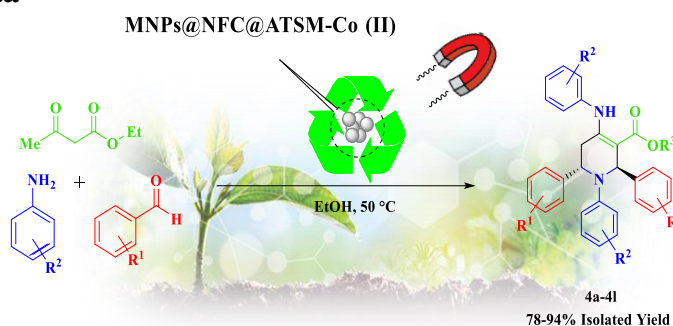


## Survey cobalt (II) supported on cellulose functionalized Fe<sub>3</sub>O<sub>4</sub> nanoparticles as a novelty catalyst for the synthesis of piperidines

Pouya Ghamari kargar <sup>a</sup>, Ghodsieh Bagherzade \* <sup>a</sup>

### Selected spectral data



#### Ethyl 1,2,6-triphenyl-4-(phenylamino)-1,2,5,6-tetrahydropyridine-3-carboxylate (4a)

White solid; m.p. (°C): = 174–175 °C.

<sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>): δ = 1.36 (3H, t, CH<sub>3</sub>), 2.64–2.81 (2H, dd-dd, CH<sub>2</sub>), 4.16–4.40 (2H, m), 5.04–5.05 (1H, d), 6.15–6.18 (2H, t), 6.34 (1H, s), 6.40 (2H, d), 6.47 (1H, t), 6.91–7.02 (5H, m), 7.04–7.29 (10H, m), 10.17 (1H, NH).

<sup>13</sup>CNMR (DMSO, 75 MHz): δ = 14.59, 35.69, 47.86, 60.62, 61.47, 101.37, 114.30, 121.04, 122.07, 127.06, 127.32, 128.36, 129.50, 134.60, 138.89, 141.40, 149.72, 167.92 ppm.

Anal. Calcd. For C<sub>32</sub>H<sub>30</sub>N<sub>2</sub>O<sub>2</sub>: C, 80.98; H, 6.37; N, 5.90; O, 6.74 Found: C, 80.89; H, 6.39; N, 5.87; O, 6.85.

#### Methyl 1,2,6-triphenyl-4-(phenylamino)-1,2,5,6-tetrahydro pyridine-3-carboxylate (4b)

White solid; m.p. = 169–170 °C.

<sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>): δ = 3.86 (3H, s), 5.06–5.07 (1H, d), 6.18–6.20 (2H, dd), 6.38 (1H, s), 6.43–6.46 (2H, d), 6.50–6.55 (1H, t), 6.96–7.26 (17H, m), 10.18 (1H, NH) ppm.

<sup>13</sup>CNMR (DMSO, 75 MHz): δ = 14.59, 35.69, 47.86, 50.60, 61.46, 101.32, 114.30, 121.04, 122.03, 127.10, 127.30, 128.37, 129.49, 134.61, 138.88, 141.48, 149.60, 167.97 ppm.

Anal. Calcd. For C<sub>32</sub>H<sub>30</sub>N<sub>2</sub>O<sub>2</sub>: C, 80.84; H, 6.13; N, 6.08; O, 6.95 Found: C, 80.83; H, 6.15; N, 6.05; O, 6.97.

#### 1-(2,6-bis(4-bromophenyl)-1-(4-chlorophenyl)-4-((4-chlorophenyl) amino)-1,2,5,6-tetra hydro pyridin-3-yl) propan-1-one (4f)

White solid; m.p. = 155–157 °C.

<sup>1</sup>H MNR (300 MHz, CDCl<sub>3</sub>): δ = 2.58–2.78 (2H, dd-dd, CH<sub>2</sub>), 3.87 (3H, s), 4.99–5.00 (1H, d), 6.19–6.22 (2H, d), 6.28–6.31 (2H, d), 6.90–7.20 (12H, m), 10.12 (1H, NH) ppm.

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<sup>13</sup>CNMR (DMSO, 75 MHz): δ= 10.91, 31.39, 35.88, 47.84, 59.88, 101.65, 116.77, 121.74, 125.64, 127.02, 127.67, 128.71, 129.50, 131.23, 132.24, 137.55, 140.85, 147.59, 199.96 ppm.

Anal. Calcd. For C<sub>32</sub>H<sub>26</sub>Br<sub>2</sub>Cl<sub>2</sub>N<sub>2</sub>O: C, 56.09; H, 3.82; N, 4.09; O, 2.33 Found: C, 56.02; H, 3.90; N, 4.06; O, 2.35.

**Methyl 2,6-bis(4-chlorophenyl)-1-phenyl-4-(phenylamino)-1,2,5,6-tetrahydropyridine-3-carboxylate (4k)**

White solid; m.p. = 183–187 °C.

<sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>): δ= 2.63-2.78 (2H, dd-dd, CH<sub>2</sub>), 3.84 (3H, s), 5.01-5.02 (1H, d), 6.28 (1H, s), 6.31-6.34 (2H, dd), 6.36-6.39 (2H, d), 6.54-6.59 (2H, t), 6.98–7.12 (6H, m), 7.15–7.18 (7H, m), 10.18 (1H, NH).

<sup>13</sup>CNMR (DMSO, 75 MHz): δ= 36.24, 47.86, 52.98, 64.83, 103.65, 114.29, 123.53, 127.51, 128.36, 128.53, 129.88, 132.24, 133.28, 136.73, 138.89, 139.44, 149.72, 167.92 ppm.

Anal. Calcd. For C<sub>31</sub>H<sub>26</sub>Cl<sub>2</sub>N<sub>2</sub>O<sub>2</sub>: C, 70.32; H, 4.95; N, 5.29; O, 6.04 Found: C, 70.35; H, 4.90; N, 5.33; O, 6.10.

**Methyl 1-(4-bromophenyl)-4-((4-bromophenyl) amino)-2,6-bis(4-methoxyphenyl)-1,2,5,6-tetrahydro pyridine-3-carboxylate (4l)**

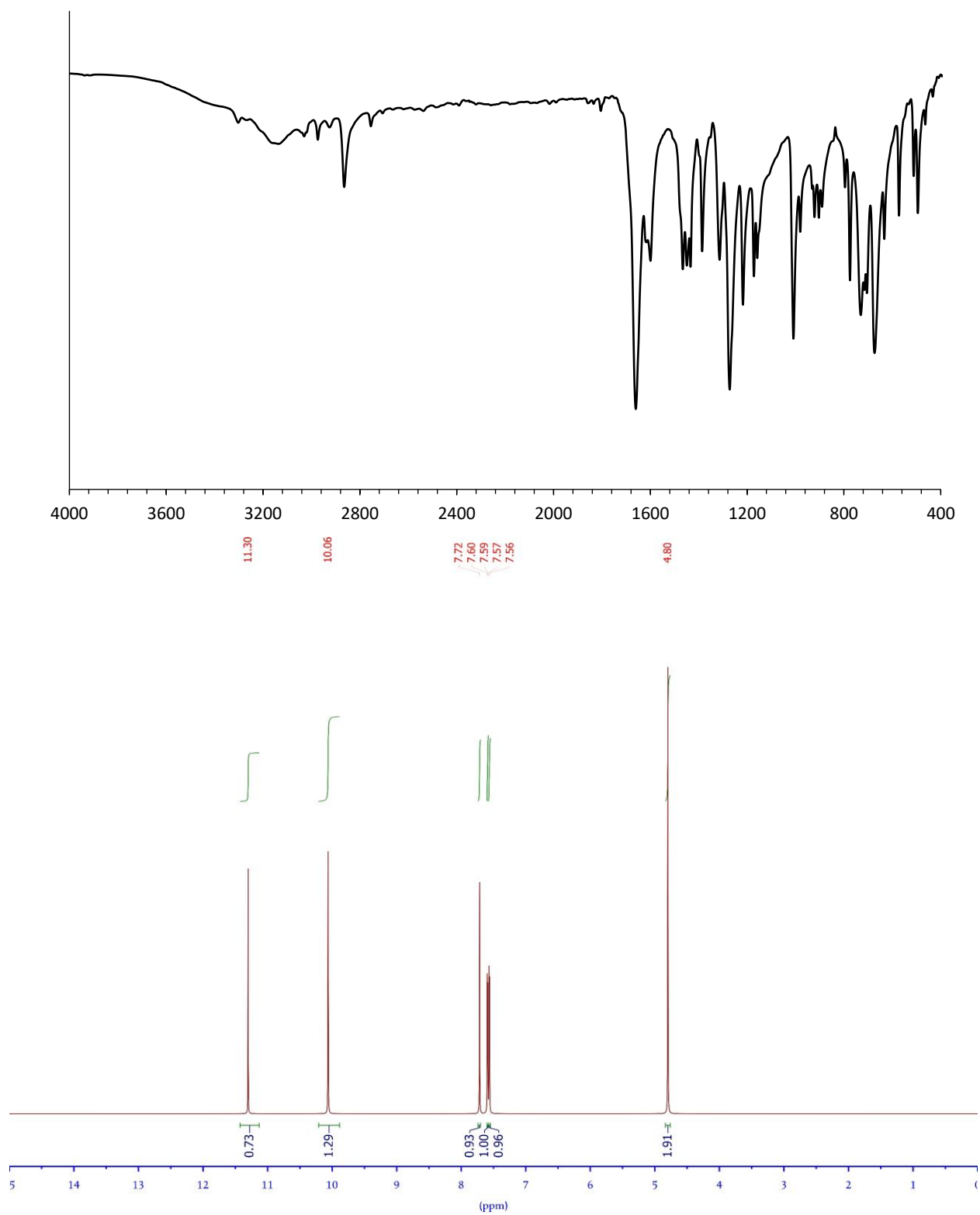
White solid; m.p. = 170–174 °C.

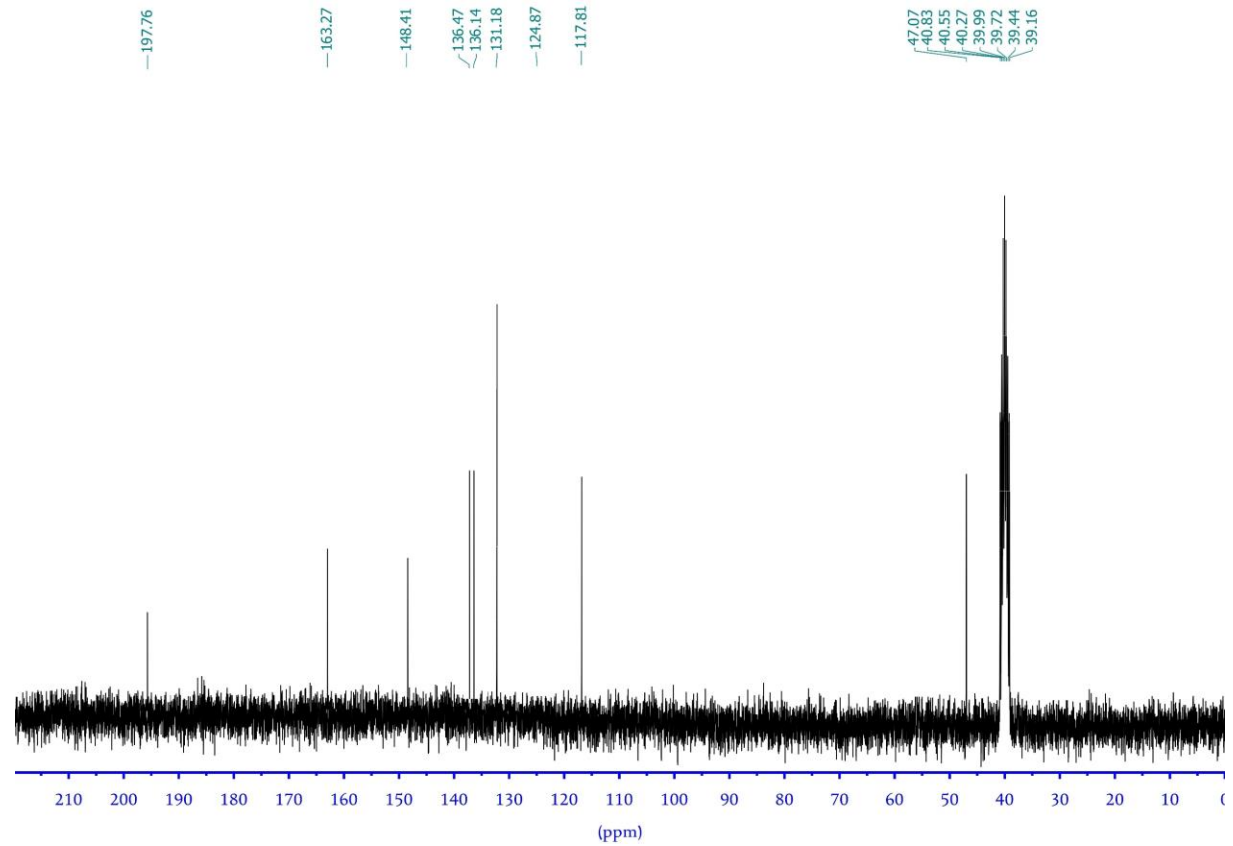
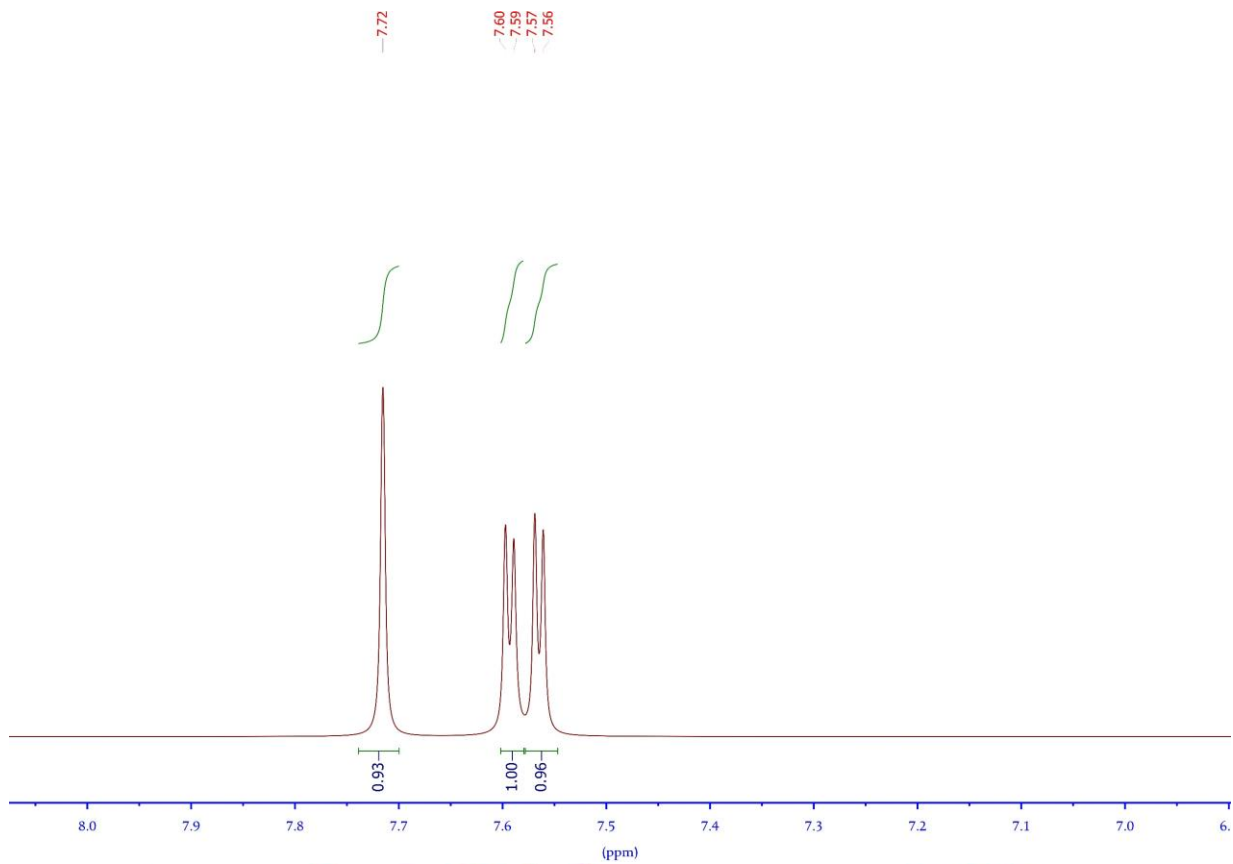
<sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>): δ= 2.69-2.89 (2H, dd-dd, CH<sub>2</sub>), 3.81 (3H, s), 3.81-3.82 (6H, d), 3.95 (3H, s), 5.07 (1H, d), 6.20-6.23 (2H, d), 6.31 (1H, s), 6.40-6.43 (2H, d), 6.83-6.86 (4H, dd), 7.05-7.08 (2H, d), 7.14–7.20 (4H, m), 7.24–7.29 (2H, d), 10.24 (1H, NH) ppm.

<sup>13</sup>CNMR (DMSO, 75 MHz): δ= 36.24, 47.86, 54.34, 55.49, 61.47, 102.46, 114.22, 116.24, 116.98, 125.48, 126.23, 127.02, 129.88, 131.23, 132.24, 132.92, 137.80, 149.05, 159.20, 168.46 ppm.

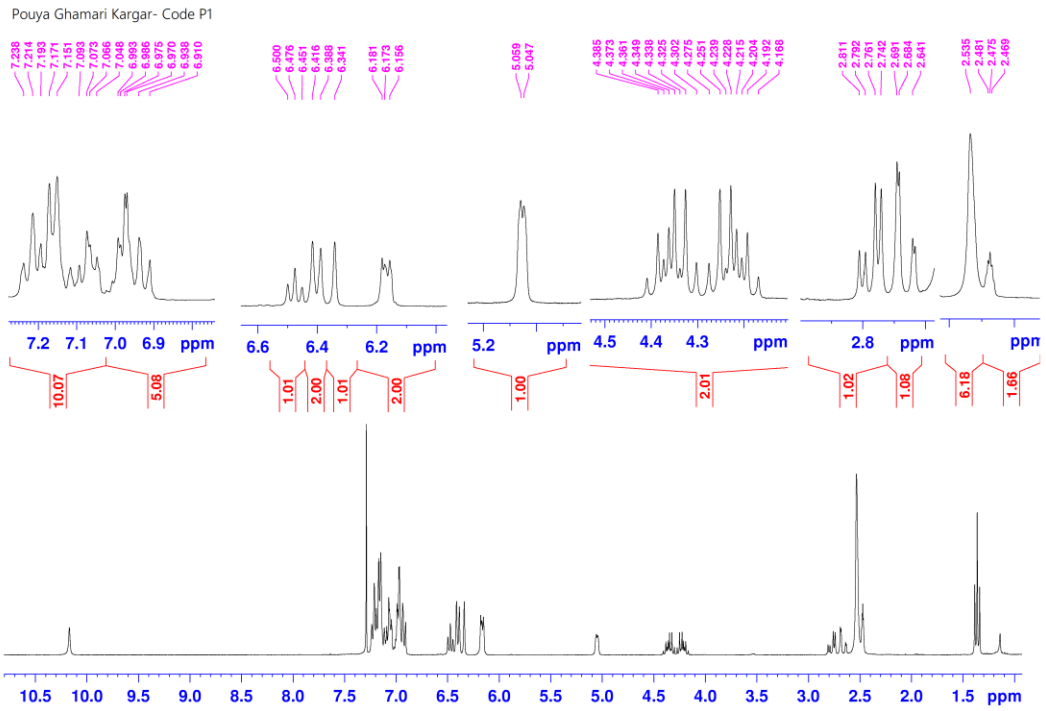
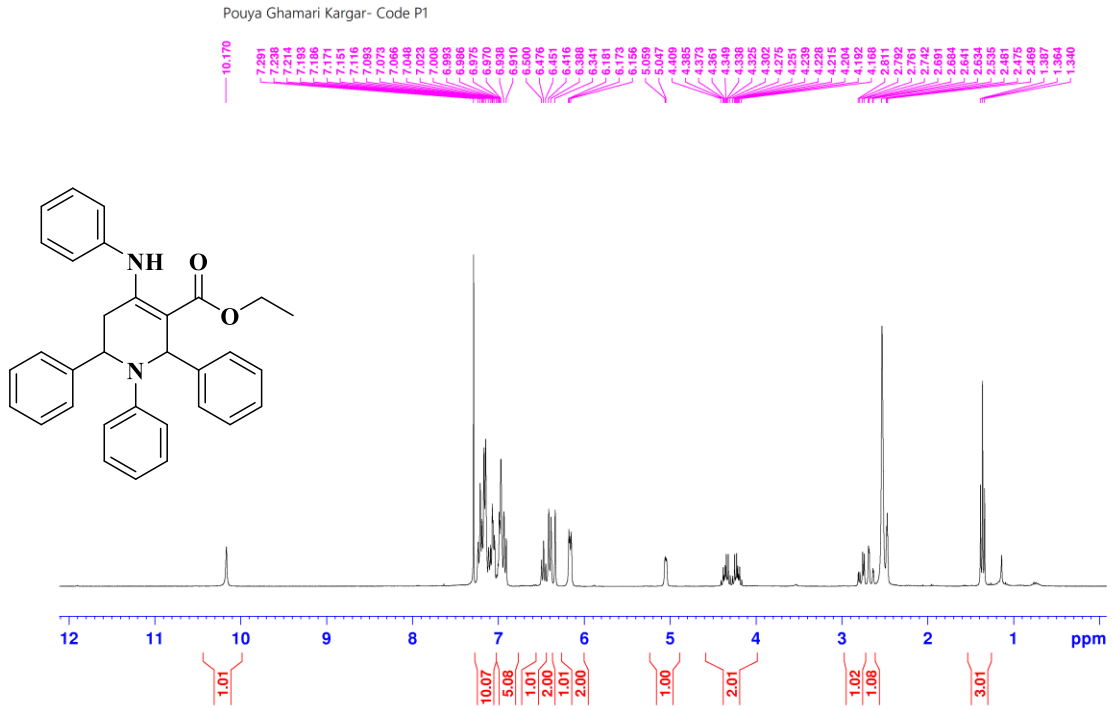
Anal. Calcd. For C<sub>33</sub>H<sub>30</sub>Br<sub>2</sub>N<sub>2</sub>O<sub>4</sub>: C, 58.42; H, 4.46; N, 4.13; O, 9.43 Found: C, 58.41; H, 4.49; N, 4.10; O, 9.41.

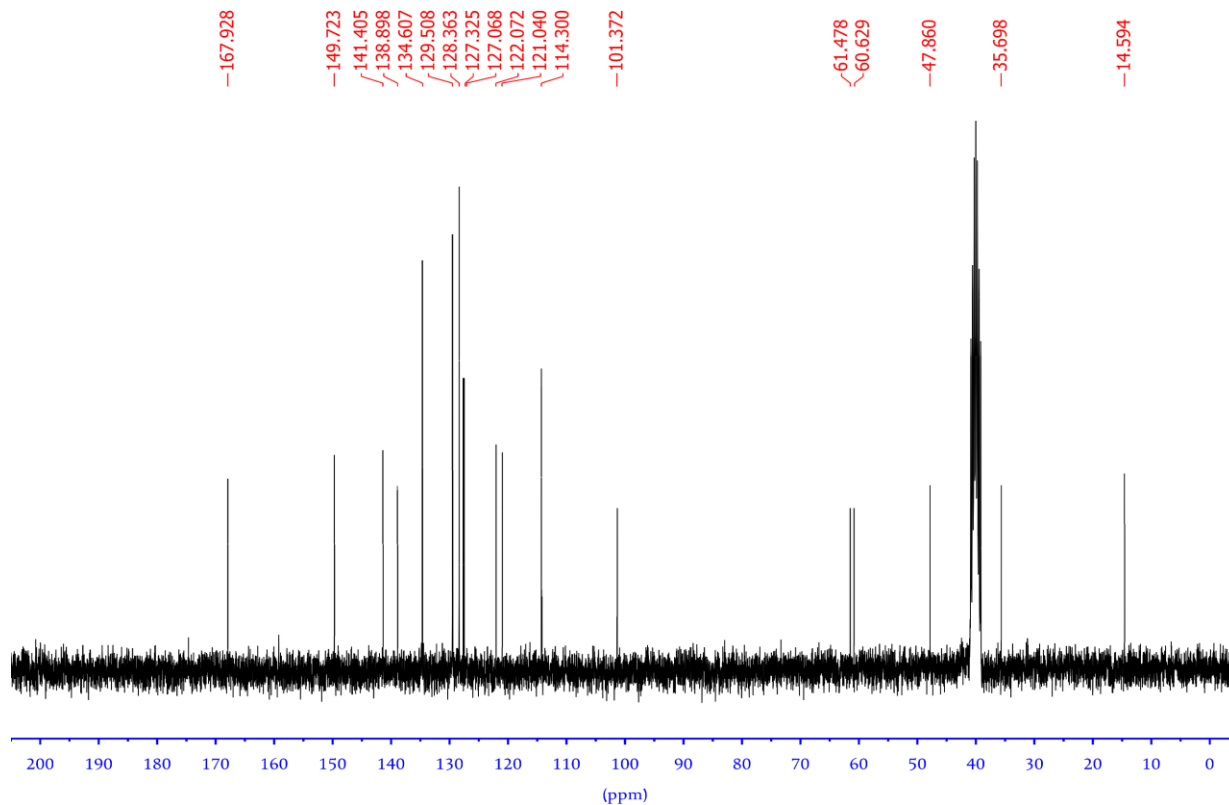
5-(chloromethyl)-2-hydroxybenz aldehyde (I)



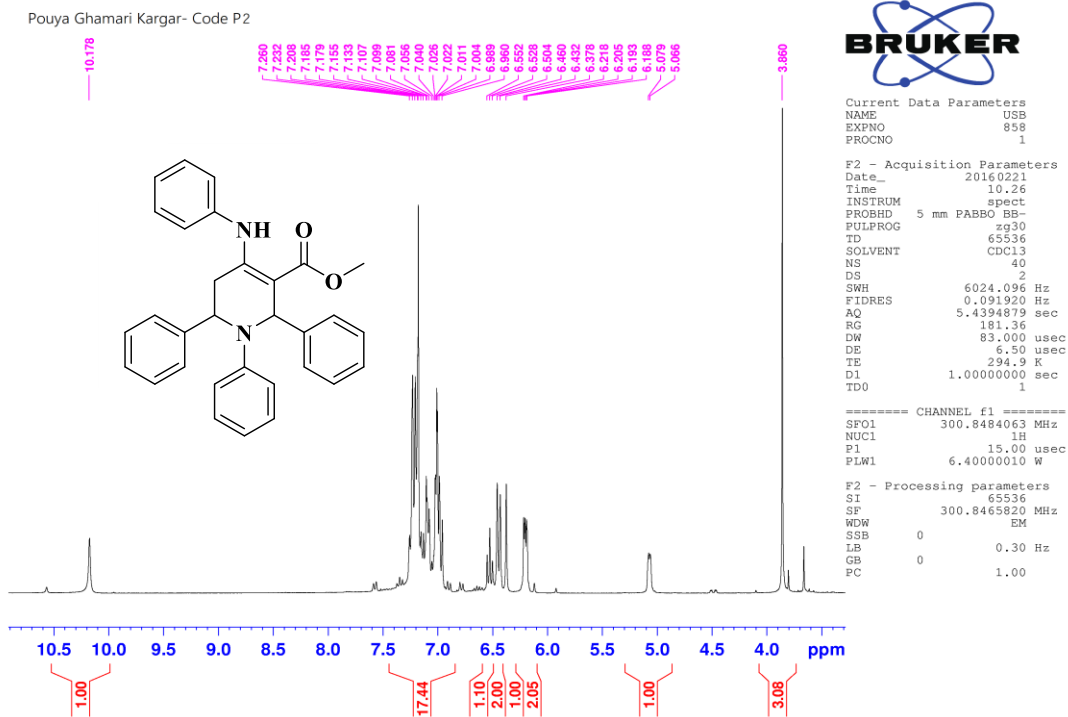


Ethyl 1,2,6-triphenyl-4-(phenylamino)-1,2,5,6-tetrahydropyridine-3-carboxylate (4a)





Methyl 1,2,6-triphenyl-4-(phenylamino)-1,2,5,6-tetrahydropyridine-3-carboxylate (4b)

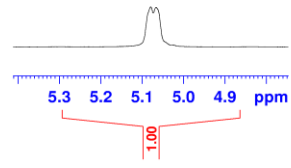
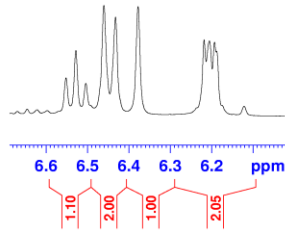
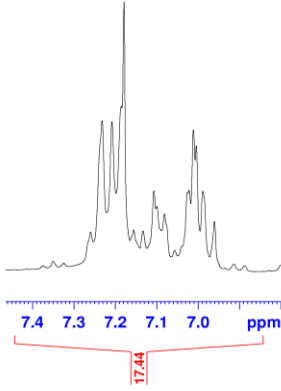


Pouya Ghamari Kargar- Code P2

7.260  
7.232  
7.205  
7.185  
7.179  
7.155  
7.133  
7.107  
7.100  
7.081  
7.056  
7.040  
7.028  
7.012  
7.011  
7.004  
6.989  
6.990

6.552  
6.528  
6.504  
6.480  
6.452  
6.378  
6.218  
6.205  
6.193  
6.188

5.079  
5.066



-167.972

-149.603

-141.485

-138.888

-134.616

-129.498

-128.372

-127.305

-127.108

-122.037

-121.043

-114.303

-101.322

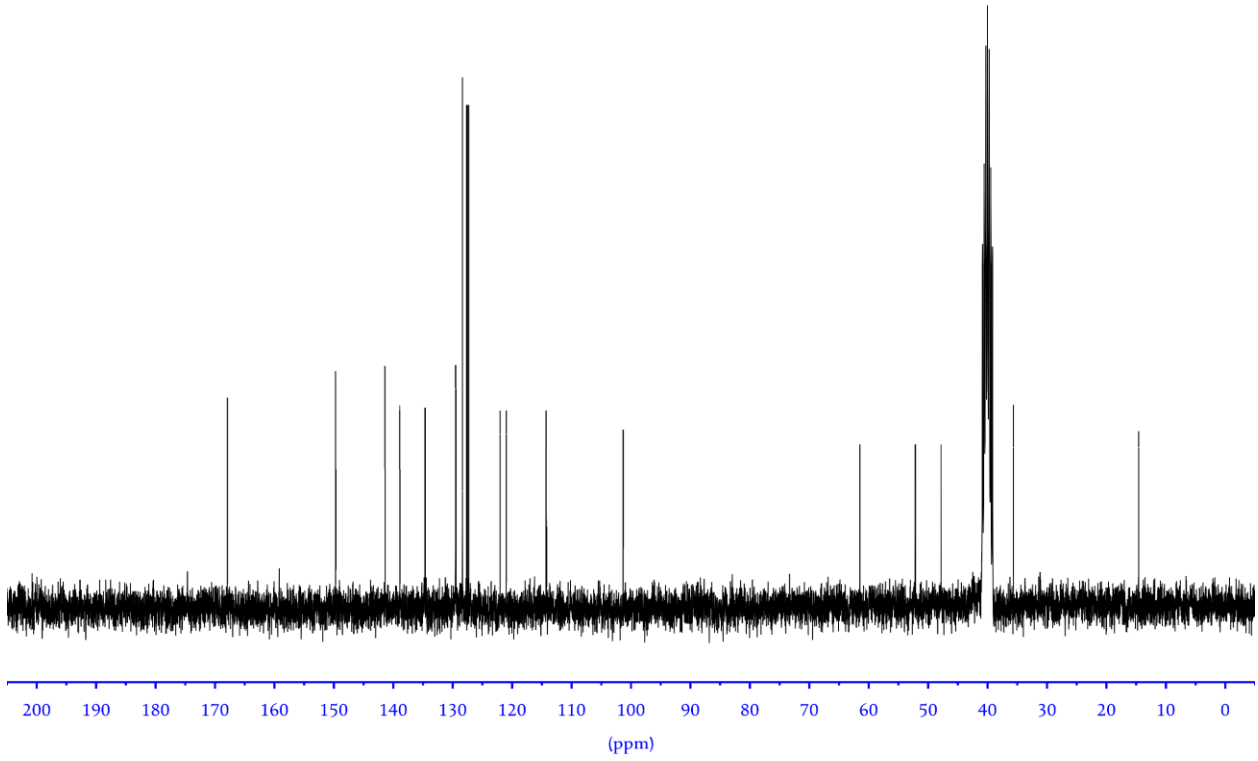
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-51.602

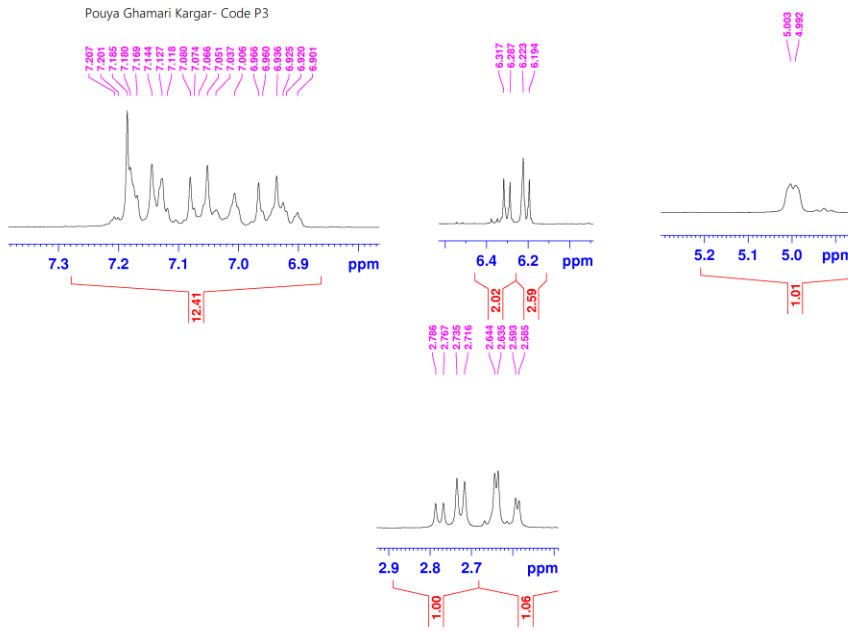
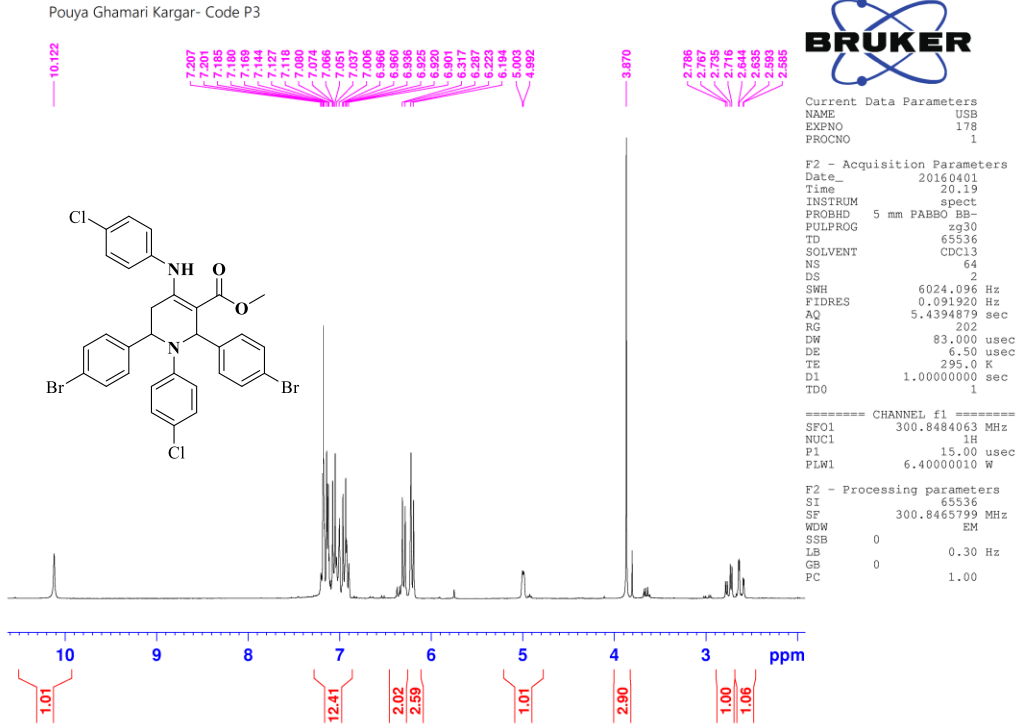
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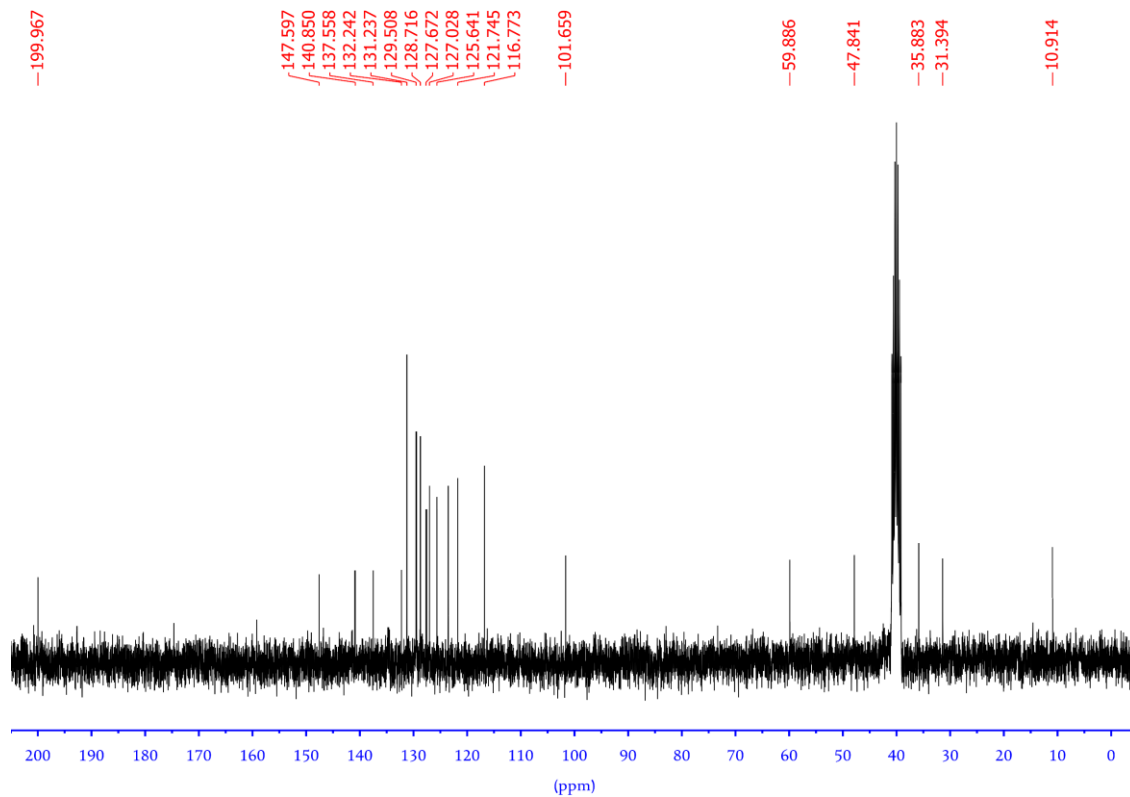
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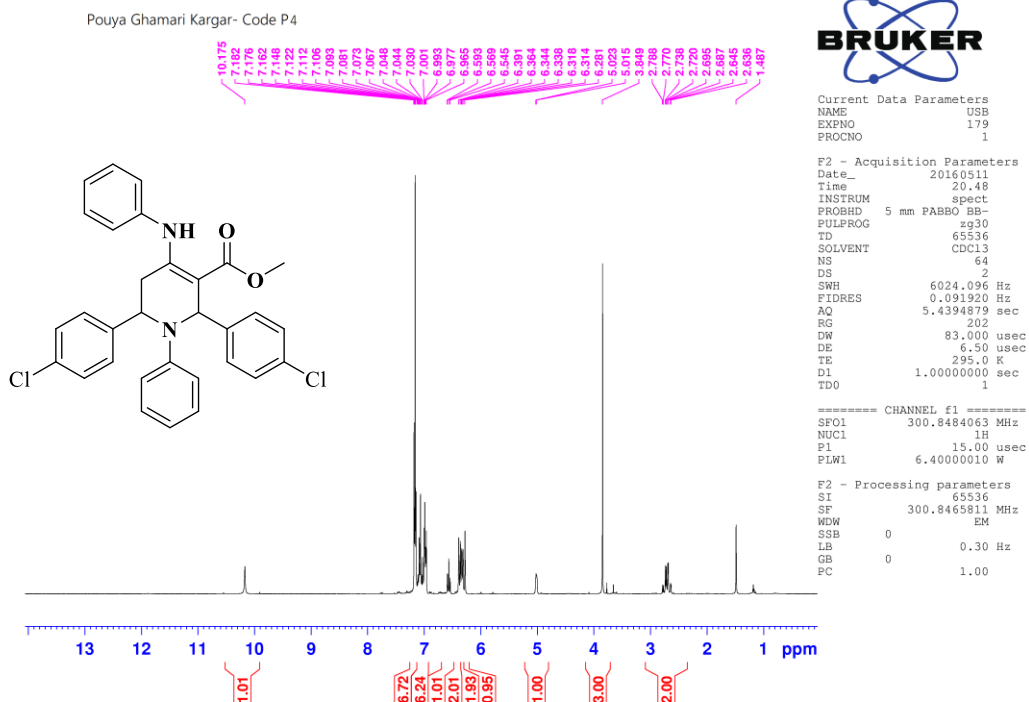
methyl 2,6-bis(4-bromophenyl)-1-(4-chlorophenyl)-4-((4-chlorophenyl) amino)-1,2,5,6-tetrahydropyridine-3-carboxylate (4f)



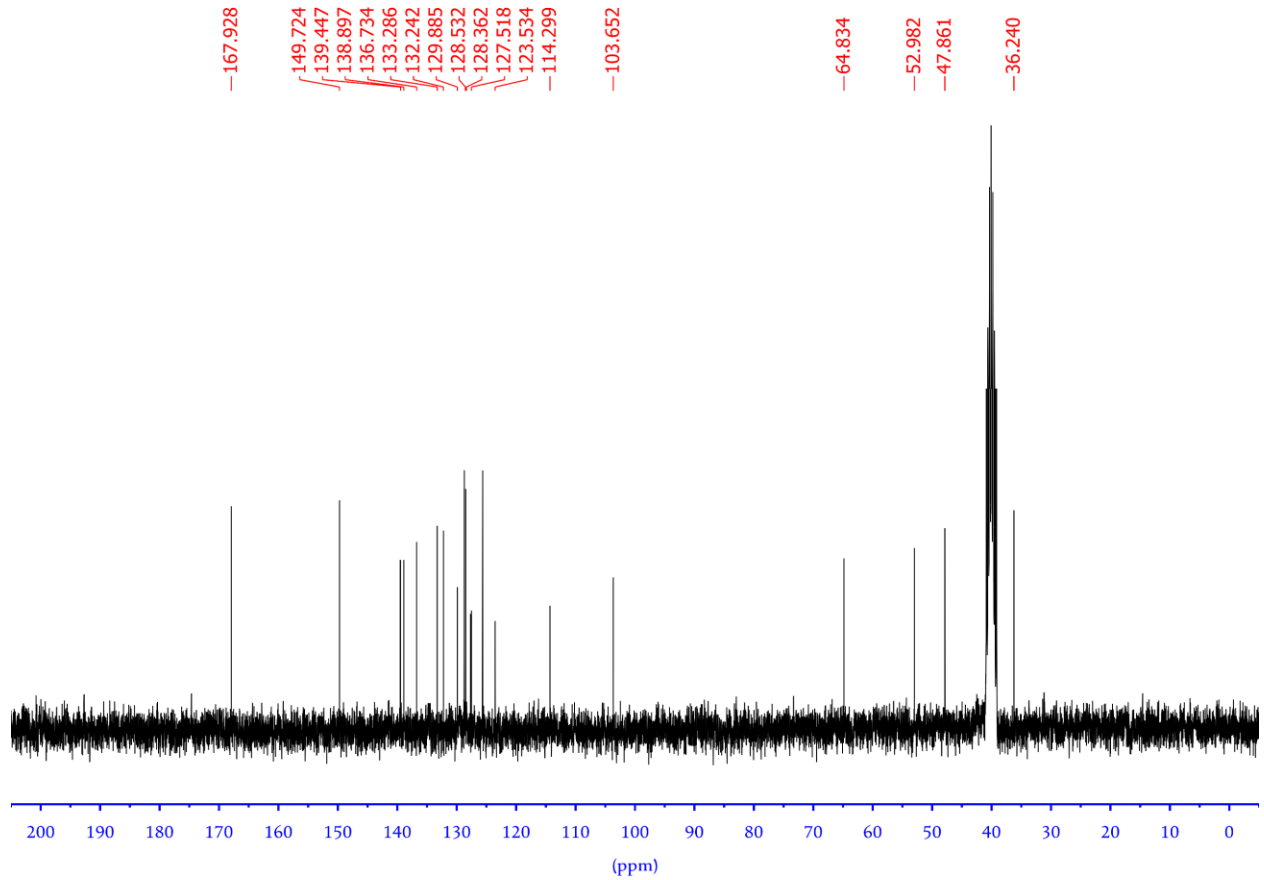
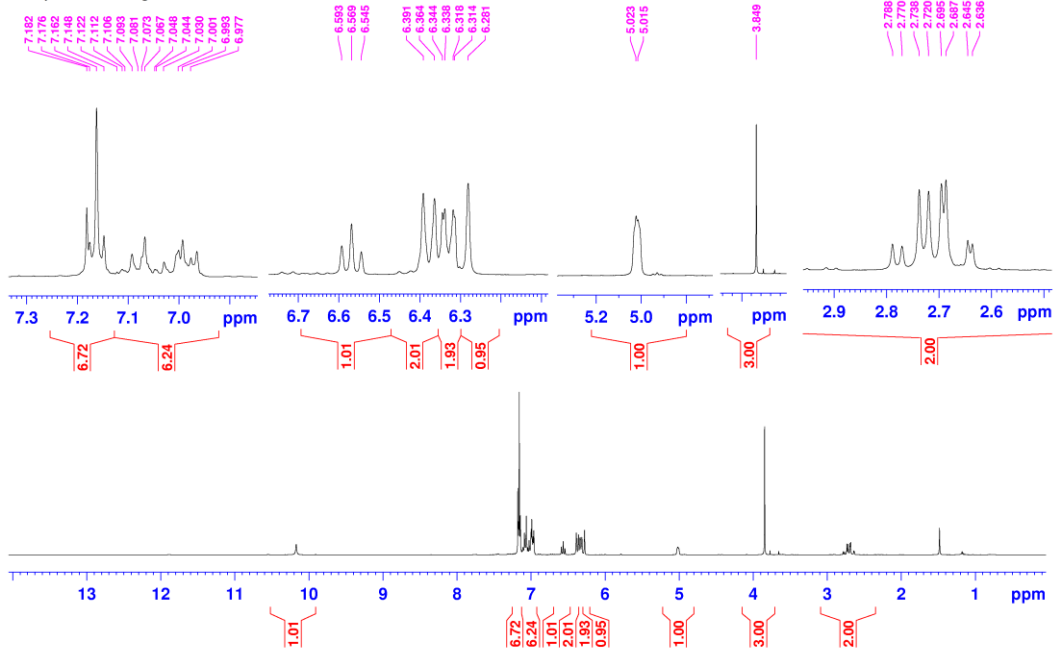




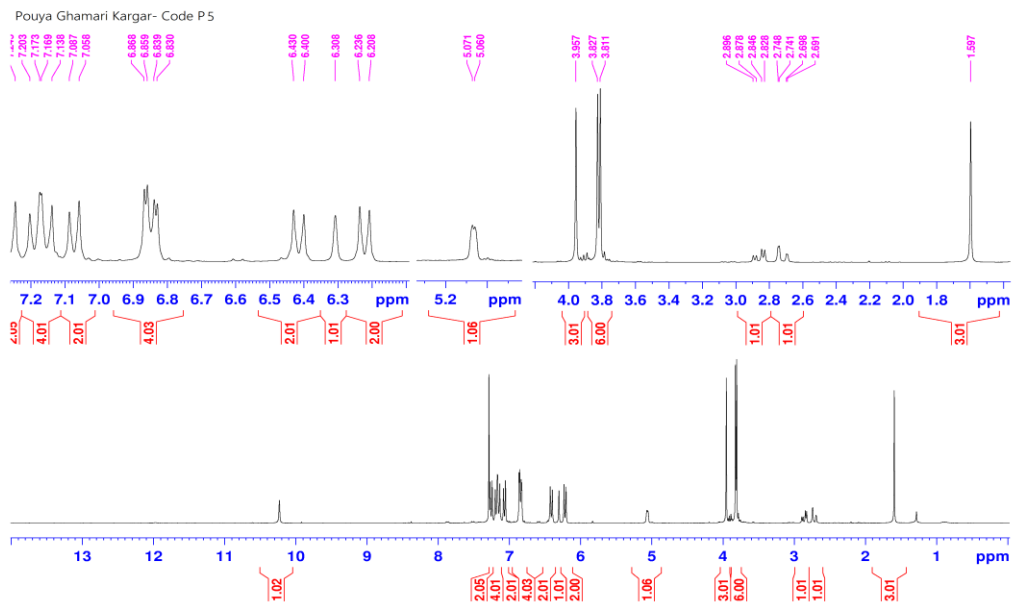
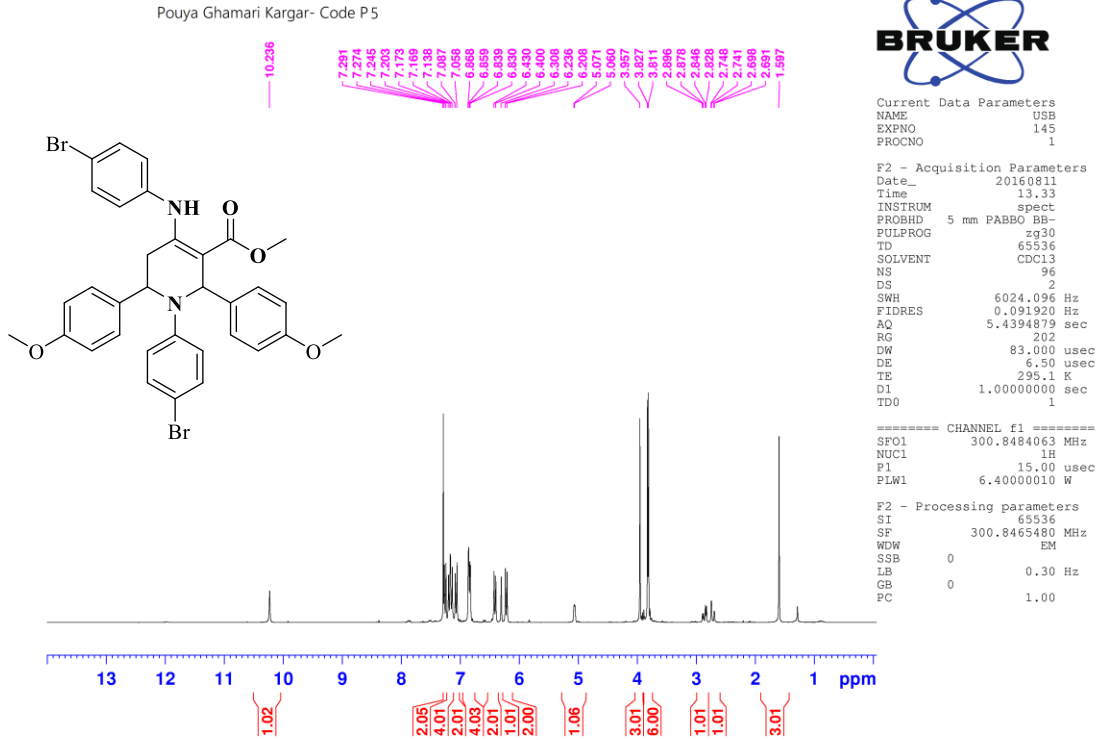
methyl 2,6-bis(4-chlorophenyl)-1-phenyl-4-(phenylamino)-1,2,5,6-tetrahydropyridine-3-carboxylate (4k)

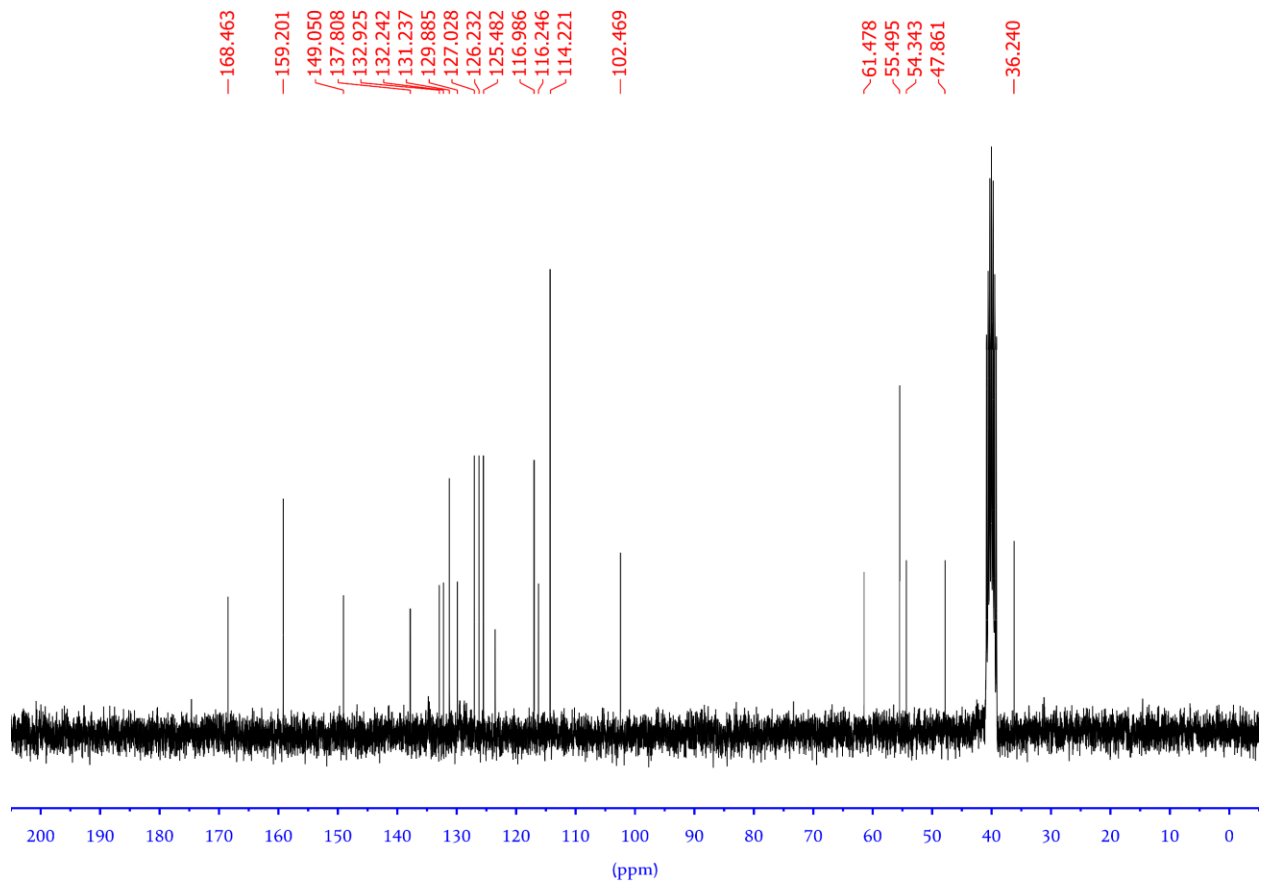


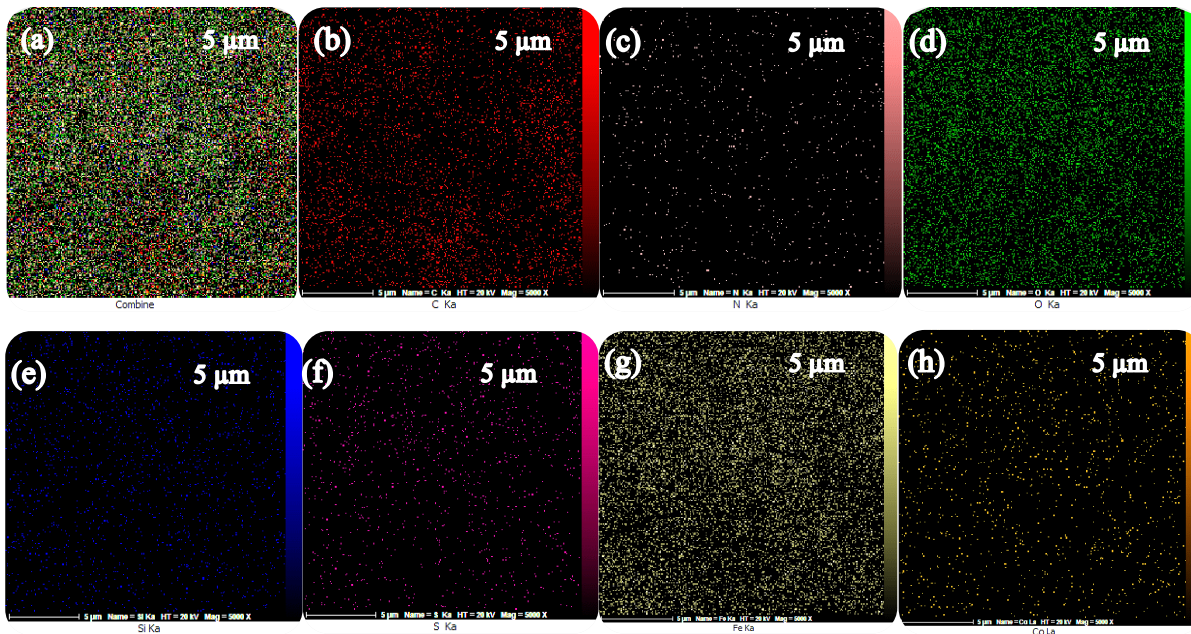
Pouya Ghamari Kargar- Code P4



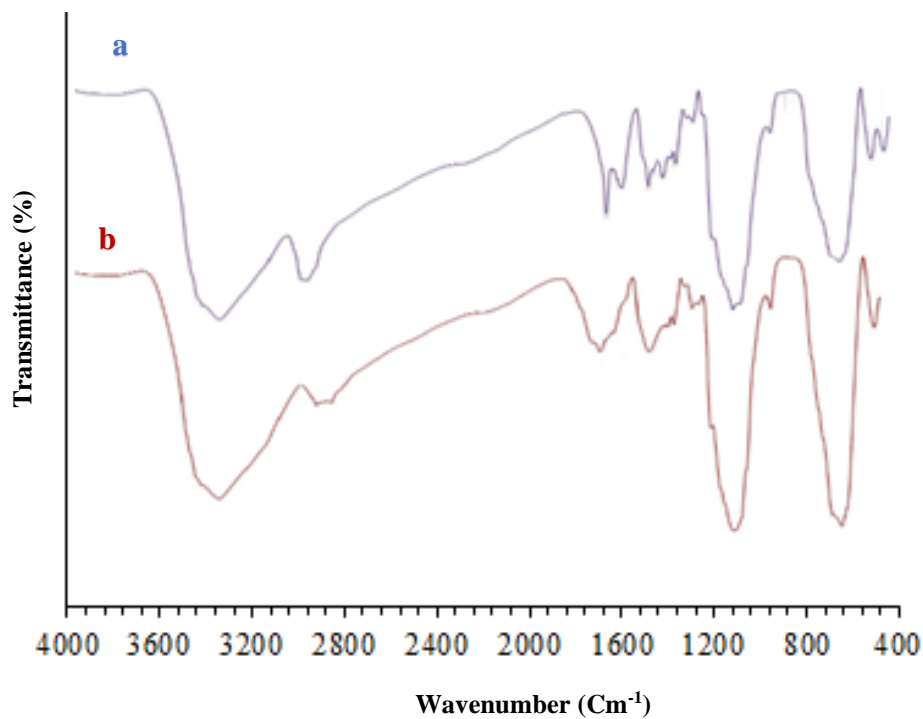
methyl 1-(4-bromophenyl)-4-((4-bromophenyl) amino)-2,6-bis(4-methoxyphenyl)-1,2,5,6-tetrahydropyridine-3-carboxylate (4l)

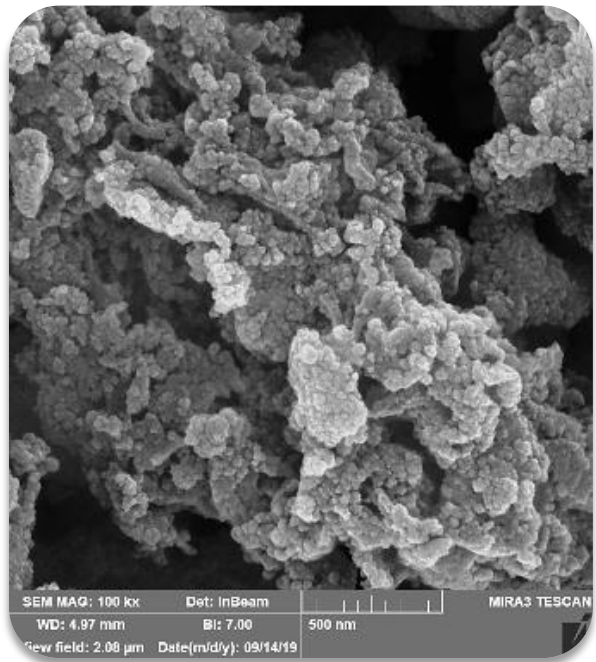
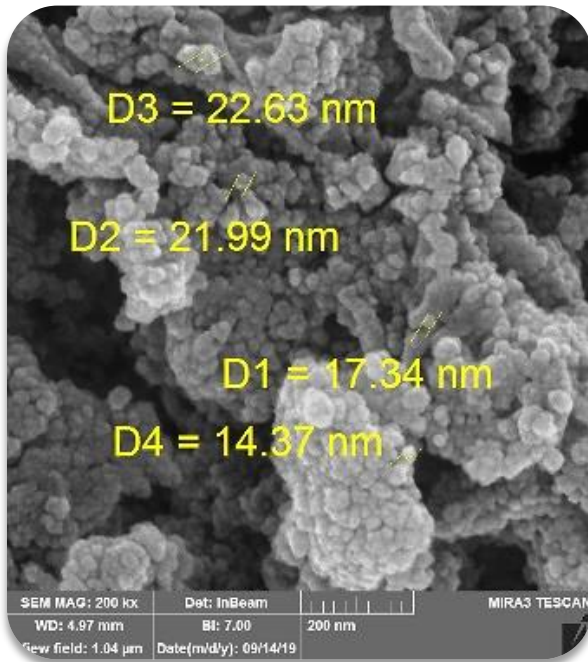
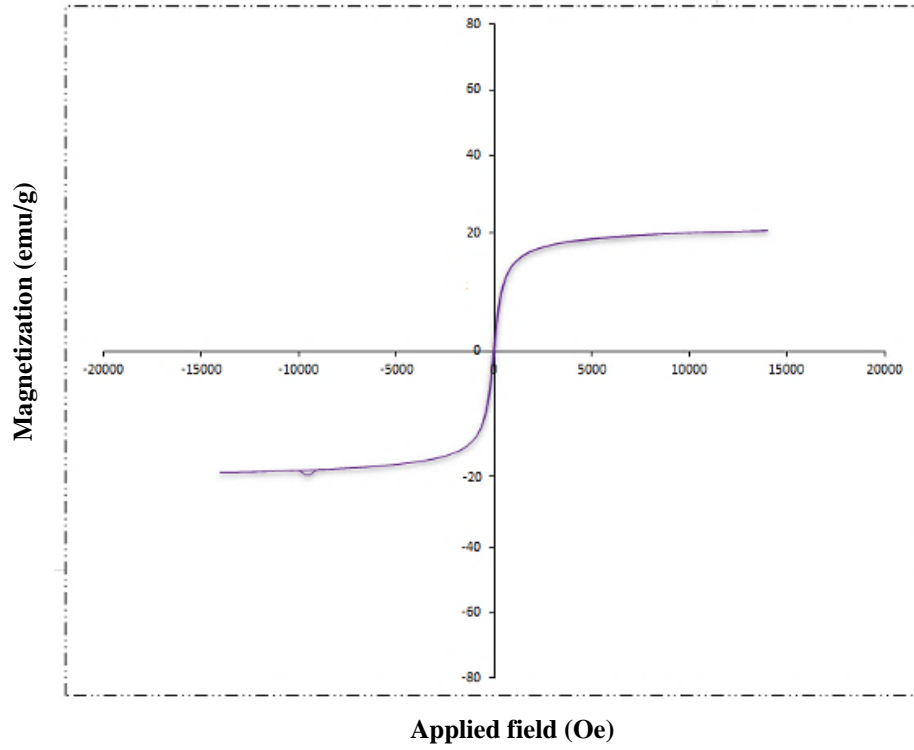


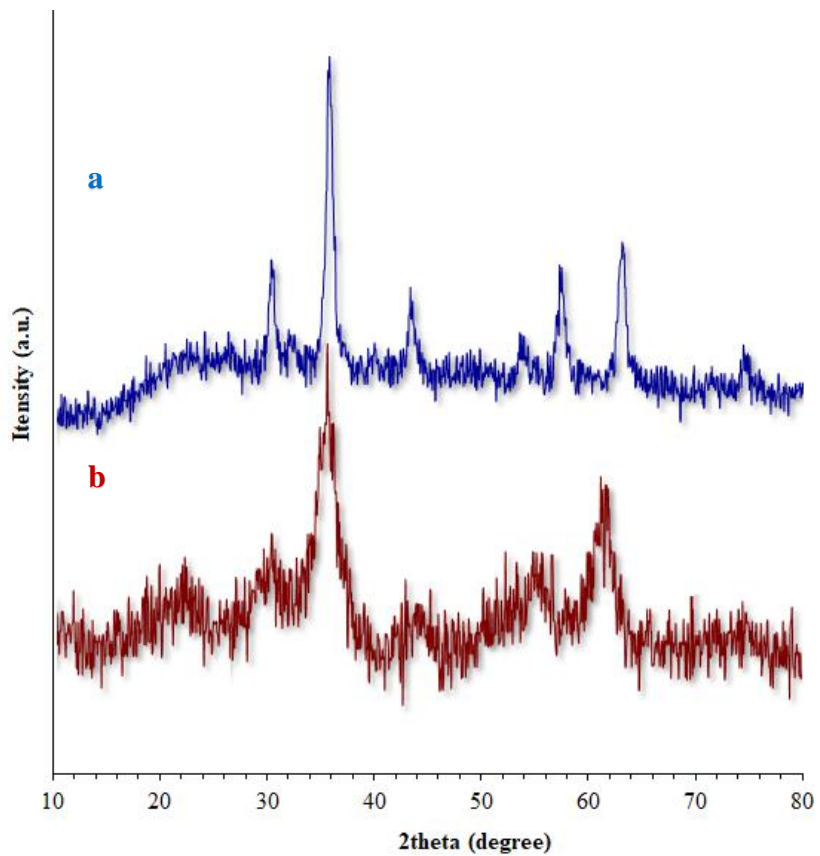




S1: EDS mapping images of a) Combining elements, b) C, e) N, d) O, e) Si, f) S, g) Fe, and h) Co







S2: FESEM image and VSM and XRD ((a) after piperidine reaction; and (b) after alcohol oxidation) and FT-IR spectra of MNPs@CNF@ATSM-Co (II): (a) after piperidine reaction; and (b) after alcohol oxidation.