# Exploring Metal/Base-Free Porphyrin Involving Carboxyl Functionalized Pyridine Moiety for Photocatalytic N-Arylation of Benzamide Validated by RSM

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## Supporting information

## INDEX

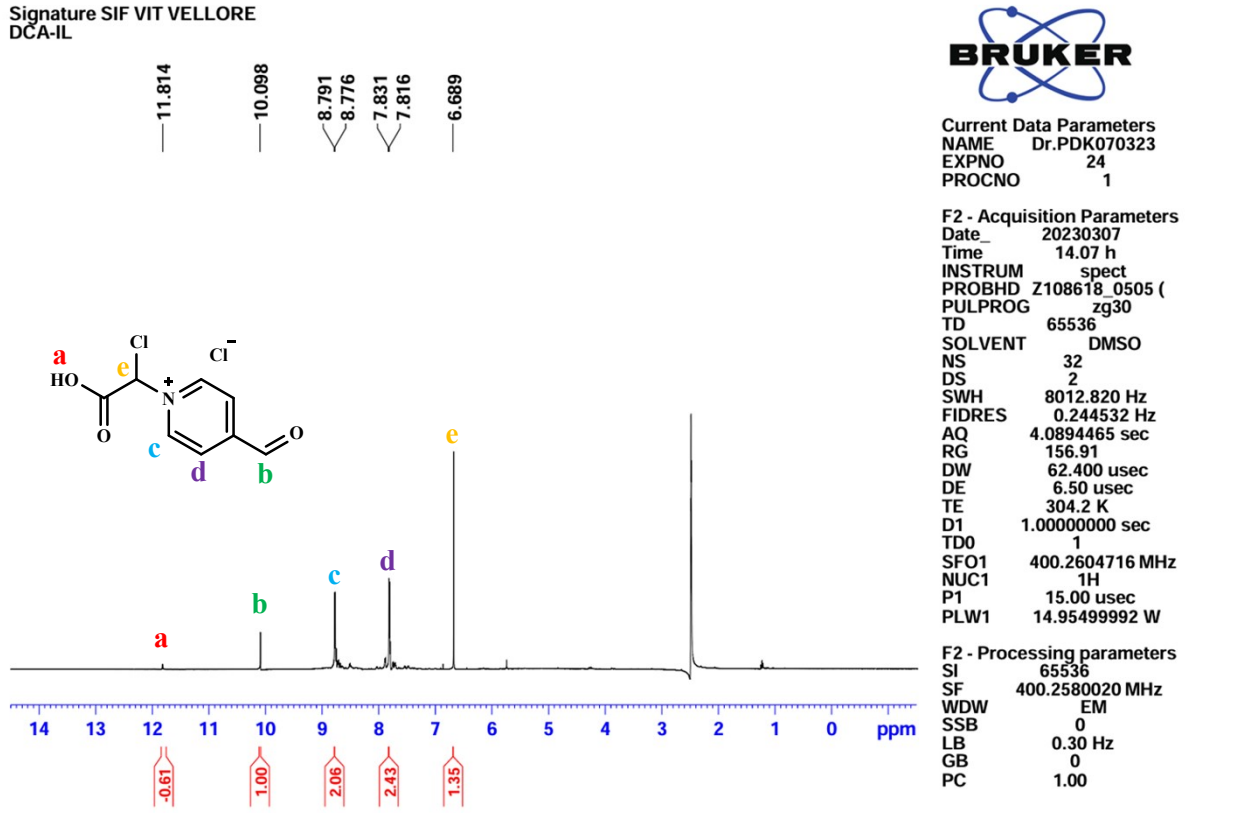


Fig S1. [1]H NMR spectrum of 1-(carboxychloromethyl)-4-formyl-pyridin-1-ium chloride [1A]

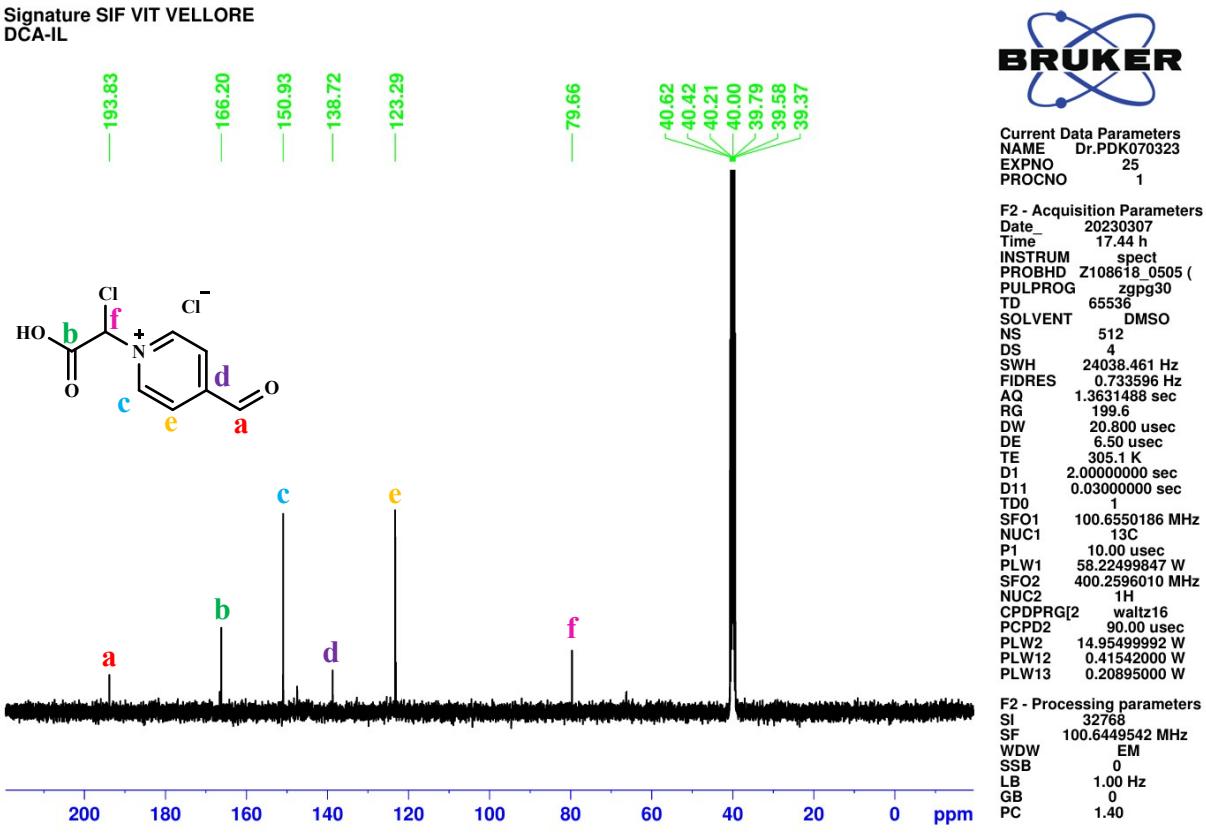


Fig S2. [13]CNMR spectrum of 1-(carboxychloromethyl)-4-formyl-pyridin-1-ium chloride [1A]

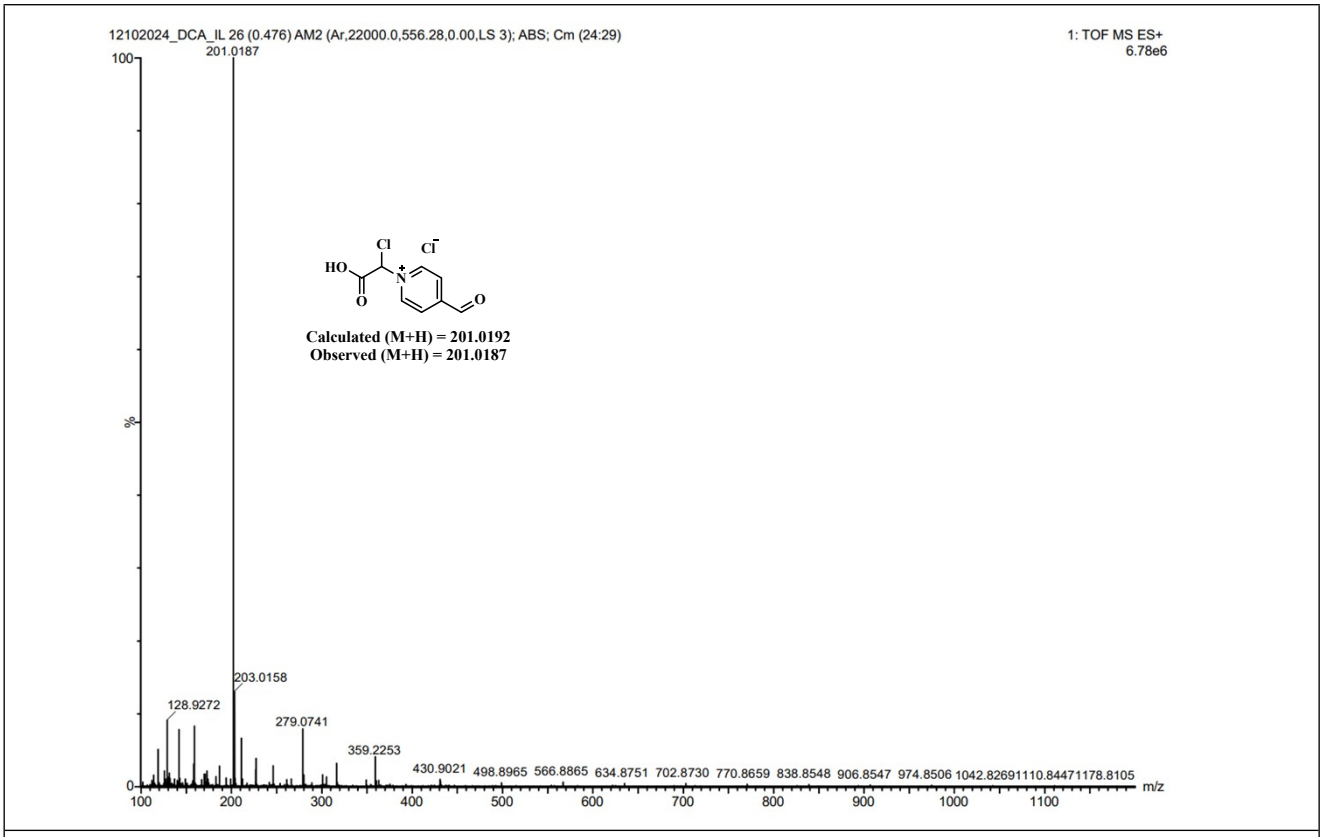


Fig S3. TOF MS ES +Ve mode of 1-(carboxychloromethyl)-4-formyl-pyridin-1-ium chloride [1A]

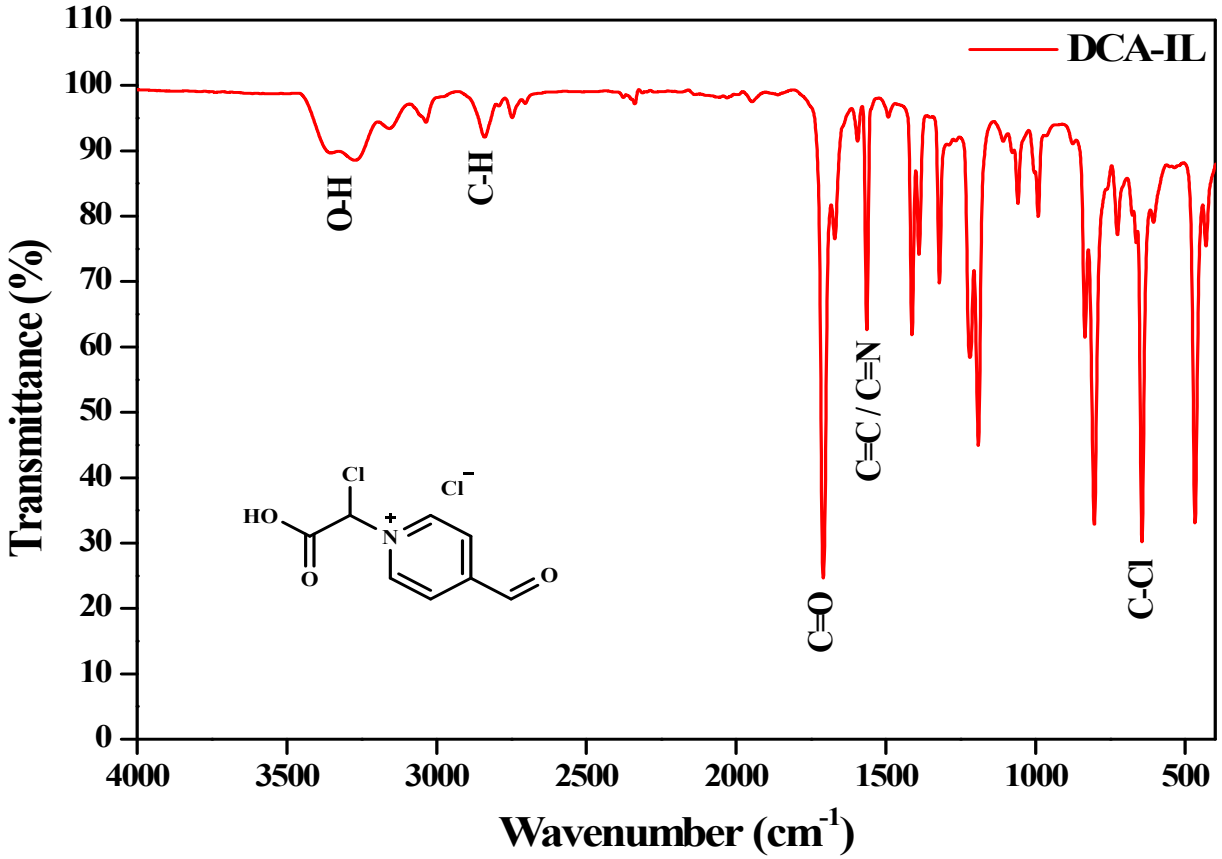


Fig S4. FT-IR spectrum of 1-(carboxychloromethyl)-4-formyl-pyridin-1-ium chloride [1A]

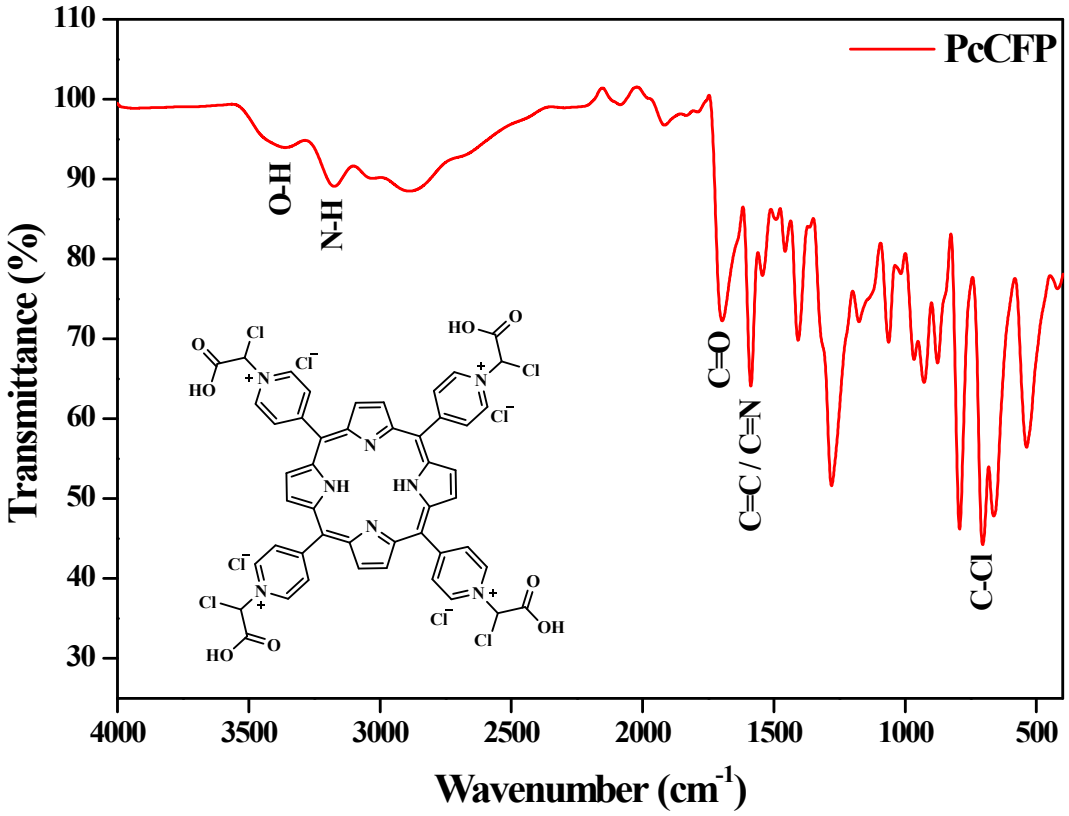


Fig S5. FT-IR Spectrum of PcCFP Photocatalyst

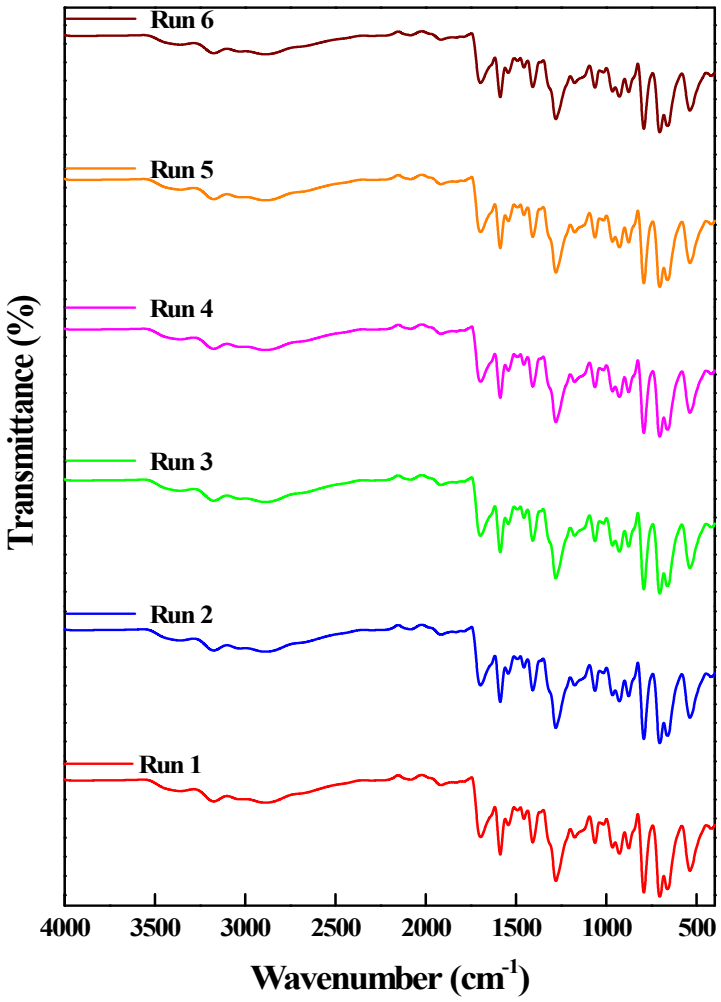


Fig S6. Comparative FT-IR Spectra of PcCFP Photocatalyst recycled upto 6th Run

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**Analysis**
Operator: VIT Date:2024/02/07
Sample ID: 20BCN-SMR-060224
Sample Desc:
Sample Weight: 0.0746 g
Approx. Outgas Time:8.4 hrs
Analysis gas: Nitrogen
Analysis Time: 3:57 hr:min
Analysis Mode: Standard
VoidVol. Mode: He Measure

**Report**
Operator: VIT Date:2024/02/09
Filename: 20BCN-SMR-060224_REC.qps
Comment:
Instrument: Autosorb iQ Station 1
Final Outgas Temp.:150 °C
Non-ideality: 6.58e-05 1/Torr
Bath temp.: 77.35 K
Cold Zone V: 3.74961 cc
Extended info: Available
CellType: 9mm
VoidVol Remeasure:off
Warm Zone V: 13.5428 cc

## BJH Pore Size Distribution Adsorption

### Data Reduction Parameters Data

Thermal Transpiration: on
Eff. mol. diameter (D): 3.54 Å
Eff. cell stem diam. (d): 4.0000 mm
t-Method
Calc. method: Carbon black
BJH/DH method
Moving pt. avg.: off
Adsorbate model: Nitrogen
Temperature 77.350K
Molec. Wt.: 28.013
Cross Section: 16.200 Å²
Liquid Density: 0.808 g/cc

### BJH Pore Size Distribution Adsorption Data

| Diameter [nm] | Pore Volume [cc/g] | Pore Surf Area [m²/g] | dV(d) [cc/nm/g] | dS(d) [m²/nm/g] | dV(logd) [cc/g] | dS(logd) [cc/g] |
|---|---|---|---|---|---|---|
| 1.2271 | 1.1718e-03 | 3.8198e+00 | 7.2943e-03 | 2.3778e+01 | 2.0580e-02 | 6.7087e+01 |
| 1.3735 | 1.7940e-03 | 5.6320e+00 | 4.7092e-03 | 1.3715e+01 | 1.4881e-02 | 4.3340e+01 |
| 1.5030 | 2.3402e-03 | 7.0856e+00 | 4.3023e-03 | 1.1450e+01 | 1.4880e-02 | 3.9602e+01 |
| 1.6262 | 2.7247e-03 | 8.0314e+00 | 3.2210e-03 | 7.9228e+00 | 1.2055e-02 | 2.9653e+01 |
| 1.7465 | 3.3619e-03 | 9.4906e+00 | 5.2512e-03 | 1.2027e+01 | 2.1109e-02 | 4.8345e+01 |
| 1.8685 | 4.1074e-03 | 1.1087e+01 | 6.0843e-03 | 1.3025e+01 | 2.6167e-02 | 5.6019e+01 |
| 1.9923 | 4.6280e-03 | 1.2132e+01 | 4.1606e-03 | 8.3535e+00 | 1.9080e-02 | 3.8308e+01 |
| 2.1189 | 5.1632e-03 | 1.3142e+01 | 4.1780e-03 | 7.8871e+00 | 2.0378e-02 | 3.8469e+01 |
| 2.2488 | 5.7109e-03 | 1.4117e+01 | 4.1589e-03 | 7.3976e+00 | 2.1529e-02 | 3.8294e+01 |
| 2.3830 | 6.3173e-03 | 1.5134e+01 | 4.4369e-03 | 7.4476e+00 | 2.4338e-02 | 4.0854e+01 |
| 2.5223 | 6.8391e-03 | 1.5962e+01 | 3.6743e-03 | 5.8268e+00 | 2.1334e-02 | 3.3832e+01 |
| 2.6673 | 7.4166e-03 | 1.6828e+01 | 3.9041e-03 | 5.8549e+00 | 2.3972e-02 | 3.5949e+01 |
| 2.8190 | 8.0296e-03 | 1.7698e+01 | 3.9437e-03 | 5.5959e+00 | 2.5591e-02 | 3.6313e+01 |
| 2.9780 | 9.2340e-03 | 1.9315e+01 | 7.4043e-03 | 9.9452e+00 | 5.0759e-02 | 6.8179e+01 |
| 3.1468 | 9.9717e-03 | 2.0253e+01 | 4.2185e-03 | 5.3623e+00 | 3.0558e-02 | 3.8844e+01 |
| 3.3253 | 1.0649e-02 | 2.1068e+01 | 3.7173e-03 | 4.4716e+00 | 2.8456e-02 | 3.4229e+01 |
| 3.5151 | 1.1439e-02 | 2.1967e+01 | 4.0018e-03 | 4.5538e+00 | 3.2382e-02 | 3.6848e+01 |
| 3.7197 | 1.2134e-02 | 2.2714e+01 | 3.2826e-03 | 3.5299e+00 | 2.8108e-02 | 3.0225e+01 |
| 3.9385 | 1.2843e-02 | 2.3435e+01 | 3.1403e-03 | 3.1893e+00 | 2.8471e-02 | 2.8915e+01 |
| 4.1755 | 1.3494e-02 | 2.4058e+01 | 2.6211e-03 | 2.5109e+00 | 2.5193e-02 | 2.4134e+01 |
| 4.4330 | 1.4259e-02 | 2.4748e+01 | 2.8675e-03 | 2.5875e+00 | 2.9261e-02 | 2.6403e+01 |
| 4.7119 | 1.5904e-02 | 2.6144e+01 | 5.6539e-03 | 4.7997e+00 | 6.1322e-02 | 5.2057e+01 |
| 5.0214 | 1.6907e-02 | 2.6943e+01 | 3.0574e-03 | 2.4355e+00 | 3.5337e-02 | 2.8149e+01 |
| 5.3678 | 1.7713e-02 | 2.7544e+01 | 2.2097e-03 | 1.6467e+00 | 2.7301e-02 | 2.0345e+01 |
| 5.7557 | 1.8606e-02 | 2.8165e+01 | 2.1742e-03 | 1.5110e+00 | 2.8803e-02 | 2.0017e+01 |
| 6.1967 | 1.9355e-02 | 2.8648e+01 | 1.5886e-03 | 1.0255e+00 | 2.2657e-02 | 1.4625e+01 |
| 6.6976 | 2.0224e-02 | 2.9167e+01 | 1.6380e-03 | 9.7824e-01 | 2.5247e-02 | 1.5078e+01 |
| 7.2798 | 2.1161e-02 | 2.9682e+01 | 1.4784e-03 | 8.1232e-01 | 2.4766e-02 | 1.3608e+01 |
| 7.9555 | 2.3169e-02 | 3.0692e+01 | 2.7983e-03 | 1.4070e+00 | 5.1225e-02 | 2.5756e+01 |
| 8.7638 | 2.4560e-02 | 3.1327e+01 | 1.5475e-03 | 7.0632e-01 | 3.1201e-02 | 1.4241e+01 |
| 9.7760 | 2.6027e-02 | 3.1927e+01 | 1.3032e-03 | 5.3321e-01 | 2.9302e-02 | 1.1989e+01 |
| 11.0392 | 2.7515e-02 | 3.2466e+01 | 1.0621e-03 | 3.8484e-01 | 2.6960e-02 | 9.7690e+00 |
| 12.6725 | 2.9417e-02 | 3.3067e+01 | 1.0200e-03 | 3.2195e-01 | 2.9709e-02 | 9.3775e+00 |
| 14.8612 | 3.1929e-02 | 3.3743e+01 | 9.9972e-04 | 2.6908e-01 | 3.4128e-02 | 9.1858e+00 |
| 17.9534 | 3.5507e-02 | 3.4540e+01 | 9.7435e-04 | 2.1708e-01 | 4.0138e-02 | 8.9427e+00 |

Continued on next page



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**Analysis**
Operator: VIT Date:2024/02/07
Sample ID: 20BCN-SMR-060224

**Report**
Operator: VIT Date:2024/02/09
Filename: 20BCN-SMR-060224_REC.qps

## BJH Pore Size Distribution Adsorption Data continued

| Diameter [nm] | Pore Volume [cc/g] | Pore Surf Area [m²/g] | dV(d) [cc/nm/g] | dS(d) [m²/nm/g] | dV(logd) [cc/g] | dS(logd) [cc/g] |
|---|---|---|---|---|---|---|
| 22.9696 | 4.3307e-02 | 3.5898e+01 | 1.2263e-03 | 2.1356e-01 | 6.4443e-02 | 1.1222e+01 |
| 32.2137 | 5.6050e-02 | 3.7480e+01 | 1.0507e-03 | 1.3047e-01 | 7.7007e-02 | 9.5621e+00 |
| 55.3070 | 8.6063e-02 | 3.9651e+01 | 8.8123e-04 | 6.3734e-02 | 1.0858e-01 | 7.8531e+00 |
| 177.7493 | 1.4881e-01 | 4.1063e+01 | 2.9761e-04 | 6.6974e-03 | 1.0587e-01 | 2.3824e+00 |

### BJH adsorption summary

Surface Area = 41.063 m²/g
Pore Volume = 0.149 cc/g
Pore Diameter Dv(d) = 2.978 nm



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**Analysis**
Operator: VIT Date:2024/02/07
Sample ID: 20BCN-SMR-060224
Sample Desc:
Sample Weight: 0.0746 g
Approx. Outgas Time:8.4 hrs
Analysis gas: Nitrogen
Analysis Time: 3:57 hr:min
Analysis Mode: Standard
VoidVol. Mode: He Measure

**Report**
Operator: VIT Date:2024/02/09
Filename: 20BCN-SMR-060224_REC.qps
Comment:
Instrument: Autosorb iQ Station 1
Final Outgas Temp.:150 °C
Non-ideality: 6.58e-05 1/Torr
Bath temp.: 77.35 K
Cold Zone V: 3.74961 cc
Extended info: Available
CellType: 9mm
VoidVol Remeasure:off
Warm Zone V: 13.5428 cc

## Isotherm

### Data Reduction Parameters Data

Thermal Transpiration: on
Eff. mol. diameter (D): 3.54 Å
Eff. cell stem diam. (d): 4.0000 mm
Adsorbate model: Nitrogen
Temperature 77.350K
Molec. Wt.: 28.013
Cross Section: 16.200 Å²
Liquid Density: 0.808 g/cc

### Isotherm Data

| Relative Pressure | Volume @ STP [cc/g] | Relative Pressure | Volume @ STP [cc/g] | Relative Pressure | Volume @ STP [cc/g] |
|---|---|---|---|---|---|
| 2.51518e-02 | 2.5743 | 7.01179e-01 | 14.0302 | 6.49003e-01 | 18.0332 |
| 5.17001e-02 | 3.0923 | 7.26423e-01 | 14.5315 | 6.23879e-01 | 17.3930 |
| 7.67702e-02 | 3.5074 | 7.50560e-01 | 15.4693 | 5.98901e-01 | 16.9411 |
| 1.02217e-01 | 3.9116 | 7.75627e-01 | 16.1741 | 5.73740e-01 | 16.4128 |
| 1.26668e-01 | 4.2714 | 8.00920e-01 | 16.9302 | 5.48477e-01 | 15.8633 |
| 1.51596e-01 | 4.6822 | 8.25615e-01 | 17.7143 | 5.23684e-01 | 15.2810 |
| 1.76552e-01 | 5.1109 | 8.50494e-01 | 18.7192 | 4.98850e-01 | 14.6700 |
| 2.01597e-01 | 5.4891 | 8.74726e-01 | 20.0562 | 4.74349e-01 | 13.6548 |
| 2.26619e-01 | 5.8669 | 8.98829e-01 | 21.9928 | 4.48851e-01 | 12.9834 |
| 2.51593e-01 | 6.2437 | 9.24204e-01 | 26.3023 | 4.23521e-01 | 12.6584 |
| 2.76620e-01 | 6.6315 | 9.48784e-01 | 33.6238 | 3.98291e-01 | 12.2306 |
| 3.01626e-01 | 6.9961 | 9.73226e-01 | 51.6819 | 3.73666e-01 | 11.7282 |
| 3.26559e-01 | 7.3712 | 9.93234e-01 | 91.3296 | 3.48574e-01 | 11.2100 |
| 3.51541e-01 | 7.7533 | 9.91799e-01 | 91.1542 | 3.23746e-01 | 10.6698 |
| 3.76364e-01 | 8.2829 | 9.75849e-01 | 75.5209 | 2.98626e-01 | 10.1329 |
| 4.01589e-01 | 8.6902 | 9.50492e-01 | 56.5807 | 2.73519e-01 | 9.6023 |
| 4.26331e-01 | 9.0759 | 9.24447e-01 | 41.6929 | 2.48714e-01 | 9.0620 |
| 4.51450e-01 | 9.4949 | 9.00242e-01 | 35.0934 | 2.23311e-01 | 8.6525 |
| 4.76559e-01 | 9.8863 | 8.76132e-01 | 30.5436 | 1.98557e-01 | 8.1367 |
| 5.01406e-01 | 10.2799 | 8.49026e-01 | 27.1825 | 1.72501e-01 | 7.5551 |
| 5.26565e-01 | 10.6585 | 8.26150e-01 | 25.2089 | 1.47296e-01 | 6.9996 |
| 5.51384e-01 | 11.0716 | 8.00112e-01 | 23.9800 | 1.23594e-01 | 6.4665 |
| 5.76036e-01 | 11.7666 | 7.74974e-01 | 22.6868 | 9.85408e-02 | 5.8693 |
| 6.01180e-01 | 12.2581 | 7.50016e-01 | 21.5303 | 7.36706e-02 | 5.2684 |
| 6.26225e-01 | 12.6861 | 7.24358e-01 | 20.5259 | 4.86875e-02 | 4.6321 |
| 6.51281e-01 | 13.1490 | 6.99544e-01 | 19.6654 | 2.49894e-02 | 3.9594 |
| 6.76500e-01 | 13.5656 | 6.74138e-01 | 18.8408 | | |



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**Analysis**
Operator: VIT Date:2024/02/07
Sample ID: 20BCN-SMR-060224
Sample Desc:
Sample Weight: 0.0746 g
Approx. Outgas Time:8.4 hrs
Analysis gas: Nitrogen
Analysis Time: 3:57 hr:min
Analysis Mode: Standard
VoidVol. Mode: He Measure

**Report**
Operator: VIT Date:2024/02/09
Filename: 20BCN-SMR-060224_REC.qps
Comment:
Instrument: Autosorb iQ Station 1
Final Outgas Temp.:150 °C
Non-ideality: 6.58e-05 1/Torr
Bath temp.: 77.35 K
Cold Zone V: 3.74961 cc
Extended info: Available
CellType: 9mm
VoidVol Remeasure:off
Warm Zone V: 13.5428 cc

## Isotherm : Linear

### Data Reduction Parameters

Thermal Transpiration: on
Eff. mol. diameter (D): 3.54 Å
Eff. cell stem diam. (d): 4.0000 mm
Adsorbate model: Nitrogen
Temperature 77.350K
Molec. Wt.: 28.013
Cross Section: 16.200 Å²
Liquid Density: 0.808 g/cc

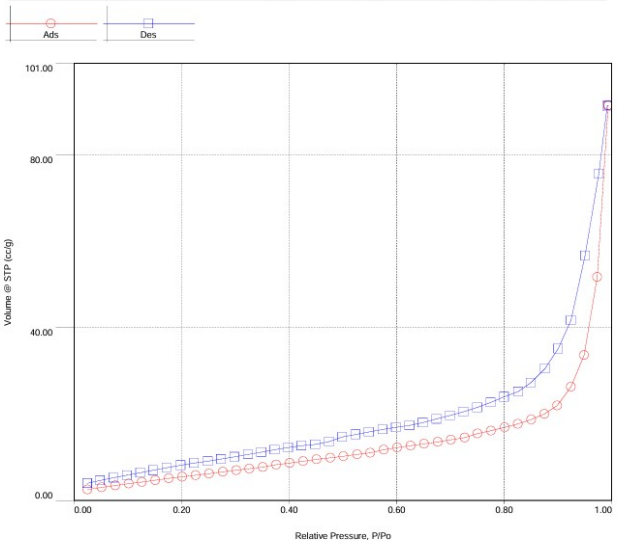





Fig S7. BET Data of PcCFP Photocatalyst

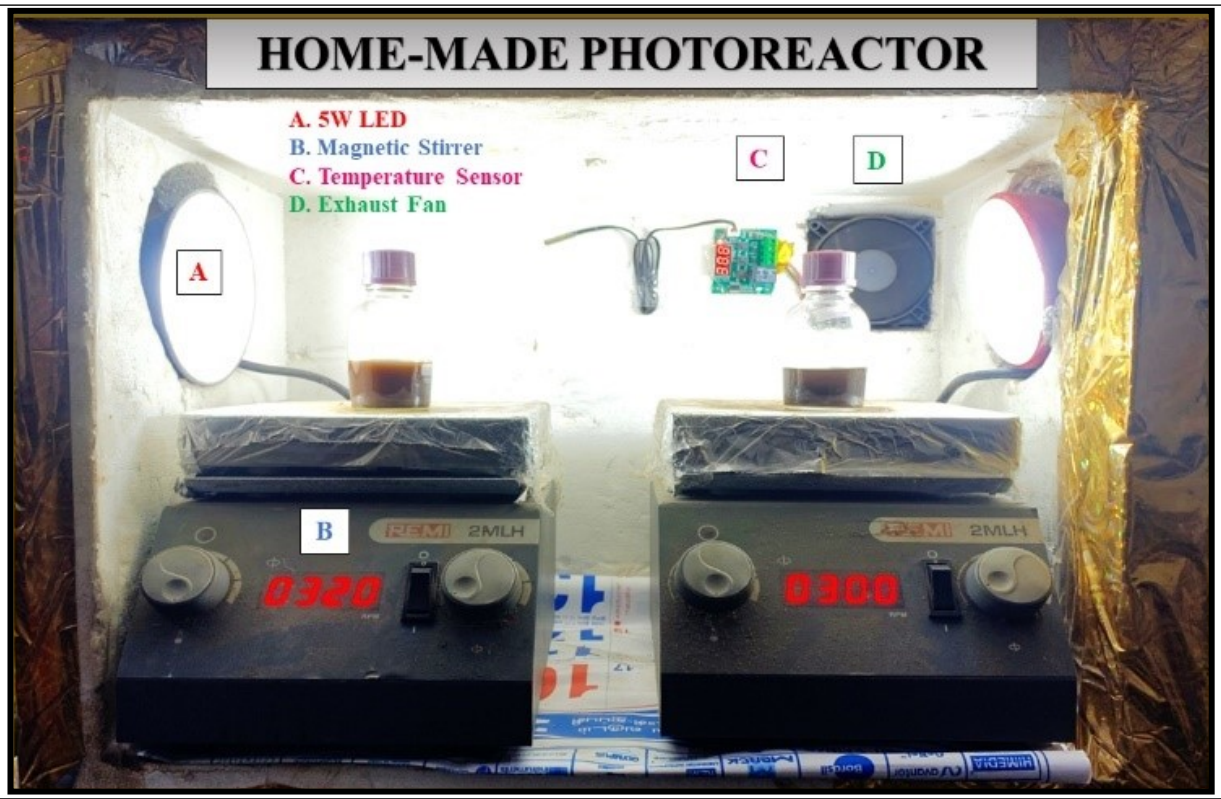



**Fig S8.** Home-Made Photoreactor

**Explanation of Normal Distribution Plots:**

The use of normal probability plots allows for a comparison between expected and residual responses, facilitating a visual assessment of the normality of these residuals, as depicted in Figure S9. Evaluating the model's adequacy necessitates a comparison between predicted values and experimental data. It is vital to ascertain whether the residuals exhibit a normal distribution to ensure an optimal distribution of data. This analysis plays a significant role in validating the reliability of the outputs generated by the predictive model. Additionally, the configuration of data points in relation to the fitted line can be employed to evaluate which model aligns most closely with the data. The plot of normal probability against externally studentized residuals (Fig S9. a) exhibited a linear association, though with some deviations, suggesting that data points conforming to the principles of normal distribution would yield superior model performance. Therefore, linearity in the data would be evident if the connecting line forms a 45° angle.

To determine the adequacy of the models used for the conversion of Benzamide to N-Aryl Amides through the photocatalytic process, we assessed both residuals and the distribution plot. The alignment of the plotted points with the theoretical normality line was analyzed to evaluate the model's suitability and significance (Fig S9. b). Likewise, Fig S9.c adeptly showcases the random characteristics of the residuals concerning the predicted response, highlighting the absence of any noticeable patterns or trends in the experimental data. This scatter plot confirms the lack of systematic variation, reinforcing the unpredictable nature of the residuals. Additionally, a plot of residuals plotted against the run number displays a random and scattered distribution (Fig S9. d). Such results are pivotal in affirming the adequacy and credibility of the model utilized.

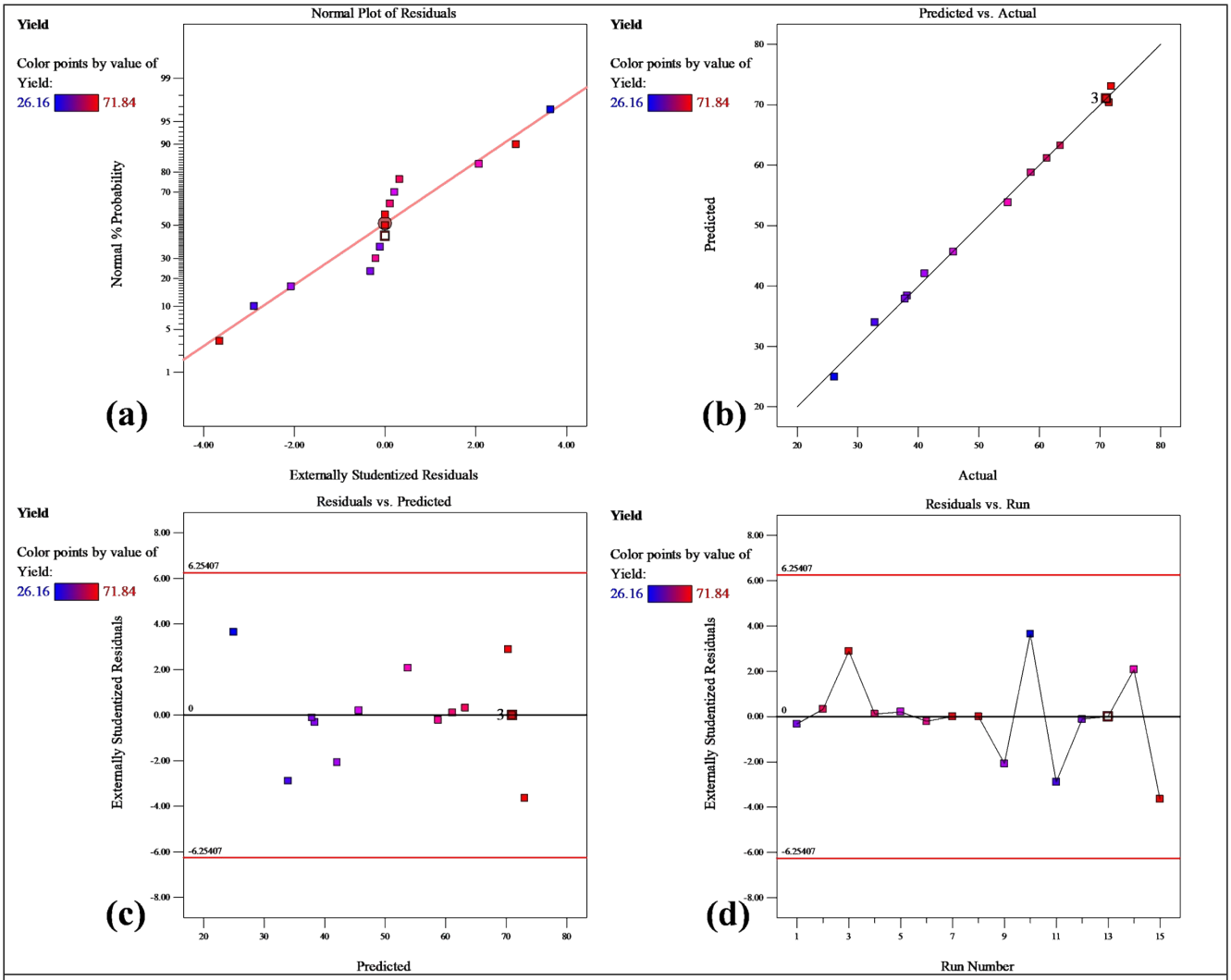



**Fig S9.** Plot illustrating the normal distribution of Linear models **a.** depicting the efficiency of PcCFP Photocatalyst for the N-Arylation of Benzamide. **b.** Comparison between the observed and predicted results for photocatalytic N-Arylation of Benzamide. Normal probability plots of residual for photo-transesterification of UFO to Biofuel as a function of **c.** Predicted Response and **d.** Run Number

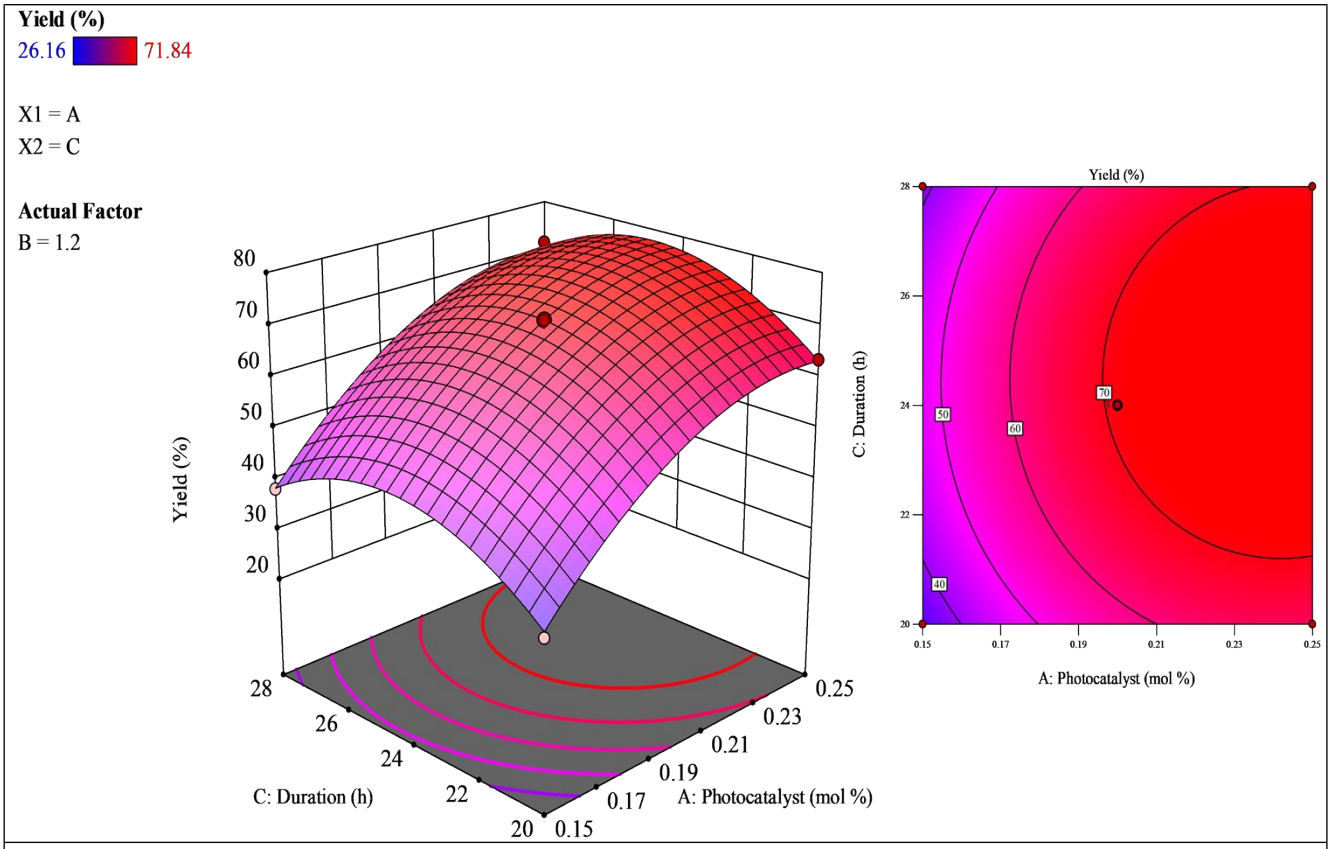



**Fig S10.** 3-D Surface and Contour Plot of N-arylation of Benzamide highlighting the relationship between the amount of PcCFP Photocatalyst (A) and duration of reaction (C) with constant molar ratio of reactants (B)

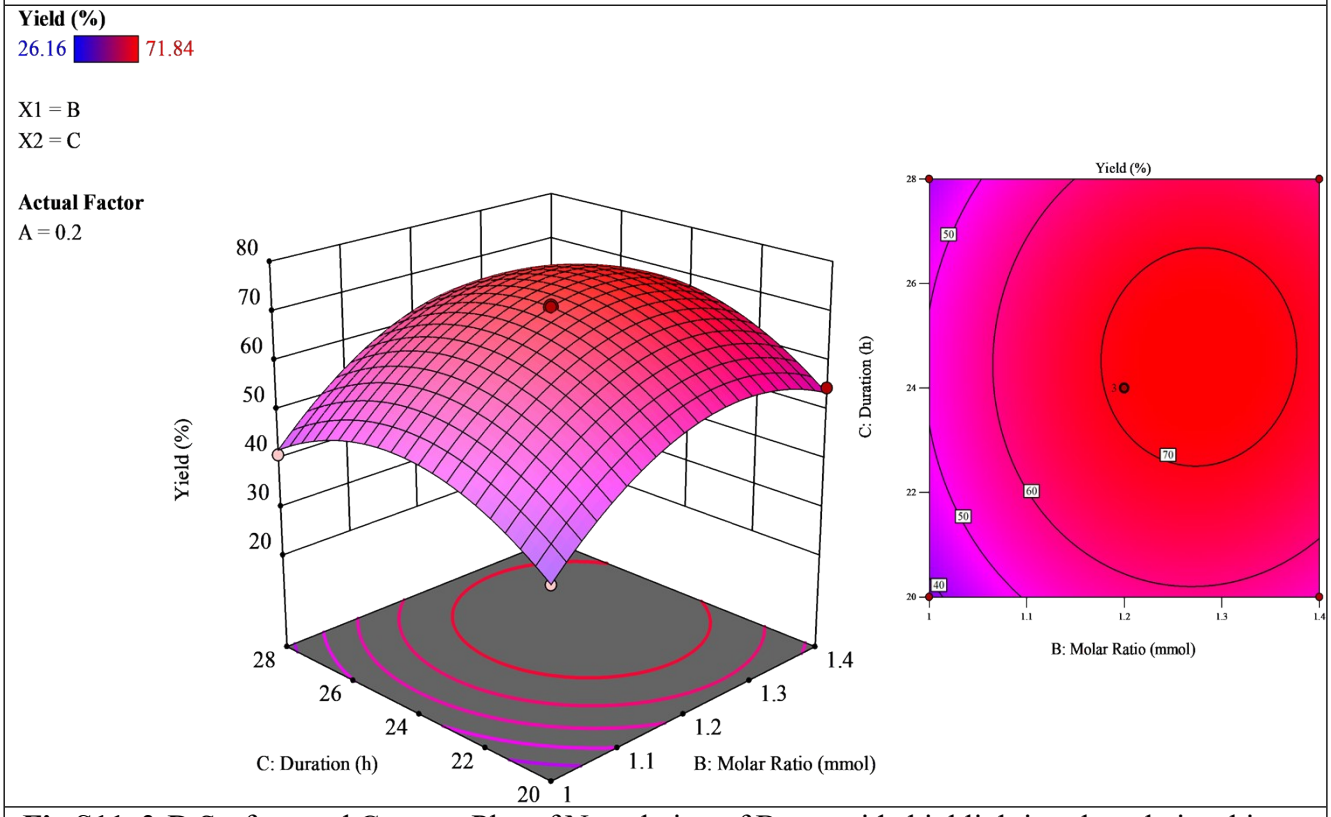



**Fig S11.** 3-D Surface and Contour Plot of N-arylation of Benzamide highlighting the relationship between the molar ratio of reactants (B) and duration of reaction (C) with constant amount of PcCFP Photocatalyst (A)

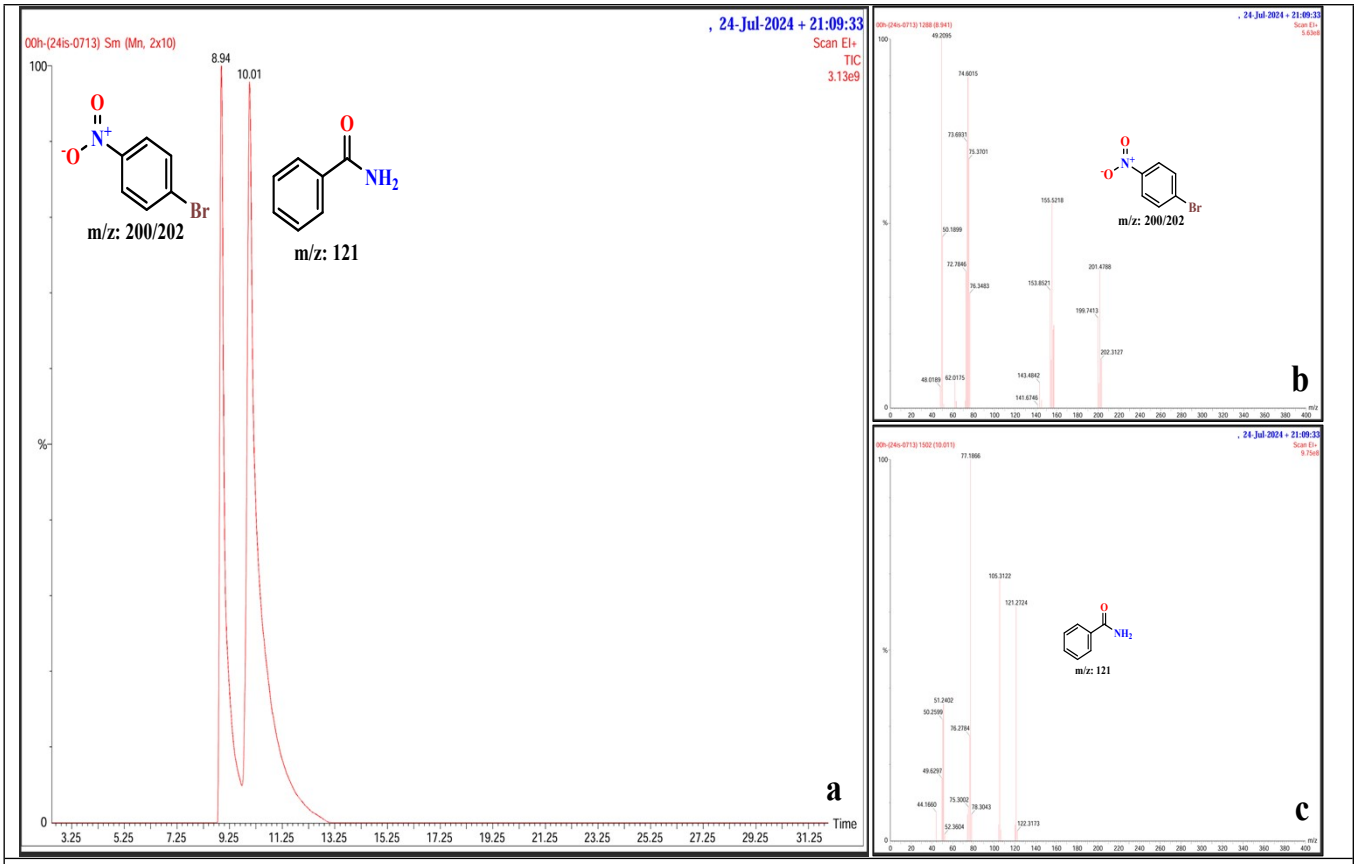



**Fig S12. a.** GC-MS Chromatogram of sample taken initially at 0 hour of reaction time. **b.** m/z of Ar-Br obtained at 8.94 RT in chromatogram. **c.** m/z of benzamide obtained at 10.01 RT in chromatogram.

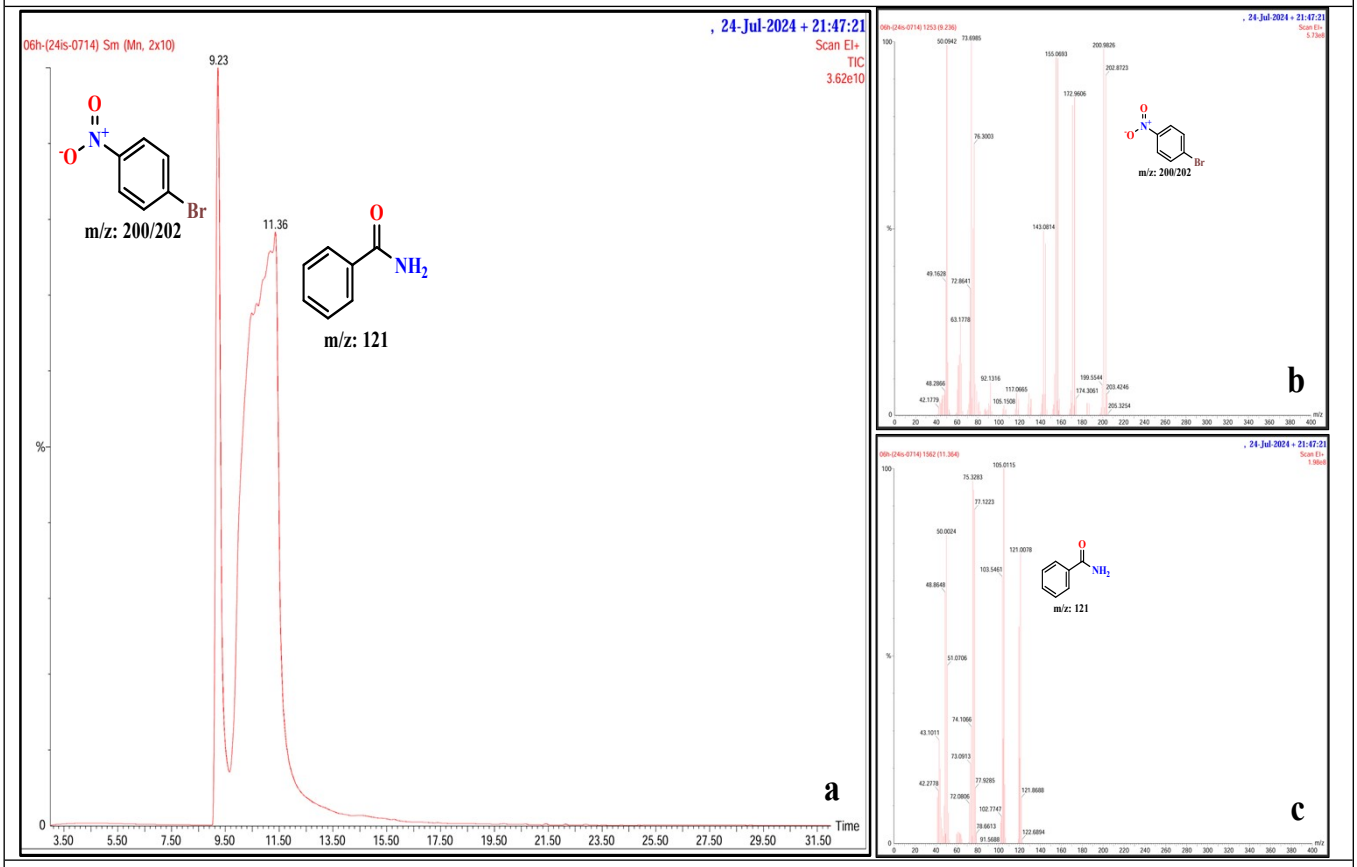



**Fig S13. a.** GC-MS Chromatogram of sample taken initially at 6 hour of reaction time. **b.** m/z of Ar-Br obtained at 9.23 RT in chromatogram. **c.** m/z of benzamide obtained at 11.36 RT in chromatogram.

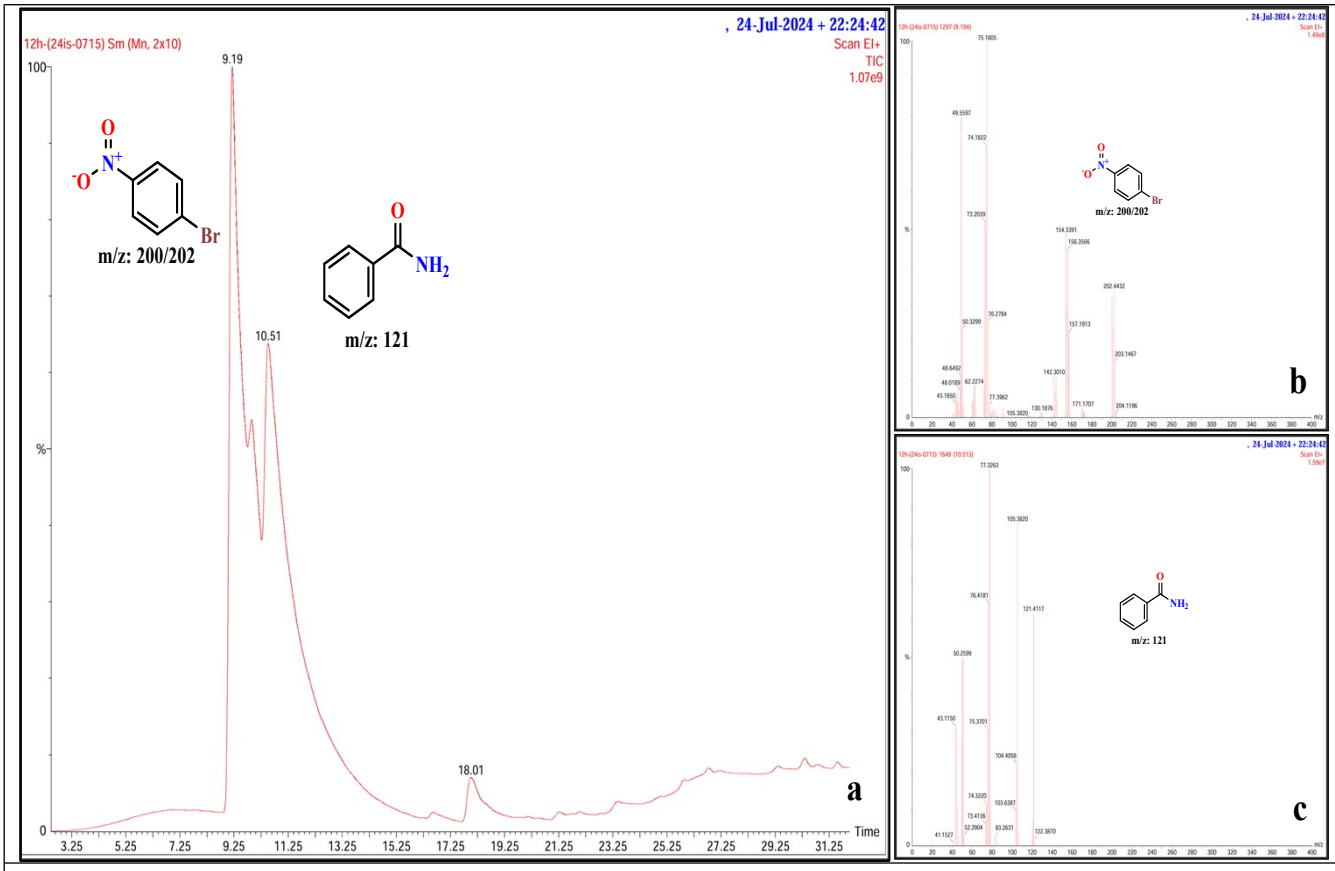



**Fig S14. a.** GC-MS Chromatogram of sample taken initially at 12 hour of reaction time. **b.** m/z of Ar-Br obtained at 9.19 RT in chromatogram. **c.** m/z of benzamide obtained at 10.51 RT in chromatogram.

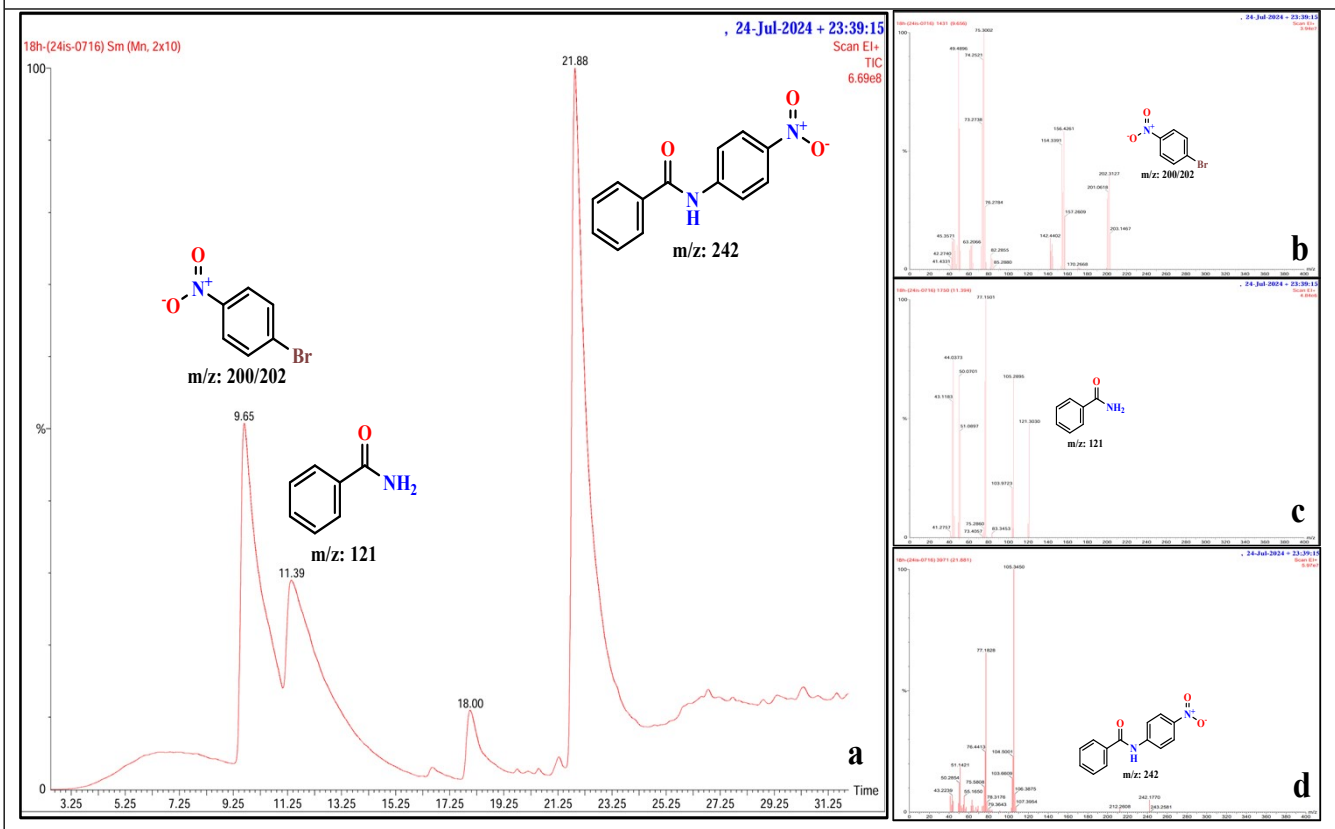



**Fig S15. a.** GC-MS Chromatogram of sample taken initially at 18 hour of reaction time. **b.** m/z of Ar-Br obtained at 9.65 RT in chromatogram. **c.** m/z of benzamide obtained at 11.39 RT in chromatogram. **d.** m/z of product obtained at 21.88 RT in chromatogram.

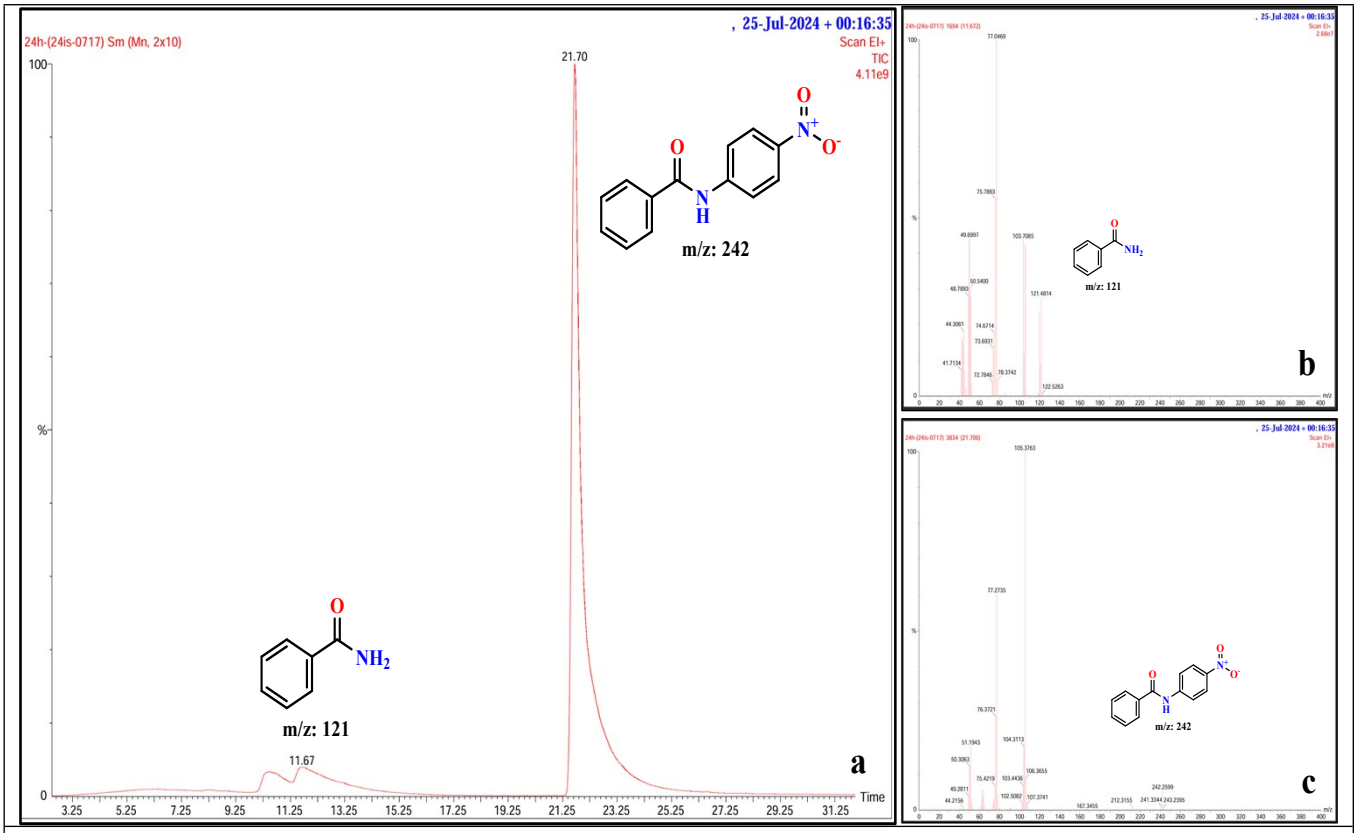



**Fig S16. a.** GC-MS Chromatogram of sample taken initially at 24 hour of reaction time. **b.** m/z of benzamide traces obtained at 11.67 RT in chromatogram. **c.** m/z of product obtained at 21.70 RT in chromatogram.

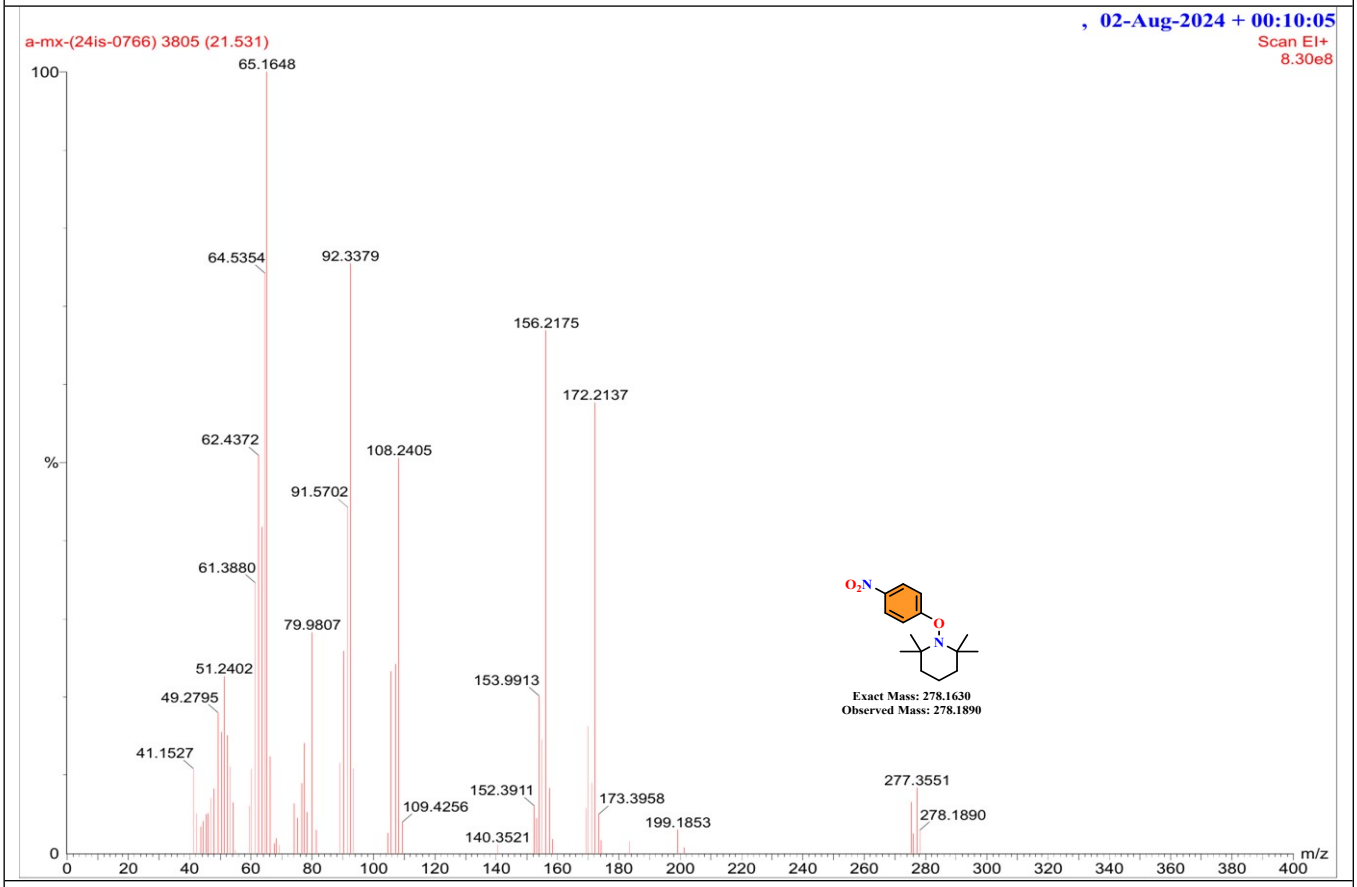
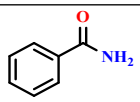
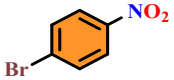
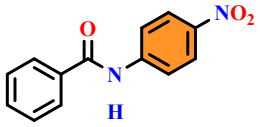
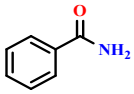
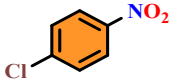
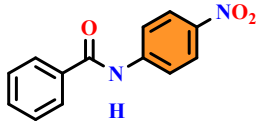
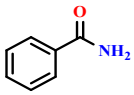
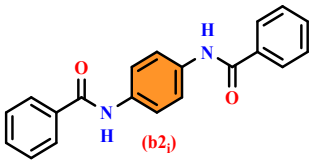
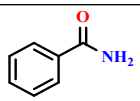
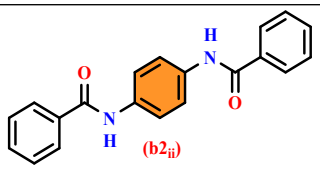
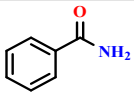
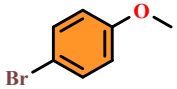
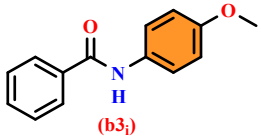
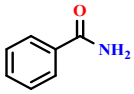
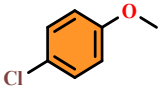
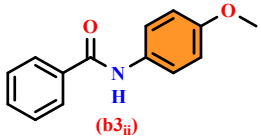
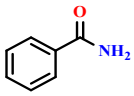
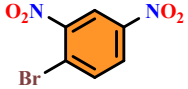
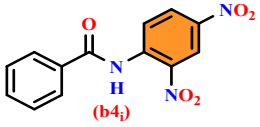
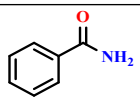
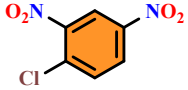
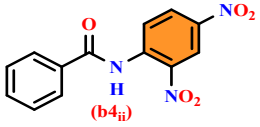
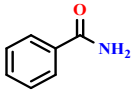
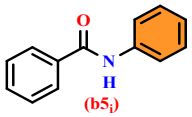
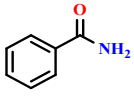
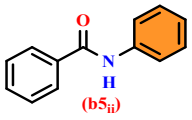
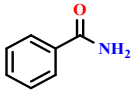
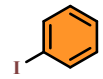
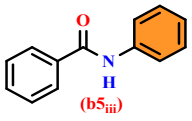
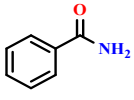
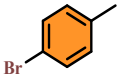
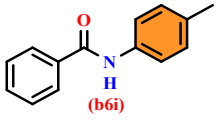
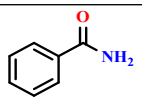
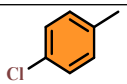
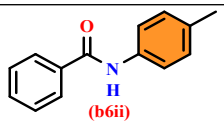
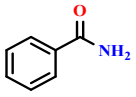
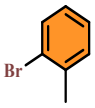
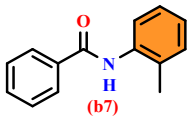
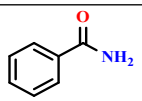
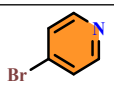
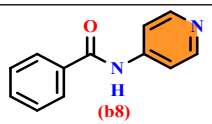
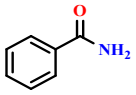
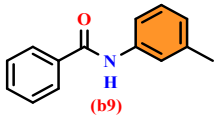
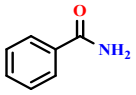
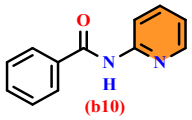
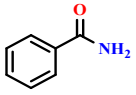
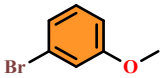
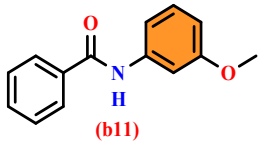
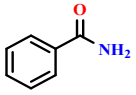
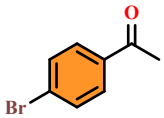
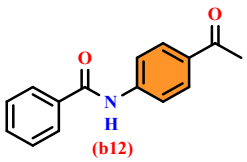
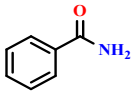
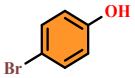
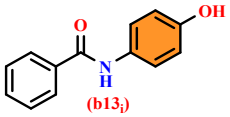
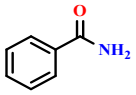
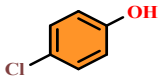
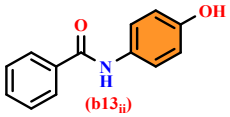
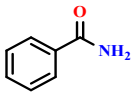
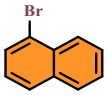
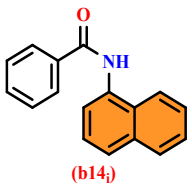
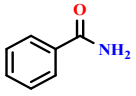
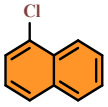
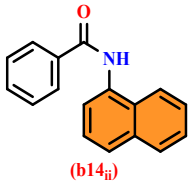
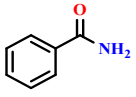
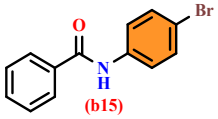
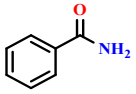
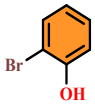
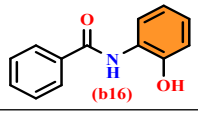
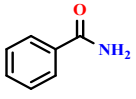
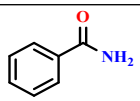
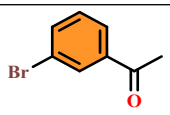
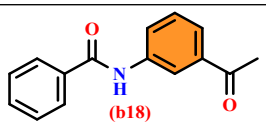
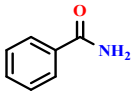
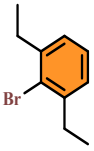
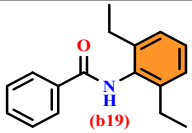
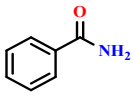
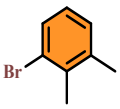
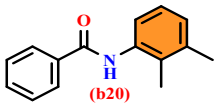
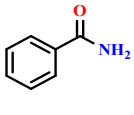
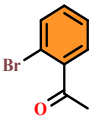
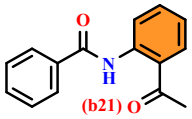
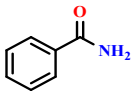
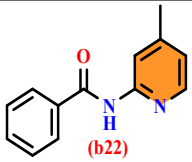
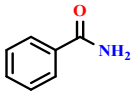
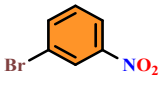
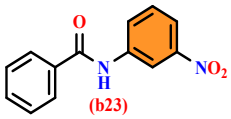
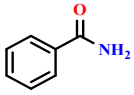
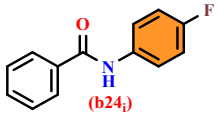
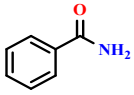
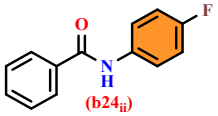
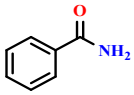
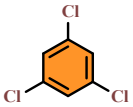
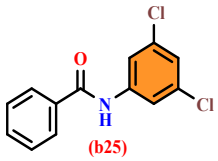



**Fig S17.** GC-Mass Spectrum of TEMPO adduct formed from Aryl radical

**Table S1.** Precursor with respective halogens and its Product obtained via N-arylation of Benzamide

| Sr. No | Product Code | Reactant R1 | Reactants R2 | Product | Yield (%) |
|---|---|---|---|---|---|
| 1. | $b1_i$ |  |  |  | 71% |
| 2. | $b1_{ii}$ |  |  |  | 29% |
| 3. | $b2_i$ |  |  |  | 64% |
| 4. | $b2_{ii}$ |  |  |  | 27% |
| 5. | $b3_i$ |  |  |  | 61% |
| 6. | $b3_{ii}$ |  |  |  | 22% |
| 7. | $b4_i$ |  |  |  | 73% |
| 8. | $b4_{ii}$ |  |  |  | 35% |
| 9. | $b5_i$ |  |  |  | 63% |
| 10. | $b5_{ii}$ |  |  |  | 30% |
| 11. | $b5_{iii}$ |  |  |  | 72% |
| 12. | $b6_i$ |  |  |  | 58% |

| | | | | | |
|---|---|---|---|---|---|
| 13. | $b6_{ii}$ |  |  |  (b6ii) | 21% |
| 14. | b7 |  |  |  (b7) | 54% |
| 15. | b8 |  |  |  (b8) | 67% |
| 16. | b9 |  |  |  (b9) | 60% |
| 17. | b10 |  |  |  (b10) | 62% |
| 18. | b11 |  |  |  (b11) | 61% |
| 19. | b12 |  |  |  (b12) | 73% |
| 20. | $b13_i$ |  |  |  ($b13_i$) | 59% |
| 21. | $b13_{ii}$ |  |  |  ($b13_{ii}$) | 22% |
| 22. | $b14_i$ |  |  |  ($b14_i$) | 60% |
| 23. | $b14_{ii}$ |  |  |  ($b14_{ii}$) | 26% |
| 24. | b15 |  |  |  (b15) | 68% |
| 25. | b16 |  |  |  (b16) | 51% |
| 26. | b17 |  |  |  (b17) | 60% |

| | | | | | |
|---|---|---|---|---|---|
| 27. | b18 |  |  |  | 63% |
| 28. | b19 |  |  |  | 53% |
| 29. | b20 |  |  |  | 55% |
| 30. | b21 |  |  |  | 61% |
| 31. | b22 |  |  |  | 28% |
| 32. | b23 |  |  |  | 69% |
| 33. | $b24_i$ |  |  |  | 70% |
| 34. | $b24_{ii}$ |  |  |  | 28% |
| 35. | b25 |  |  |  | 31% |

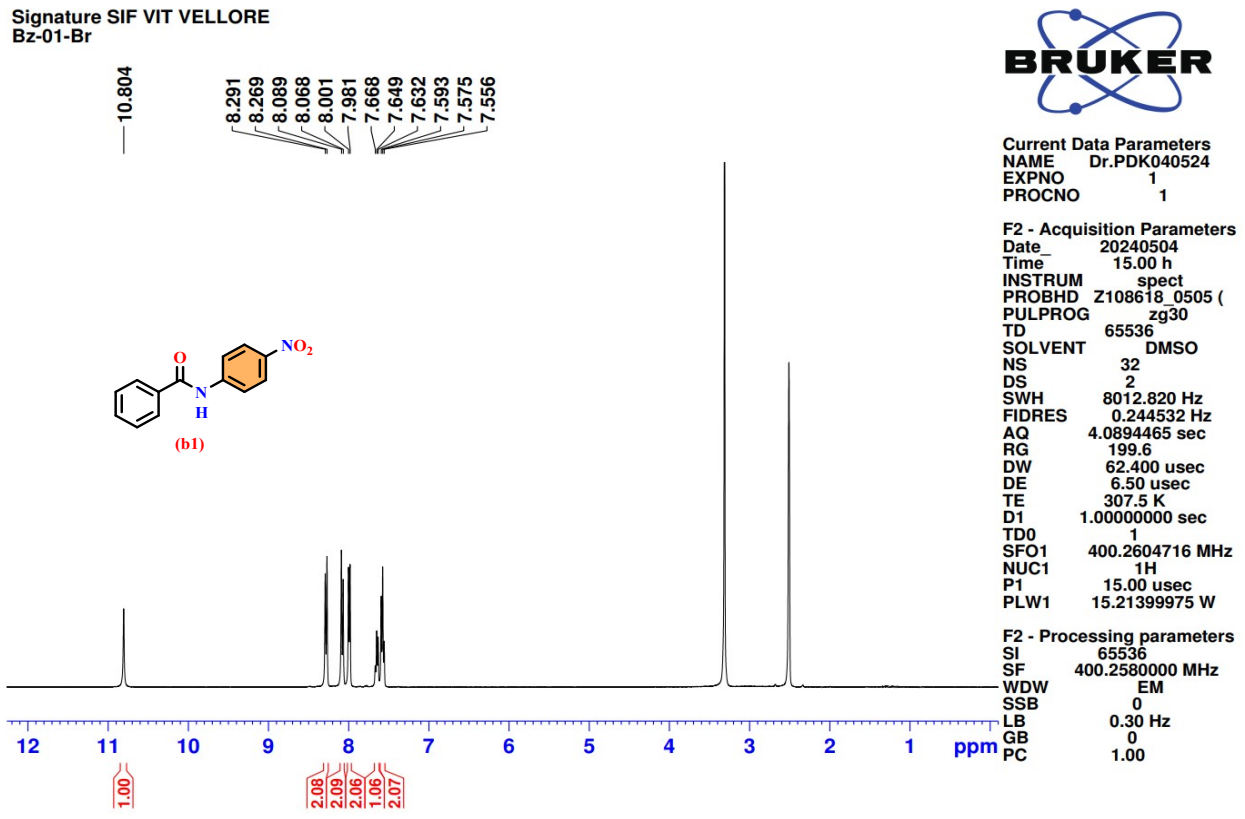



**Fig S18.** $^{1}$H NMR spectrum of ***N-(4-nitrophenyl)benzamide (b1$_i$)***

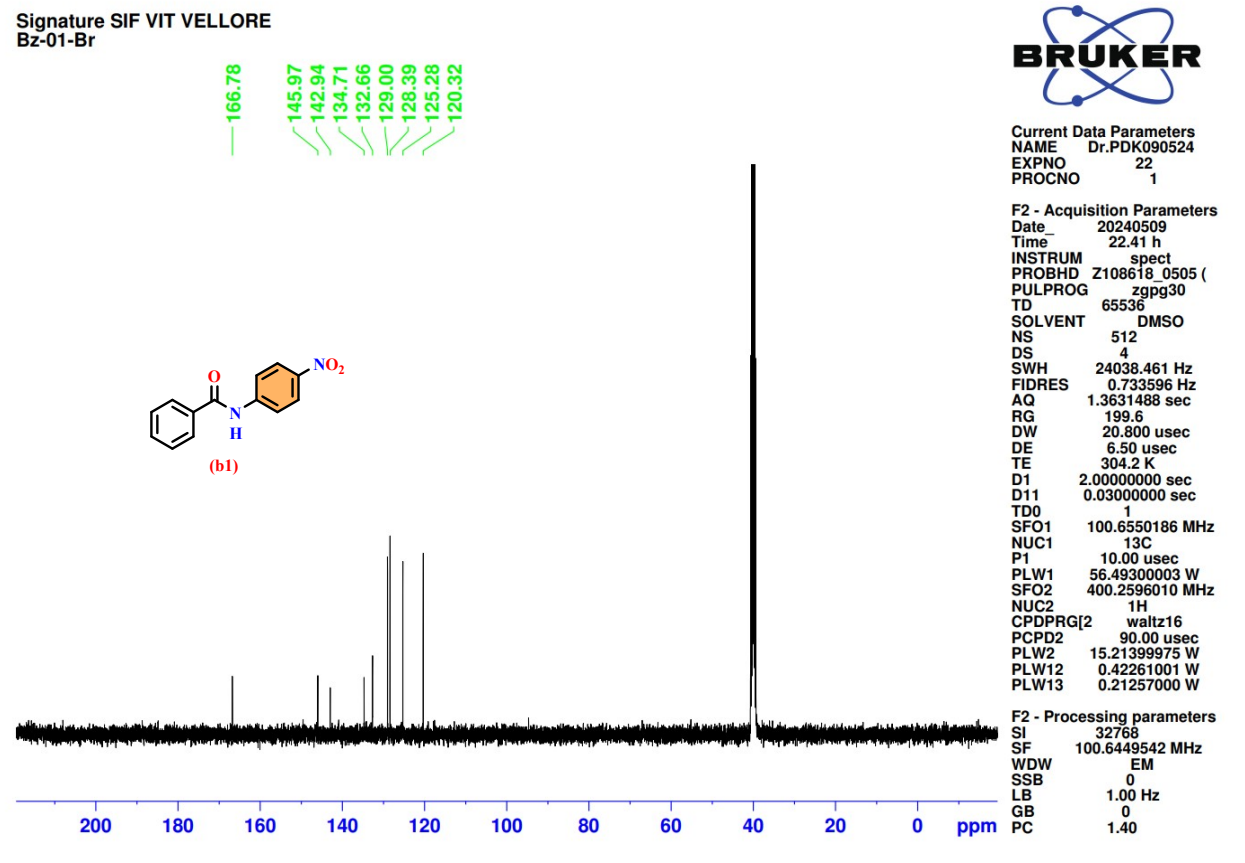



**Fig S19.** $^{13}$C NMR spectrum of ***N-(4-nitrophenyl)benzamide (b1$_i$)***

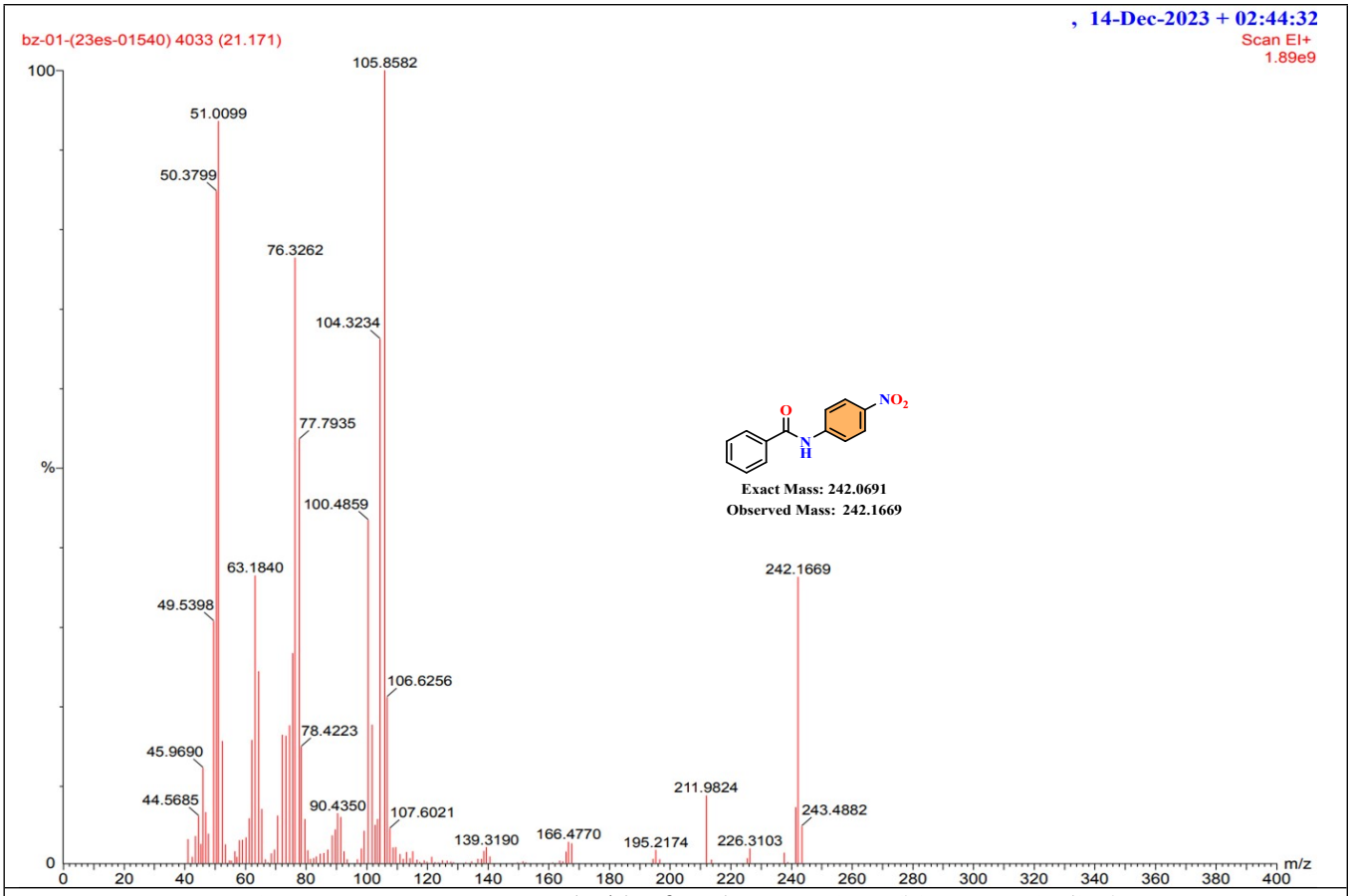



**Fig S20.** GC-Mass spectrum (m/z) of ***N-(4-nitrophenyl)benzamide (b1$_i$)***

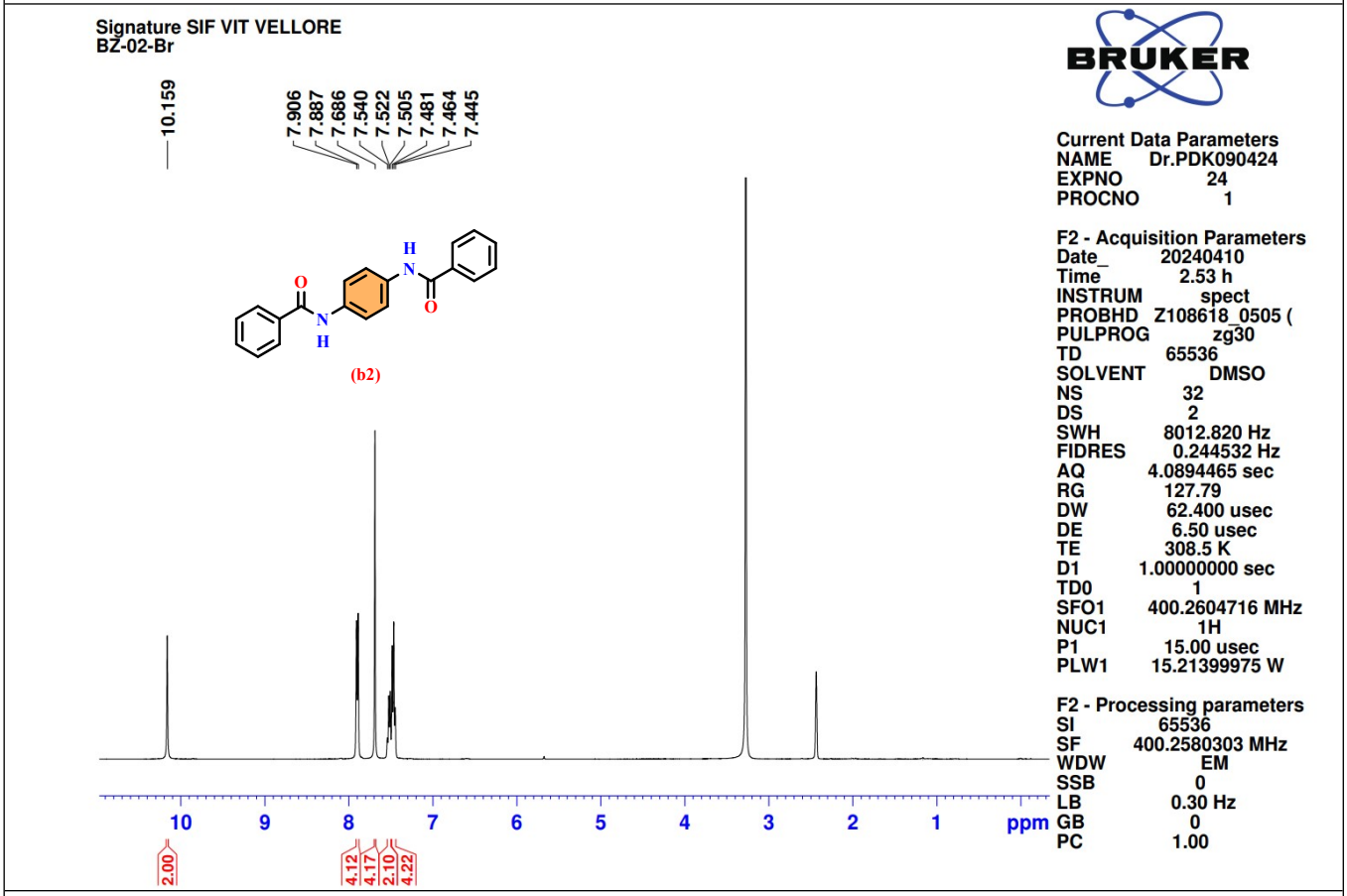



**Fig S21.** $^1$H NMR spectrum of ***N,N'-(1,4-phenylene)dibenzamide (b2$_i$)***

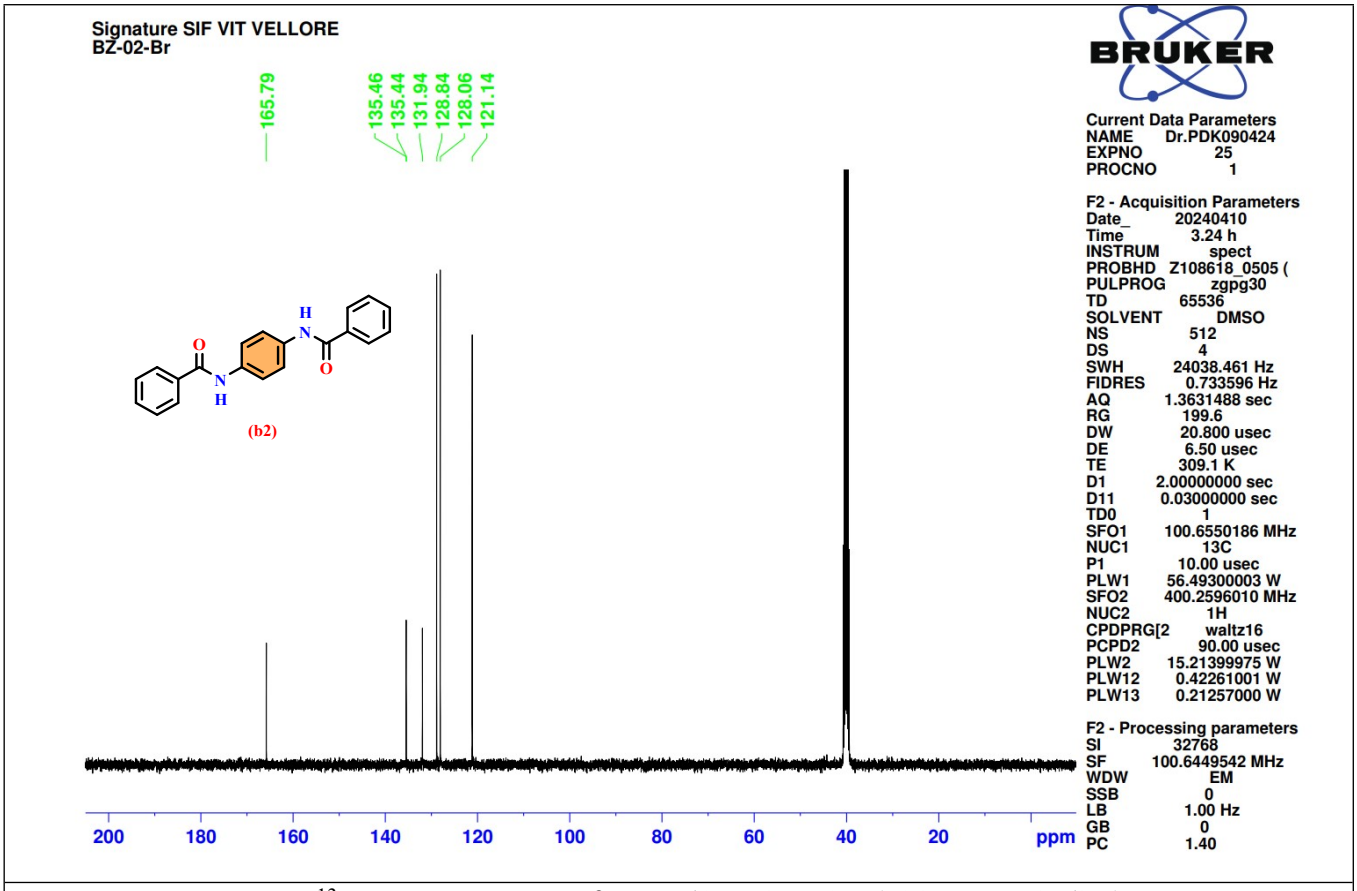



**Fig S22.** $^{13}$C NMR spectrum of ***N,N'-(1,4-phenylene)dibenzamide (b2$_i$)***

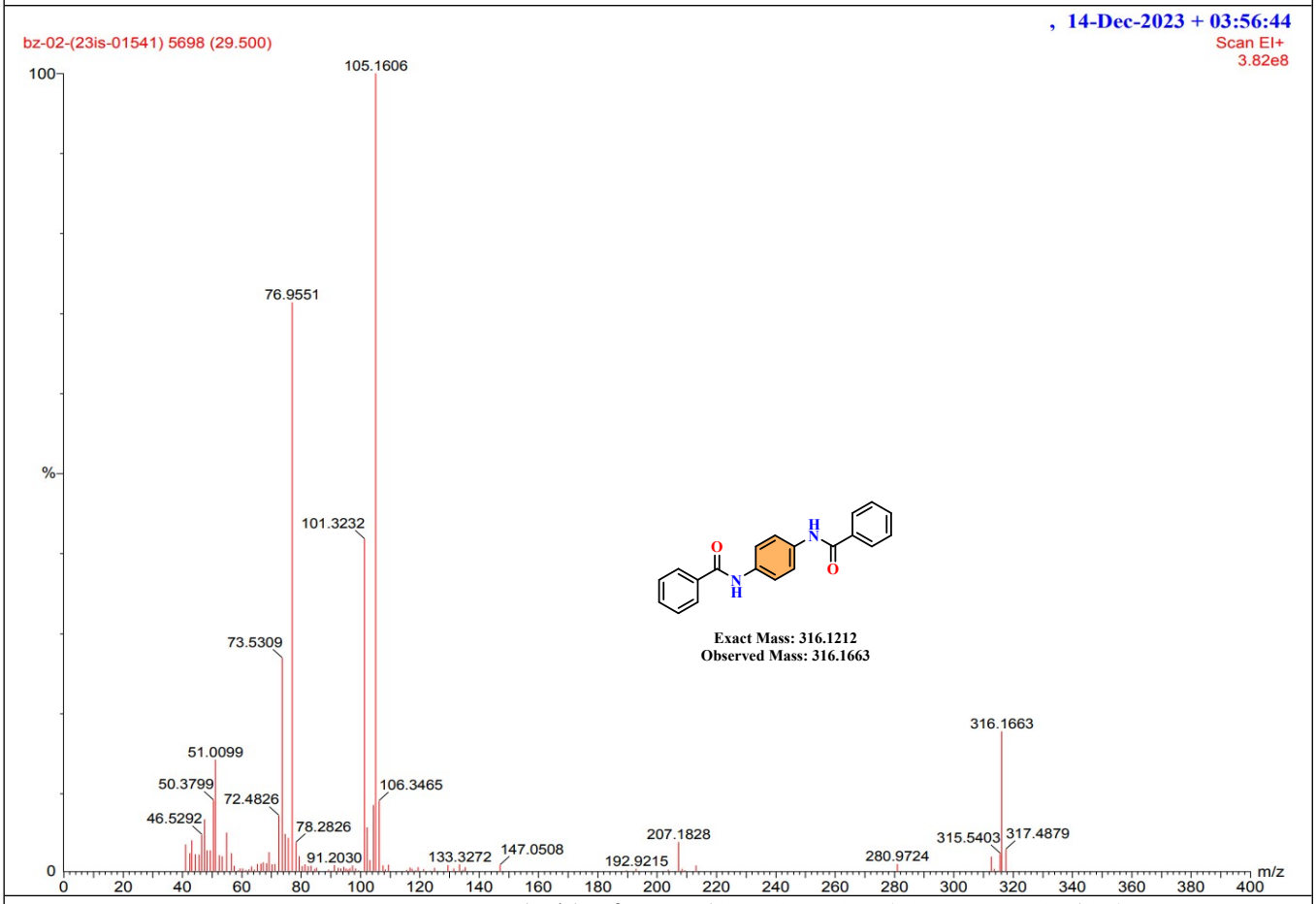



**Fig S23.** GC-Mass spectrum (m/z) of ***N,N'-(1,4-phenylene)dibenzamide (b2$_i$)***

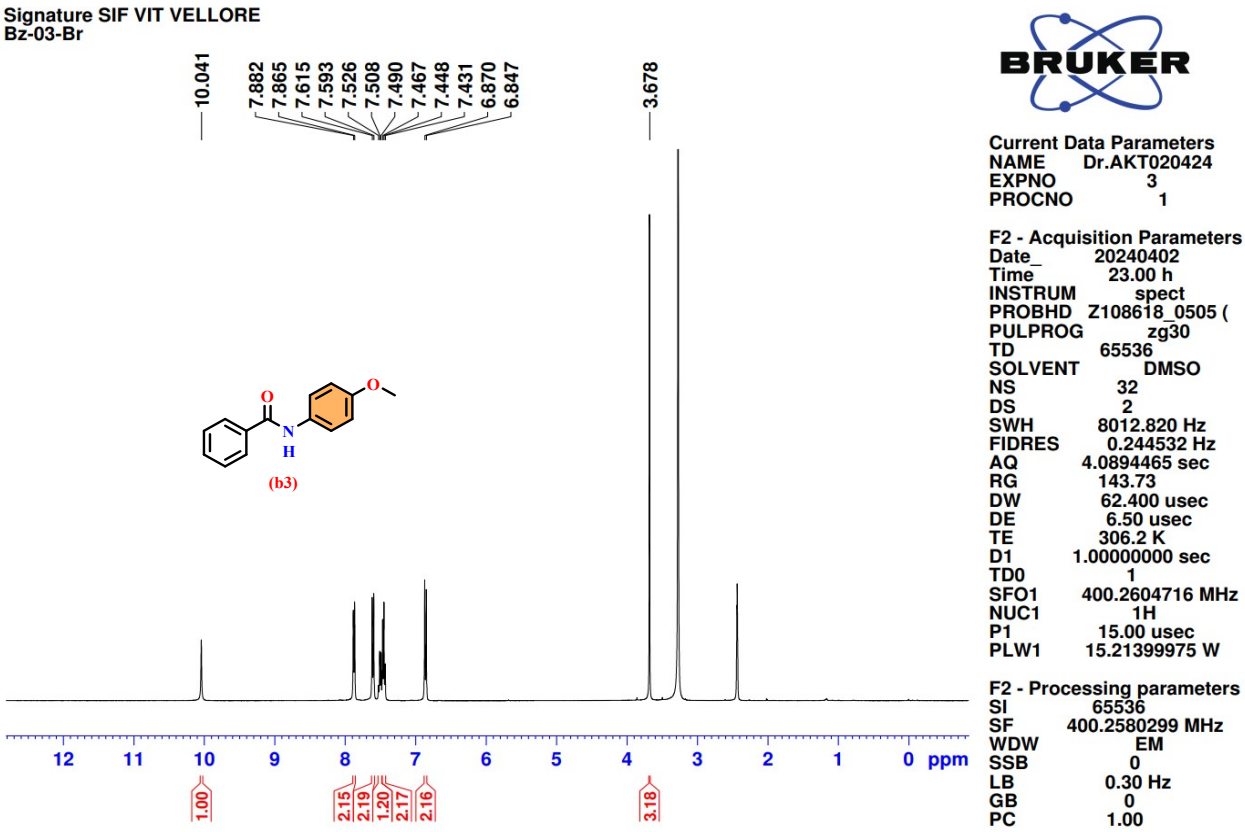



**Fig S24.** $^{1}$H NMR spectrum of ***N-(4-methoxyphenyl)benzamide (b3$_i$)***

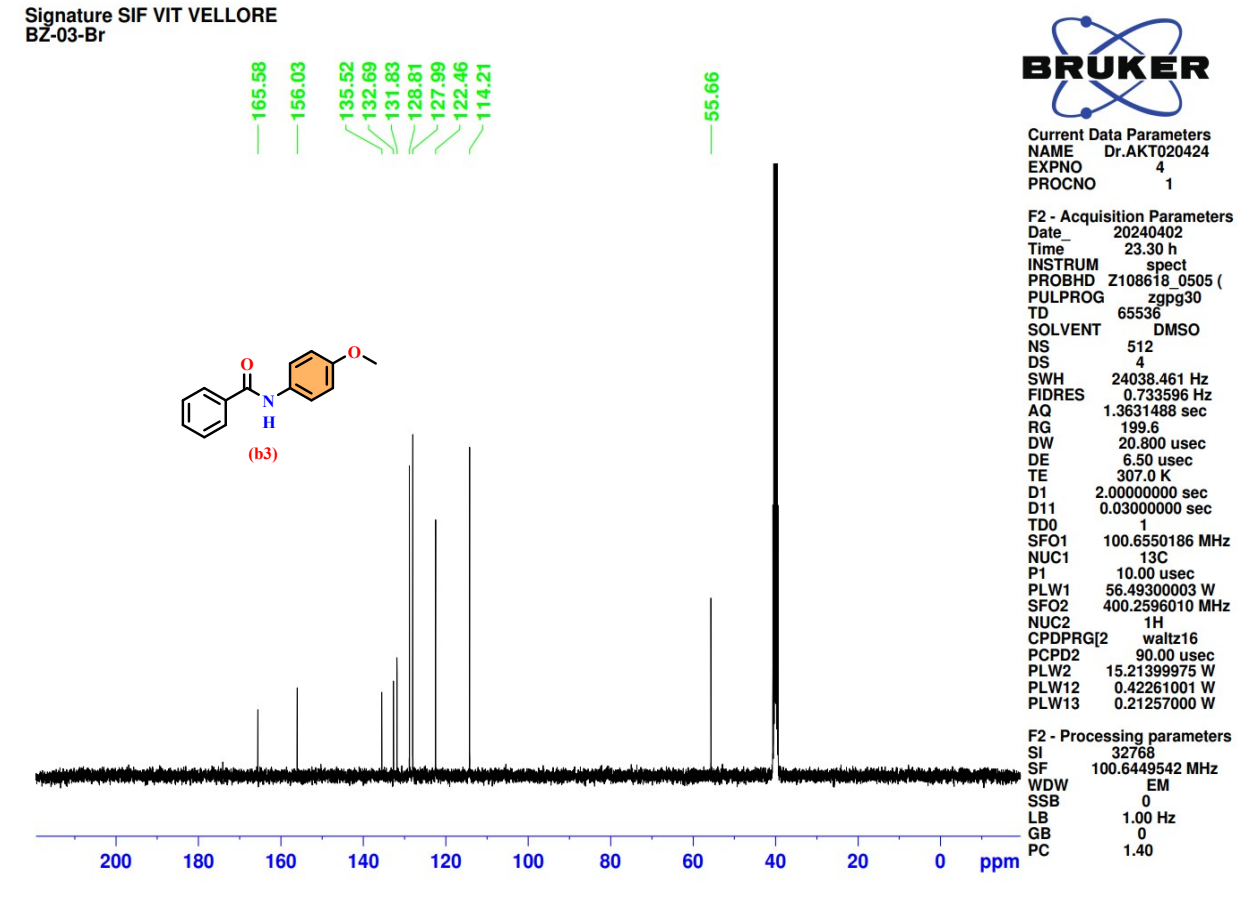



**Fig S25.** $^{13}$C NMR spectrum of ***N-(4-methoxyphenyl)benzamide (b3$_i$)***

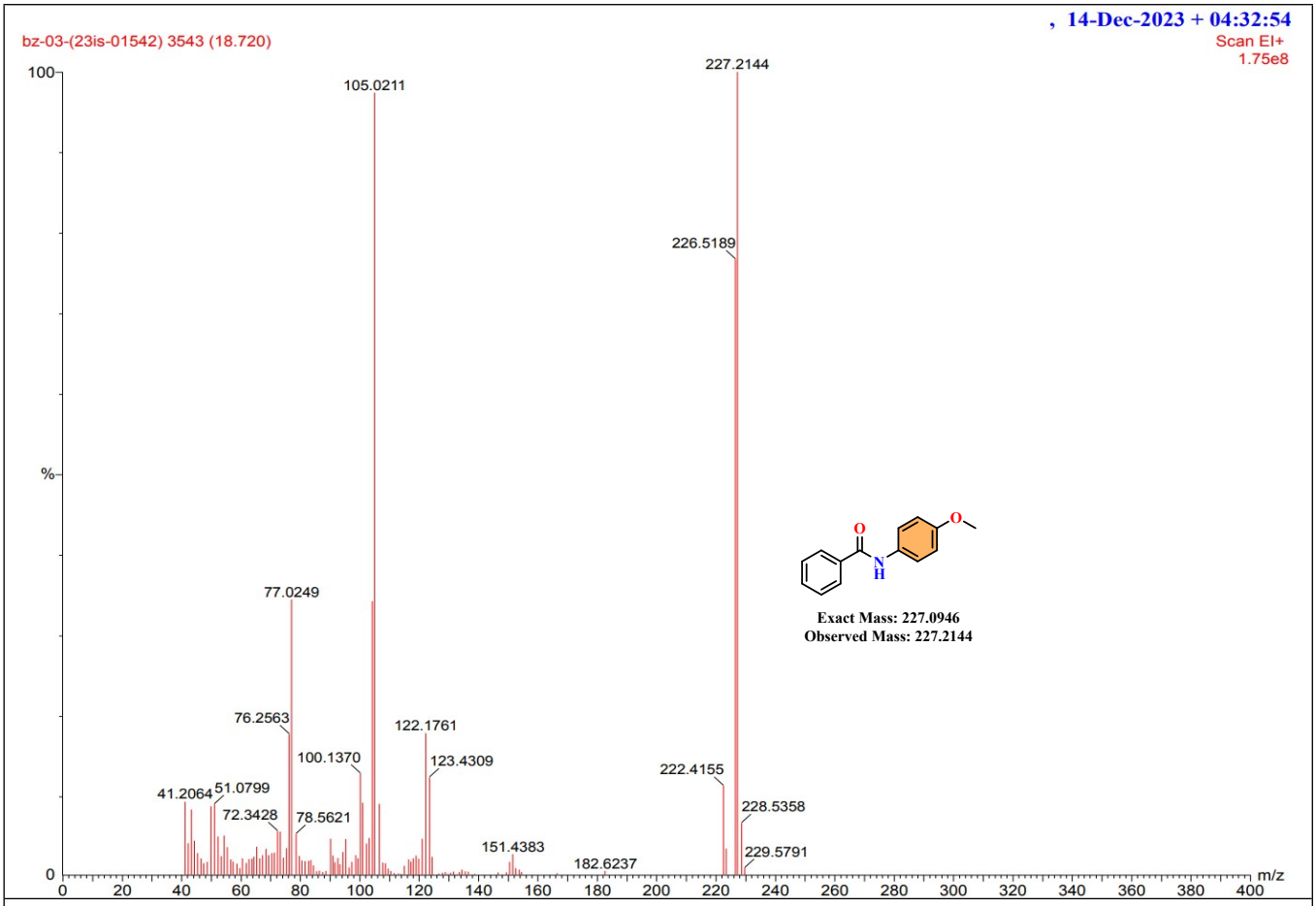



**Fig S26.** GC-Mass spectrum (m/z) of ***N-(4-methoxyphenyl)benzamide (b3$_i$)***

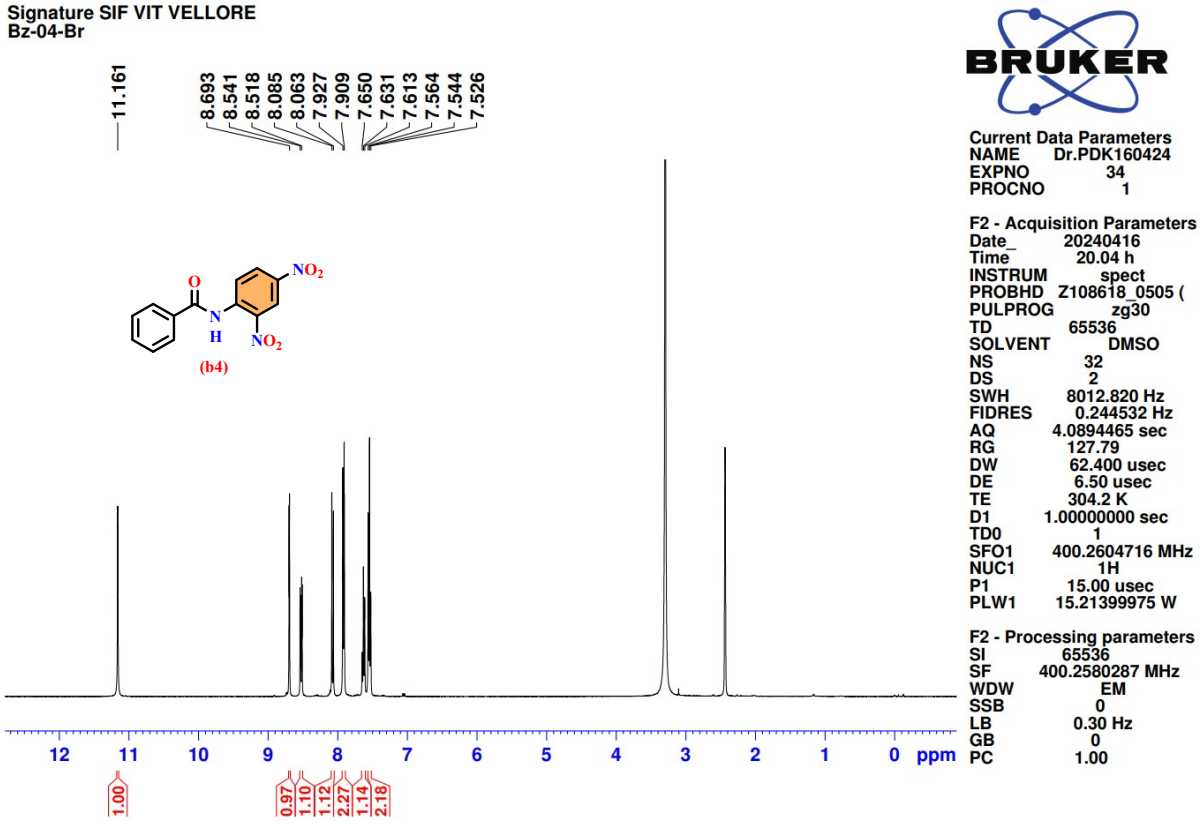



**Fig S27.** $^1$H NMR spectrum of ***N-(2,4-dinitrophenyl)benzamide (b4$_i$)***

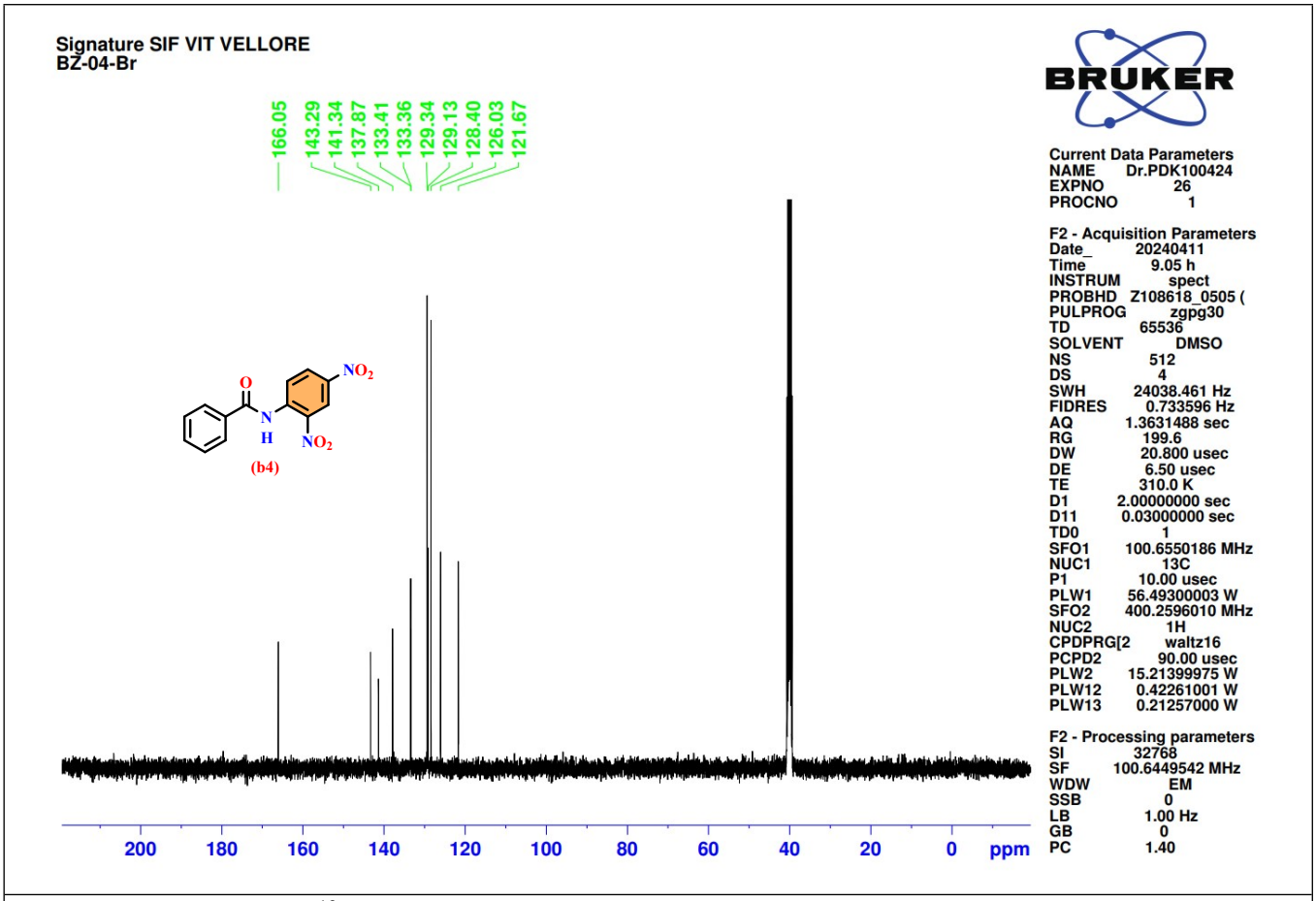



**Fig S28.** $^{13}$C NMR spectrum of ***N-(2,4-dinitrophenyl)benzamide (b4$_i$)***

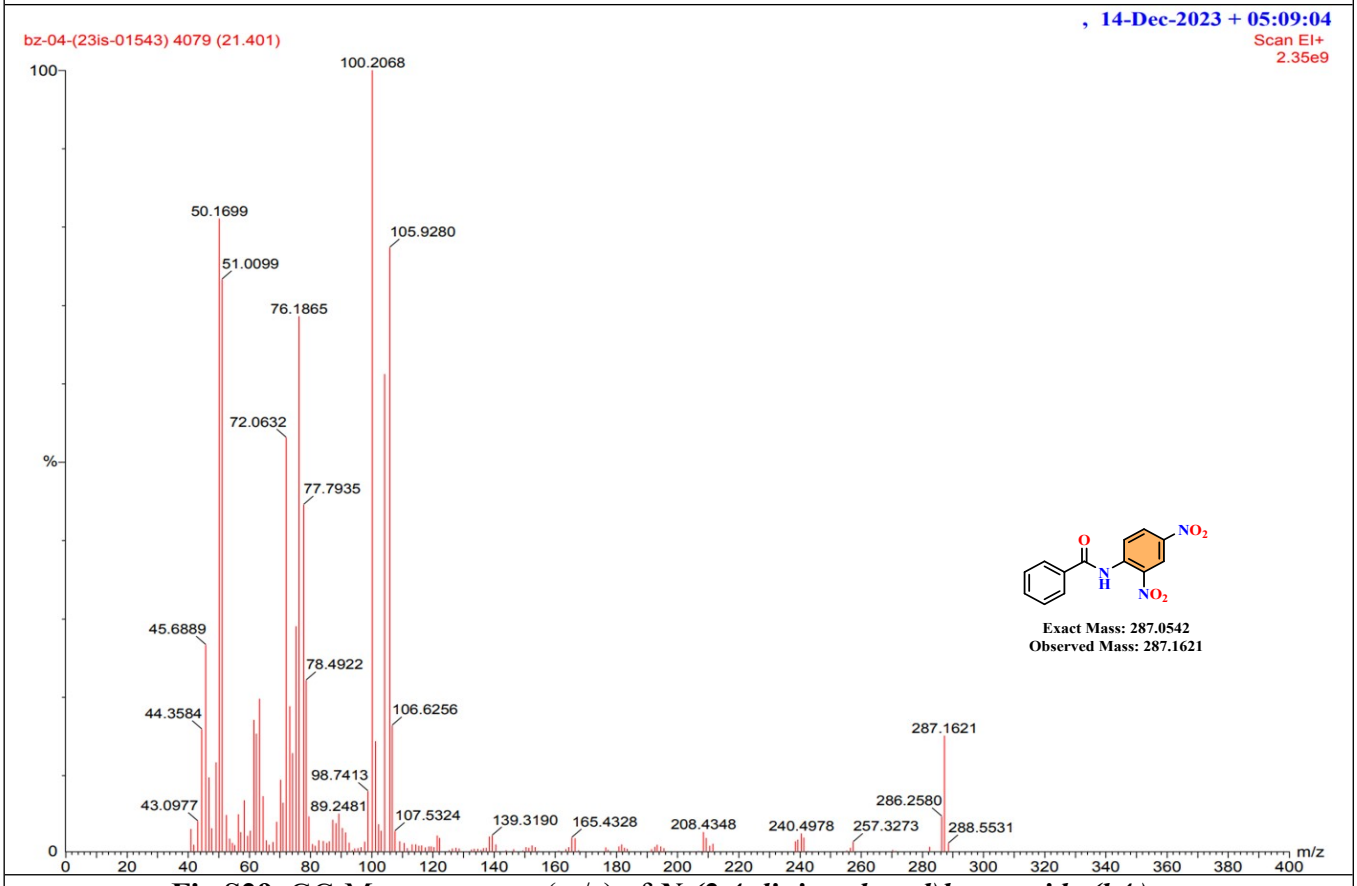



**Fig S29.** GC-Mass spectrum (m/z) of ***N-(2,4-dinitrophenyl)benzamide (b4$_i$)***

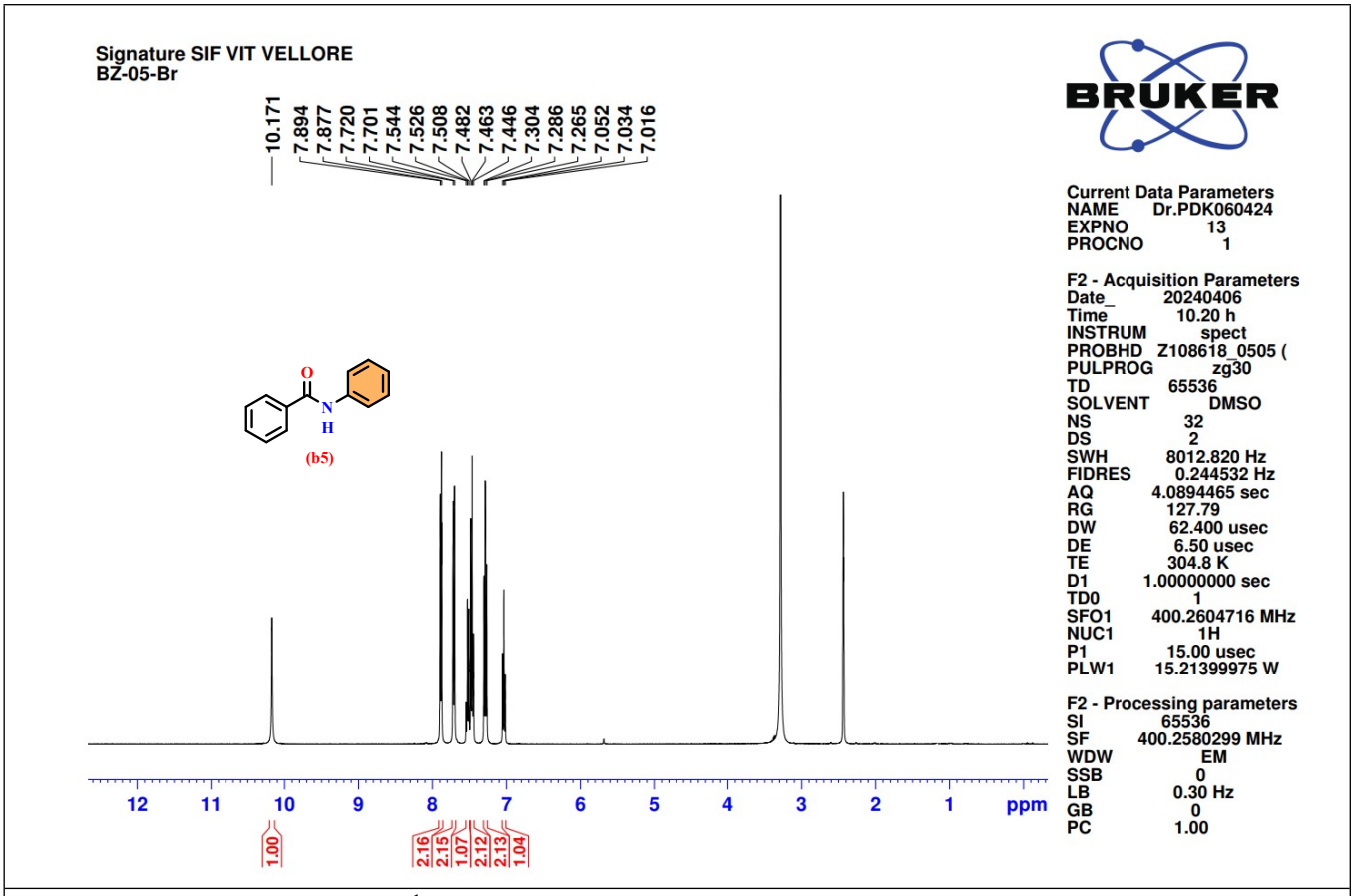



**Fig S30.** $^{1}$H NMR spectrum of ***N-phenylbenzamide (b5$_i$)***

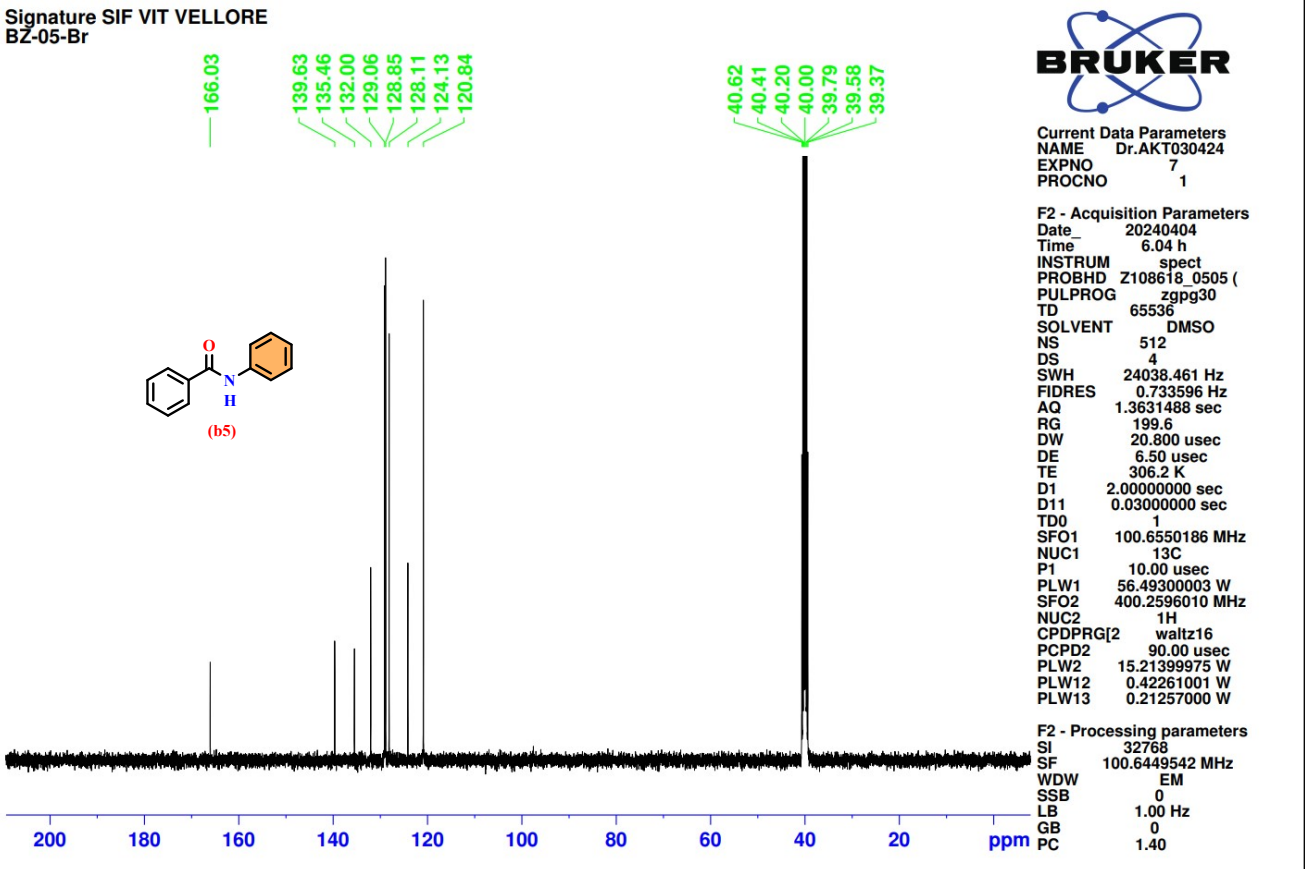



**Fig S31.** $^{13}$C NMR spectrum of ***N-phenylbenzamide (b5$_i$)***

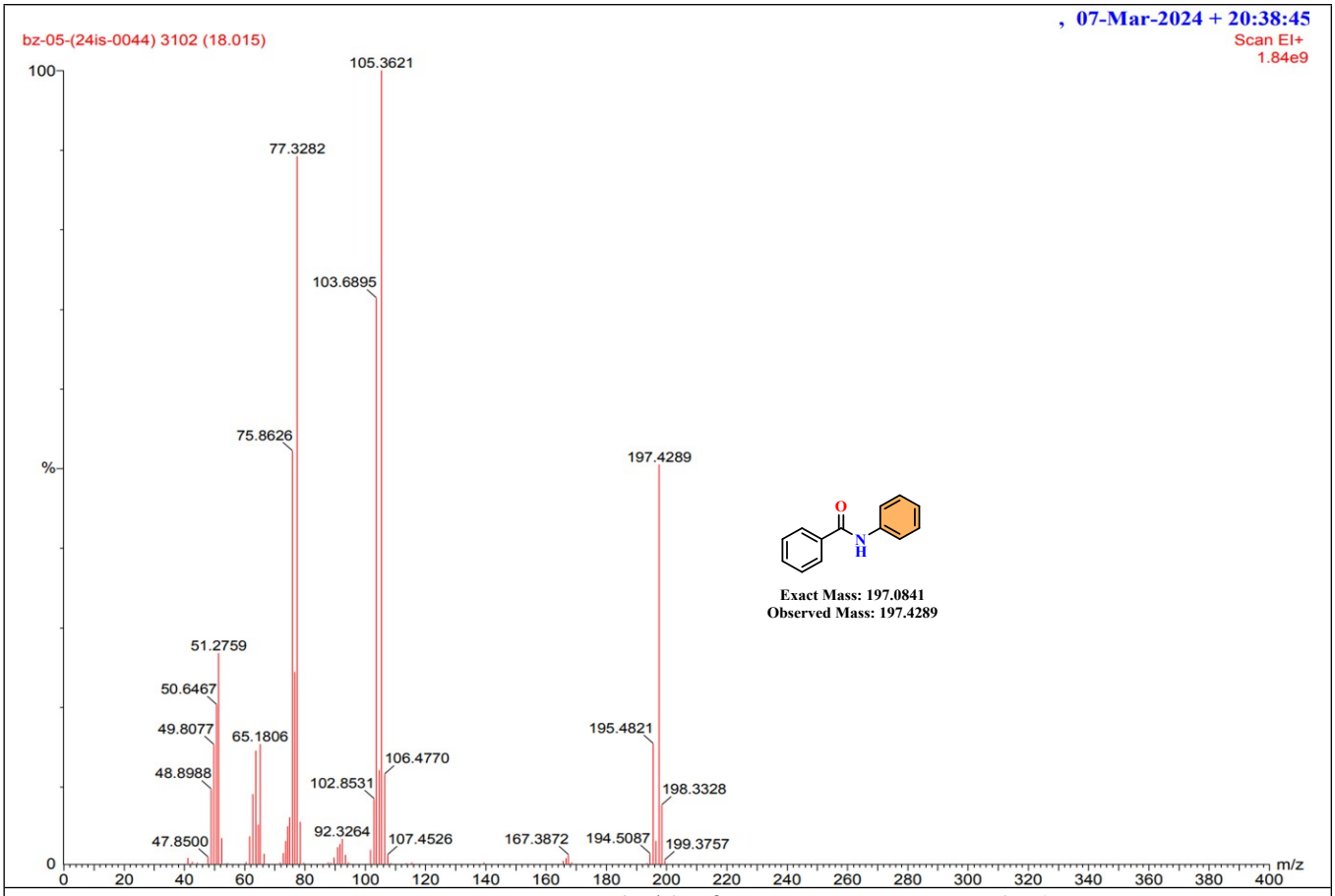



**Fig S32.** GC-Mass spectrum (m/z) of ***N-phenylbenzamide (b5$_i$)***

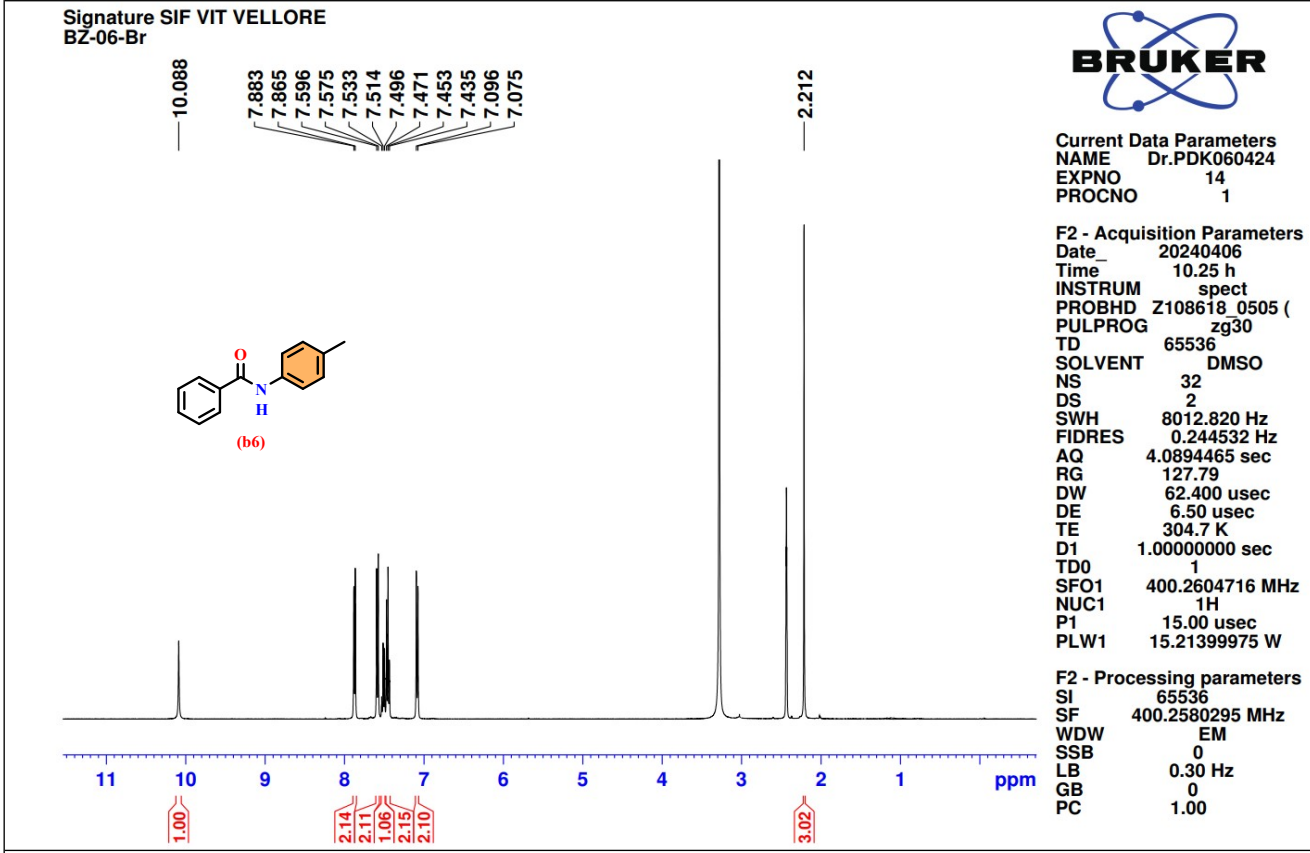



**Fig S33.** $^1$H NMR spectrum of ***N-(p-tolyl)benzamide (b6$_i$)***

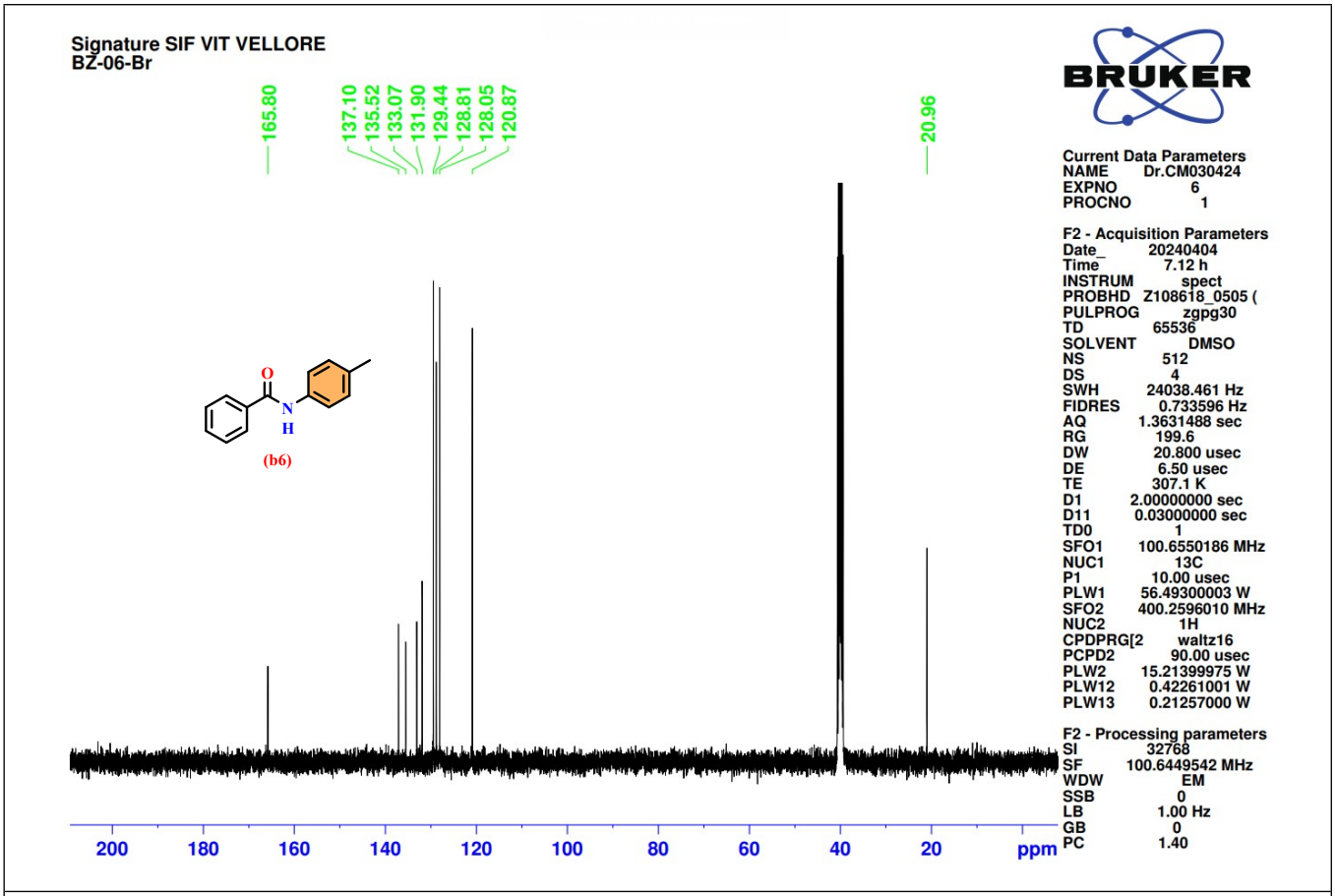



**Fig S34.** $^{13}$C NMR spectrum of ***N-(p-tolyl)benzamide (b6$_i$)***

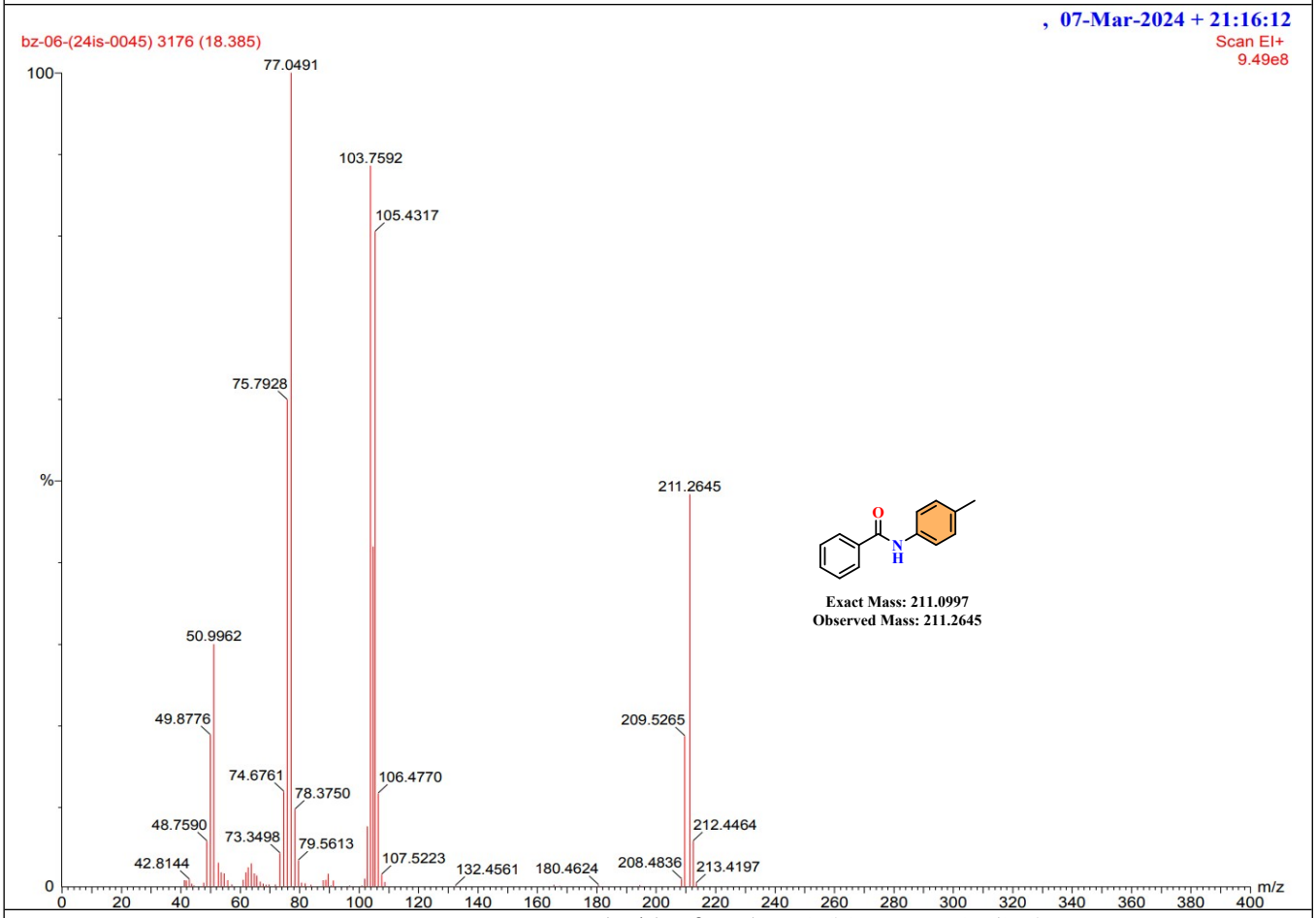



**Fig S35.** GC-Mass spectrum (m/z) of ***N-(p-tolyl)benzamide (b6$_i$)***

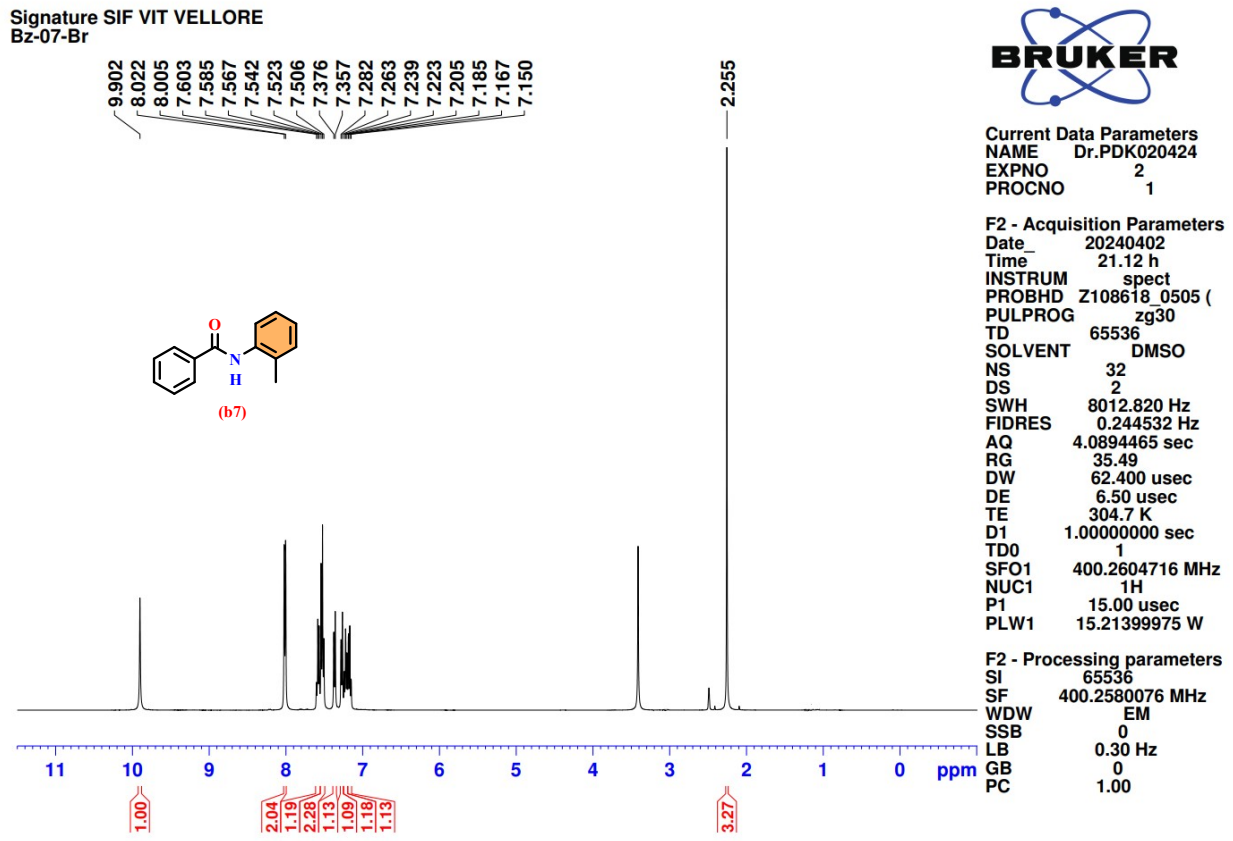



**Fig S36.** $^{1}$H NMR spectrum of ***N-(o-tolyl)benzamide (b7)***

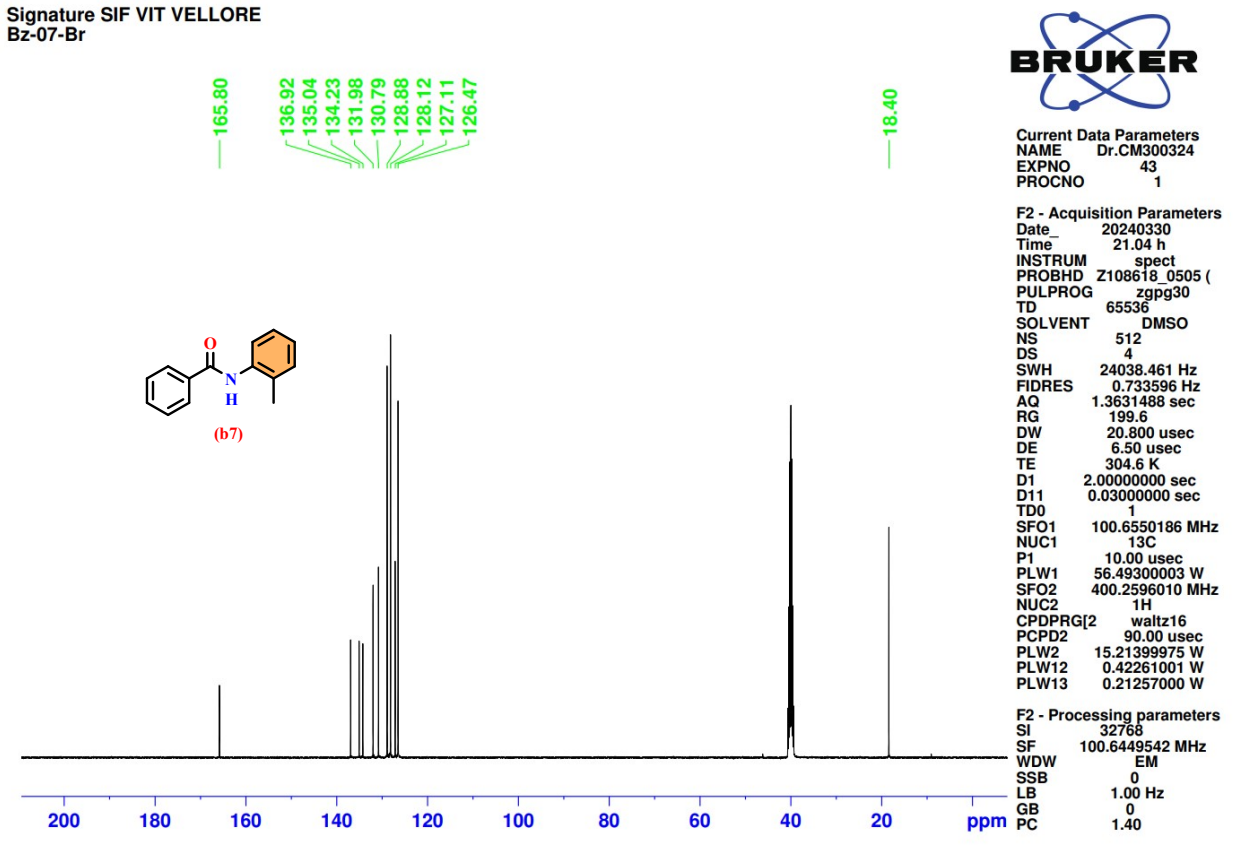



**Fig S37.** $^{13}$C NMR spectrum of ***N-(o-tolyl)benzamide (b7)***

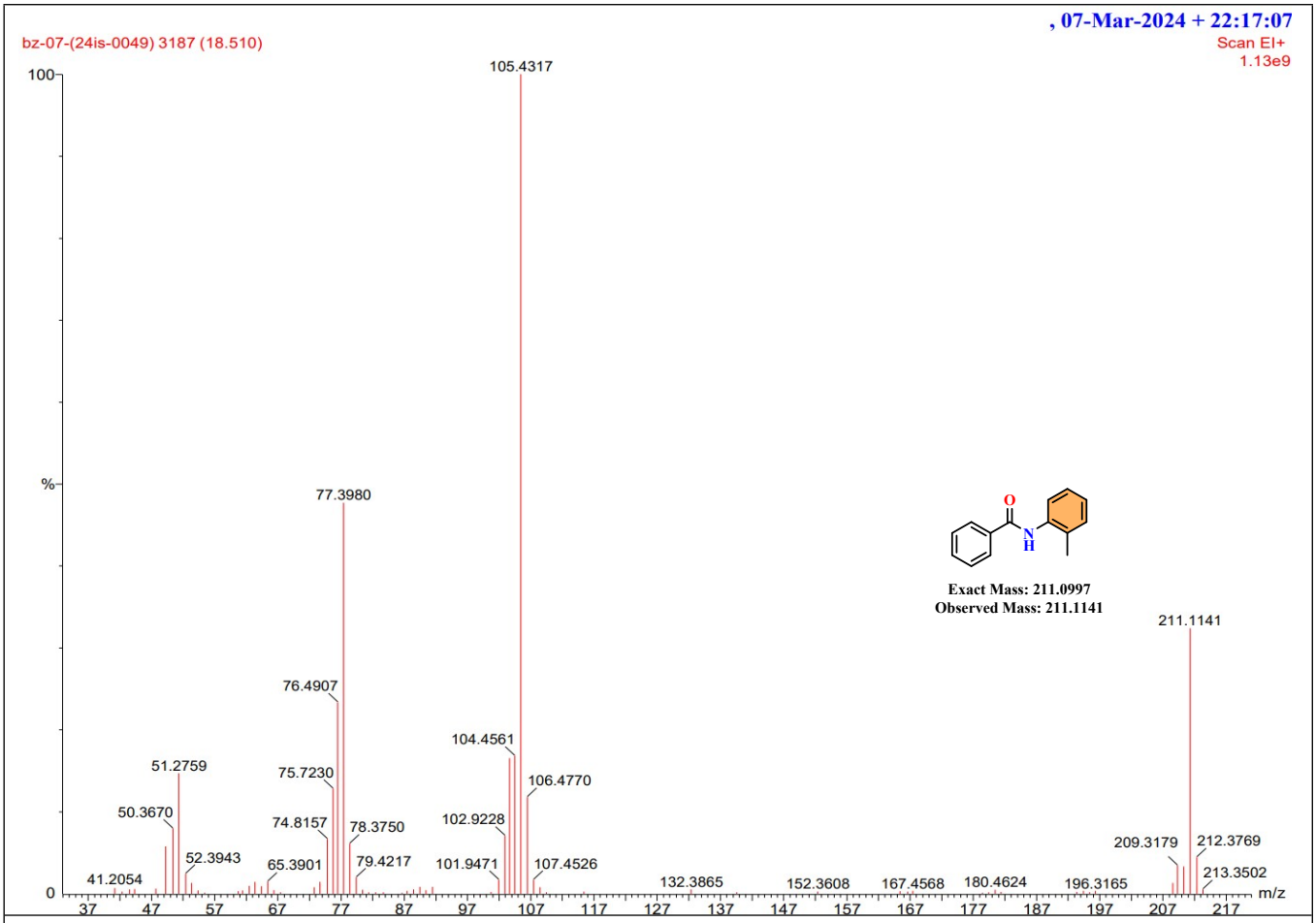



**Fig S38.** GC-Mass spectrum (m/z) of ***N-(o-tolyl)benzamide (b7)***

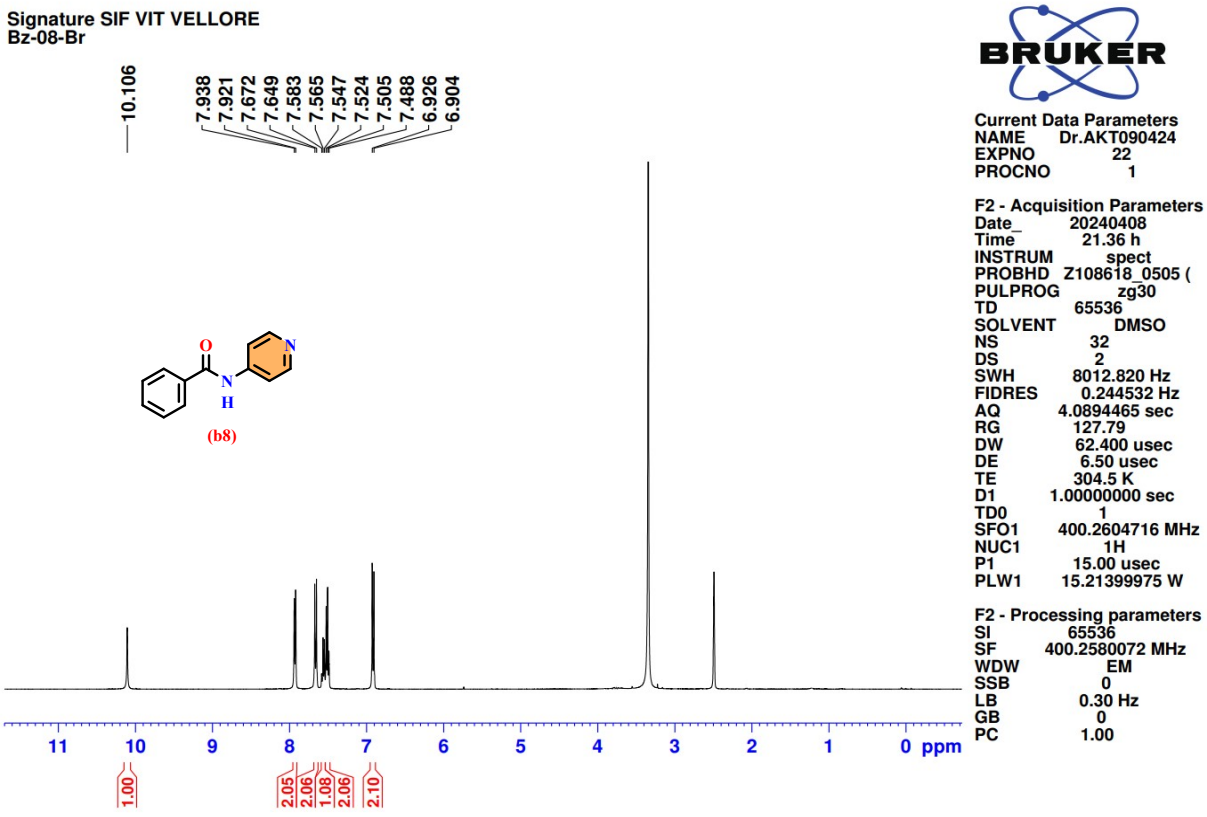



**Fig S39.** $^{1}$H NMR spectrum of ***N-(pyridin-4-yl)benzamide (b8)***

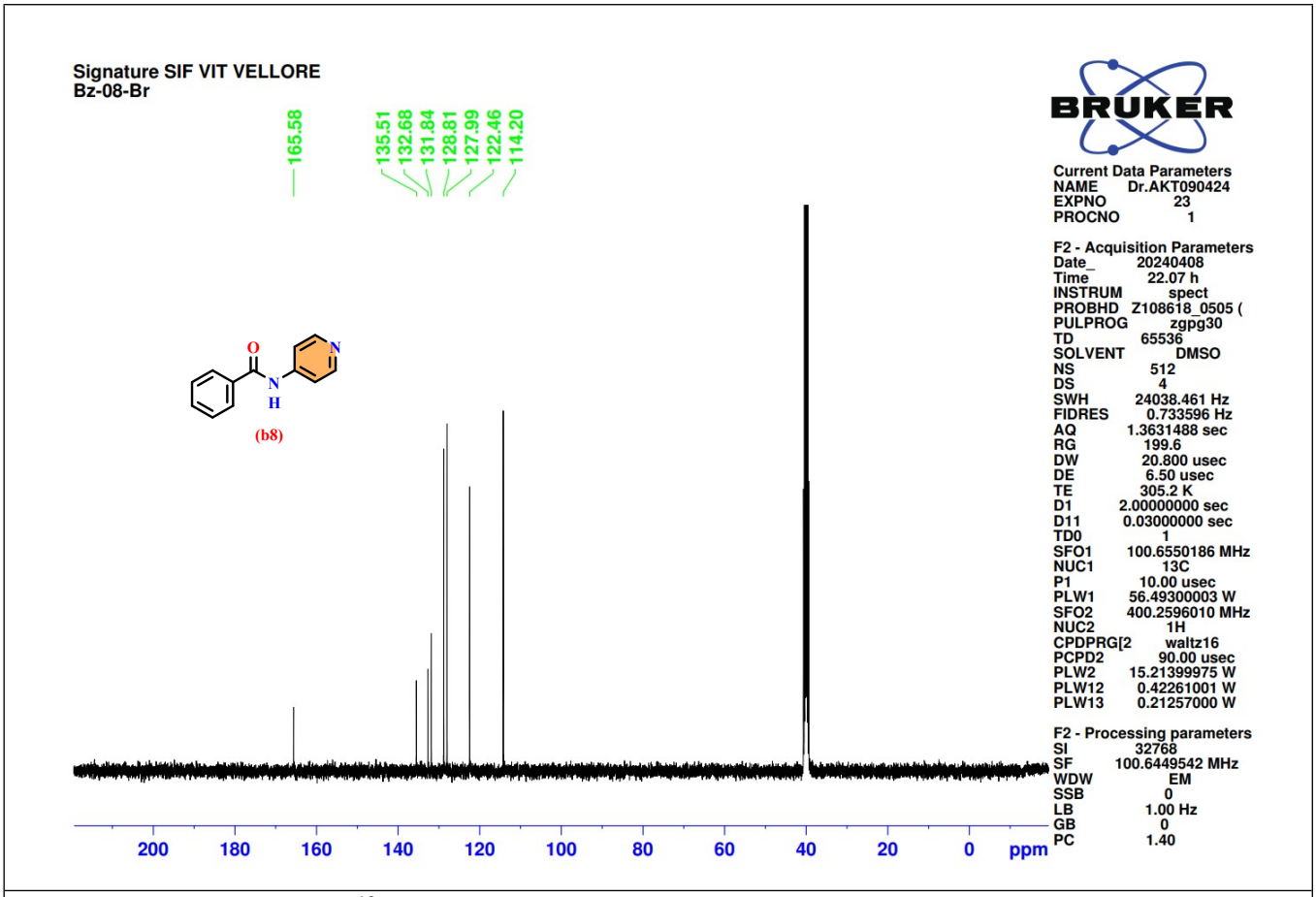



**Fig S40.** $^{13}$C NMR spectrum of ***N-(pyridin-4-yl)benzamide (b8)***

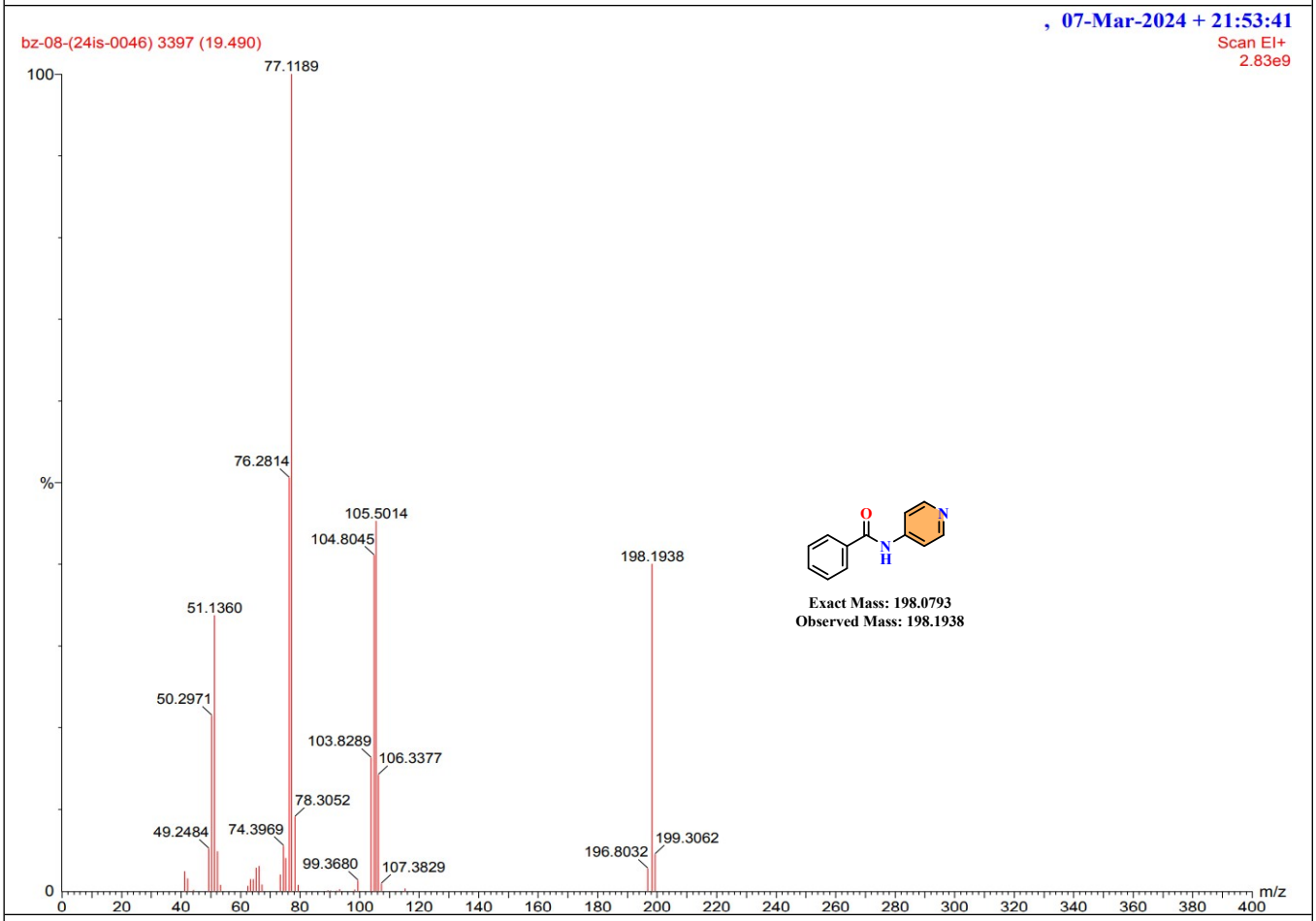



**Fig S41.** GC-Mass spectrum (m/z) of ***N-(pyridin-4-yl)benzamide (b8)***

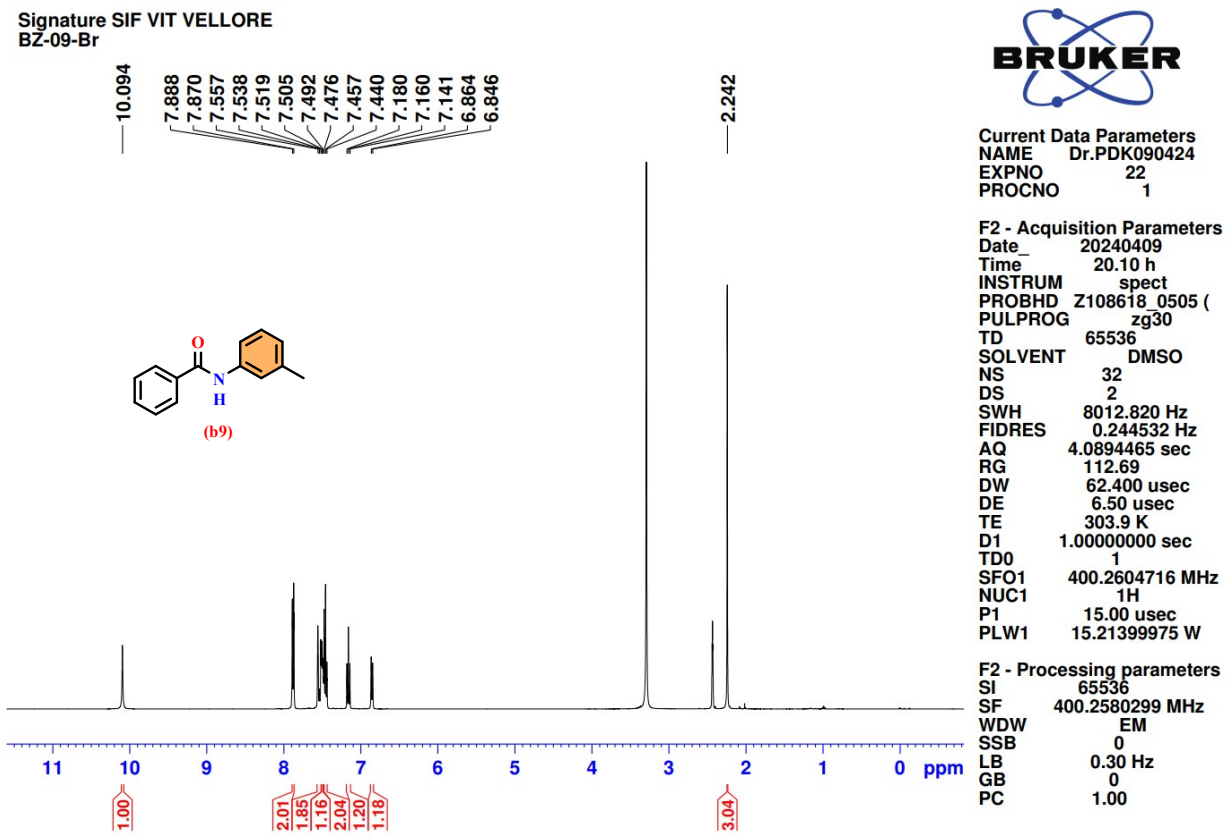



**Fig S42.** $^{1}$H NMR spectrum of ***N-(m-tolyl)benzamide (b9)***

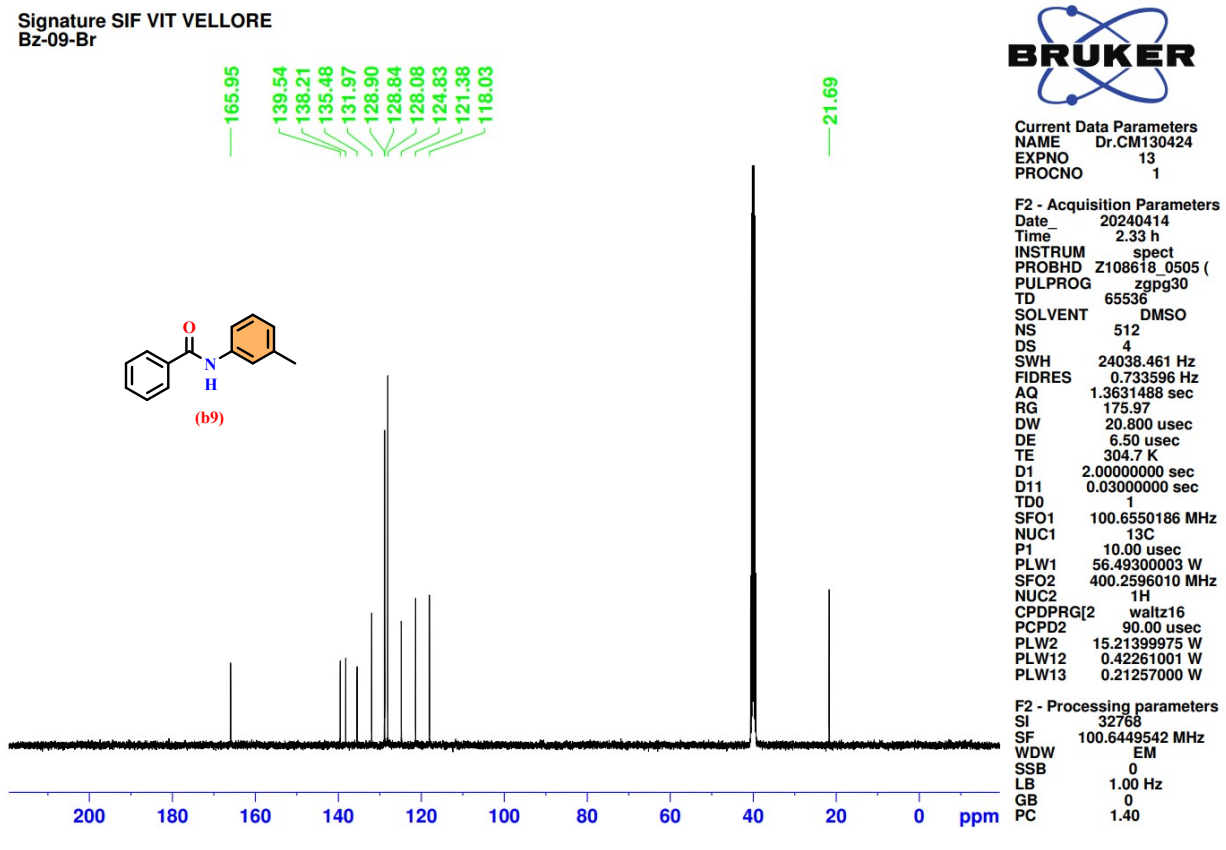



**Fig S43.** $^{13}$C NMR spectrum of ***N-(m-tolyl)benzamide (b9)***

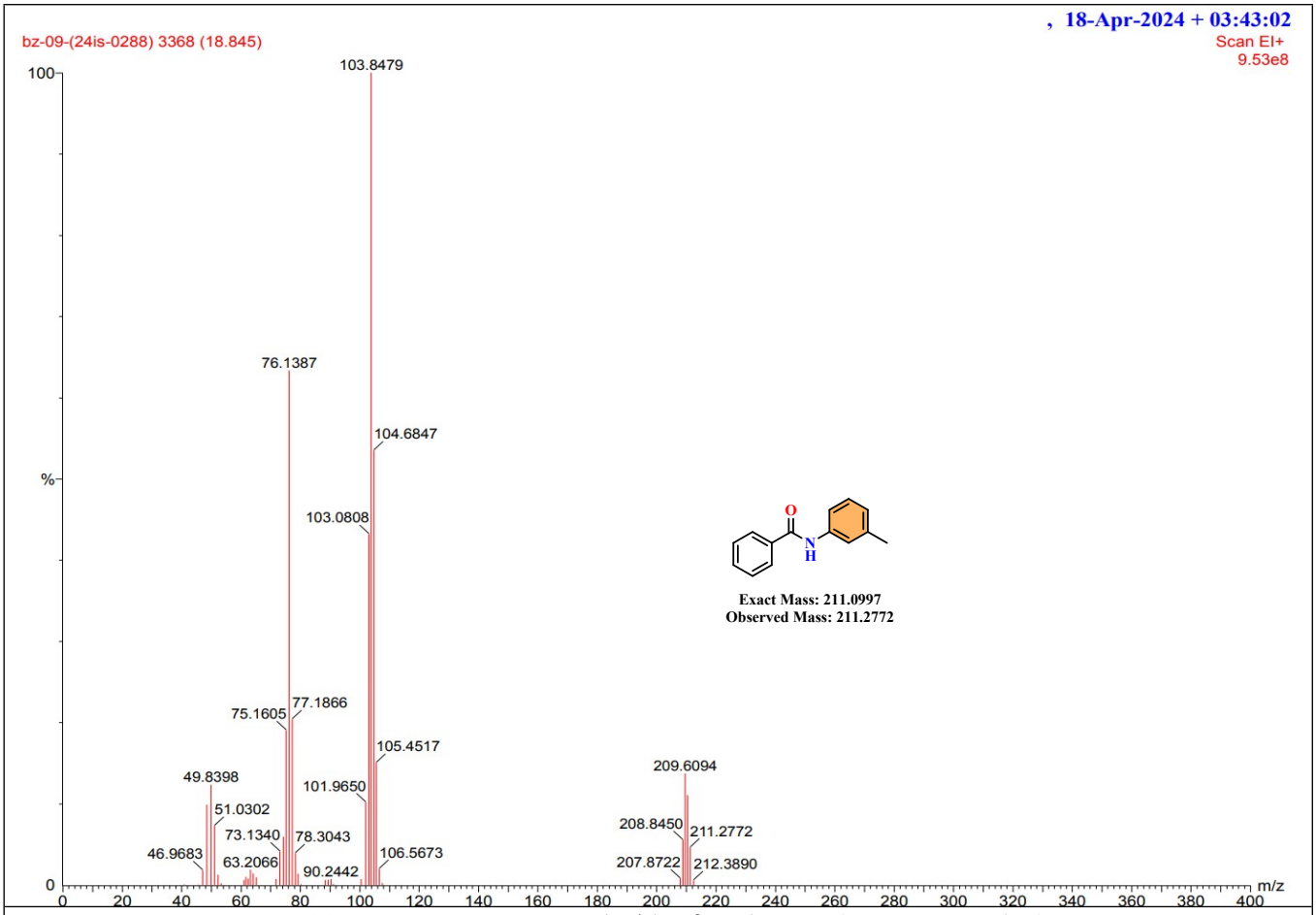



**Fig S44.** GC-Mass spectrum (m/z) of ***N-(m-tolyl)benzamide (b9)***

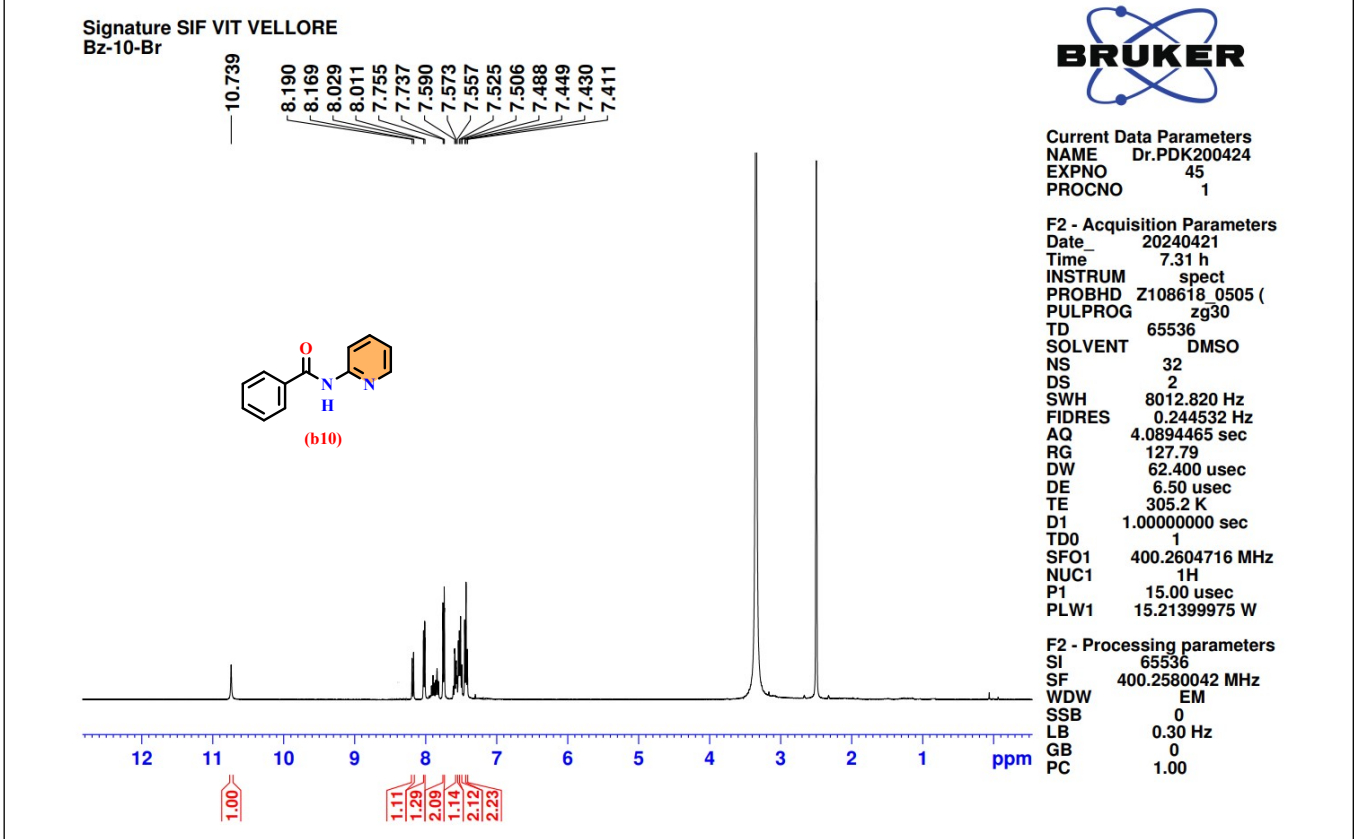



**Fig S45.** $^{1}$H NMR spectrum of ***N-(pyridin-2-yl)benzamide (b10)***

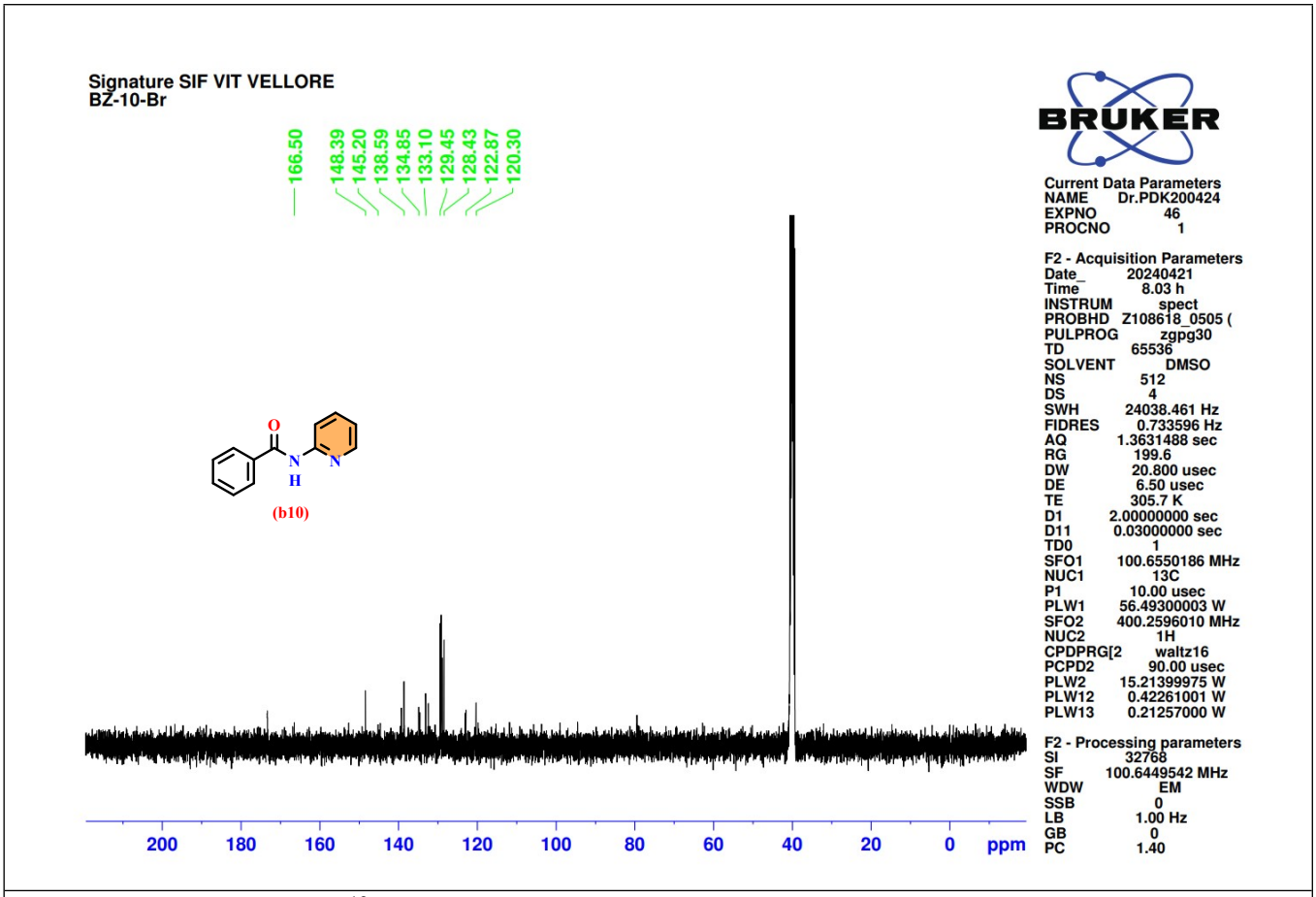



**Fig S46.** $^{13}$C NMR spectrum of ***N-(pyridin-2-yl)benzamide (b10)***

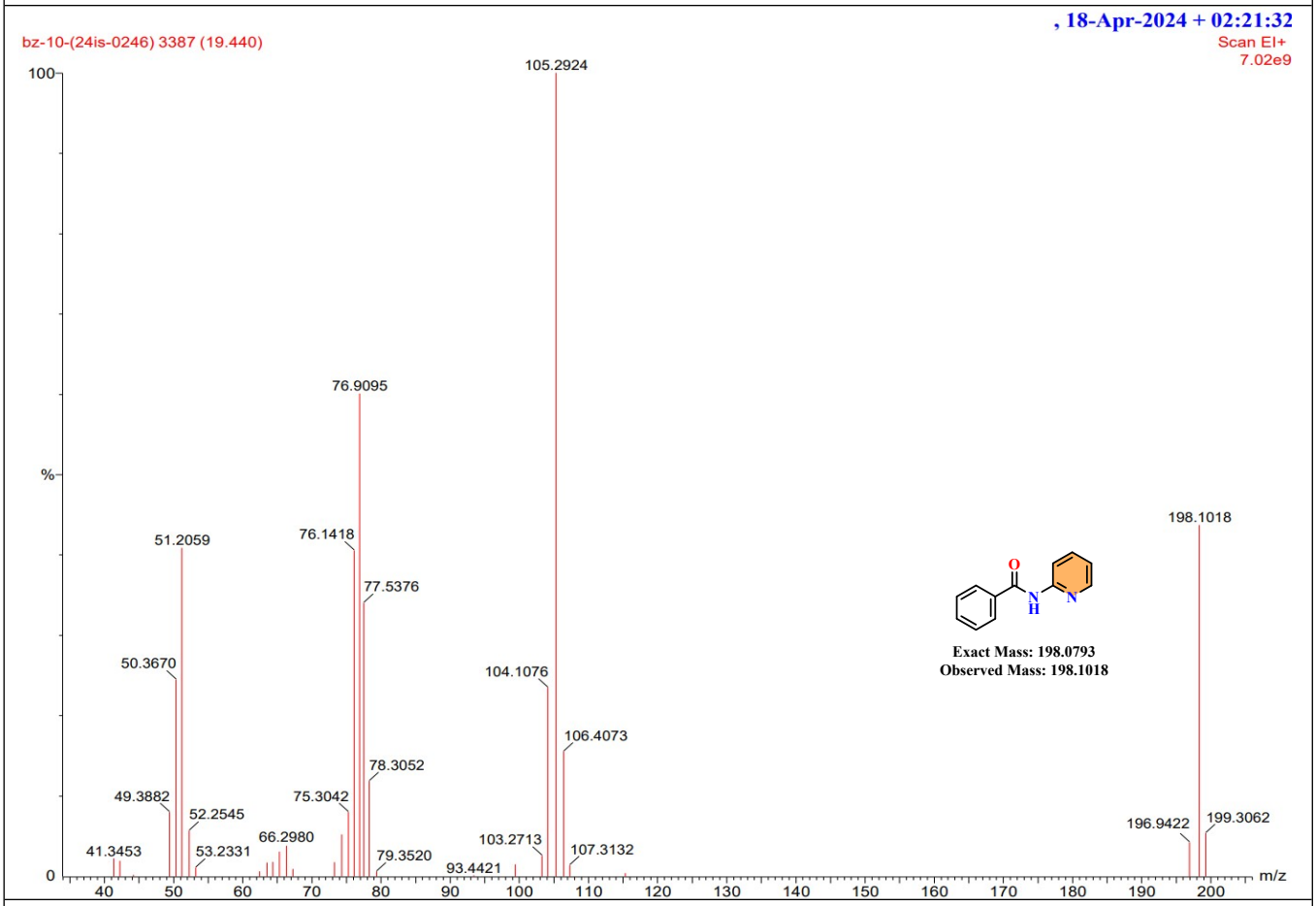



**Fig S47.** GC-Mass spectrum (m/z) of ***N-(pyridin-2-yl)benzamide (b10)***

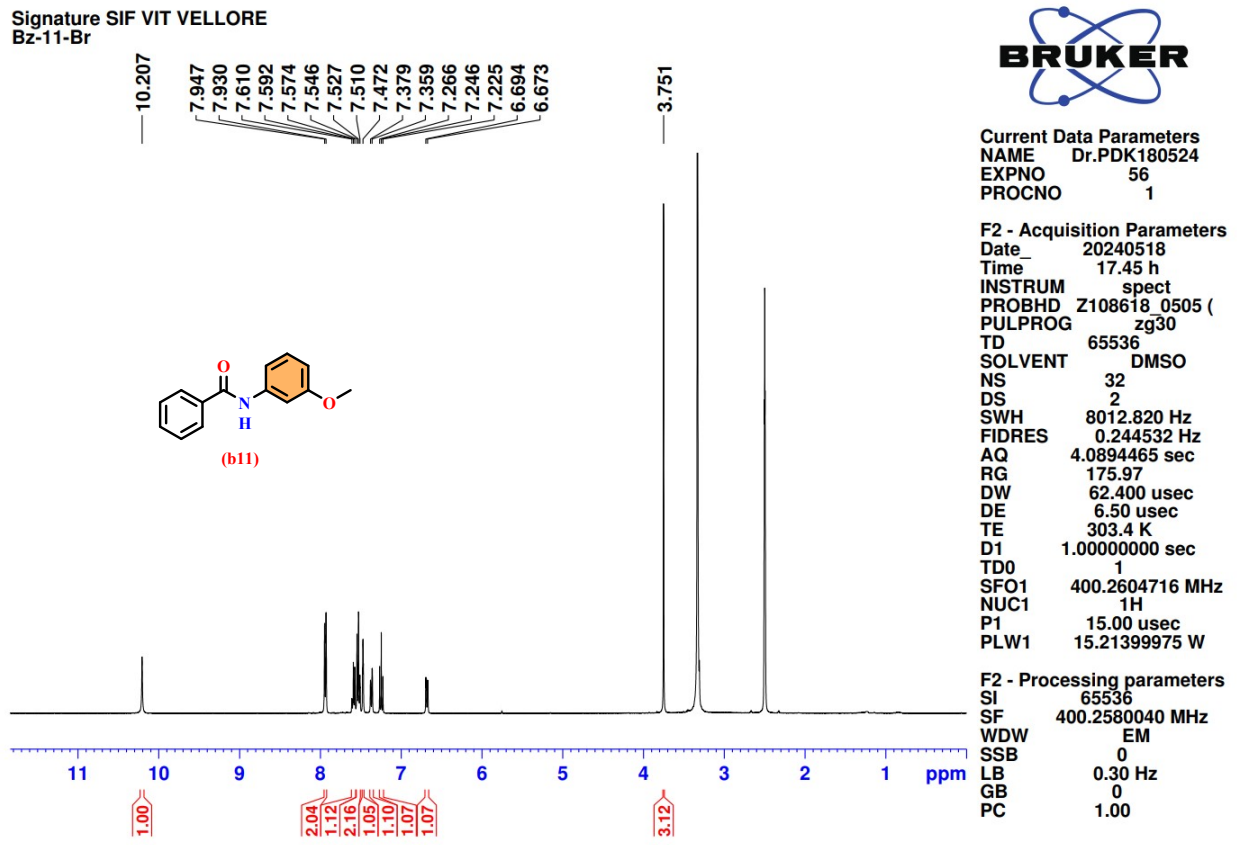



**Fig S48.** $^{1}$H NMR spectrum of ***N-(3-methoxyphenyl)benzamide (b11)***

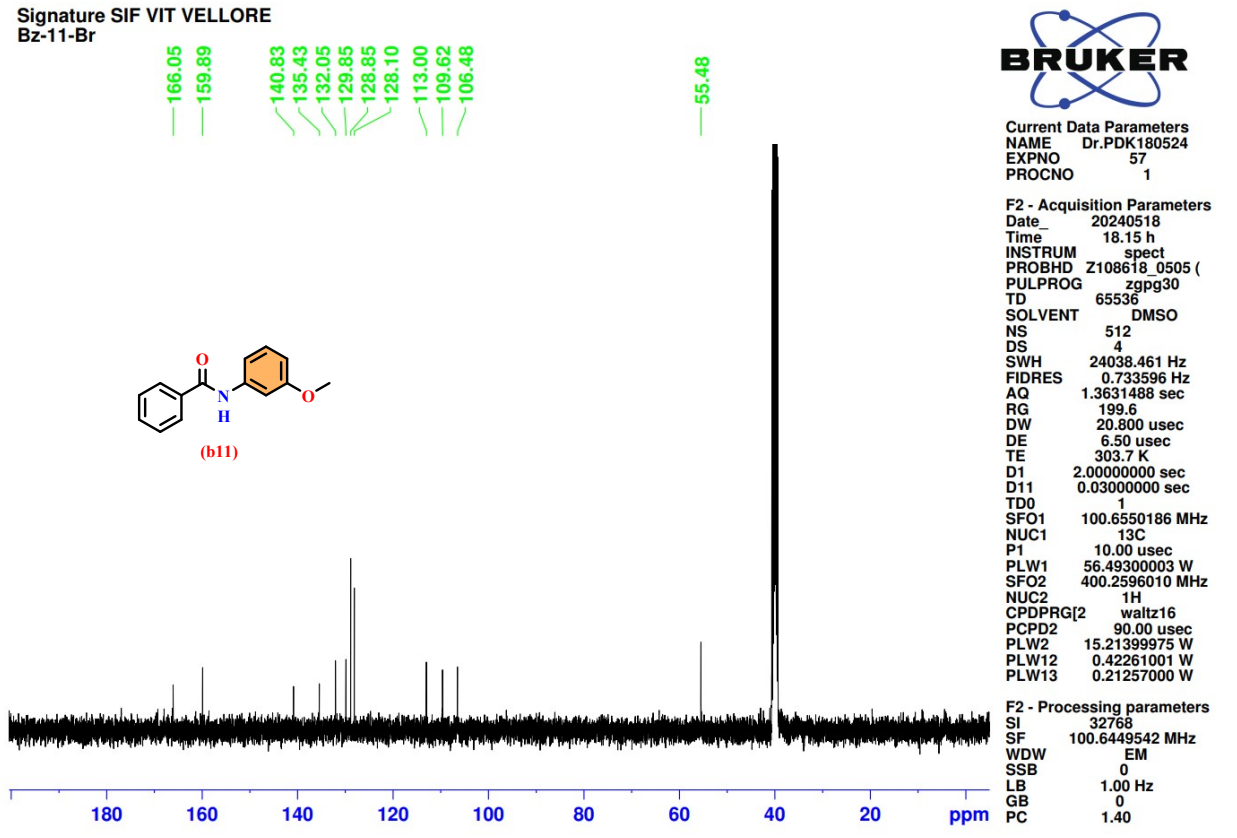



**Fig S49.** $^{13}$C NMR spectrum of ***N-(3-methoxyphenyl)benzamide (b11)***

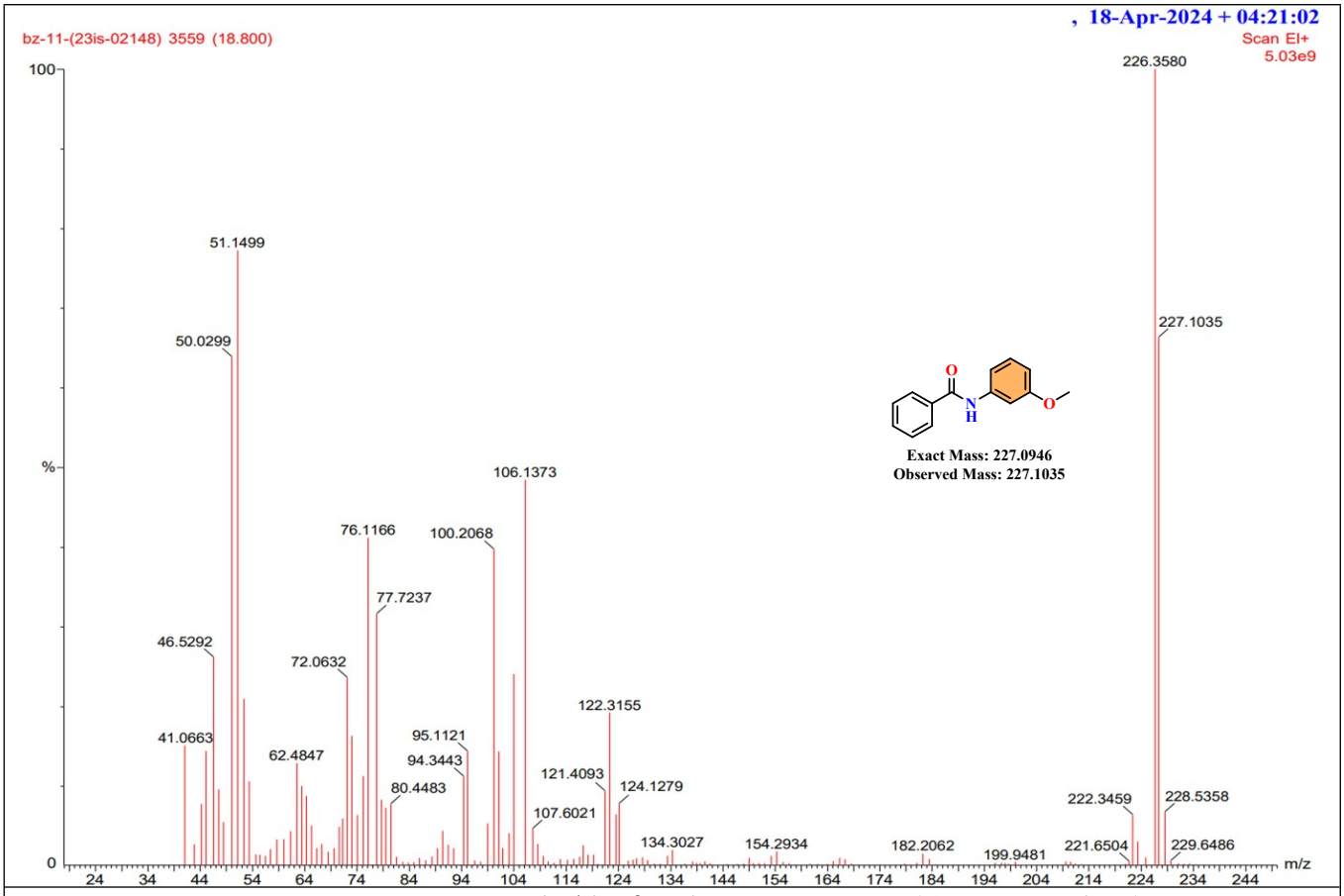



**Fig S50.** GC-Mass spectrum (m/z) of ***N-(3-methoxyphenyl)benzamide (b11)***

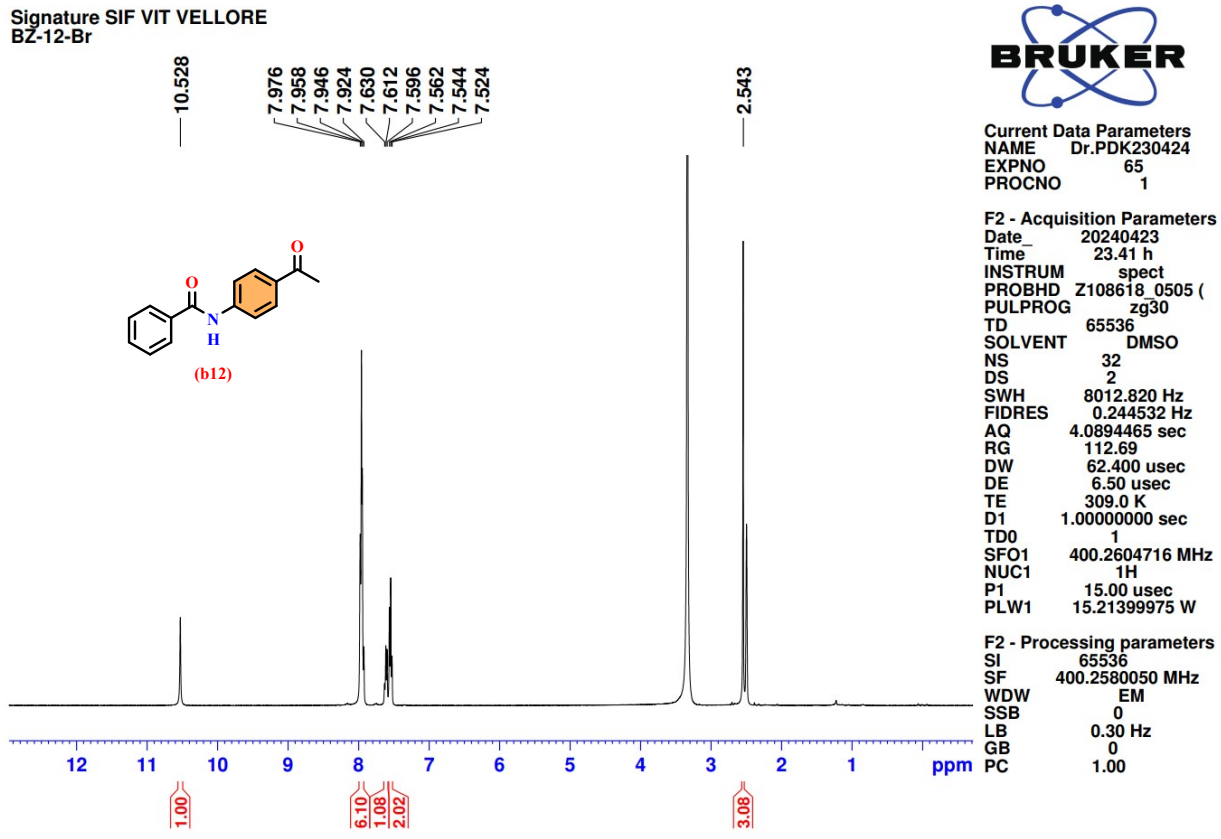



**Fig S51.** $^{1}$H NMR spectrum of ***N-(4-acetylphenyl)benzamide (b12)***

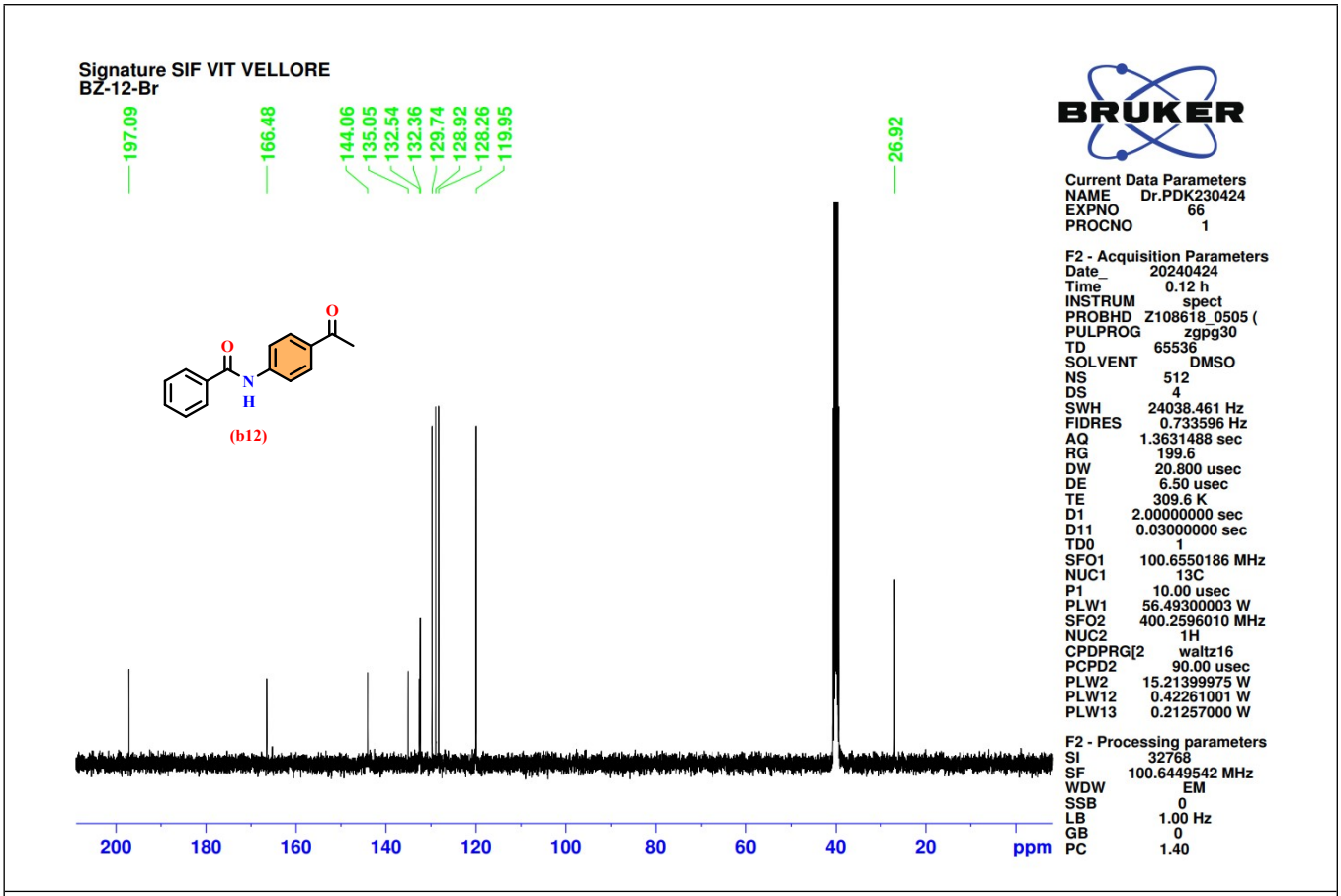



**Fig S52.** $^{13}$C NMR spectrum of ***N-(4-acetylphenyl)benzamide (b12)***

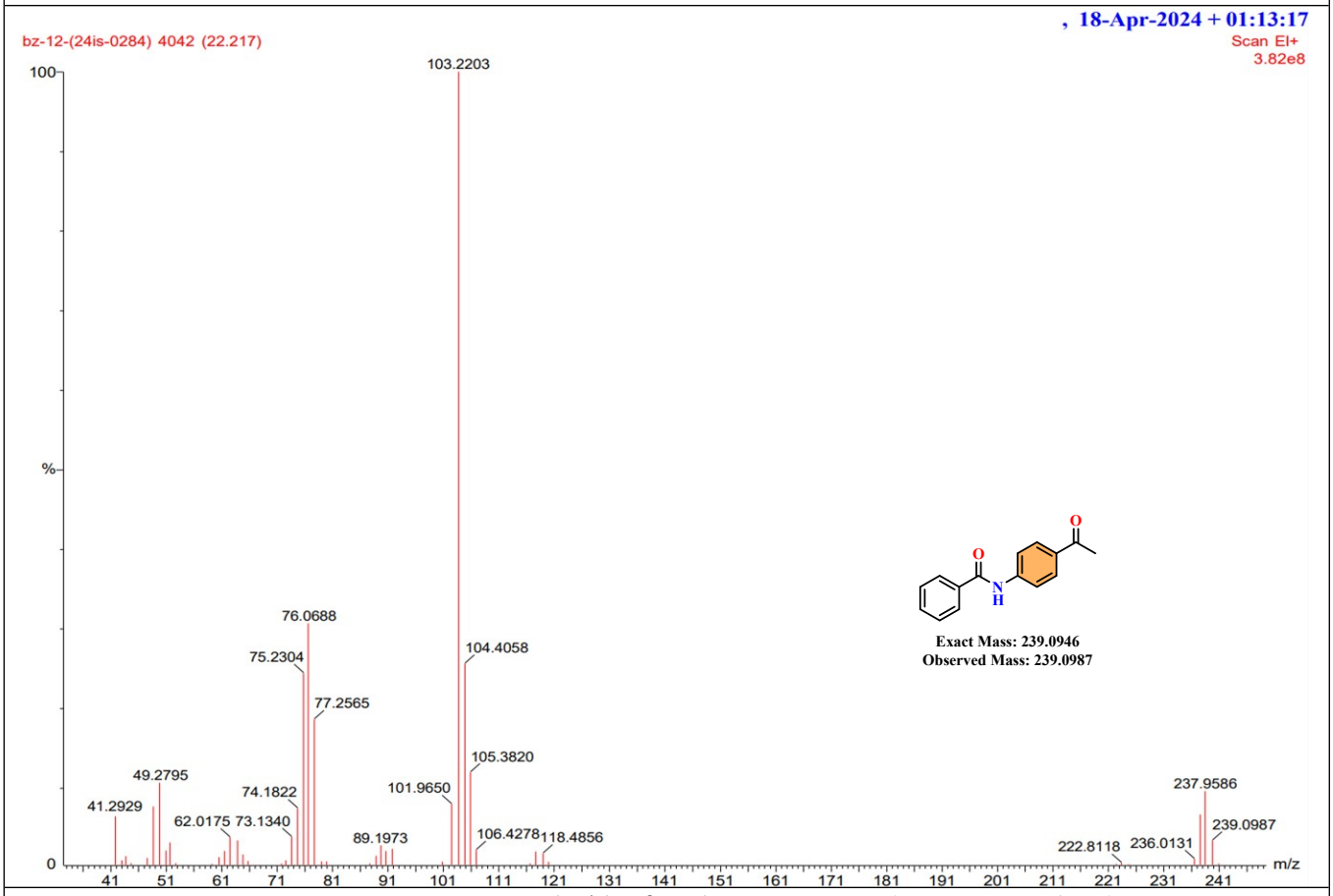



**Fig S53.** GC-Mass spectrum (m/z) of ***N-(4-acetylphenyl)benzamide (b12)***

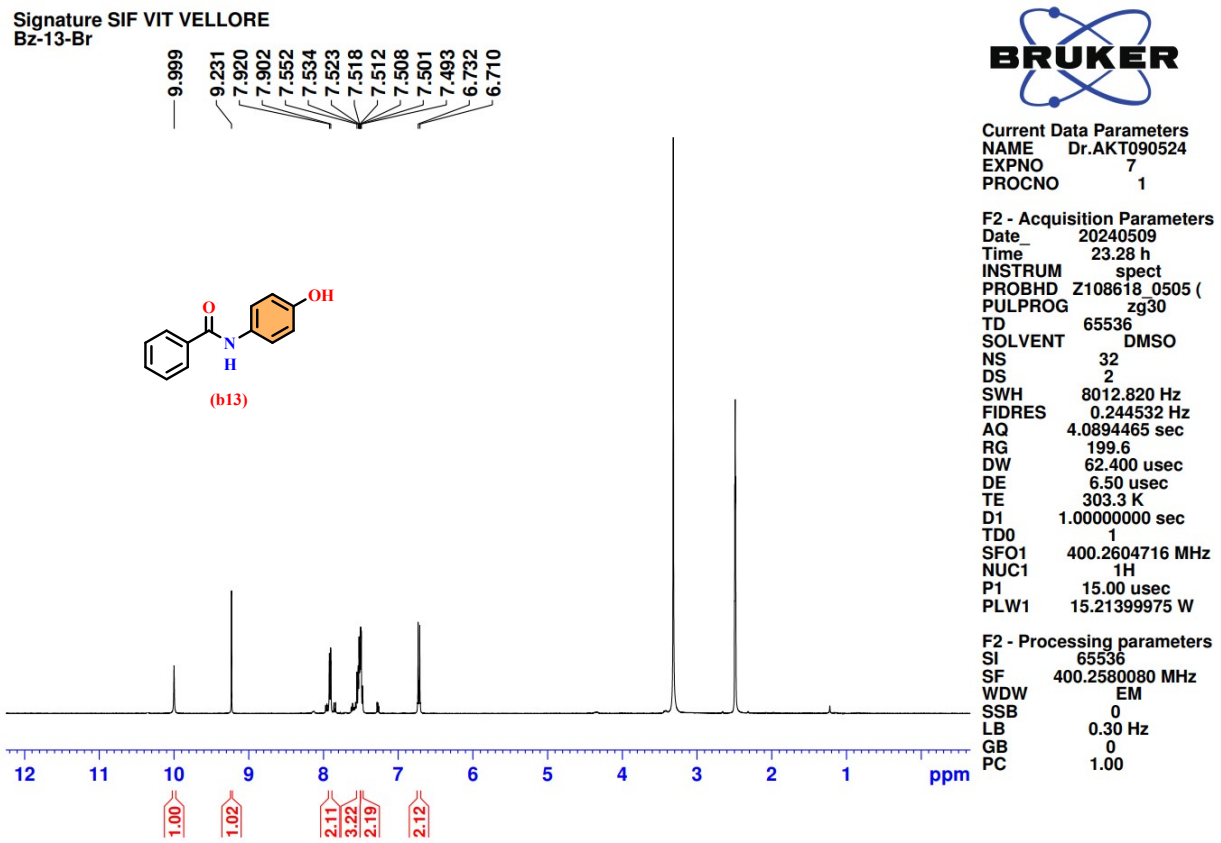



**Fig S54.** $^{1}$H NMR spectrum of ***N-(4-hydroxyphenyl)benzamide (b13)***

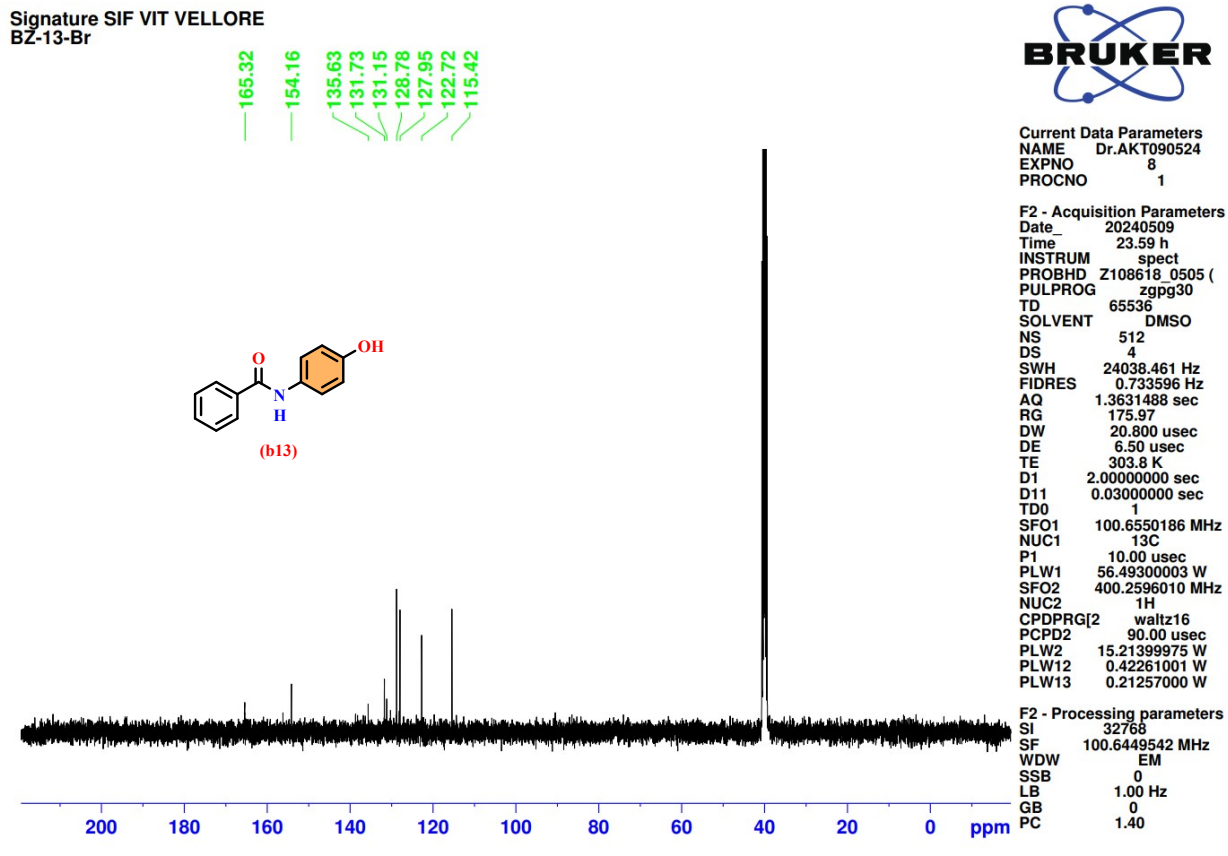



**Fig S55.** $^{13}$C NMR spectrum of ***N-(4-hydroxyphenyl)benzamide (b13)***

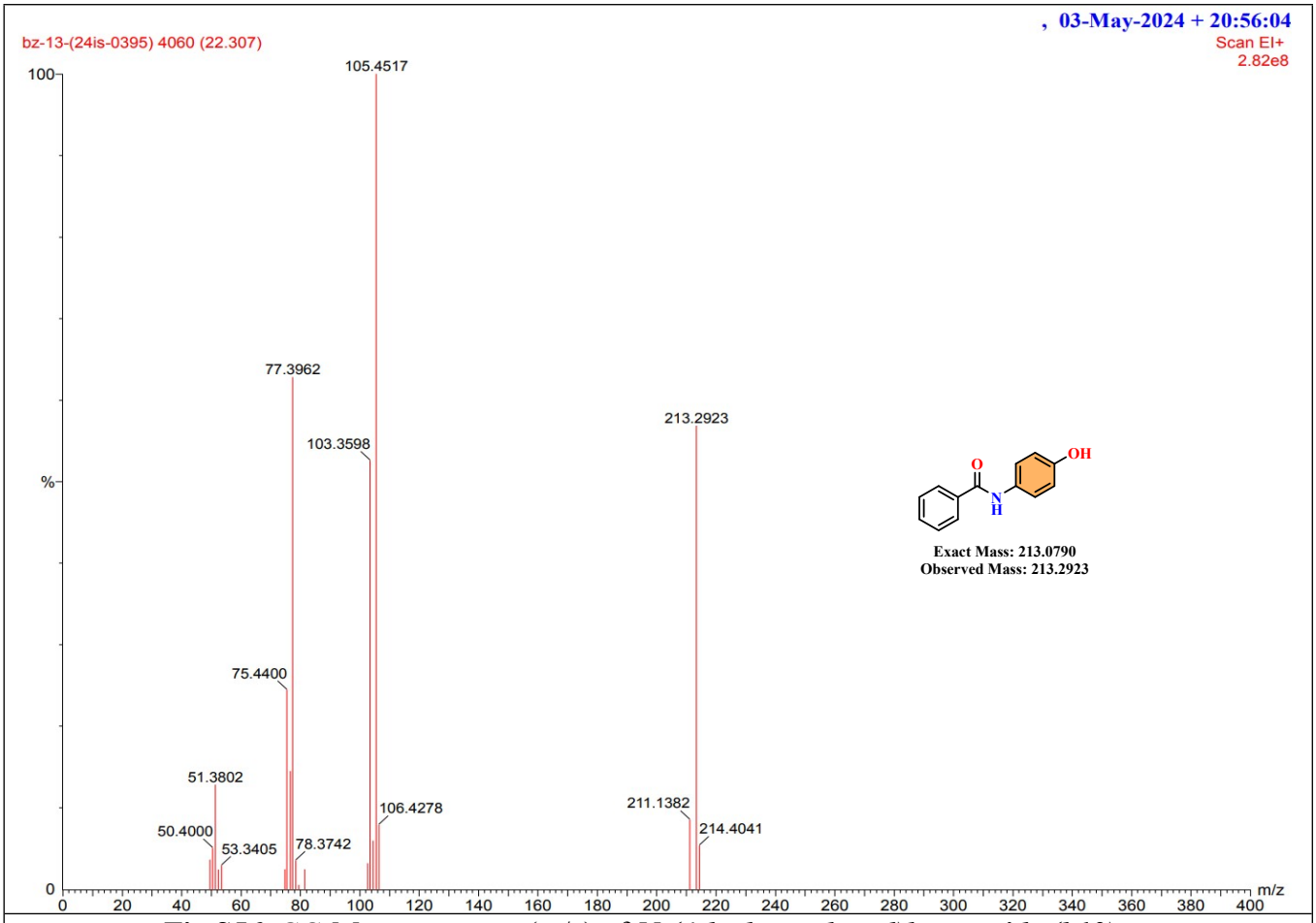



**Fig S56.** GC-Mass spectrum (m/z) of ***N-(4-hydroxyphenyl)benzamide (b13)***

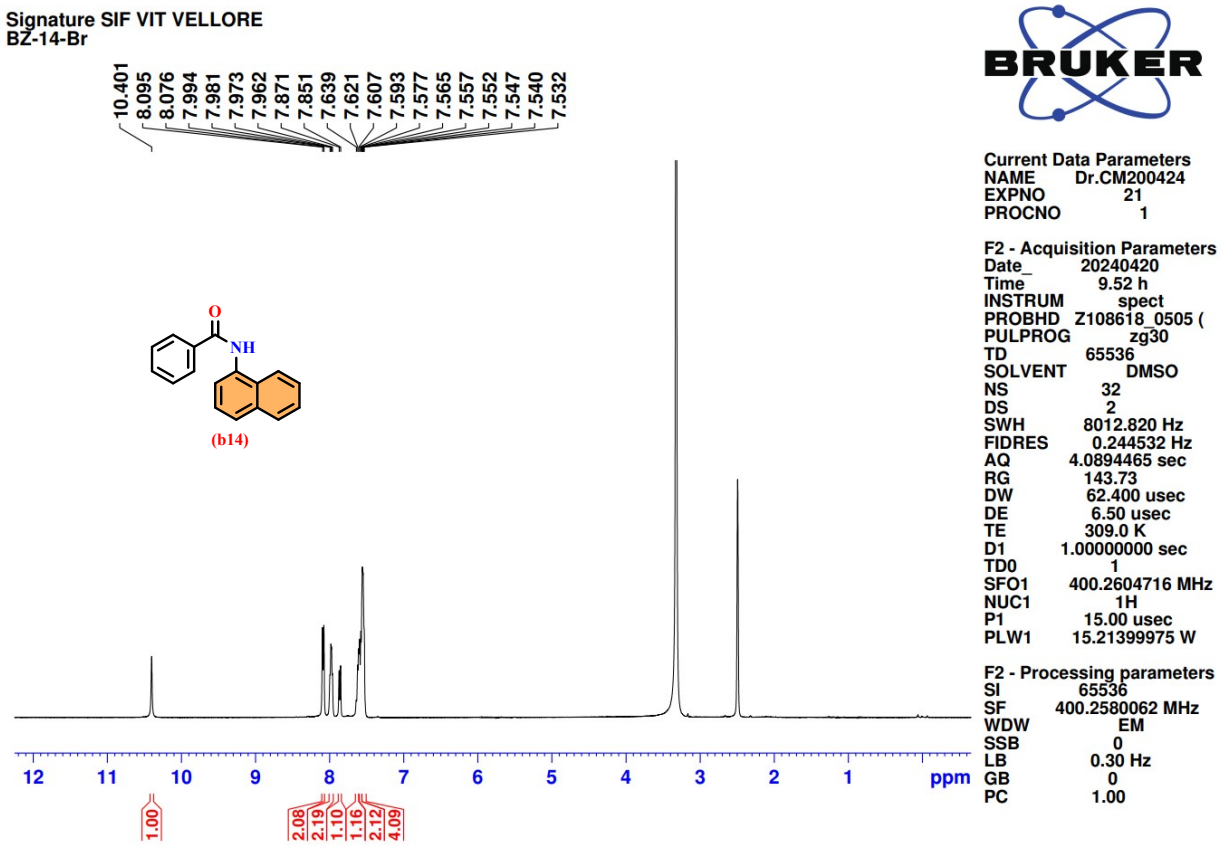



**Fig S57.** $^{1}$H NMR spectrum of ***N-(naphthalen-1-yl)benzamide (b14)***

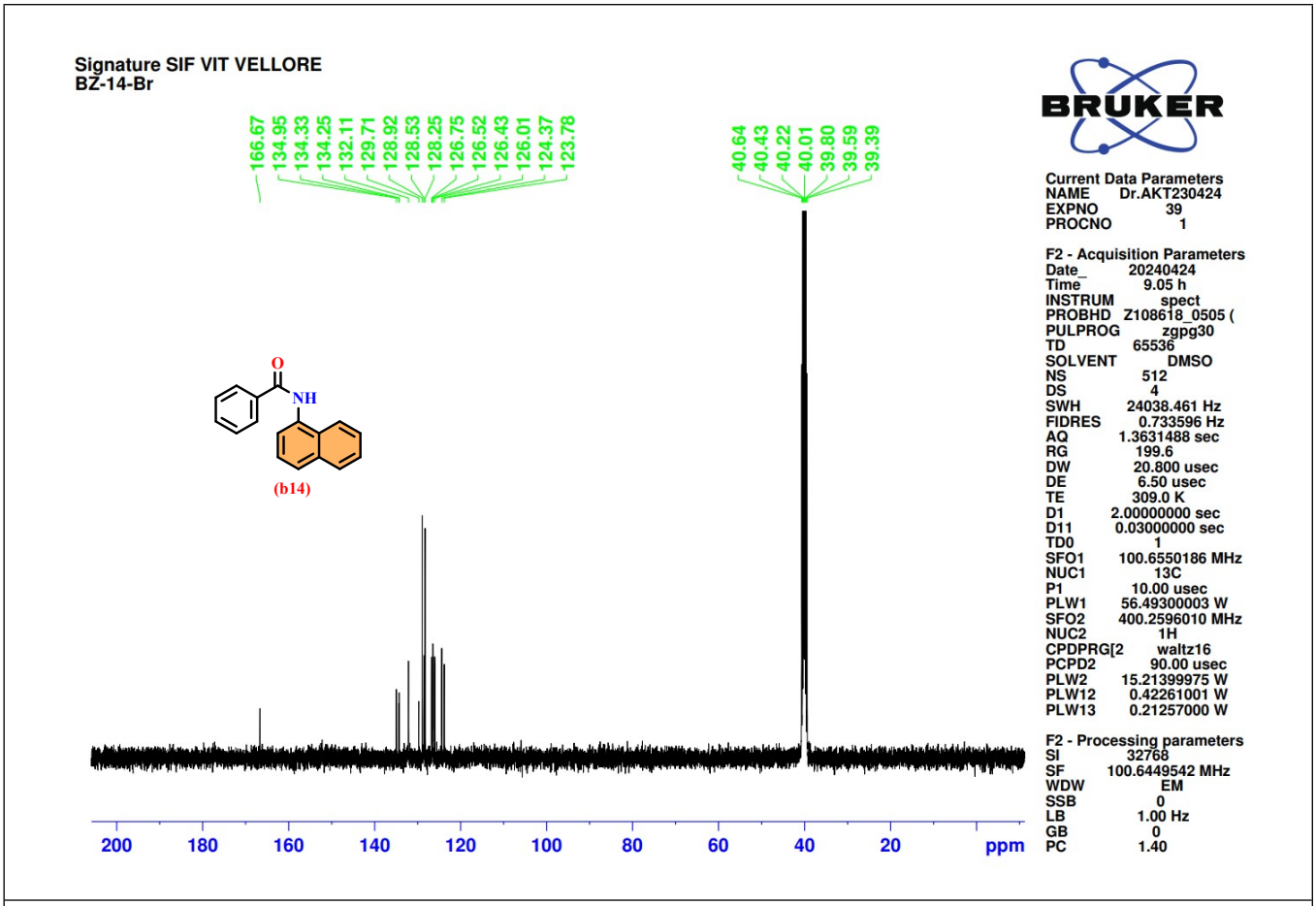



**Fig S58.** $^{13}$C NMR spectrum of ***N-(naphthalen-1-yl)benzamide (b14)***

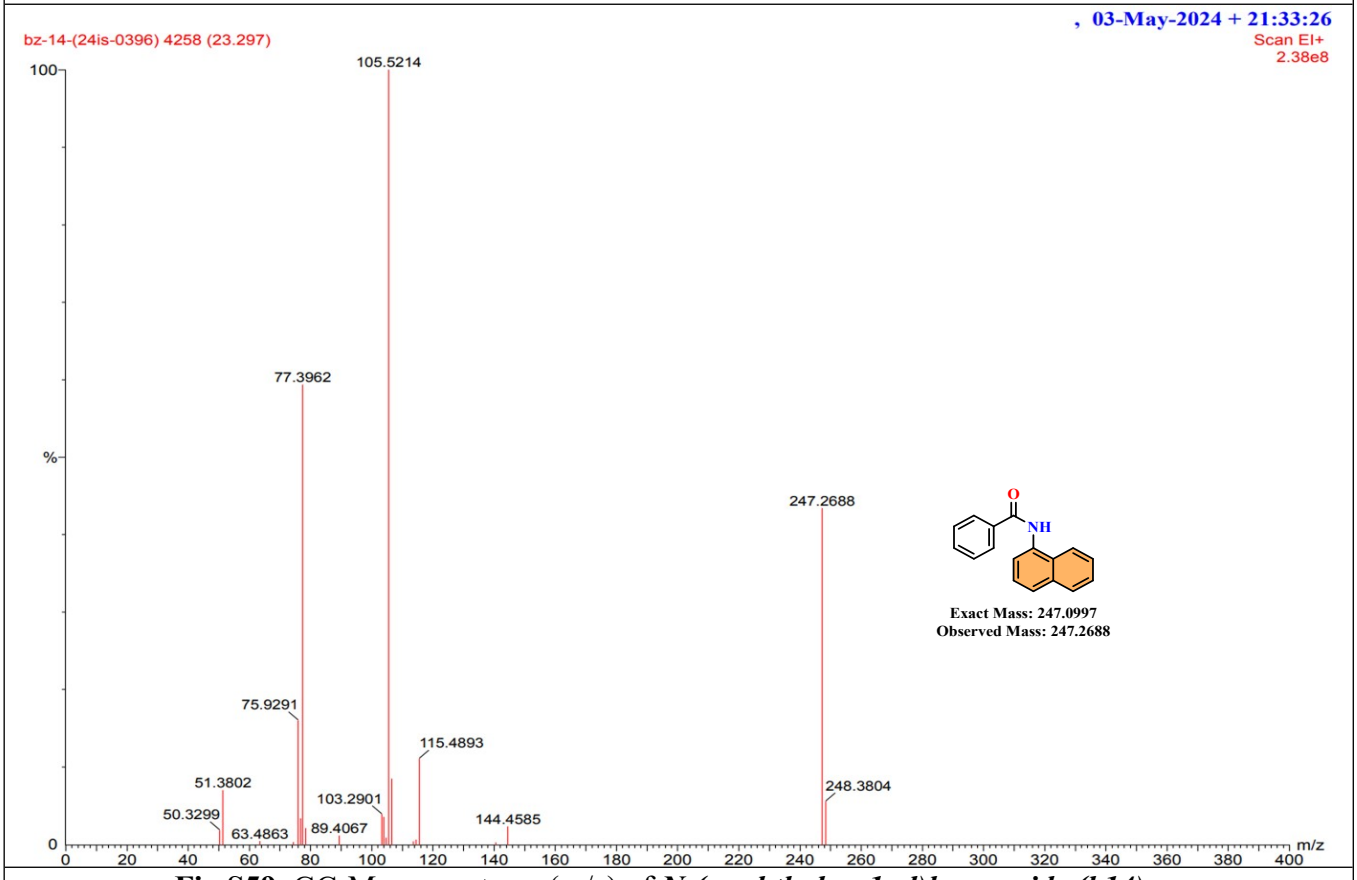



**Fig S59.** GC-Mass spectrum (m/z) of ***N-(naphthalen-1-yl)benzamide (b14)***

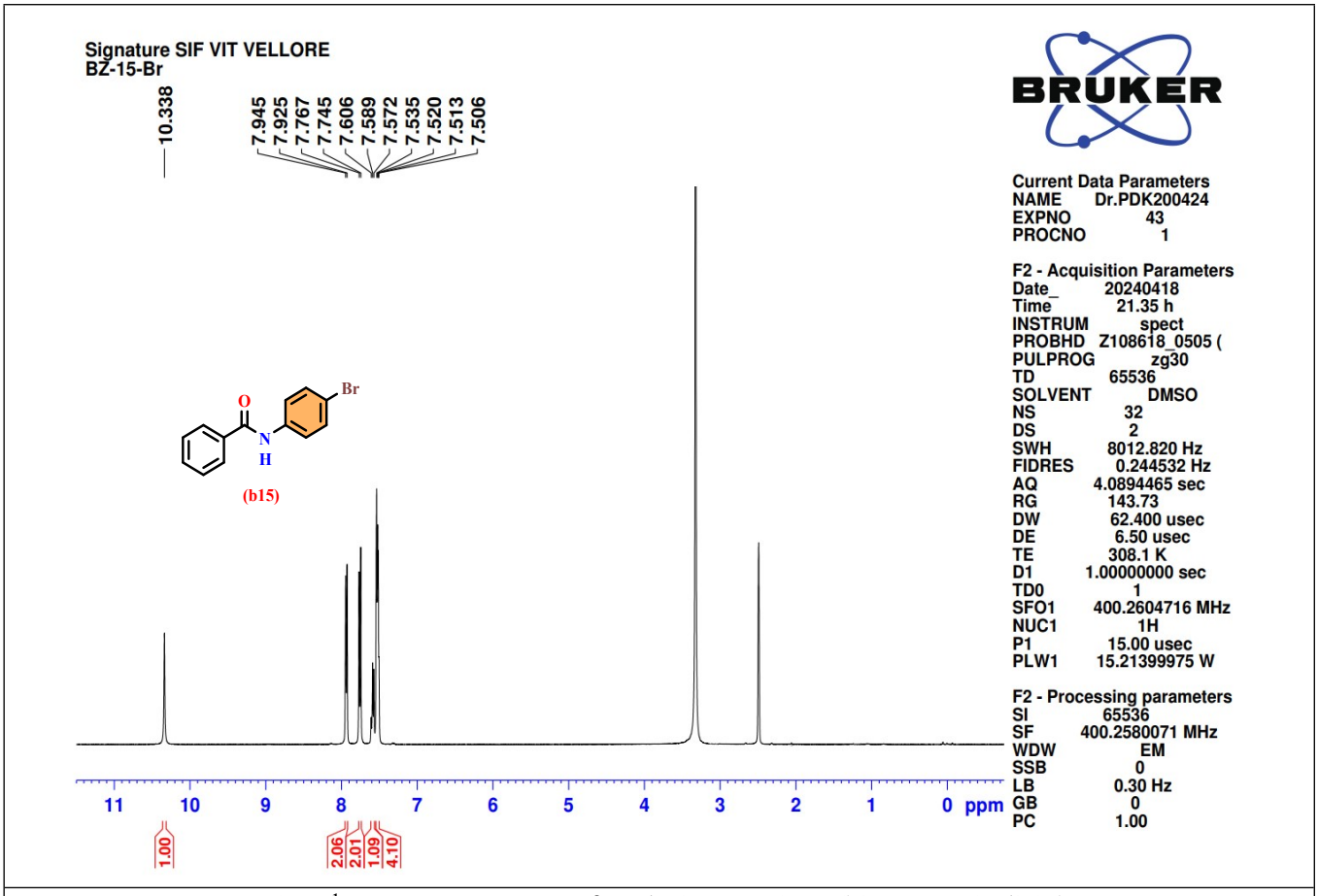



**Fig S60.** $^{1}$H NMR spectrum of ***N-(4-bromophenyl)benzamide (b15)***

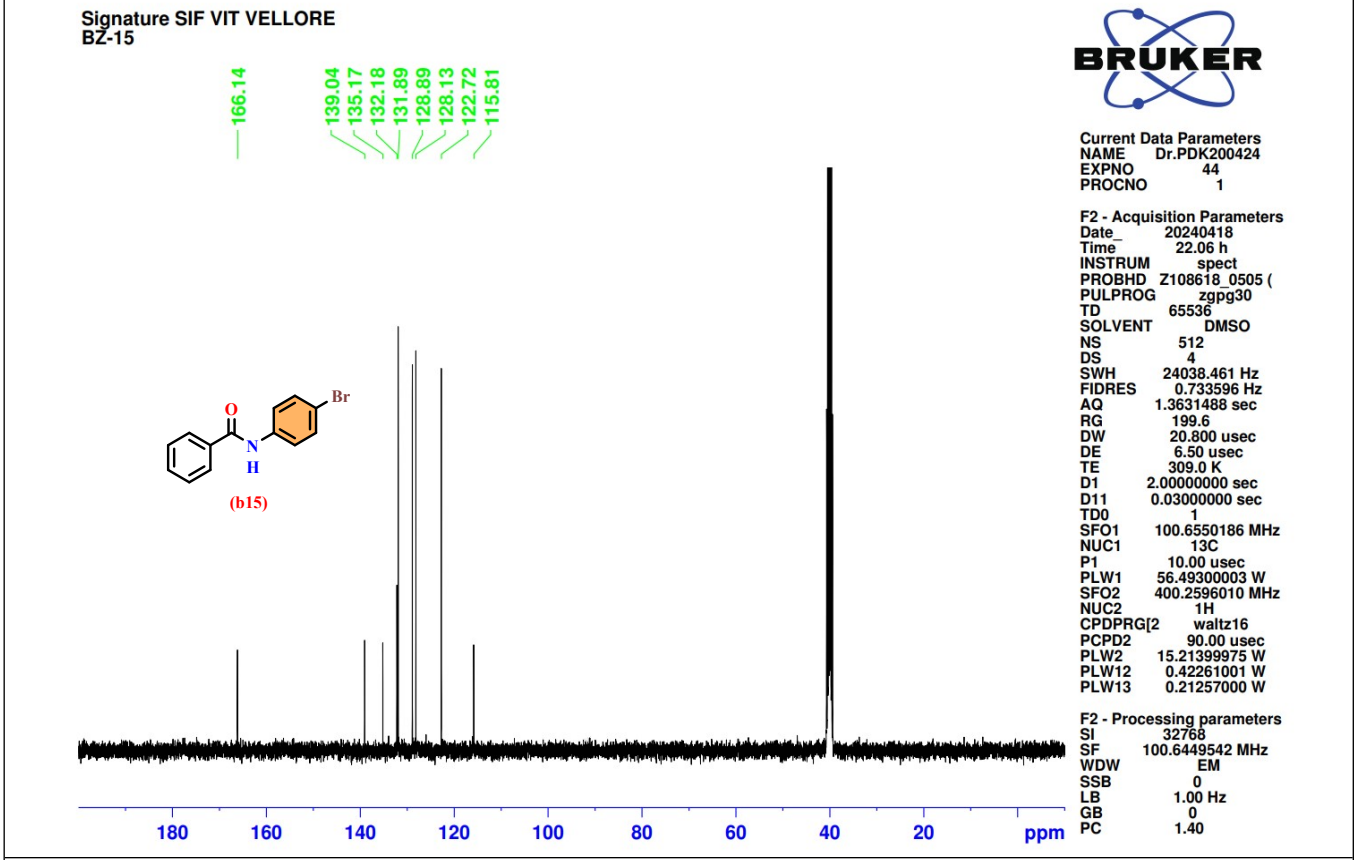



**Fig S61.** $^{13}$C NMR spectrum of ***N-(4-bromophenyl)benzamide (b15)***

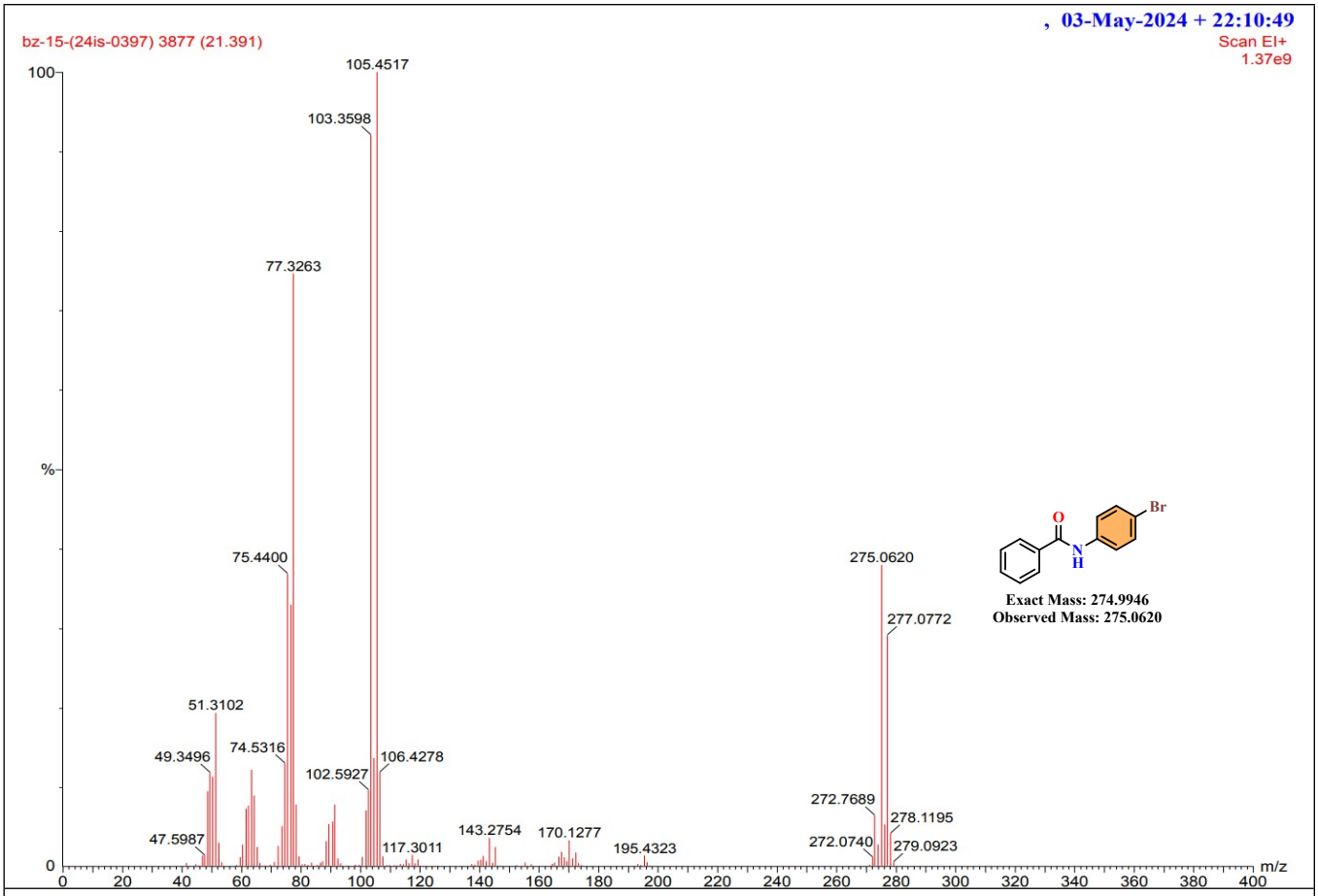



**Fig S62.** GC-Mass spectrum (m/z) of ***N-(4-bromophenyl)benzamide (b15)***

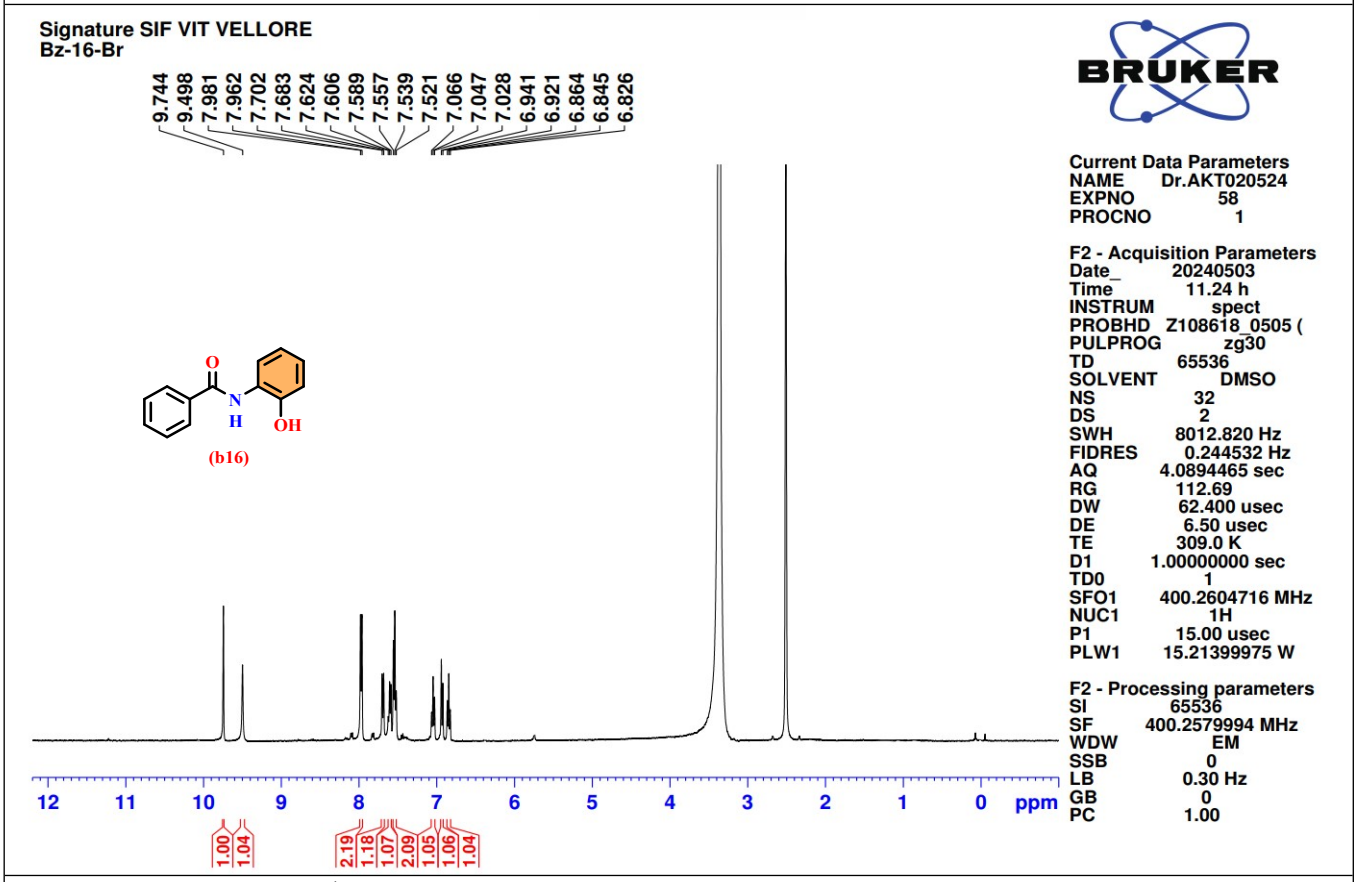



**Fig S63.** $^{1}$H NMR spectrum of ***N-(2-hydroxyphenyl)benzamide (b16)***

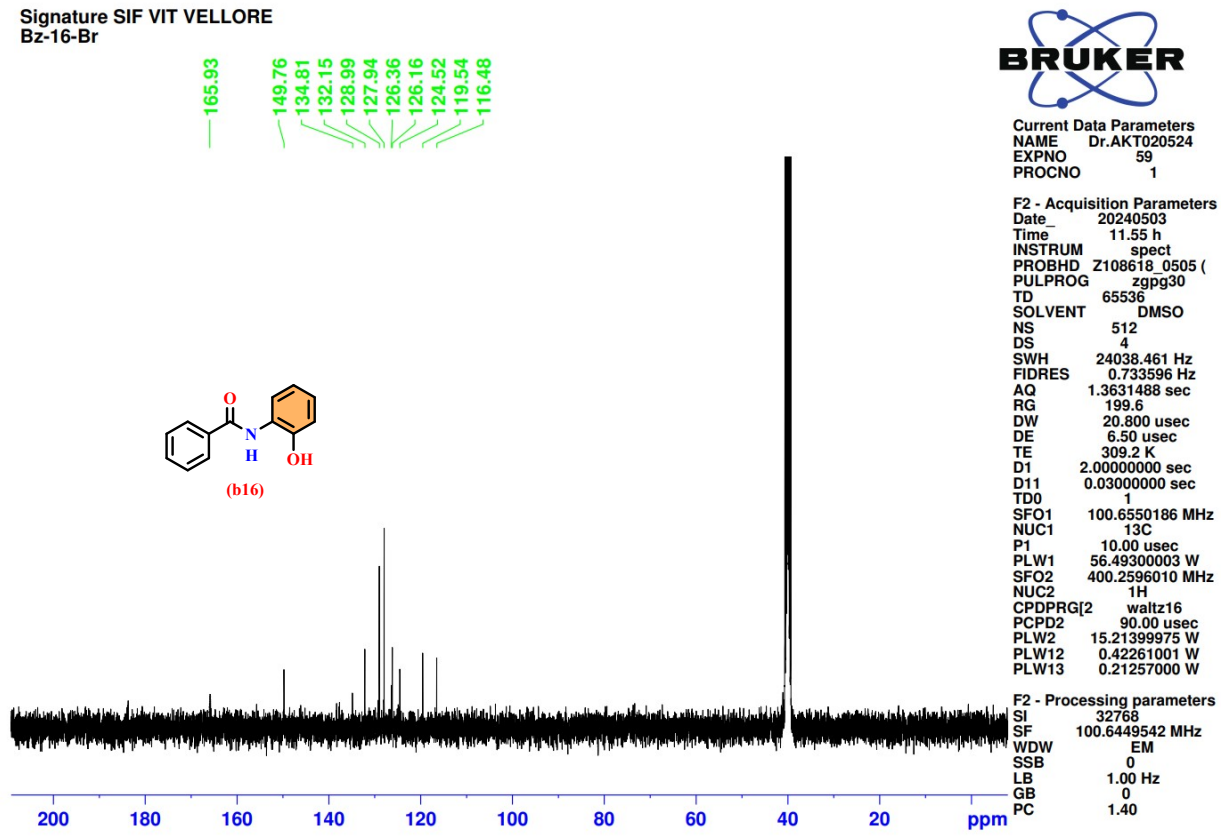



**Fig S64.** $^{13}$C NMR spectrum of ***N-(2-hydroxyphenyl)benzamide (b16)***

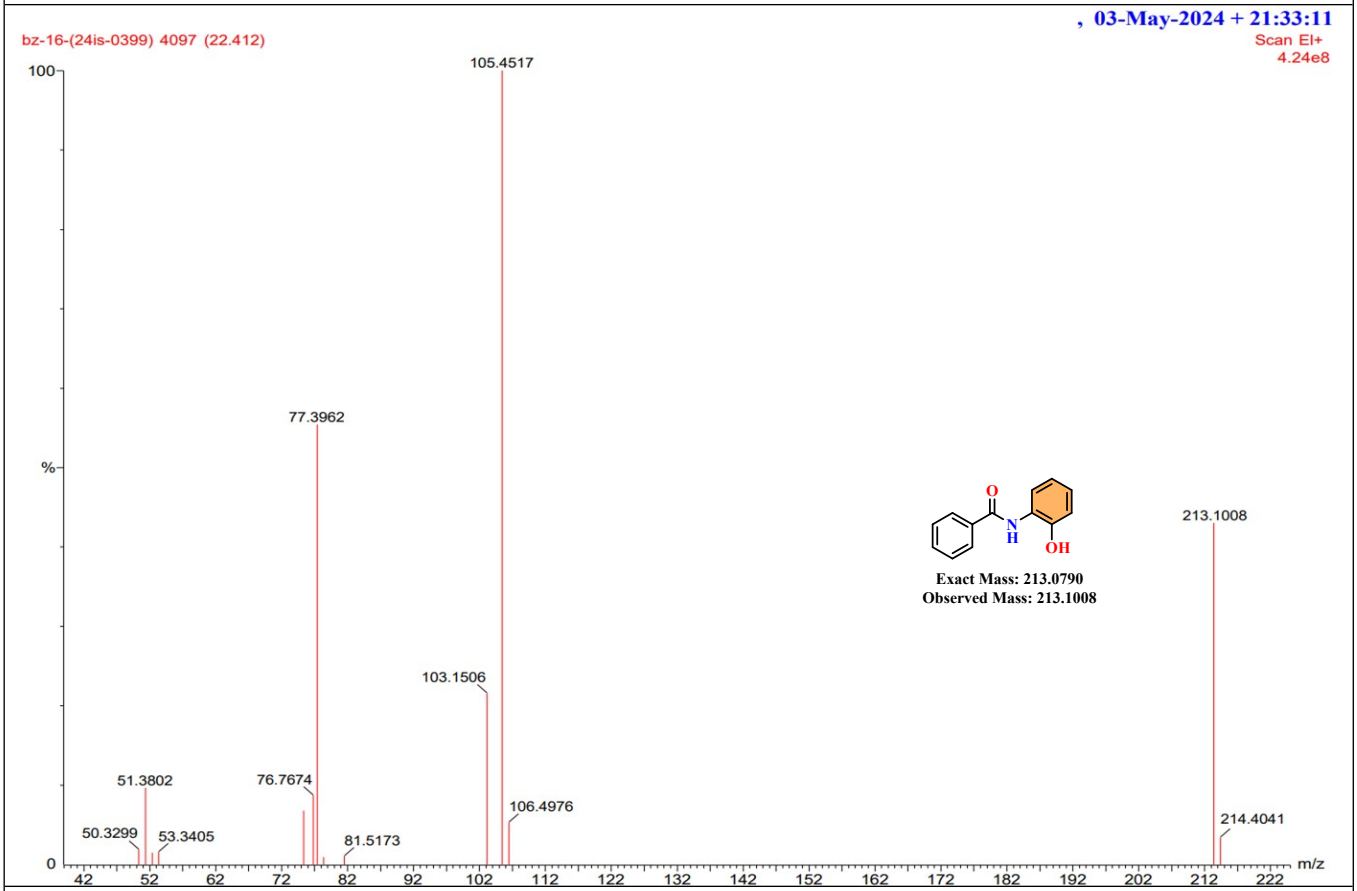



**Fig S65.** GC-Mass spectrum (m/z) of ***N-(2-hydroxyphenyl)benzamide (b16)***

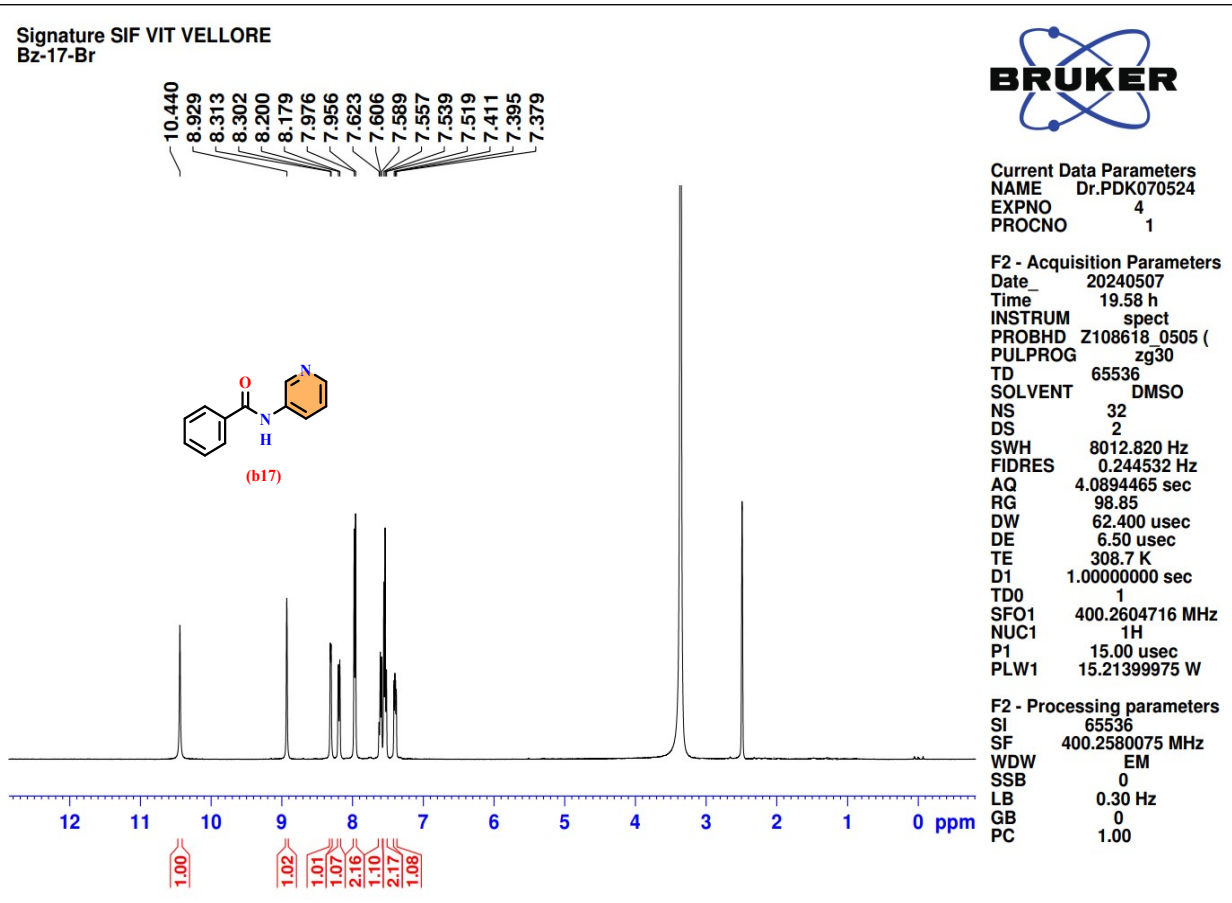



**Fig S66.** $^{1}$H NMR spectrum of ***N-(pyridin-3-yl)benzamide (b17)***

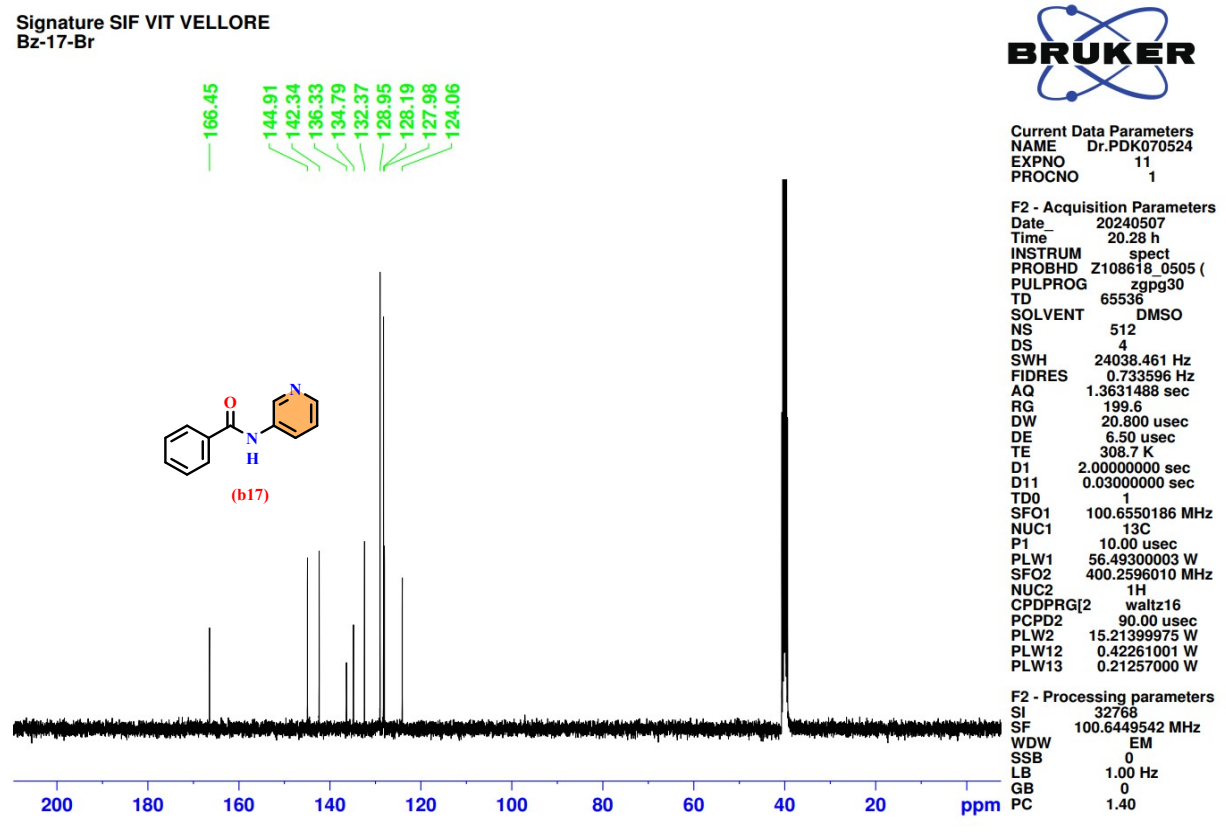



**Fig S67.** $^{13}$C NMR spectrum of ***N-(pyridin-3-yl)benzamide (b17)***

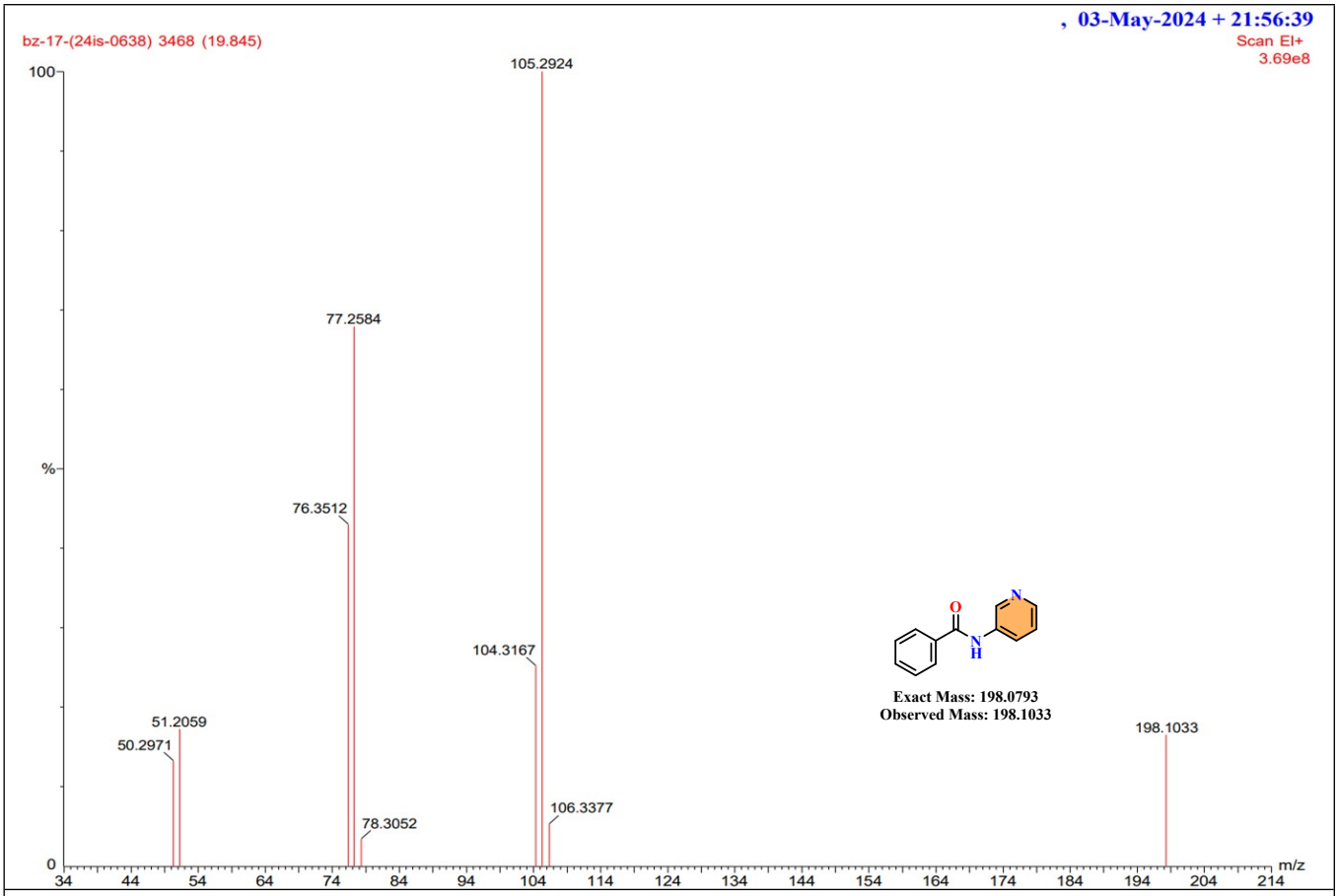



**Fig S68.** GC-Mass spectrum (m/z) of ***N-(pyridin-3-yl)benzamide (b17)***

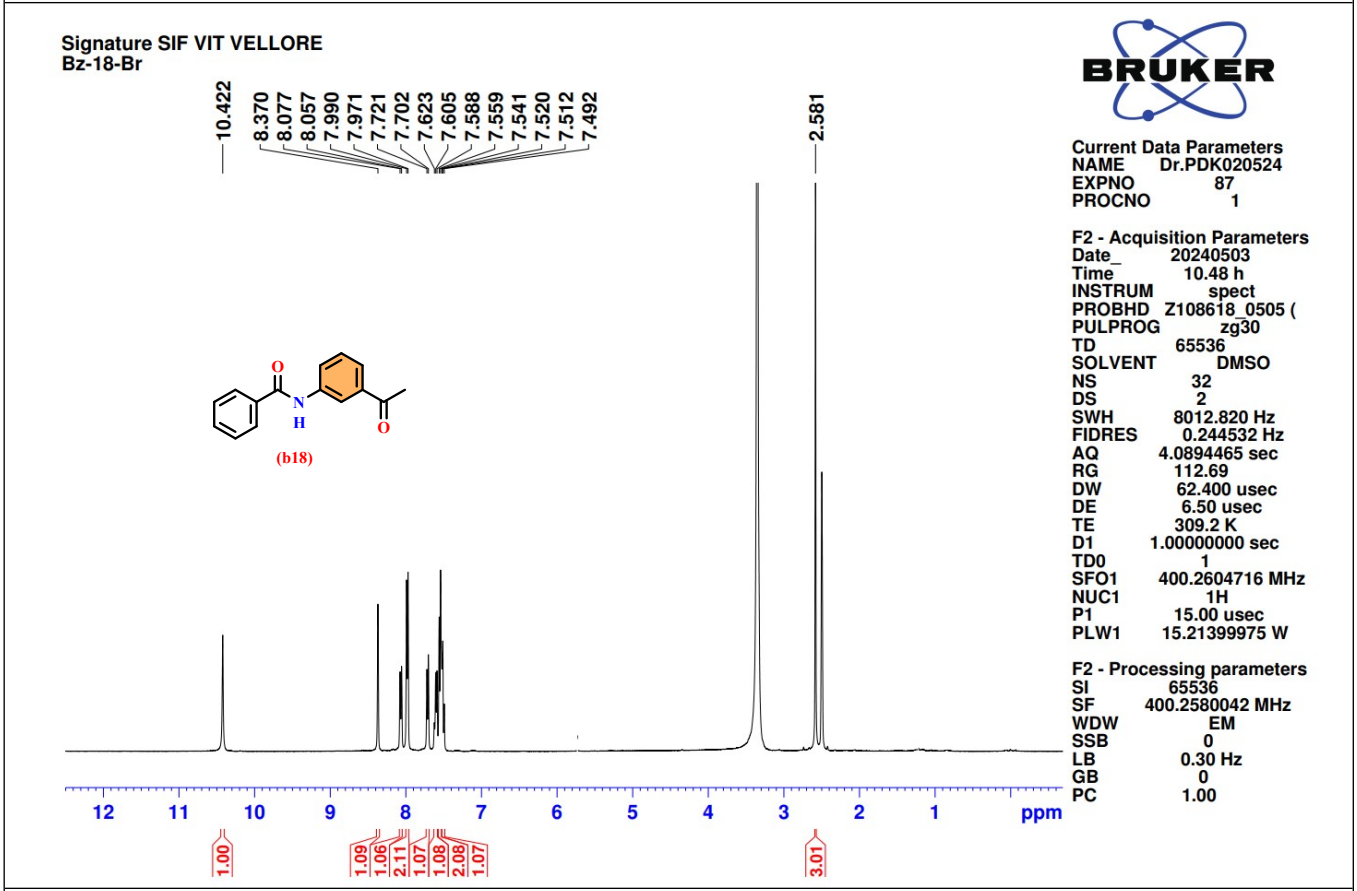



**Fig S69.** $^{1}$H NMR spectrum of ***N-(3-acetylphenyl)benzamide (b18)***

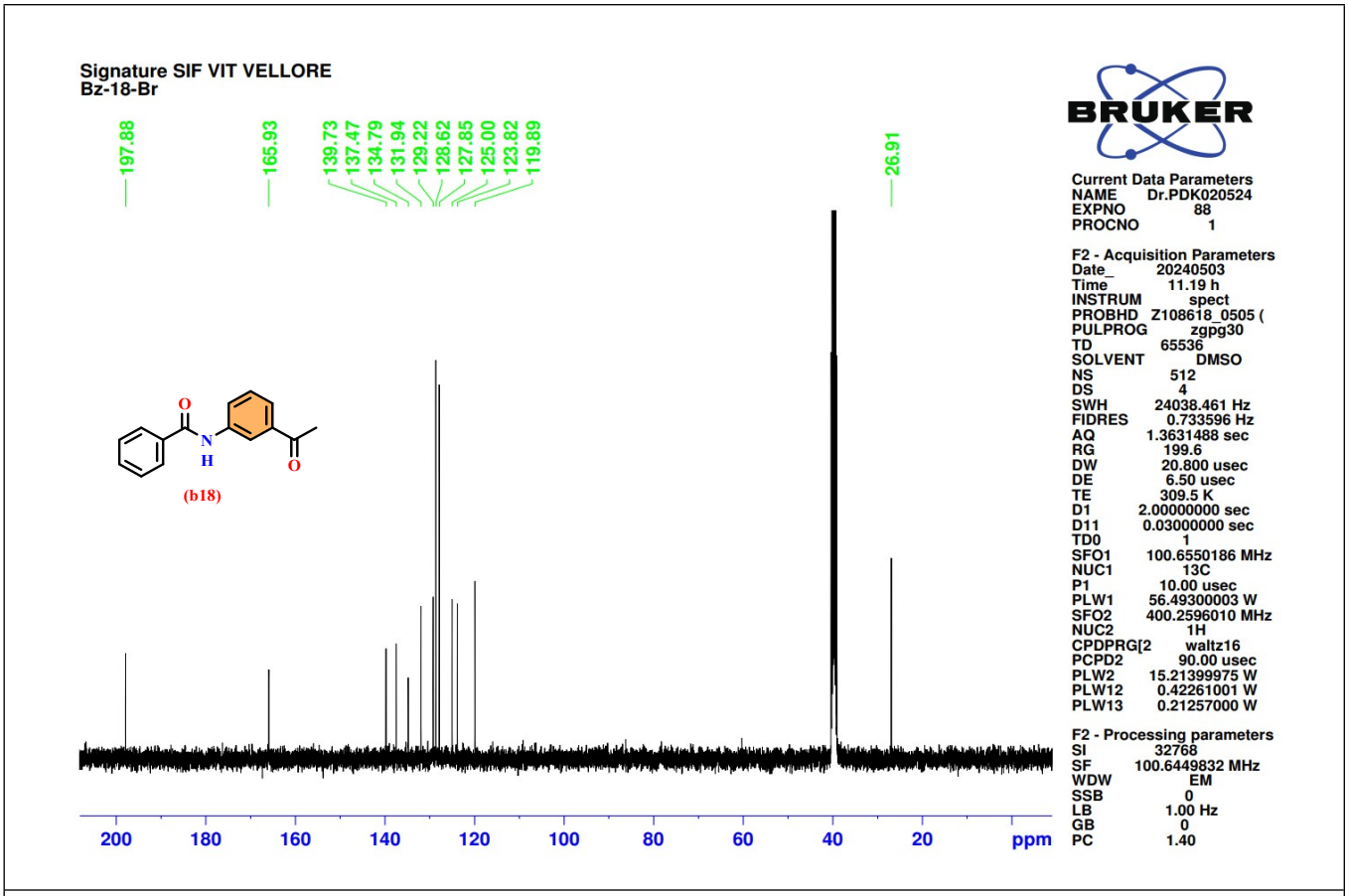



**Fig S70.** $^{13}$C NMR spectrum of ***N-(3-acetylphenyl)benzamide (b18)***

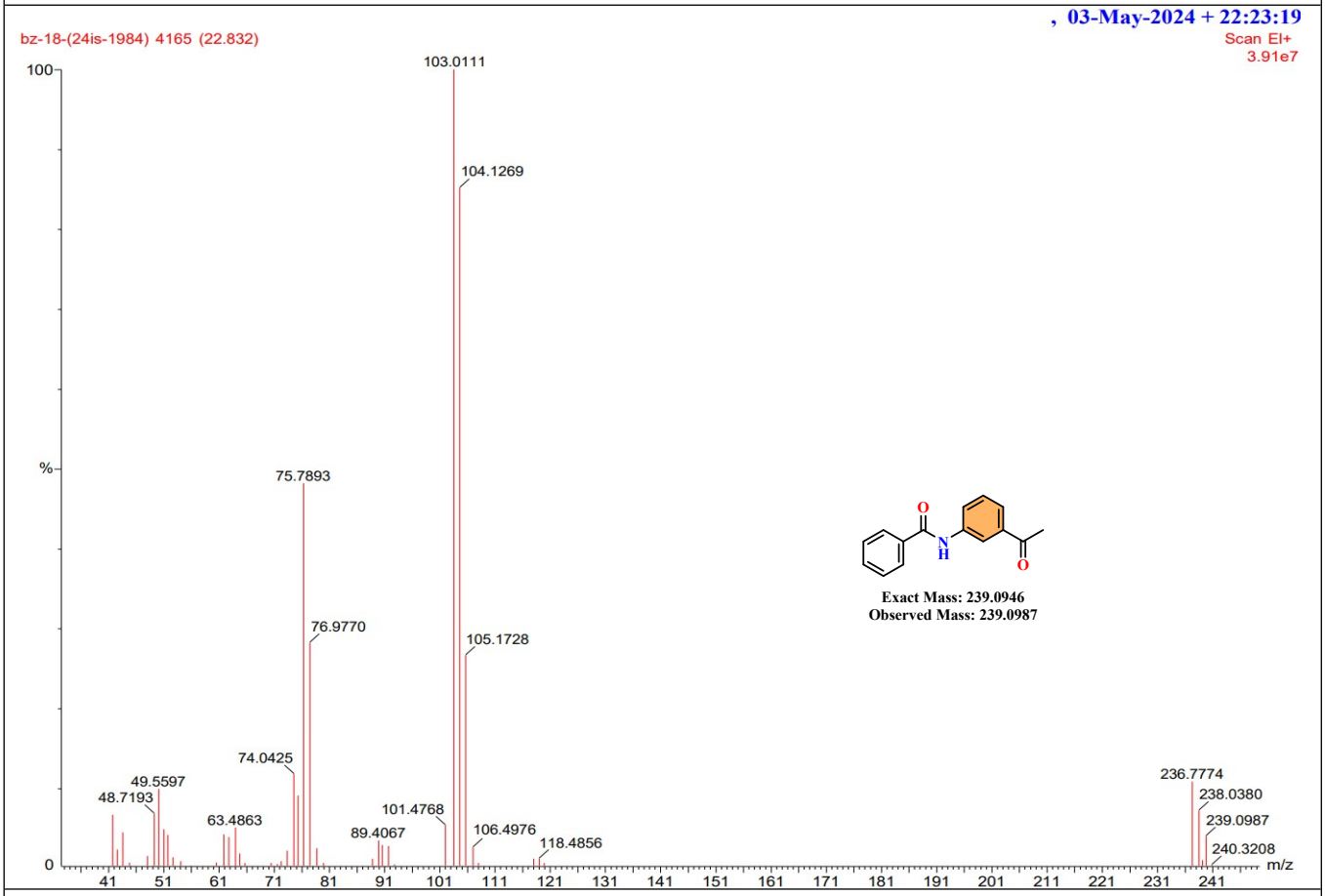



**Fig S71.** GC-Mass spectrum (m/z) of ***N-(3-acetylphenyl)benzamide (b18)***

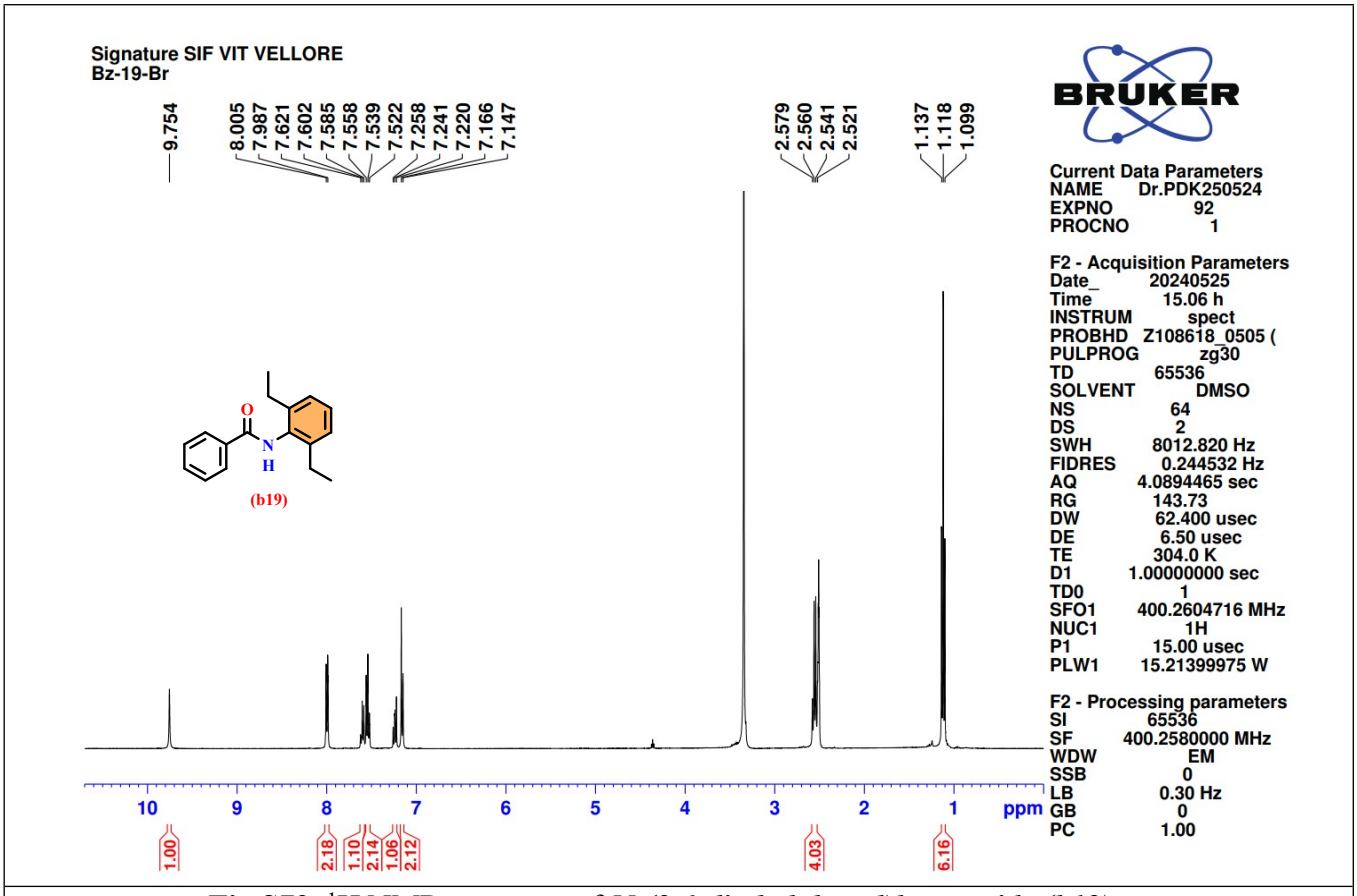



**Fig S72.** $^{1}$H NMR spectrum of ***N-(2,6-diethylphenyl)benzamide (b19)***

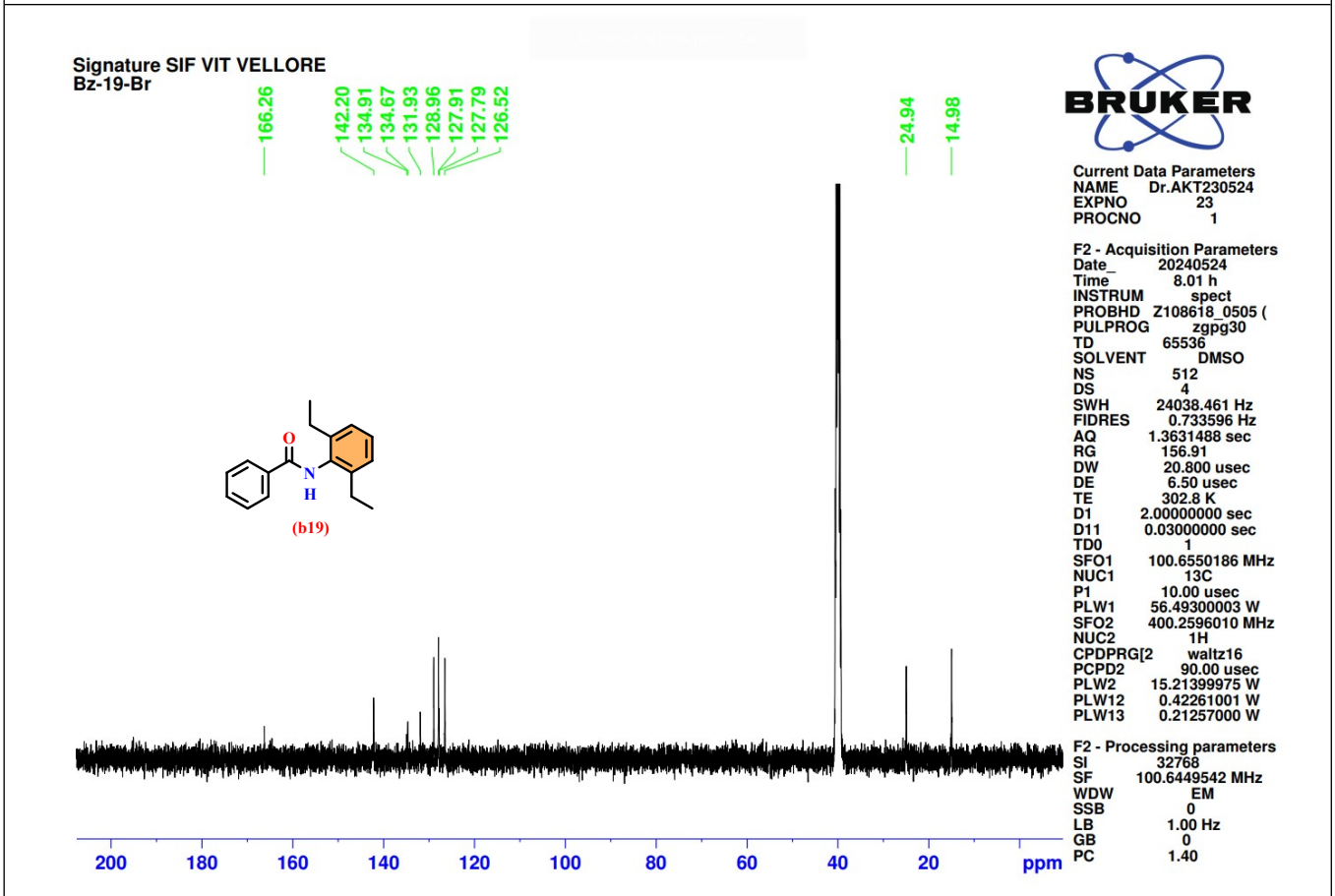



**Fig S73.** $^{13}$C NMR spectrum of ***N-(2,6-diethylphenyl)benzamide (b19)***

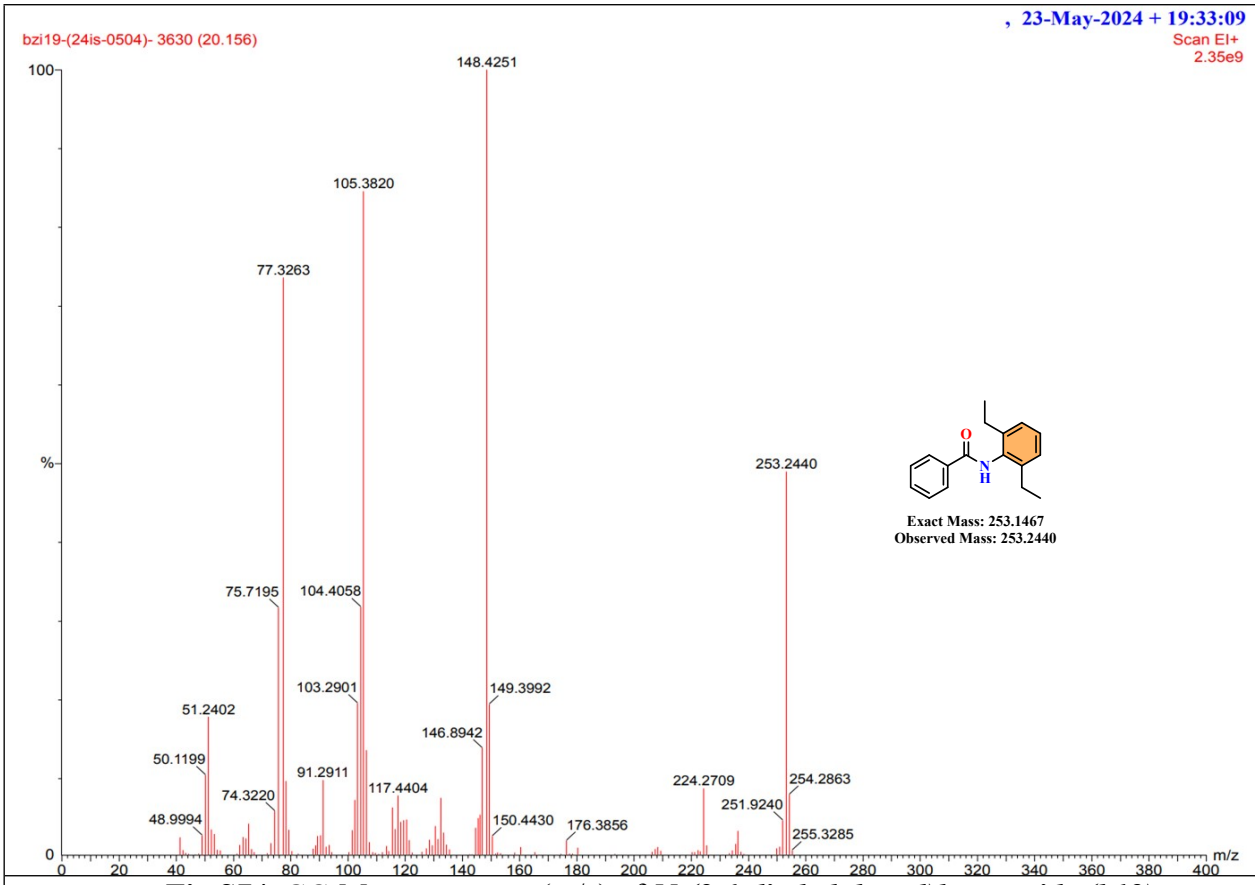



**Fig S74.** GC-Mass spectrum (m/z) of ***N-(2,6-diethylphenyl)benzamide (b19)***

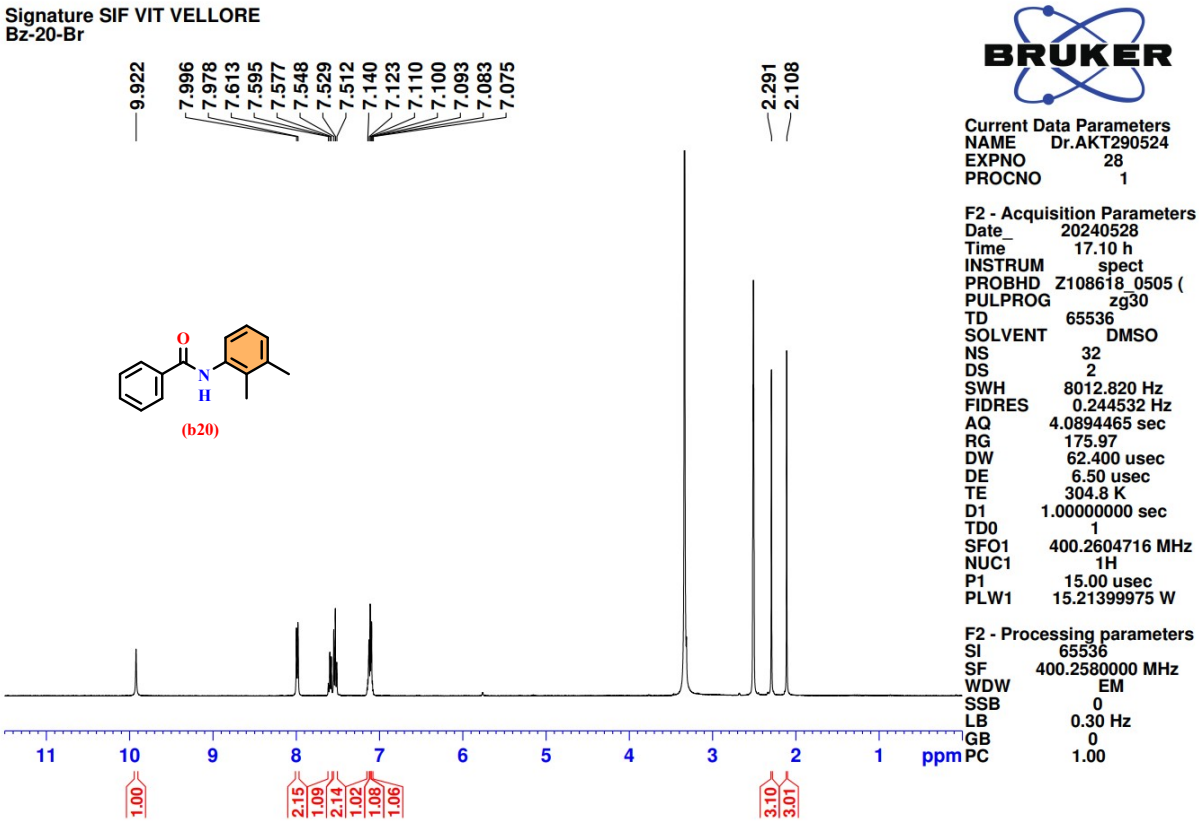



**Fig S75.** $^{1}$H NMR spectrum of ***N-(2,3-dimethylphenyl)benzamide (b20)***

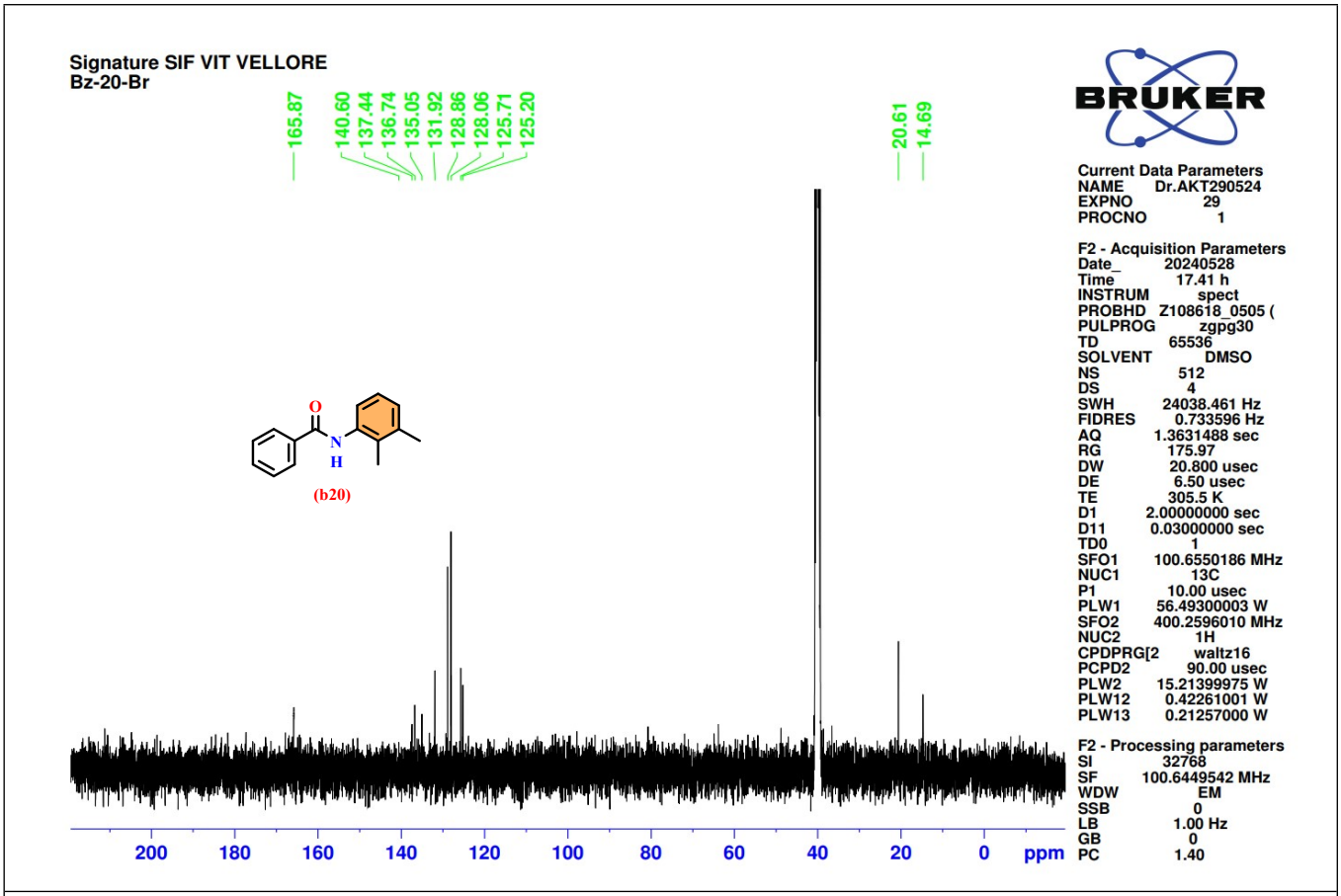



**Fig S76.** $^{13}$C NMR spectrum of ***N-(2,3-dimethylphenyl)benzamide (b20)***

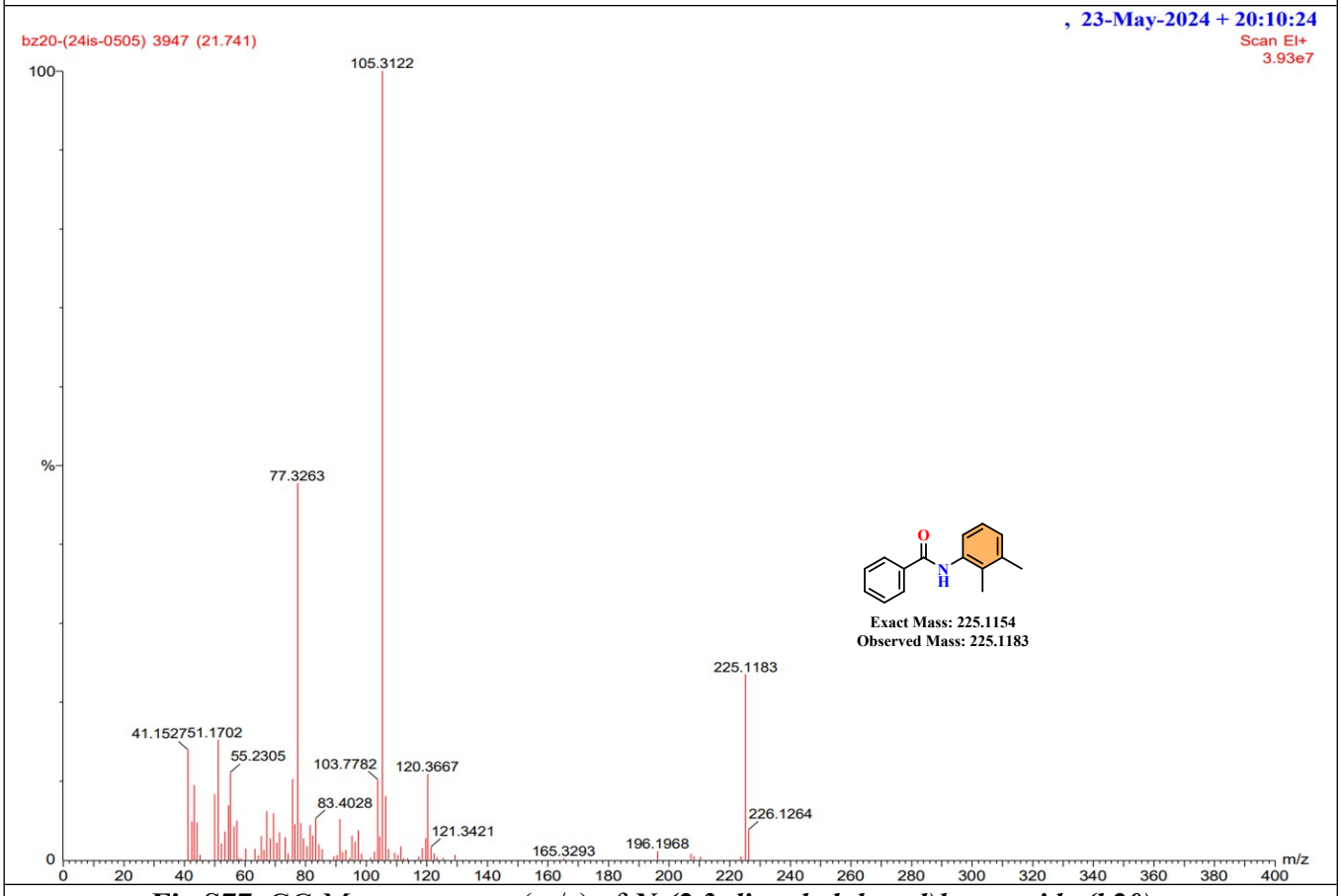



**Fig S77.** GC-Mass spectrum (m/z) of ***N-(2,3-dimethylphenyl)benzamide (b20)***

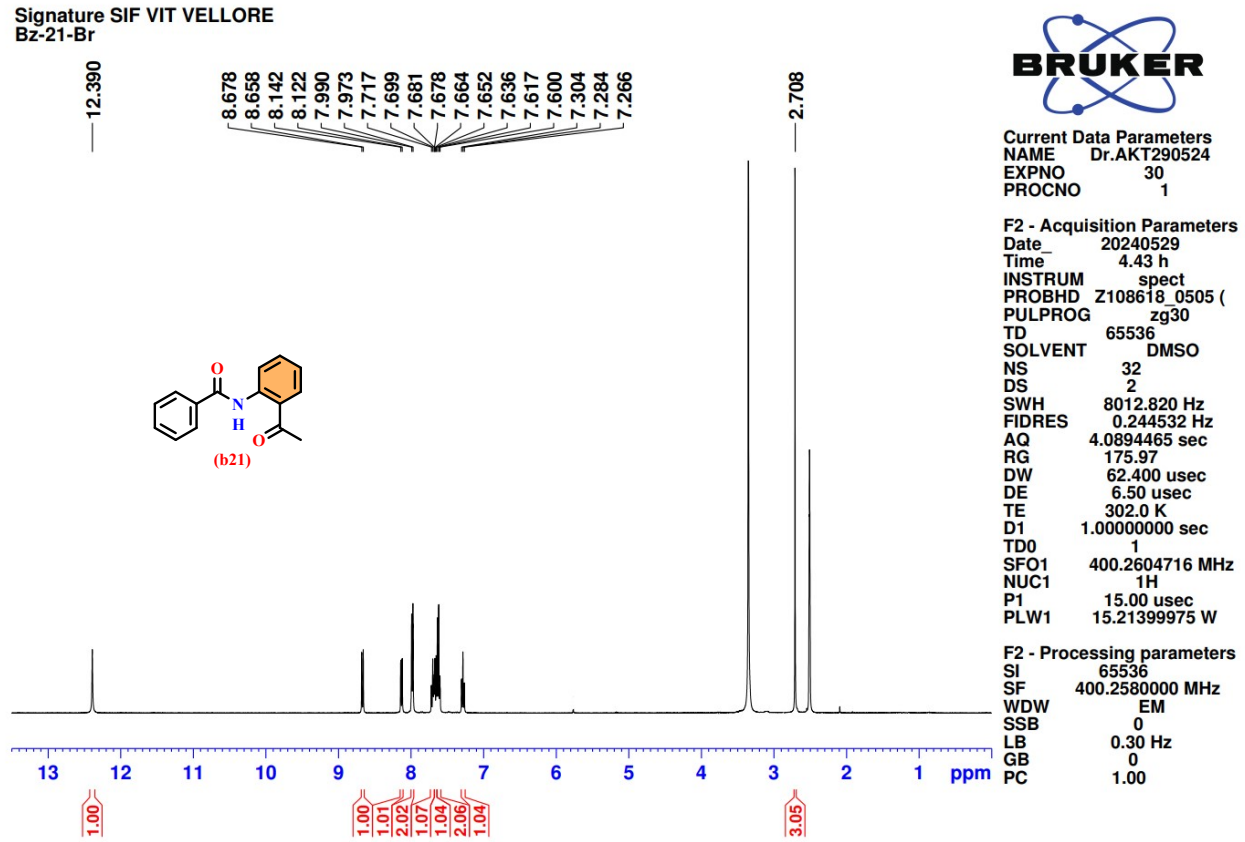



**Fig S78.** $^{1}$H NMR spectrum of ***N-(2-acetylphenyl)benzamide (b21)***

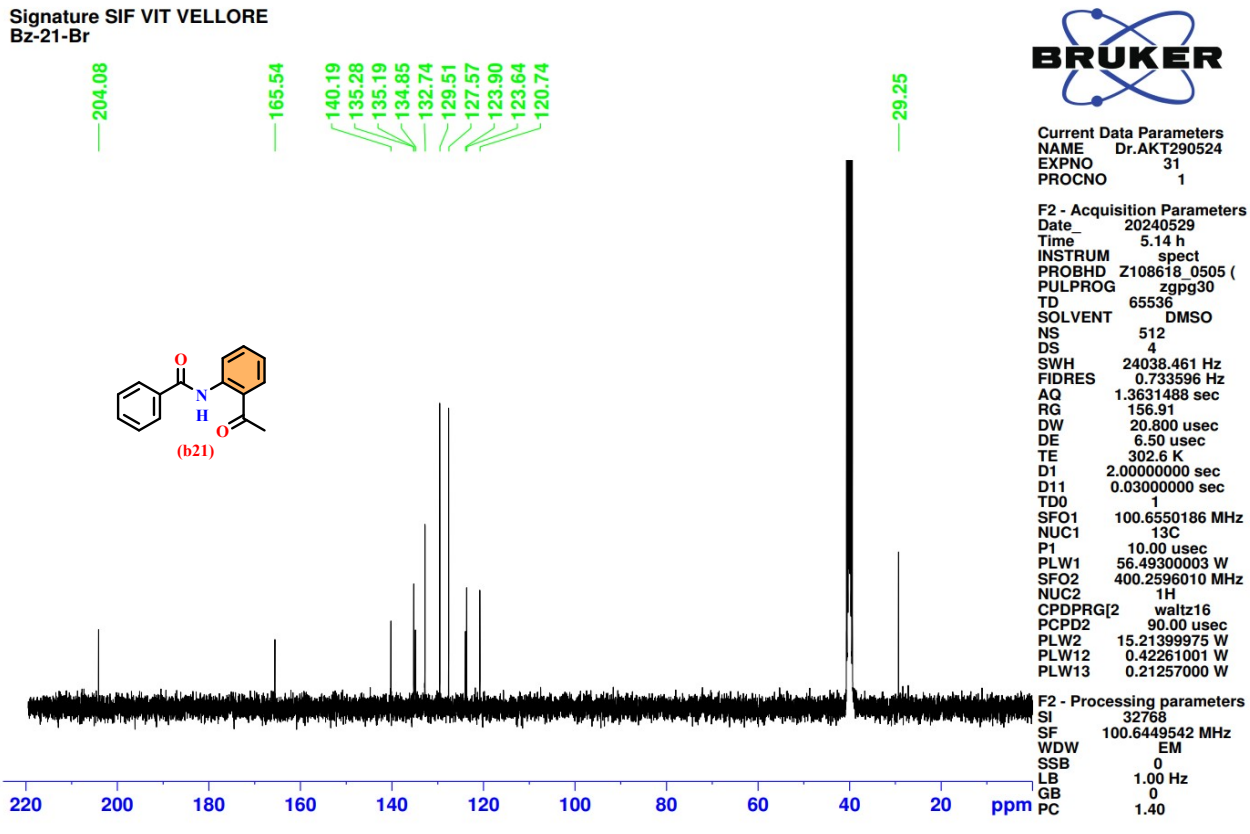



**Fig S79.** $^{13}$C NMR spectrum of ***N-(2-acetylphenyl)benzamide (b21)***

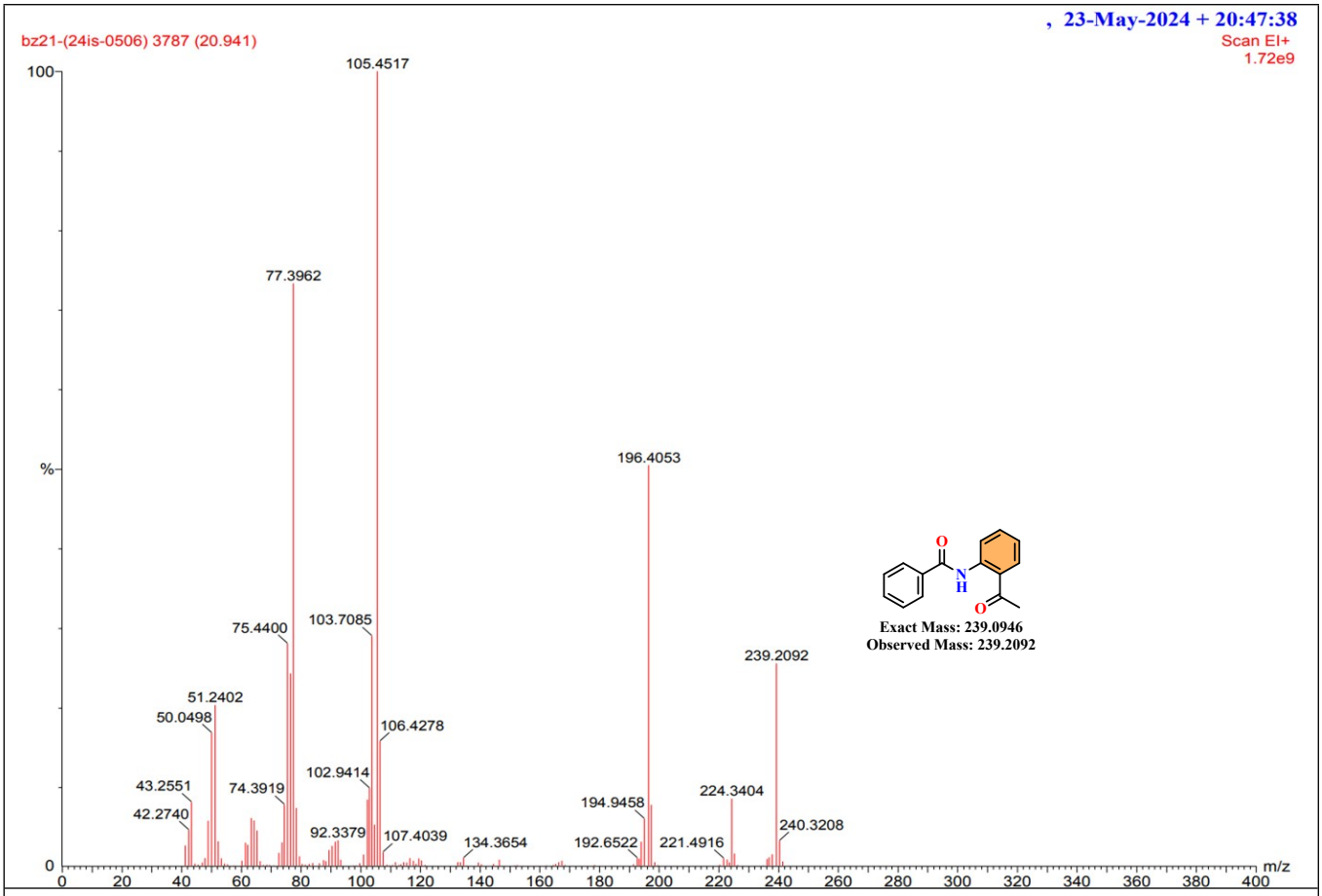



**Fig S80.** GC-Mass spectrum (m/z) of ***N-(2-acetylphenyl)benzamide (b21)***

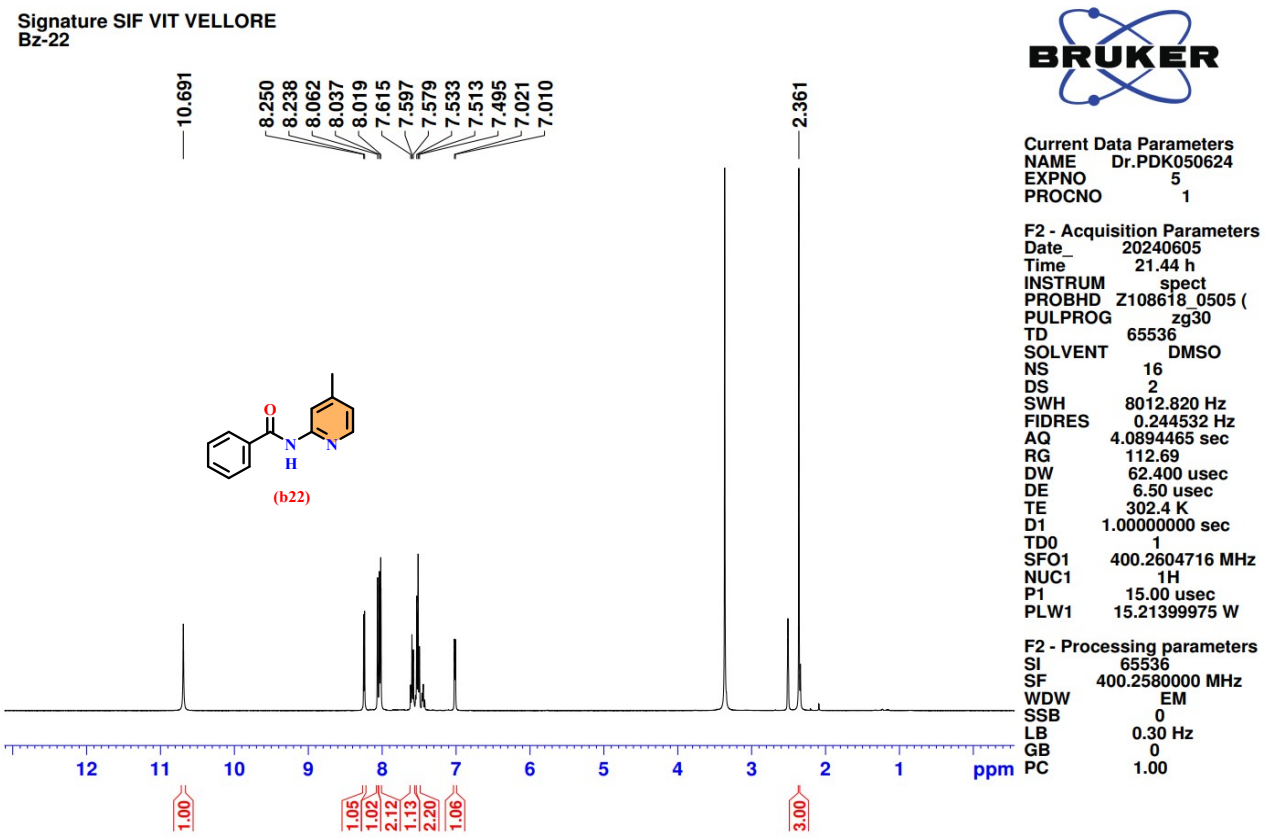



**Fig S81.** $^{1}$H NMR spectrum of ***N-(4-methylpyridin-2-yl)benzamide (b22)***

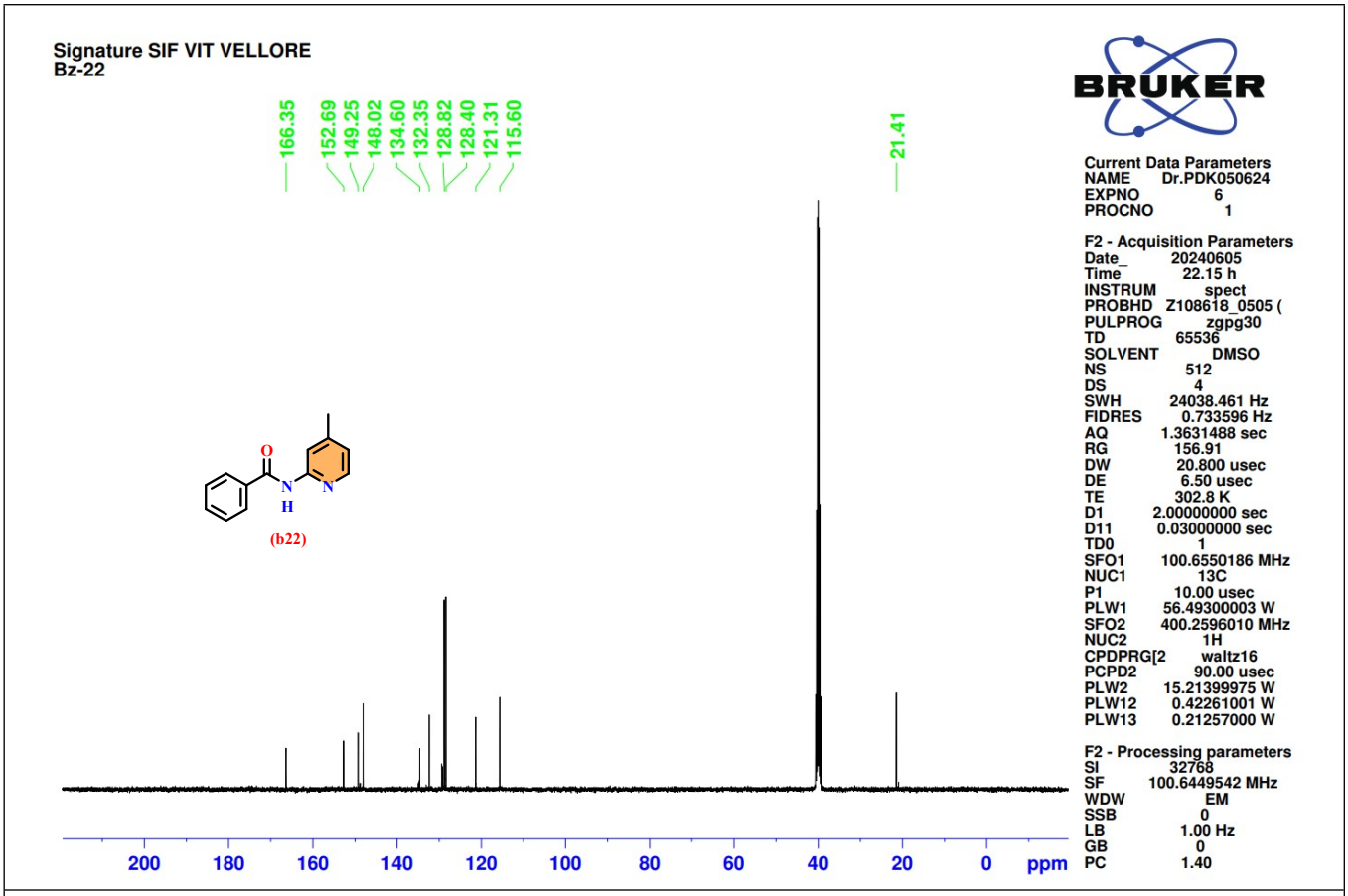



**Fig S82.** $^{13}$C NMR spectrum of ***N-(4-methylpyridin-2-yl)benzamide (b22)***

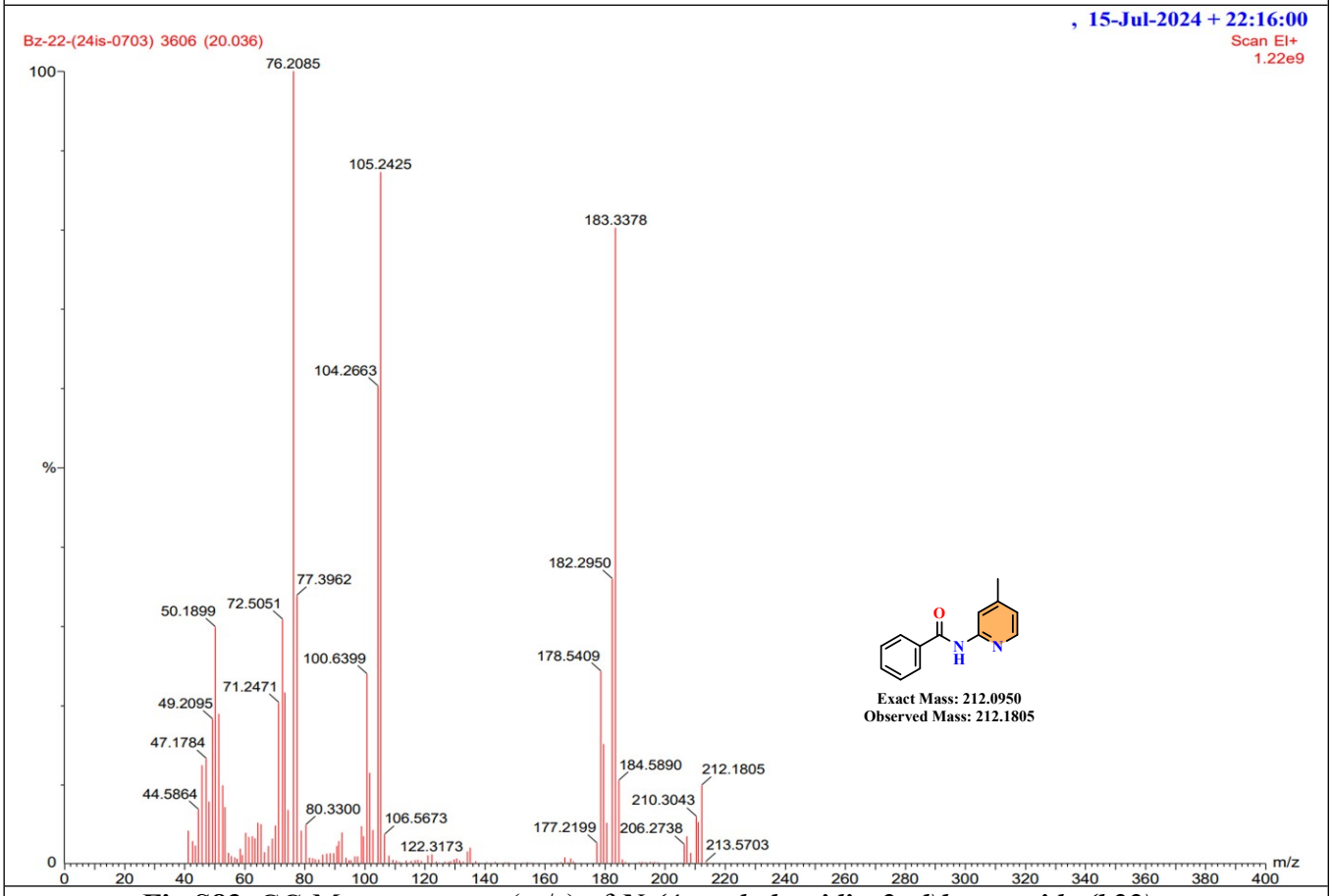



**Fig S83.** GC-Mass spectrum (m/z) of ***N-(4-methylpyridin-2-yl)benzamide (b22)***

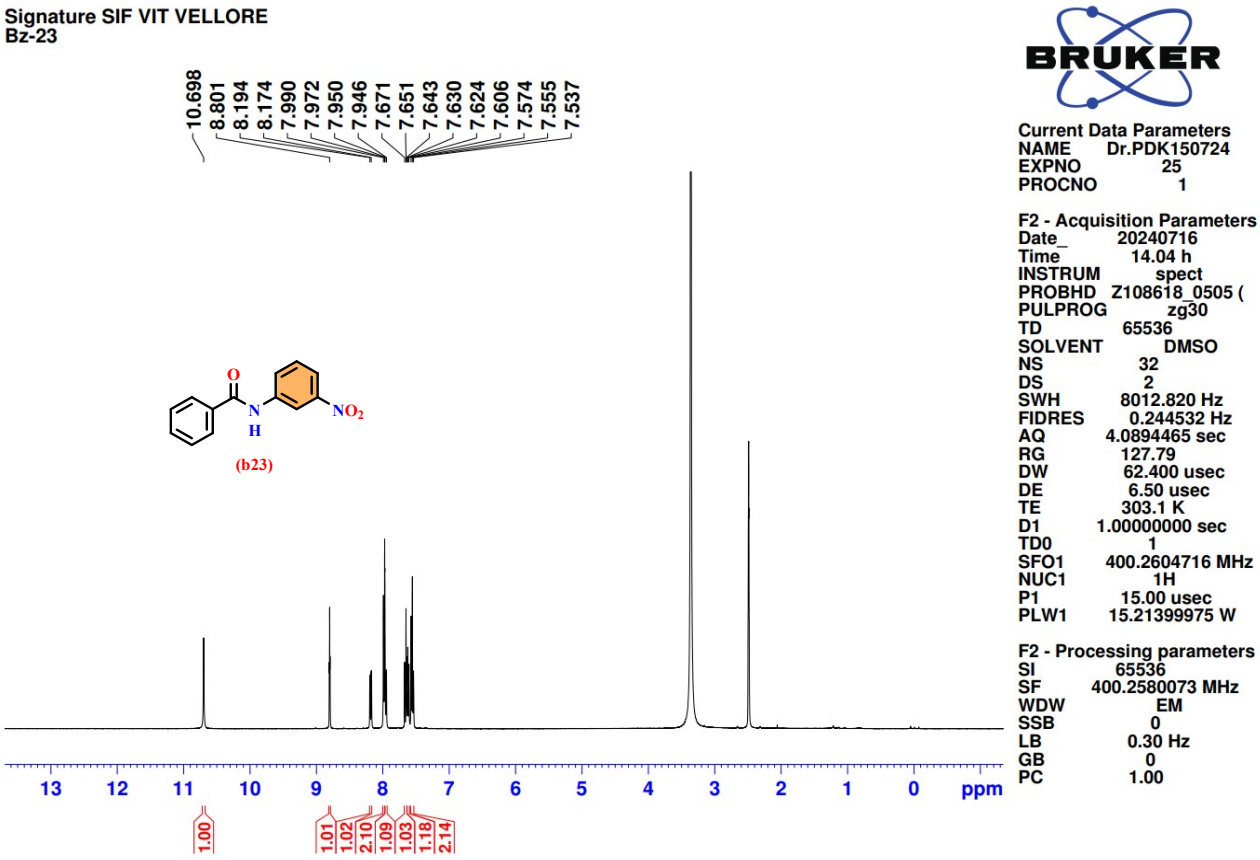



**Fig S84.** $^{1}$H NMR spectrum of ***N-(3-nitrophenyl)benzamide (b23)***

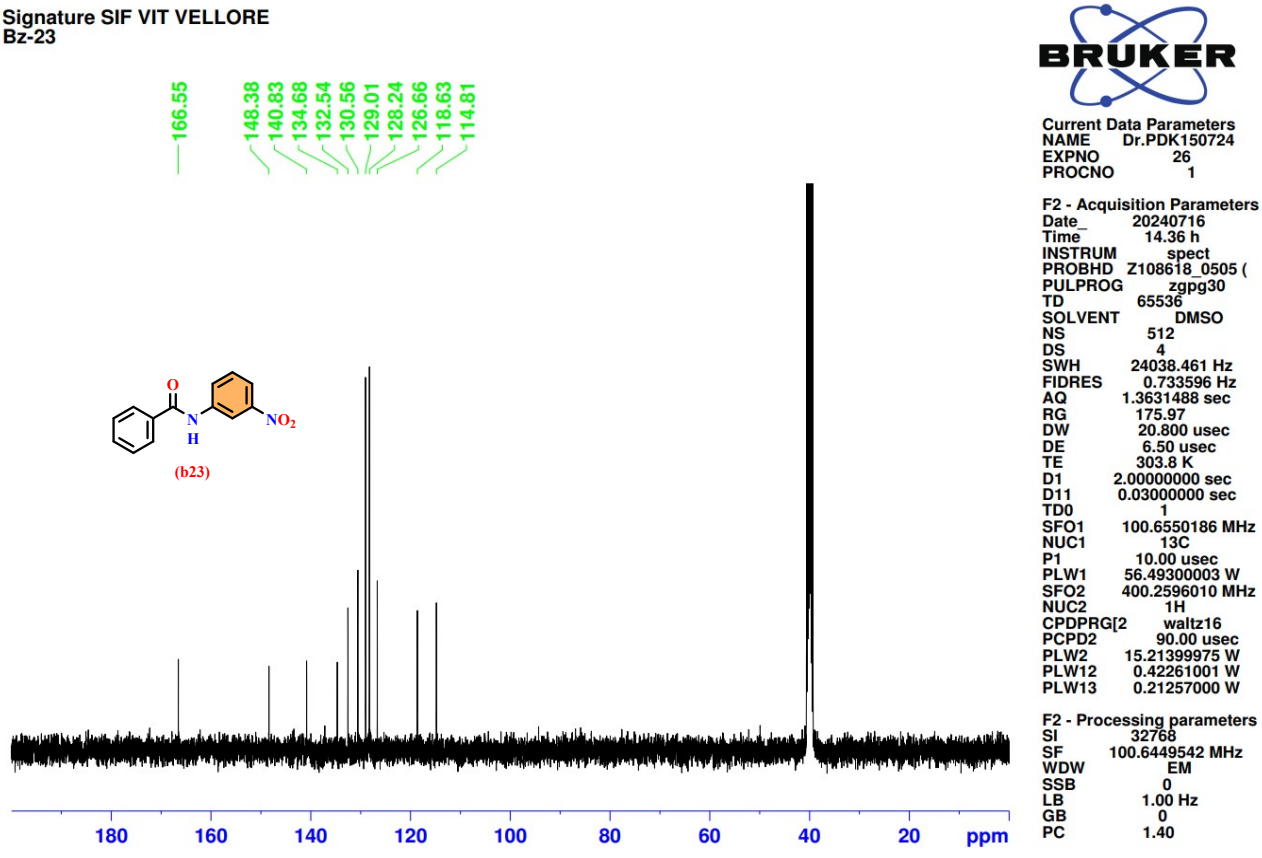



**Fig S85.** $^{13}$C NMR spectrum of ***N-(3-nitrophenyl)benzamide (b23)***

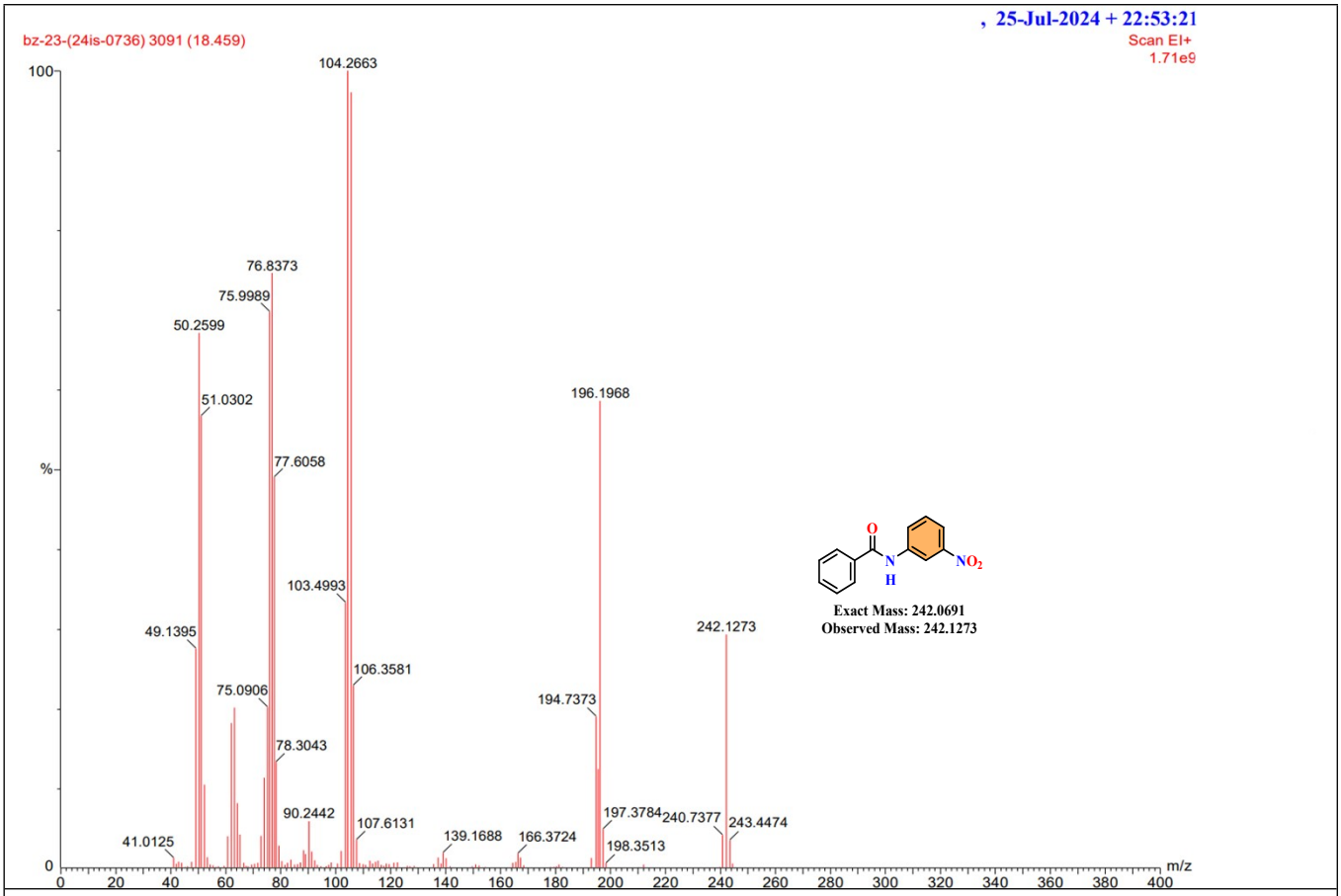



**Fig S86.** GC-Mass spectrum (m/z) of ***N-(3-nitrophenyl)benzamide (b23)***

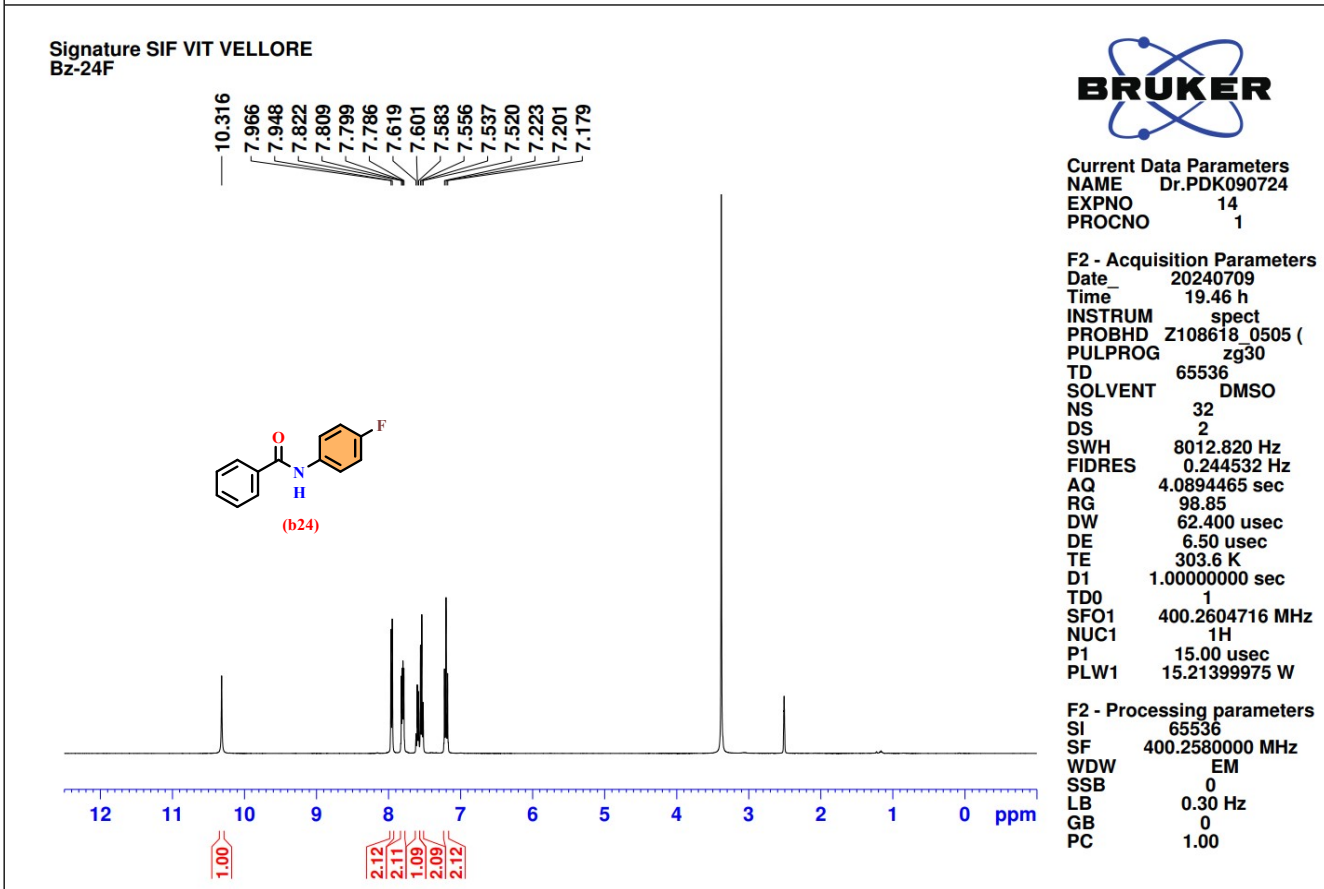



**Fig S87.** $^{1}$H NMR spectrum of ***N-(4-fluorophenyl)benzamide (b24$_i$)***

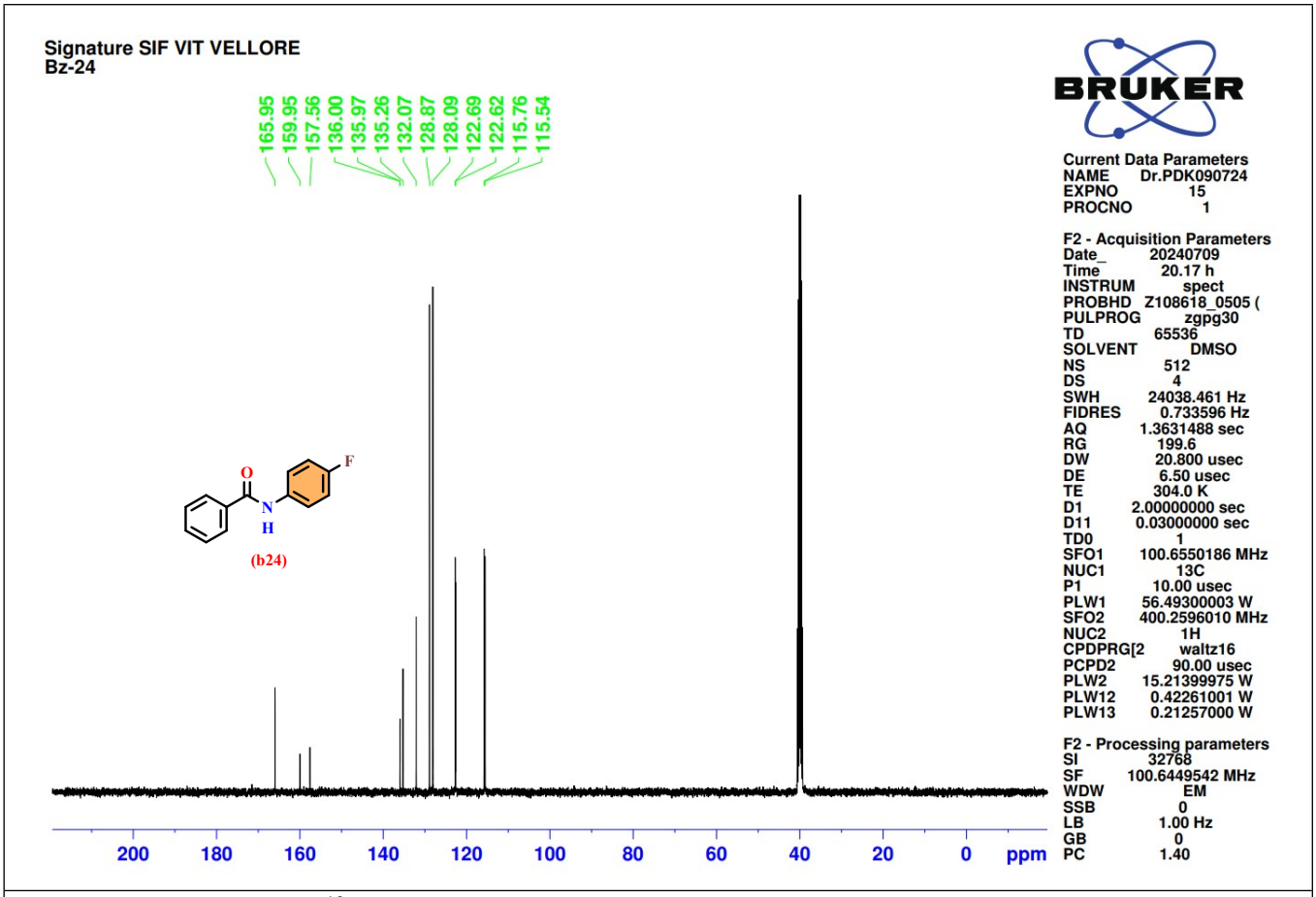



**Fig S88.** $^{13}$C NMR spectrum of ***N-(4-fluorophenyl)benzamide (b24$_i$)***

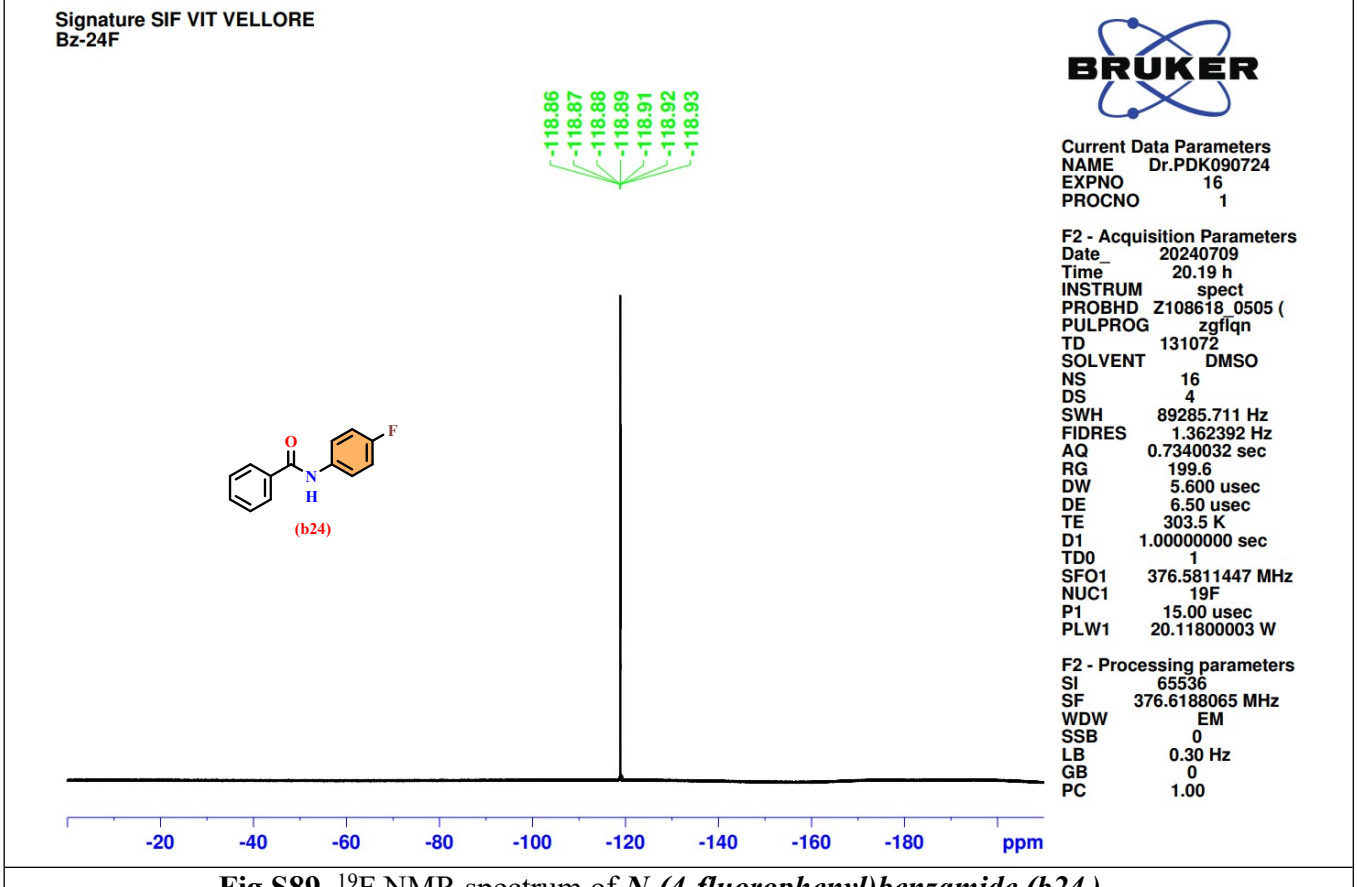



**Fig S89.** $^{19}$F NMR spectrum of ***N-(4-fluorophenyl)benzamide (b24$_i$)***

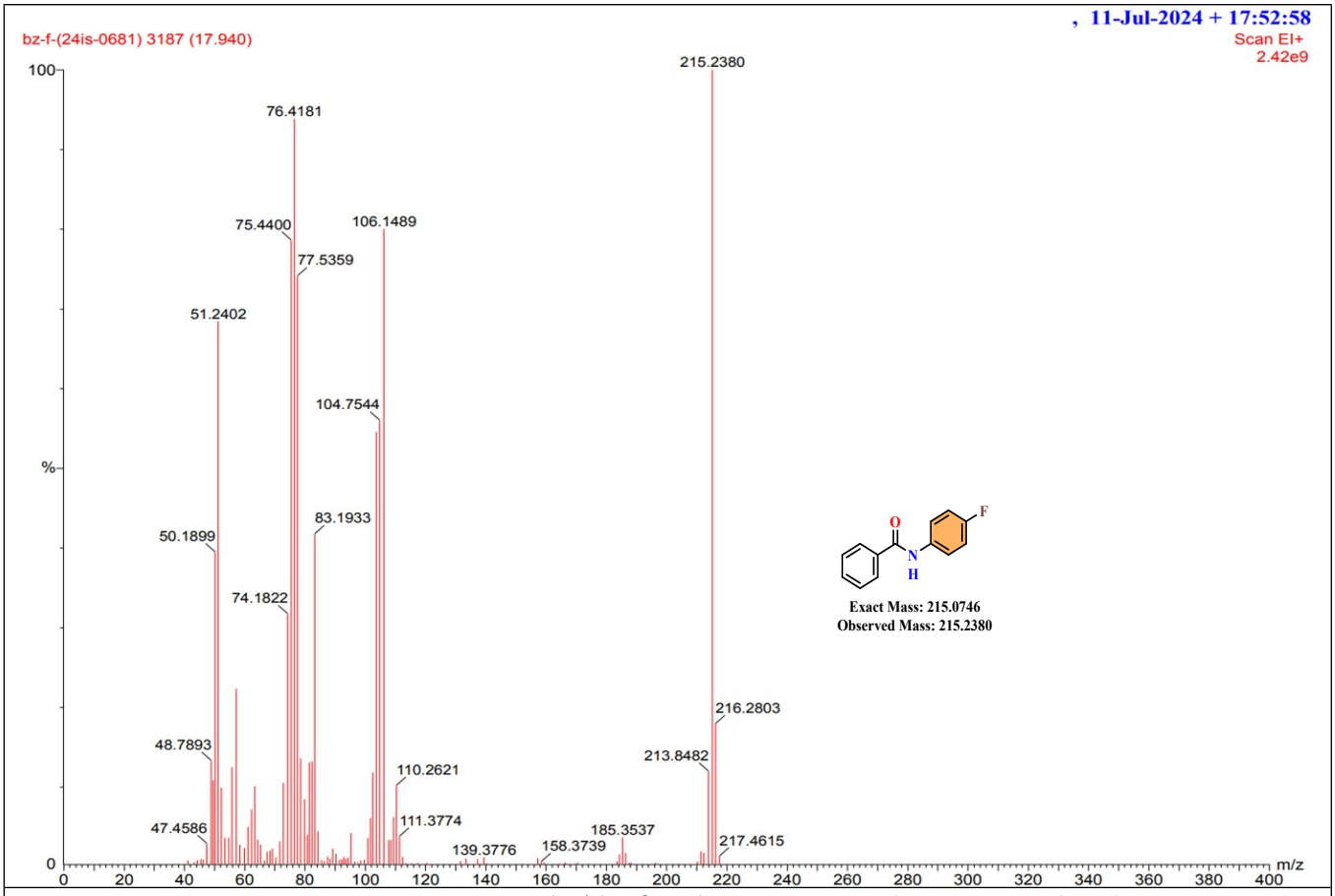



**Fig S90.** GC-Mass spectrum (m/z) of ***N-(4-fluorophenyl)benzamide (b24$_i$)***

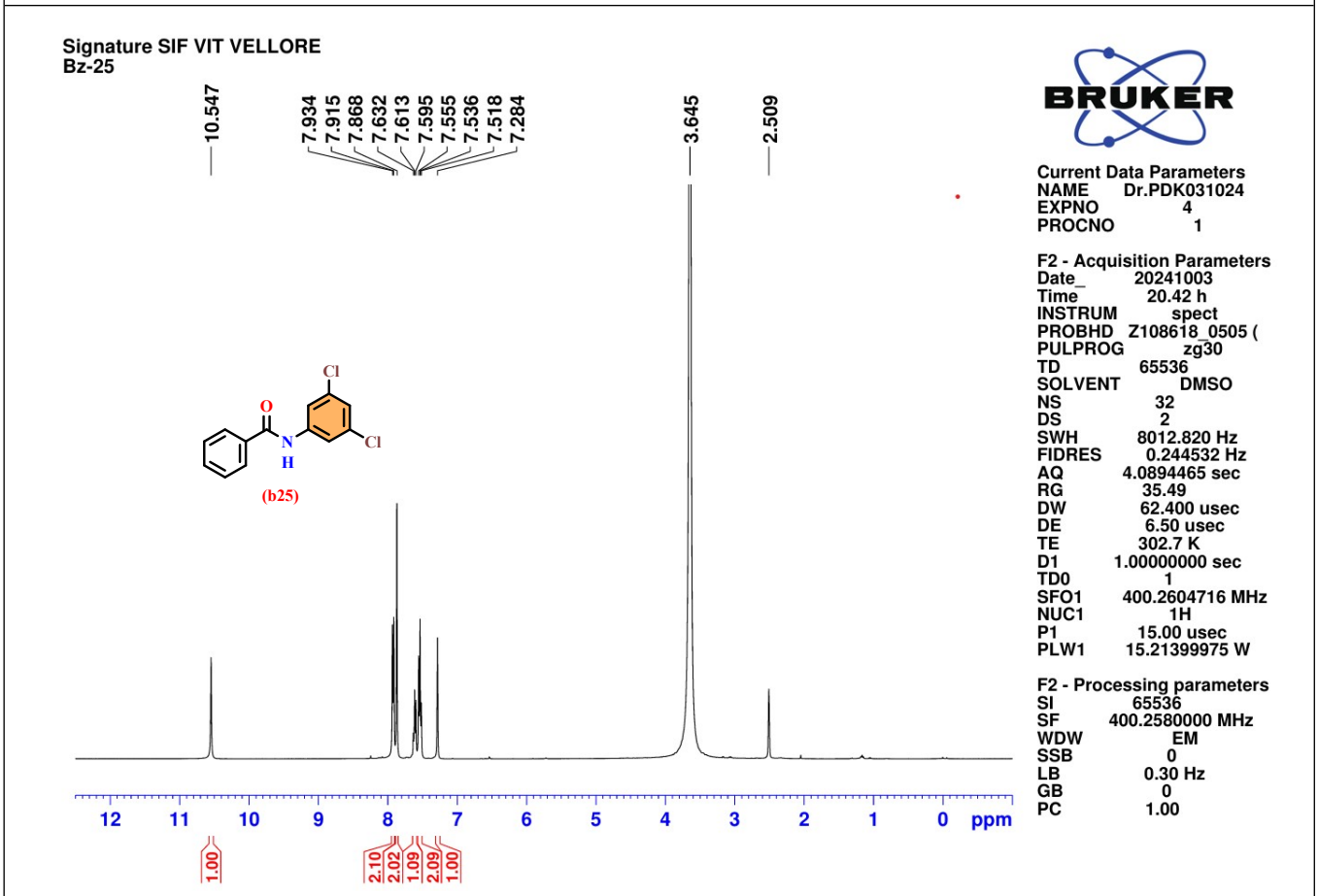



**Fig S91.** $^1$H NMR spectrum of ***N-(3,5-dichlorophenyl)benzamide (b25)***

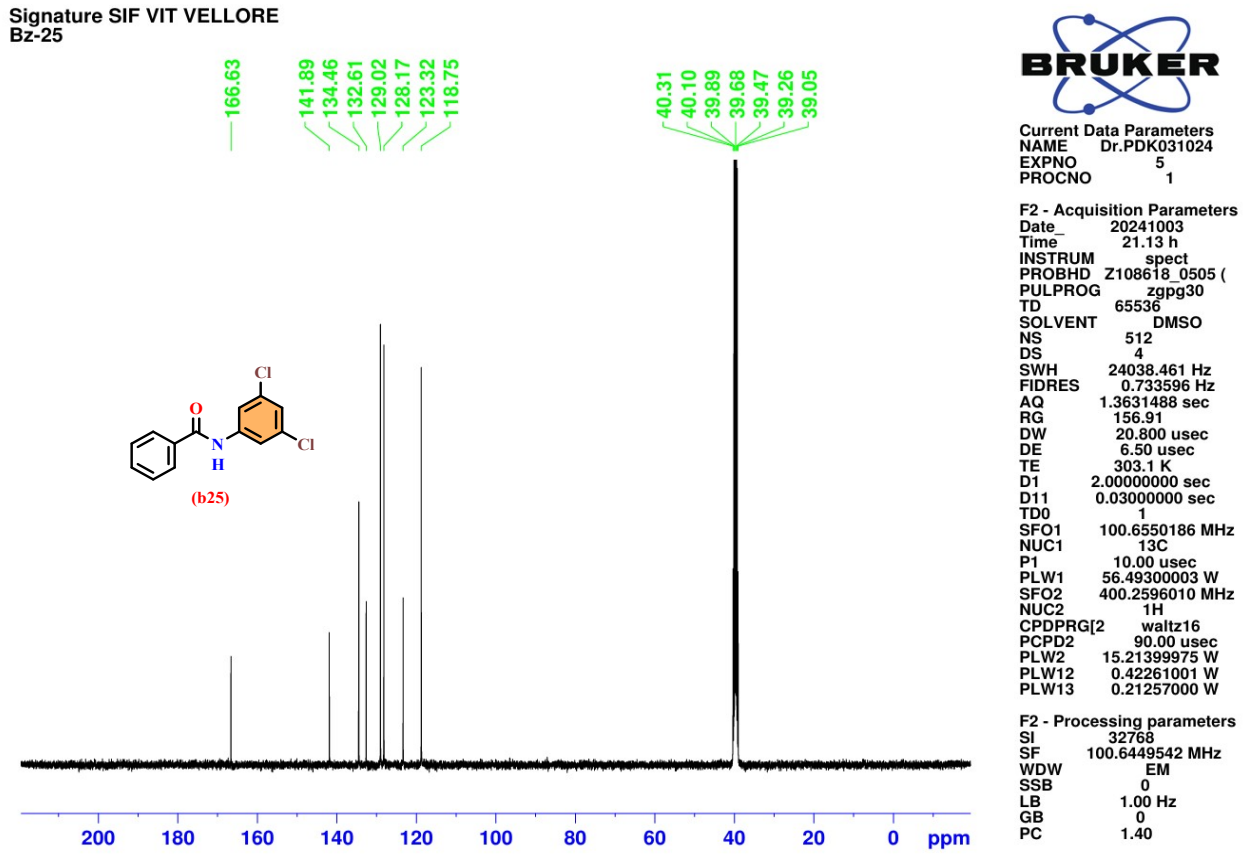



**Fig S92.** $^{13}$C NMR spectrum of ***N-(3,5-dichlorophenyl)benzamide (b25)***

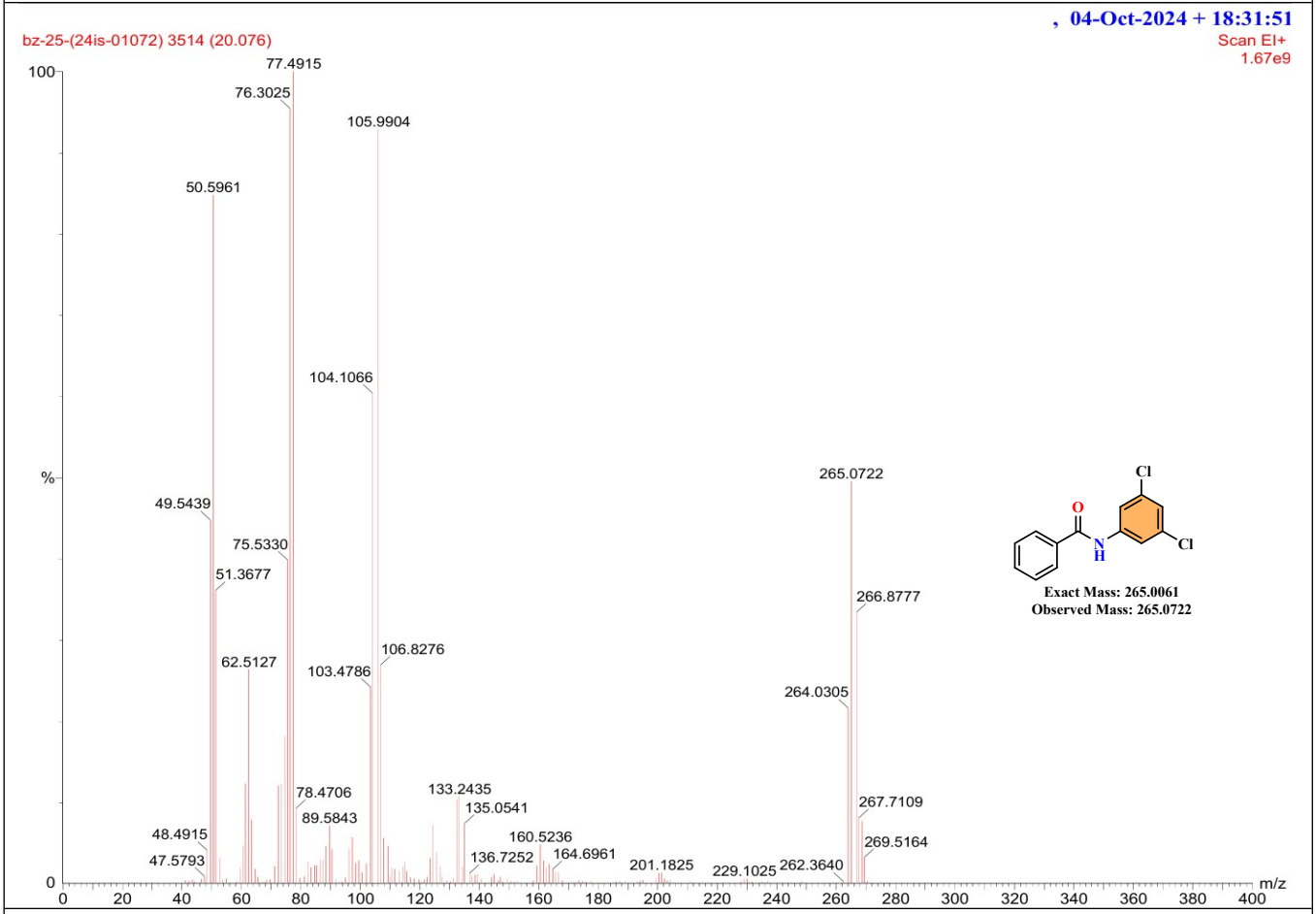



**Fig S93.** GC-Mass spectrum (m/z) of ***N-(3,5-dichlorophenyl)benzamide (b25)***

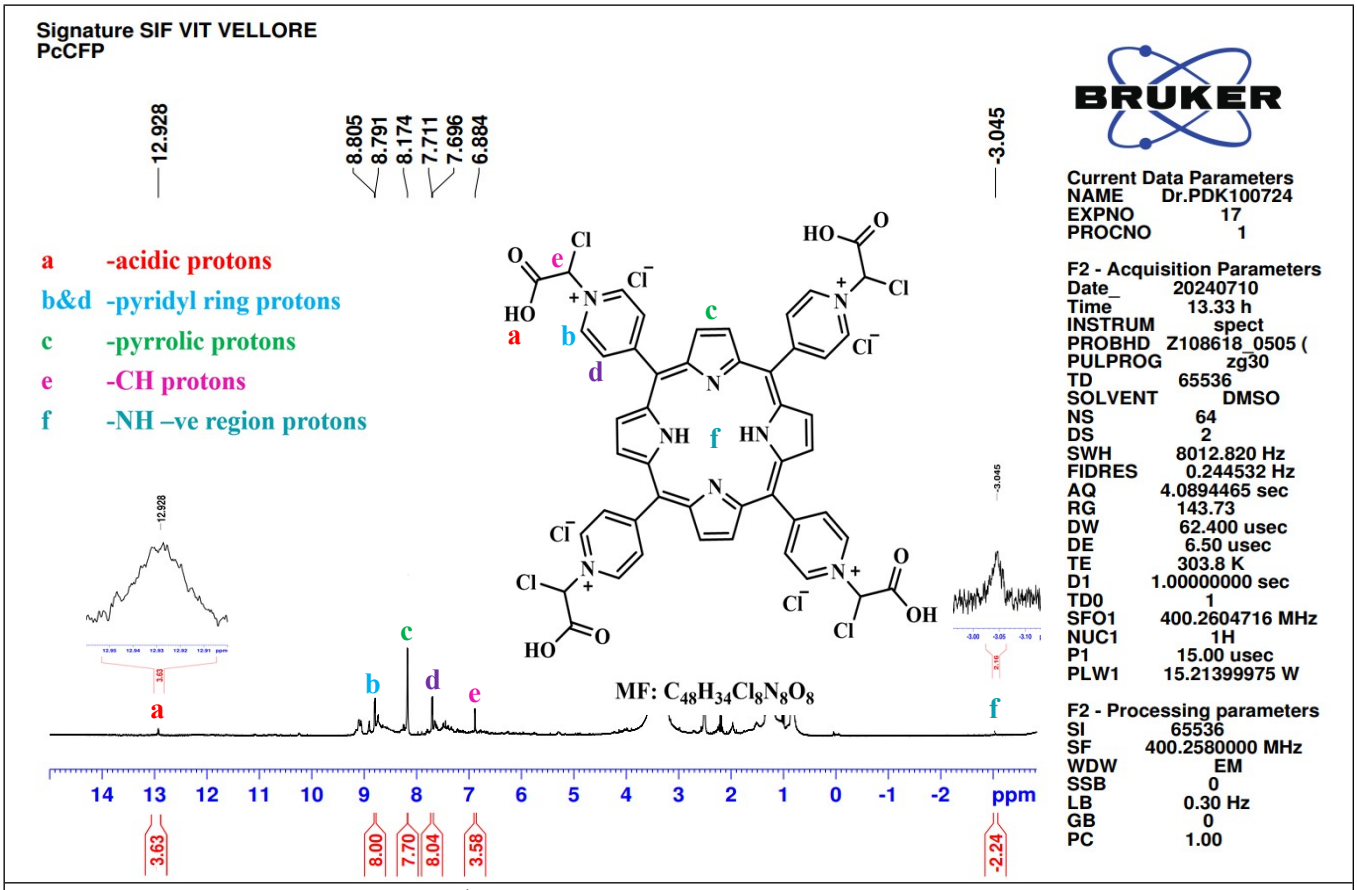



**Fig S94.** $^{1}$H NMR spectrum of PcCFP Photocatalyst

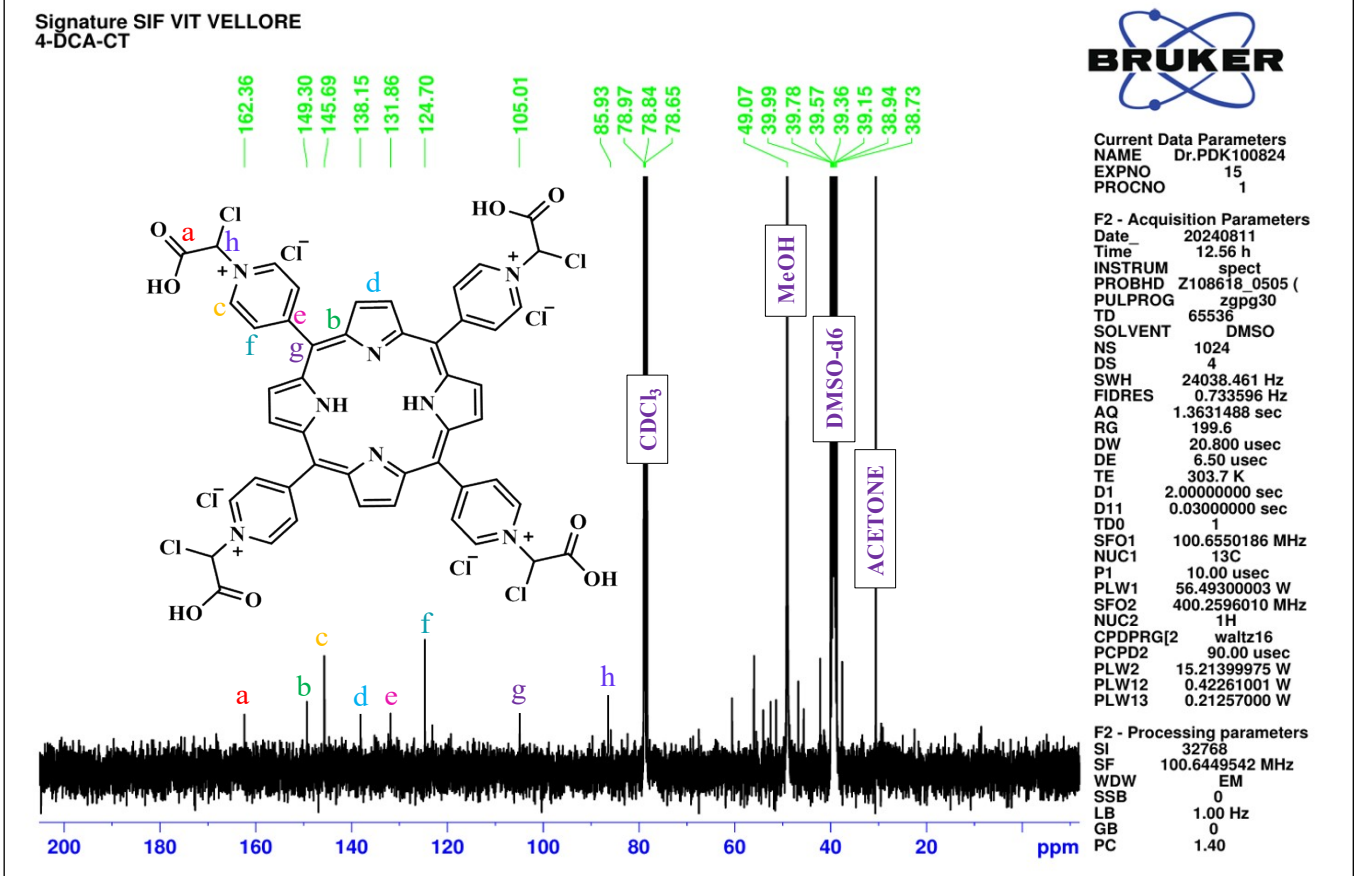



**Fig S95.** $^{13}$C NMR spectrum of PcCFP Photocatalyst

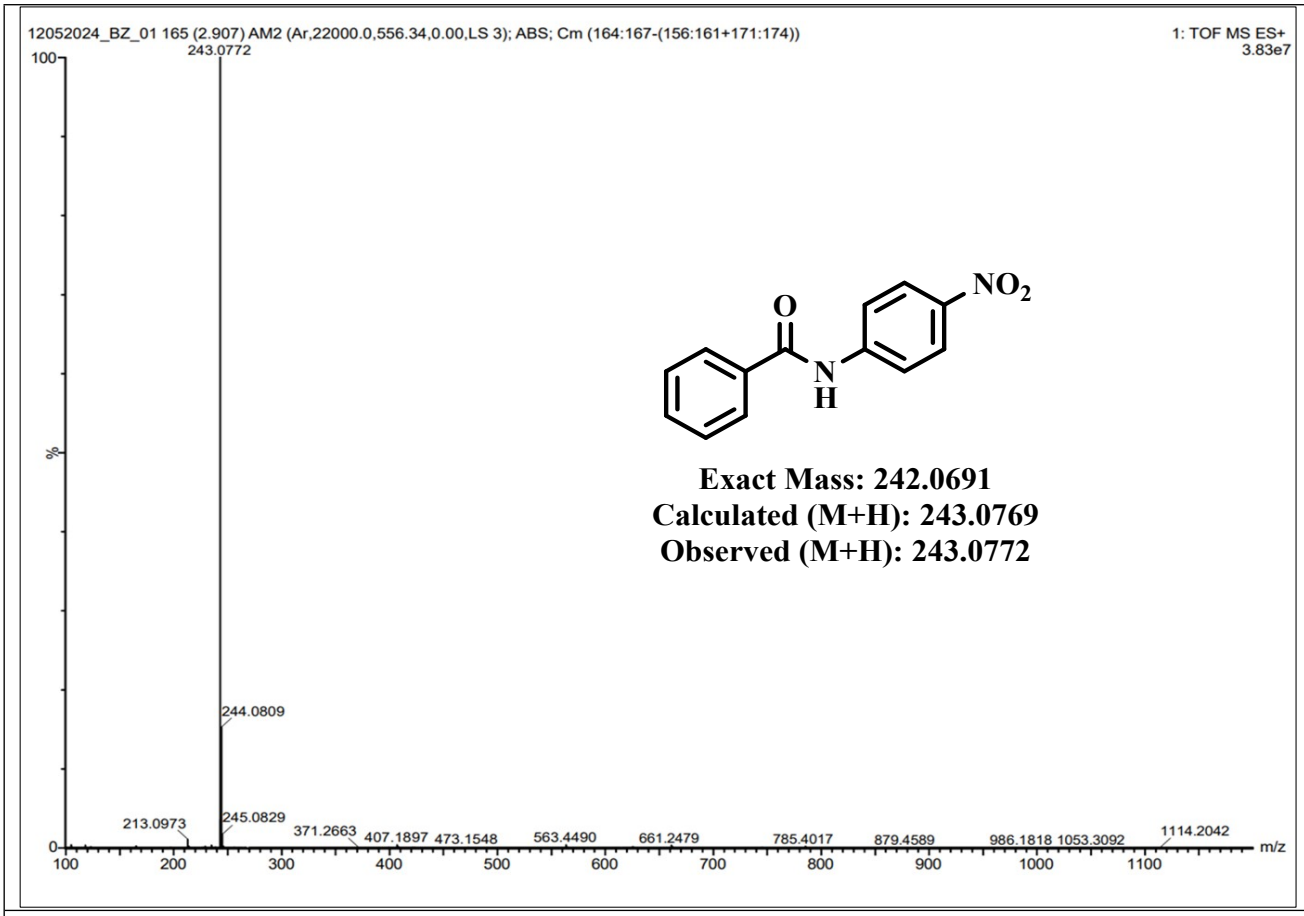



**Fig S96.** High Resolution Mass spectrum (m/z) of ***N-(4-nitrophenyl)benzamide (b1$_i$)***

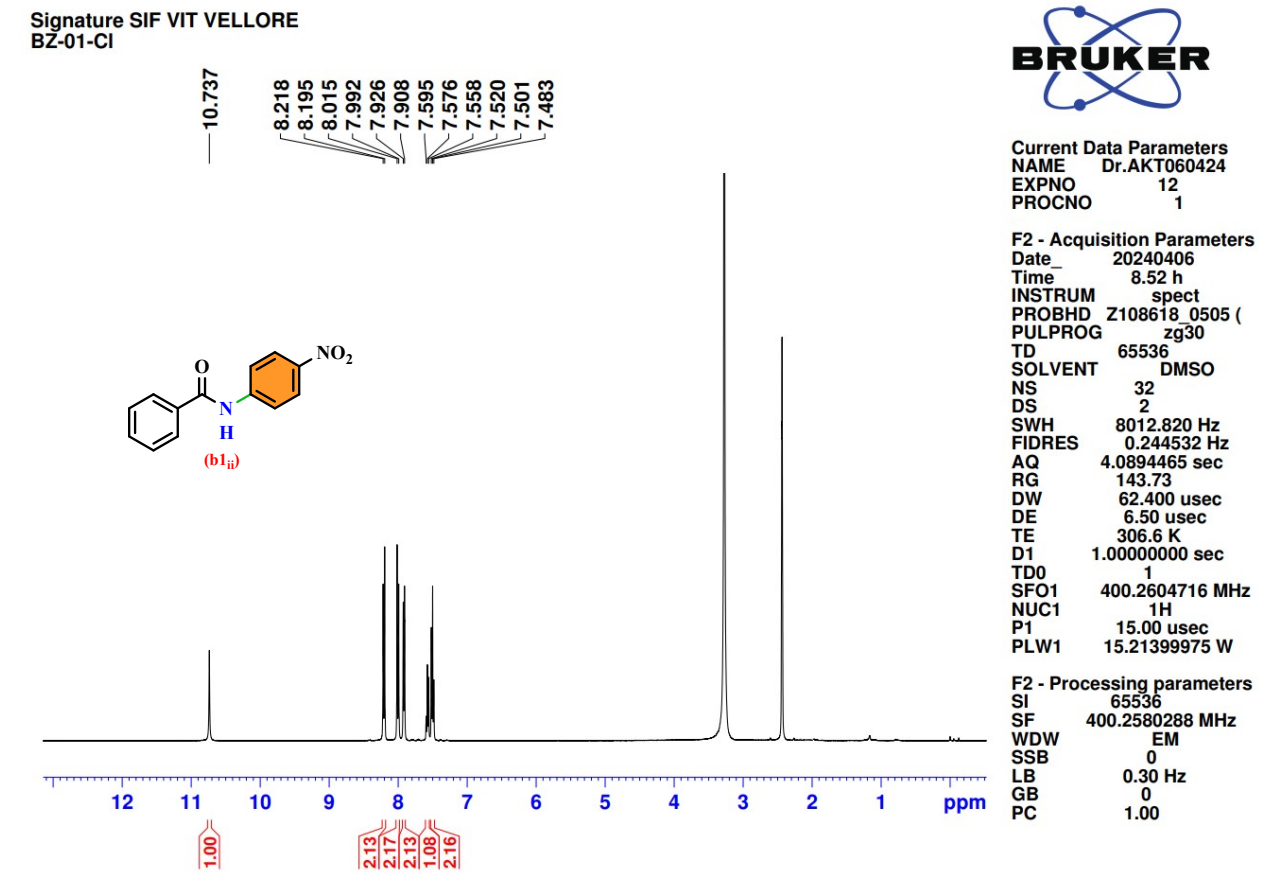



**Fig S97.** $^1$H NMR spectrum of ***N-(4-nitrophenyl)benzamide (b1$_{ii}$)***

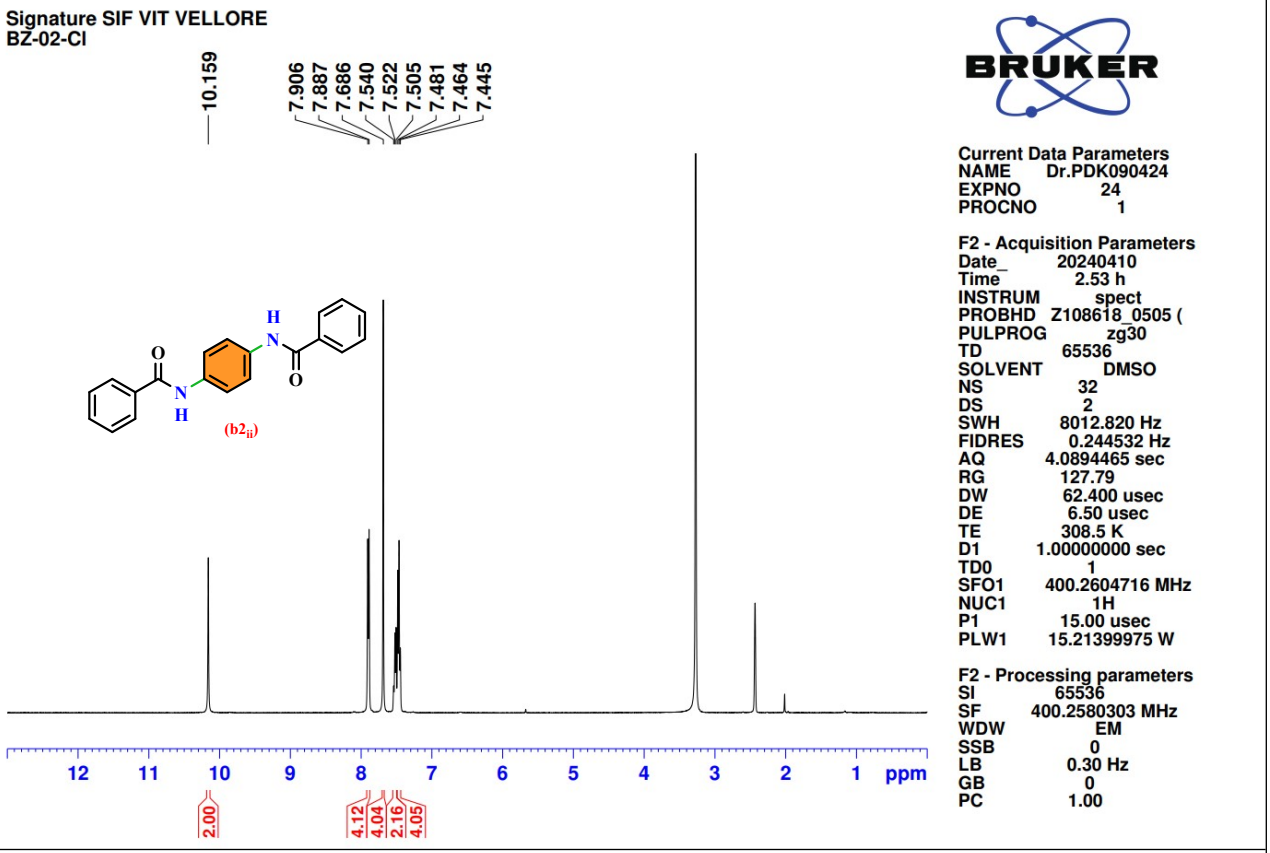



**Fig S98.** $^{1}$H NMR spectrum of ***N,N'-(1,4-phenylene)dibenzamide (b2$_{ii}$)***

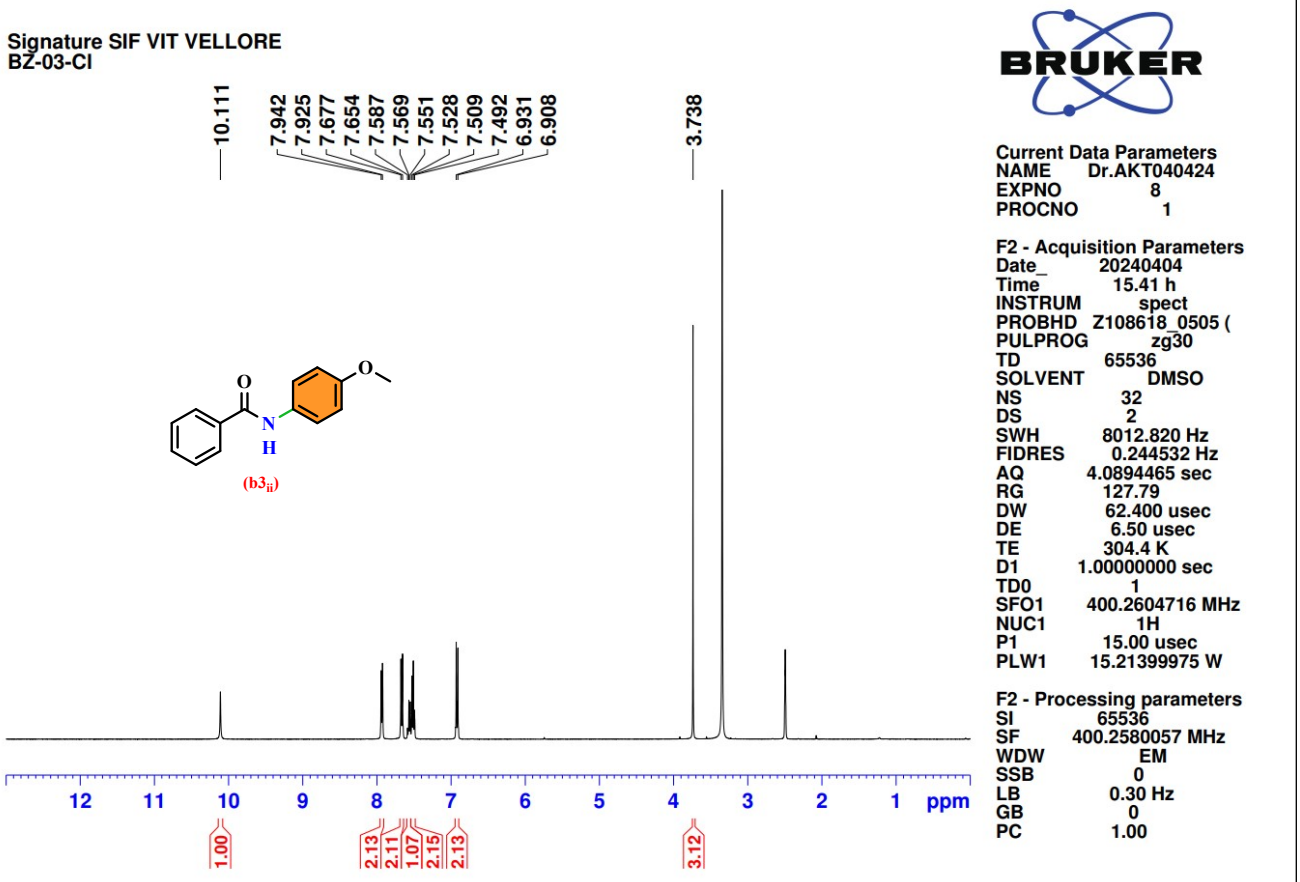



**Fig S99.** $^{1}$H NMR spectrum of ***N-(4-methoxyphenyl)benzamide (b3$_{ii}$)***

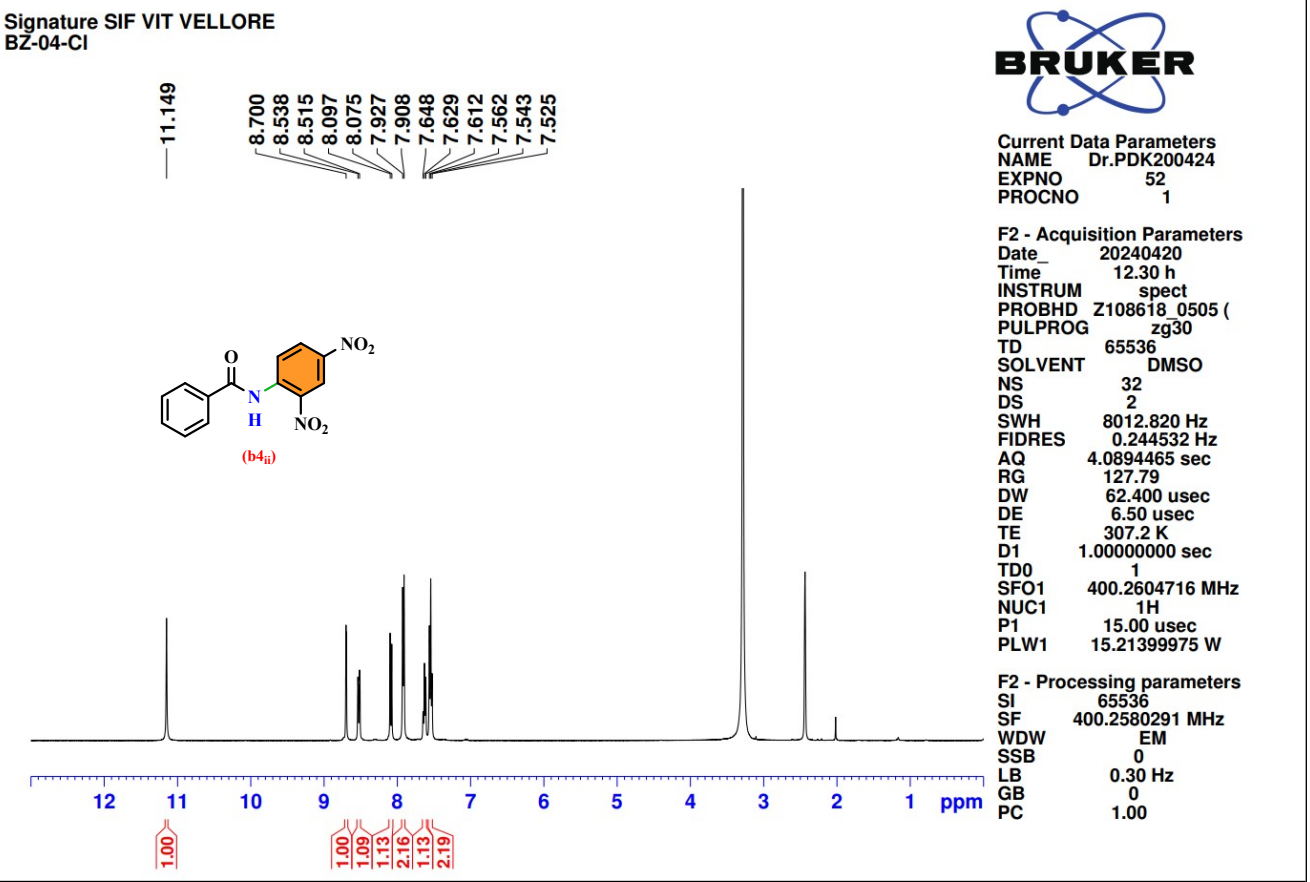



**Fig S100.** $^{1}$H NMR spectrum of ***N-(2,4-dinitrophenyl)benzamide (b4$_{ii}$)***

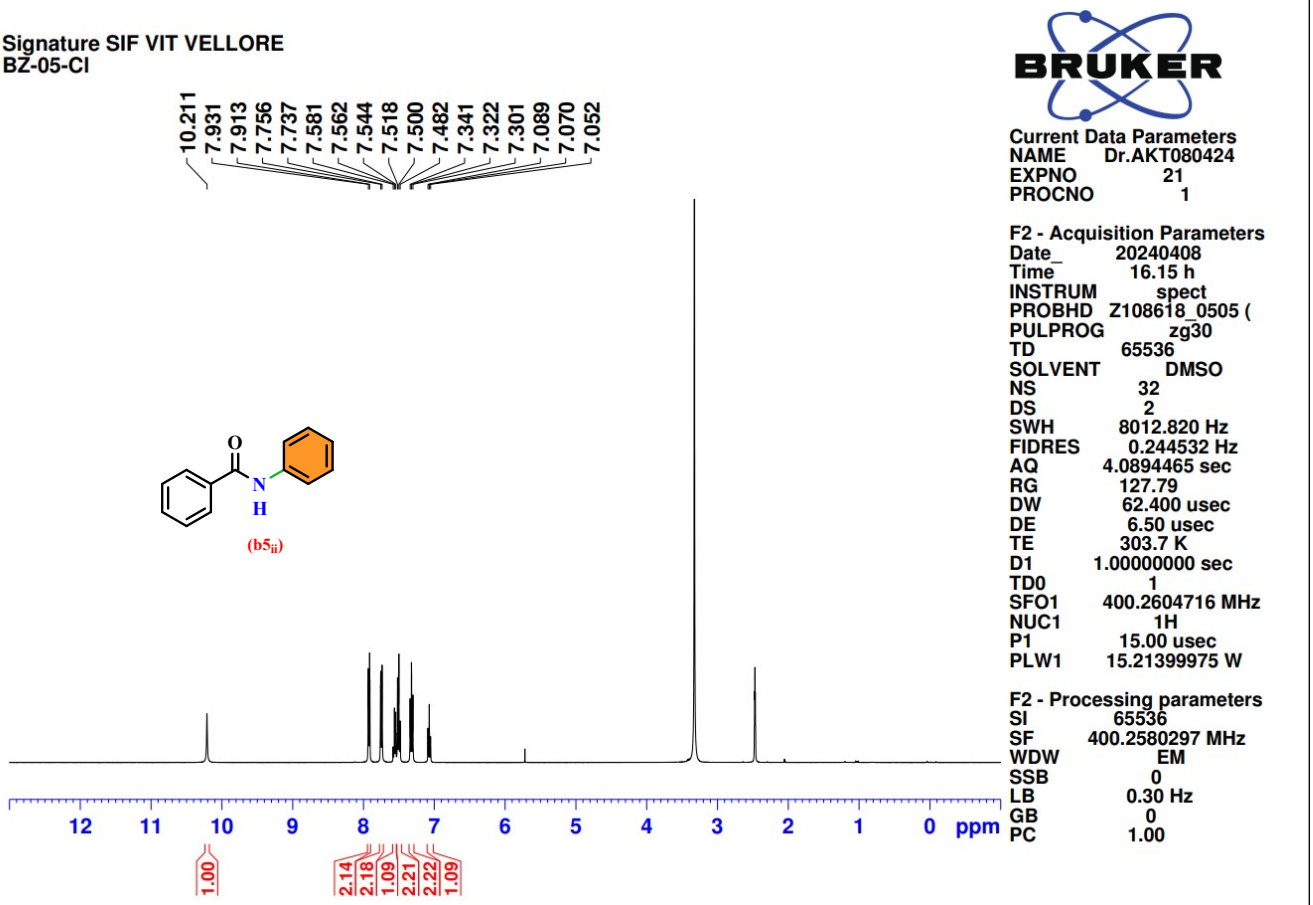



**Fig S101.** $^{1}$H NMR spectrum of ***N-phenylbenzamide (b5$_{ii}$)***

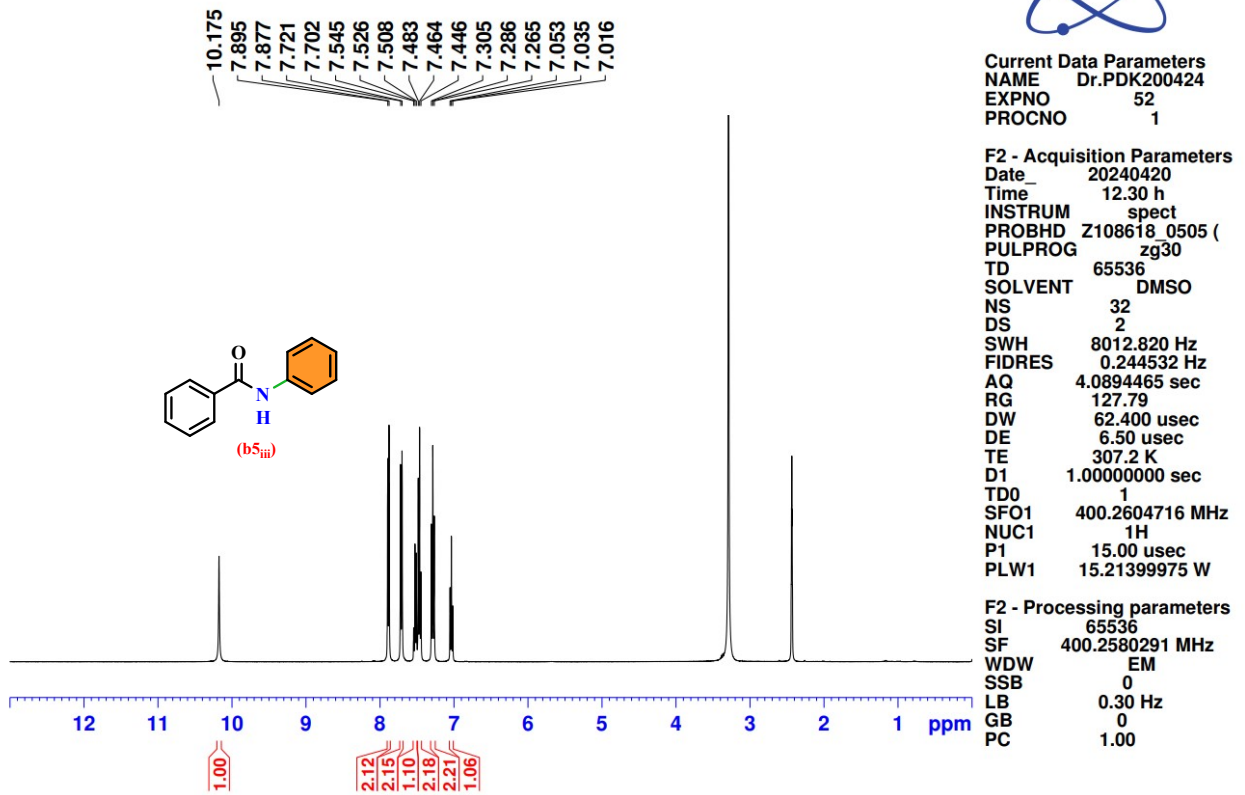



**Fig S102.** $^{1}$H NMR spectrum of ***N-phenylbenzamide (b5$_{iii}$)***

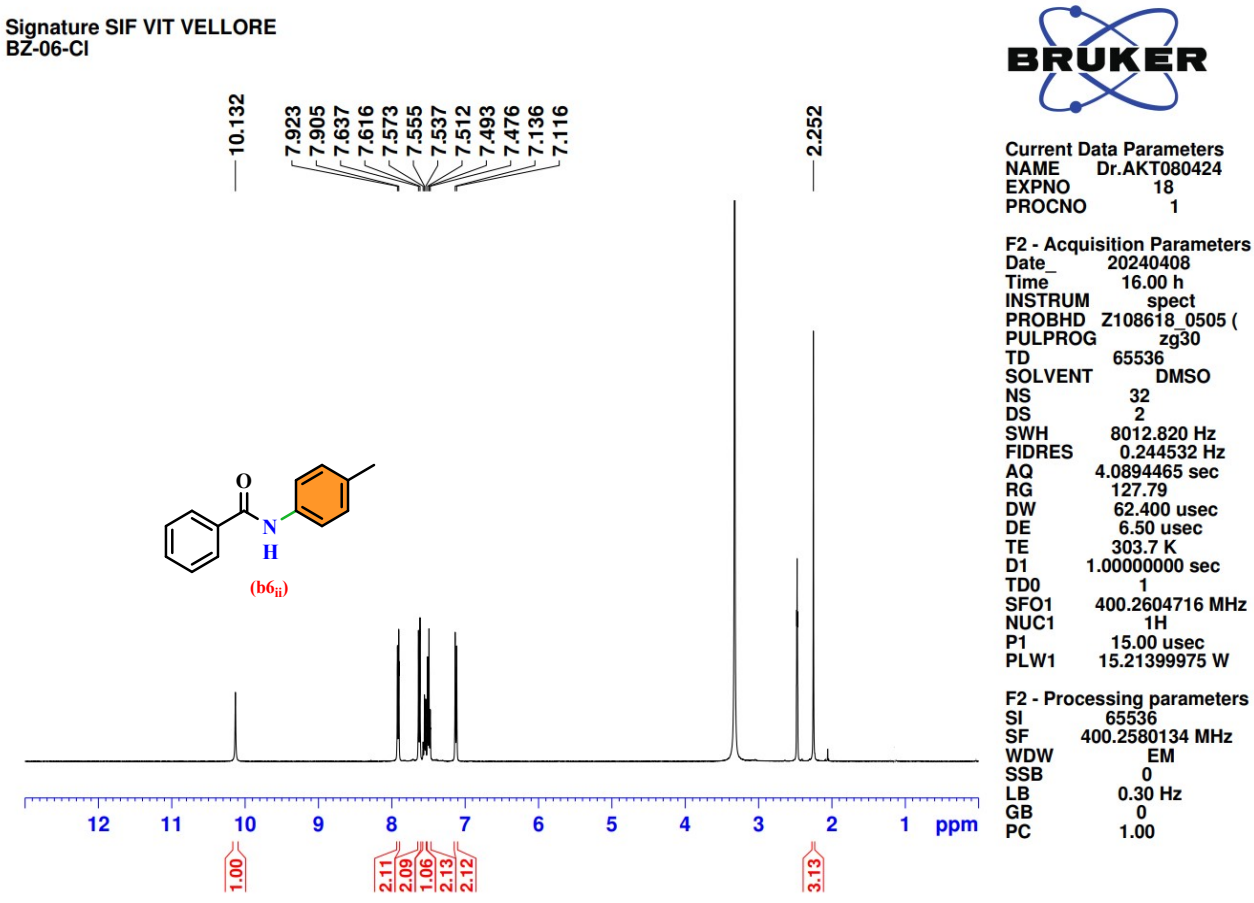



**Fig S103.** $^{1}$H NMR spectrum of ***N-(p-tolyl)benzamide (b6)***

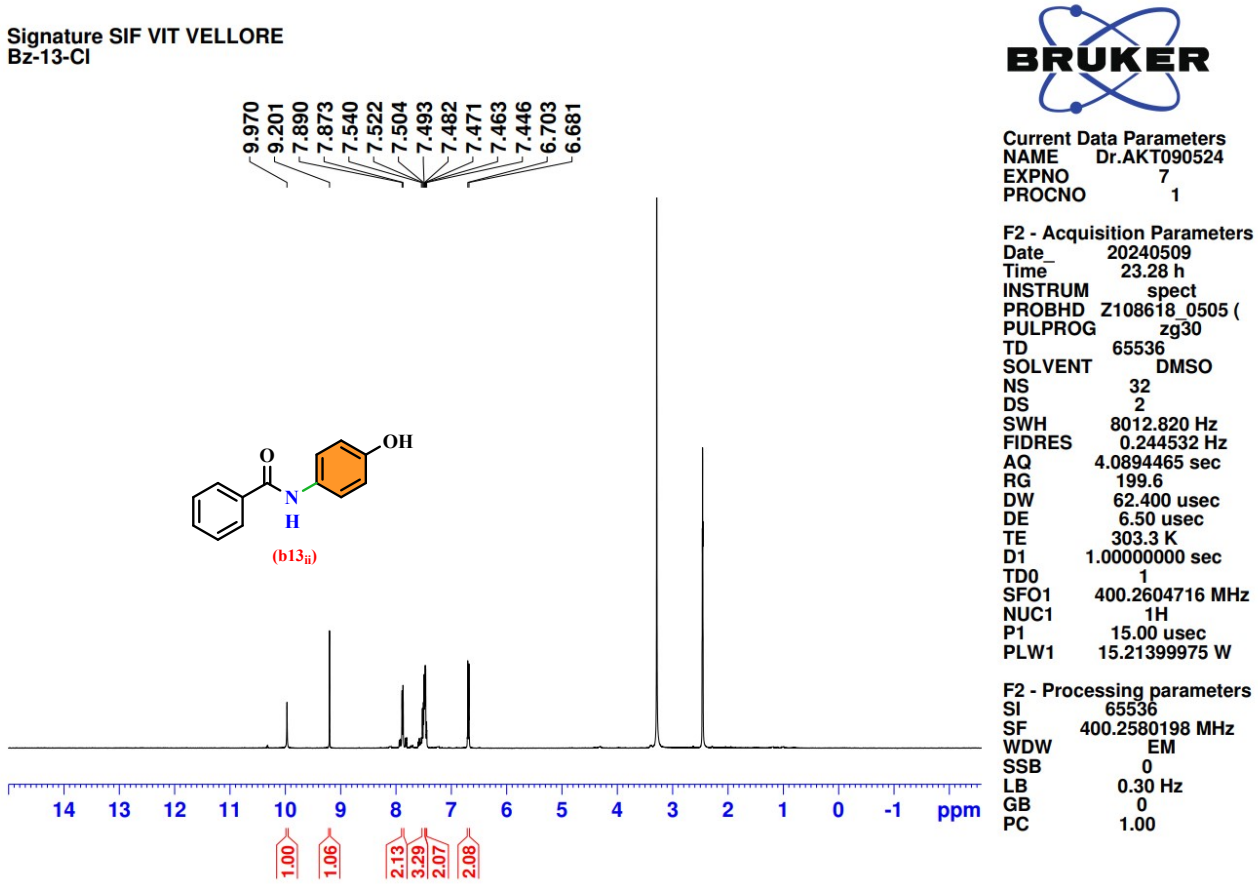



**Fig S104.** $^{1}$H NMR spectrum of ***N-(4-hydroxyphenyl)benzamide (b13$_{ii}$)***

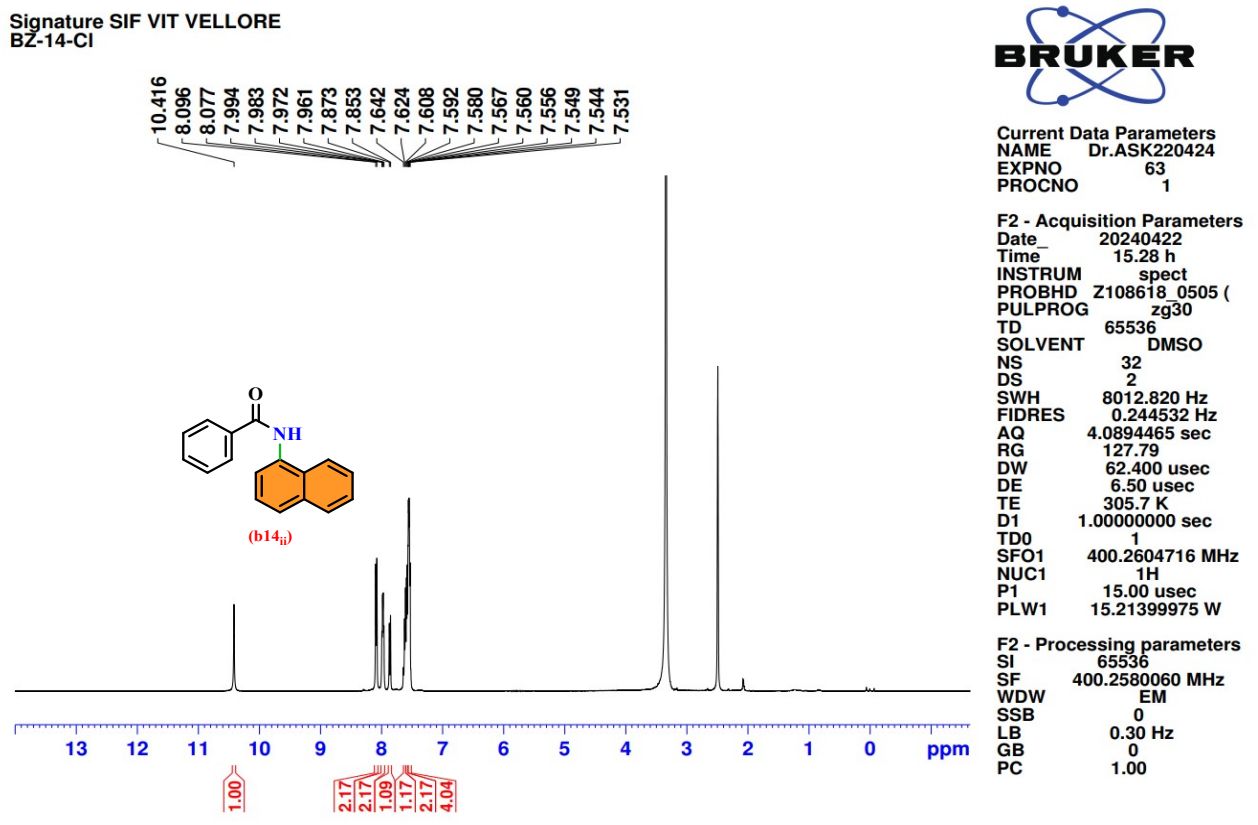



**Fig S105.** $^{1}$H NMR spectrum of ***N-(naphthalen-1-yl)benzamide (b14$_{ii}$)***

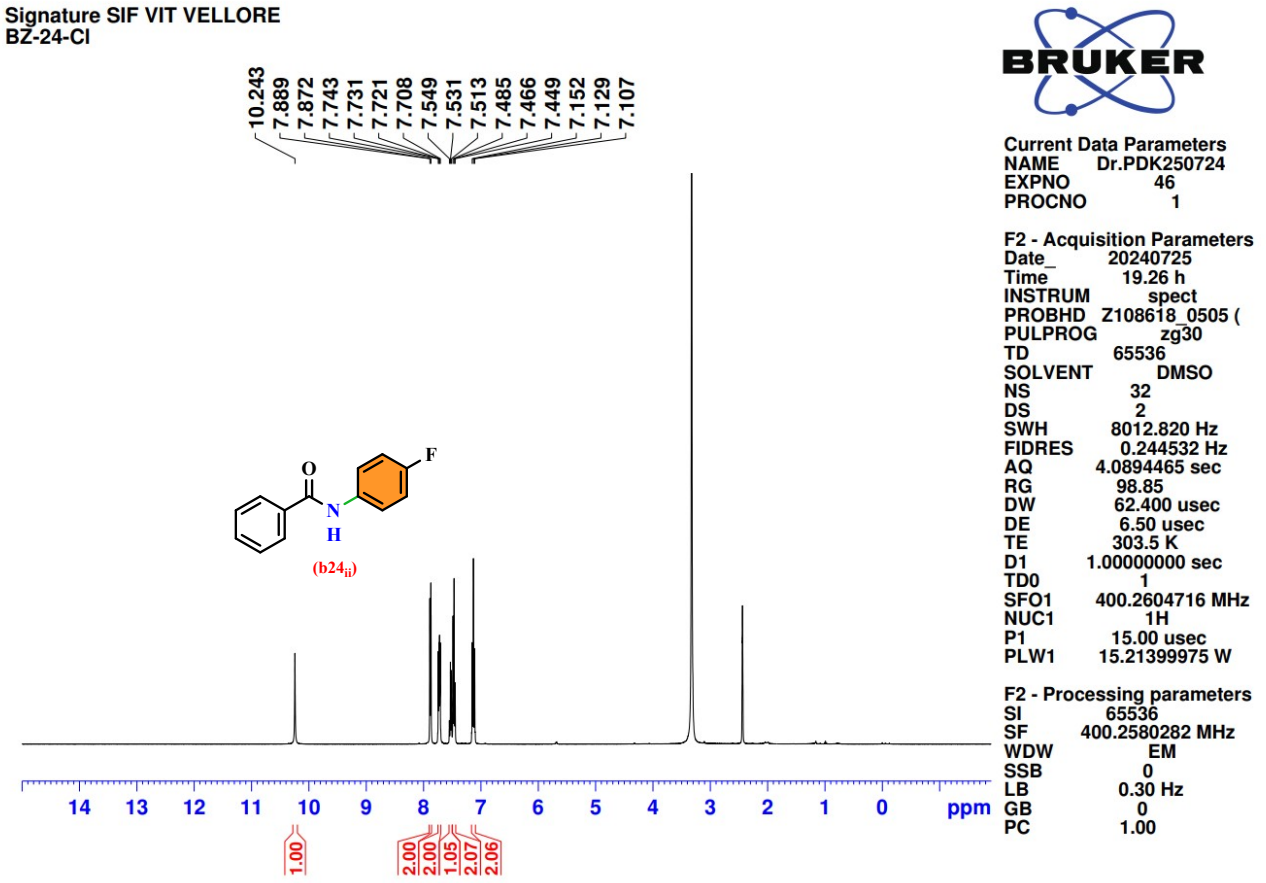
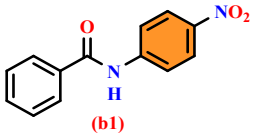
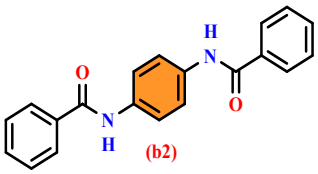
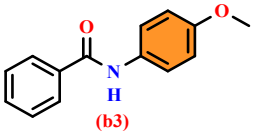
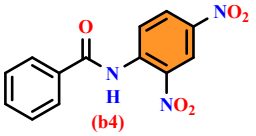
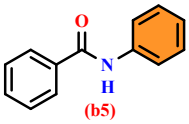
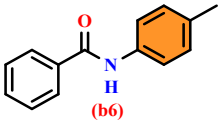
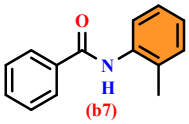
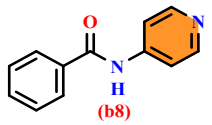
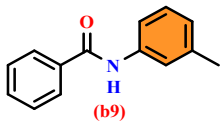
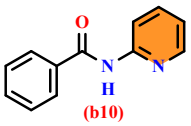
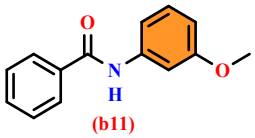
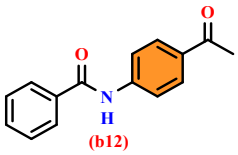
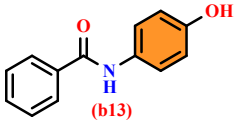
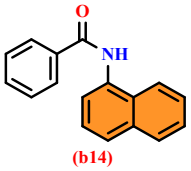



**Fig S106.** $^{1}$H NMR spectrum of ***N-(4-fluorophenyl)benzamide (b24$_{ii}$)***

**Table S2.** Spectral data of Products

| Sr. No | CODE | Characterization Data | Derivative Structure |
|---|---|---|---|
| 1. | $b1_i$ | $^1$H NMR 400 MHz, DMSO-d6: δ 10.80 (s, 1H), 8.28 (d, J = 8.80 Hz, 2H), 8.08 (d, J = 8.40 Hz, 2H), 7.99 (d, J = 8.00 Hz, 2H), 7.65 (t, J = 6.80 Hz, 1H), 7.58 (t, J = 7.60 Hz, 2H). $^{13}$C NMR 100 MHz, DMSO-d6: δ 166.78, 145.97, 142.94, 134.71, 132.66, 129, 128.39, 125.28, 120.32. GCMS exact m/z$^+$ 242.0691 & observed m/z$^+$ 242.1669. HRMS calculated (M+H) 243.0691 & observed (M+H) 243.0772. |  (b1) |
| 2. | $b2_i$ | $^1$H NMR 400 MHz, DMSO-d6: δ 10.16 (s, 2H), 7.90 (d, J = 7.60 Hz, 4H), 7.69 (s, 4H), 7.52 (t, J = 6.80 Hz, 2H), 7.46 (t, J = 7.60 Hz, 4H). $^{13}$C NMR 100 MHz, DMSO-d6: δ 165.79, 135.46, 135.44, 131.94, 128.84, 128.06, 121.14. GCMS exact m/z 316.1212 & observed m/z is 316.1663. |  (b2) |
| 3. | $b3_i$ | $^1$H NMR 400 MHz, DMSO-d6: δ 10.04 (s, 1H), 7.87 (d, J = 6.80 Hz, 2H), 7.60 (d, J = 8.80 Hz, 2H), 7.51 (t, J = 7.20 Hz, 1H), 7.45 (t, J = 6.80 Hz, 2H), 6.86 (d, J = 9.20 Hz, 2H), 3.68 (s, 3H). $^{13}$C NMR 100 MHz, DMSO-d6: δ 165.58, 156.03, 135.52, 132.69, 131.83, 128.81, 127.99, 122.46, 114.21, 55.66. GCMS exact m/z 227.0946 & observed m/z is 227.2144. |  (b3) |
| 4. | $b4_i$ | $^1$H NMR 400 MHz, DMSO-d6: δ 11.16 (s, 1H), 8.69 (s, 1H), 8.53 (d, J = 9.20 Hz, 1H), 8.07 (d, J = 8.80 Hz, 1H), 7.92 (d, J = 7.20 Hz, 2H), 7.63 (t, J = 7.20 Hz, 1H), 7.54 (t, J = 7.20 Hz, 1H). $^{13}$C NMR 100 MHz, DMSO-d6: δ 166.05, 143.29, 141.34, 137.87, 133.41, 133.36, 129.34, 129.13, 128.40, 126.03, 121.67. GCMS exact m/z 287.0542 & observed m/z is 287.1621. |  (b4) |
| 5. | $b5_i$ | $^1$H NMR 400 MHz, DMSO-d6: δ 10.17 (s, 1H), 7.89 (d, J = 6.80 Hz, 2H), 7.71 (d, J = 7.60 Hz, 2H), 7.53 (t, J = 7.20 Hz, 1H), 7.46 (t, J = 6.80 Hz, 2H), 7.29 (t, J = 8.40 Hz, 2H), 7.03 (t, J = 7.20 Hz, 1H). $^{13}$C NMR 100 MHz, DMSO-d6: δ 166.03, 139.63, 135.46, 132.00, 129.06, 128.85, 128.11, 124.13, 120.84. GCMS exact m/z 197.0841 & observed m/z is 197.4289. |  (b5) |
| 6. | $b6_i$ | $^1$H NMR 400 MHz, DMSO-d6: δ 10.09 (s, 1H), 7.87 (d, J = 7.20 Hz, 2H), 7.59 (d, J = 8.40 Hz, 2H), 7.51 (t, J = 7.20 Hz, 1H), 7.45 (t, J = 7.20 Hz, 2H), 7.09 (d, J = 8.40 Hz, 2H), 2.21(s, 3H). $^{13}$C NMR 100 MHz, DMSO-d6: δ 165.80, 137.10, 135.52, 133.07, 131.90, 129.44, 128.81, 128.05, 120.87, 20.96. GCMS exact m/z 211.0997 & observed m/z is 211.2645. |  (b6) |
| 7. | b7 | $^1$H NMR 400 MHz, DMSO-d6: δ 9.90 (s, 1H), 8.01 (d, J = 6.80 Hz, 2H), 7.59 (t, J = 7.20 Hz, 1H), 7.52 (t, J = 6.80 Hz, 2H), 7.37 (d, J = 7.60 Hz, 1H), 7.27 (d, J = 7.60 Hz, 1H), 7.22 (t, J = 7.20 Hz, 1H), 7.17 (t, J = 6.80 Hz, 1H), 2.25 (s, 3H). $^{13}$C NMR 100 MHz, DMSO-d6: δ 165.80, 136.92, 135.04, 134.23, 131.98, 130.79, 128.88, 128.12, 127.11, 126.47, 18.40. GCMS exact m/z 211.0997 & |  (b7) |

| | | | |
|---|---|---|---|
| | | observed m/z is 211.1141. | |
| 8. | b8 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.11 (s, 1H), 7.93 (d, J = 6.80 Hz, 2H), 7.66 (d, J = 9.20 Hz, 2H), 7.57 (t, J = 7.20 Hz, 1H), 7.51 (t, J = 6.80 Hz, 2H), 6.92 (d, J = 8.80 Hz, 2H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 165.58, 135.51, 132.68, 131.84, 12881, 127.99, 122.46, 114.20. GCMS exact m/z 198.0793 & observed m/z is 198.1938. |  <br>(b8) |
| 9. | b9 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.09 (s, 1H), 7.88 (d, J = 7.20 Hz, 2H), 7.55 (d, J = 7.60 Hz, 2H), 7.51 (t, J = 5.20 Hz, 1H), 7.46 (t, J = 6.80 Hz, 2H), 7.16 (t, J = 7.60 Hz, 1H), 6.86 (d, J = 7.20 Hz, 1H), 2.24 (s, 3H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 165.95, 139.54, 138.21, 135.48, 131.97, 128.90, 128.84, 128.08, 124.83, 121.38, 118.03, 21.69. GCMS exact m/z 211.0977 & observed m/z is 211.2772. |  <br>(b9) |
| 10. | b10 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.74 (s, 1H), 8.18 (d, J = 8.40 Hz, 1H), 8.02 (d, J = 7.20 Hz, 1H), 7.75 (d, J = 7.20 Hz, 2H), 7.57 (t, J = 6.40 Hz, 1H), 7.51 (t, J = 7.20 Hz, 2H), 7.43 (t, J = 7.60 Hz, 2H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 166.50, 148.39, 145.20, 138.59, 134.85, 133.10, 129.45, 128.43, 122.87, 120.30. GCMS exact m/z 198.0793 & observed m/z is 198.1018. |  <br>(b10) |
| 11. | b11 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.21 (s, 1H), 7.94 (d, J = 6.80 Hz, 2H), 7.59 (t, J = 6.40 Hz, 1H), 7.53 (t, J = 6.80 Hz, 2H), 7.47 (s, 1H), 7.37 (d, J = 8.00 Hz, 1H), 7.25 (t, J = 8.40 Hz, 1H), 6.68 (d, J = 8.40 Hz, 1H), 3.75 (s, 3H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 166.05, 159.89, 140.83, 135.43, 132.05, 129.85, 128.85, 128.10, 113.00, 109.62, 106.48, 55.48. GCMS exact m/z 227.0946 & observed m/z is 227.1035. |  <br>(b11) |
| 12. | b12 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.53 (s, 1H), 7.92-7.95 (m, 6H), 7.61 (t, J = 6.40 Hz, 1H), 7.54 (t, J = 8.00 Hz, 2H), 2.54 (s, 3H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 197.09, 166.48, 144.06, 135.05, 132.54, 129.74, 128.92, 128.26, 119.95, 26.92. GCMS exact m/z 239.0946 & observed m/z is 239.0987. |  <br>(b12) |
| 13. | b13$_i$ | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.00 (s, 1H), 9.23 (s, 1H), 7.91 (d, J = 7.20 Hz, 2H), 7.54 (d, J = 7.20 Hz, 2H), 7.52 (t, J = 2.40 Hz, 1H), 7.51 (t, J = 2.80 Hz, 2H), 6.72 (d, J = 8.80 Hz, 2H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 165.32, 154.16, 135.63, 131.73, 131.15, 128.78, 127.95, 122.72, 115.42. GCMS exact m/z 213.0790 & observed m/z is 213.2923. |  <br>(b13) |
| 14. | b14$_i$ | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.40 (s, 1H), 8.09 (d, J = 7.60 Hz, 2H), 7.96-7.97 (m, 2H), 7.86 (d, J = 8.00 Hz, 1H), 7.53-7.64 (m, 7H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 166.67, 134.95, 134.33, 134.25, 132.11, 129.71, 128.92, 128.53, 128.25, 126.75, 126.52, 126.43, 126.01, 124.37, 123.78. GCMS exact m/z 247.0997 & observed m/z is 247.2688. |  <br>(b14) |
| 15. | b15 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.34 (s, 1H), 7.94 | |

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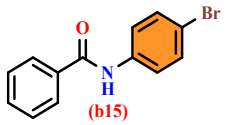
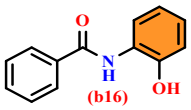
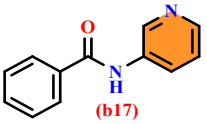
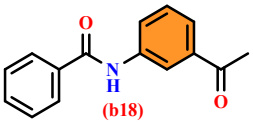
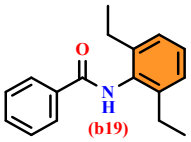
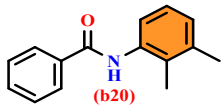
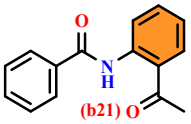
| | | (d, J = 8.00 Hz, 2H), 7.76 (d, J = 8.80 Hz, 2H), 7.59 (t, J = 6.80 Hz, 1H), 7.51-7.54 (m, 4H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 166.14, 139.04, 135.17, 132.18, 131.89, 128.89, 128.13, 122.72, 115.81. GCMS exact m/z 274.9946 & observed m/z is 275.0620. |  |
| 16. | b16 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 9.74 (s, 1H), 9.50 (s, 1H), 7.97 (d, J = 7.60 Hz, 2H), 7.69 (d, J = 7.60 Hz, 1H), 7.61 (t, J = 6.80 Hz, 1H), 7.54 (t, J = 7.20 Hz, 2H), 7.05 (t, J = 7.60 Hz, 1H), 6.93 (d, J = 8.00 Hz, 1H), 6.85 (t, J = 7.60 Hz, 1H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 165.93, 149.76, 134.81, 132.15, 128.99, 127.94, 126.36, 126.16, 124.52, 119.54, 116.48. GCMS exact m/z 213.0790 & observed m/z is 213.1008. |  |
| 17. | b17 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.44 (s, 1H), 8.93 (s, 1H), 8.31 (d, J = 4.40 Hz, 1H), 8.19 (d, J = 8.40 Hz, 1H), 7.97 (d, J = 8.00 Hz, 2H), 7.61 (t, J = 6.80 Hz, 1H), 7.54 (t, J = 8.00 Hz, 2H), 7.40 (t, J = 6.40 Hz, 1H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 166.45, 144.91, 142.34, 136.33, 134.79, 132.37, 128.95, 128.19, 127.98, 124.06. GCMS exact m/z 198.0793 & observed m/z is 198.1033. |  |
| 18. | b18 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.44 (s, 1H), 8.37 (s, 1H), 8.07 (d, J = 8.00 Hz, 1H), 7.98 (d, J = 7.60 Hz, 2H), 7.71 (d, J = 7.60 Hz, 1H), 7.61 (t, J = 6.80 Hz, 1H), 7.54 (t, J = 8.40 Hz, 2H), 7.50 (d, J = 8.00 Hz, 1H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ197.88, 165.93, 139.73, 137.47, 134.79, 131.94, 129.22, 128.62, 127.85, 125.00, 123.82, 119.89, 26.91. GCMS exact m/z 239.0946 & observed m/z is 239.0987. |  |
| 19. | b19 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 9.75 (s, 1H), 8.00 (s, 1H), 7.60 (t, J = 6.80 Hz, 1H), 7.54 (t, J = 6.80 Hz, 2H), 7.24 (t, J = 8.40 Hz, 1H), 7.16 (d, J = 7.60 Hz, 2H), 2.55 (q, J = 8.00 Hz, 4H), 1.12 (t, J = 7.60 Hz, 6H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 166.26, 142.20, 134.91, 134.67, 131.93, 128.96, 127.91, 127.79, 126.52, 24.94, 14.98. GCMS exact m/z 253.1467 & observed m/z 253.2440. |  |
| 20. | b20 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 9.92 (s, 1H), 7.99 (d, J = 7.20 Hz, 2H), 7.60 (t, J = 7.20 Hz, 1H), 7.53 (t, J = 6.80 Hz, 2H), 7.08-7.14 (m, 3H), 2.29 (s, 3H), 2.11 (s, 3H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 165.87, 140.60, 137.44, 136.74, 135.05, 131.92, 128.86, 128.06, 125.71, 125.20, 20.61, 14.69. GCMS exact m/z 225.1154 & observed m/z 225.1183. |  |
| 21. | b21 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 12.39 (s, 1H), 8.67 (d, J = 8.00 Hz, 1H), 8.13 (d, J = 8.00 Hz, 1H), 7.98 (d, J = 6.80 Hz, 2H), 7.70 (t, J = 7.20 Hz, 1H), 7.66 (t, J = 4.80 Hz, 1H), 7.62 (t, J = 6.80 Hz, 2H), 7.28 (t, J = 7.20 Hz, 1H), 2.71 (s, 3H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 204.08, 165.54, 140.19, 135.28, 135.19, 134.85, 132.74, 129.51, 127.57, 123.90, 123.64, 120.74, 29.25. GCMS exact m/z 239.0946 & observed m/z 239.2092. |  |
| 22. | b22 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.69 (s, 1H), 8.24 | |

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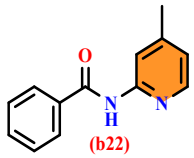
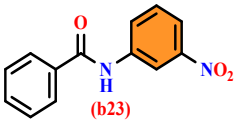
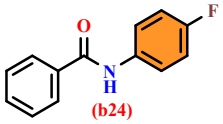
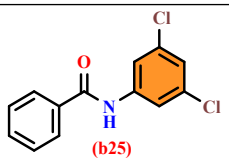
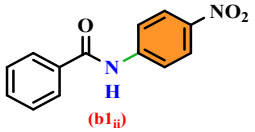
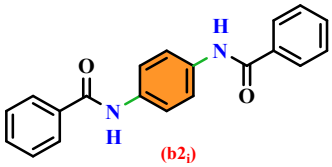
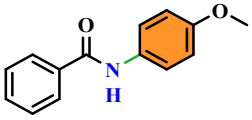
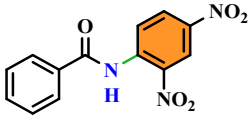
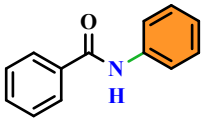
|---|---|---|---|
| | | (d, J = 4.80 Hz, 1H), 8.06 (s, 1H), 8.03 (d, J = 7.20 Hz, 2H), 7.60 (t, J = 7.20 Hz, 1H), 7.51 (t, J = 7.20 Hz, 2H), 7.02 (d, J = 4.40 Hz, 1H), 2.36 (s, 3H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 166.35, 152.69, 149.25, 148.02, 134.60, 132.35, 128.82, 128.40, 121.31, 115.60, 21.41. GCMS exact m/z 212.0950 & observed m/z 212.1805. |  <br>(b22) |
| 23. | b23 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.70 (s, 1H), 8.80 (s, 1H), 8.18 (d, J = 8.00 Hz, 1H), 7.98 (d, J = 7.20 Hz, 2H), 7.95 (d, J = 1.60 Hz, 1H), 7.66 (t, J = 3.20 Hz, 1H), 7.62 (t, J = 7.20 Hz, 1H), 7.56 (t, J = 7.20 Hz, 2H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 166.55, 148.38, 140.83, 134.68, 132.54, 130.56, 129.01, 128.24, 126.66, 118.63, 114.81. GCMS exact m/z 242.0691 & observed m/z 242.1273. |  <br>(b23) |
| 24. | b24$_{i}$ | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.32 (s, 1H), 7.96 (d, J = 7.20 Hz, 2H), 7.79-7.80 (m, 2H), 7.60 (t, J = 7.20 Hz, 1H), 7.54 (t, J = 6.80 Hz, 2H), 7.20 (t, J = 8.80 Hz, 2H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 165.95, 159.95, 157.56, 136.00, 135.97, 135.26, 132.07, 128.87, 128.09, 122.69, 122.62, 115.76, 115.54. $^{19}$F NMR 377 MHz, DMSO-d6: δ – (118.93-118.86, m, 1F). GCMS exact m/z 215.0746 & observed m/z 215.2380. |  <br>(b24) |
| 25. | b25 | $^{1}$H NMR 400 MHz, DMSO-d6: δ 7.92 (d, J = 7.60 Hz, 2H), 7.87 (S, 2H), 7.61 (t, J = 7.20 Hz, 1H), 7.54 (t, J = 6.80 Hz, 2H), 7.28 (S, 1H).<br>$^{13}$C NMR 100 MHz, DMSO-d6: δ 166.63, 141.89, 134.46, 132.61, 129.02, 128.17, 123.32, 118.75. GCMS exact m/z 265.0061 & observed m/z 265.0722. |  <br>(b25) |
| 26. | b1$_{ii}$ | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.74 (s, 1H), 8.20 (d, J = 8.80 Hz, 2H), 8.00 (d, J = 8.40 Hz, 2H), 7.91 (d, J = 8.00 Hz, 2H), 7.57 (t, J = 6.80 Hz, 1H), 7.5 (t, J = 7.60 Hz, 2H). |  <br>(b1$_{ii}$) |
| 27. | b2$_{ii}$ | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.16 (s, 2H), 7.90 (d, J = 7.60 Hz, 4H), 7.69 (s, 4H), 7.52 (t, J = 6.80 Hz, 2H), 7.46 (t, J = 7.60 Hz, 4H). |  <br>(b2$_{i}$) |
| 28. | b3$_{ii}$ | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.11 (s, 1H), 7.93 (d, J = 6.80 Hz, 2H), 7.66 (d, J = 8.80 Hz, 2H), 7.57 (t, J = 7.20 Hz, 1H), 7.5 (t, J = 6.80 Hz, 2H), 6.92 (d, J = 9.20 Hz, 2H), 3.73 (s, 3H). |  <br>(b3$_{ii}$) |
| 29. | b4$_{ii}$ | $^{1}$H NMR 400 MHz, DMSO-d6: δ 11.15 (s, 1H), 8.7 (s, 1H), 8.52 (d, J = 9.20 Hz, 1H), 8.08 (d, J = 8.80 Hz, 1H), 7.92 (d, J = 7.20 Hz, 2H), 7.63 (t, J = 7.20 Hz, 1H), 7.53 (t, J = 7.20 Hz, 1H). |  <br>(b4$_{ii}$) |
| 30. | b5$_{ii}$ | $^{1}$H NMR 400 MHz, DMSO-d6: δ 10.21 (s, 1H), 7.92 (d, J = 6.80 Hz, 2H), 7.74 (d, J = 7.60 Hz, 2H), 7.56 (t, J = 7.20 Hz, 1H), 7.49 (t, J = 6.80 Hz, 2H), 7.32 (t, J = 8.40 Hz, 2H), 7.06 (t, J = 7.20 Hz, 1H). |  <br>(b5$_{ii}$) |

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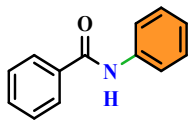
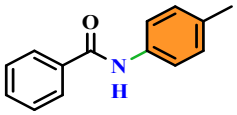
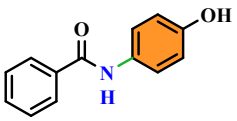
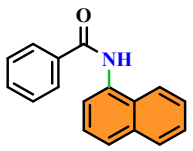
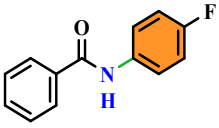
| 31. | $b5_{iii}$ | $^1$H NMR 400 MHz, DMSO-d6: δ 10.18 (s, 1H), 7.89 (d, J = 6.80 Hz, 2H), 7.71 (d, J = 7.60 Hz, 2H), 7.52 (t, J = 7.20 Hz, 1H), 7.46 (t, J = 6.80 Hz, 2H), 7.29 (t, J = 8.40 Hz, 2H), 7.02 (t, J = 7.20 Hz, 1H). |  ($b5_{iii}$) |
| 32. | $b6_{ii}$ | $^1$H NMR 400 MHz, DMSO-d6: δ 10.13 (s, 1H), 7.91 (d, J = 7.20 Hz, 2H), 7.62 (d, J = 8.40 Hz, 2H), 7.55 (t, J = 7.20 Hz, 1H), 7.49 (t, J = 7.20 Hz, 2H), 7.12 (d, J = 8.40 Hz, 2H), 2.25(s, 3H). |  ($b6_{ii}$) |
| 33. | $b13_{ii}$ | $^1$H NMR 400 MHz, DMSO-d6: δ 9.97 (s, 1H), 9.2 (s, 1H), 7.88 (d, J = 7.20 Hz, 2H), 7.52 (d, J = 7.20 Hz, 2H), 7.49 (t, J = 2.40 Hz, 1H), 7.46 (t, J = 2.80 Hz, 2H), 6.69 (d, J = 8.80 Hz, 2H). |  ($b13_{ii}$) |
| 34. | $b14_{ii}$ | $^1$H NMR 400 MHz, DMSO-d6: δ 10.42 (s, 1H), 8.09 (d, J = 7.60 Hz, 2H), 7.96-7.99 (m, 2H), 7.86 (d, J = 8.00 Hz, 1H), 7.53-7.64 (m, 7H). |  ($b14_{ii}$) |
| 35. | $b24_{ii}$ | $^1$H NMR 400 MHz, DMSO-d6: δ 10.24 (s, 1H), 7.88 (d, J = 7.20 Hz, 2H), 7.71-7.74 (m, 2H), 7.53 (t, J = 7.20 Hz, 1H), 7.47 (t, J = 6.80 Hz, 2H), 7.13 (t, J = 8.80 Hz, 2H). |  ($b24_{ii}$) |

**ICP-MS of PcCFP Photocatalyst**

A quantity of 1 mg of PC was dissolved in 4 mL of aqua regia within a borosilicate glass beaker until complete dissolution was achieved. The resulting transparent solution was subsequently transferred to a 100 mL volumetric flask, where double distilled water was added to bring the total volume to 100 mL. This final volume corresponds to a 10ppm solution of the photocatalyst. From this 100 mL solution, 0.5 mL was extracted using a pipette and added to a 10 mL volumetric flask, which was then filled with double distilled water to achieve a total volume of 10 mL. This preparation results in a concentration of 0.5 ppm, equivalent to 500 ppb, necessary for the sample preparation.

The ICP-MS analysis was carried out by using 500ppb of solution and the metals are detected in Below Detection Limit (BDL)

**Table S3.** Metal detection in Photocatalyst by ICP-MS

| **Sample ID** | **Cu 63 (ppb)** | **Fe 57 (ppb)** | **Ni 60 (ppb)** | **Zn 66 (ppb)** | **Pd 106 (ppb)** | **Ir 193 (ppb)** |
|---|---|---|---|---|---|---|
| Standard 1 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| Standard 2 | 9.960 | 9.270 | 9.992 | 9.555 | 9.999 | 9.924 |
| Standard 3 | 49.949 | 47.653 | 49.998 | 49.613 | 50.056 | 52.032 |
| Standard 4 | 100.069 | 95.294 | 100.367 | 99.412 | 109.008 | 110.906 |
| Standard 5 | 215.366 | 192.887 | 200.236 | 199.040 | | |
| | | | | | | |
| PcCFP | 4.947 | 9.401 | 0.898 | 20.488 | 0.033 | 0.007 |