFORMATION

Sample Name:	DMT Pure (1.00 mg)	Acquired By:	Breeze
Sample Type:	Unknown	Date Acquired:	11-05-2020 12:09:32 IST
Vial:	1	Acq. Method:	DMT
Injection #:	2	Date Processed:	29-06-2021 10:32:18 IST
Injection Volume:	20.00 ul	Channel Name:	W2489 ChA
Run Time:	30.00 Minutes	Sample Set Name:	

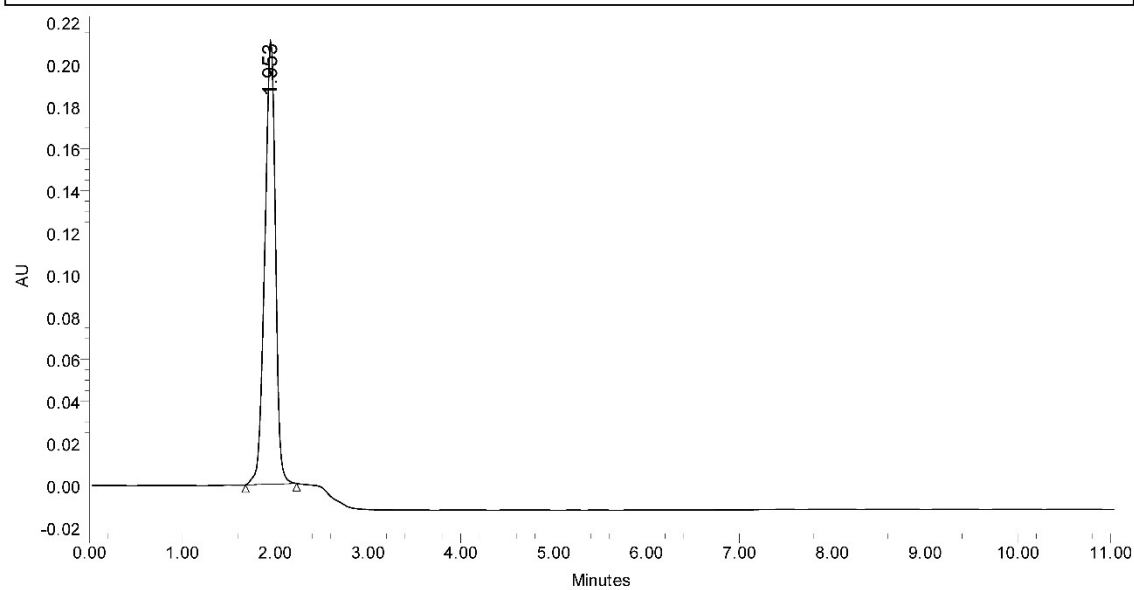


Peak Name	RT (min)	Area (μV*sec)	% Area	Height (μV)	% Height
1 Peak1	7.354	19348572	100.00	2057226	100.00

Figure S8: HPLC data of commercial ethylene glycol

### SAMPLE INFORMATION

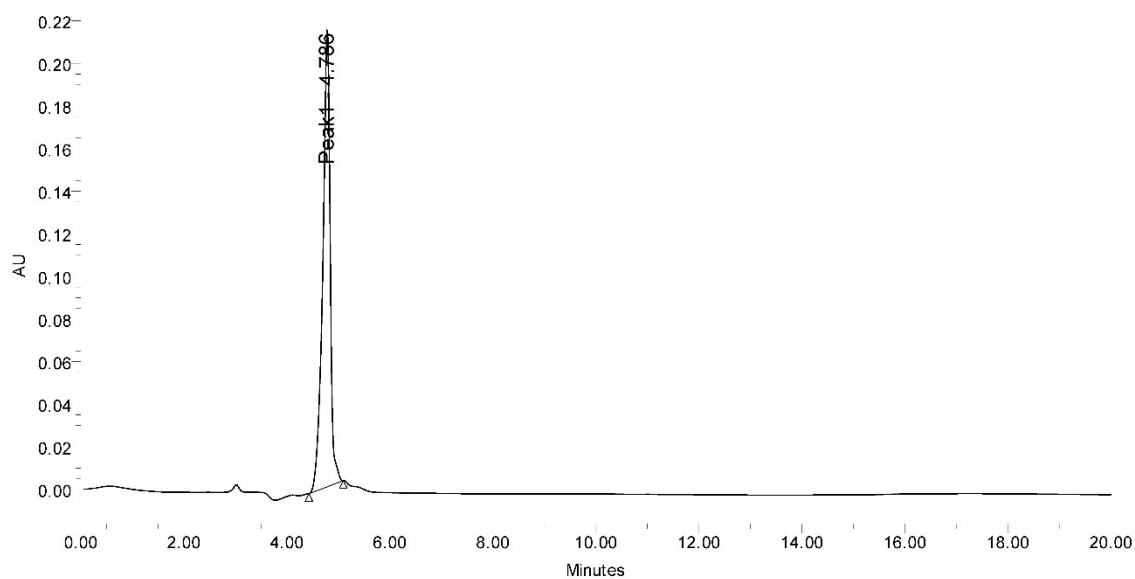
Sample Name: ethylene glycol crude	Acquired By: Breeze
Sample Type: Unknow n	Date Acquired: 28-04-2020 12:31:11 IST
Vial: 1	Acq. Method: bhet
Injection #: 1	Date Processed: 14-08-2020 17:37:10 IST
Injection Volume: 20.00 ul	Channel Name: W2489 ChA
Run Time: 30.00 Minutes	Sample Set Name:



	RT (min)	Area ( $\mu\text{V}\cdot\text{sec}$ )	% Area	Height ( $\mu\text{V}$ )	% Height
1	1.953	1680058	100.00	210724	100.00

**Figure S9: HPLC data of HEMT**

SAMPLE INFORMATION			
Sample Name:	HEMT	Acquired By:	Breeze
Sample Type:	Unknown	Date Acquired:	20-11-2020 17:08:03 IST
Vial:	1	Acq. Method:	BHET 2
Injection #:	1	Date Processed:	29-04-2021 14:15:46 IST
Injection Volume:	20.00 ul	Channel Name:	W2489 ChA
Run Time:	20.00 Minutes	Sample Set Name:	

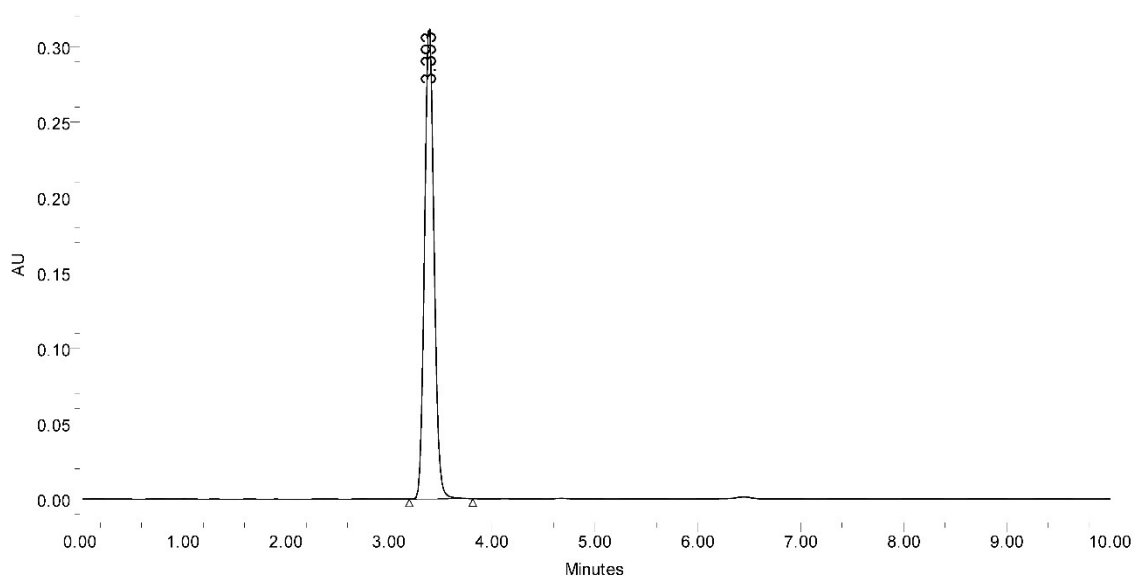


Peak Name	RT (min)	Area (μV*sec)	% Area	Height (μV)	% Height
1 Peak1	4.786	2155448	100.00	214317	100.00

**Figure S10: HPLC data of BHET**

### SAMPLE INFORMATION

Sample Name: bhet recrystallize1	Acquired By: Breeze
Sample Type: Unknown	Date Acquired: 06-02-2020 14:18:55 IST
Vial: 1	Acq. Method: bhet
Injection #: 1	Date Processed: 27-10-2020 16:47:28 IST
Injection Volume: 20.00 ul	Channel Name: W2489 ChA
Run Time: 10.00 Minutes	Sample Set Name:



	RT (min)	Area ( $\mu\text{V}\cdot\text{sec}$ )	% Area	Height ( $\mu\text{V}$ )	% Height
1	3.393	2015945	100.00	313590	100.00

**Figure S11:  $^1\text{H}$  NMR data of recrystallized DMT**

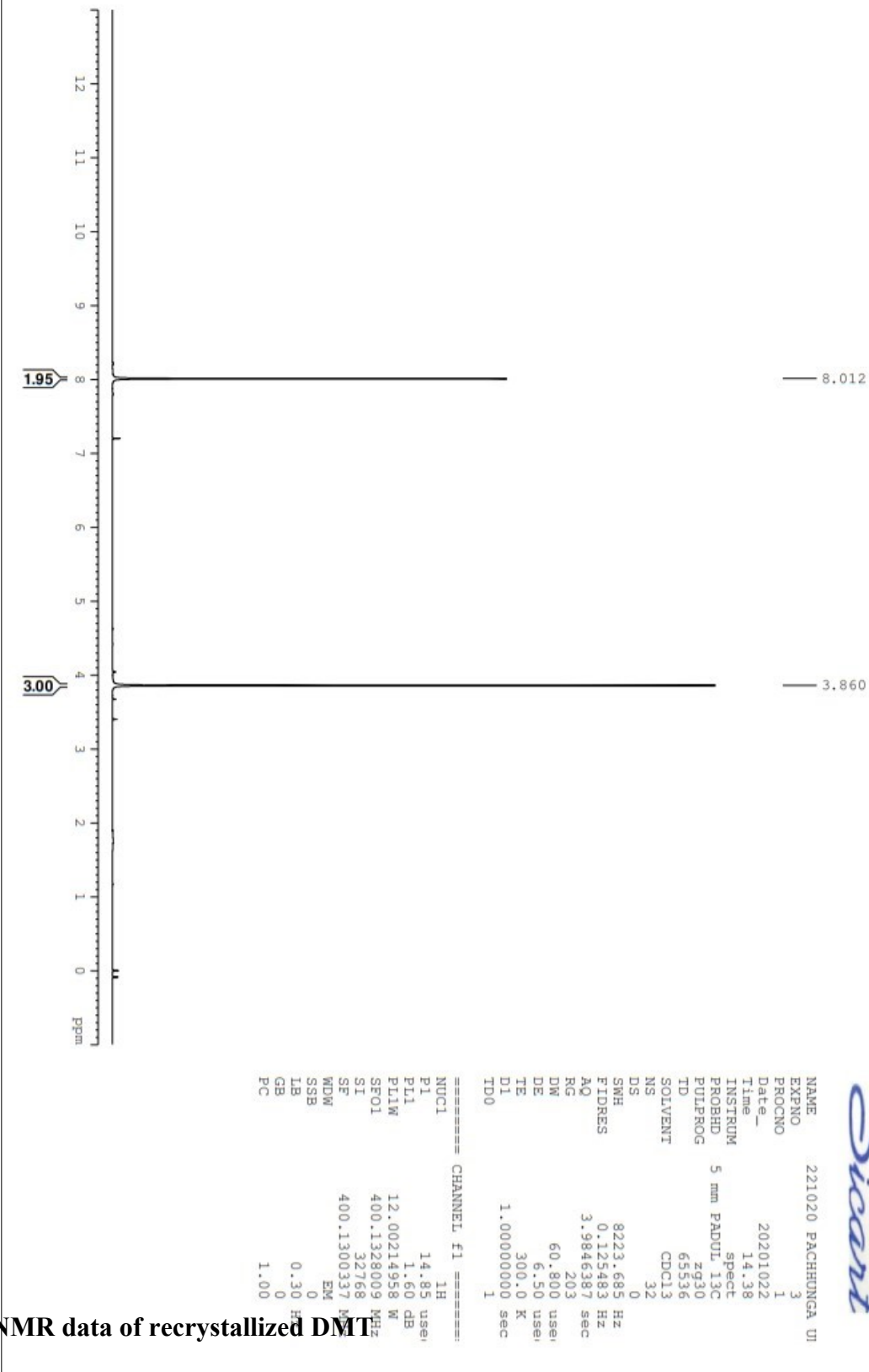


Figure S12: <sup>13</sup>C NMR data of recrystallized DMT

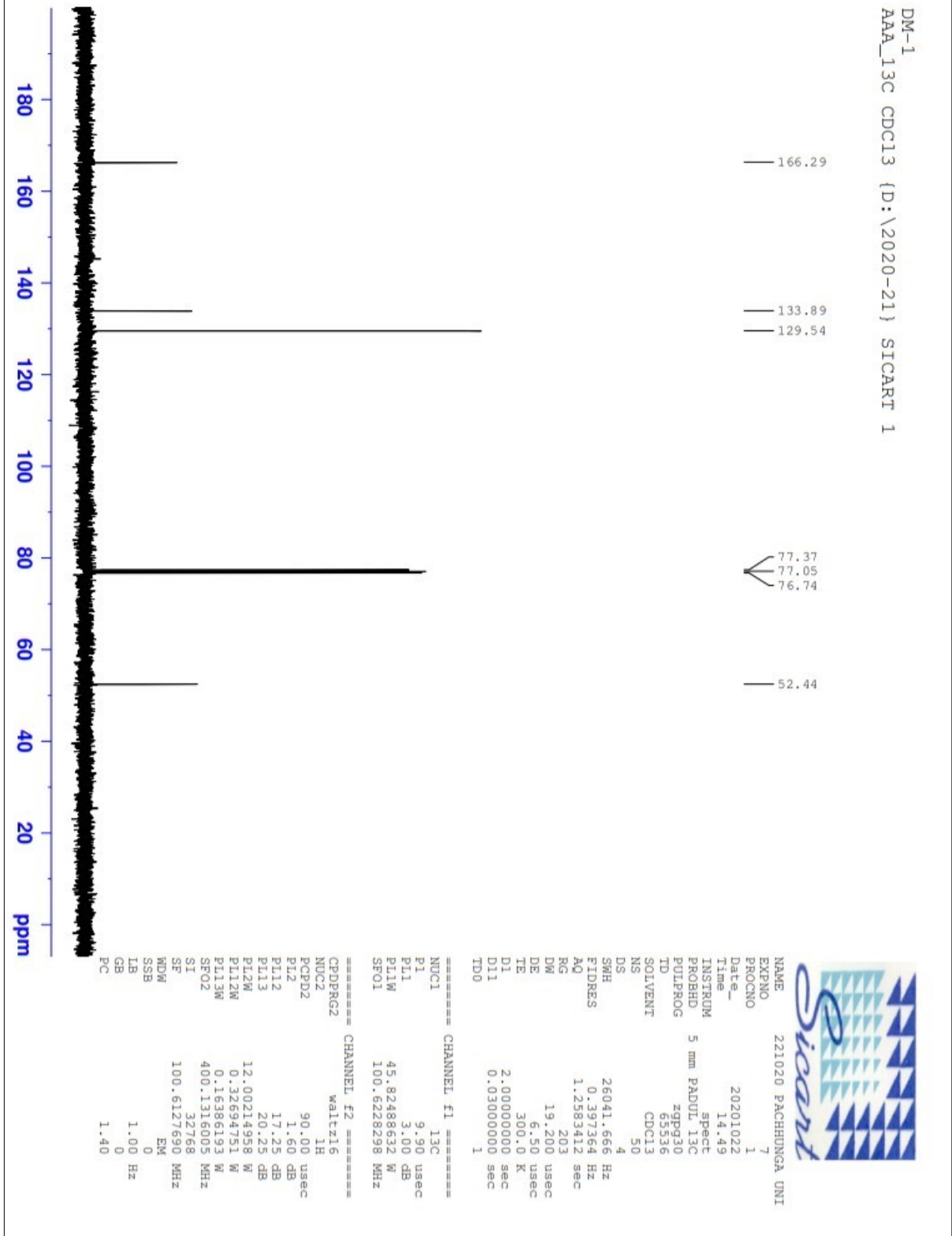
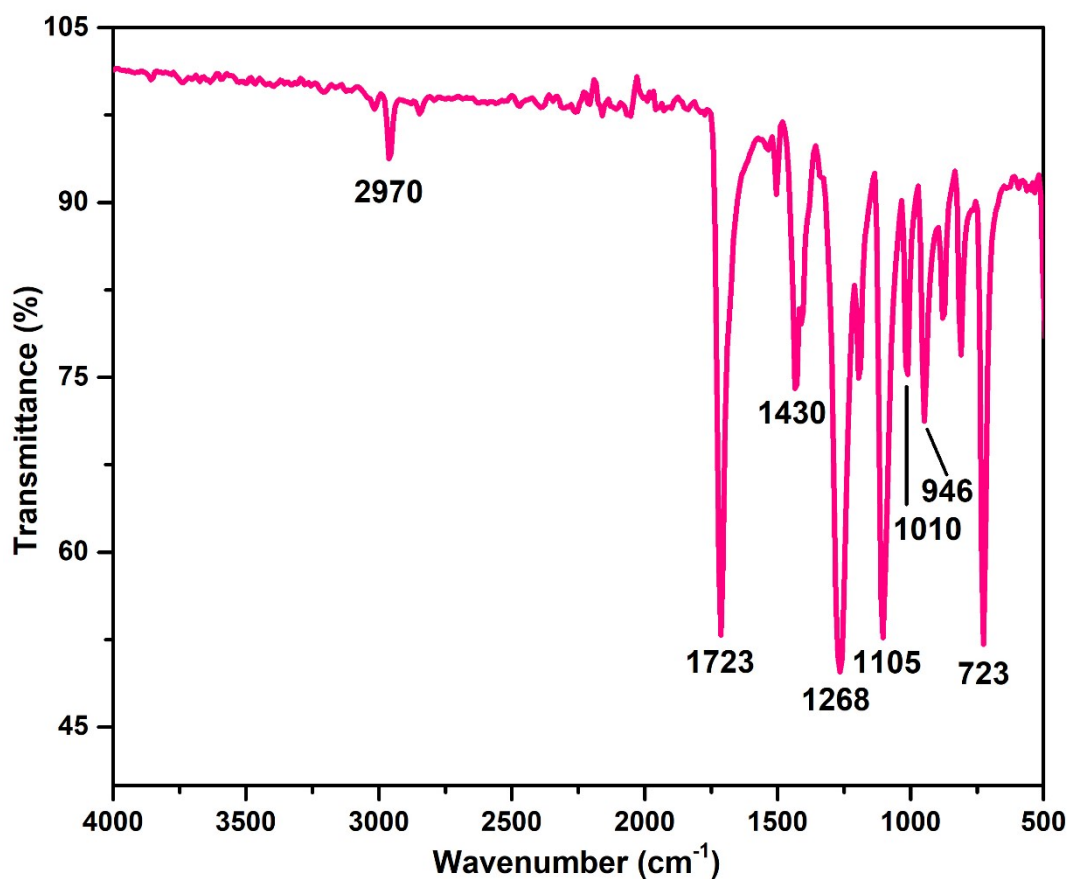
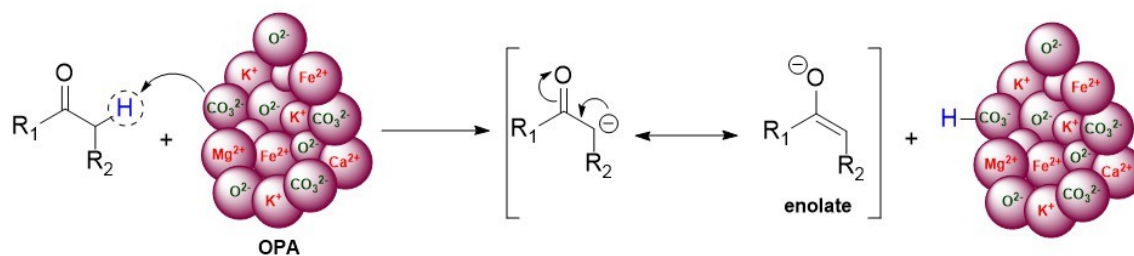


Figure S13: IR data of recrystallized DMT

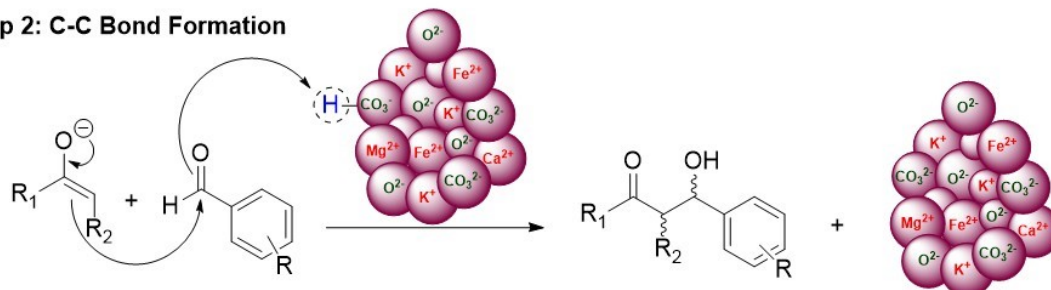


**Scheme S1: Proposed reaction mechanism of aldol reaction with OPA catalyst**

**Step 1: Generation of Carbanion and formation of enolate**



**Step 2: C-C Bond Formation**

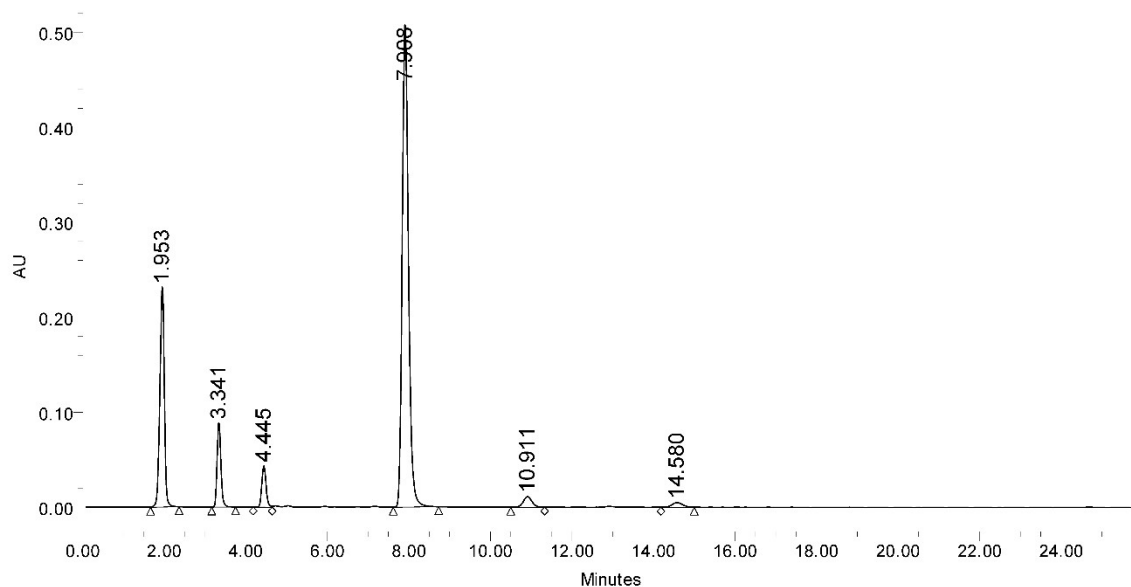


**Figure S14: HPLC data of the crude product using a reduced methanol loading**



### SAMPLE INFORMATION

Sample Name:	DMT Crude	Acquired By:	Breeze
Sample Type:	Unknown n	Date Acquired:	11-05-2020 13:05:48 IST
Vial:	1	Acq. Method:	DMT
Injection #:	4	Date Processed:	13-05-2021 11:50:38 IST
Injection Volume:	20.00 ul	Channel Name:	W2489 ChA
Run Time:	30.00 Minutes	Sample Set Name:	

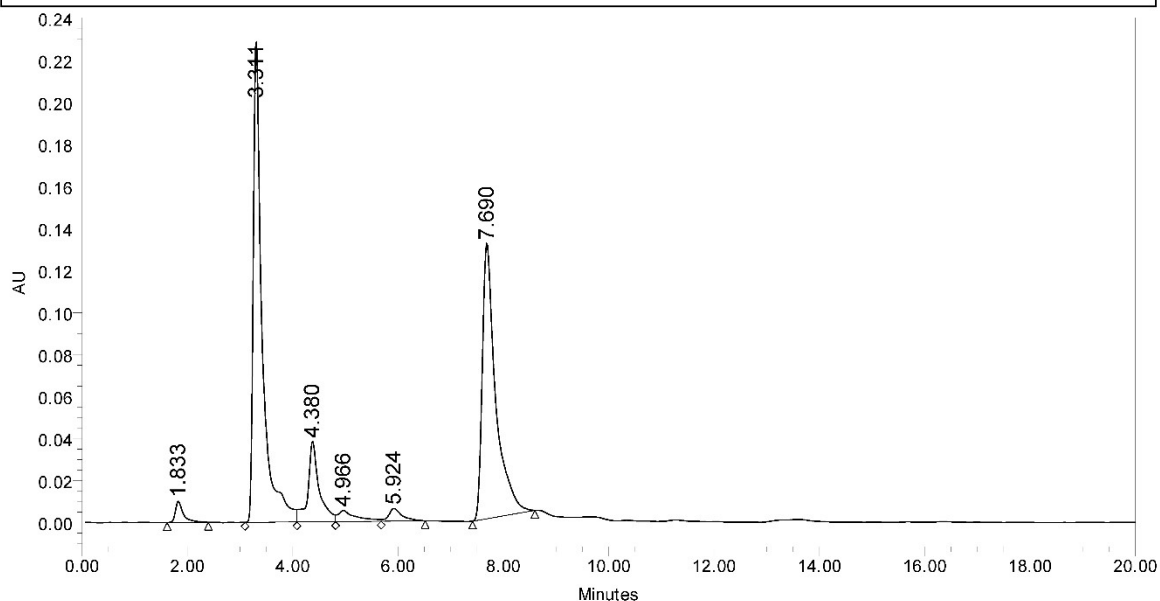


	RT (min)	Area (μV*sec)	% Area	Height (μV)	% Height
1	1.953	1786095	21.30	232044	26.01
2	3.341	585112	6.98	89348	10.02
3	4.445	321168	3.83	43772	4.91
4	7.908	5429925	64.77	510719	57.25
5	10.911	169048	2.02	11217	1.26
6	14.580	92362	1.10	4970	0.56

**Figure S15: HPLC data of the crude product after 2 hrs reaction time**

**SAMPLE INFORMATION**

Sample Name: DMT Crude	Acquired By: Breeze
Sample Type: Unknown	Date Acquired: 21-12-2020 17:53:31 IST
Vial: 1	Acq. Method: BHET 2
Injection #: 1	Date Processed: 29-06-2021 10:27:54 IST
Injection Volume: 20.00 ul	Channel Name: W2489 ChA
Run Time: 20.00 Minutes	Sample Set Name:

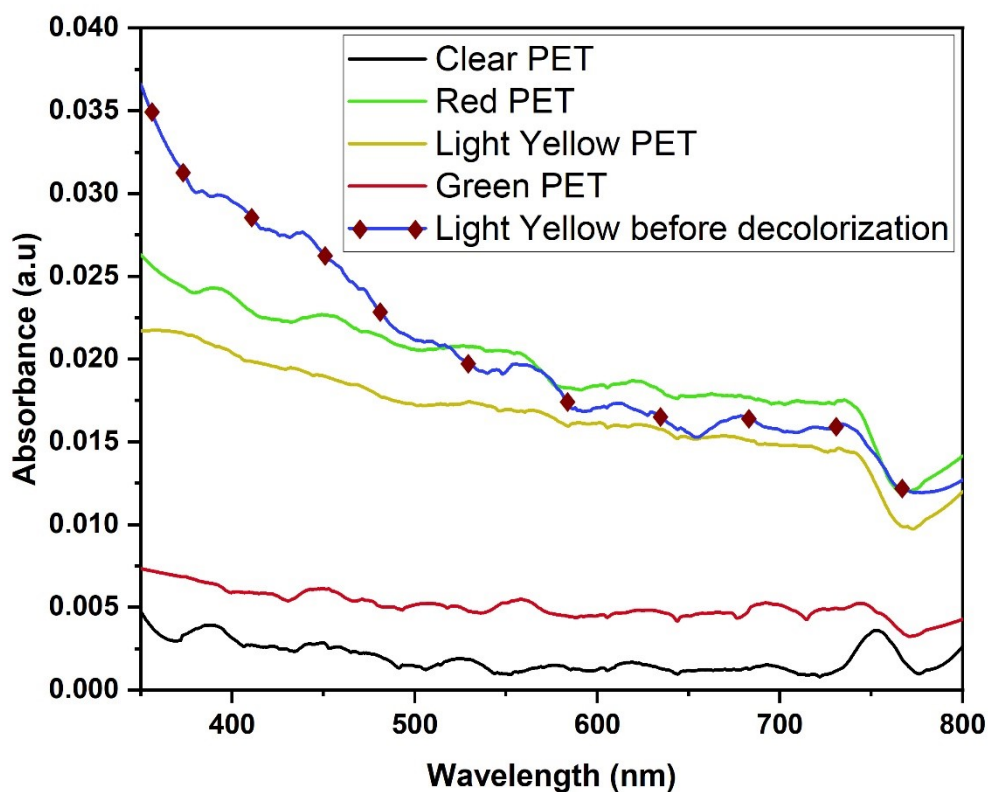


	RT (min)	Area (μV*sec)	% Area	Height (μV)	% Height
1	1.833	105535	1.78	10065	2.39
2	3.311	2717211	45.74	229329	54.56
3	4.380	569432	9.59	38319	9.12
4	4.966	125246	2.11	5272	1.25
5	5.924	103212	1.74	6041	1.44
6	7.690	2320139	39.05	131330	31.24

**Table S2: Methanalysis of Colored PET Bottles using OPA**

Sl. No.	PET Color	Catalyst Loading	MeOH (mL)	Time (h)	Temp. (°C)	DMT Yield %
1.	Clear	30	5	1	200	78
2.	Red	30	5	1	200	69
3.	Light-Yellow	30	5	1	200	61
4.	Green	30	5	1	200	74

**Figure S16: UV-Vis Spectra of DMT monomer obtained from clear, red, light-yellow and green PET bottles. The samples were dissolved in chloroform (5 mg/ml).**

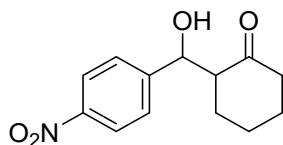


**Table S3: Reusability of the Catalyst**

Sl. No.	No. of Catalyst Cycle	Catalyst Loading	MeOH	Time (h)	Temp. (°C)	DMT Yield %
1	First	30	5	1	200	78
2	Second	30	5	1.5	200	73
3	Third	30	5	2.5	200	71
4	Fourth	30	5	3.5	200	68

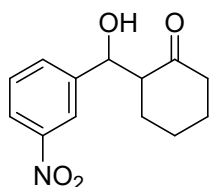
## NMR SPECTRAL DATA OF THE ALDOL PRODUCT:

**2-(hydroxy(4-nitrophenyl)methyl)cyclohexan-1-one (7a, white solid):**



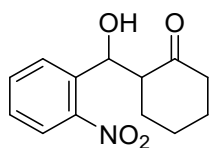
$^1\text{H NMR}$  (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.22 - 7.47 (m, 4H), 5.48 (d,  $J = 2.4$  Hz, 1H for *syn*), 4.90 (d,  $J = 8.4$  Hz, 1H for *anti*), 2.48 - 1.54 (m, 9H);  $^{13}\text{CNMR}$  (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  214.95, 214.26, 149.30, 148.58, 128.11, 126.85, 123.81, 123.70, 74.28, 70.38, 57.43, 57.04, 42.91, 42.85, 31.00, 28.08, 27.87, 26.16, 25.02, 24.94.

**2-(hydroxy(3-nitrophenyl)methyl)cyclohexan-1-one (7b, oily liquid):**



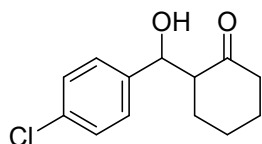
$^1\text{H NMR}$  (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.21 - 7.51 (m, 4H), 5.48 (d,  $J = 2.0$  Hz, 1H for *syn*), 4.89 (d,  $J = 8.4$  Hz, 1H for *anti*), 2.62 - 1.55 (m, 9H);  $^{13}\text{CNMR}$  (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  215.06, 214.33, 148.55, 144.06, 143.51, 133.42, 132.18, 129.53, 129.38, 123.10, 122.32, 122.26, 121.11, 74.28, 70.15, 57.37, 57.00, 42.89, 42.84, 30.98, 28.09, 27.86, 26.15, 24.99, 24.90.

**2-(hydroxy(2-nitrophenyl)methyl)cyclohexan-1-one (7c, oily liquid):**



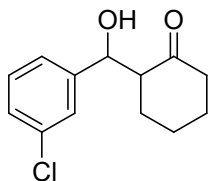
$^1\text{H NMR}$  (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.11 - 7.42 (m, 4H), 5.96 (d,  $J = 2.0$  Hz, 1H for *syn*), 5.47 (d,  $J = 8.4$  Hz, 1H for *anti*), 2.46 - 1.55 (m, 9H);  $^{13}\text{CNMR}$  (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  214.28, 188.34, 137.22, 134.28, 133.92, 133.37, 129.88, 129.86, 128.17, 124.89, 124.74, 66.93, 55.08, 42.80, 28.23, 26.76, 25.10.

**2-((4-chlorophenyl)(hydroxy)methyl)cyclohexan-1-one (7d, white solid):**



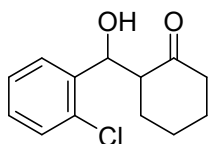
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.41 - 7.10 (m, 4H), 5.27 (s, 1H for *syn*), 4.69-4.66 (dd,  $J_1 = 2.8$  Hz,  $J_2 = 2.4$  Hz, 1H for *anti*), 3.91 (d,  $J = 2.8$  Hz, 1H for OH), 2.50-1.03 (m, 9H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  213.96, 213.32, 142.97, 141.25, 131.43, 131.36, 127.98, 127.54, 121.72, 121.12, 74.13, 70.32, 57.43, 57.12, 42.67, 30.85, 28.12, 27.86, 26.14, 25.24, 24.97.

**2-((3-chlorophenyl)(hydroxy)methyl)cyclohexan-1-one (7e, white solid):**



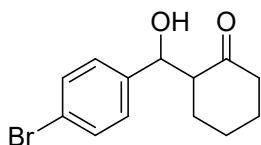
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.25 - 7.08 (m, 4H), 5.28 (s, 1H for *syn*), 4.68 - 4.66 (d,  $J = 8.8$  Hz, 1H for *anti*), 3.96 (s, 1H for OH), 2.52 - 1.46 (m, 9H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  215.41, 143.31, 134.58, 129.83, 129.67, 128.28, 127.38, 126.25, 125.53, 124.10, 74.50, 70.31, 57.50, 57.20, 42.89, 31.01, 28.13, 27.95, 26.16, 25.05, 24.93.

**2-((2-chlorophenyl)(hydroxy)methyl)cyclohexan-1-one (7f, white solid):**



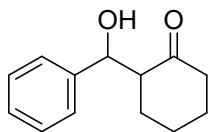
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.55 - 7.18 (m, 4H), 5.71 (2, 1H for *syn*), 5.36 - 5.33 (dd,  $J_1 = 3.6$  Hz,  $J_2 = 4.0$  Hz, 1H for *anti*), 4.05 (d,  $J = 3.6$ , 1H for OH), 2.69 - 1.53 (m, 9H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  215.27, 214.79, 139.10, 138.58, 132.97, 130.86, 129.22, 128.75, 128.54, 128.26, 128.20, 127.26, 126.61, 70.45, 67.72, 57.60, 53.57, 42.73, 42.67, 30.40, 27.95, 27.82, 25.97, 24.92, 24.86.

**2-((4-bromophenyl)(hydroxy)methyl)cyclohexan-1-one (7g, white solid):**



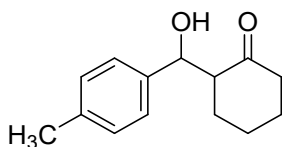
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.48 - 7.17 (m, 4H), 5.33 (d,  $J = 2.4$  Hz, 1H for *syn*), 4.75 (d,  $J = 8.8$  Hz, 1H for *anti*), 2.55 - 1.52 (m, 9H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  215.27, 214.57, 140.53, 140.02, 131.49, 131.26, 128.75, 127.55, 121.72, 120.77, 74.19, 70.15, 57.33, 56.99, 42.67, 30.76, 27.93, 27.73, 25.96, 24.85, 24.71.

**2-(hydroxy(phenyl)methyl)cyclohexan-1-one (7h, white solid):**



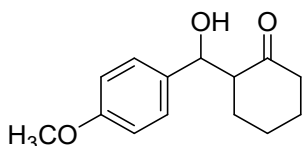
$^1\text{H NMR}$  (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.34 - 7.26 (m, 5H), 5.39 (d,  $J = 2.4$  Hz, 1H for *syn*), 4.78 (d,  $J = 8.8$  Hz, 1H for *anti*), 2.47 - 1.52(m, 9H);  $^{13}\text{CNMR}$  (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  215.78, 215.04, 141.72, 141.17, 128.63, 128.40, 128.15, 127.28, 127.23, 126.01, 75.38, 70.89, 57.67, 57.44, 42.93, 31.10, 28.19, 28.05, 26.26, 25.13, 24.98.

**2-(hydroxy(p-tolyl)methyl)cyclohexan-1-one (7i, white solid):**



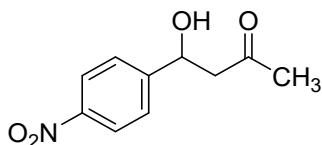
$^1\text{H NMR}$  (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.25-7.13 (m, 4H), 5.34 (d,  $J = 1.6$  Hz, 1H for *syn*), 4.75 (d,  $J = 8.8$  Hz, 1H for *anti*), 2.60 - 1.52 (m, 12H);  $^{13}\text{CNMR}$  (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  215.85, 215.07, 138.74, 138.22, 137.80, 136.79, 129.29, 129.08, 127.17, 125.94, 74.80, 70.82, 57.68, 57.49, 42.91, 31.12, 28.19, 28.06, 26.35, 25.13, 24.90, 21.38, 21.30.

**2-(hydroxy(4-methoxyphenyl)methyl)cyclohexan-1-one (7j, light yellow solid):**



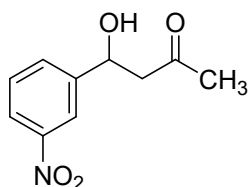
$^1\text{H NMR}$  (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.86 - 7.82 (m, 4H), 5.32 (d,  $J = 2.4$  Hz, 1H for *syn*), 4.74 (d,  $J = 8.8$  Hz, 1H for *anti*), 3.89 (s, 3H, for *syn*-isomer), 3.80 (s, 3H, for *anti*-isomer), 2.59 - 1.25 (m, 9H);  $^{13}\text{CNMR}$  (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  215.87, 215.11, 191.05, 159.52, 158.86, 133.86, 133.40, 132.23, 128.39, 127.16, 114.56, 114.03, 113.82, 74.51, 70.65, 57.74, 57.51, 55.50, 42.91, 42.89, 31.08, 28.20, 28.03, 26.43, 25.11, 24.96.

**4-hydroxy-4-(4-nitrophenyl)butan-2-one (7k, light yellow solid):**



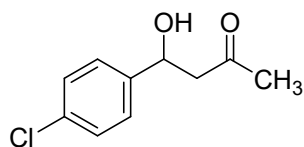
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.27 - 7.09 (m, 4H), 5.17 - 5.07 (dd,  $J = 2.4, 2.4$  Hz, 1H), 3.02 - 1.73 (m, 6H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  197.74, 148.88, 140.91, 140.31, 130.62, 129.04, 128.72, 124.45, 123.99, 50.80, 44.64, 28.27.

**4-hydroxy-4-(3-nitrophenyl)butan-2-one (7l, light pinkish white solid):**



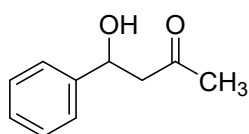
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.41 - 7.53 (m, 4H), 5.19 - 5.07 (dd,  $J = 2.4, 2.4$  Hz, 1H), 3.00 - 1.69 (m, 6H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  197.76, 151.23, 140.41, 136.54, 133.97, 130.28, 129.64, 124.94, 122.84, 51.98, 28.31.

**4-(4-chlorophenyl)-4-hydroxybutan-2-one (7m, white solid):**



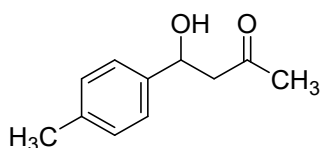
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.32 - 7.23 (m, 4H), 5.14 - 5.10 (dd,  $J = 3.6, 3.6$  Hz, 1H), 2.98 - 2.14 (m, 6H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  198.08, 141.88, 136.47, 132.96, 129.40, 129.28, 127.50, 51.28, 27.67.

**4-hydroxy-4-phenylbutan-2-one (7n, colourless liquid):**



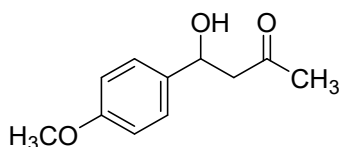
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.33 - 7.23 (m, 5H), 5.13 - 5.10 (dd,  $J = 3.6, 3.6$  Hz, 1H), 2.99 - 2.15 (m, 6H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  209.17, 143.03, 128.66, 127.79, 125.78, 69.99, 52.16, 30.88.

**4-hydroxy-4-(p-tolyl)butan-2-one (7o, light yellow liquid):**



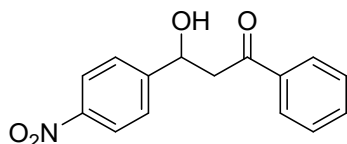
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.62 - 7.18 (m, 4H), 5.51 - 5.48 (dd,  $J = 2.4, 2.4$  Hz, 1H), 3.00 - 2.64 (m, 6H), 2.20 (s, 3H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  209.38, 140.35, 131.34, 129.54, 128.79, 127.45, 127.29, 50.23.

**4-hydroxy-4-(4-methoxyphenyl)butan-2-one (7p, white solid):**



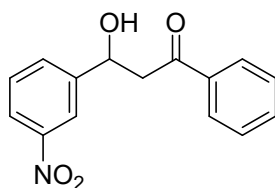
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.51 - 7.6.91 (m, 4H), 5.53 - 5.46 (dd,  $J = 2.4, 2.4$  Hz, 1H), 3.84 (s, 3H), 3.01 - 2.35 (m, 6H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  198.63, 161.87, 143.49, 130.19, 127.33, 125.28, 114.69, 55.63, 27.61.

**3-hydroxy-3-(4-nitrophenyl)-1-phenylpropan-1-one (7q, white solid):**



$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.24 - 7.26 (m, 9H), 5.47 - 5.44 (dd,  $J = 3.7, 3.2$  Hz, 1H), 3.44 - 3.31 (m, 3H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  199.73, 150.45, 147.62, 136.43, 134.25, 129.07, 128.39, 126.80, 124.04, 69.47, 47.20.

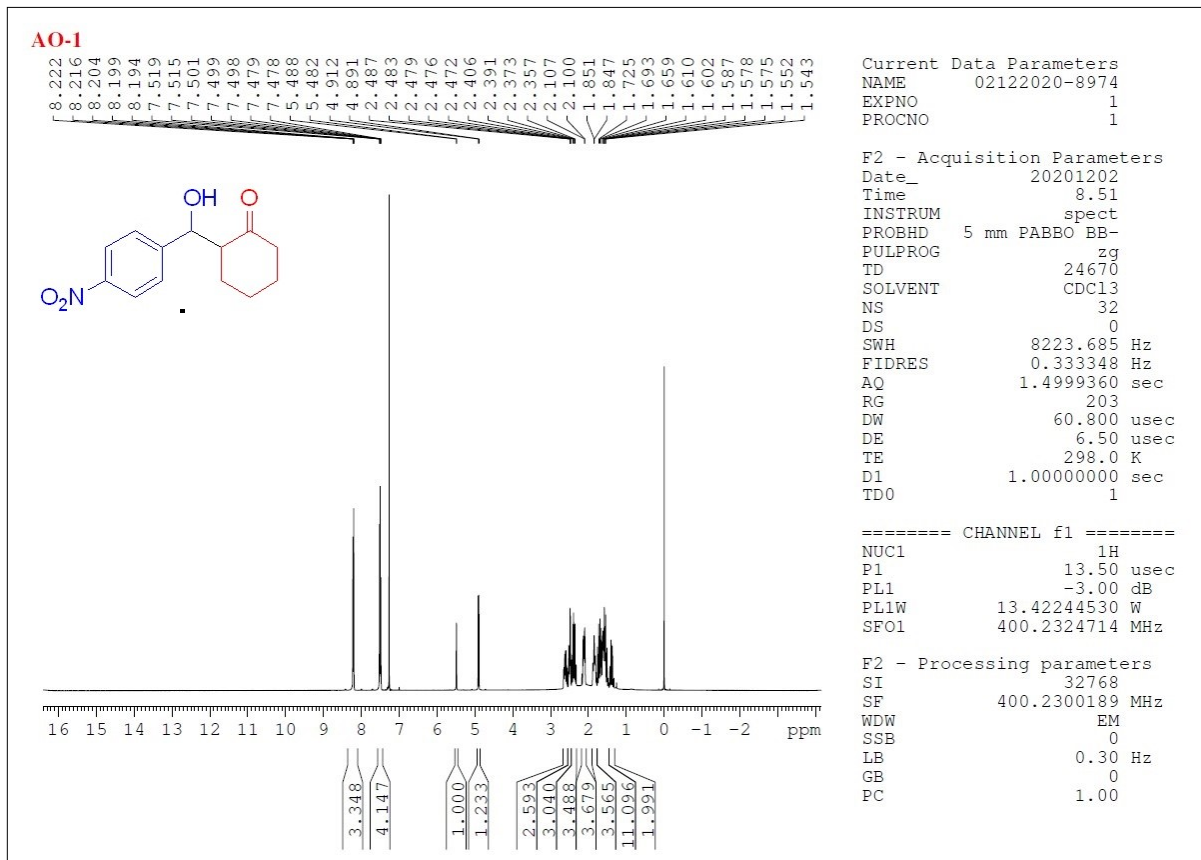
**3-hydroxy-3-(3-nitrophenyl)-1-phenylpropan-1-one (7r, light yellow solid):**



$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.32 - 7.46 (m, 9H), 5.46 - 5.44 (dd,  $J = 3.2, 3.6$  Hz, 1H), 3.46 - 3.33 (m, 3H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  199.80, 148.68, 145.34, 136.45, 134.20, 132.17, 129.74, 129.04, 128.39, 122.81, 121.11.



**Figure S17: <sup>1</sup>H NMR data of 2-(hydroxy(4-nitrophenyl)methyl)cyclohexan-1-one (7a)**



**Figure S18: <sup>13</sup>C NMR data of 2-(hydroxy(4-nitrophenyl)methyl)cyclohexan-1-one (7a)**

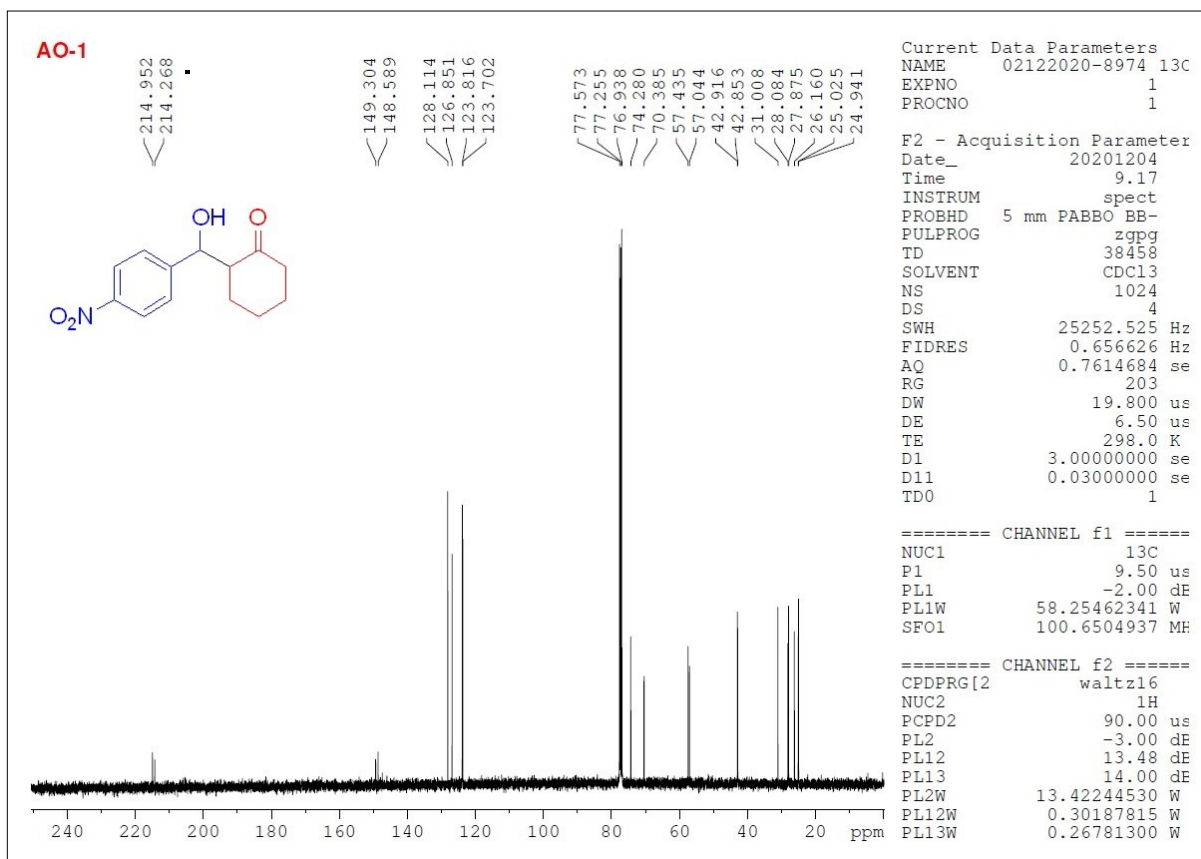


Figure S19: <sup>1</sup>H NMR data of 2-(hydroxy(3-nitrophenyl)methyl)cyclohexan-1-one (7b)

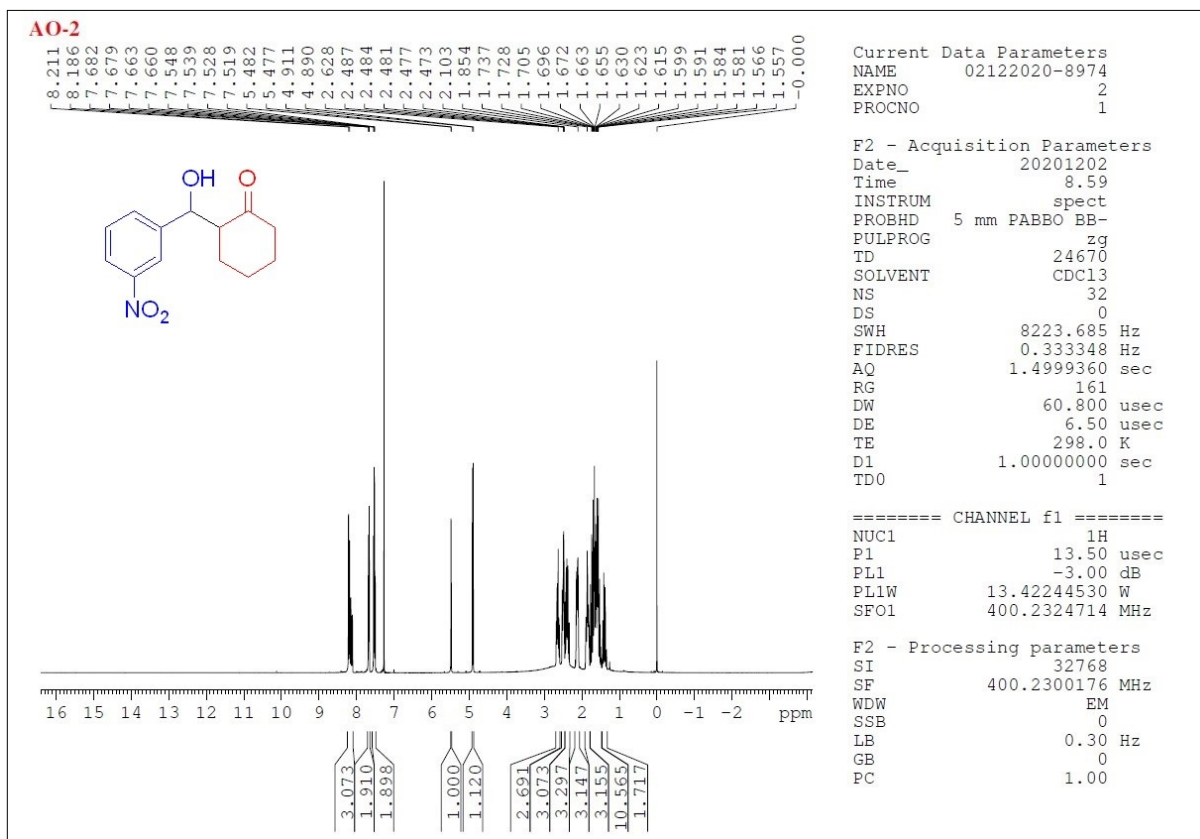


Figure S20: <sup>13</sup>C NMR data of 2-(hydroxy(3-nitrophenyl)methyl)cyclohexan-1-one (7b)

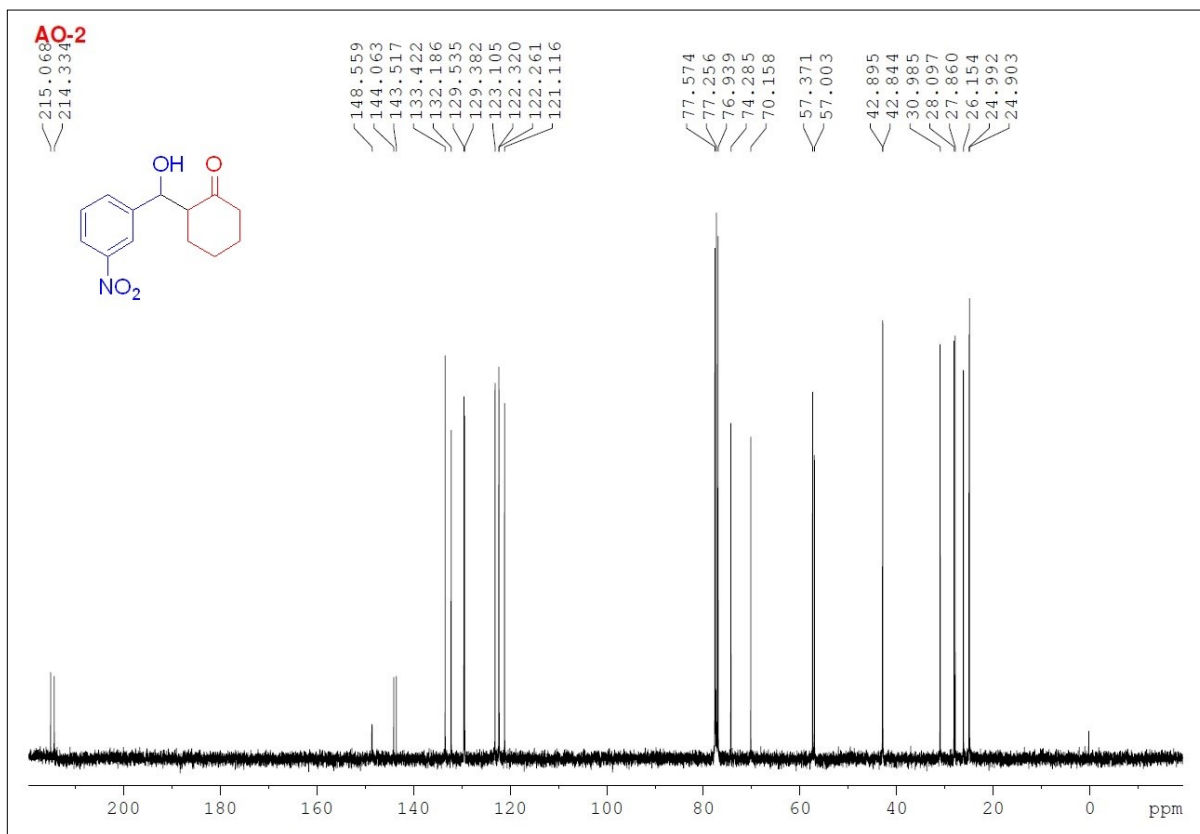


Figure S21: <sup>1</sup>H NMR data of 2-(hydroxy(2-nitrophenyl)methyl)cyclohexan-1-one (7c)

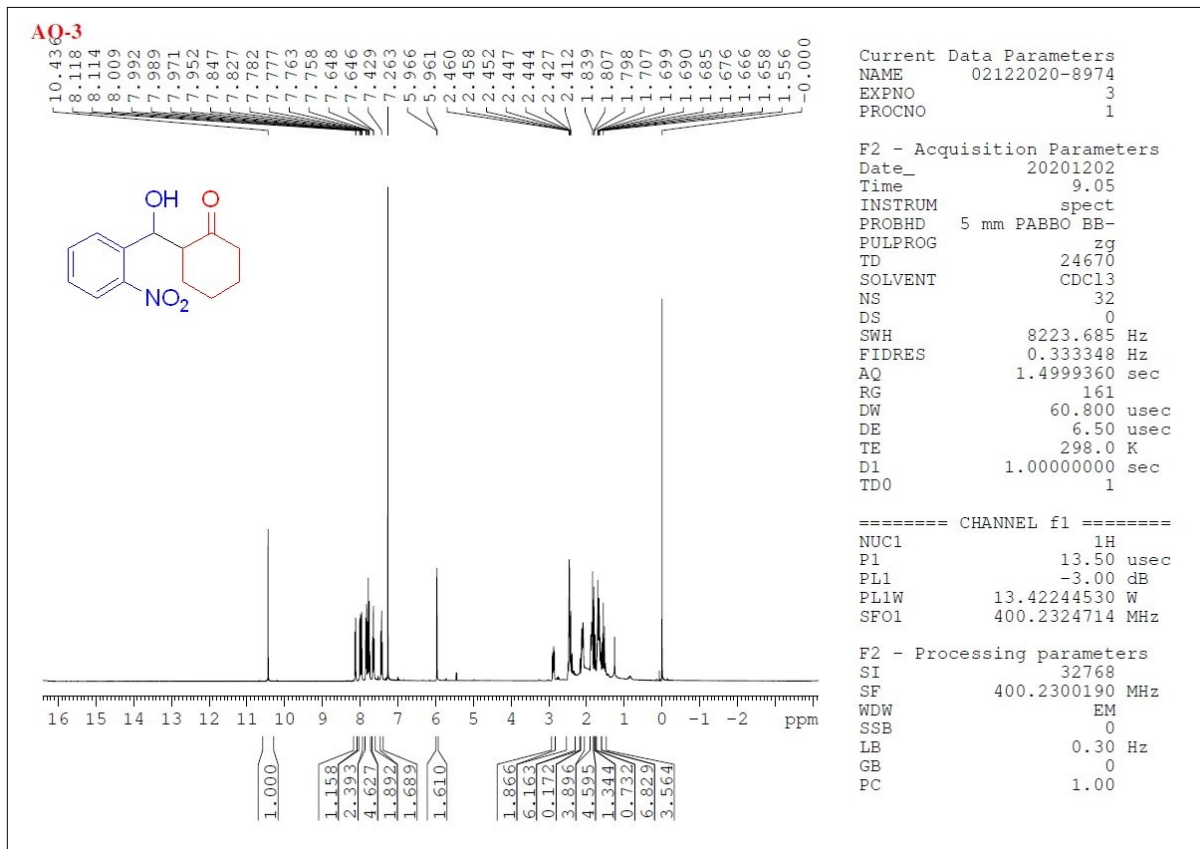
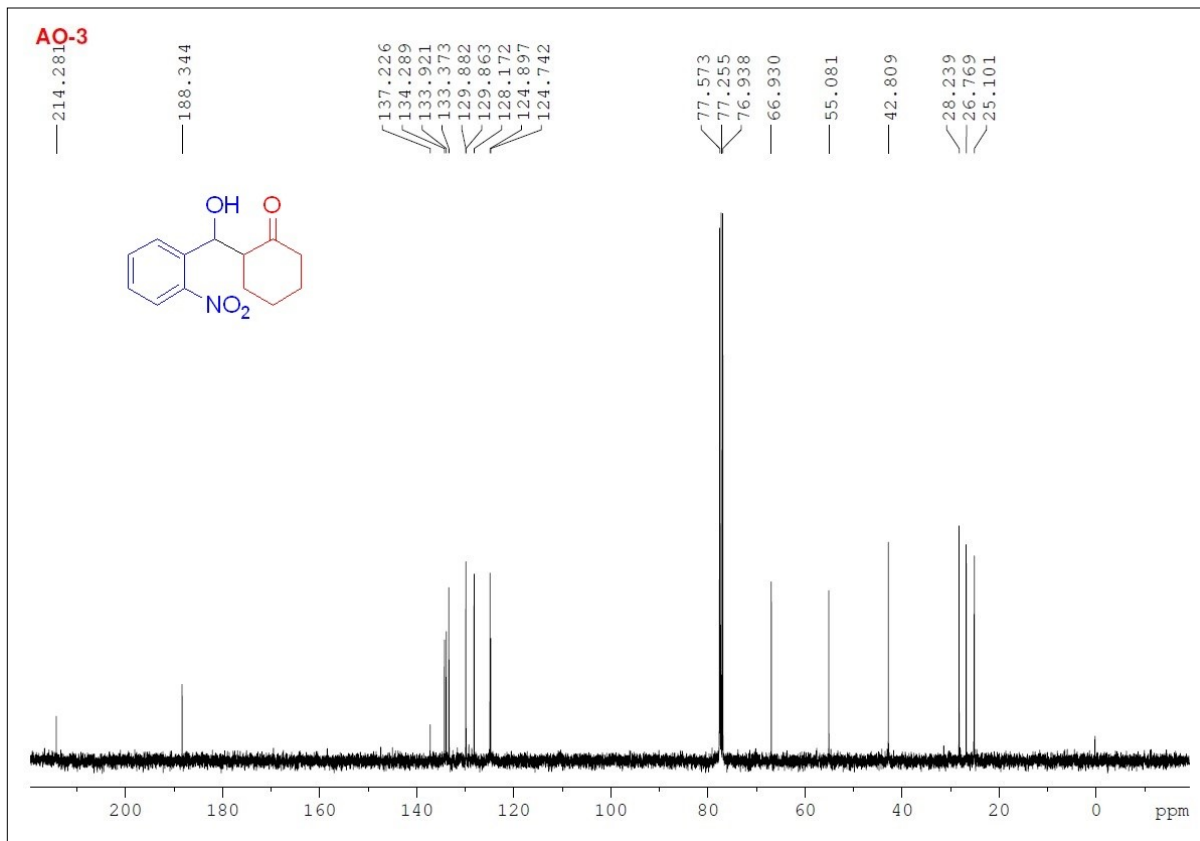
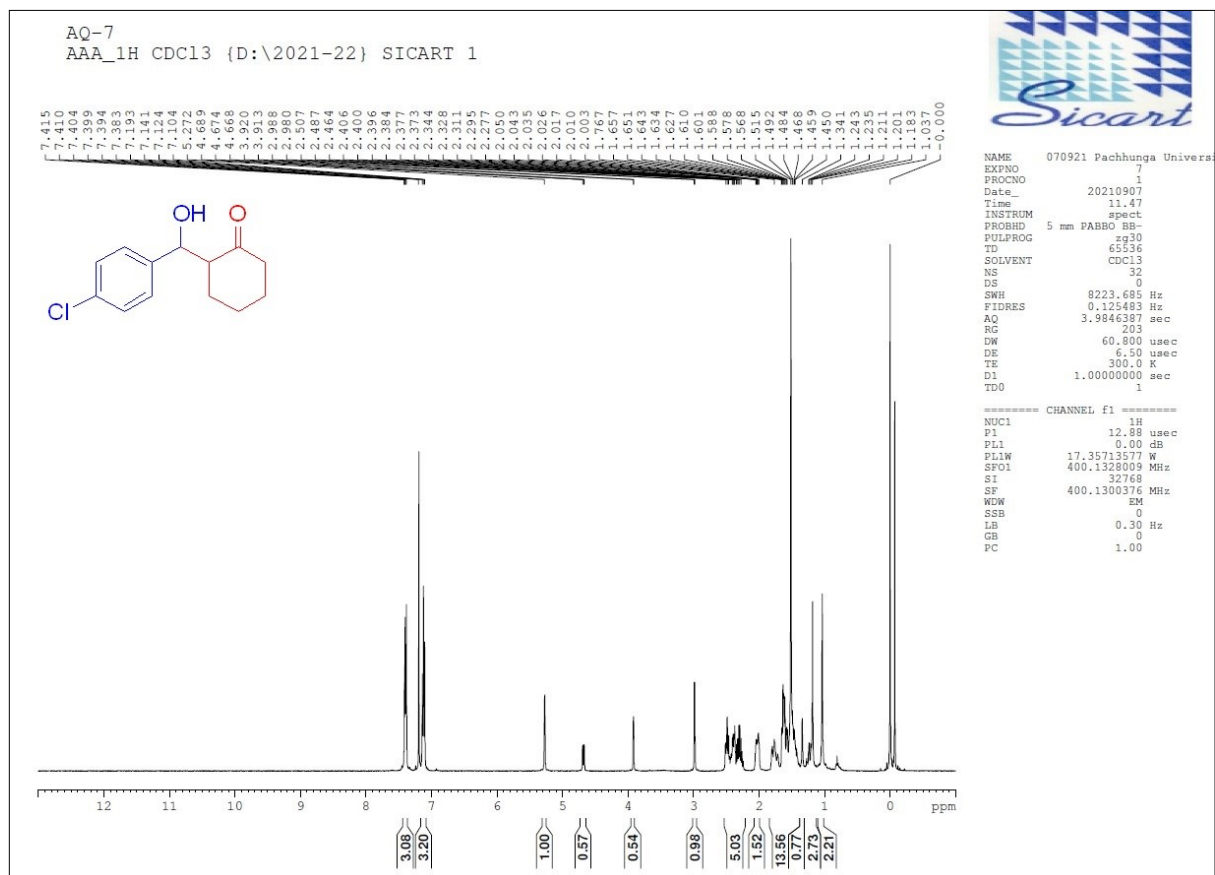


Figure S22: <sup>13</sup>C NMR data of 2-(hydroxy(2-nitrophenyl)methyl)cyclohexan-1-one (7c)



**Figure S23: <sup>1</sup>H NMR data of 2-((4-chlorophenyl)(hydroxy)methyl)cyclohexan-1-one (7d)**



**Figure S24: <sup>13</sup>C NMR data of 2-((4-chlorophenyl)(hydroxy)methyl)cyclohexan-1-one (7d)**

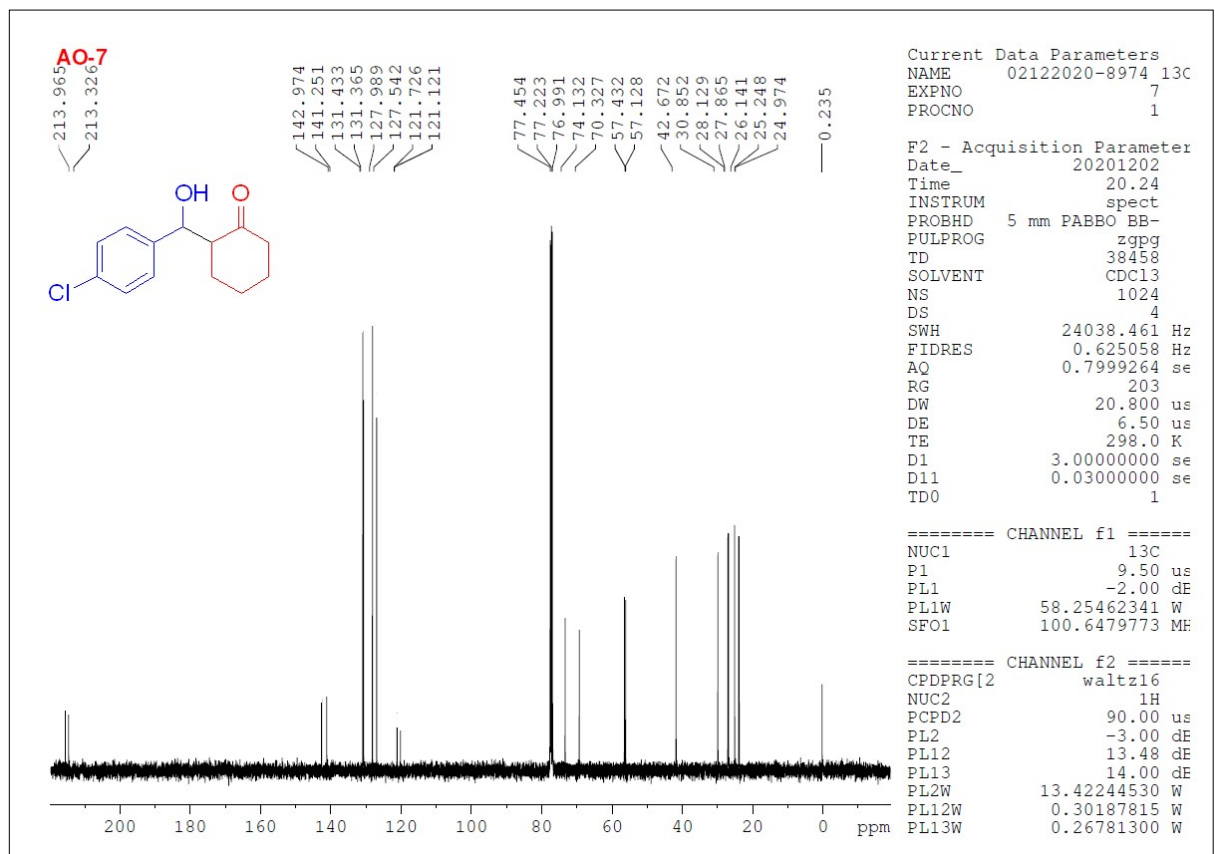


Figure S25: <sup>1</sup>H NMR data of 2-((3-chlorophenyl)(hydroxy)methyl)cyclohexan-1-one (7e)

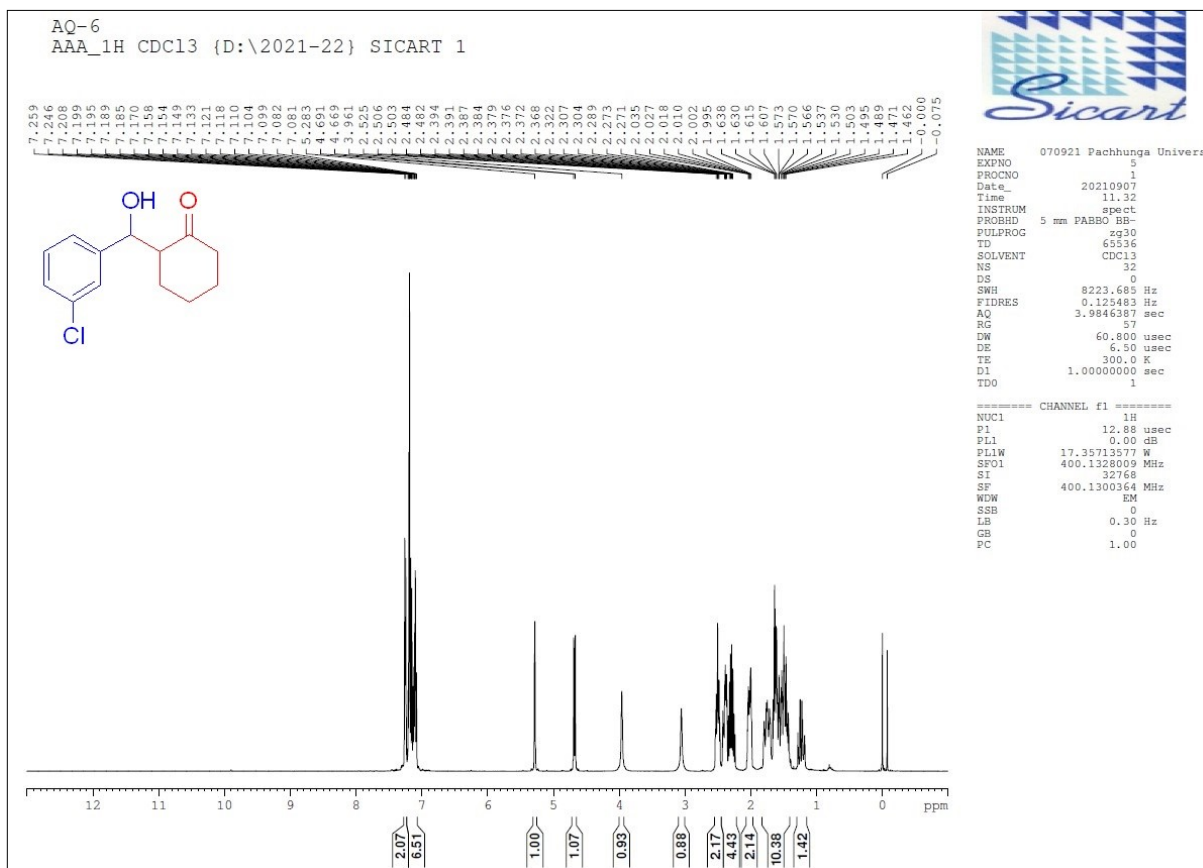


Figure S26: <sup>13</sup>C NMR data of 2-((3-chlorophenyl)(hydroxy)methyl)cyclohexan-1-one (7e)

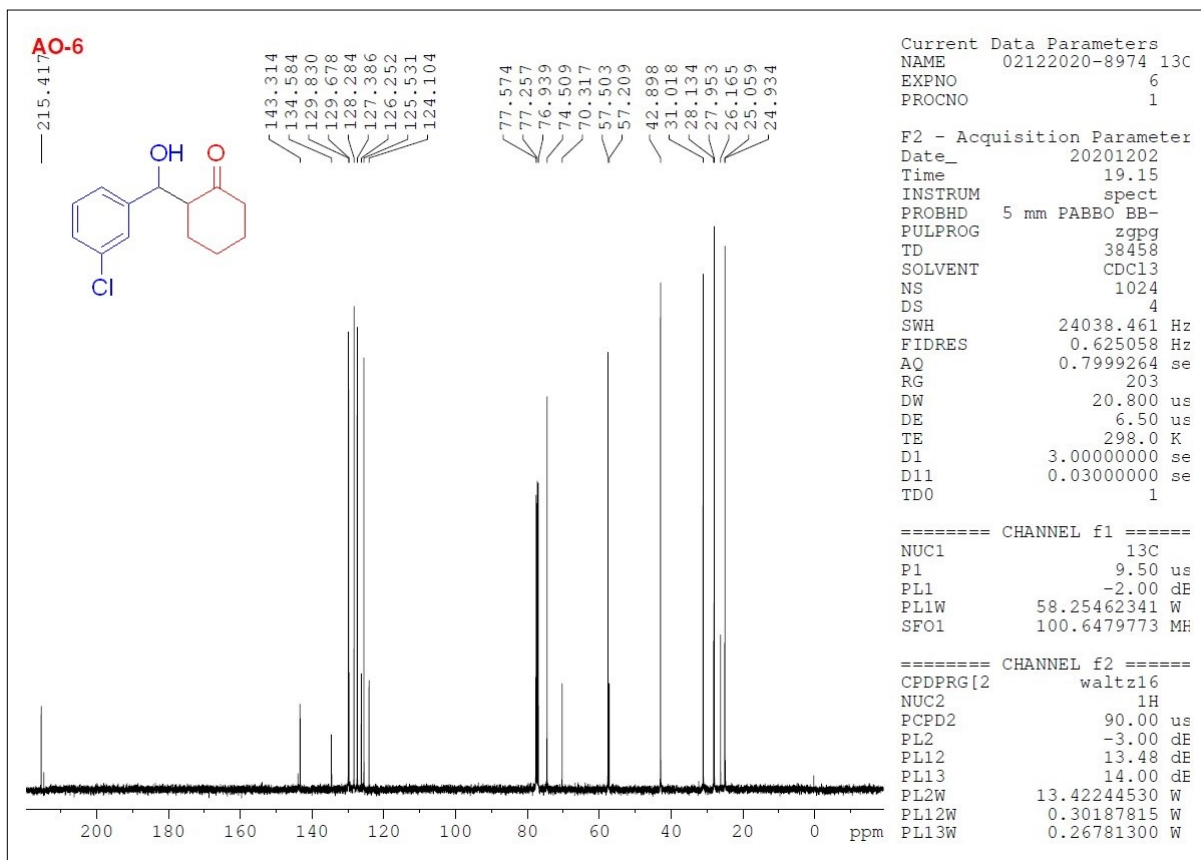


Figure S27: <sup>1</sup>H NMR data of 2-((2-chlorophenyl)(hydroxy)methyl)cyclohexan-1-one (7f)

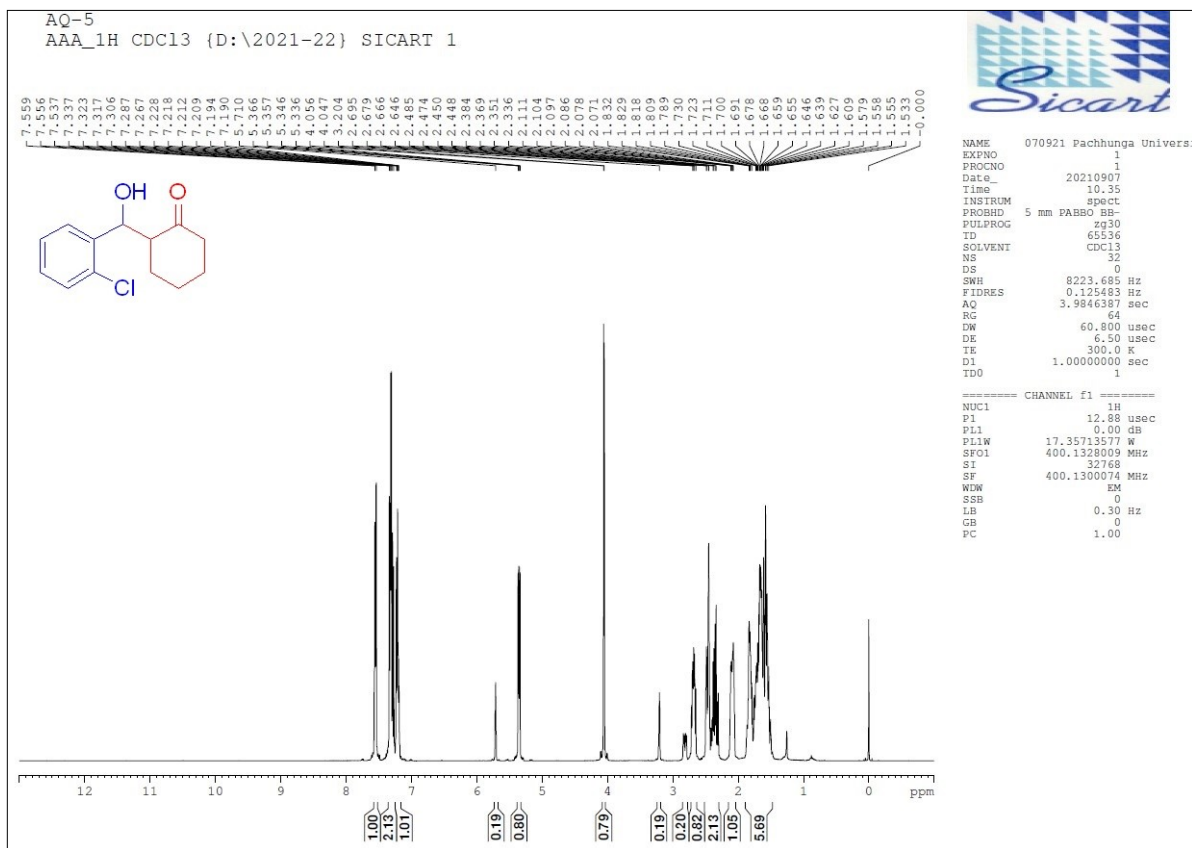
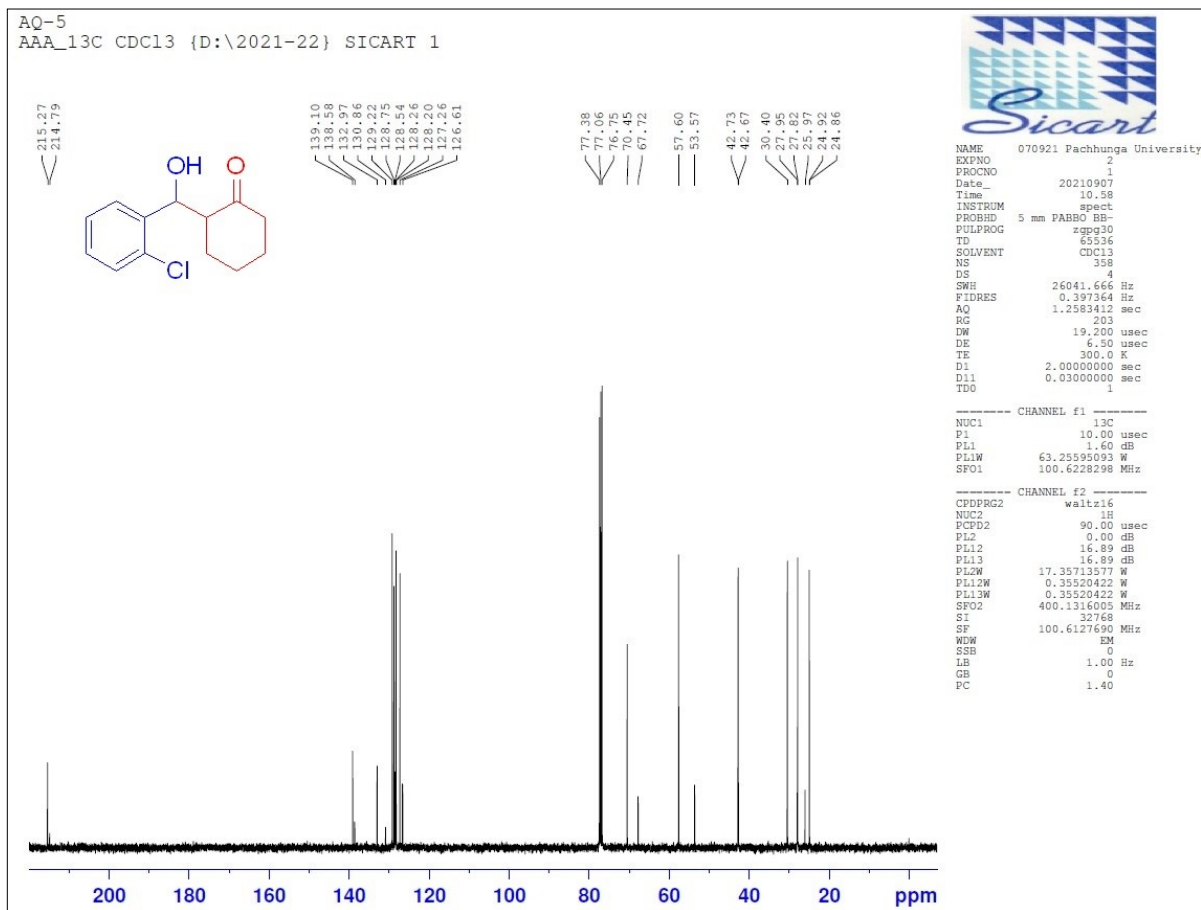
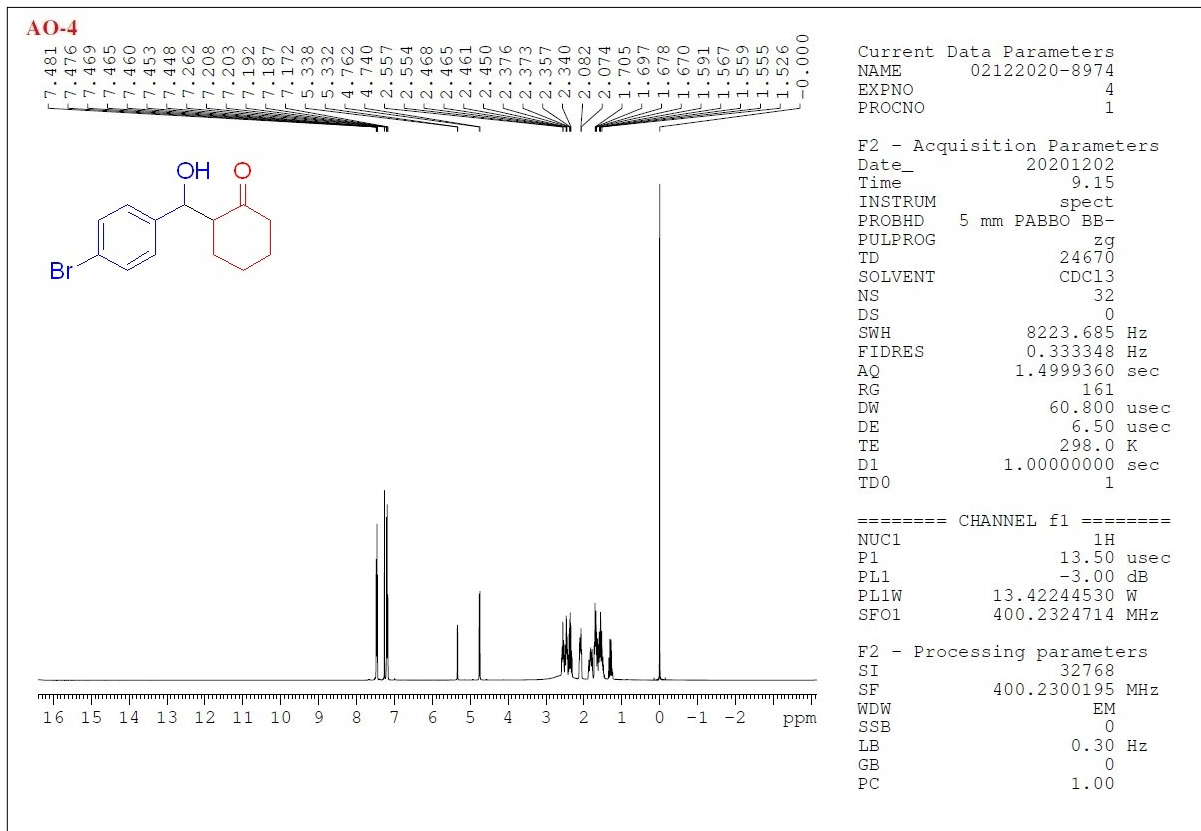


Figure S28: <sup>13</sup>C NMR data of 2-((2-chlorophenyl)(hydroxy)methyl)cyclohexan-1-one (7f)



**Figure S29: <sup>1</sup>H NMR data of 2-((4-bromophenyl)(hydroxy)methyl)cyclohexan-1-one (7g)**



**Figure S30: <sup>13</sup>C NMR data of 2-((4-bromophenyl)(hydroxy)methyl)cyclohexan-1-one (7g)**

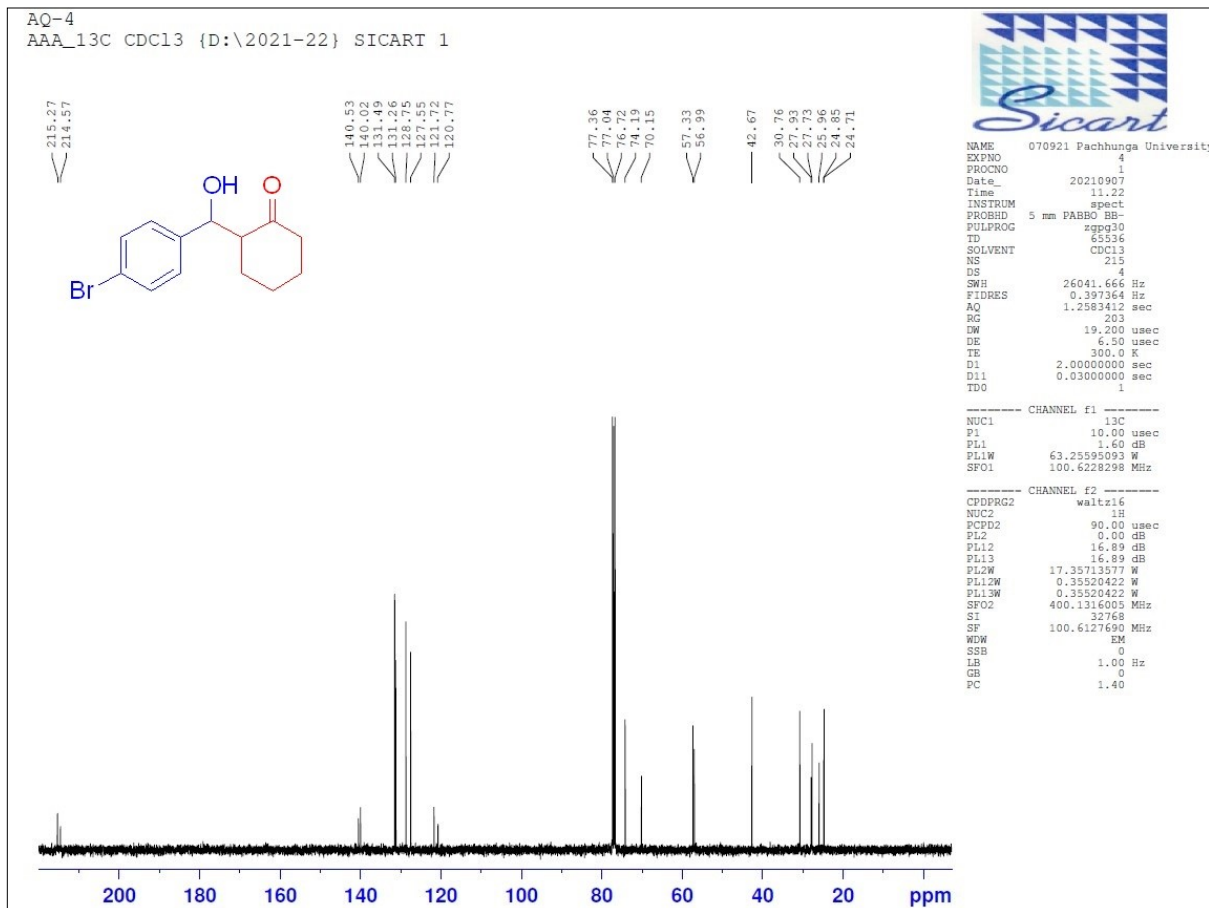


Figure S31: <sup>1</sup>H NMR data of 2-(hydroxy(phenyl)methyl)cyclohexan-1-one (7h)

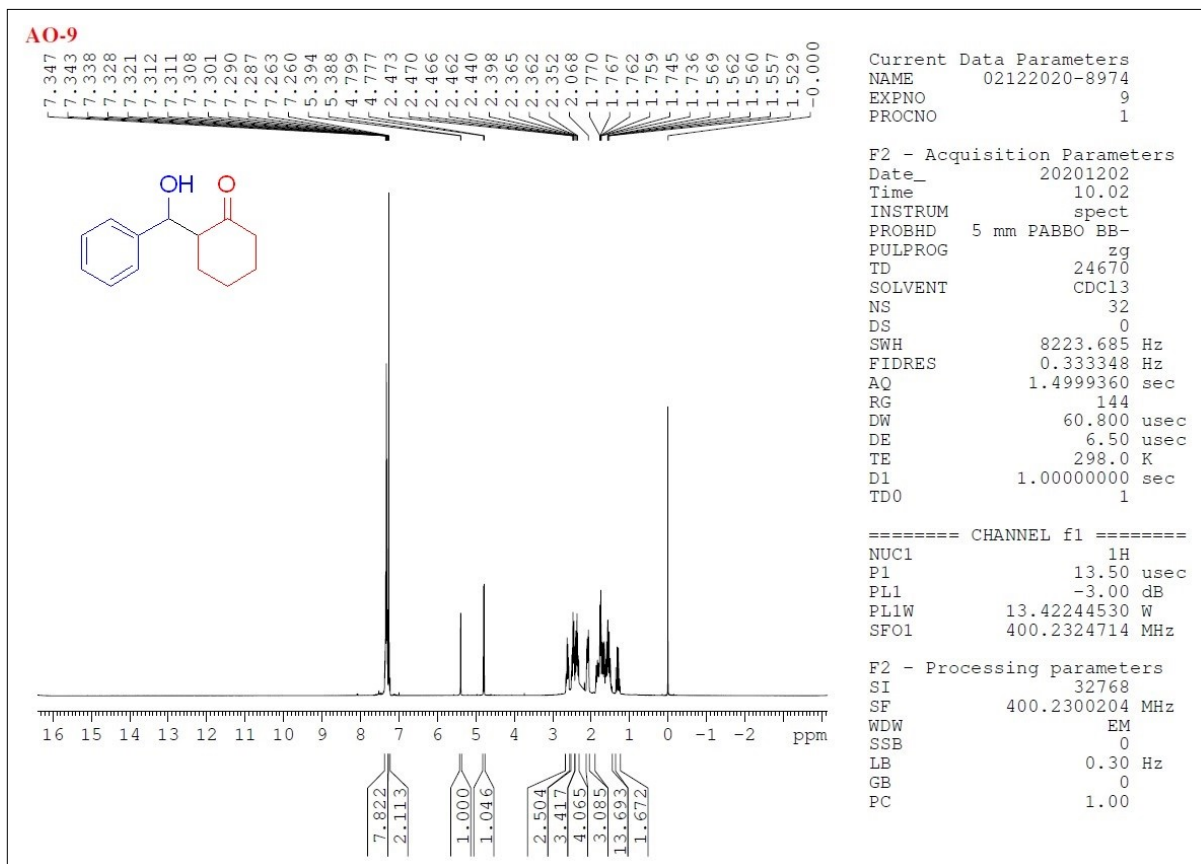
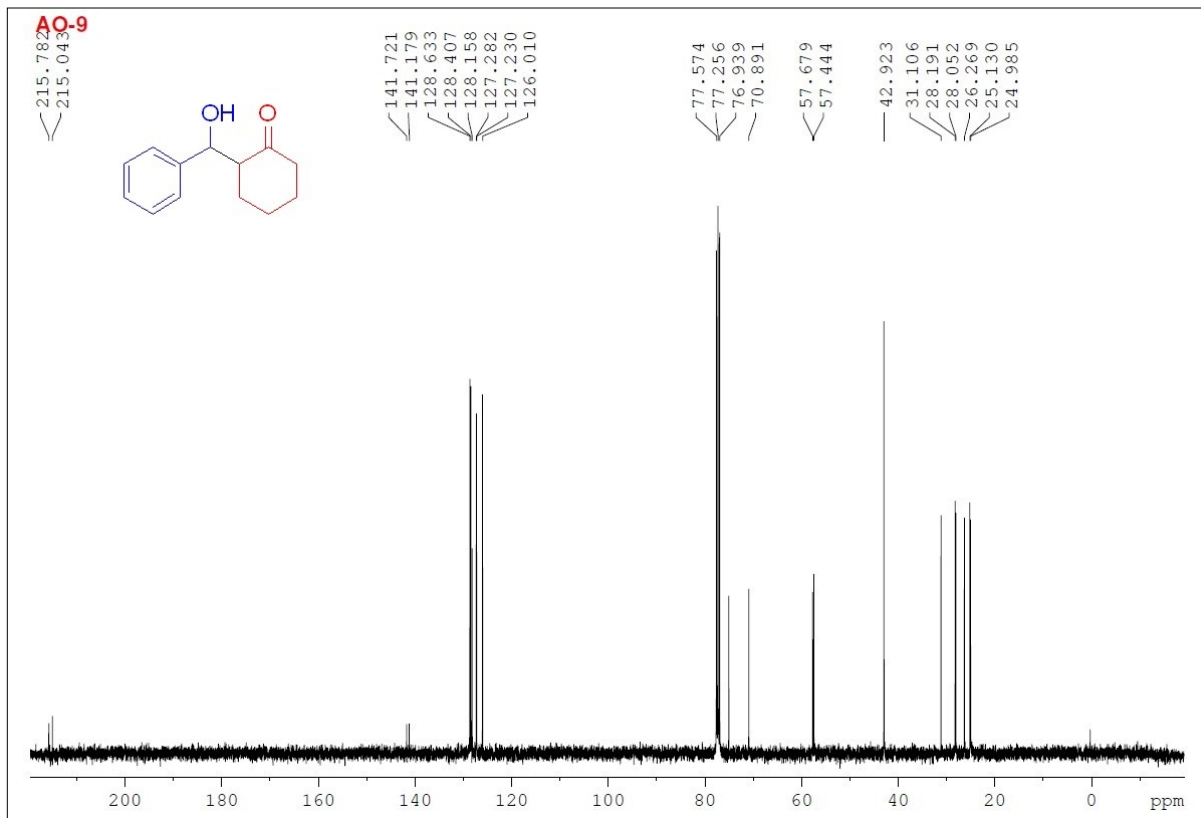
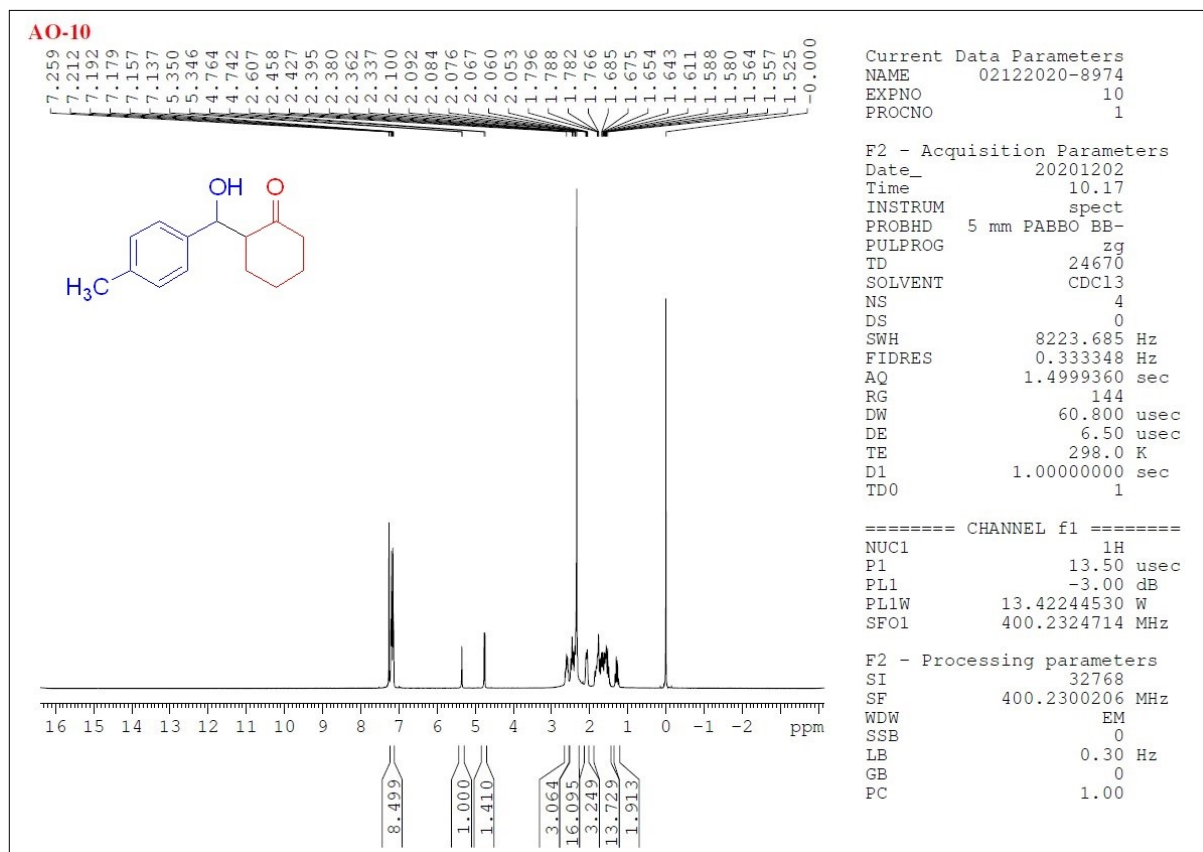


Figure S32: <sup>13</sup>C NMR data of 2-(hydroxy(phenyl)methyl)cyclohexan-1-one (7h)

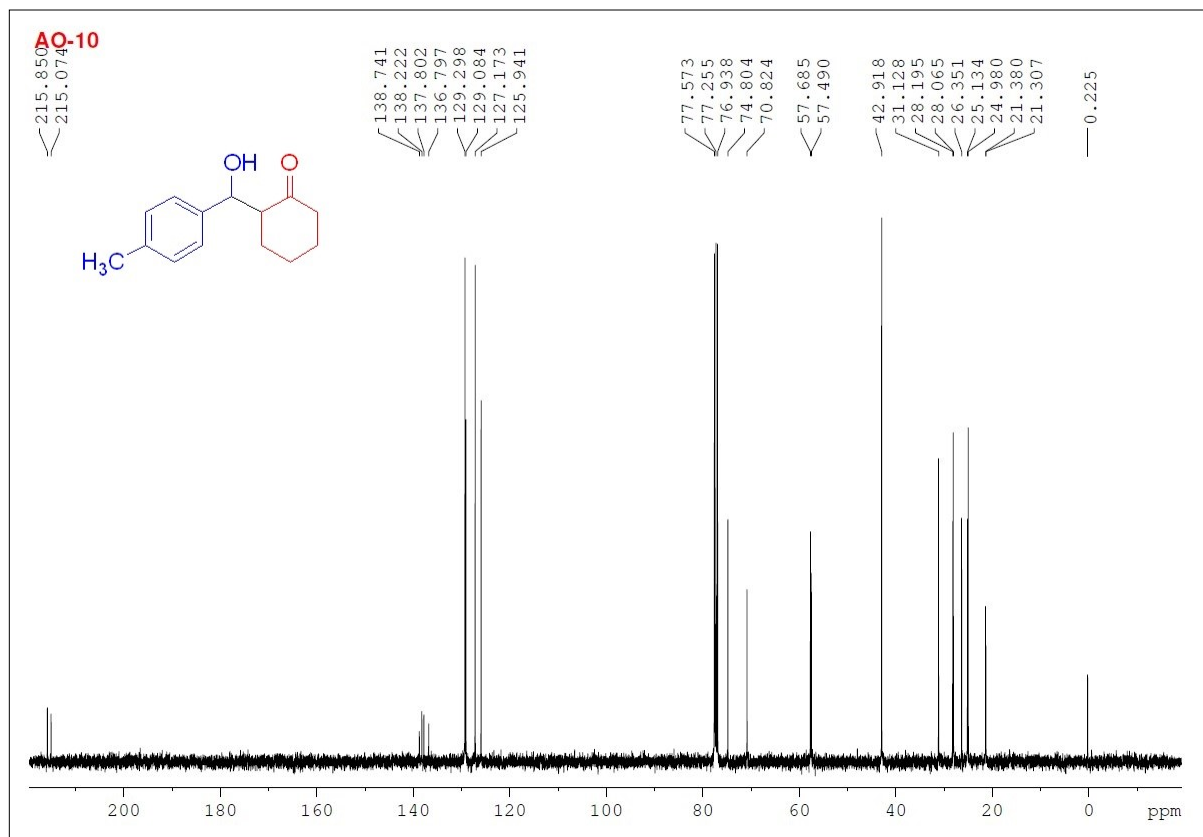




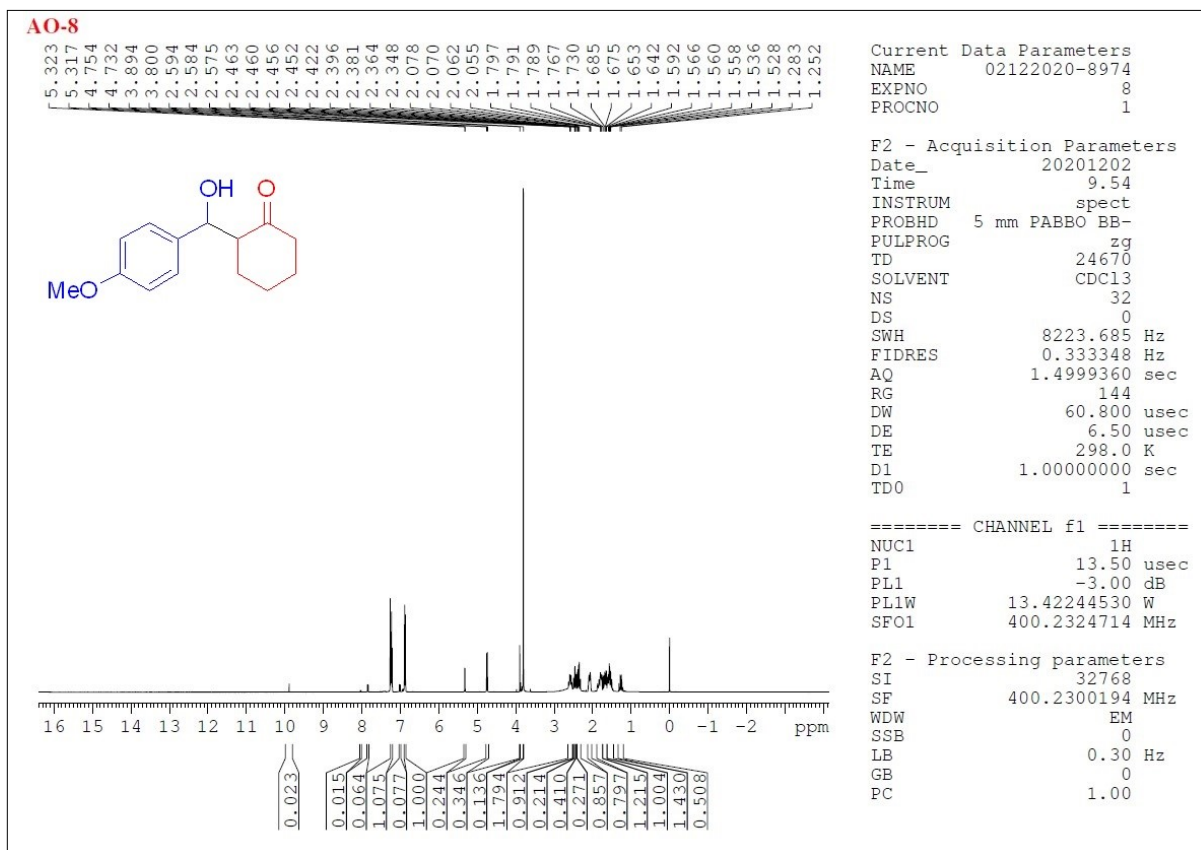
**Figure S33: <sup>1</sup>H NMR data of 2-(hydroxy(p-tolyl)methyl)cyclohexan-1-one (7i)**



**Figure S34: <sup>13</sup>C NMR data of 2-(hydroxy(p-tolyl)methyl)cyclohexan-1-one (7i)**



**Figure S35: <sup>1</sup>H NMR data of 2-(hydroxy(4-methoxyphenyl)methyl)cyclohexan-1-one (7j)**



**Figure S36: <sup>13</sup>C NMR data of 2-(hydroxy(4-methoxyphenyl)methyl)cyclohexan-1-one (7j)**

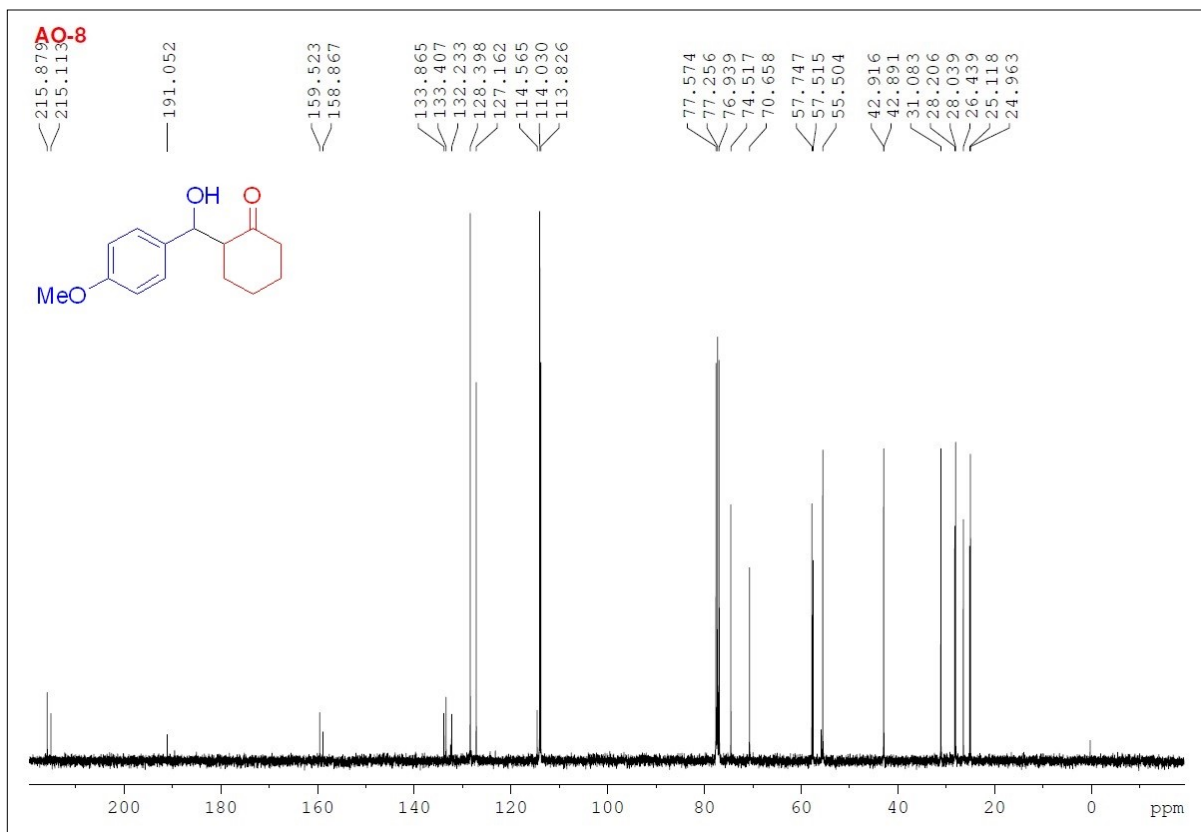


Figure S37: <sup>1</sup>H NMR data of 4-hydroxy-4-(4-nitrophenyl)butan-2-one (7k)

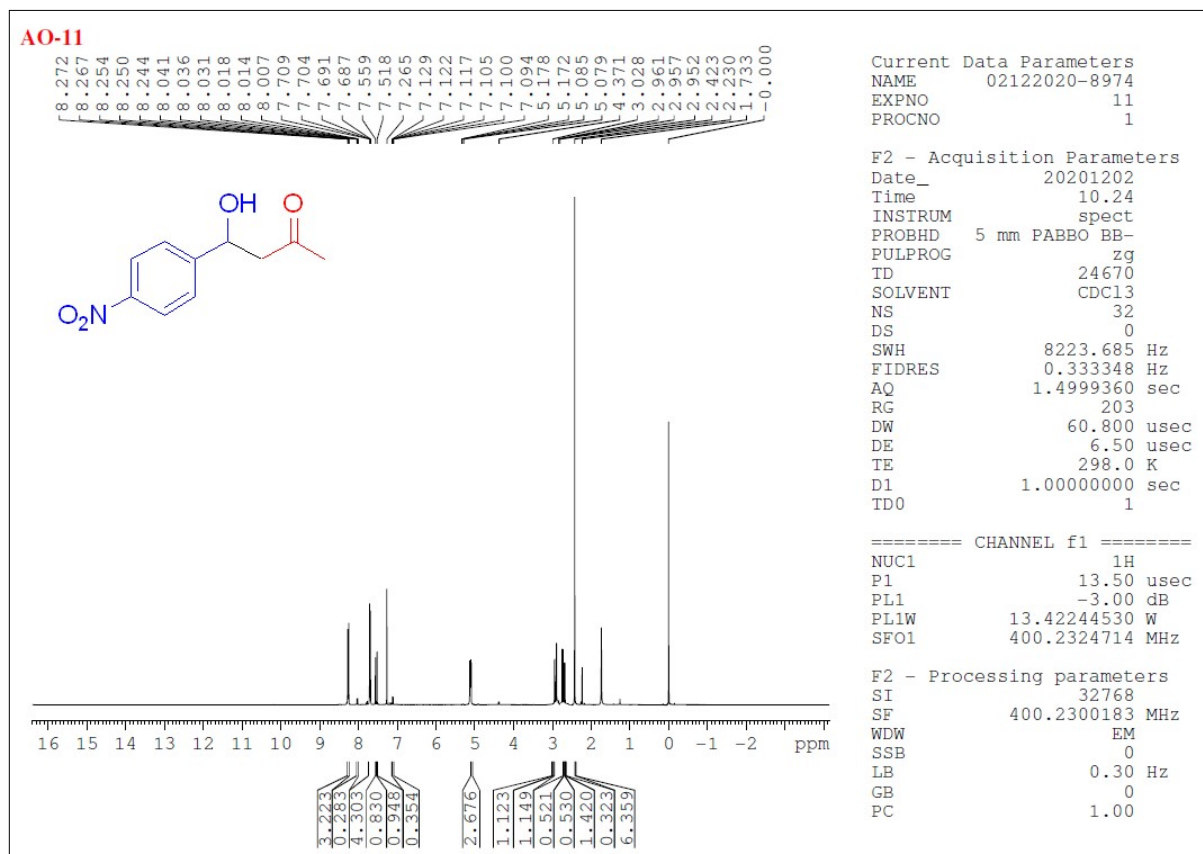


Figure S38: <sup>13</sup>C NMR data of 4-hydroxy-4-(4-nitrophenyl)butan-2-one (7k)

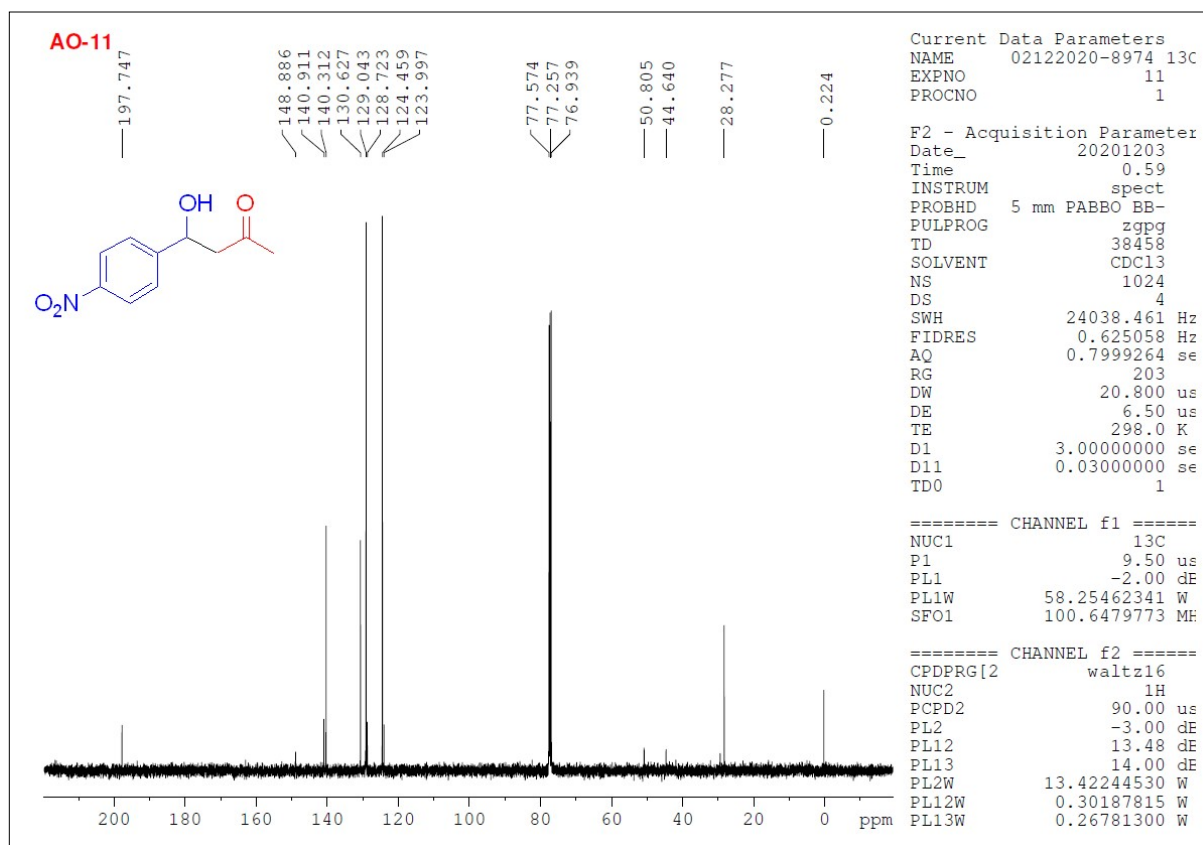


Figure S39: <sup>1</sup>H NMR data of 4-hydroxy-4-(3-nitrophenyl)butan-2-one (7l)

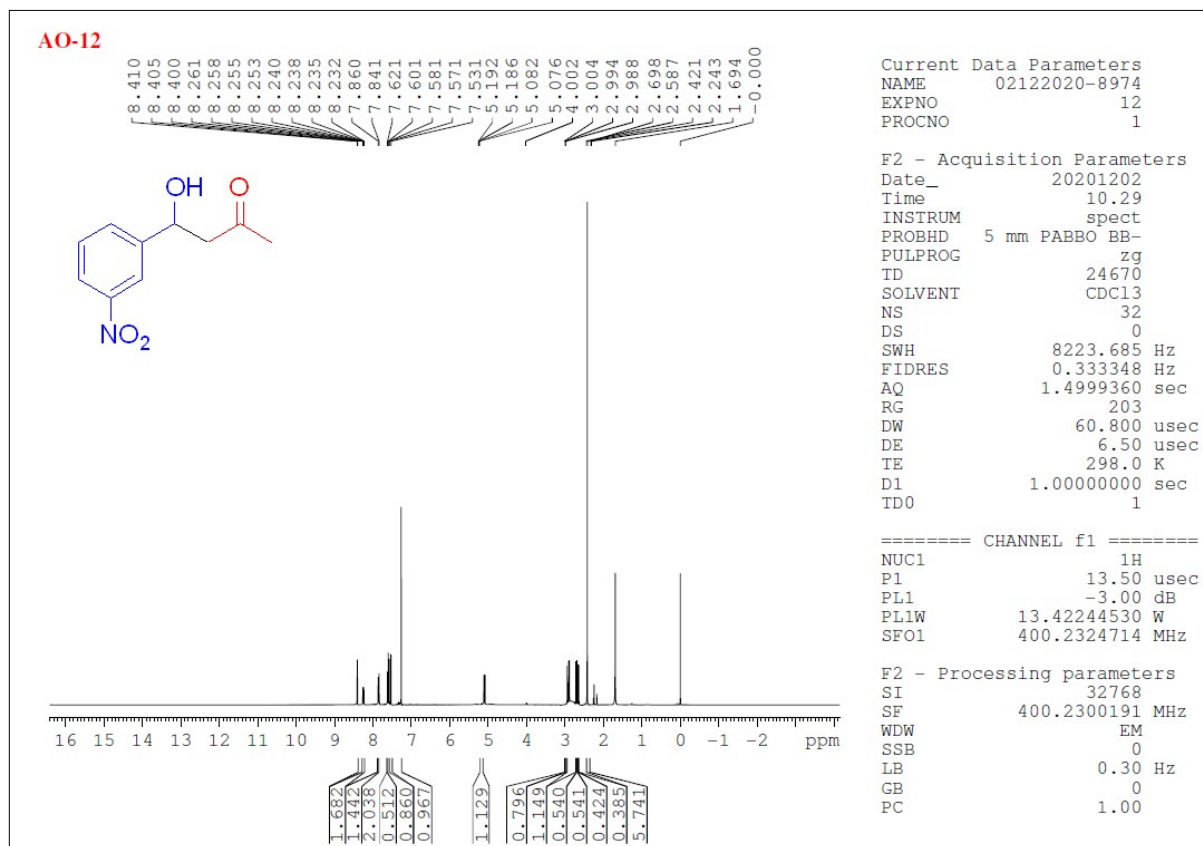


Figure S40: <sup>13</sup>C NMR data of 4-hydroxy-4-(3-nitrophenyl)butan-2-one (7l)

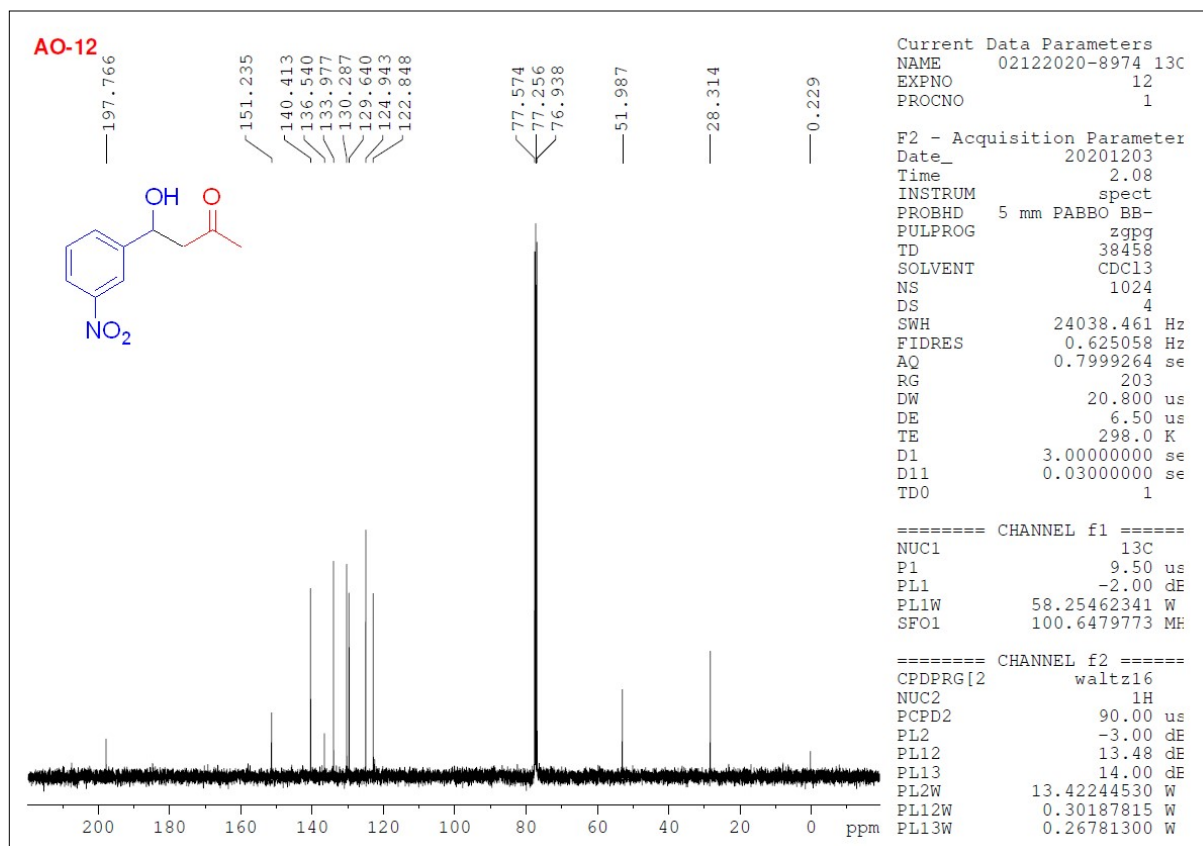


Figure S41: <sup>1</sup>H NMR data of 4-(4-chlorophenyl)-4-hydroxybutan-2-one (7m)

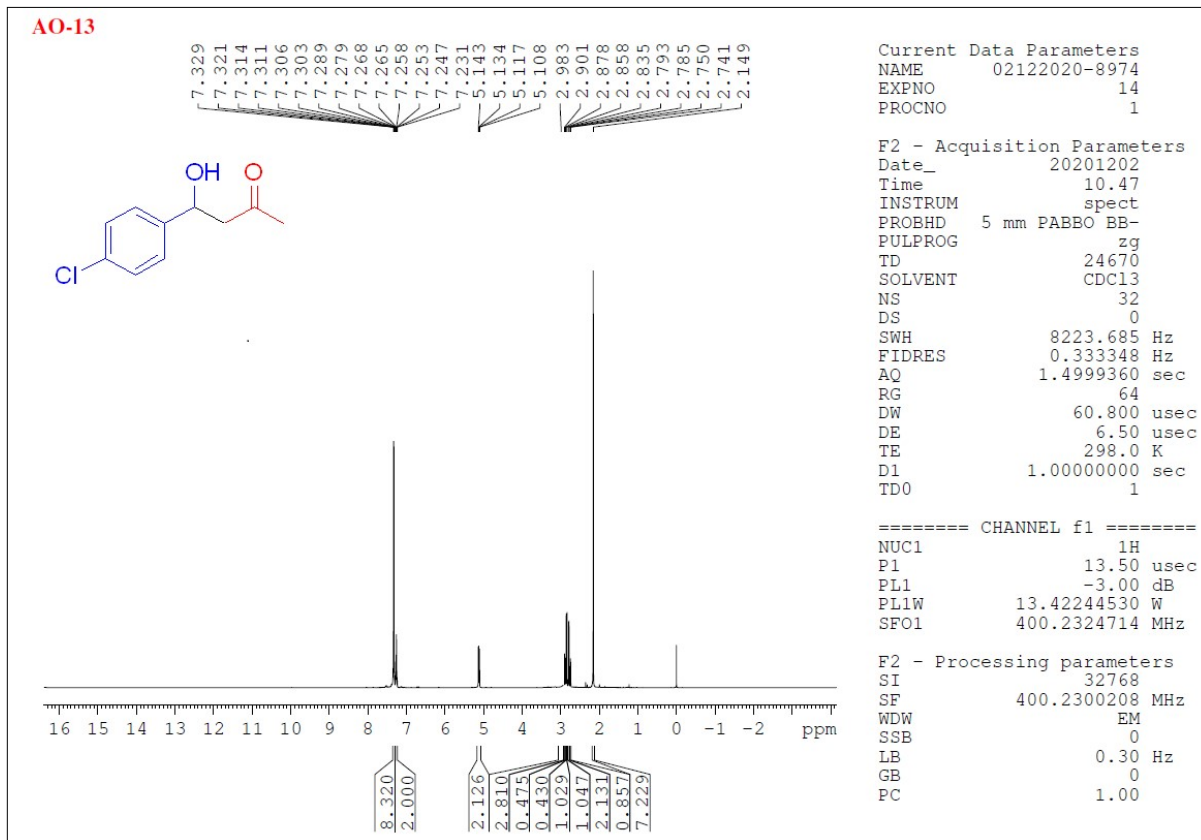


Figure S42: <sup>13</sup>C NMR data of 4-(4-chlorophenyl)-4-hydroxybutan-2-one (7m)

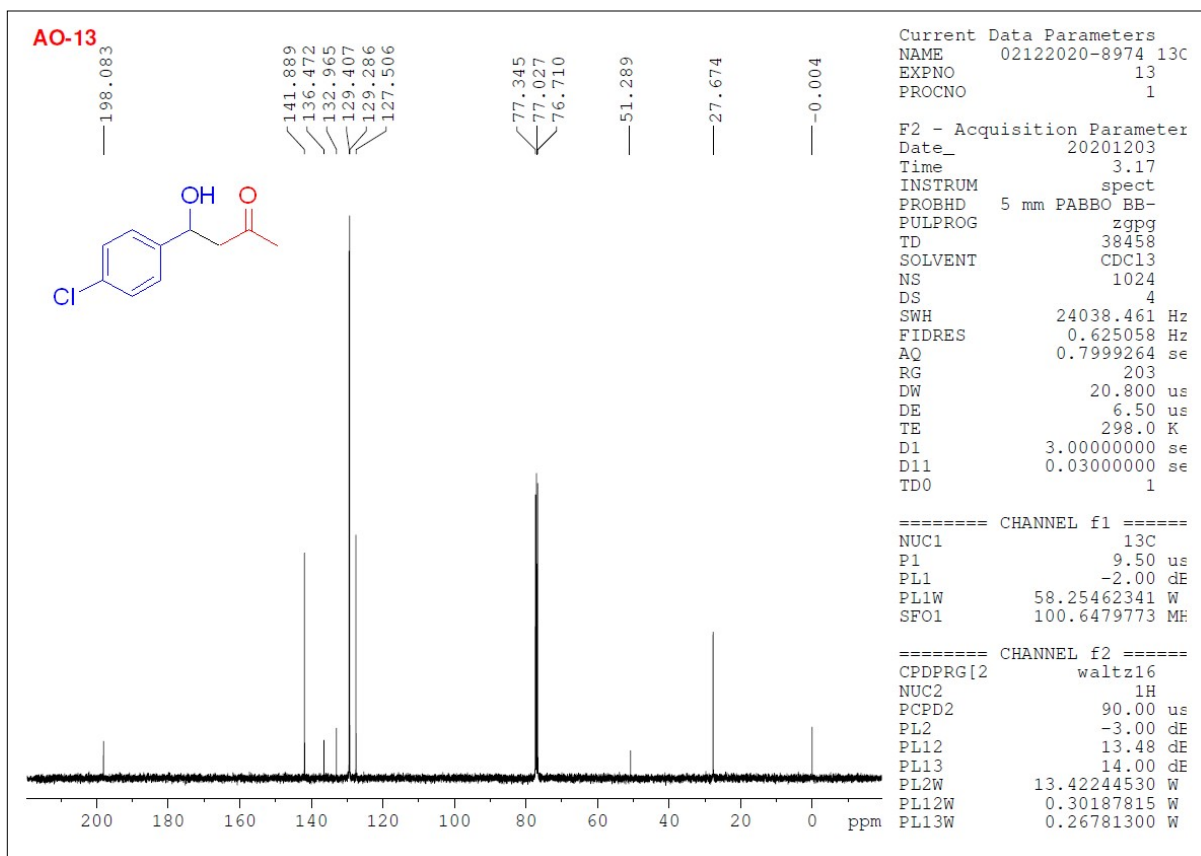


Figure S43: <sup>1</sup>H NMR data of 4-hydroxy-4-phenylbutan-2-one (7n)

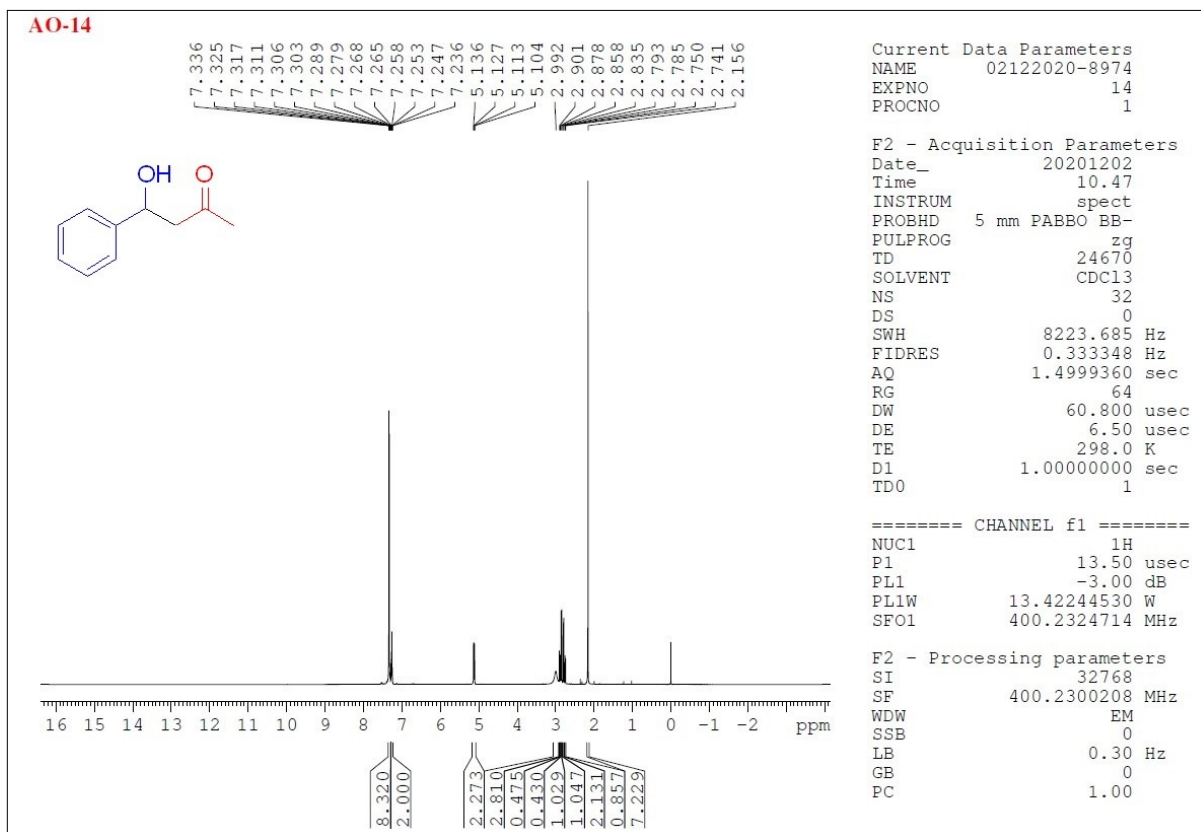


Figure S44: <sup>13</sup>C NMR data of 4-hydroxy-4-phenylbutan-2-one (7n)

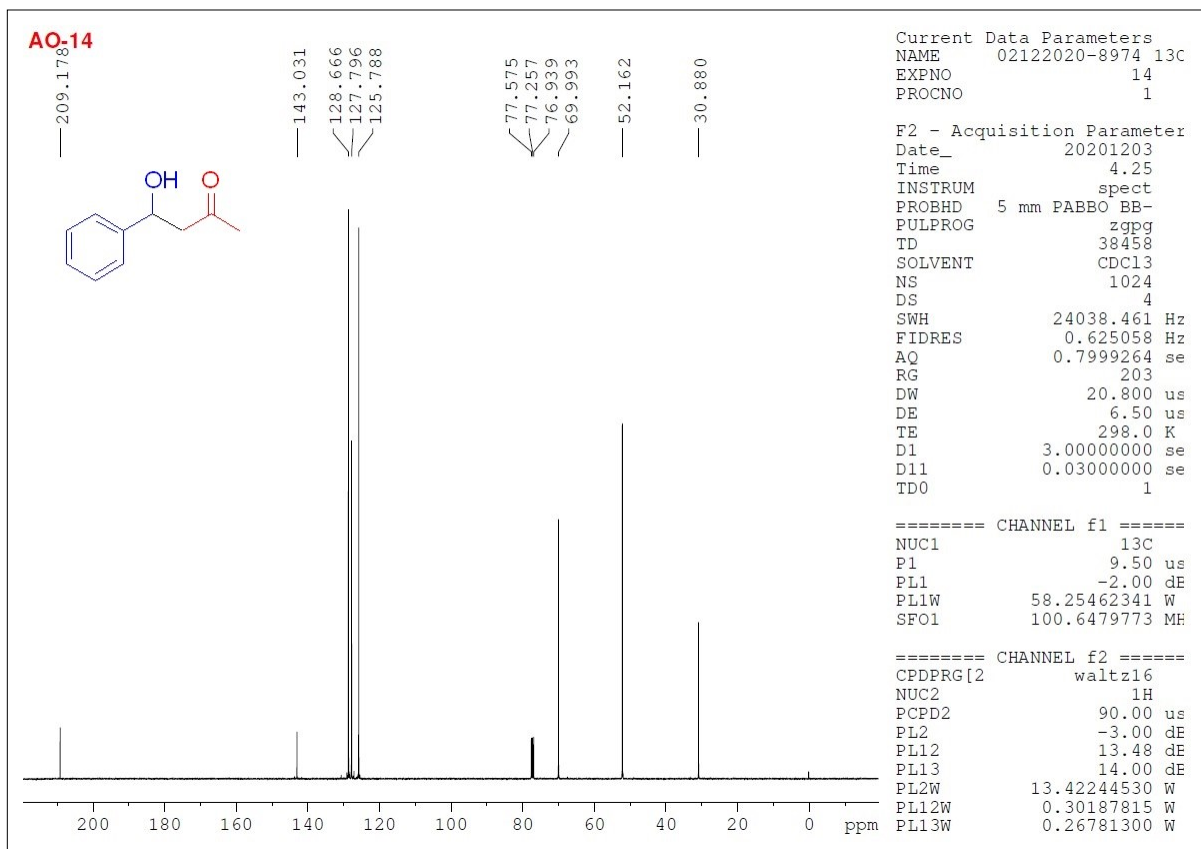


Figure S45: <sup>1</sup>H NMR data of 4-hydroxy-4-(p-tolyl)butan-2-one (7o)

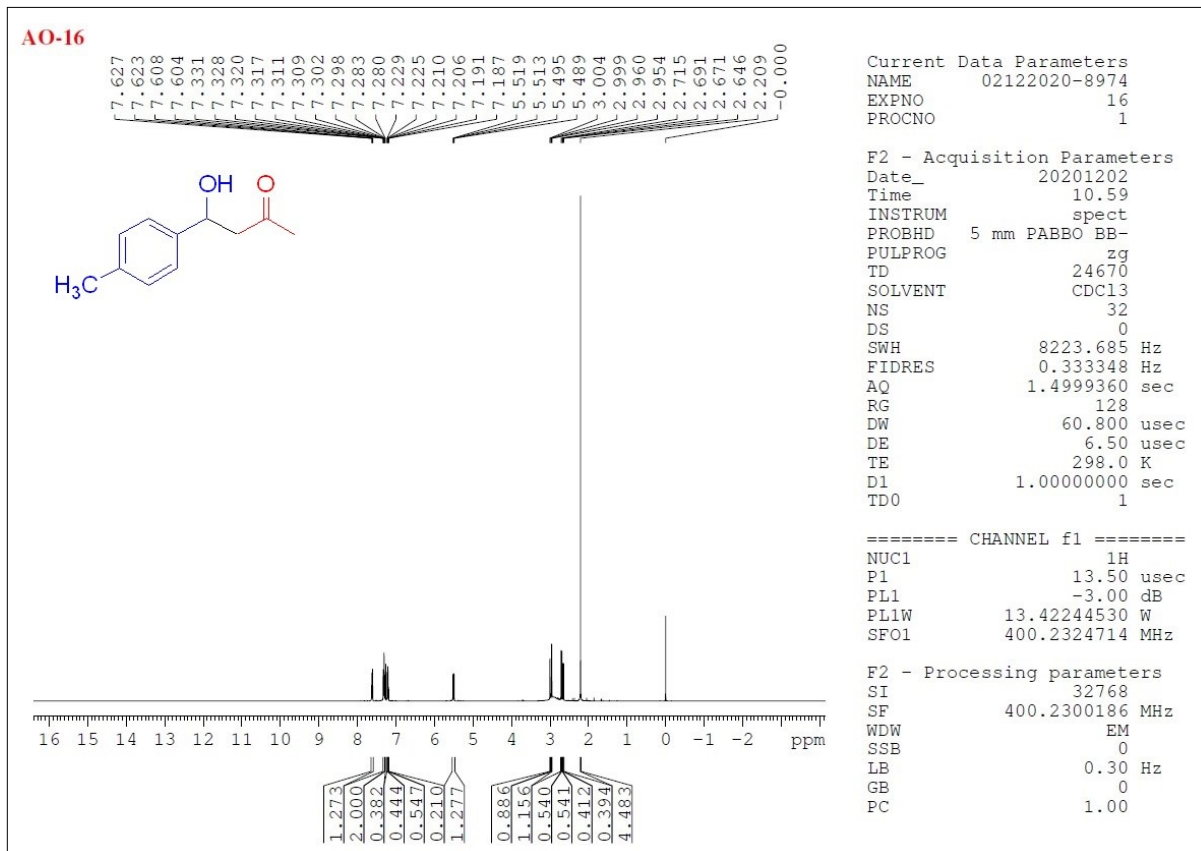


Figure S46: <sup>13</sup>C NMR data of 4-hydroxy-4-(p-tolyl)butan-2-one (7o)

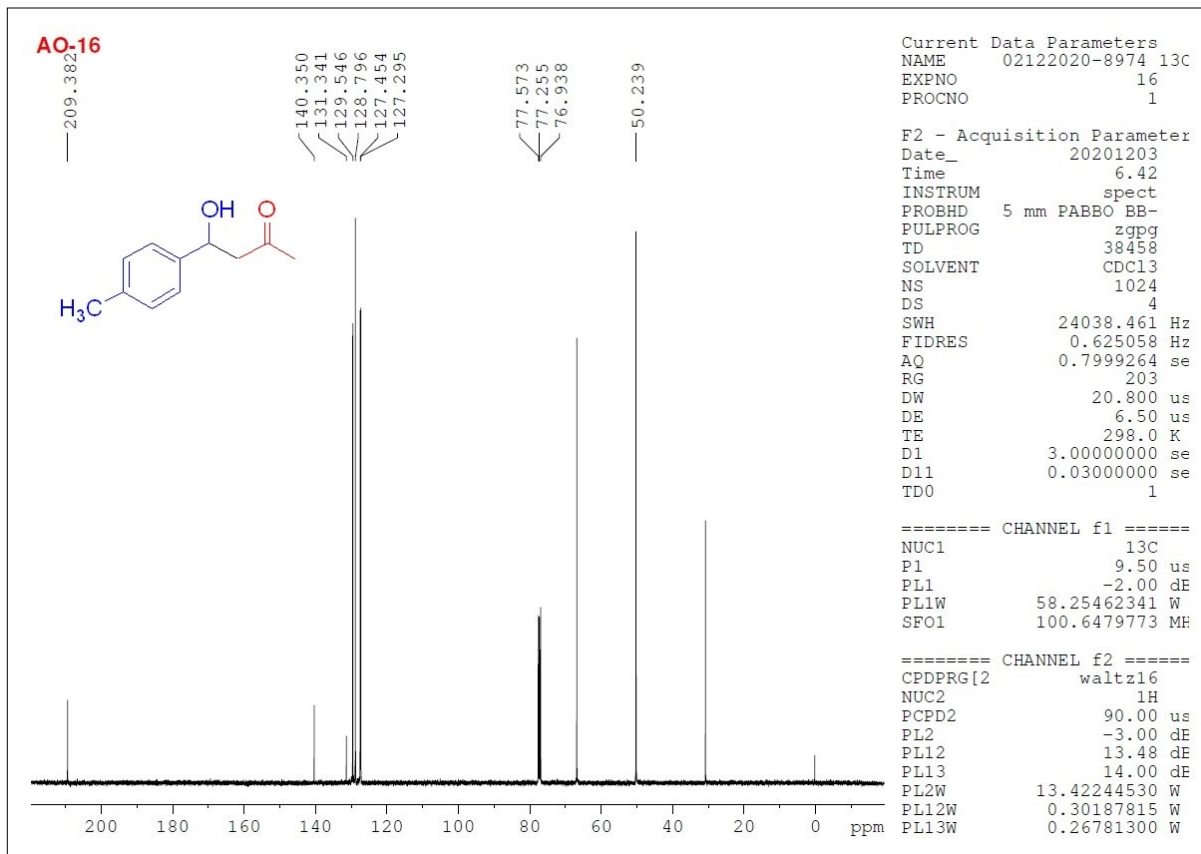


Figure S47: <sup>1</sup>H NMR data of 4-hydroxy-4-(4-methoxyphenyl)butan-2-one (7p)

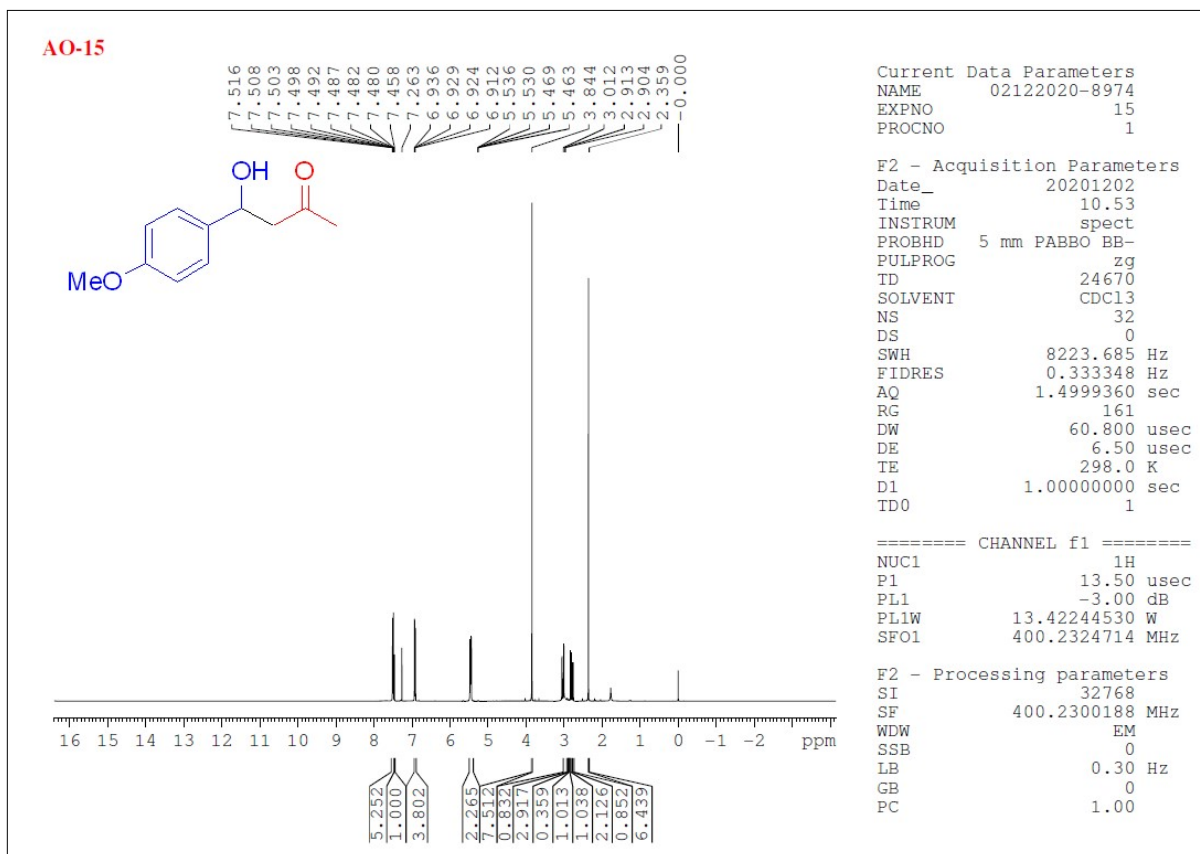
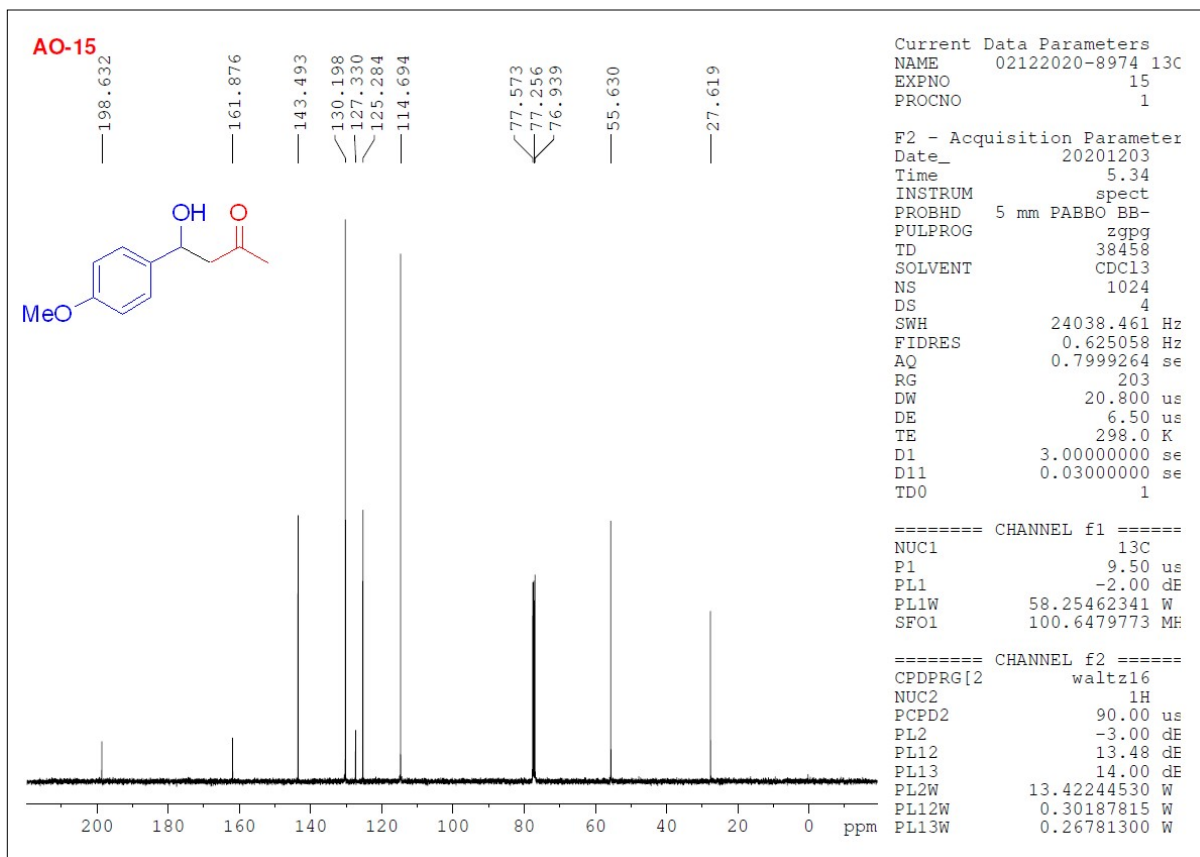
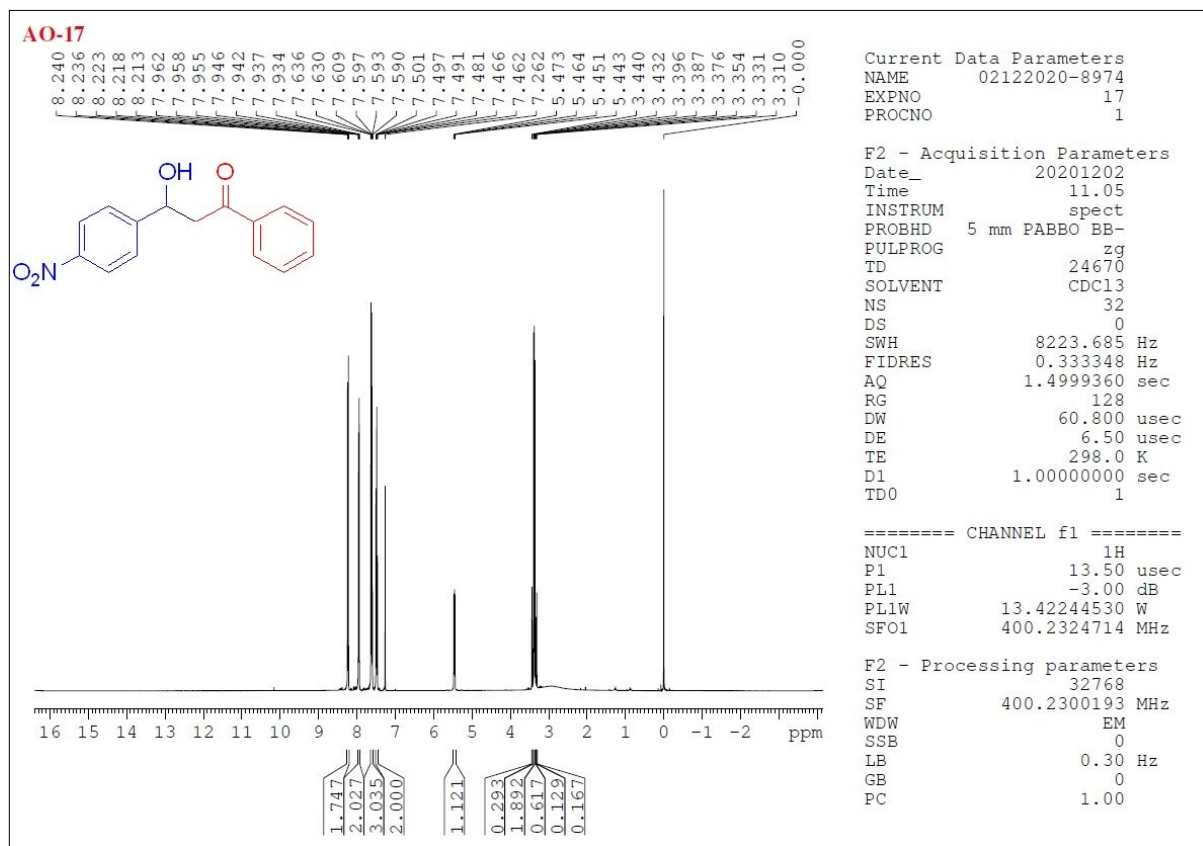


Figure S48: <sup>13</sup>C NMR data of 4-hydroxy-4-(4-methoxyphenyl)butan-2-one (7p)





**Figure S49: <sup>1</sup>H NMR data of 3-hydroxy-3-(4-nitrophenyl)-1-phenylpropan-1-one (7q)**



**Figure S50: <sup>13</sup>C NMR data of 3-hydroxy-3-(4-nitrophenyl)-1-phenylpropan-1-one (7q)**

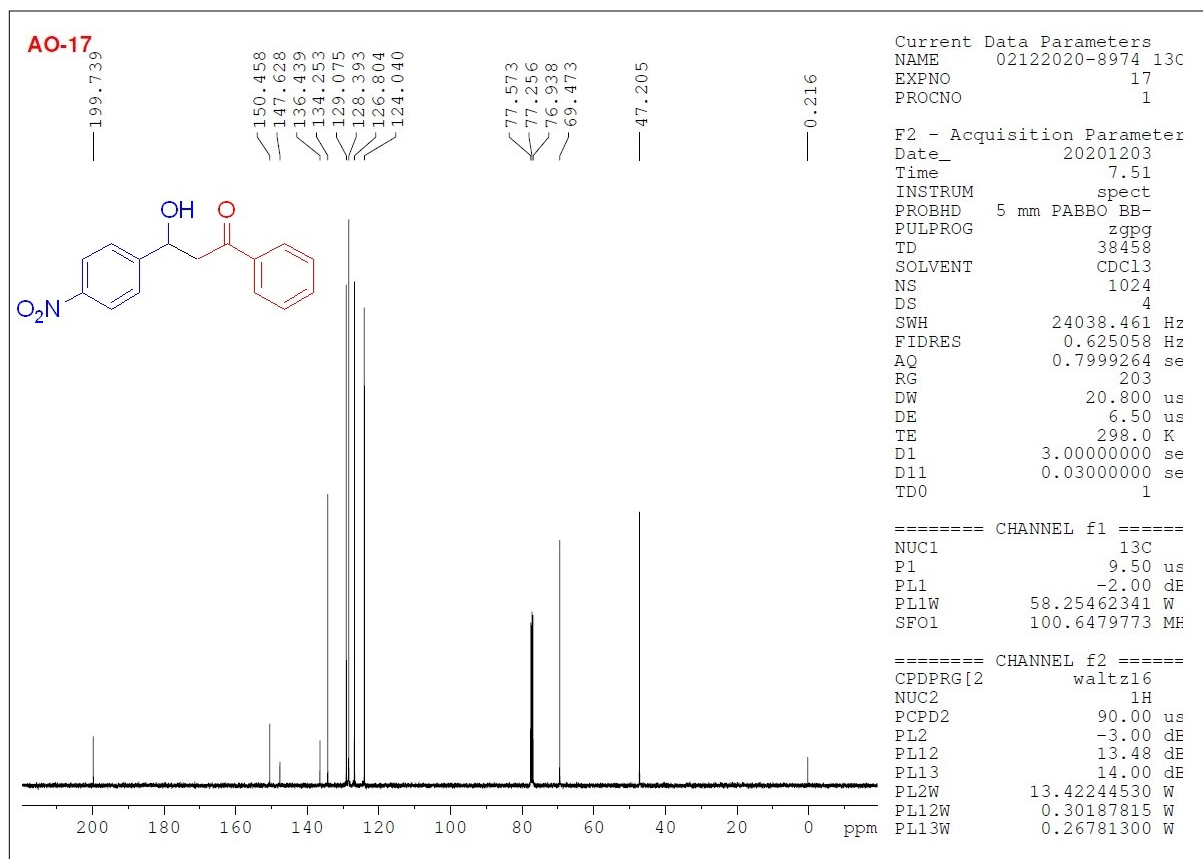


Figure S51: <sup>1</sup>H NMR data of 3-hydroxy-3-(3-nitrophenyl)-1-phenylpropan-1-one (7r)

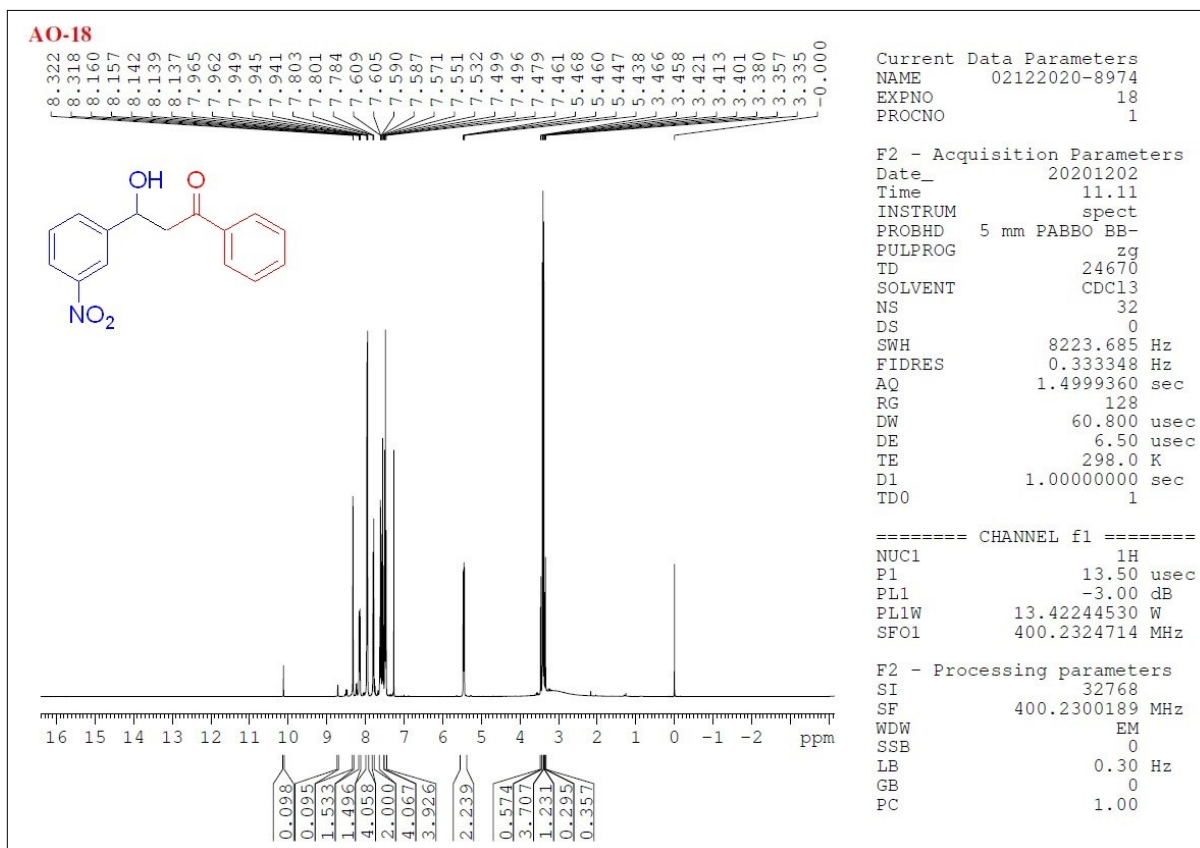


Figure S52: <sup>13</sup>C NMR data of 3-hydroxy-3-(3-nitrophenyl)-1-phenylpropan-1-one (7r)

