Electronic Supplementary Material (ESI) for Green Chemistry.

Supporting Information

A simple continuous reaction for synthesis of quinoline compounds

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1. EDS spectra of catalyst

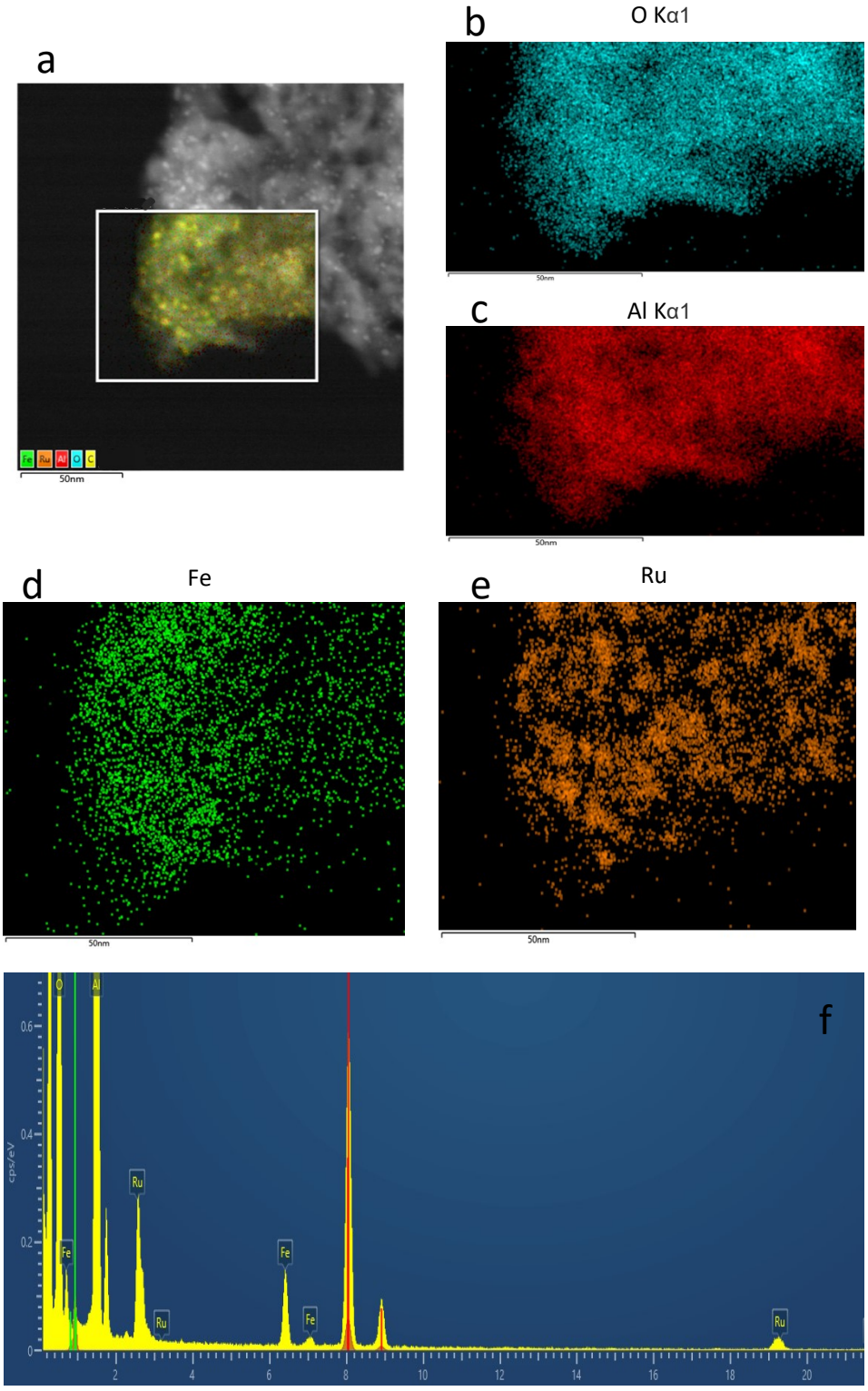


Fig. S1 EDS spectra of the Ru-Fe/γ-Al_2O_3 catalyst

2. Related experimental data

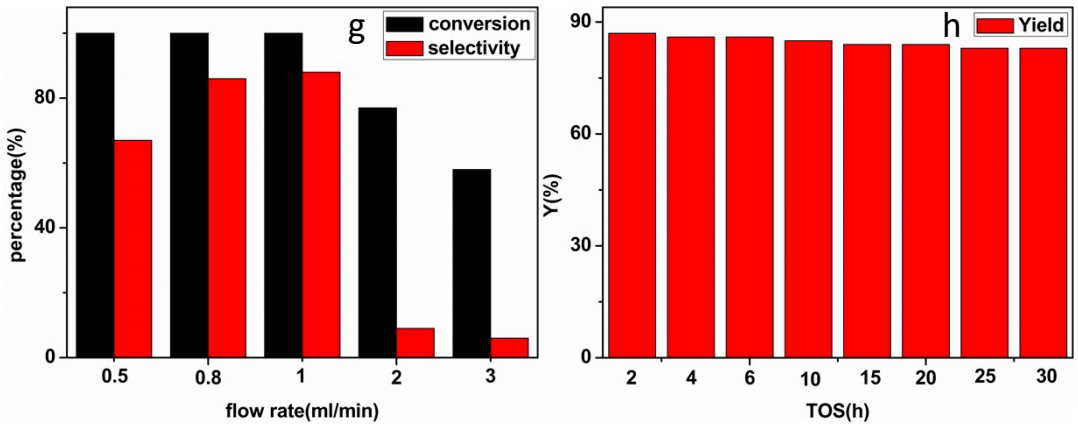


Fig. S2 Catalytic properties of flow rate (g) and stability of catalysts (h). Common reaction conditions: 2wt% m-dinitrobenzene, 3 MPa, 5 g catalysts, 180 °C.

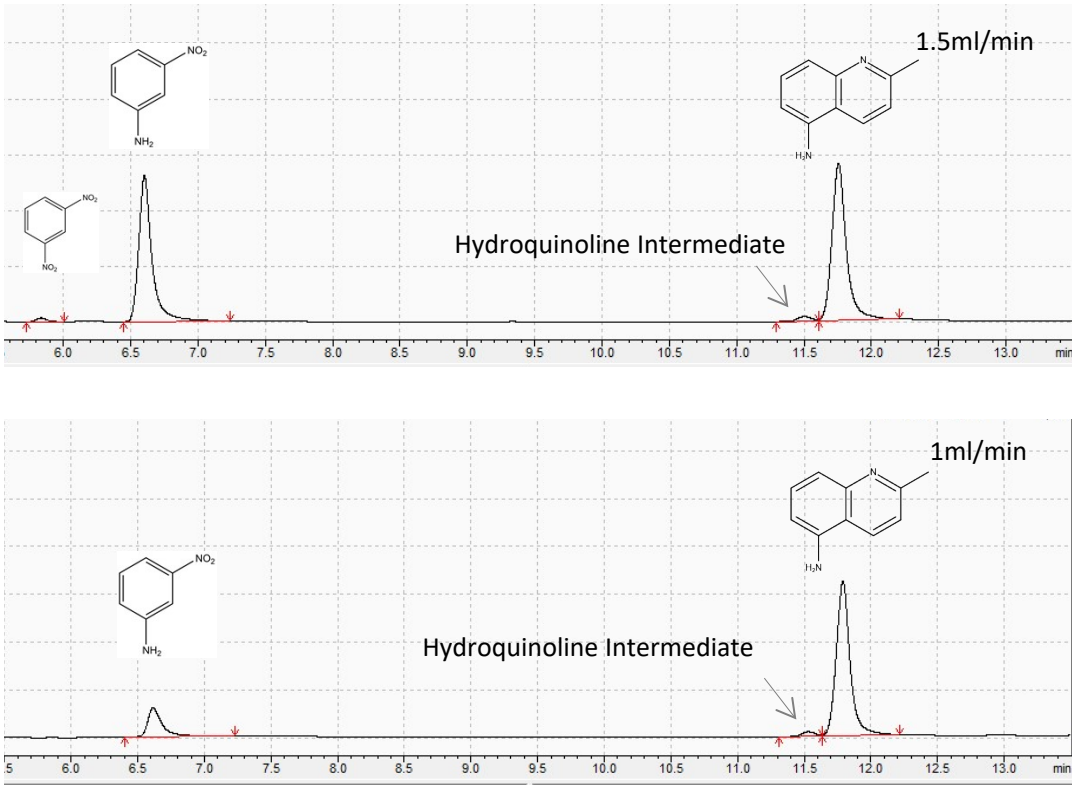


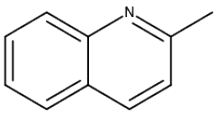
Fig. S3 GC spectrum at two different flow rates. (GC conditions: Detector temperature: 250°C, vaporization chamber temperature: 230°C, column temperature: 150°C, 2°C/min to 160°C, keep for one minute and then 5°C/min to 200°C, Keep for one minute.). Common reaction conditions: 2wt% m-dinitrobenzene, 3 MPa, 5 g catalysts, 180 °C.

Table. S1 Some reactions on the mechanism

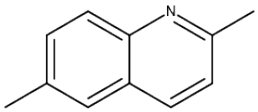
Raw material	Conversion/%	Selectivity[a]/%
m-Nitroaniline	96	70
Aniline	20	-
Aniline and 2-butenal	50	20

Reaction conditions: c (substrate) = 2wt%, 3 MPa, 1 ml/min, 5 g catalysts, ethanol-water ratios: 4:6 (V: V). [a]Corresponding to the selectivity of quinoline compounds, the main by-products are N-alkylations.

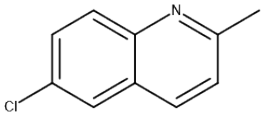
3. Analytical Data for Products



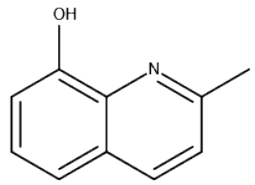
2-Methylquinoline[1], ^{1}H NMR (500 MHz, Chloroform-d): δ=7.93 (d, J = 8.4 Hz, 1H), 7.76 (d, J = 8.4 Hz, 1H), 7.56–7.47 (m, 2H), 7.27 (ddd, J = 8.1, 6.8, 1.2 Hz, 1H), 7.01 (d, J = 8.4 Hz, 1H), 2.57 (s, 3H). ^{13}C NMR (126 MHz, CDCl3): δ=158.13, 147.42, 135.29, 128.72, 128.20, 126.96, 125.91, 124.99, 121.25, 24.75.



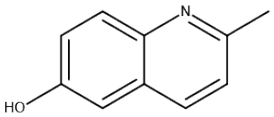
2,6-Dimethylquinoline[2],^{1}H NMR (500 MHz, Chloroform-d): δ=7.93 (t, J = 8.0 Hz, 2H), 7.50 (dd, J = 9.2, 1.4 Hz, 2H), 7.23 (d, J = 8.4 Hz, 1H), 2.72 (s, 3H), 2.51 (s, 3H). ^{13}C NMR (126 MHz, CDCl3): δ= 157.94, 146.40, 135.52, 135.34, 131.61, 128.26, 126.47, 126.35, 121.92, 25.19, 21.43.



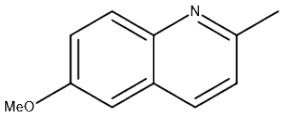
6-Chloro-2-methylquinoline[3], ^{1}H NMR (500 MHz, Chloroform-d): δ=7.93 (dd, J = 8.6, 3.7 Hz, 2H), 7.73 (d, J = 2.3 Hz, 1H), 7.60 (dd, J = 9.0, 2.4 Hz, 1H), 7.29 (s, 1H), 2.73 (s, 3H). ^{13}C NMR (126 MHz, CDCl3): δ=159.32, 146.24, 135.13, 131.25, 130.27, 130.21, 127.03, 126.12, 122.81, 25.32.



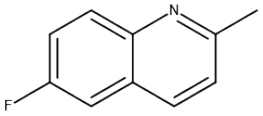
2-Methyl-8-quinolinol[3], ^{1}H NMR (500 MHz, DMSO-d6): δ=9.44 (s, 1H), 8.16 (d, J = 8.4 Hz, 1H), 7.45–7.27 (m, 3H), 7.08 (dd, J = 7.2, 1.7 Hz, 1H), 2.67 (s, 3H). ^{13}C NMR (126 MHz, DMSO): δ= 157.10, 152.95, 138.26, 136.55, 127.38, 126.82, 123.02, 118.00, 111.49, 25.14.



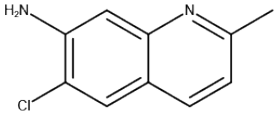
6-Hydroxy-2-methylquinoline, ^{1}H NMR (500 MHz, DMSO-d6): δ=9.83 (s, 1H), 8.02 (d, J = 8.4 Hz, 1H), 7.76 (d, J = 9.0 Hz, 1H), 7.30–7.23 (m, 2H), 7.10 (d, J = 2.7 Hz, 1H), 2.58 (s, 3H). ^{13}C NMR (126 MHz, DMSO): δ=156.40, 154.54, 142.04, 135.83, 129.07, 127.85, 123.06, 122.11, 109.00, 24.13.



6-Methoxy-2-methylquinoline[2], ^{1}H NMR (500 MHz, Chloroform-d): δ=7.94 (dd, J = 11.6, 8.8 Hz, 2H), 7.35 (dd, J = 9.2, 2.8 Hz, 1H), 7.25 (d, J = 8.4 Hz, 1H), 7.05 (d, J = 2.8 Hz, 1H), 3.93 (s, 3H), 2.72 (s, 3H). ^{13}C NMR (126 MHz, CDCl3): δ=157.15, 156.33, 143.88, 135.02, 130.00, 127.30, 122.21, 121.84, 105.24, 55.48, 25.00.



6-Fluoro-2-methylquinoline[2], ^{1}H NMR (500 MHz, Chloroform-d): δ=7.99 (dd, J = 9.2, 5.3 Hz, 1H), 7.95 (d, J = 8.4 Hz, 1H), 7.46–7.39 (m, 1H), 7.35 (dd, J = 8.8, 2.9 Hz, 1H), 7.26 (d, J = 8.4 Hz, 1H), 2.71 (s, 3H). ^{13}C NMR (126 MHz, CDCl3): δ=160.89, 158.22, 144.89, 135.41, 130.93, 126.88, 122.69, 119.28, 110.54, 25.15.



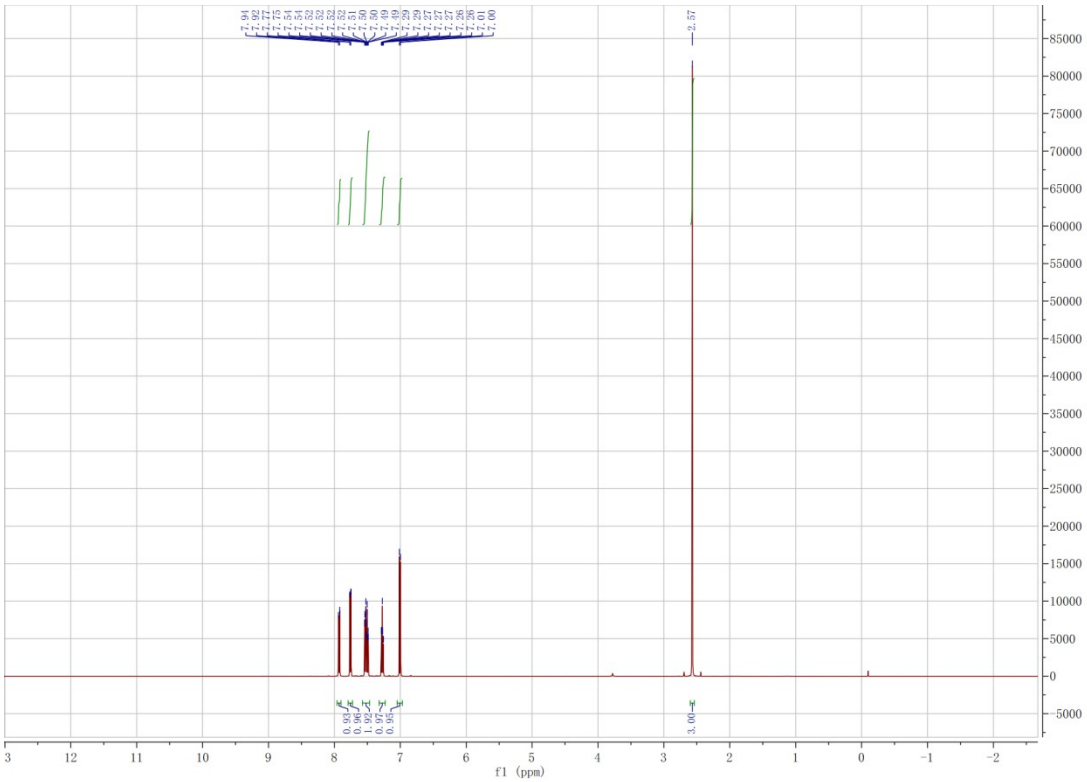
^{1}H NMR (600 MHz, Chloroform-d): δ=7.82 (d, J = 8.3 Hz, 1H), 7.71 (s, 1H), 7.28 (s, 1H), 7.06 (d, J = 8.3 Hz, 1H), 4.44 (s, 2H), 2.68 (s, 3H). ^{13}C NMR (126 MHz, CDCl3): δ=159.53, 147.95, 144.14, 134.98, 127.23, 121.44, 120.48, 119.23, 109.94, 25.30.

5-aminoquinaldine, ^{1}H NMR (600 MHz, Chloroform-d): δ=7.88 (d, J = 8.1 Hz, 1H), 7.58 (d, J = 8.6 Hz, 1H), 7.17 (d, J = 2.2 Hz, 1H), 7.05 (d, J = 8.2 Hz, 1H), 6.93 (dd, J = 8.6, 2.3 Hz, 1H), 4.05 (s, 2H), 2.69 (s, 3H). ^{13}C NMR (126 MHz, CDCl3): δ=159.18, 149.54, 147.68, 135.88, 128.62, 120.44, 118.57, 117.56, 108.93, 25.27.

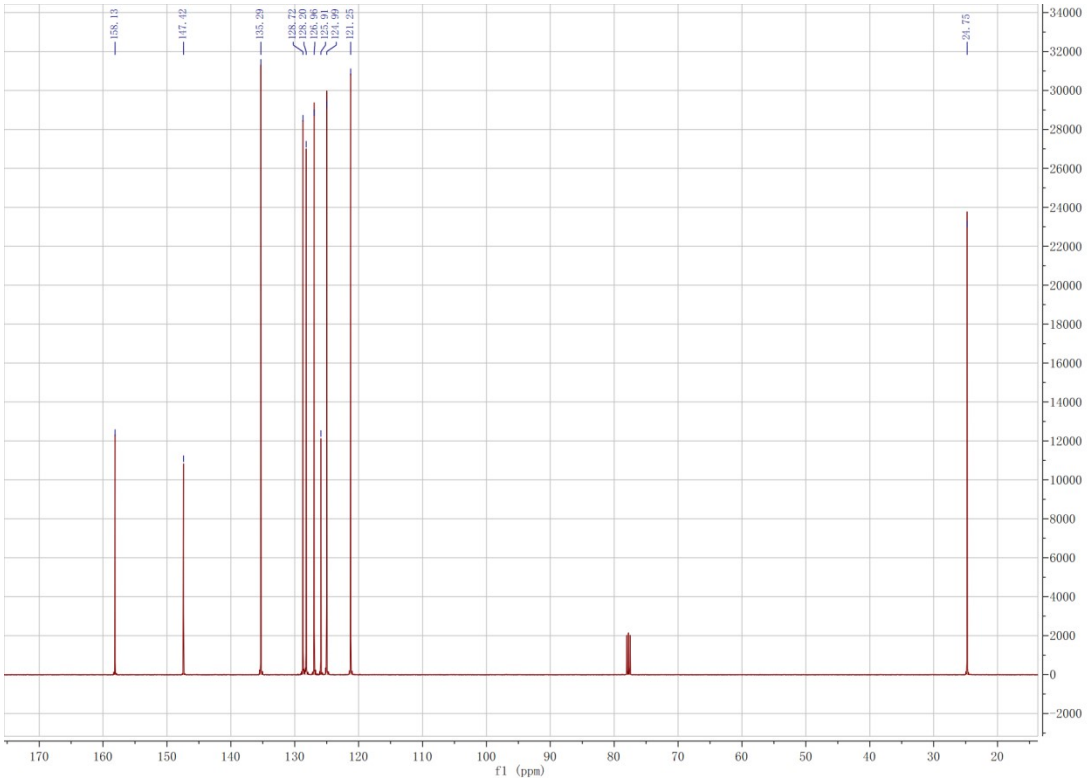
1. L. He, J. Q. Wang, Y. Gong, Y. M. Liu, Y. Cao, H. Y. He and K. N. Fan, *Angew Chem Int Ed Engl*, 2011, **50**, 10216-10220.
2. Y. Matsubara, S. Hirakawa, Y. Yamaguchi and Z. Yoshida, *Angew Chem Int Ed Engl*, 2011, **50**, 7670-7673.
3. Z. Zhang, J. Tan and Z. Wang, *Organic Letters*, 2008, **10**, 173-175.

4. ^{1}H and ^{13}C NMR Spectra

(^{1}H NMR)



(^{13}C NMR)



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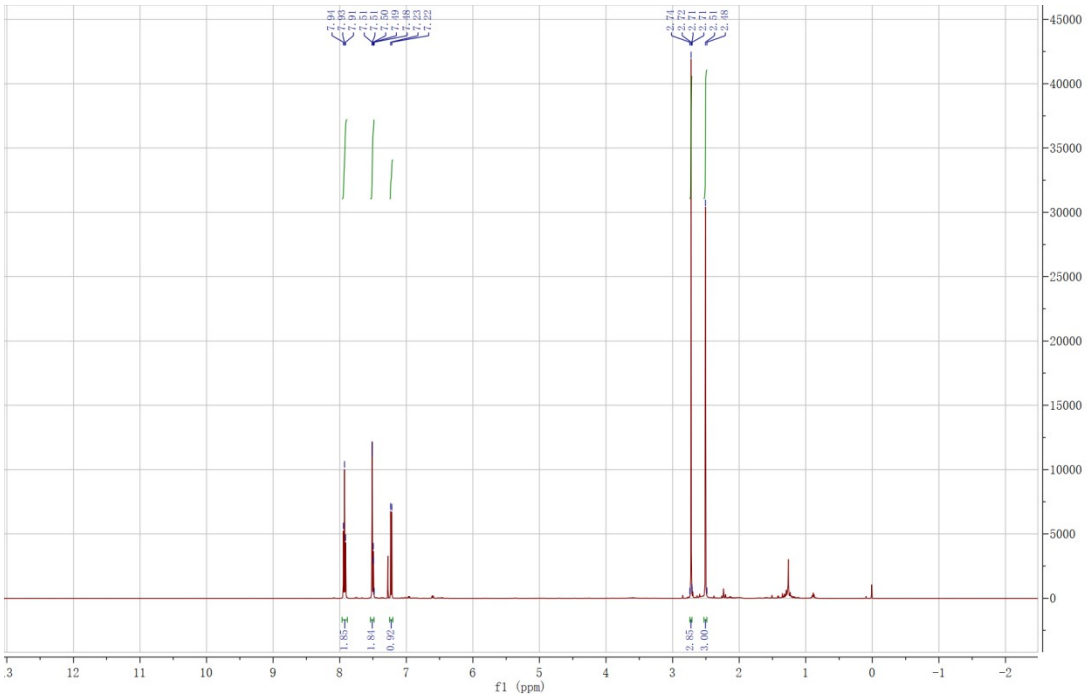

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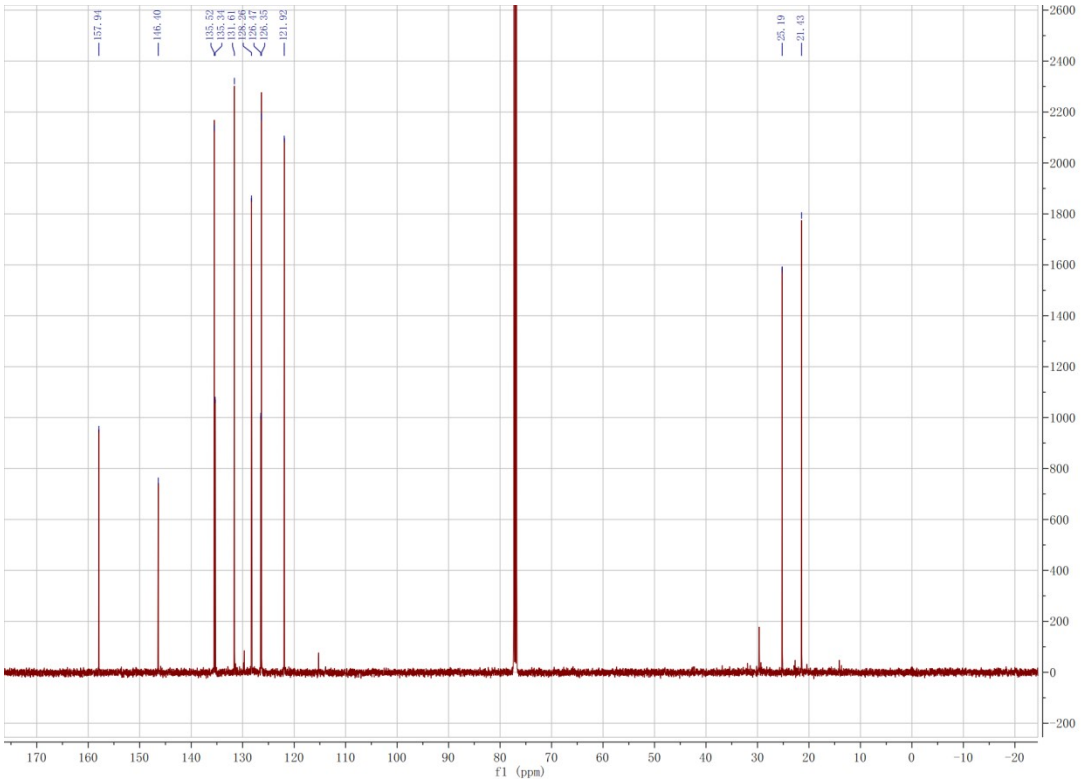

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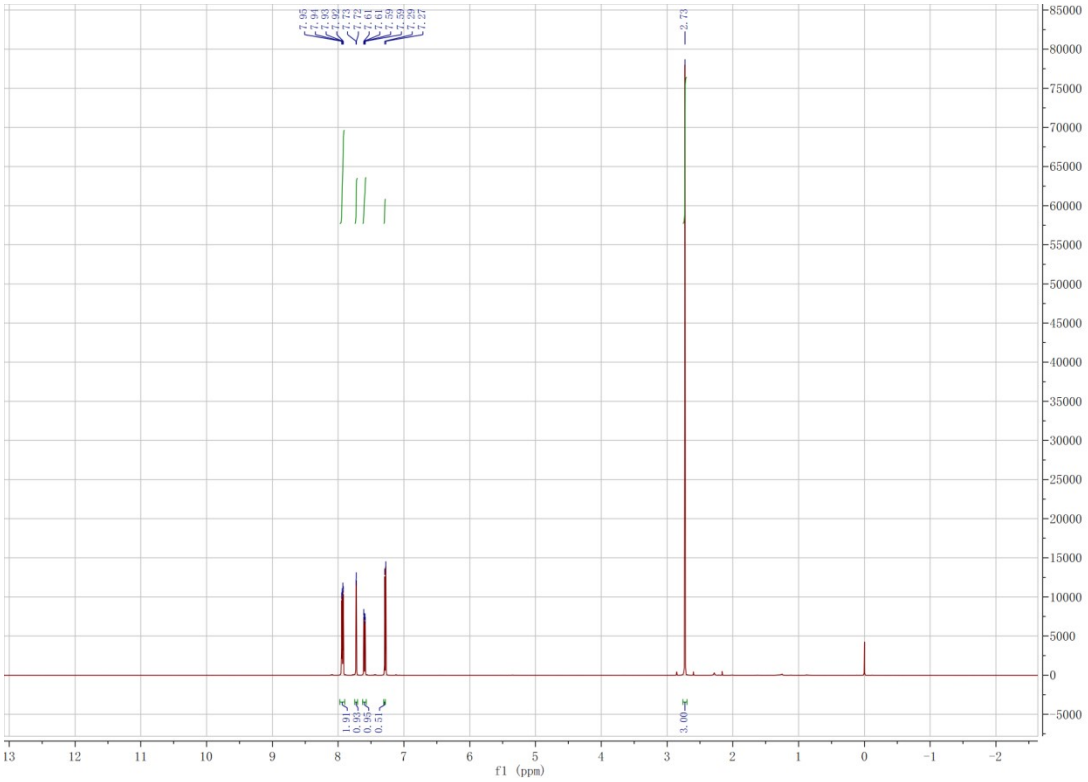

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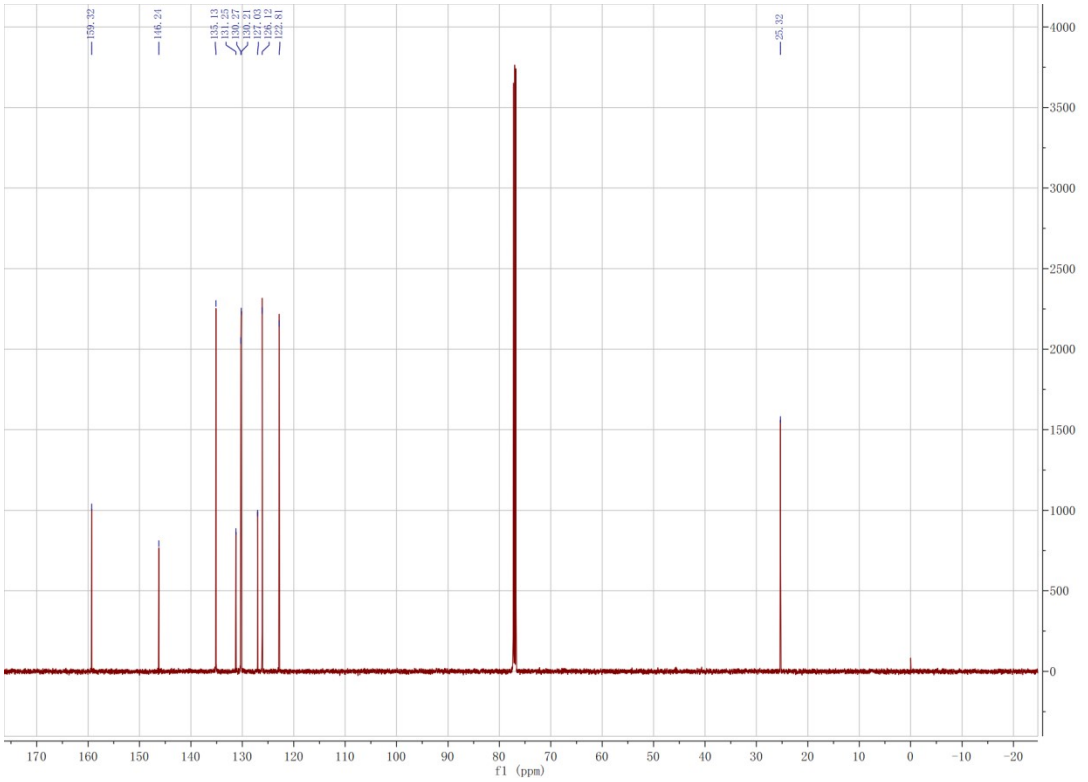

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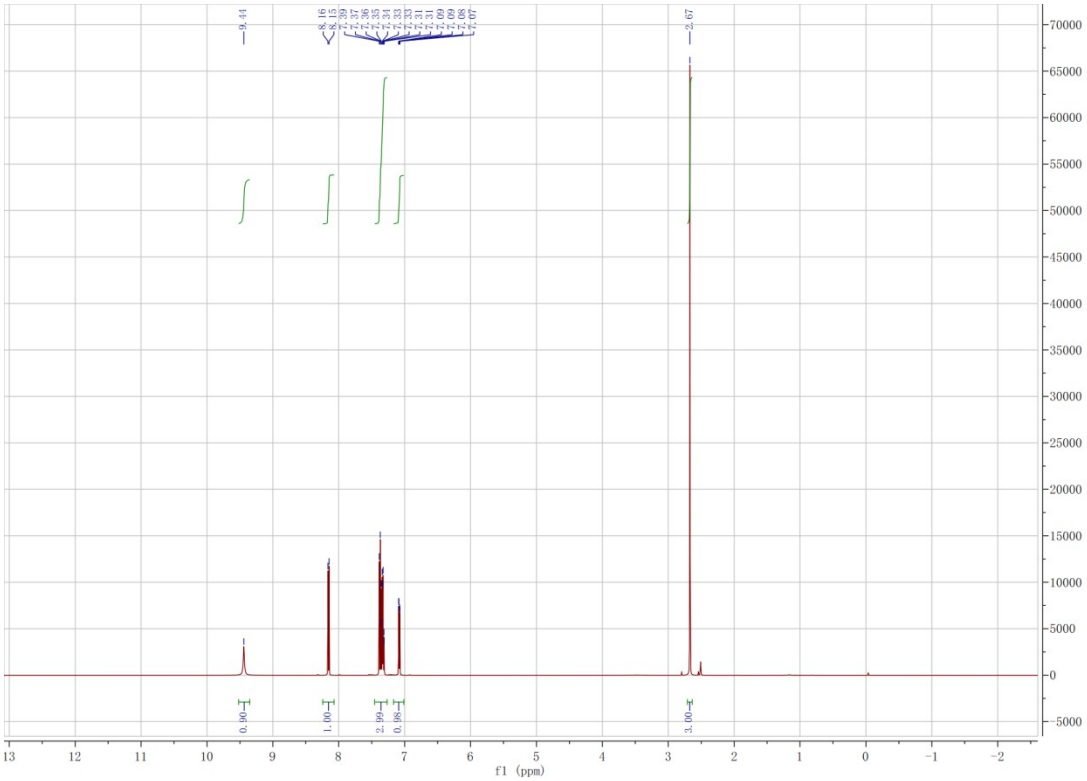

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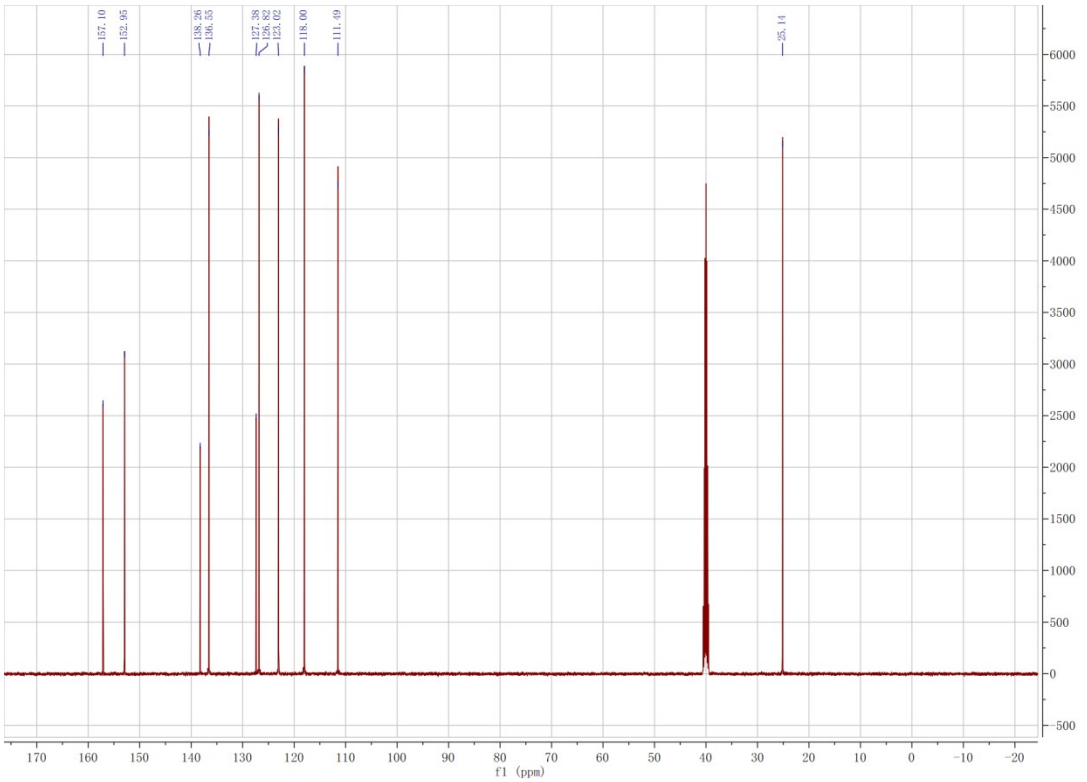

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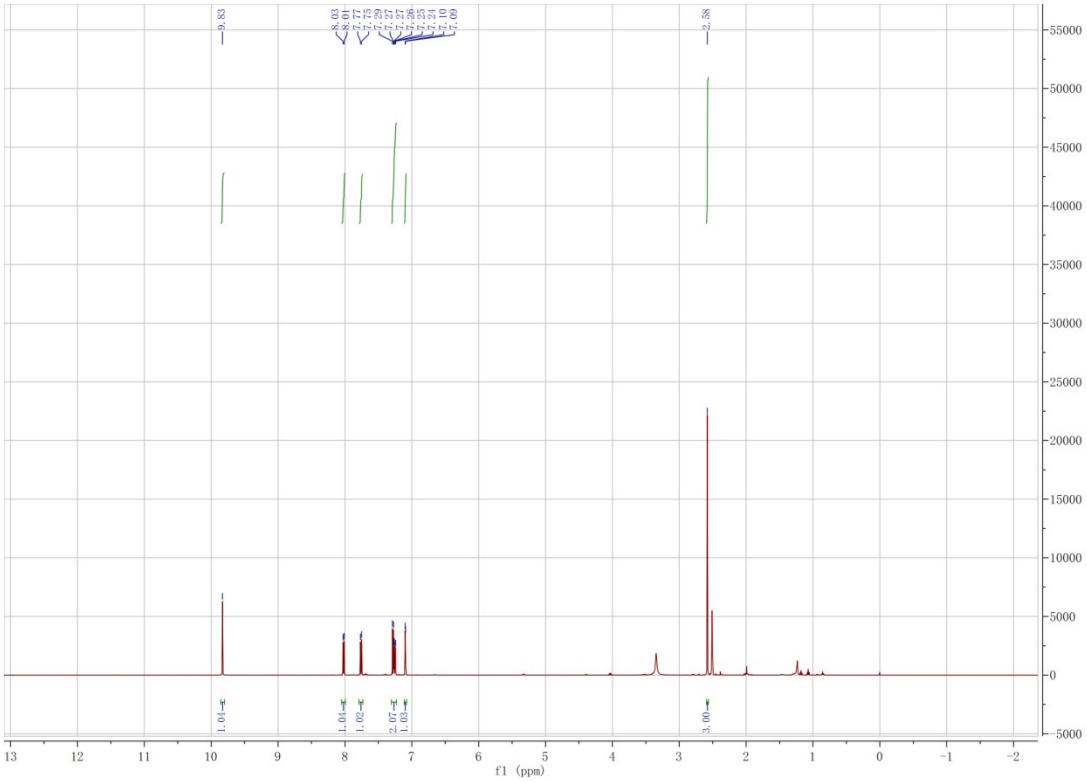

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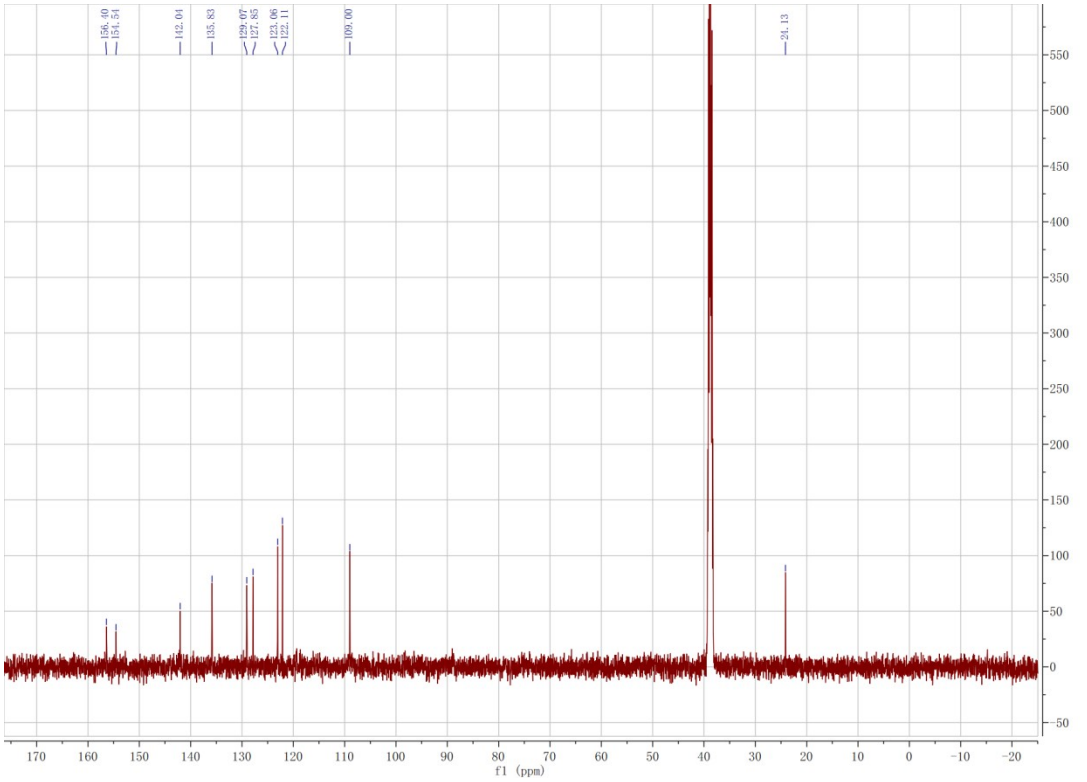

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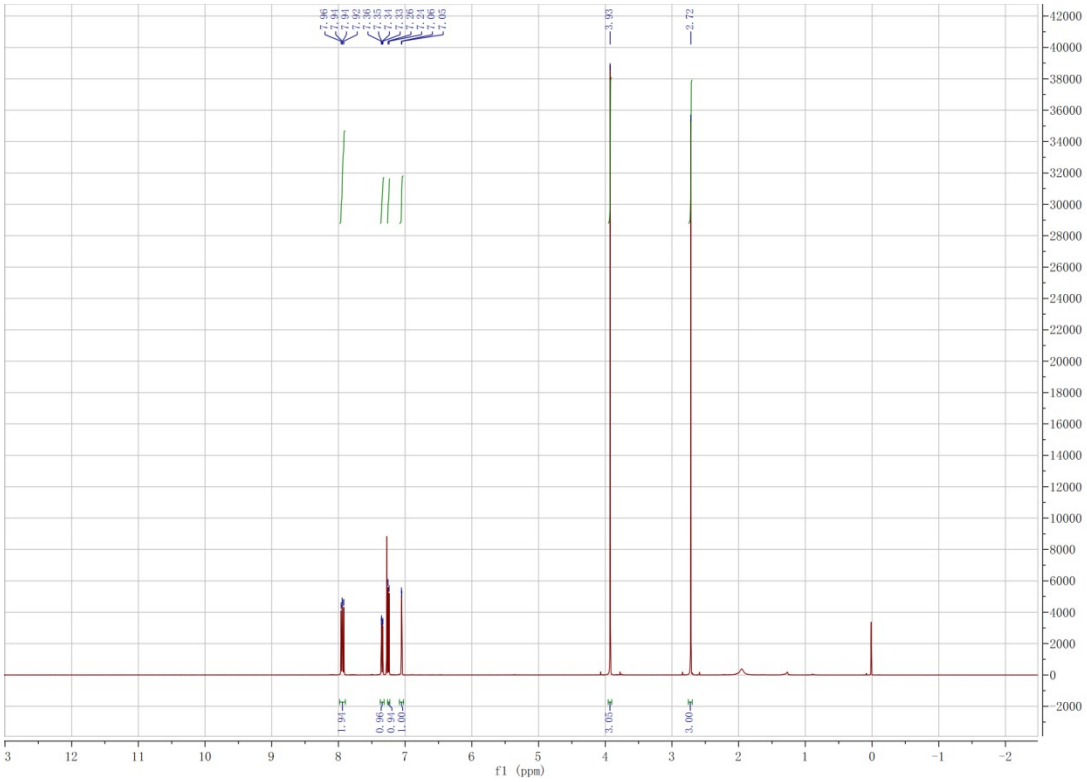

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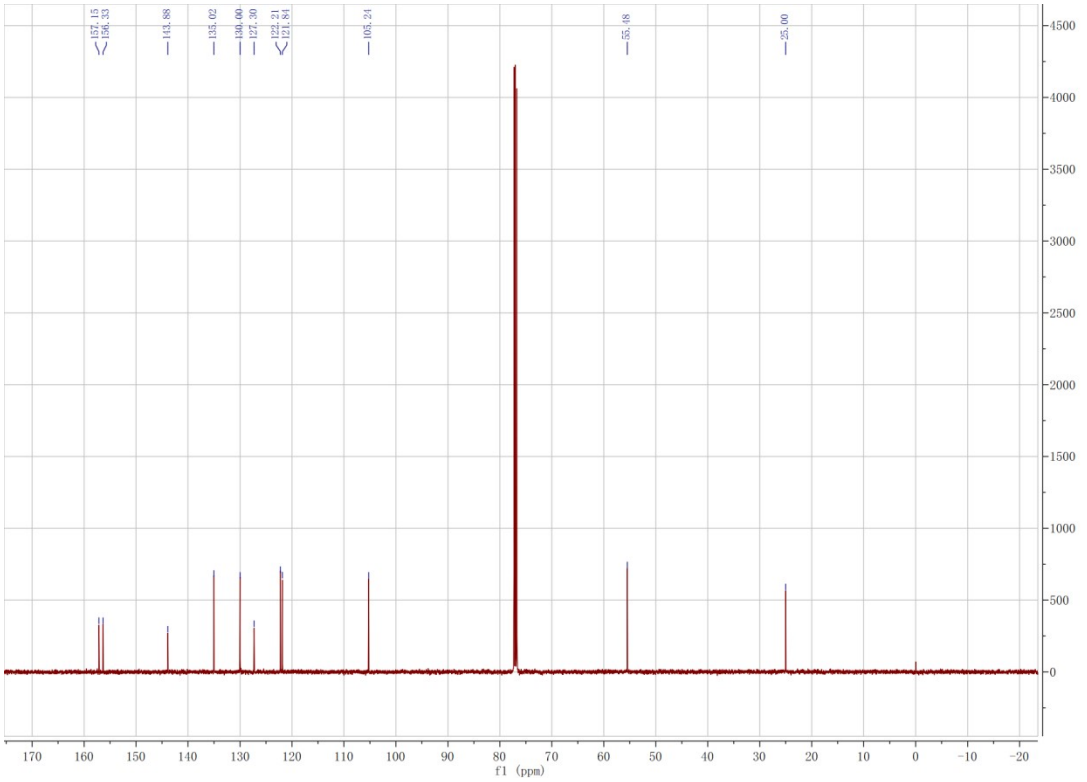

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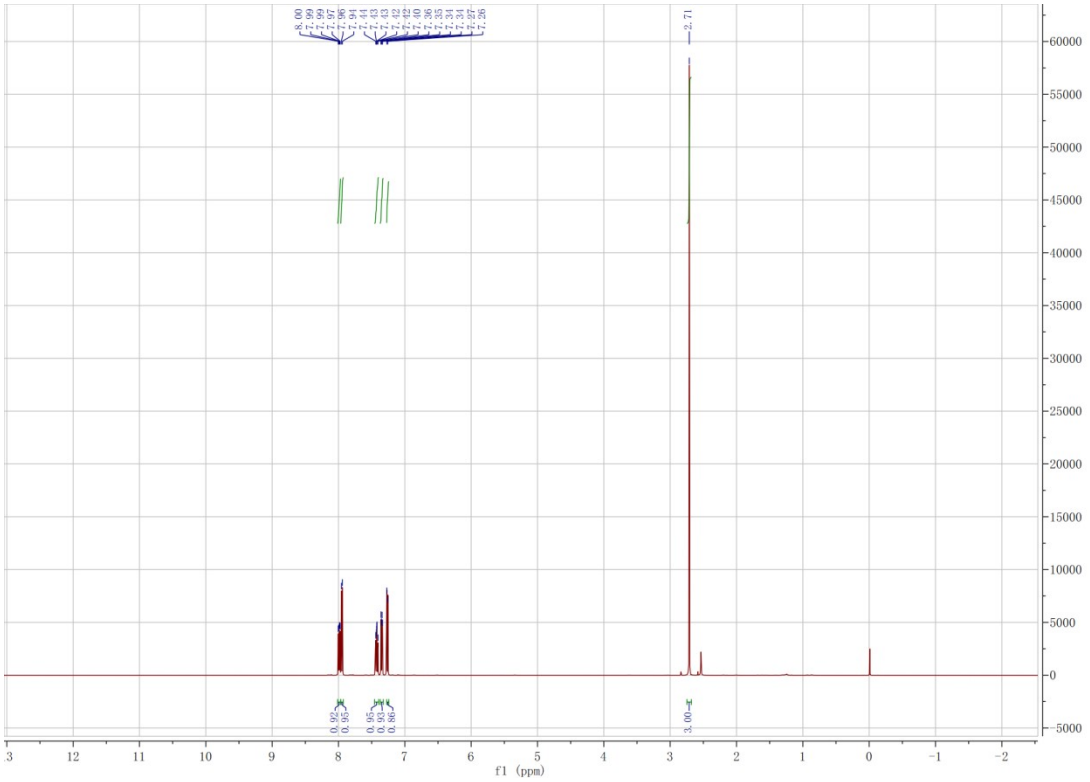

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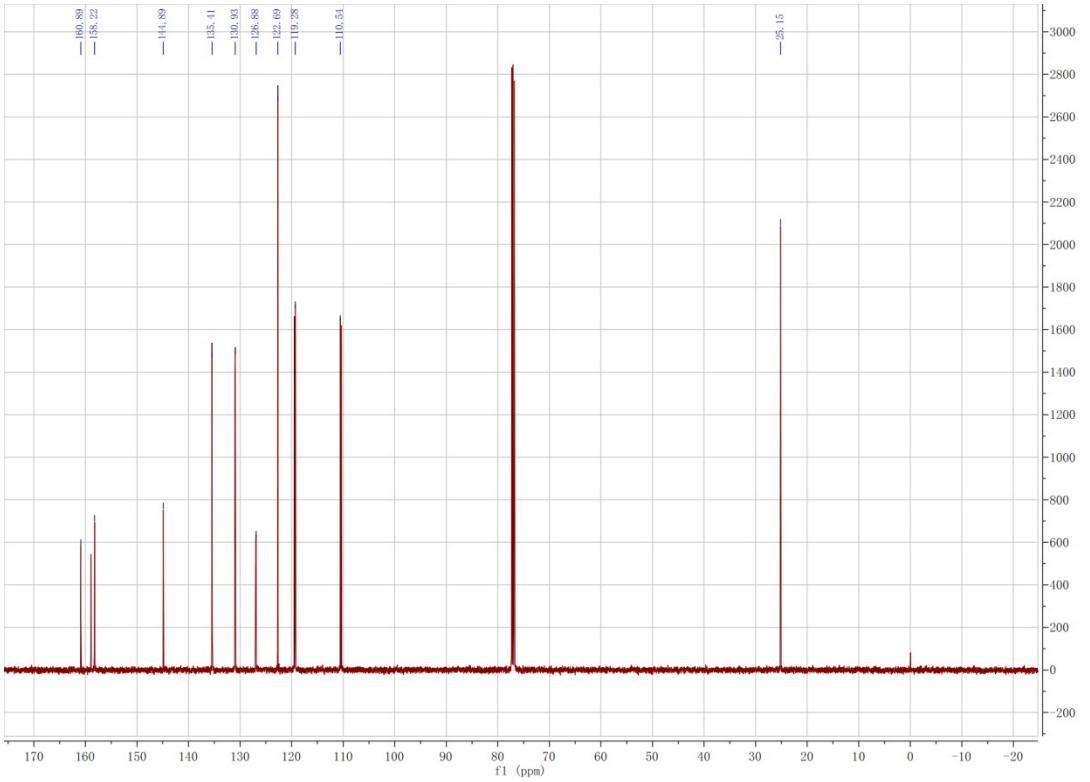

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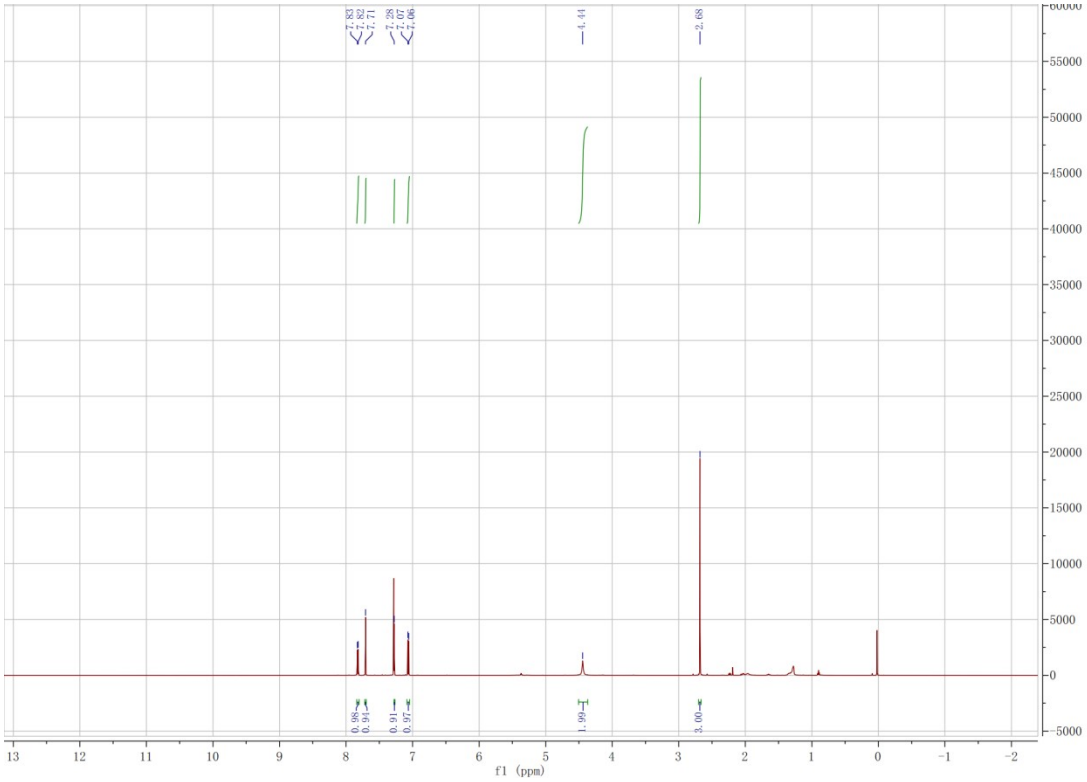

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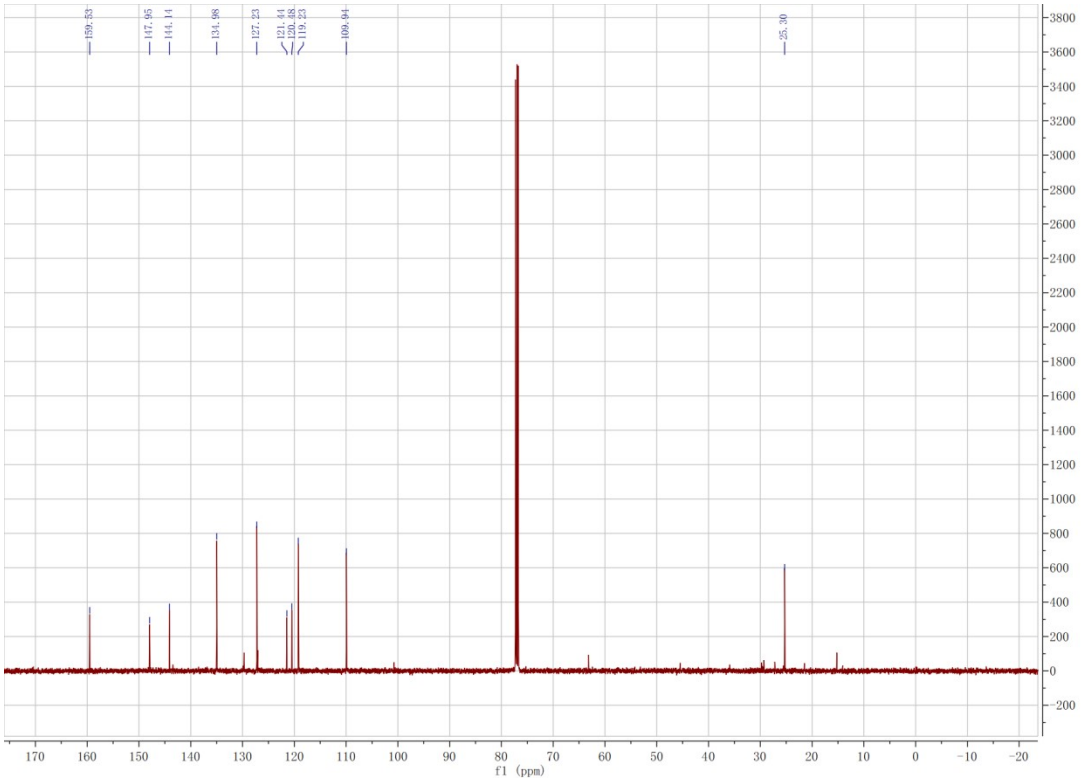

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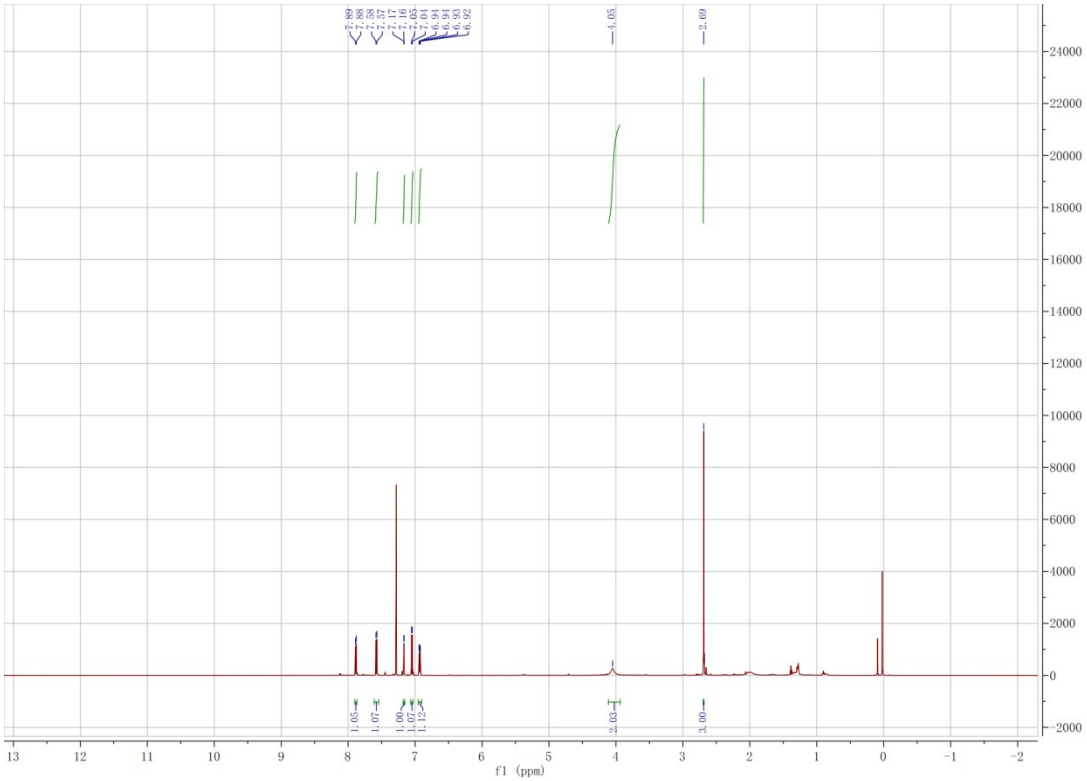

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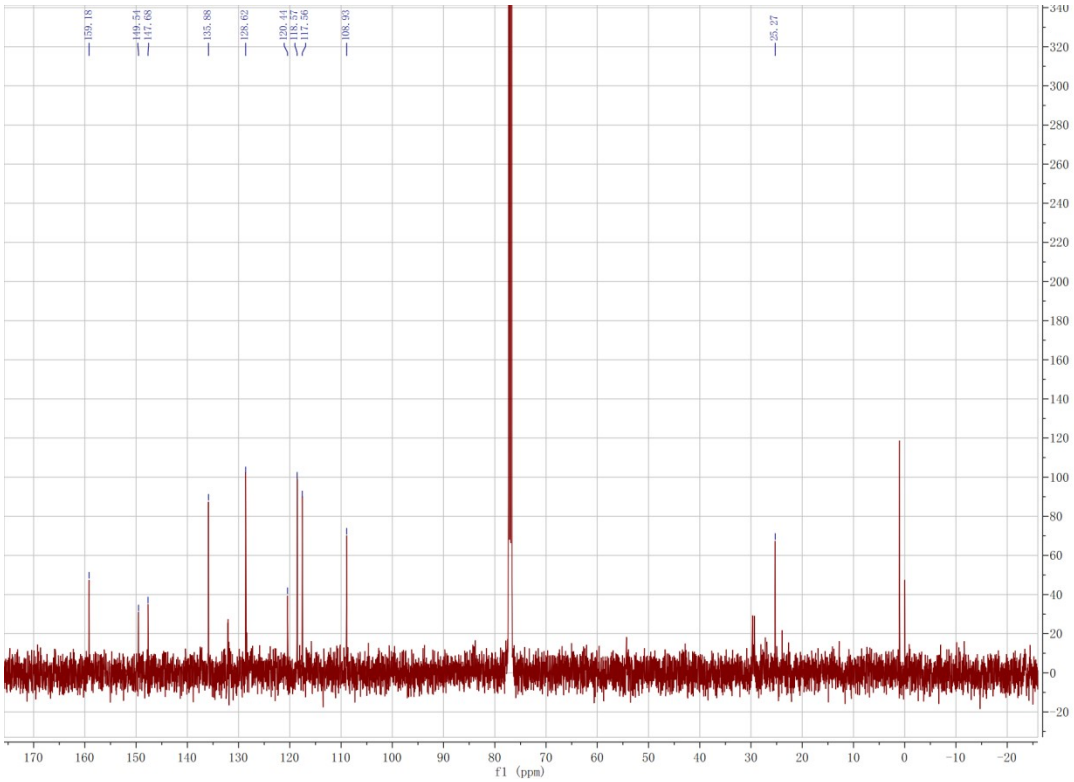
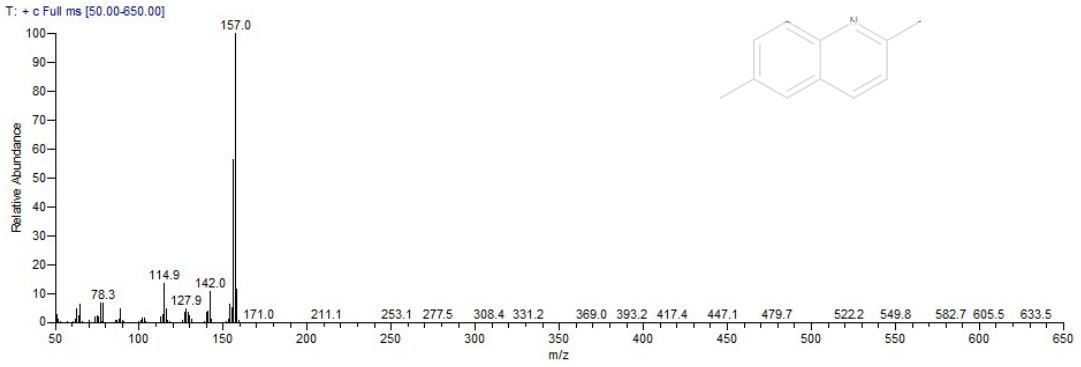
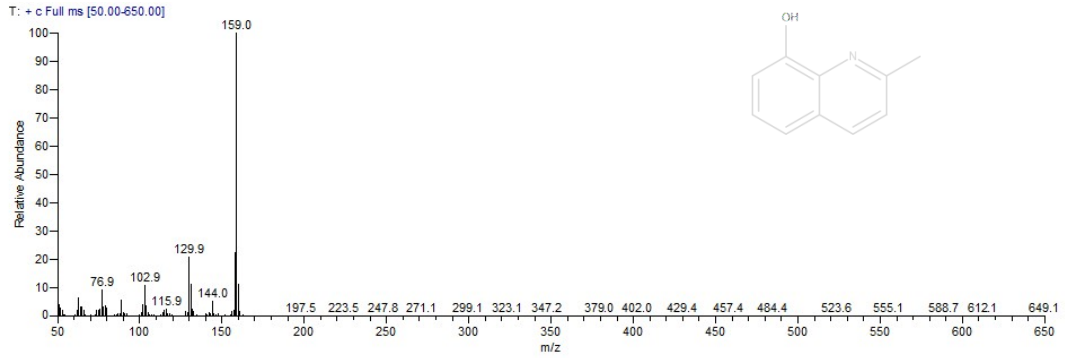
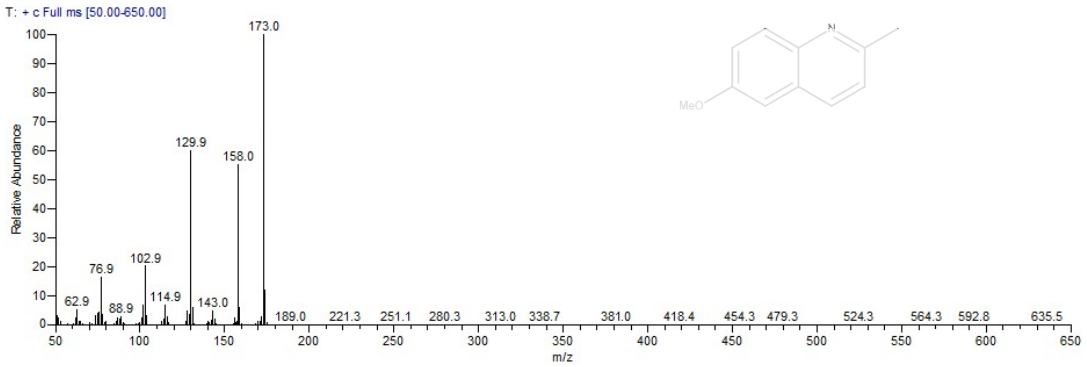
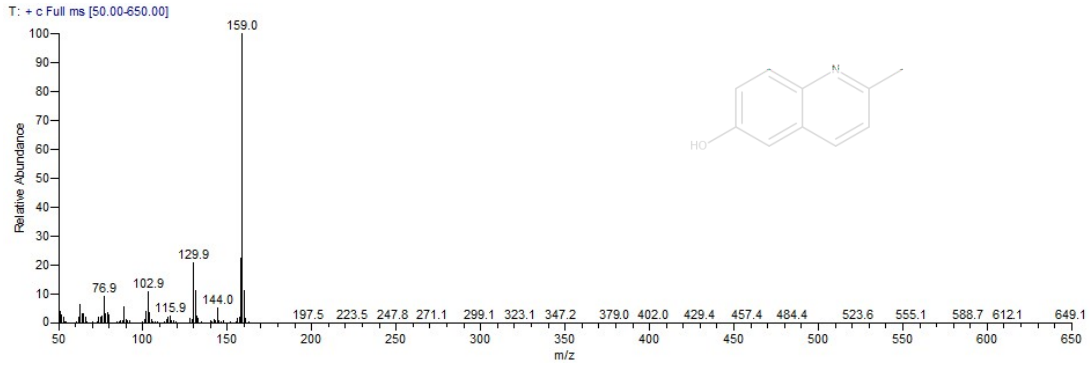


5. Mass spectrum





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Relative Abundance
m/z
159.0
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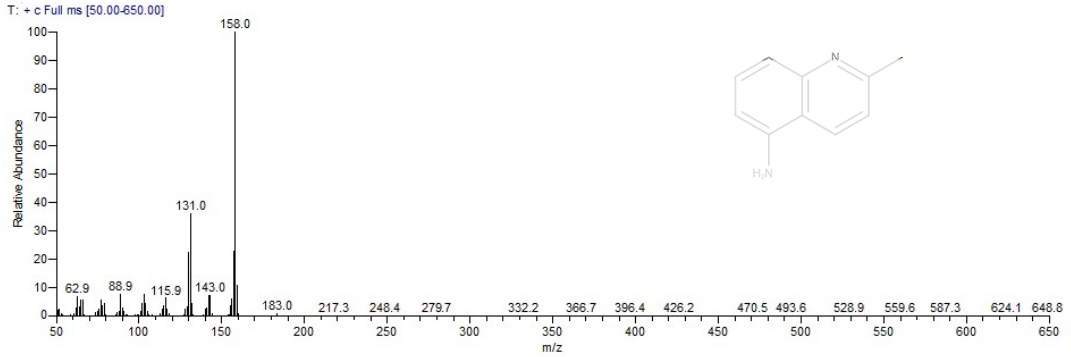
76.9
102.9
115.9
144.0
HO
N


T: + c Full ms [50.00-650.00]
Relative Abundance
m/z
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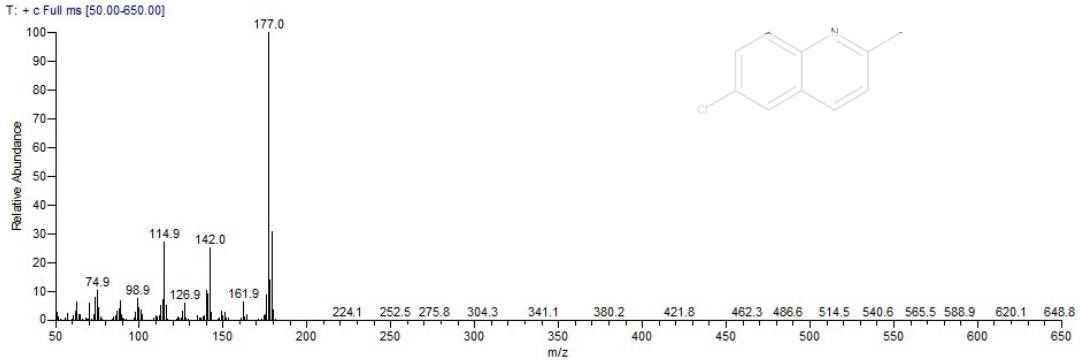
62.9
88.9
115.9
143.0
H2N
N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Relative Abundance
m/z
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74.9
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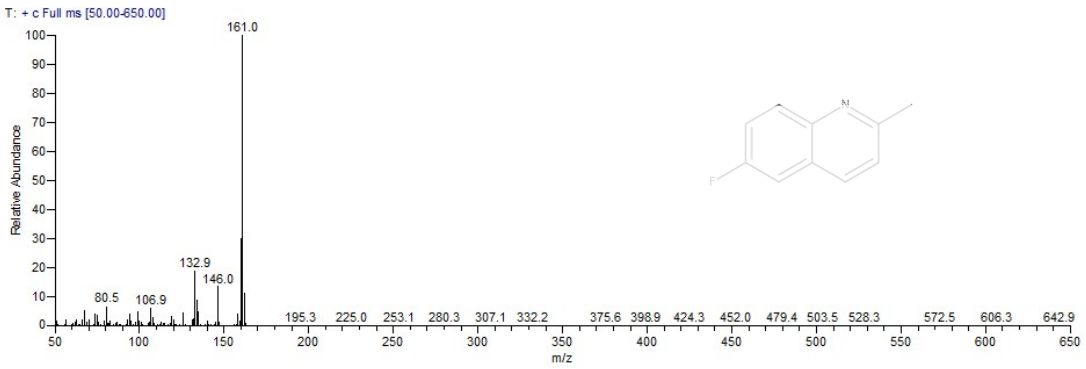
126.9
161.9
Cl
N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106.9
F
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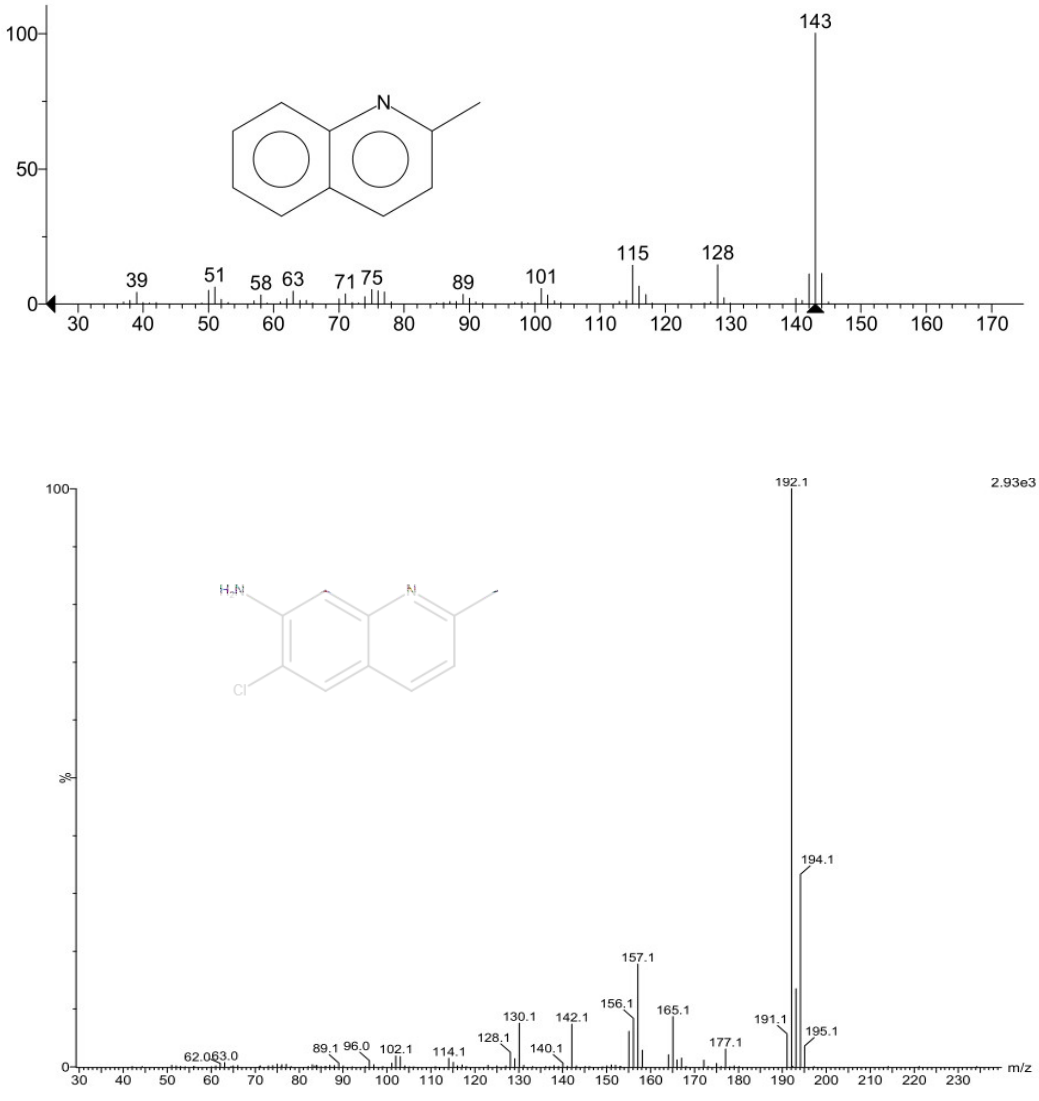

Fig. S3 The Mass spectrum of 2-methylquinoline compounds