

## Supplementary Material

Selective catalysis for the reductive amination of furfural toward furfurylamine by the  
graphene-co-shelled cobalt nanoparticles

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### **This document includes:**

- S1. The low magnification TEM images
- S2. The Pyridine-IR and NH<sub>3</sub>-TPD results.
- S3. The H<sup>1</sup> NMR and GC-MS spectra.

## S1. The low magnification TEM images

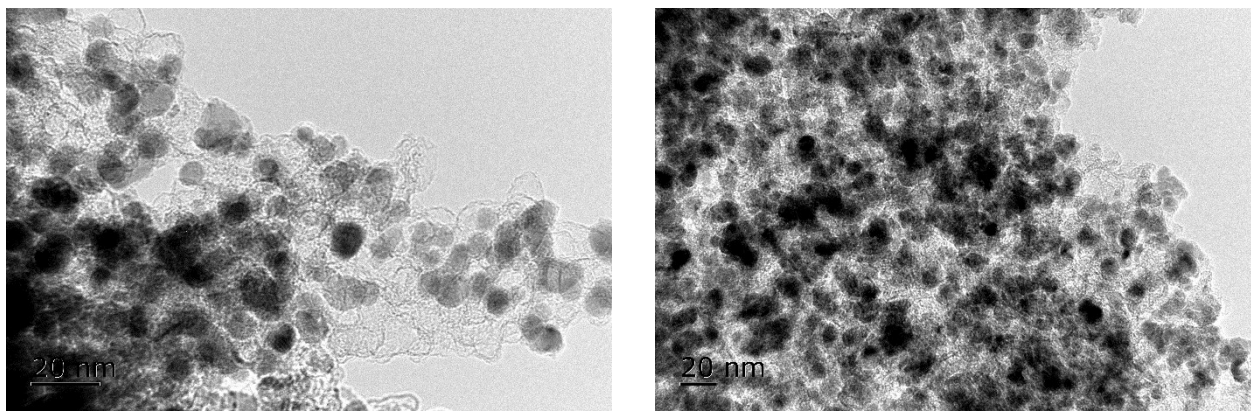


Fig. S1 TEM images of Co@C-600-EtOH (left) and Co/CoO@C-600-EtOH (right)

## S2. The Pyridine-IR and NH<sub>3</sub>-TPD results

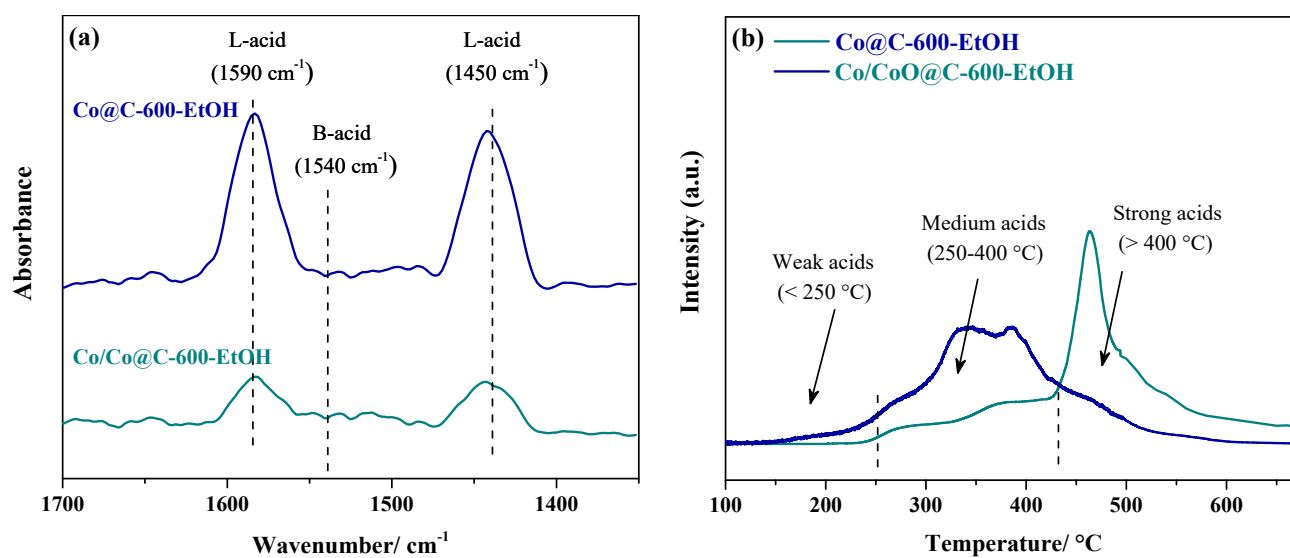


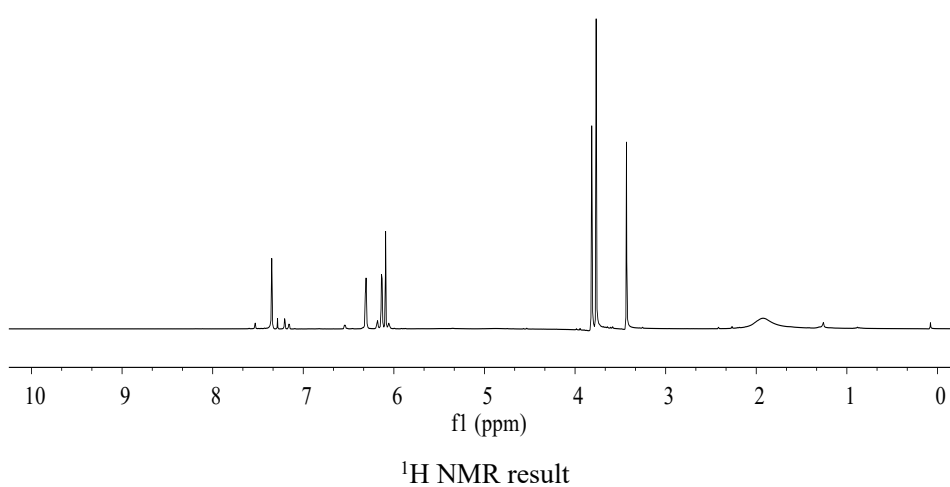
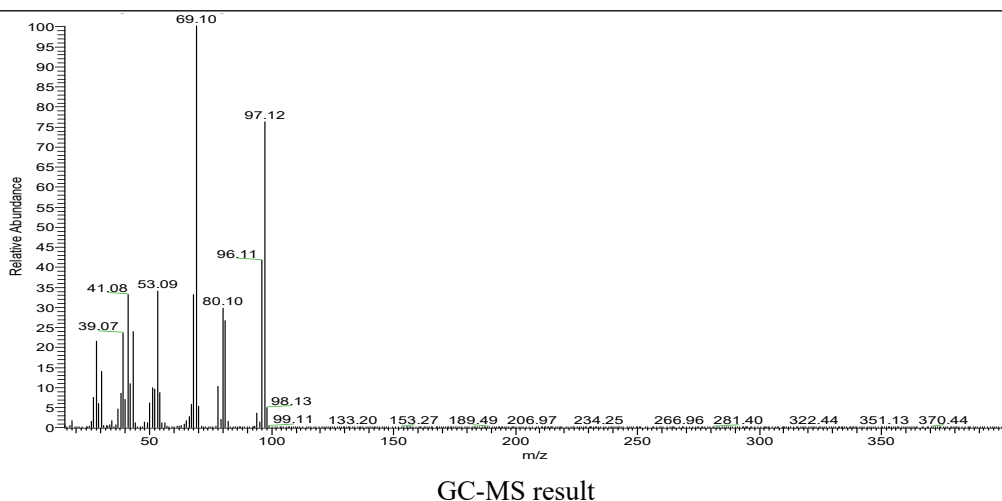
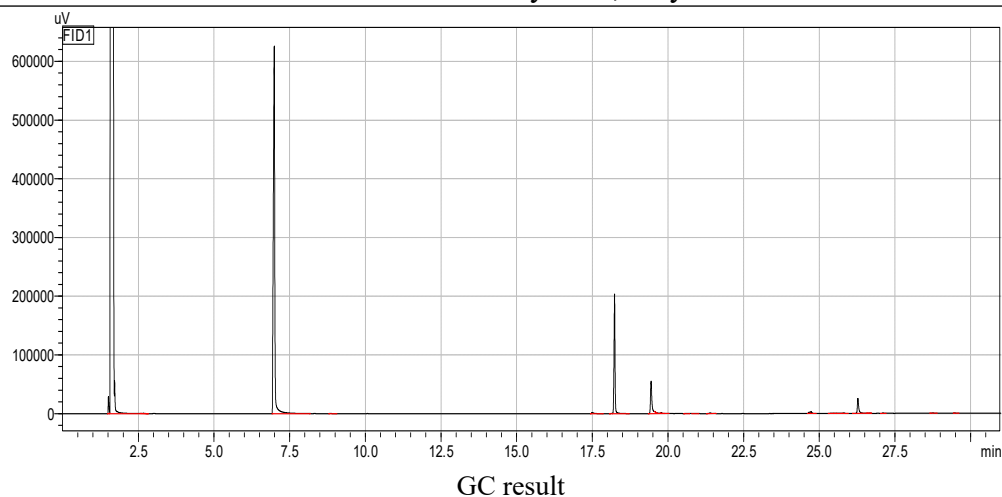
Fig. S2 Pyridine-FTIR spectra of the prepared catalysts with different metal precursors and procedure (a), and the NH<sub>3</sub>-TPD profile of Co@HC<sub>Im-180</sub> (b).

**S3. H1 NMR and GC-MS spectra** (in this GC-MS procedure, the first 3 min is held at 40 °C

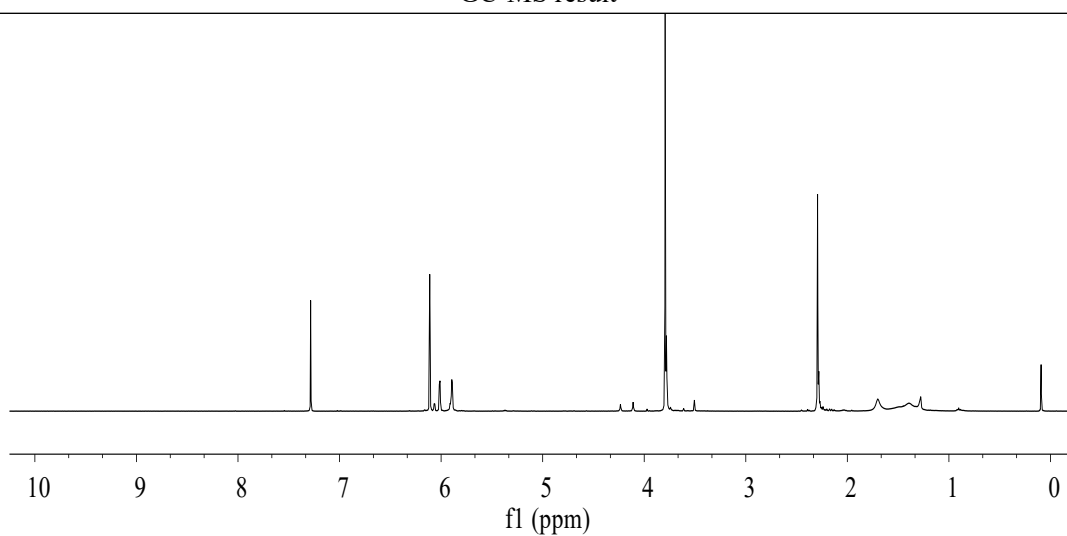
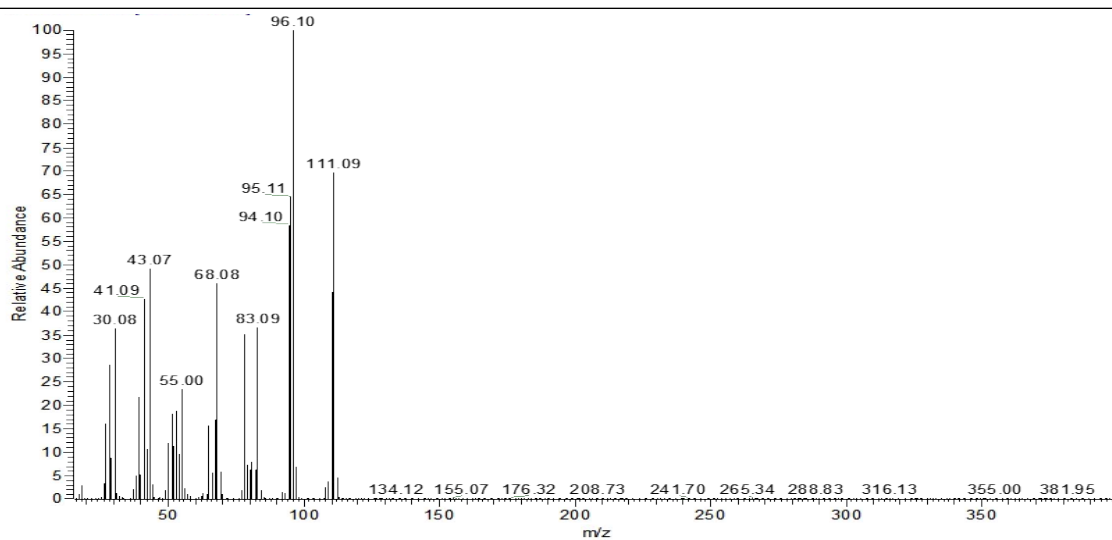
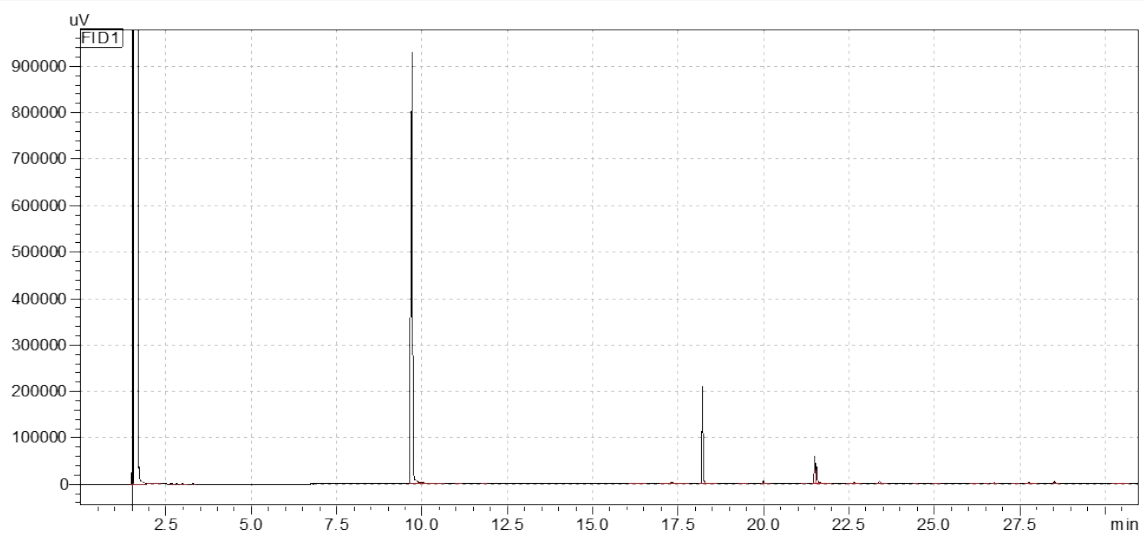
to stabilize the baseline and to evaporate the methanol solution, so that the huge peak in this period is not included in the calculation; the peaks at 18.2 min represents 1,3,5-trimethoxybenzene)

**Entry 39 (CAS: 617-89-0; MW: 97.12; RT: 7.0 min)**

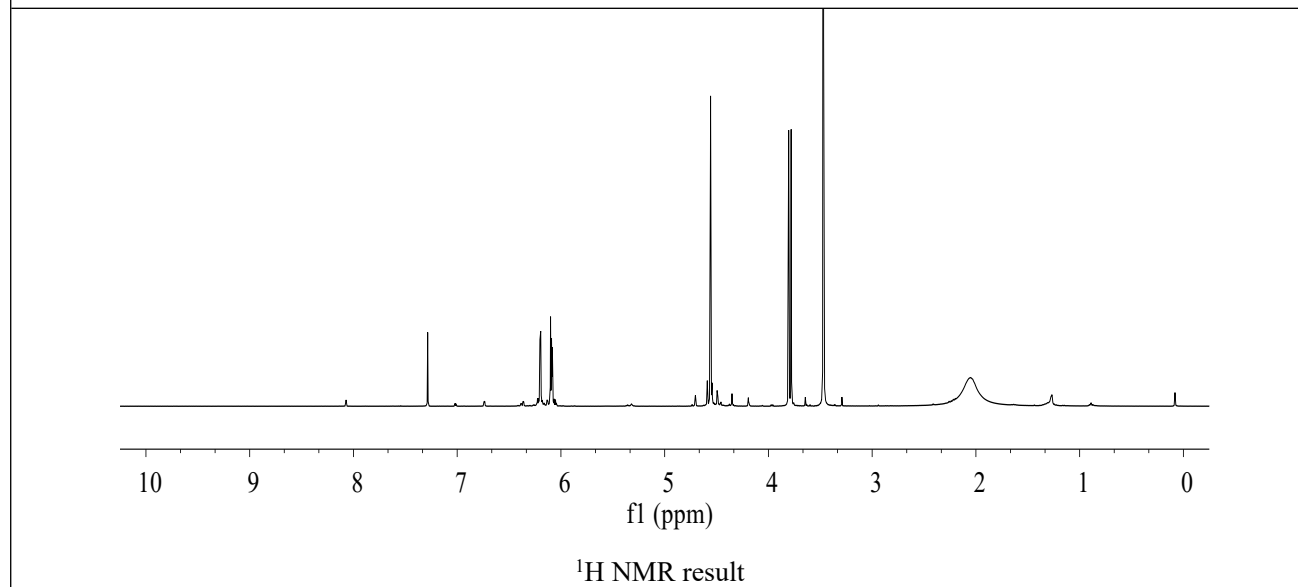
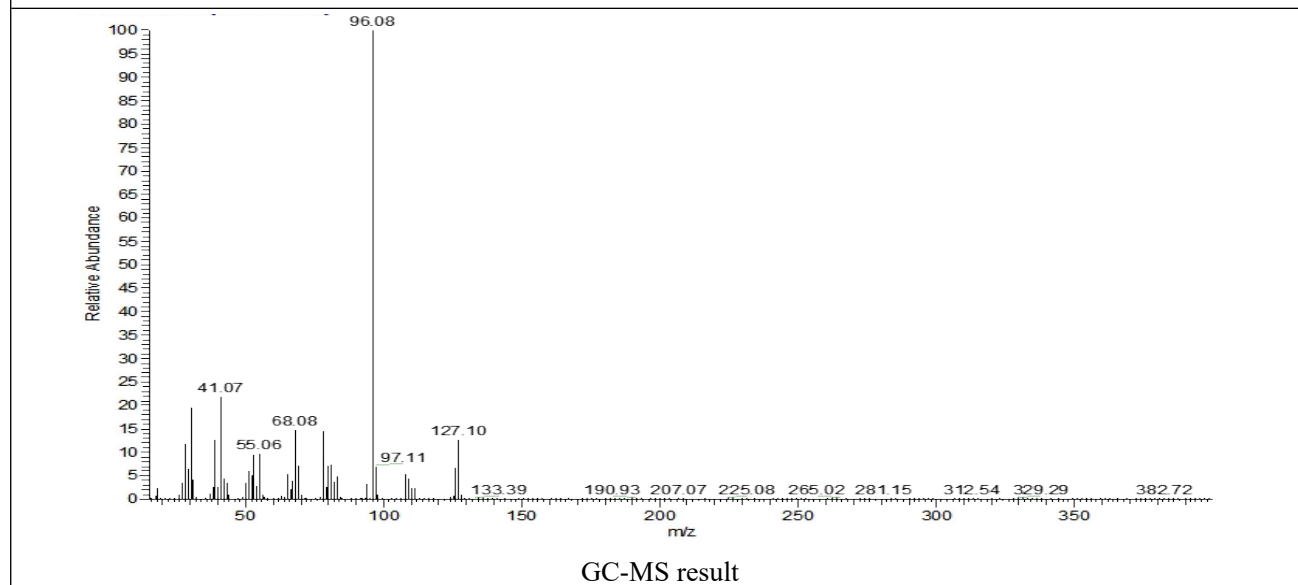
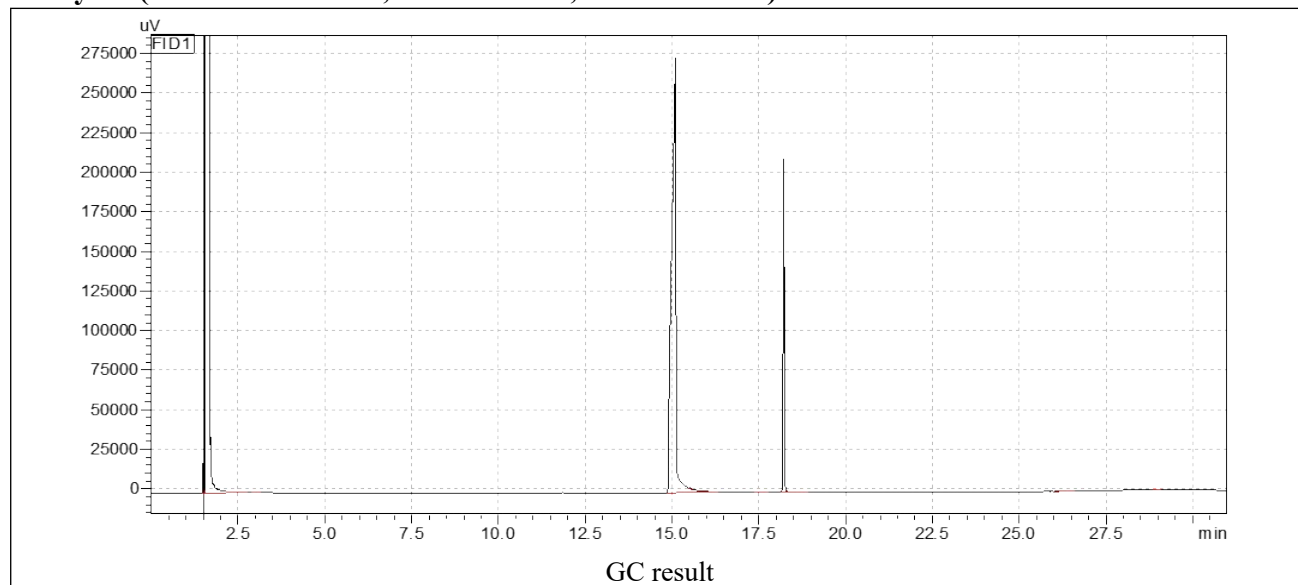
Please note that the similar substance is used in Entry 1-38, only the reaction conditions are different.



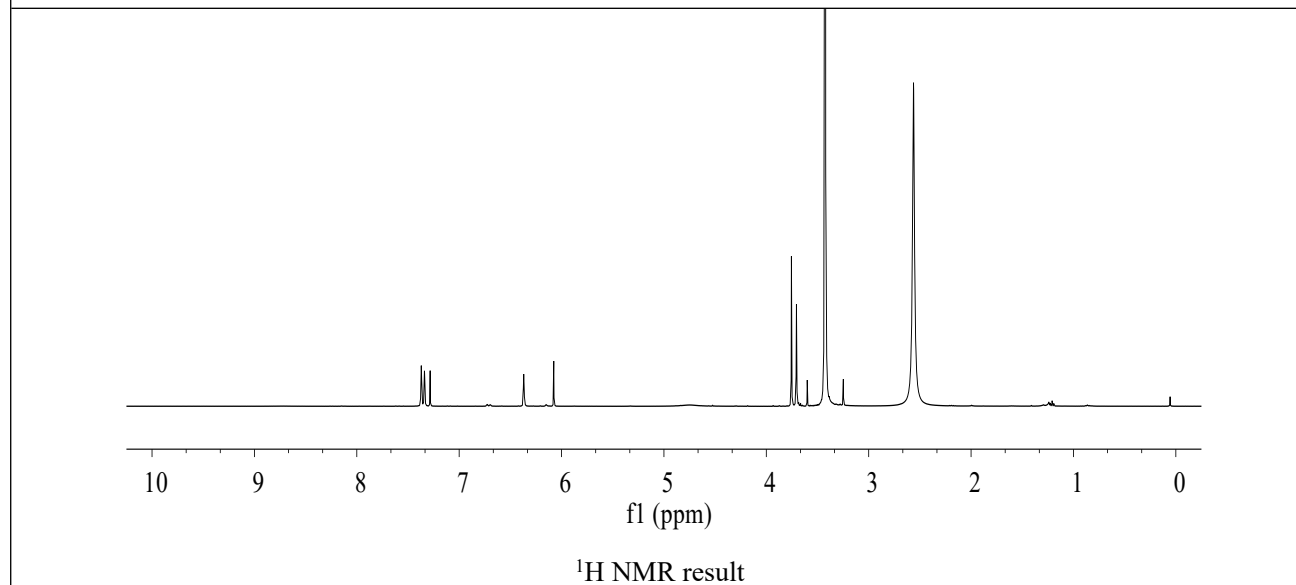
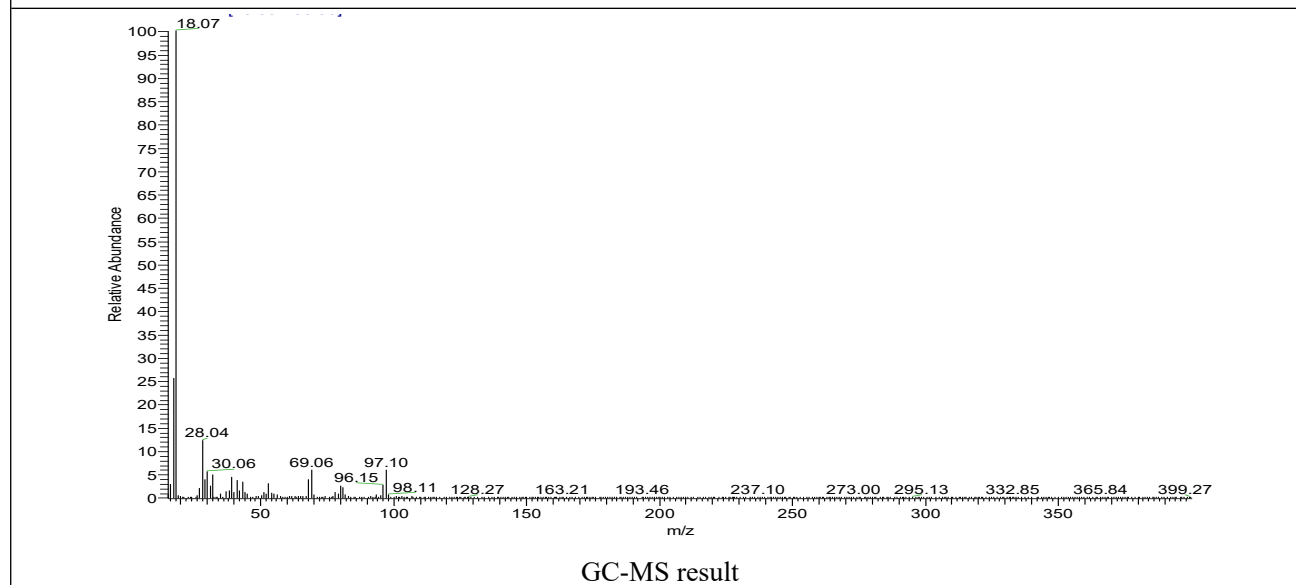
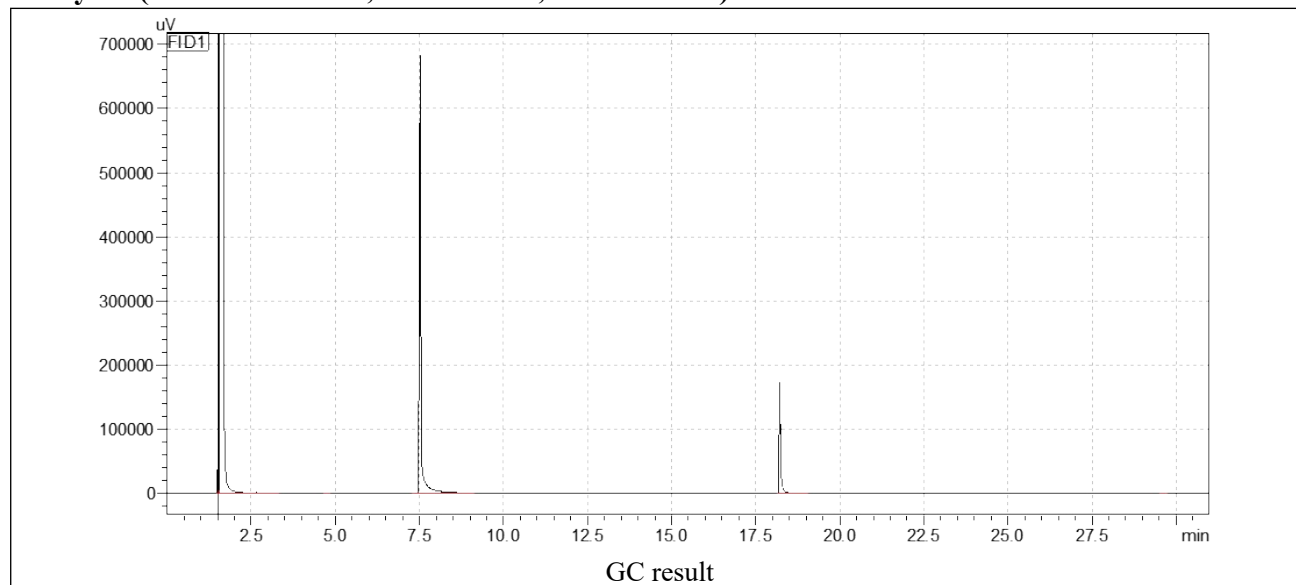
**Entry 40 (CAS: 14003-16-8; MW: 111.14; RT: 9.6 min)**



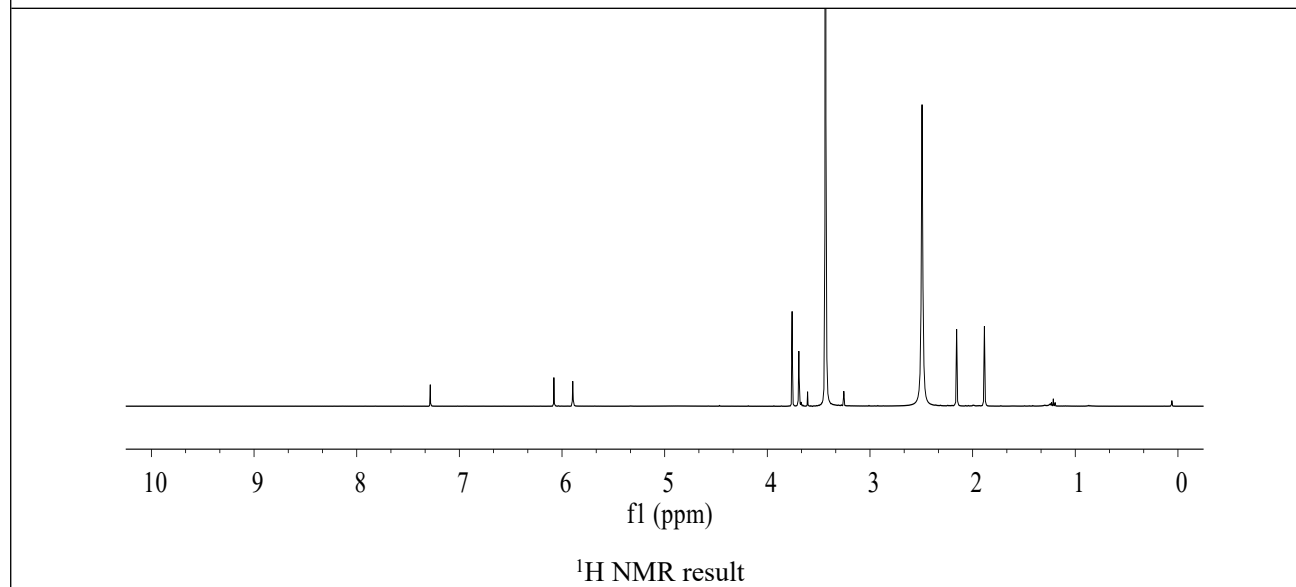
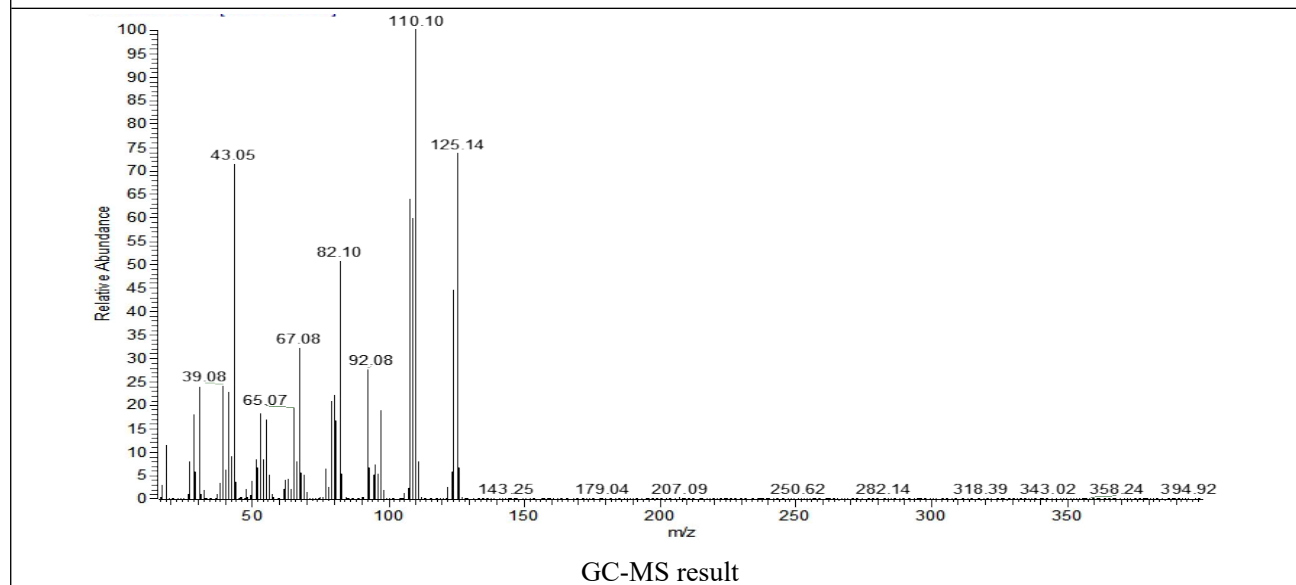
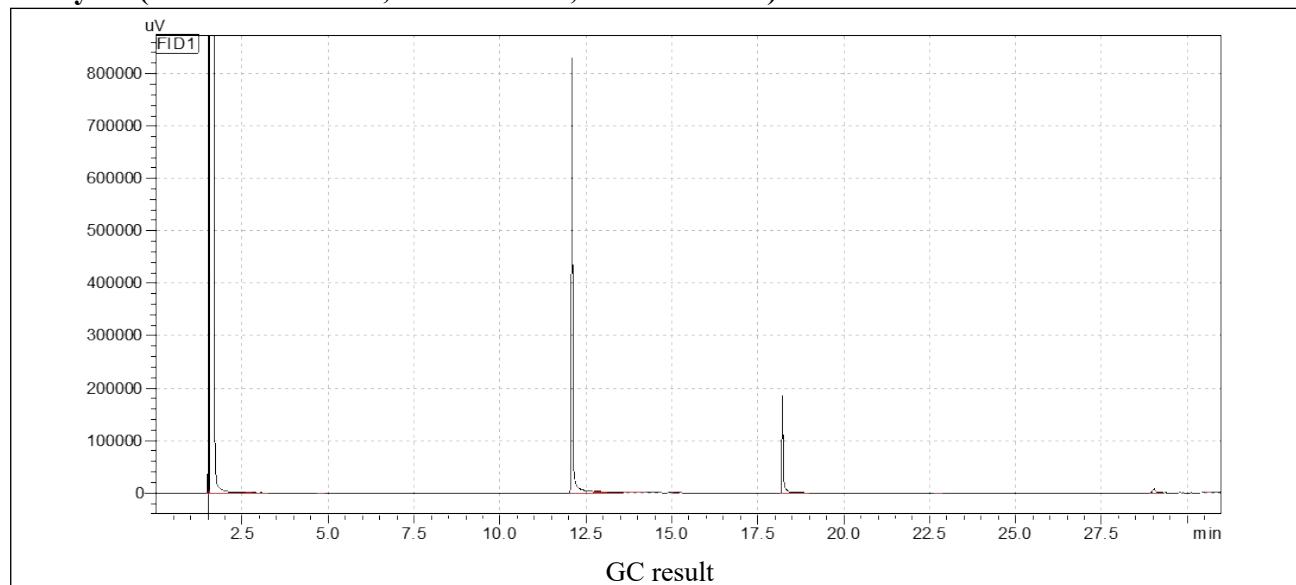
**Entry 41 (CAS: 88910-22-9; MW: 127.14; RT: 15.0 min)**



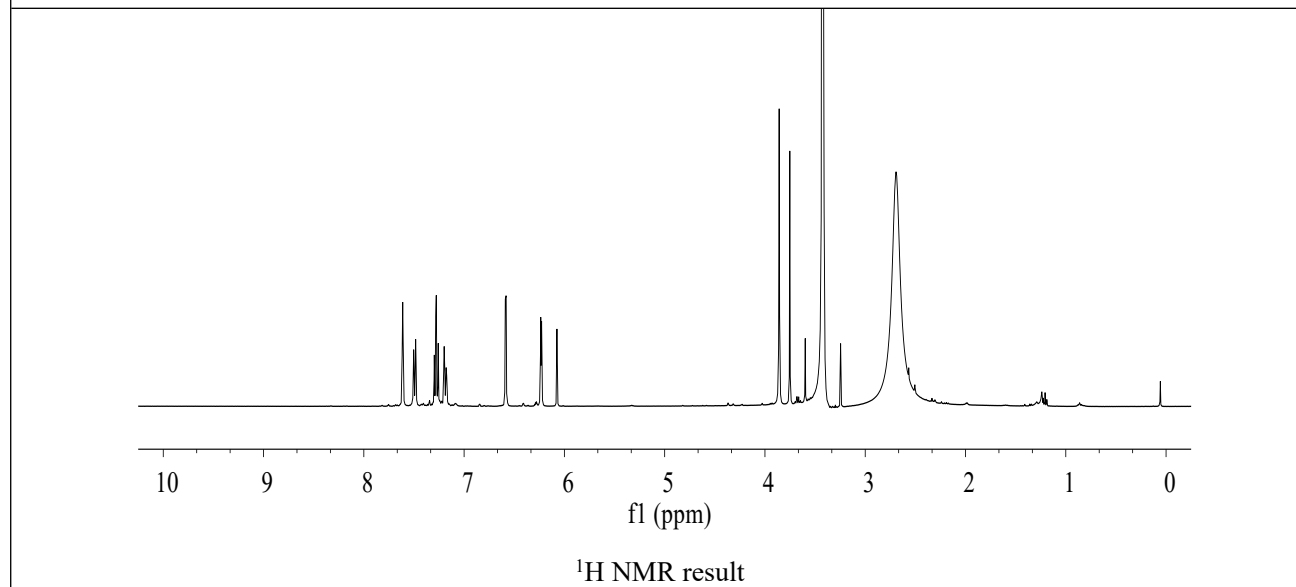
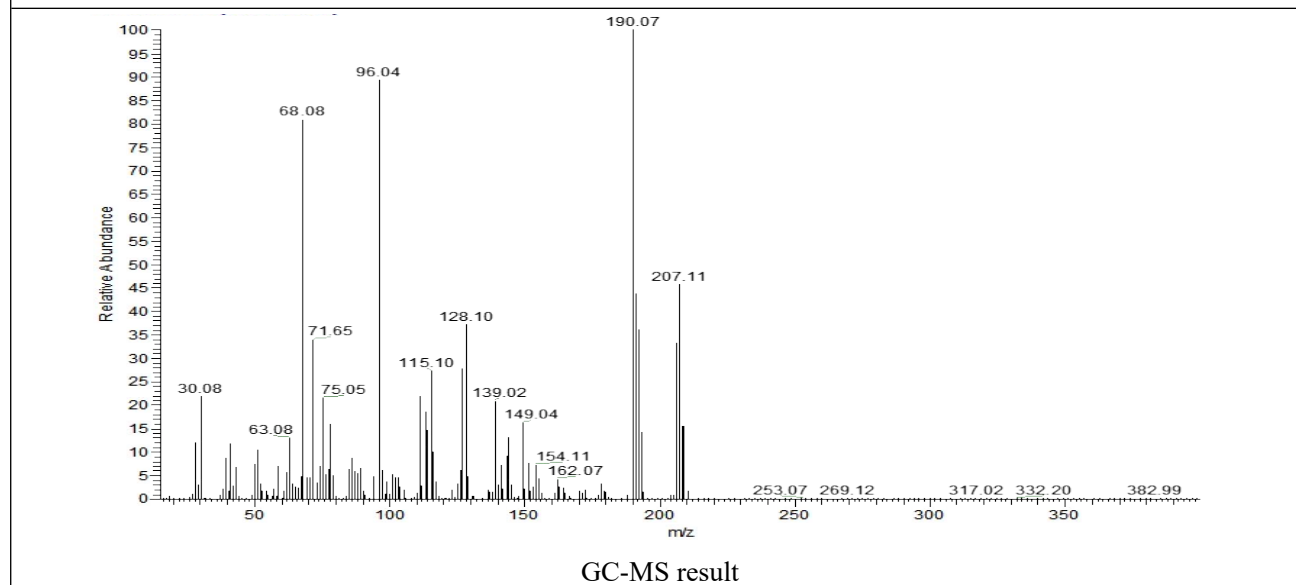
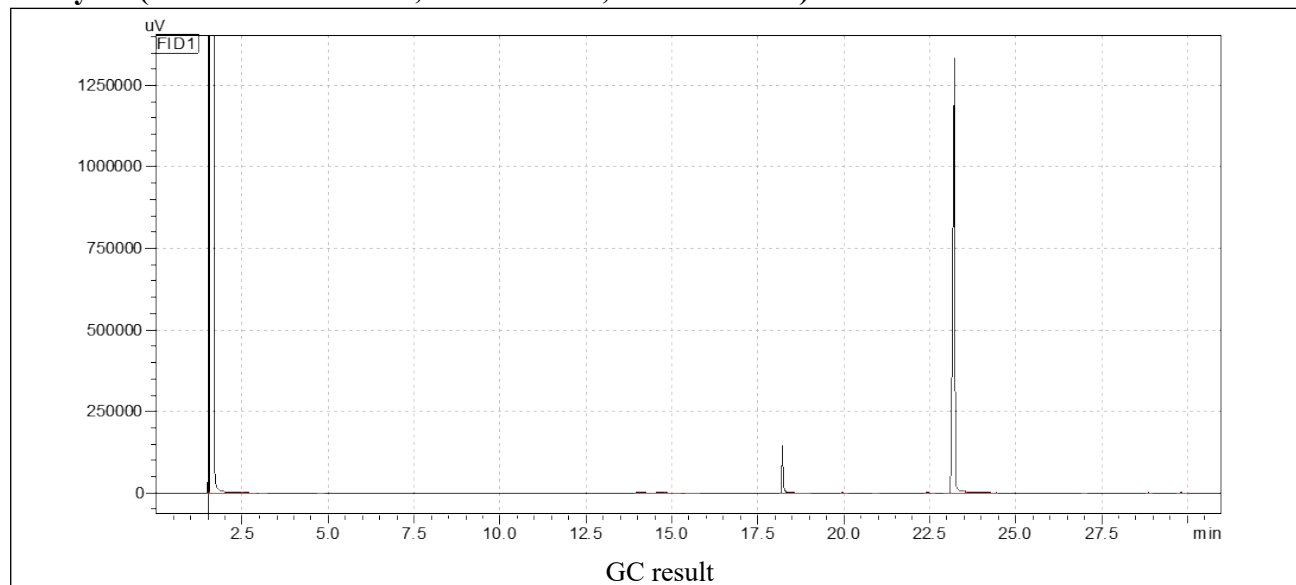
**Entry 42 (CAS: 4543-47-9; MW: 97.12; RT: 7.5 min)**



**Entry 43 (CAS: 30263-41-3; MW: 125.16; RT: 12.1 min)**

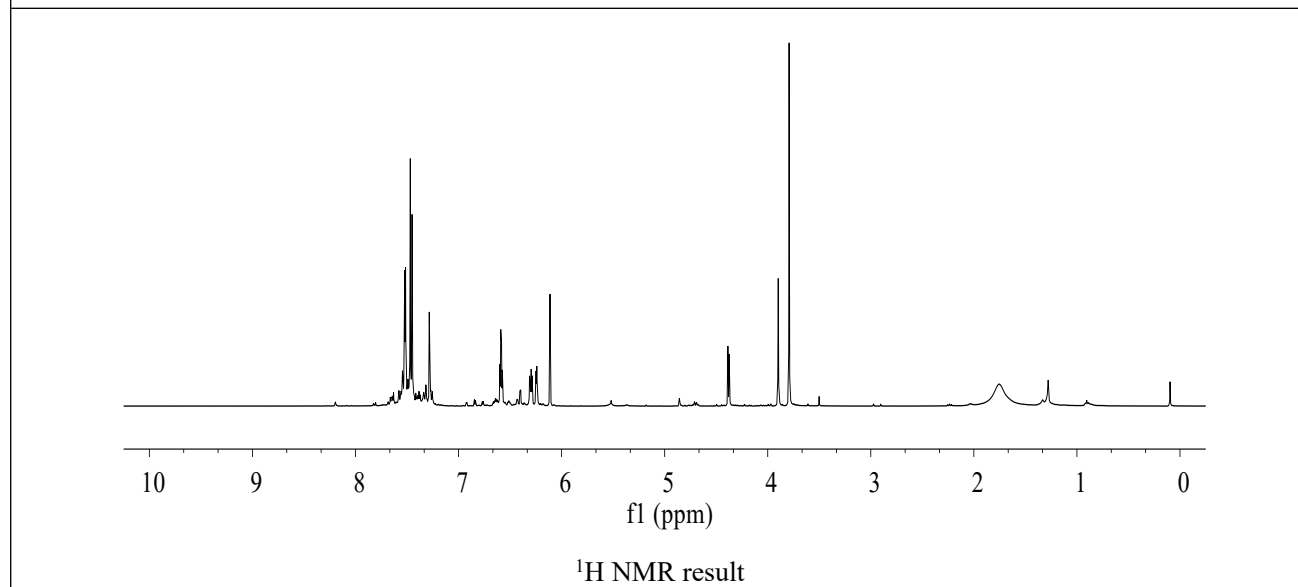
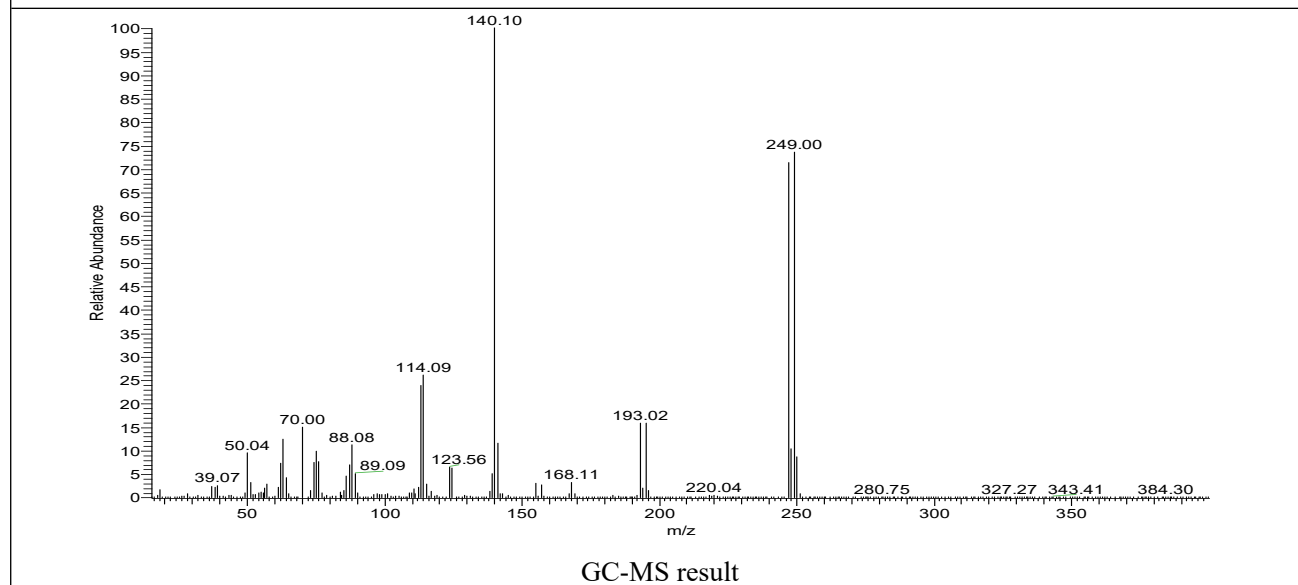
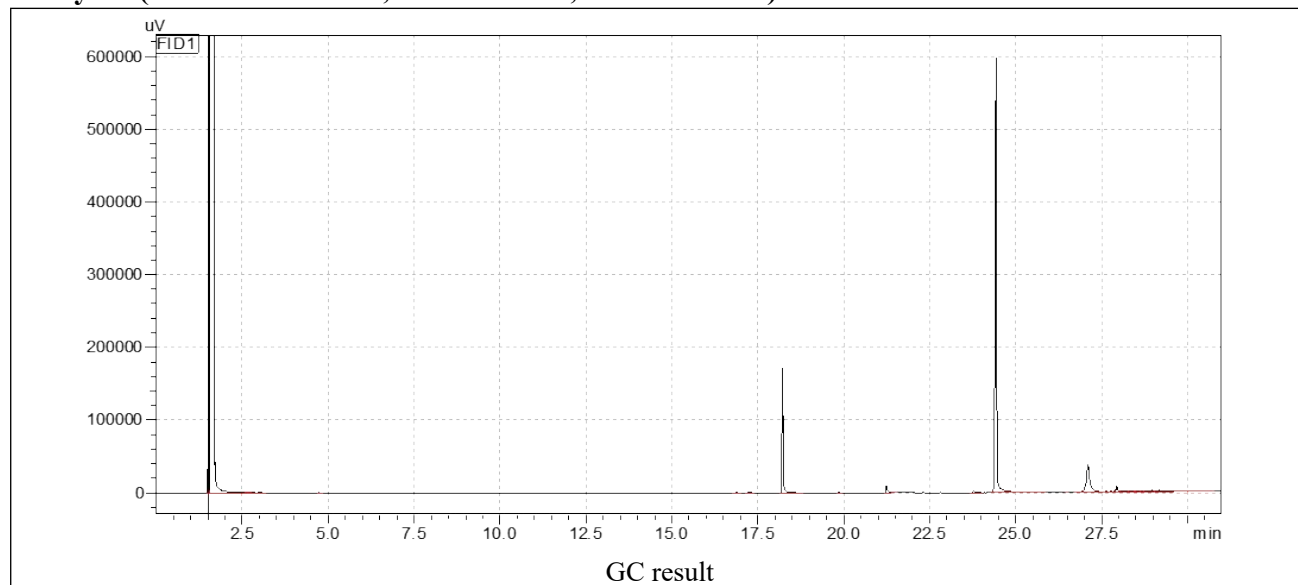


**Entry 44 (CAS: 1017414-86-6; MW: 207.66; RT: 23.1 min)**

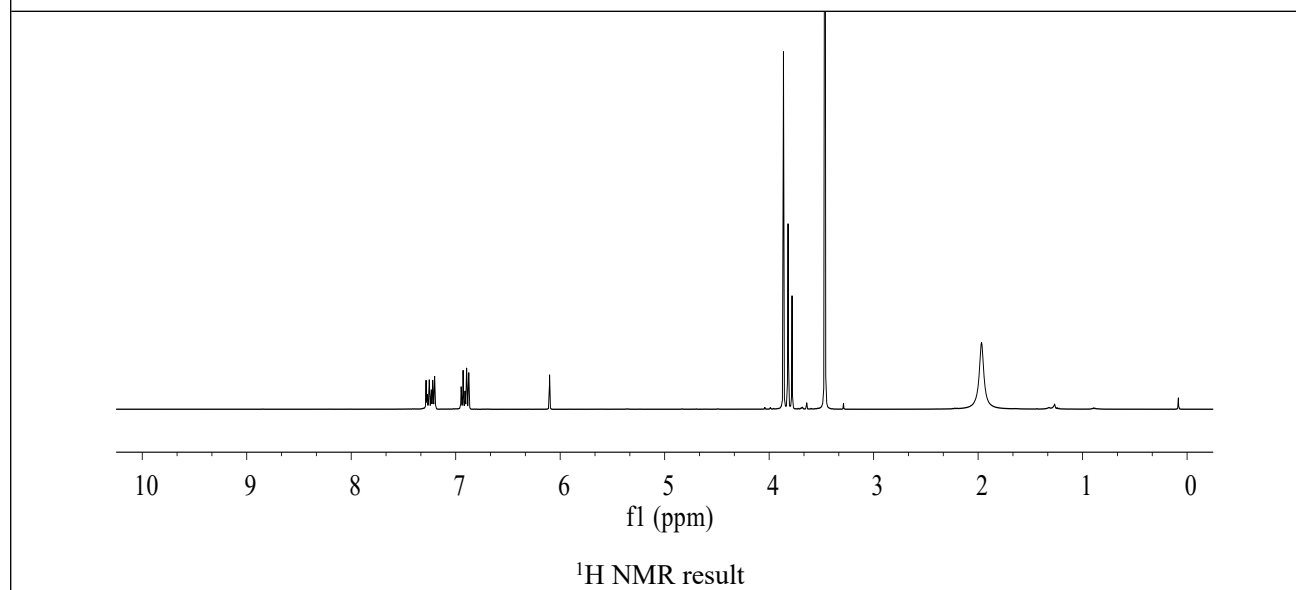
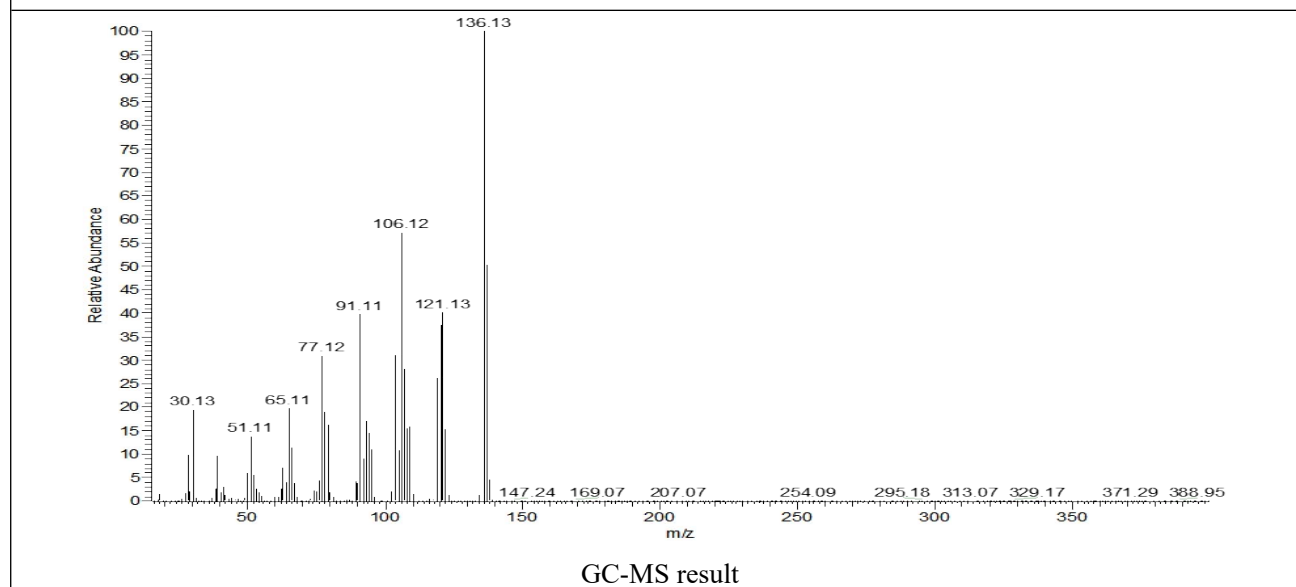
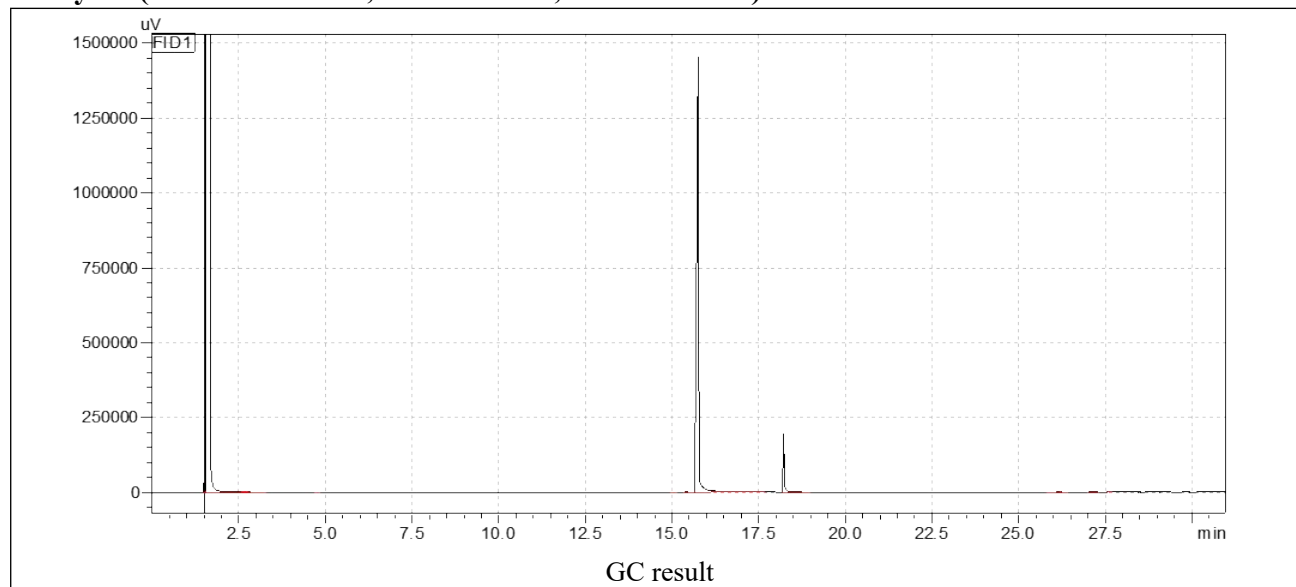




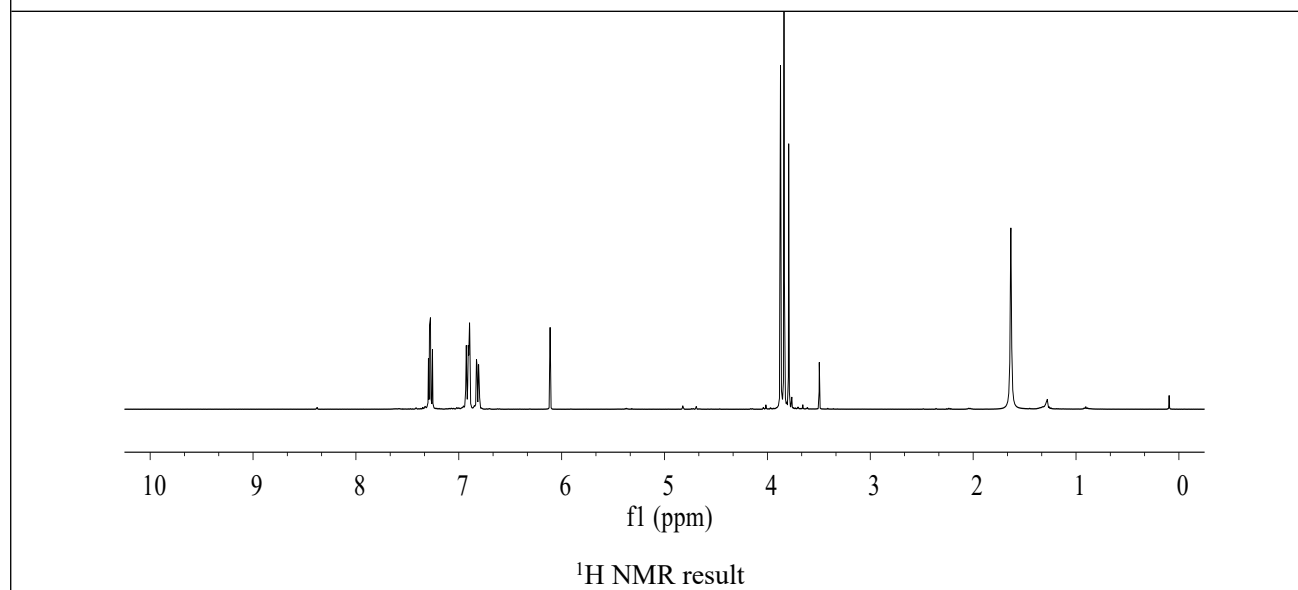
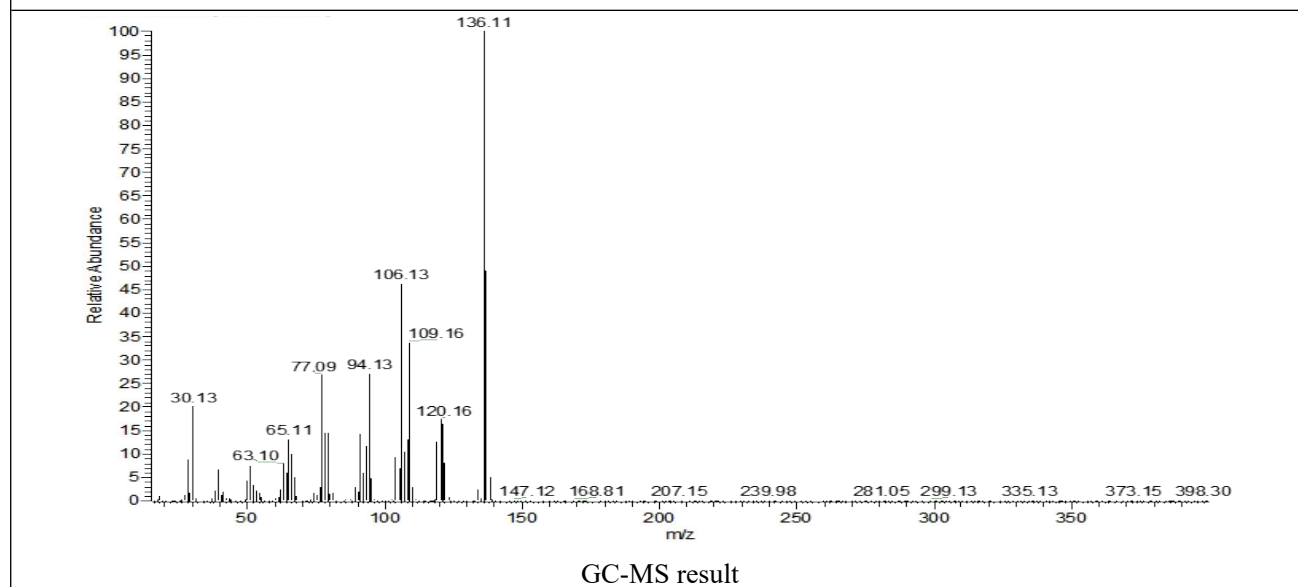
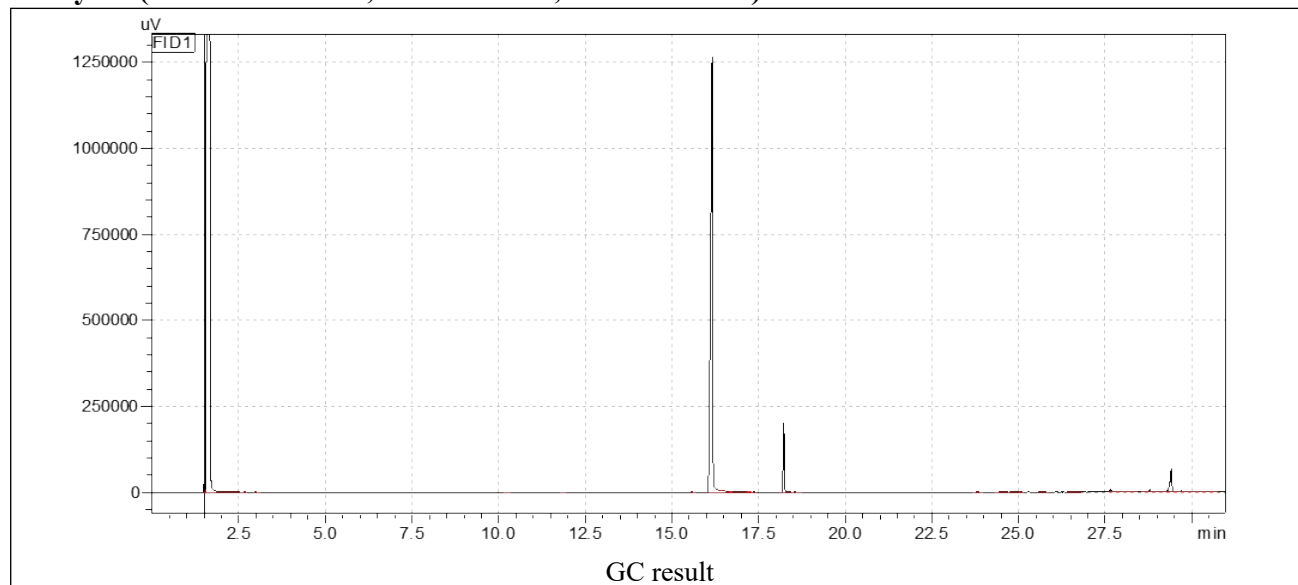
**Entry 45 (CAS: 39169-94-3; MW: 252.11; RT: 24.4 min)**



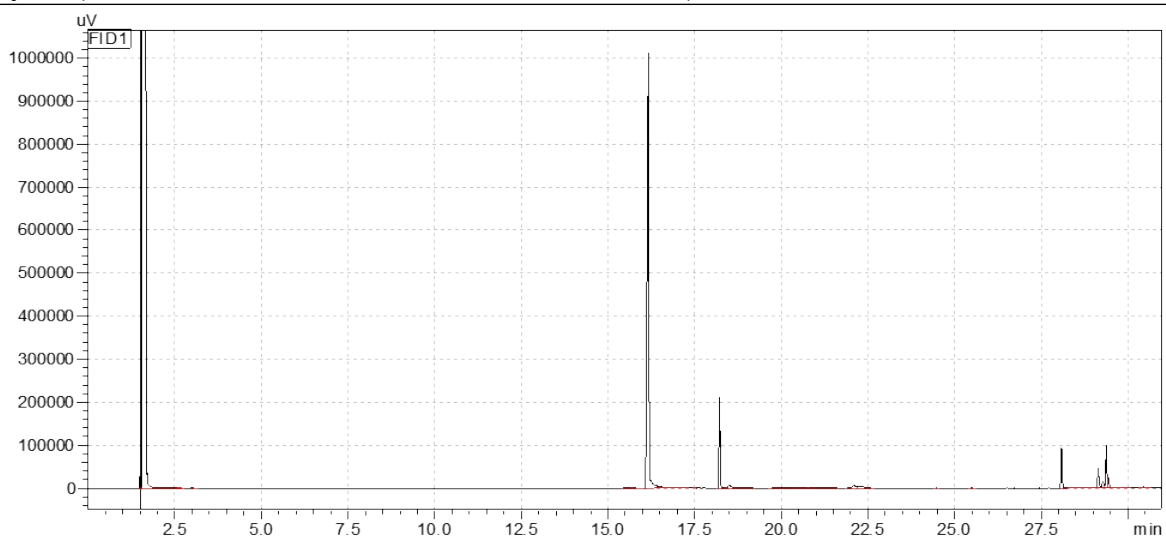
**Entry 46 (CAS: 6850-57-3; MW: 137.18; RT: 15.7 min)**



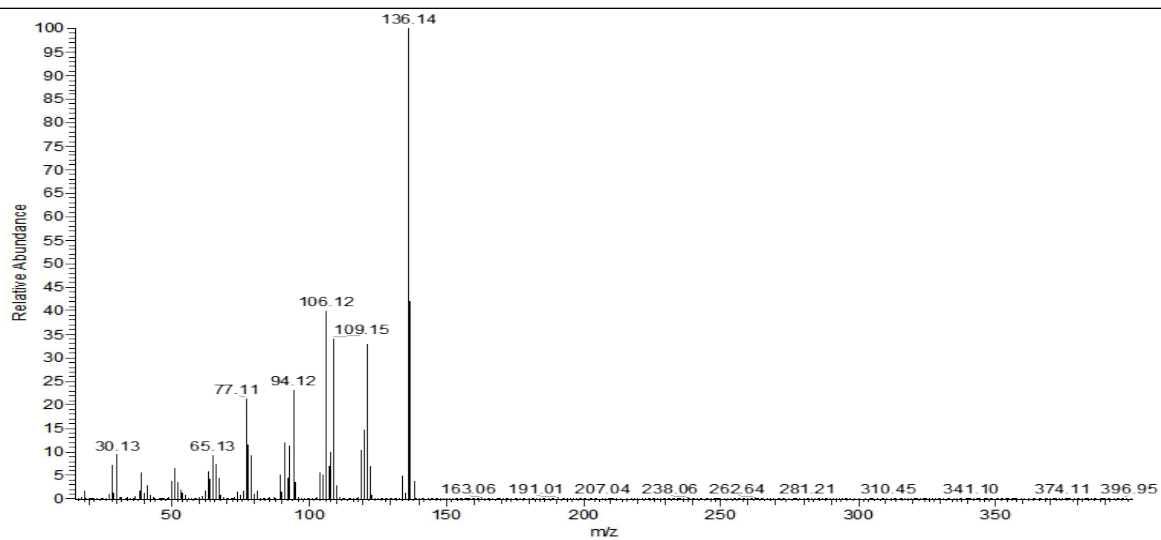
**Entry 47 (CAS: 5071-96-5; MW: 137.18; RT: 16.1 min)**



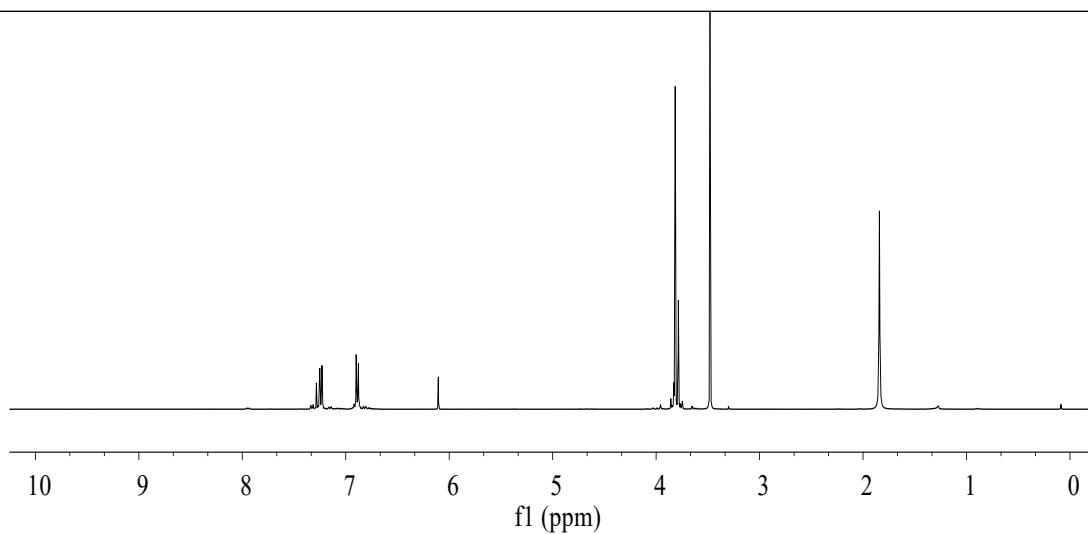
**Entry 48 (CAS: 2393-23-9; MW: 137.18; RT: 16.1 min)**



GC result

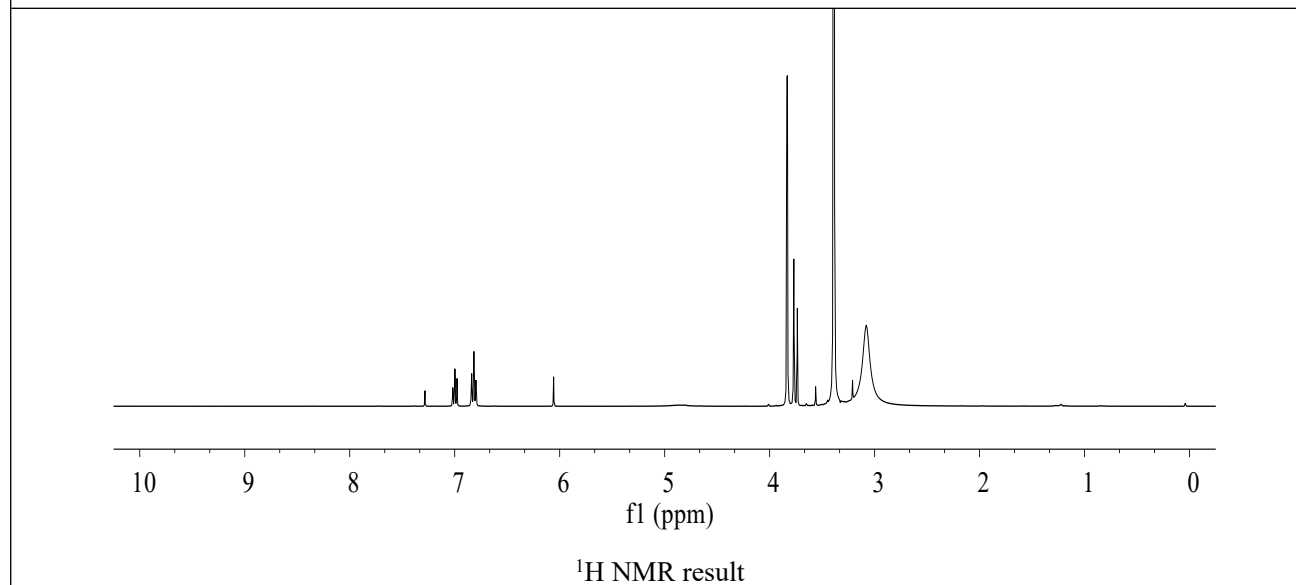
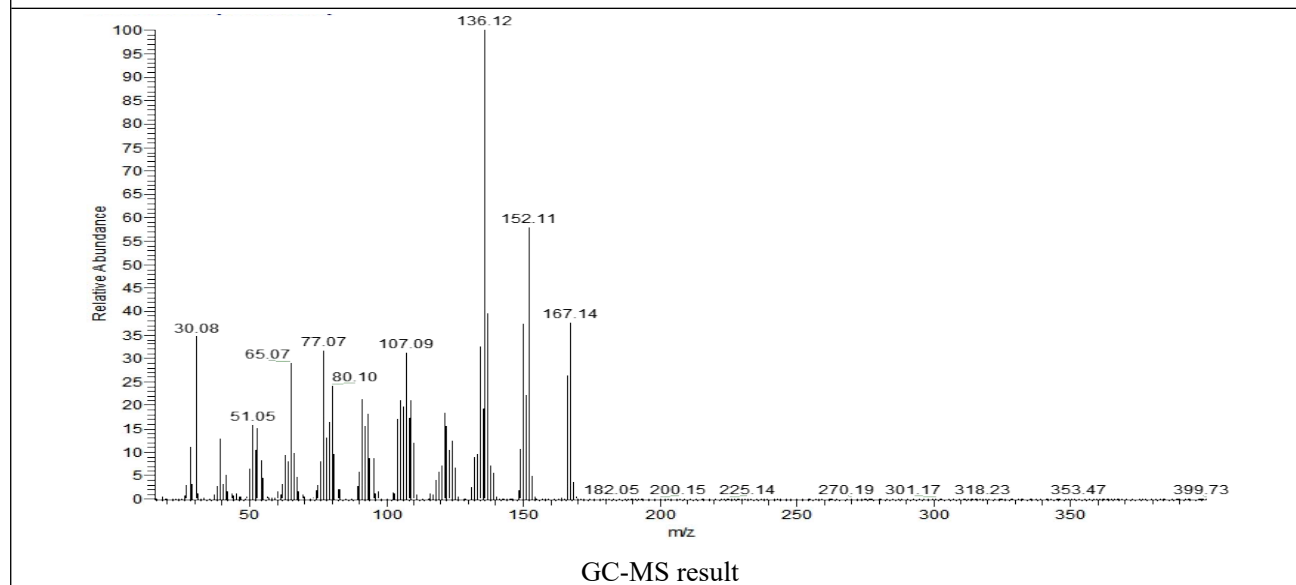
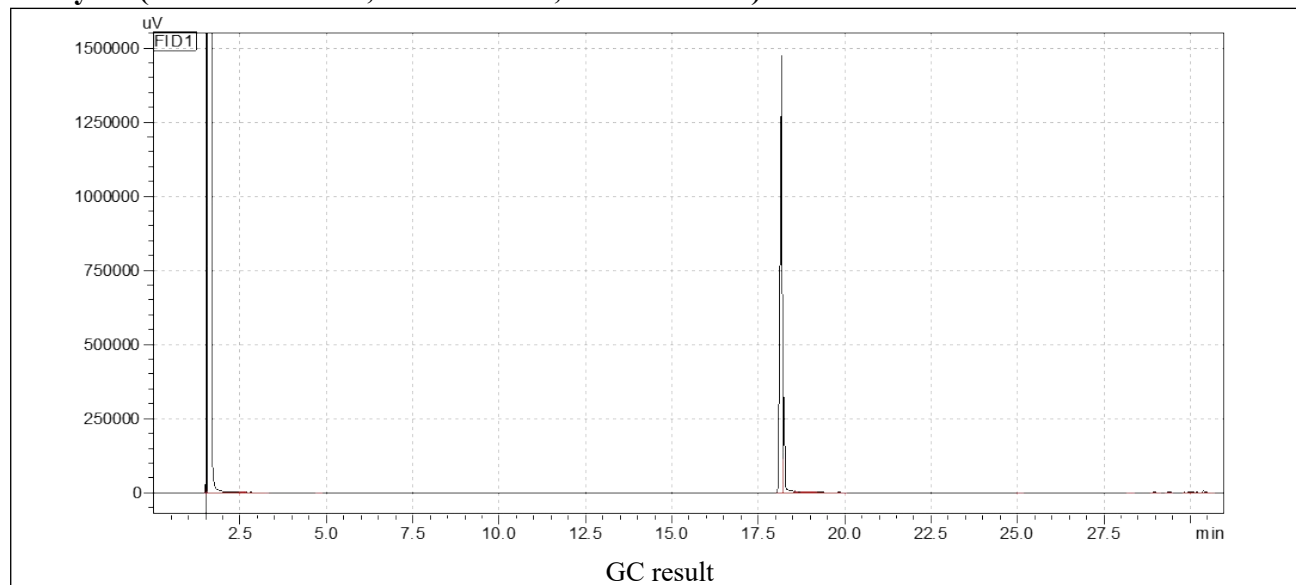


GC-MS result

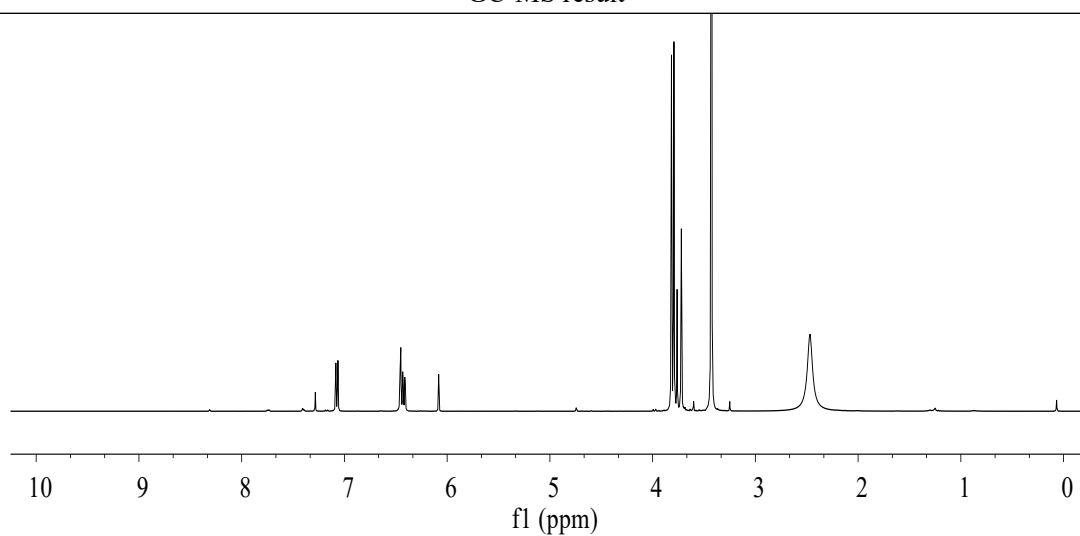
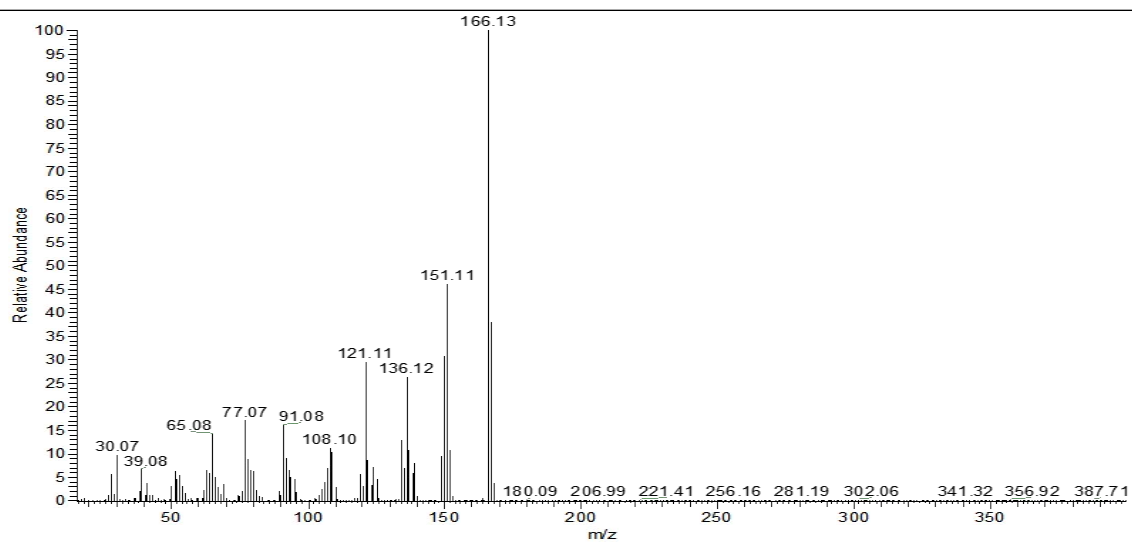
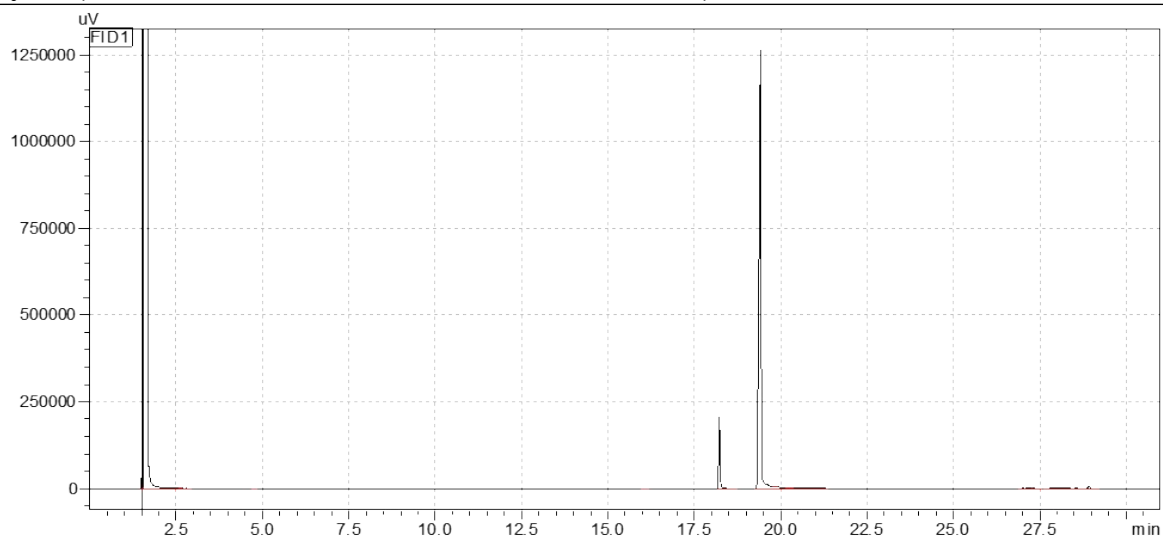


<sup>1</sup>H NMR result

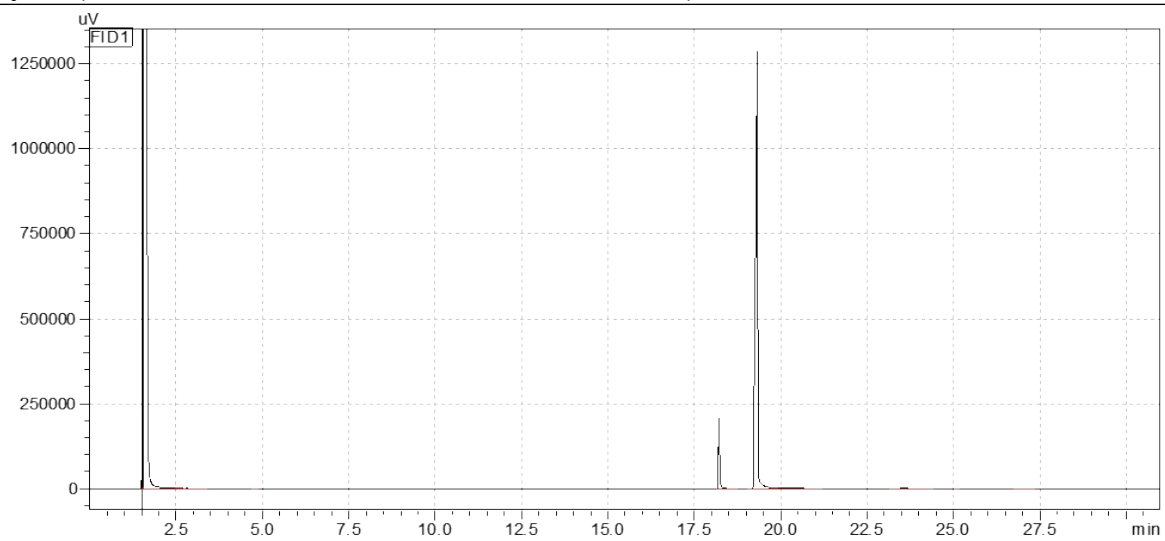
**Entry 49 (CAS: 4393-09-3; MW: 167.21; RT: 18.2 min)**



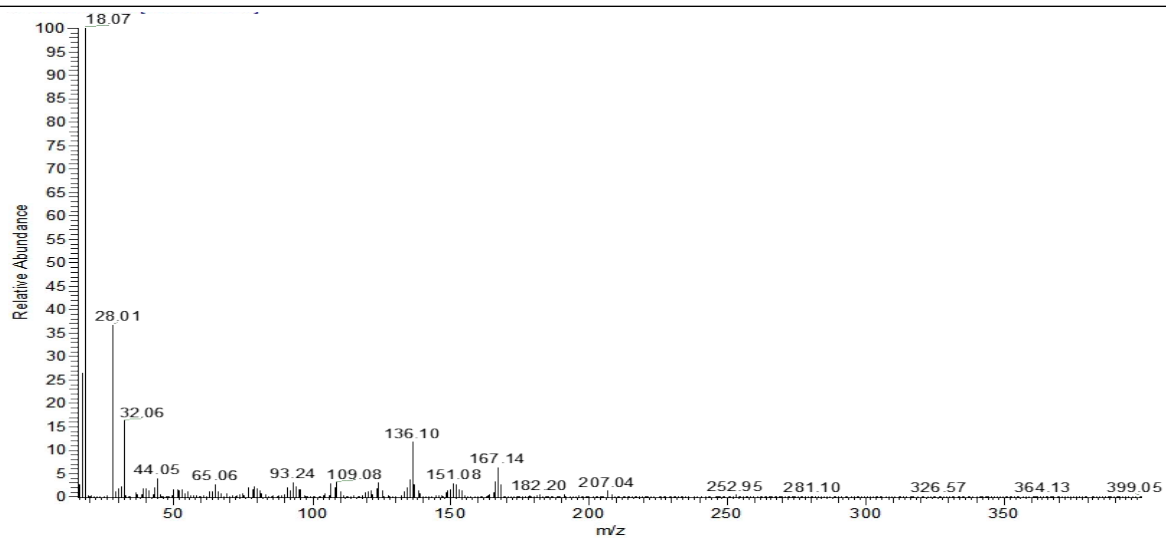
**Entry 50 (CAS: 20781-20-8; MW: 167.21; RT: 19.4 min)**



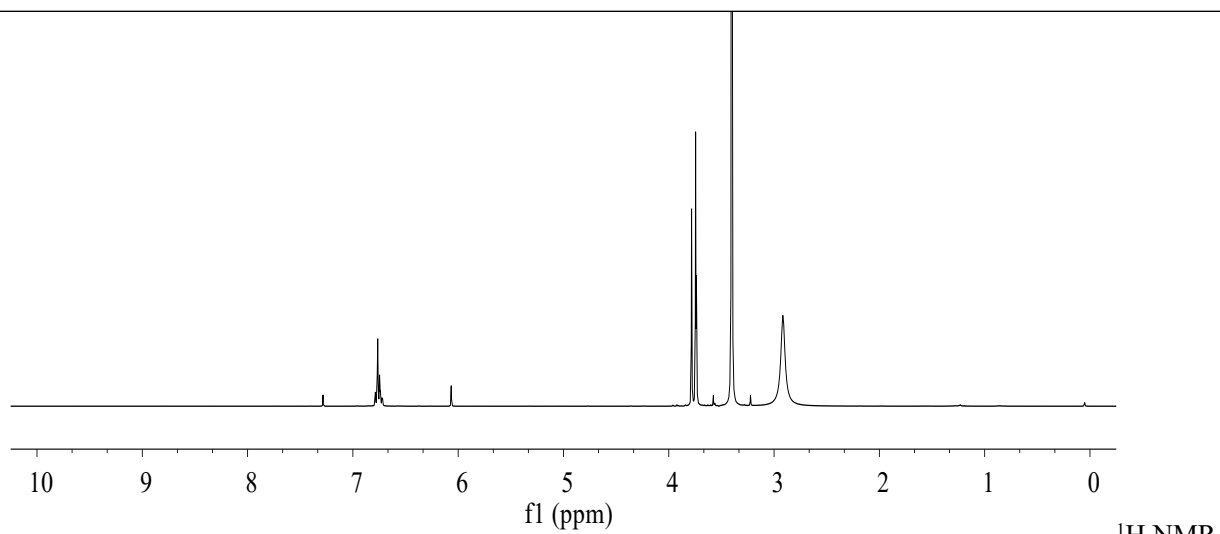
**Entry 51 (CAS: 3275-95-4; MW: 167.21; RT: 19.3 min)**



GC result



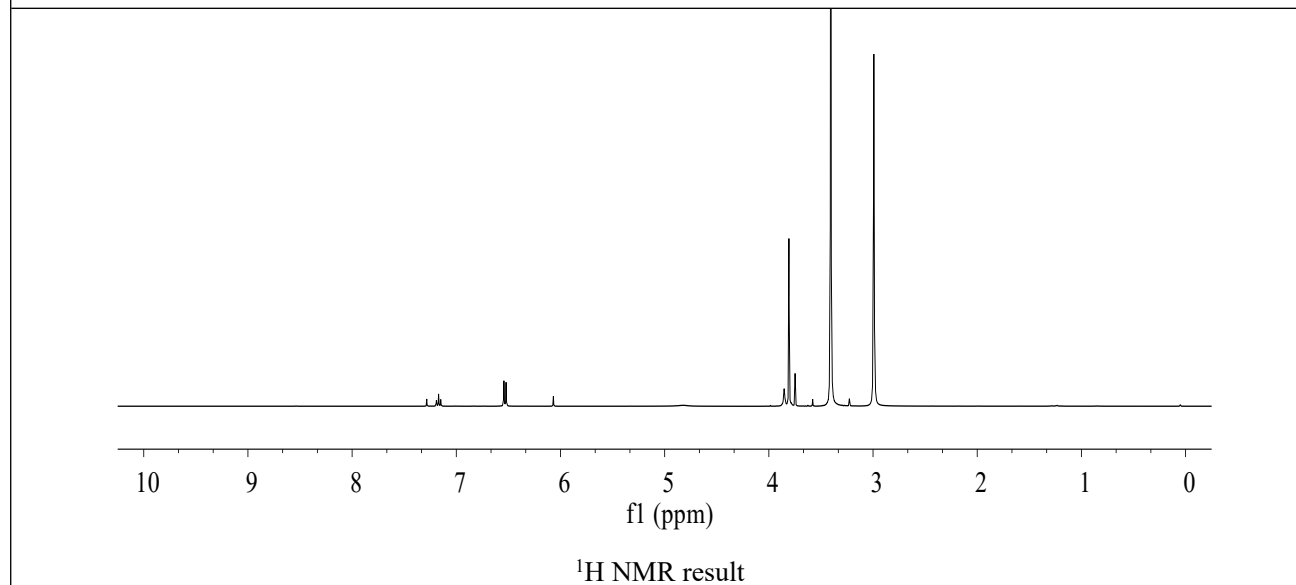
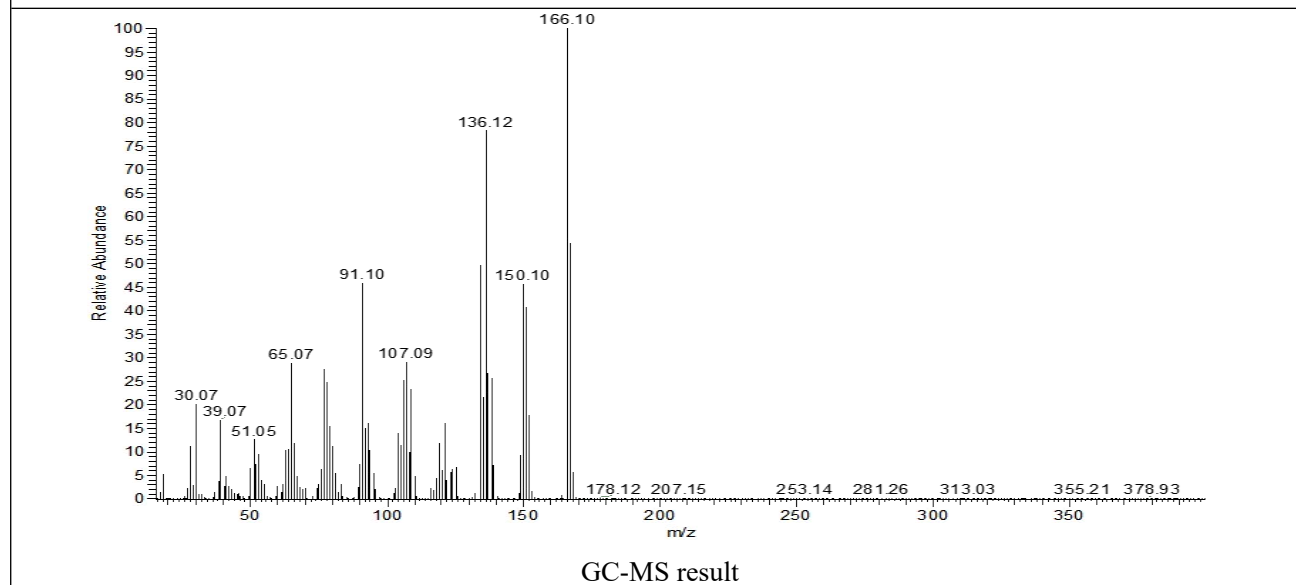
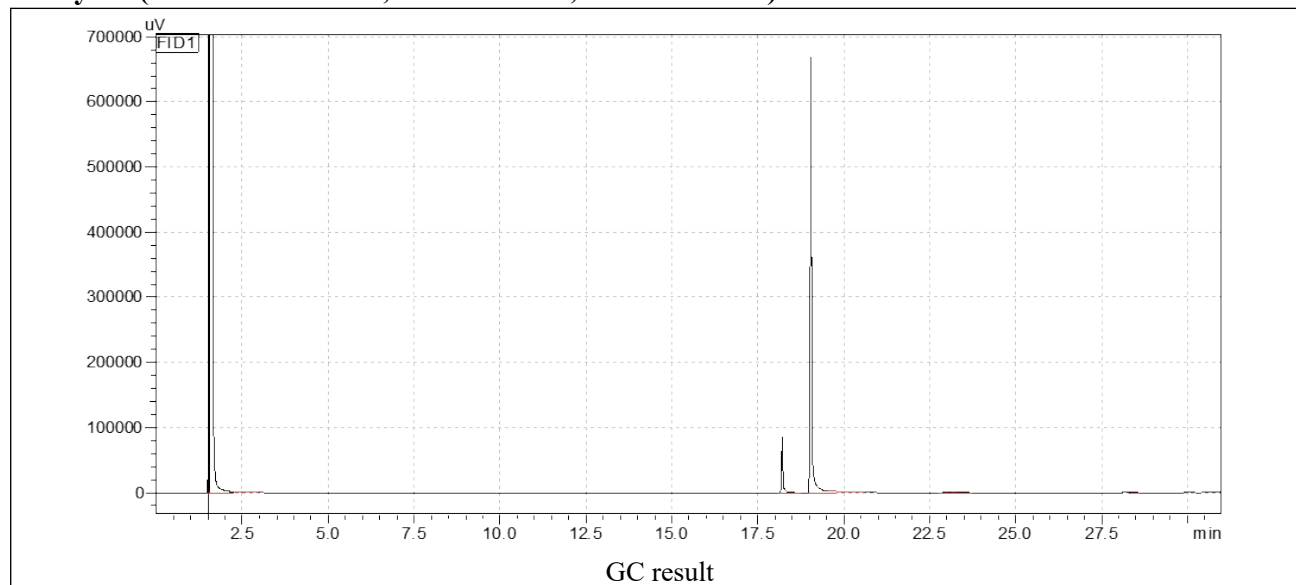
GC-MS result



result

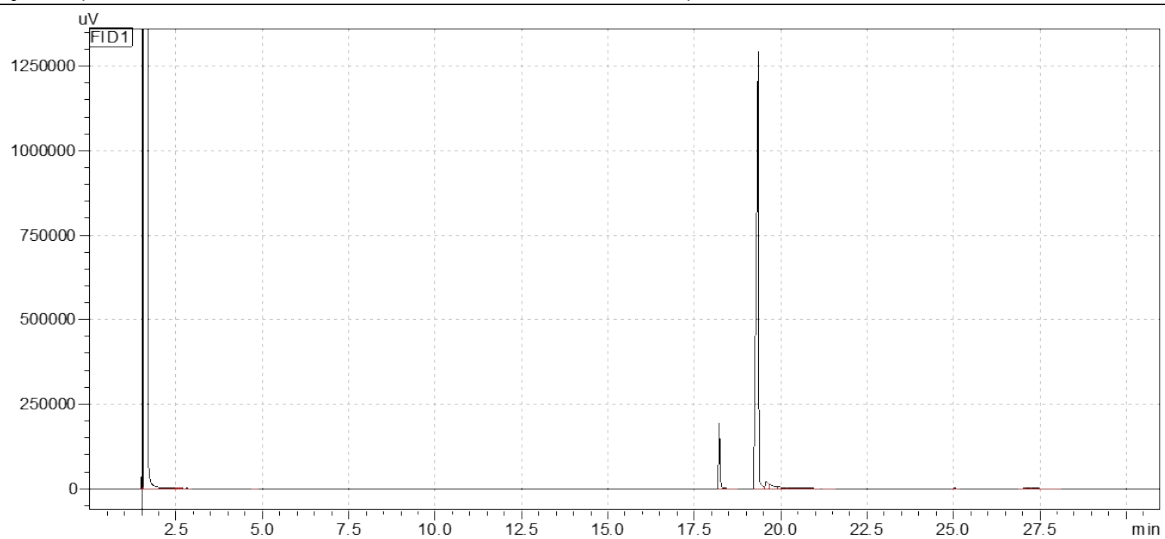
<sup>1</sup>H NMR

**Entry 52 (CAS: 20781-22-0; MW: 167.21; RT: 19.1 min)**

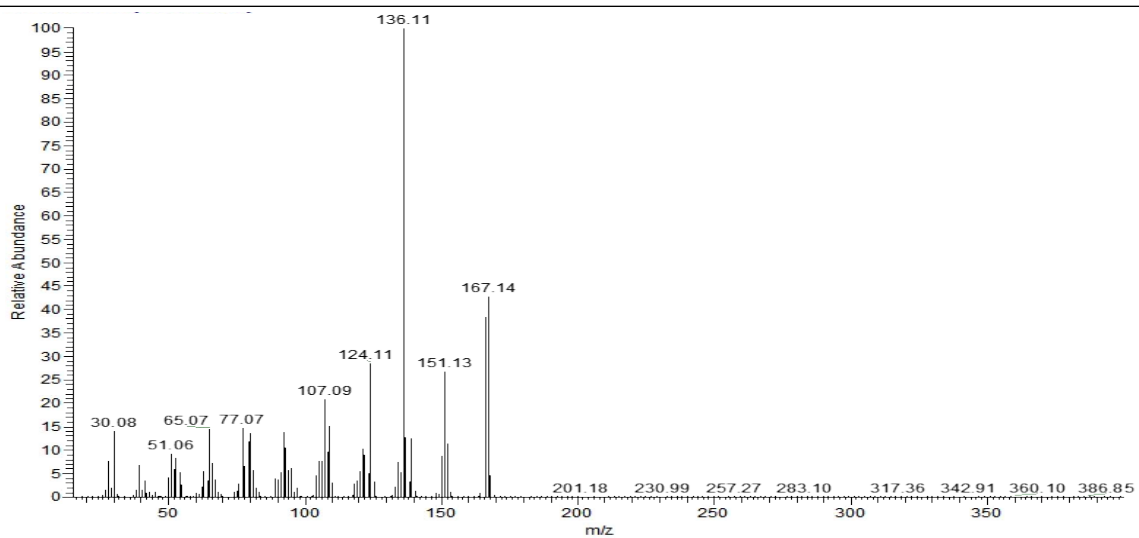




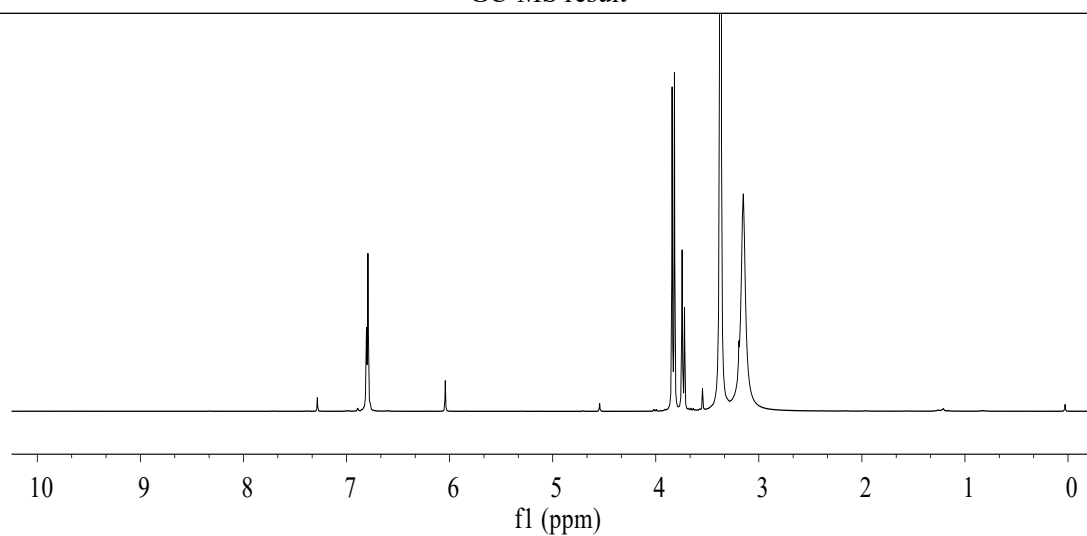
**Entry 53 (CAS: 5763-61-1; MW: 167.21; RT: 19.2 min)**



GC result

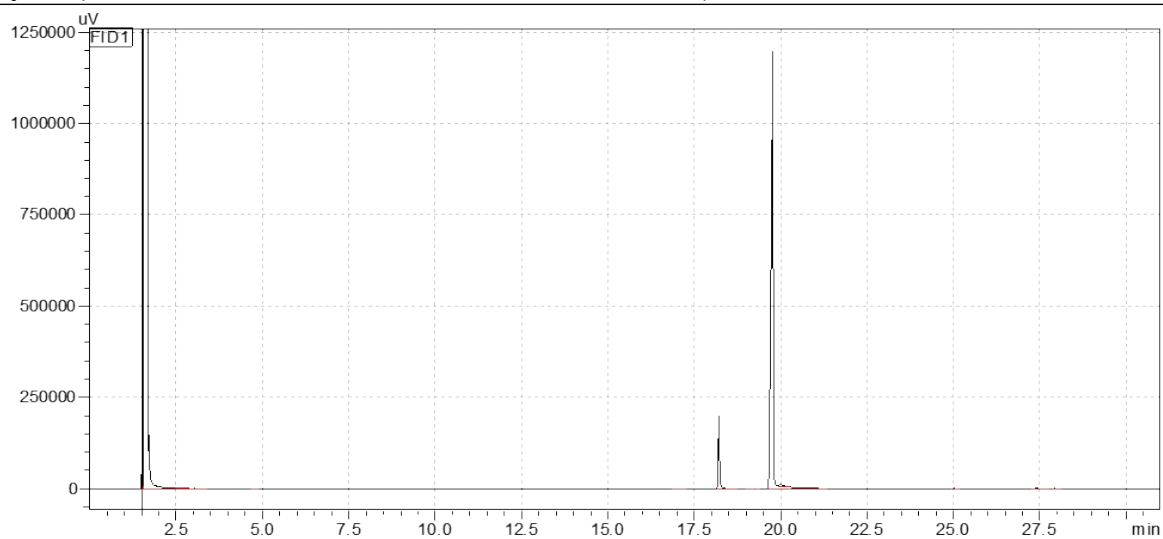


GC-MS result

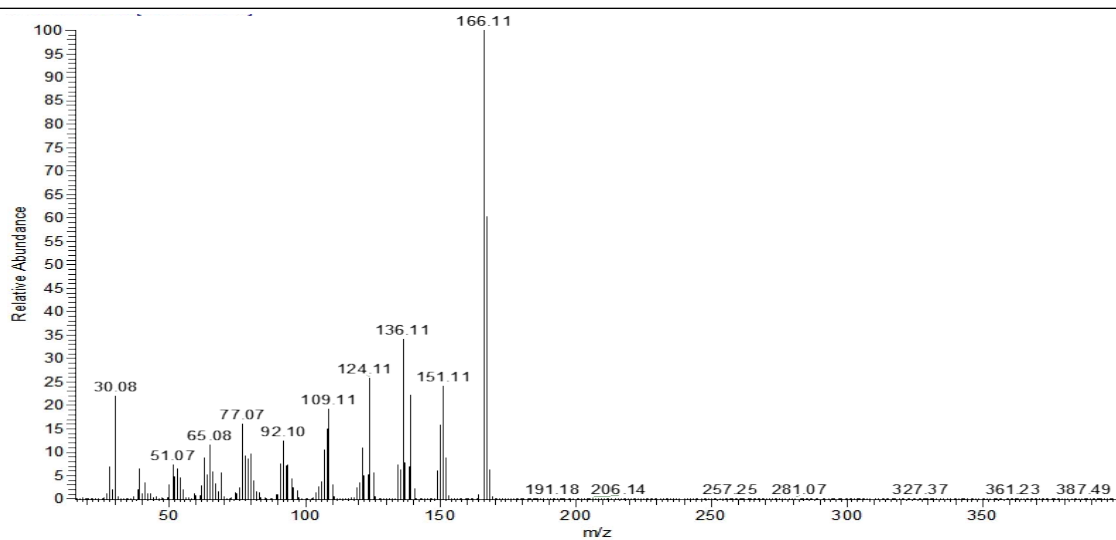


<sup>1</sup>H NMR result

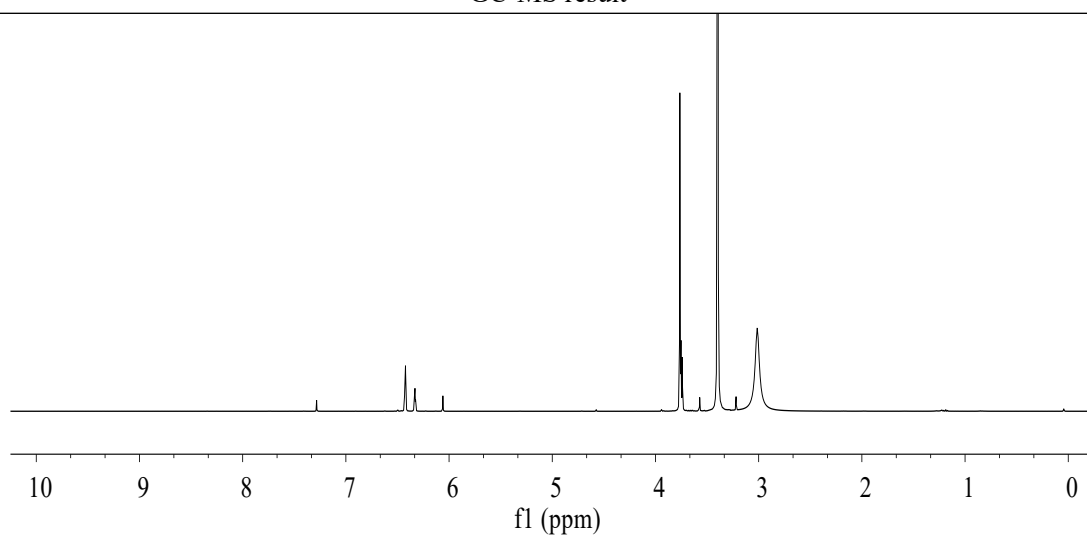
**Entry 54 (CAS: 34967-24-3; MW: 167.21; RT: 19.7 min)**



GC result

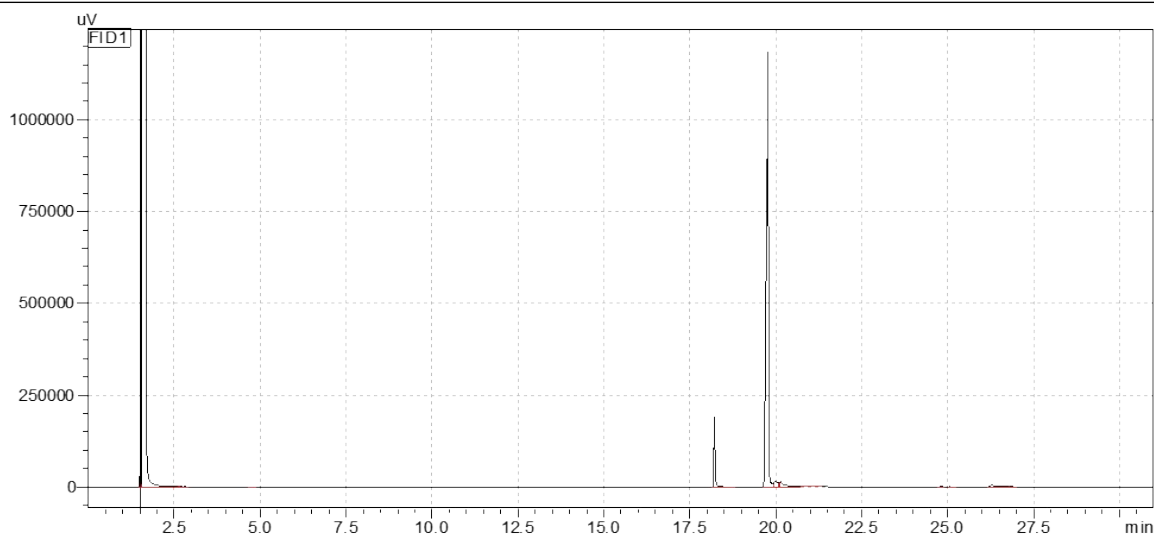


GC-MS result



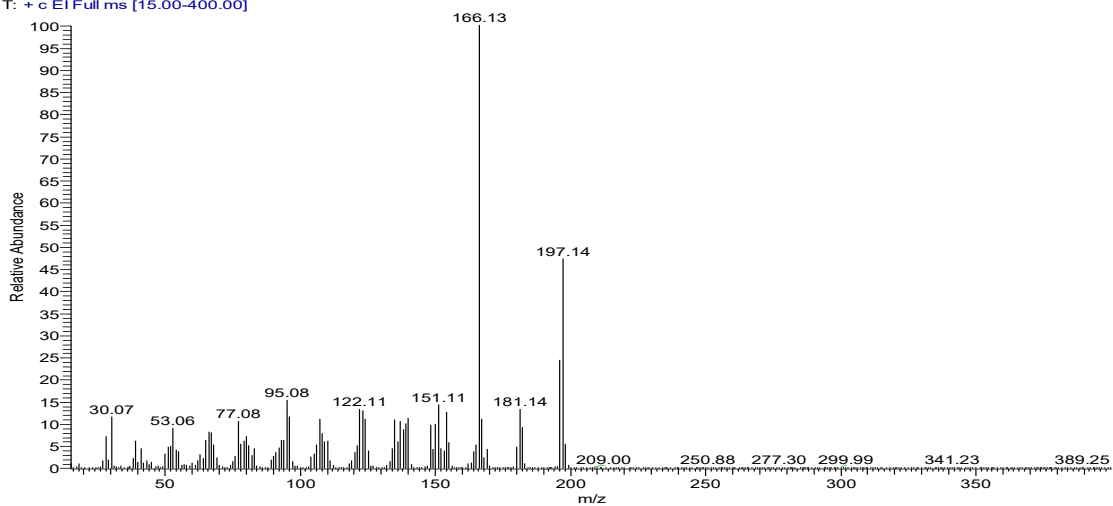
<sup>1</sup>H NMR result

**Entry 55 (CAS: 41219-16-3; MW: 197.23; RT: 19.7 min)**

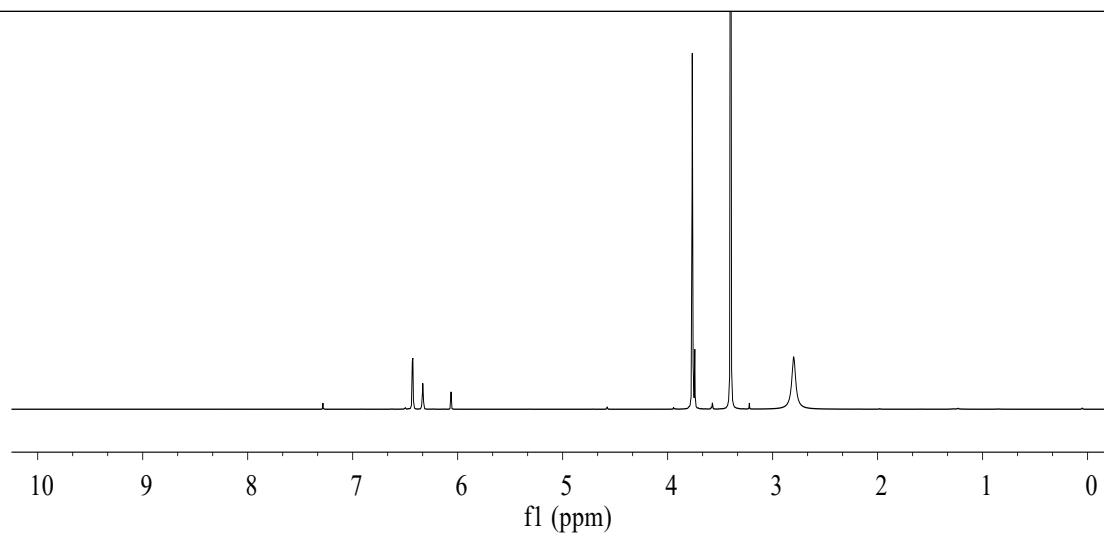


GC result

D-2-53 #5161 RT: 17.58 AV: 1 NL: 2.24E8  
T: + c EI Full ms [15.00-400.00]

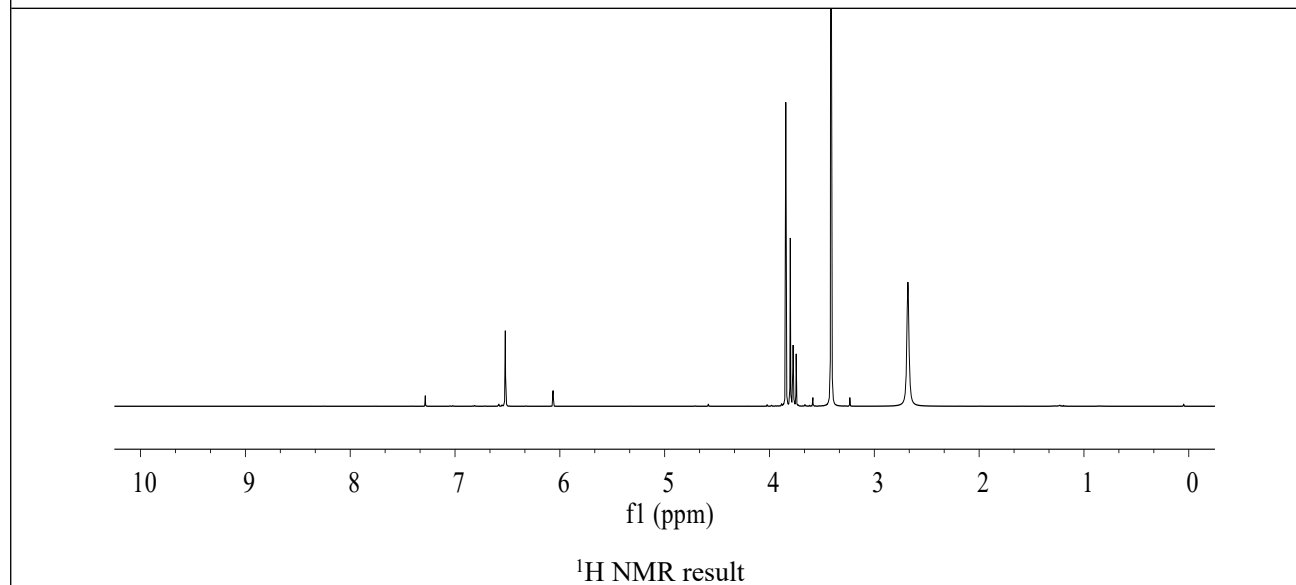
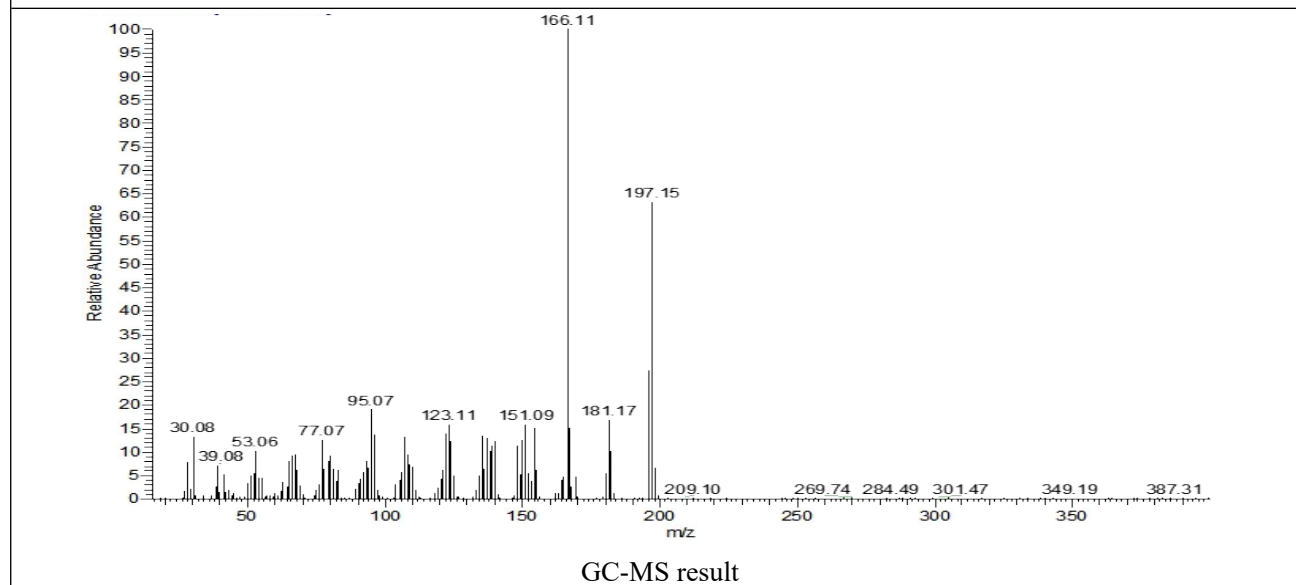
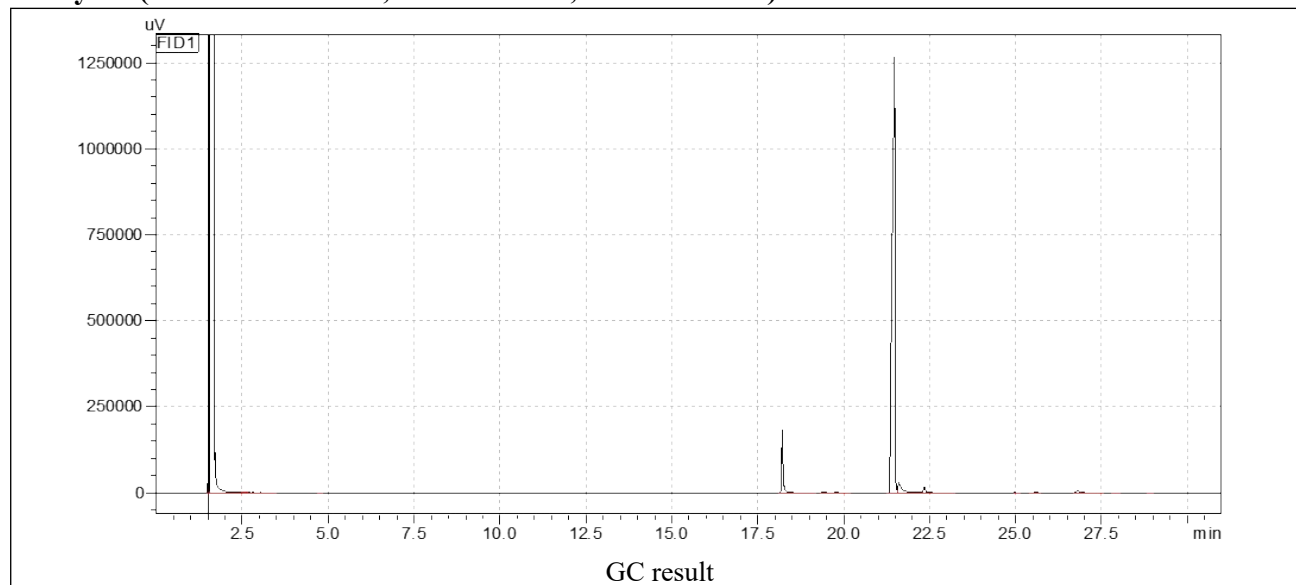


GC-MS result

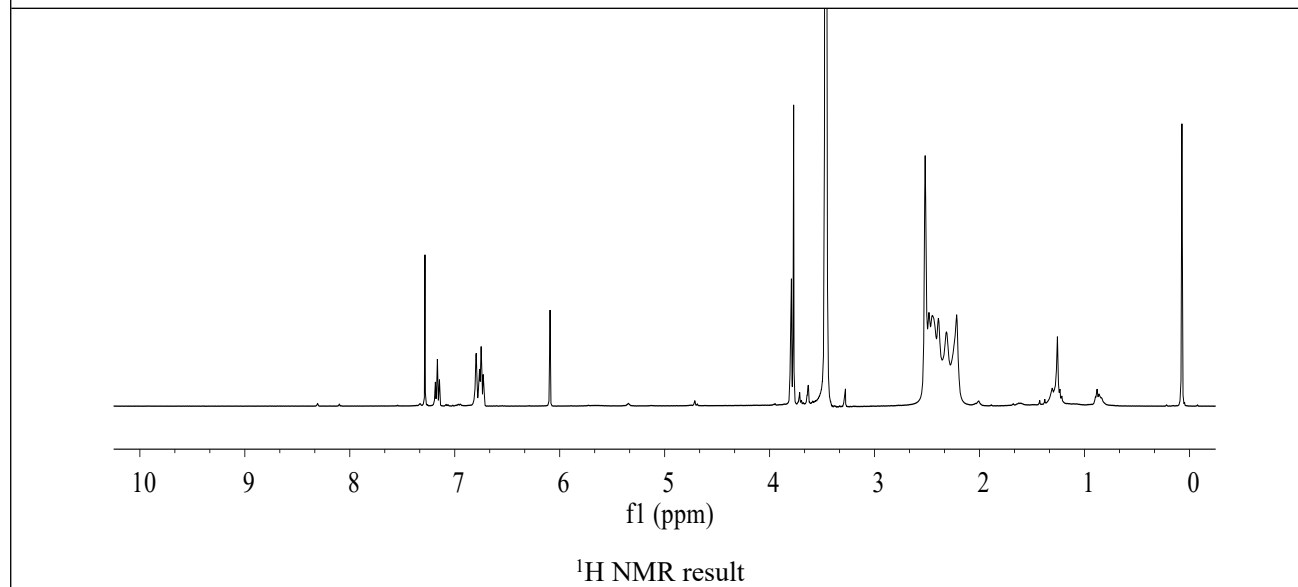
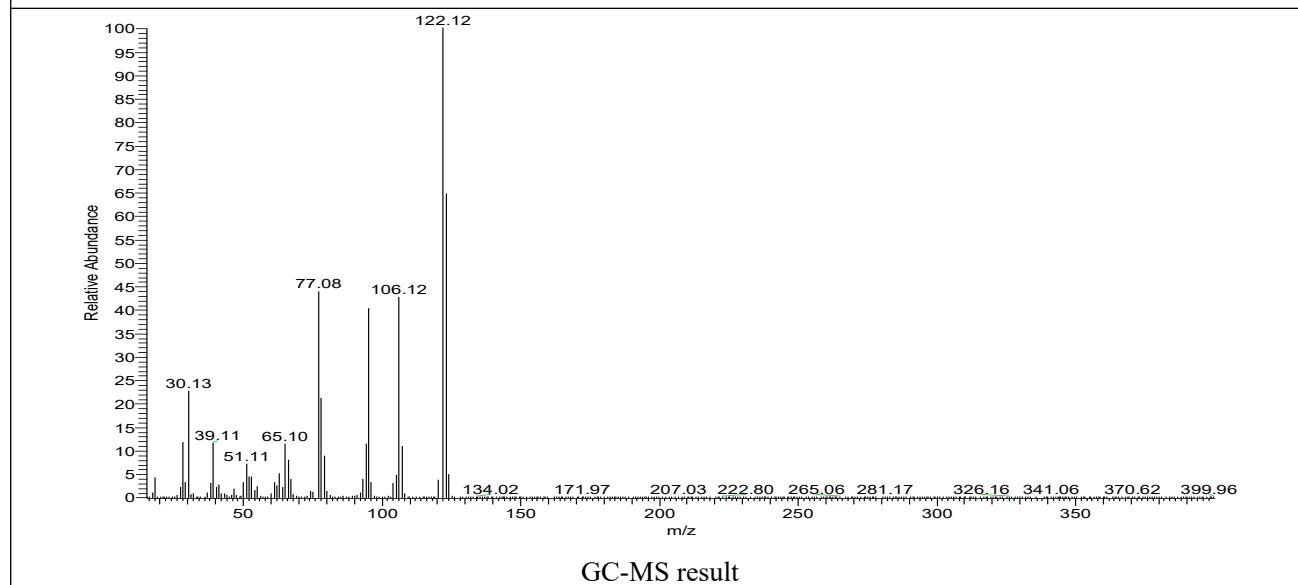
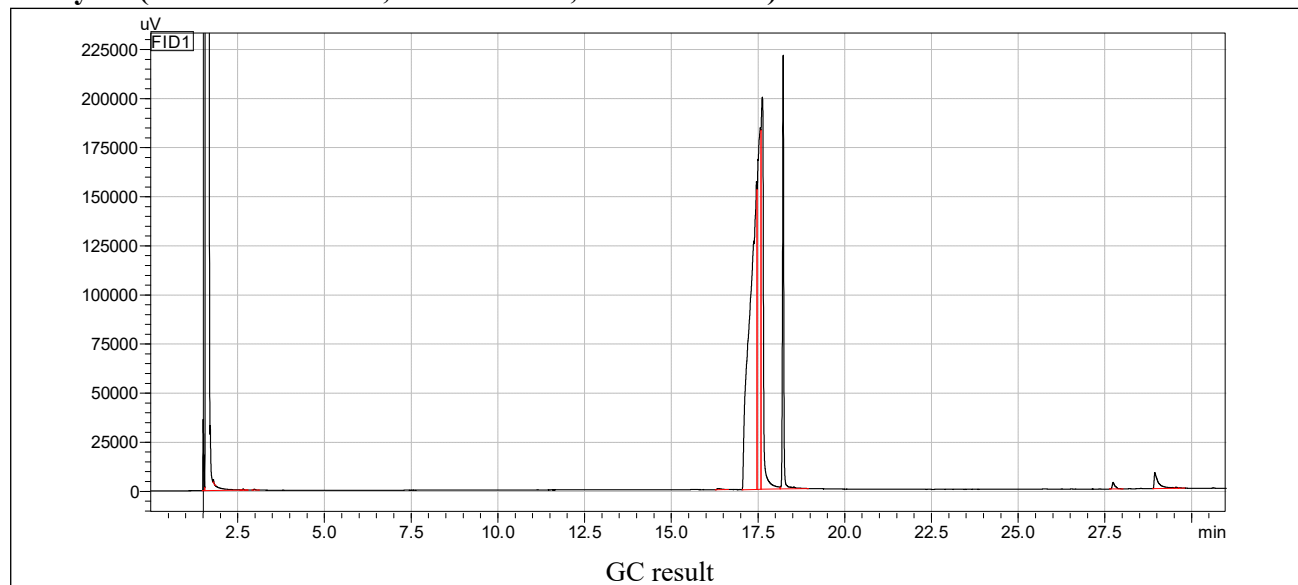


<sup>1</sup>H NMR result

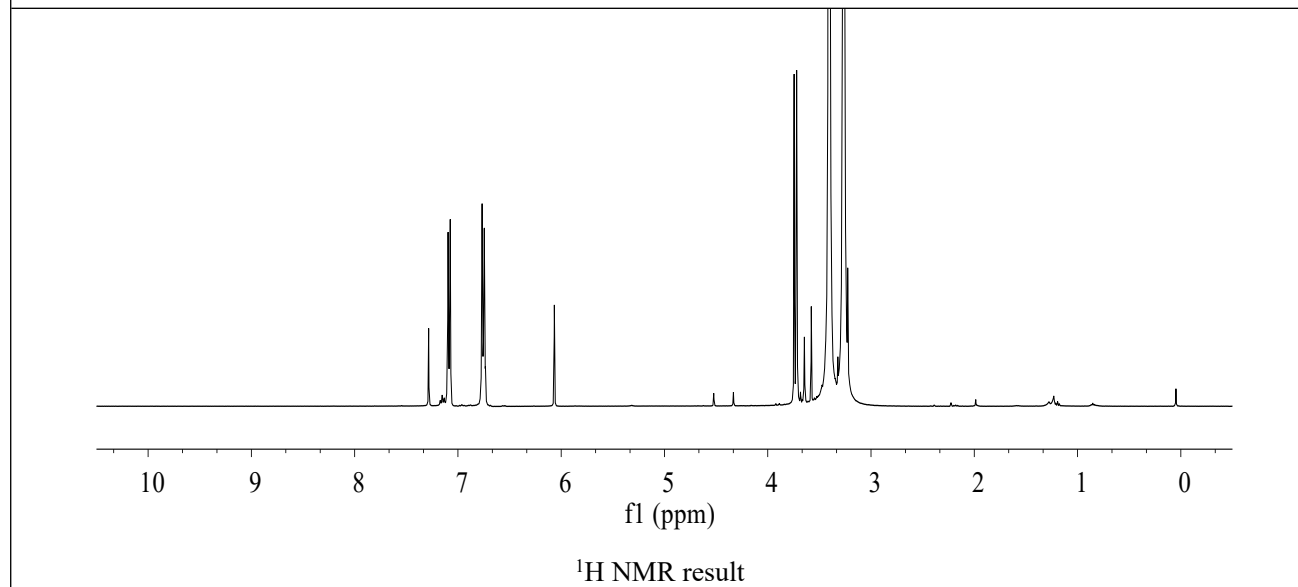
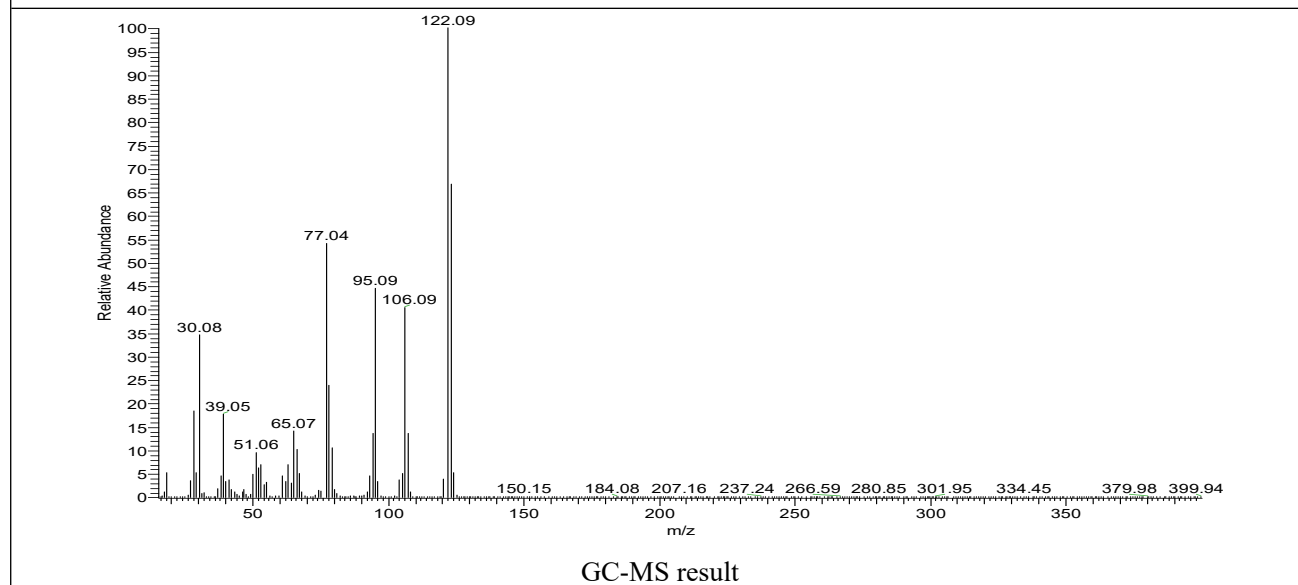
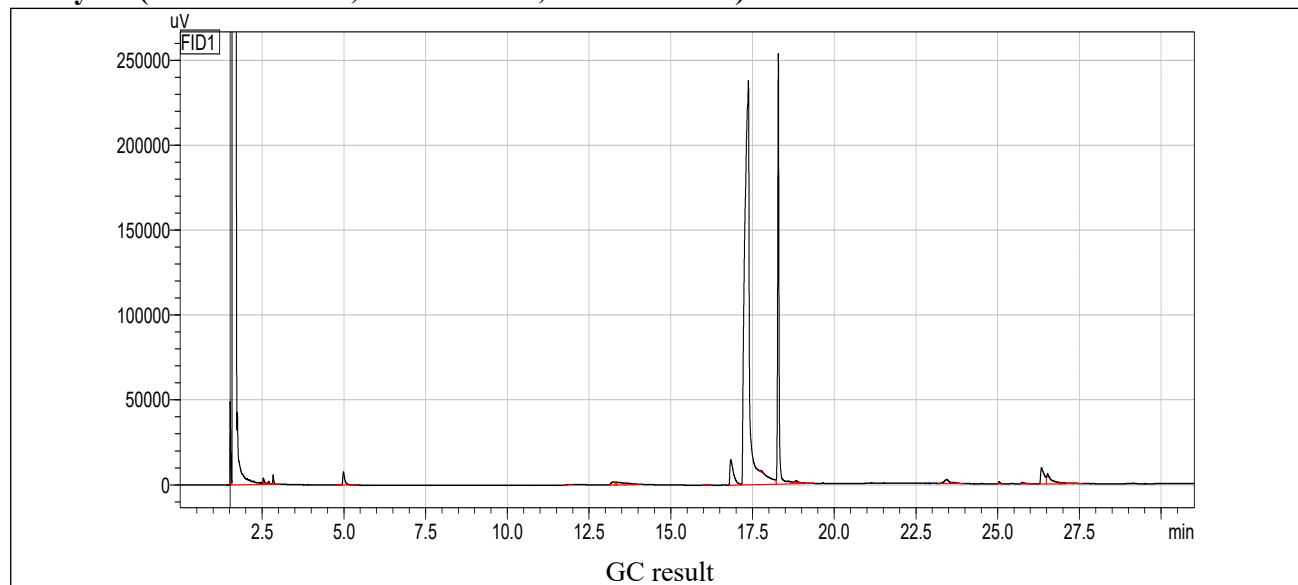
**Entry 56 (CAS: 18638-99-8; MW: 197.23; RT: 21.8 min)**



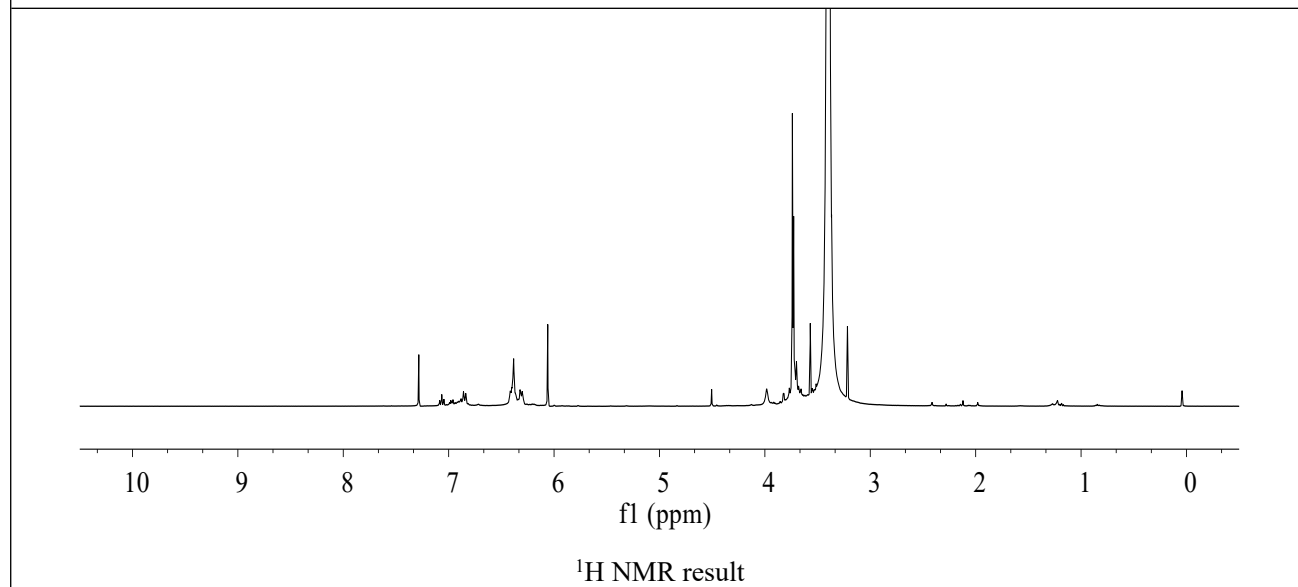
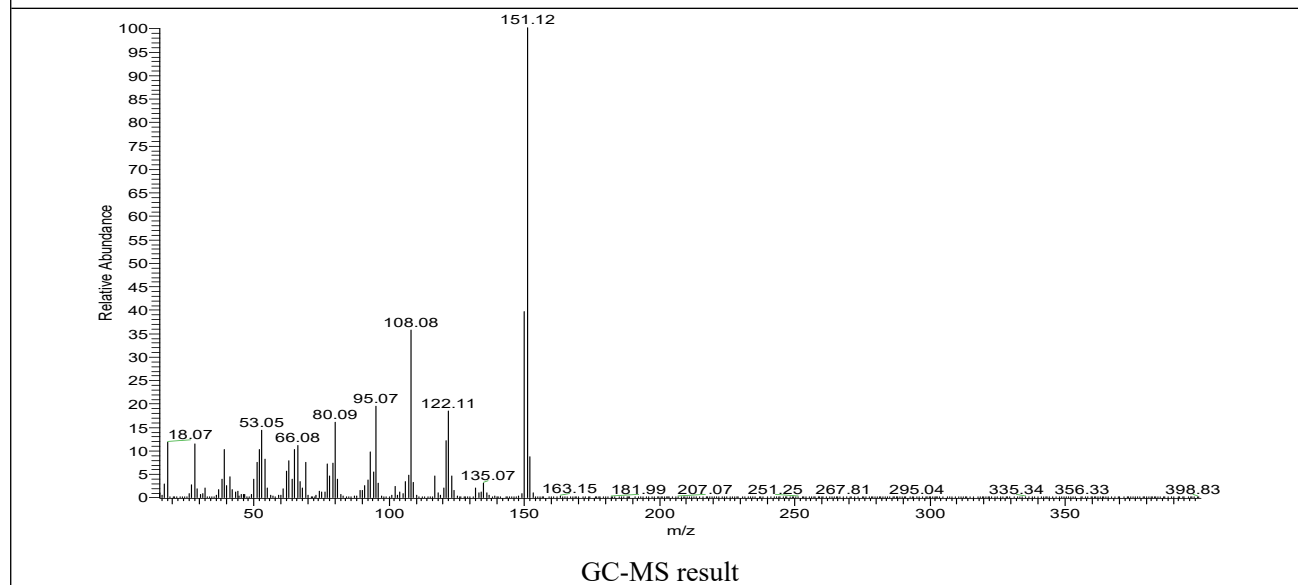
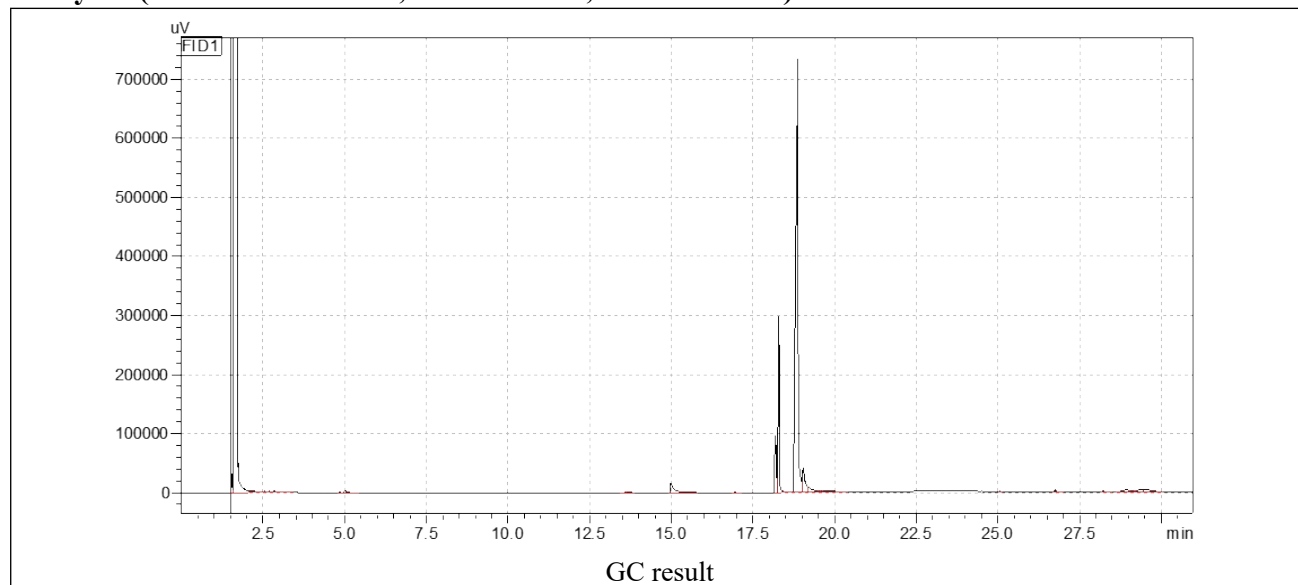
**Entry 57 (CAS: 73604-31-6; MW: 123.15; RT: 17.2 min)**



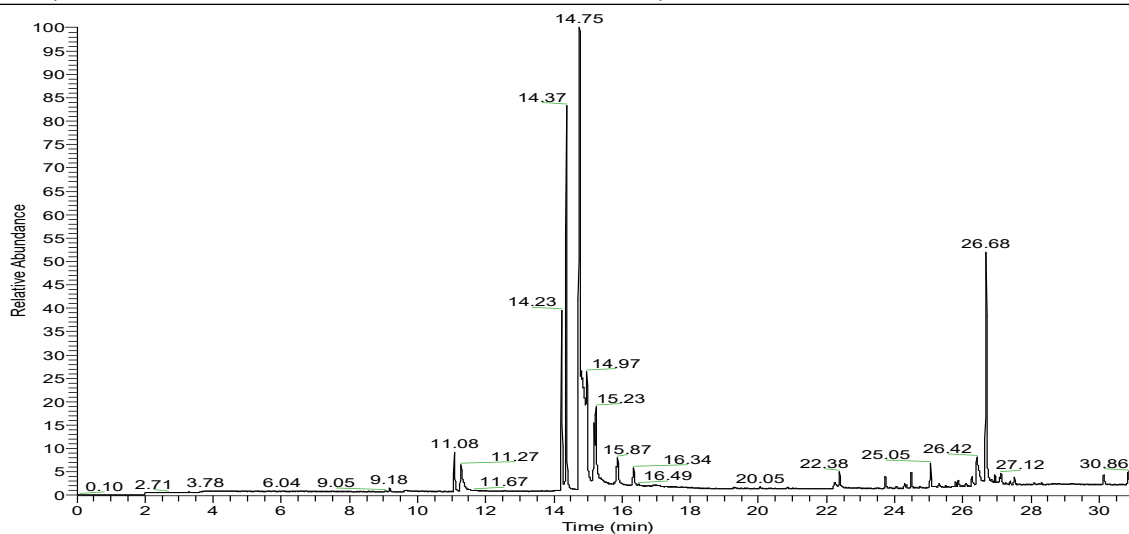
**Entry 58 (CAS: 696-60-6; MW: 123.15; RT: 16.9 min)**



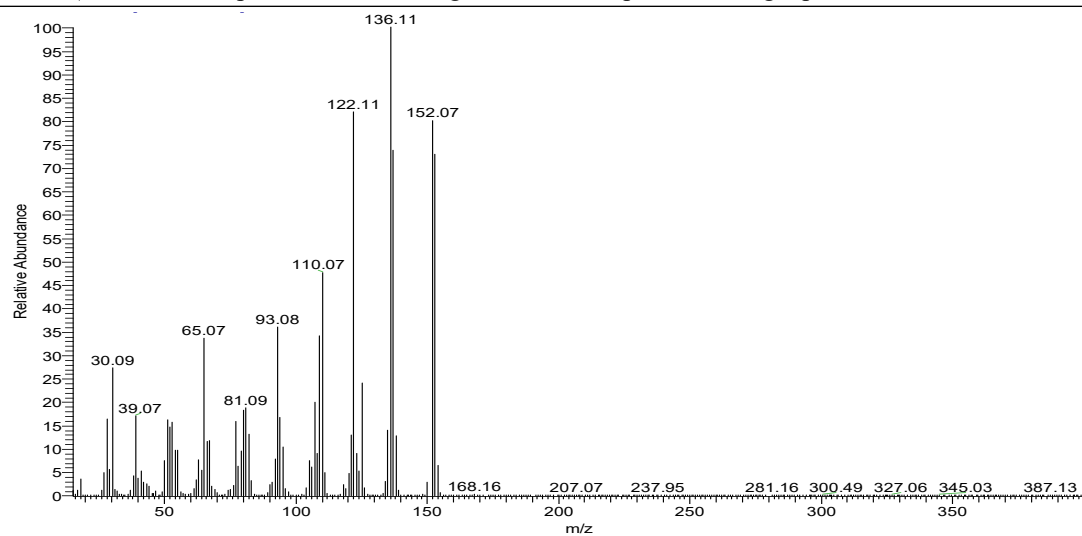
**Entry 59 (CAS: 164515-08-6; MW: 153.18; RT: 18.8 min)**



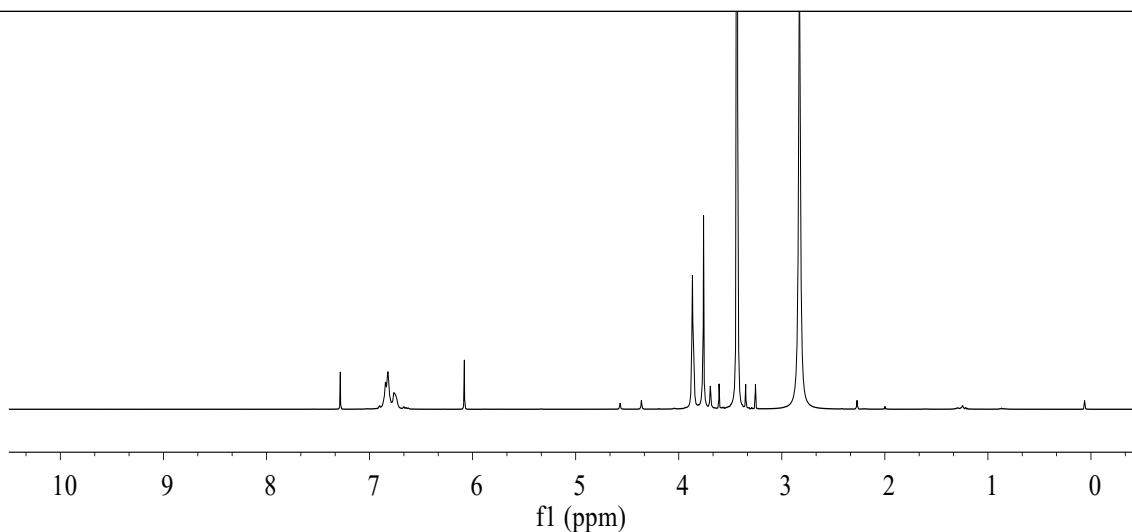
**Entry 60 (CAS: 1196-92-5; MW: 153.18; RT: 14.7 min)**



GC result (Note: GC-MS procedure was changed in here to separate the target product and the Interior standard)



GC-MS result



<sup>1</sup>H NMR result



**Entry 61 (CAS: 130632-98-3; MW: 183.2; RT: 19.1 min)**

