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## Supplementary information

# Synthesis, Antitumor Activity, 3D-QSAR and Molecular Docking Studies of New Iodinated 4-(3*H*)-quinazolinones 3*N*-substituted

Marcia Pérez-Fehrmann[a], Víctor Kesternich[a], Arturo Puelles[a], Víctor Quezada[a], Fernanda Salazar[a], Philippe Christen[b], Jonathan Castillo[c], Juan Guillermo Cárcamo[c,d], Alejandro Castro-Alvarez[e,f], Ronald Nelson[a*].

[a.] *Departamento de Química, Facultad de Ciencias, Universidad Católica del Norte, Casilla 567, Antofagasta, Chile.*

[b.] *School of Pharmaceutical Sciences, University of Geneva, University of Lausanne, Rue Michel-Servet 1, CH-1211 Geneva 4, Switzerland.*

[c.] *Instituto de Bioquímica y Microbiología, Facultad de Ciencias, Universidad Austral de Chile, Campus Isla Teja, Valdivia, Chile.*

[d.] *Centro FONDAP, Interdisciplinary Center for Aquaculture Research (INCAR), Chile.*

[e.] *Laboratorio de bioproductos farmacéuticos y cosméticos, Centro de Excelencia en Medicina Traslacional, Facultad de Medicina, Universidad de La Frontera, Av. Francisco Salazar 01145, Temuco, 4780000, Chile.*

[f.] *Departamento de Química de los Materiales, Facultad de Química y Biología, Universidad de Santiago de Chile, Casilla 40, Correo 33, Santiago, Chile.*

*Corresponding Author E-mail: rnelson@ucn.cl

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## 1. General

**Synthesis:** Melting points were determined on a Kofler-type apparatus and were uncorrected. The IR spectra were taken on a Perkin-Elmer 200 spectrophotometer with KBr. NMR spectra were collected in DMSO-$d_6$ or $CD_3OD$ with a Varian Unity Inova 500 MHz spectrometer. Chemical shifts were reported in parts per million ($\delta$) using the residual solvent signals (DMSO-$d_6$: $\delta_H$ 2.50, $\delta_C$ 39.5 or $CD_3OD$; $\delta_H$ H 3.31, $\delta_C$ C 49.0) as the internal standards for the $^1H$ and $^{13}C$ NMR spectra and coupling constants ($J$) in Hz. HRMS spectra were recorded on a Micromass-LCT Premier Time-of-Flight ESI spectrometer with an Acquity Ultra-high-performance liquid chromatography interface system. TLC was performed on Si gel Merck 60 $F_{254}$ (Al plates) and the TLC plates were visualized by spraying with phosphomolybdic acid reagent and heating. The starting materials and reagents were purchased from Sigma–Aldrich or Merck and used without further purification.

**Cytotoxicity assay:** Human gallbladder adenocarcinoma (G415), human gallbladder adenocarcinoma (Gbd1), human promyelocytic leukemia (HL60), human histiocytic lymphoma (U937), human cervix adenocarcinoma (HeLa) and human brain glioblastoma multiforma (T98G) cell lines were purchased from the American Type Culture Collection (Manassas, VA, USA). All cell lines were grown at 37 °C in a humidified atmosphere of 5% $CO_2$ environment and the adherent cells were removed from culture plates by trypsinization (0.5 mM EDTA, 0.05% trypsin). G-415 and Gbd1 were maintained in RPMI 1640 supplemented with 2 mM glutamine, 10% FBS, penicillin/streptomycin/amphotericin-B (100 units/ml; 100µg/ml; 0.25 µg/ml). Confluent cultures of these two adherent cell lines were split 1:3 to 1:6 by trypsinization and seeded at 2-4x$10^4$ cells/$cm^2$. HL60 and U937 cells were grown in the same medium and seeded at 1-5x$10^5$ and 2-9 x$10^5$ cells/mL, respectively. Three times per week, the culture cells were diluted under the same conditions to maintain density and were harvested in the exponential phase of growth. HeLa cells were cultured in MEM, containing 2 mM glutamine, 10% FBS, 1% non-essential amino acids, penicillin/streptomycin/amphotericin-B (100 units/mL; 100 µg/mL; 0.25 µg/mL). T98G cells were grown in DMEM-F12 supplemented with 2 mM glutamine, 10% FBS, 1% non-essential amino acids, 1% sodium pyruvate, penicillin/streptomycin /amphotericin-B (100 units/mL; 100 µg/mL; 0.25 µg/mL). Confluent cultures of these last two adherent cell lines were split 1:3 to 1:6 by trypsinization and seeded at 2-4 x$10^4$ cells/$cm^2$. For cytotoxicity studies, cells were seeded in a 96-well microtiter plate at a density of 5 x $10^5$/mL and allowed to adhere for 24 h in a $CO_2$ incubator. One day after seeding, cells were treated with fresh medium containing the compounds, dissolved in DMSO (1% final concentration in the well) plus culture medium, incubating by 24 h at 37 °C. The compound concentrations ranged from 0 µM up to 200 µM. After incubation, 10 µL aliquots of MTT solution (5 mg/mL in PBS) were added to each well and re-incubated for 4 h at 37 °C, followed by low centrifugation at 800 rpm for 5 minutes. Cell viability was determined by means of MTT reduction and the cells incubated in culture medium alone and 1% DMSO served as control for cell viability (untreated cells). 200 µL of supernatant was carefully aspirated and 200 µL aliquots of 100% DMSO were added to each well to dissolve the formazan crystals, followed by incubation of 10 minutes at 37 °C to dissolve air bubbles. The culture plate was placed on an *Emax* model micro-plate reader (Molecular Devices) and the absorbance was measured spectrophotometrically at 650 nm. The amount of color produced is directly proportional to

the number of viable cells. Untreated cells and the controls containing 1% DMSO were used as 100% viability controls. Paclitaxel (T7191, Sigma-Aldrich) was used as reference compound. All assays were performed twice with three replicates and processed independently. Mean ± SD was used to estimate the cell viability. Cell viability rate was calculated as the percentage of MTT absorption as follows:

% survival = (mean experimental absorbance/mean control absorbance) × 100

The compound concentration was plotted against the corresponding percentage (%) of cell viability obtained with MTT assays, and the 50% inhibitory concentration ($IC_{50}$) was calculated by non-linear regression. The curve fittings were performed using GraphPad Prism®6 from Systat Software, Inc. Compounds with $IC_{50}$ >200 µM were considered as inactive.

**Computational method:** The preparations of iodinated 4-(3*H*)-quinazolinone 3D structures were obtained with OpenBabel[1] from SMILES annotations for each ligand. Protonation states were adjusted to pH 7.2 using FixpKa and AM1BCC charges implemented in the QUACPAC package,[2] followed by conformer generation using OMEGA.[3] Docking was performed using FRED[4] and the coordinates of the co-crystal structure of DFHR (PDB code 4M6J),[5] keeping 20 poses for each docked molecule. Optimization of the docked poses was carried out using a two-step protocol and SZYBKI.[6] First, optimization of the ligand's Cartesian coordinates was performed using a constraint of 1 kcal/mol, followed by optimization of the complex using MMFF94s as a force field, a Poisson−Boltzmann model, and AM1BCC charges for the ligands. Flexibility of residue side chains were kept within 6 Å of the ligand. The resulting poses were ranked according to the predicted ligand-protein energy, and the pose with the lowest score was selected as the best pose for each molecule.

3D-QSAR models were obtained with the Open3DQSAR package,[7] which performs partial least squares (PLS) regression models from molecular interaction fields (MIF). Unless otherwise noted, default parameters were employed for Open3DQSAR. The input to Open3DQSAR is a set of aligned conformers of the dataset with associated bioactivities. A grid was constructed around the aligned molecules in such a way that its box exceeded 5 Å in the largest molecule, and grid spacing was set to 0.5 Å. Steric and electrostatic molecular mechanics of MIFs were computed using the Merck force field (MMFF94). The pictures were obtained with Chimera UCSF and PyMol software.

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[1] N. M. O'Boyle, M. Banck, C. A. James, C. Morley, T. Vandermeersch and G. R. Hutchison, *Journal of Cheminformatics*, 2011, **3**, 1–14

[2] QUACPAC 2.0.1.2: OpenEye Scientific Software, Santa Fe, NM. http://www.eyesopen.com

[3] P. C. D. Hawkins, A. G. Skillman, G. L. Warren, B. A. Ellingson and M. T. Stahl, *Journal of Chemical Information and Modeling*, 2010, **50**, 572–584.

[4] M. McGann, *Journal of Chemical Information and Modeling*, 2011, **51**, 578–596.

[5] G. Bhabha, D. C. Ekiert, M. Jennewein, C. M. Zmasek, L. M. Tuttle, G. Kroon, H. J. Dyson, A. Godzik, I. A. Wilson and P. E. Wright, *Nature Structural and Molecular Biology*, 2013, **20**, 1243–1249.

[6] SZYBKI 1.10.1.2: OpenEye Scientific Software, Santa Fe, NM. http://www.eyesopen.com

[7] P. Tosco and T. Balle, *Journal of Molecular Modeling*, 2011, **17**, 201–208.

**2. Cytotoxicity assay**

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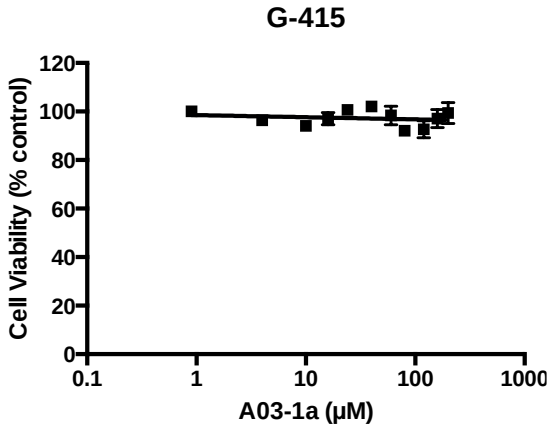


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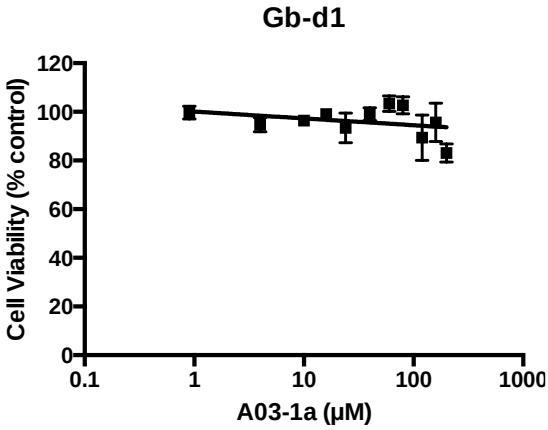


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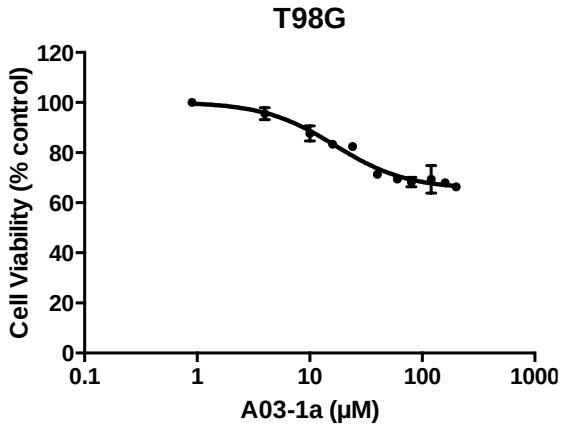


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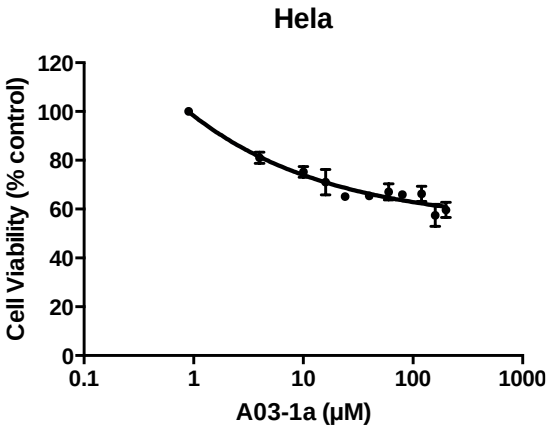


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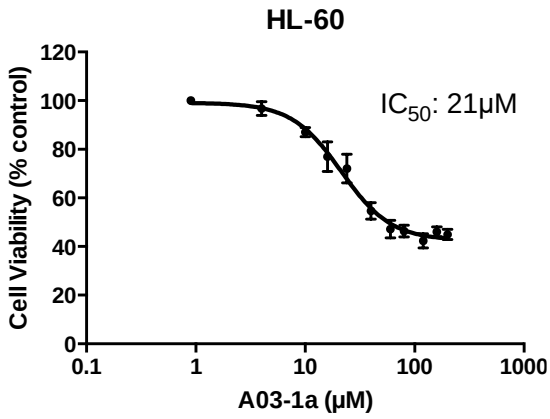


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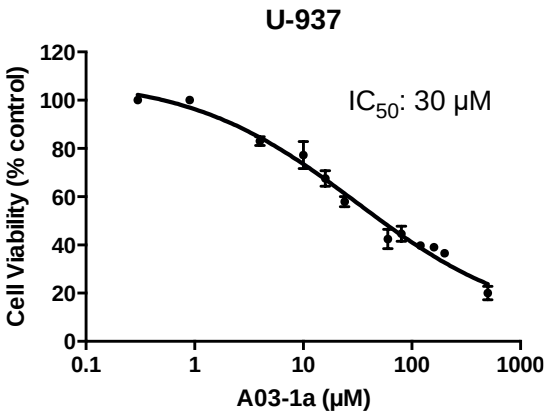

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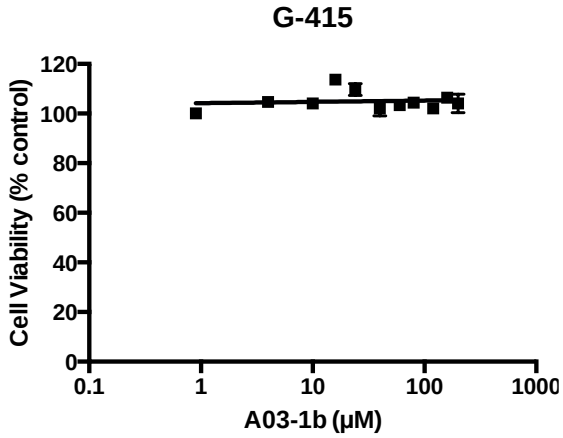


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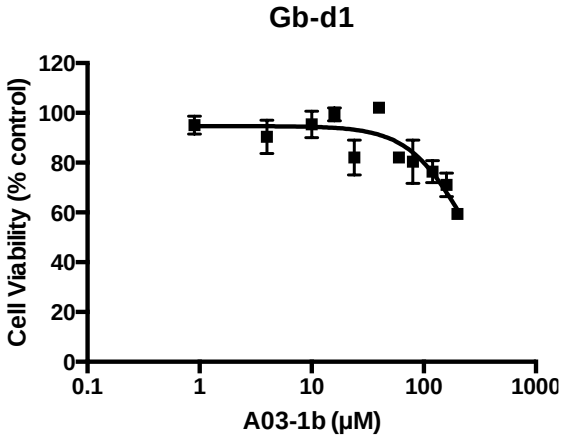


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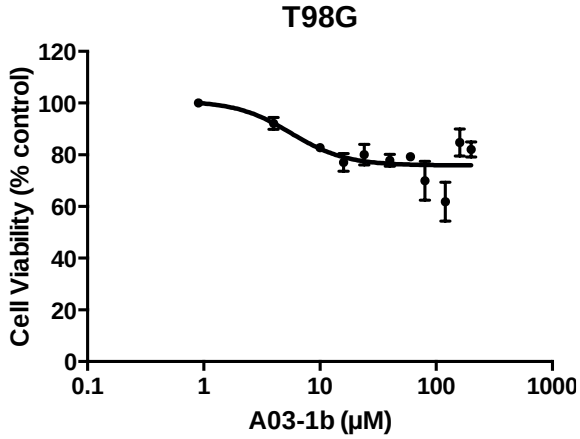


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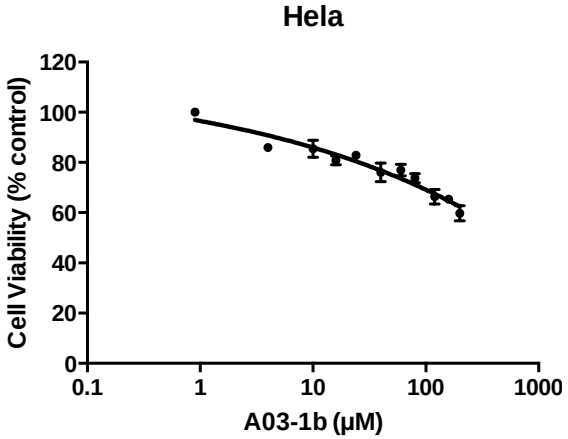


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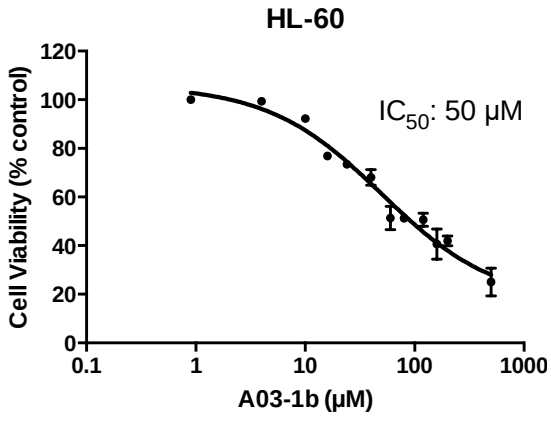


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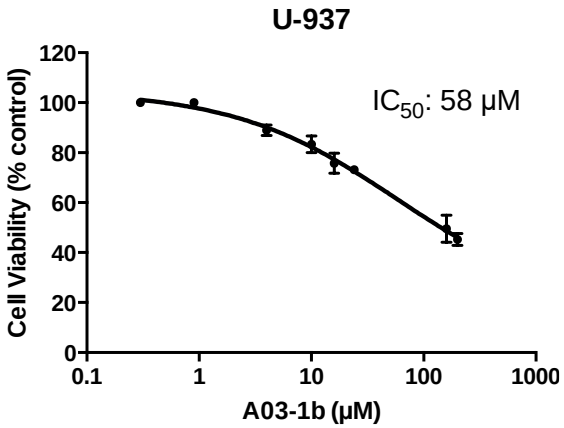

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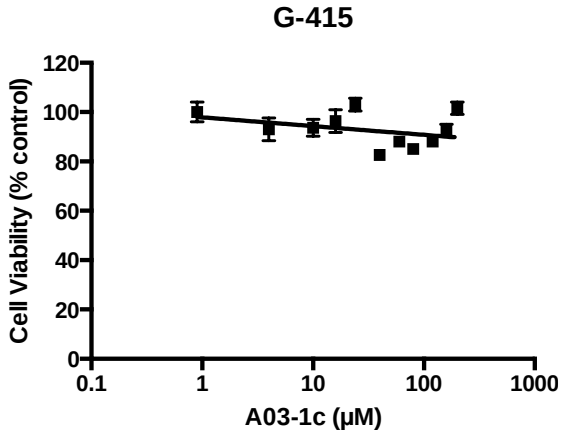


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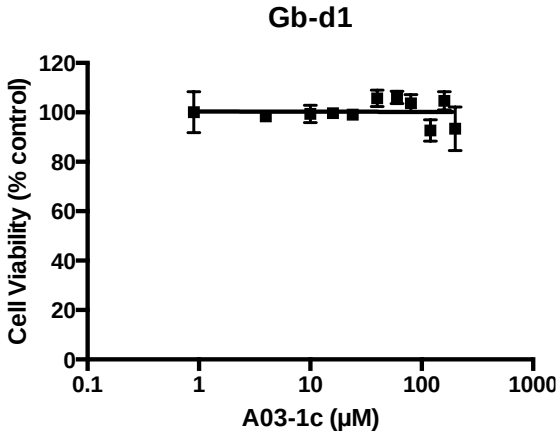


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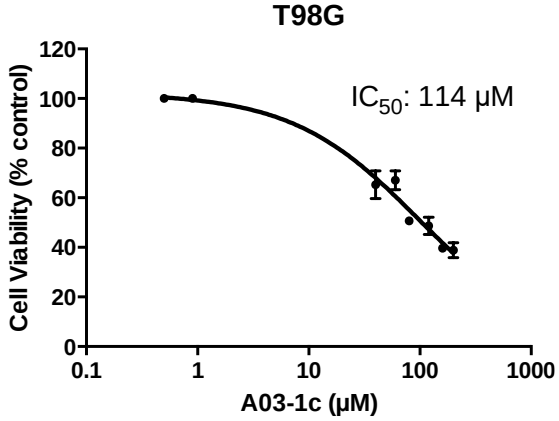


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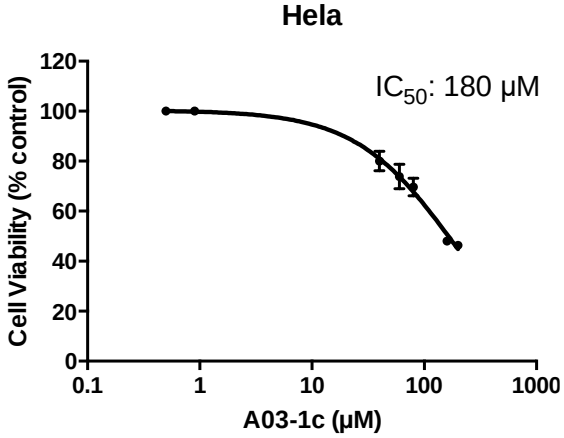


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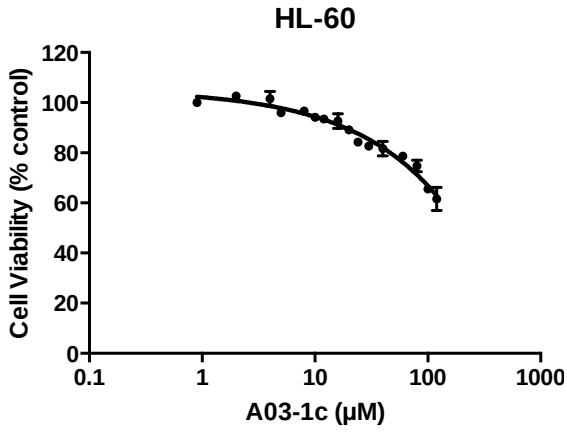


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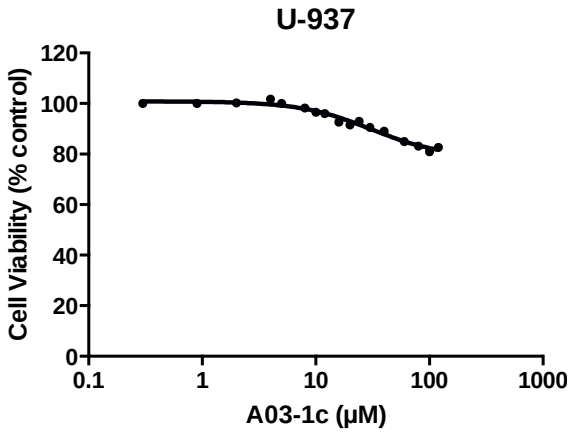

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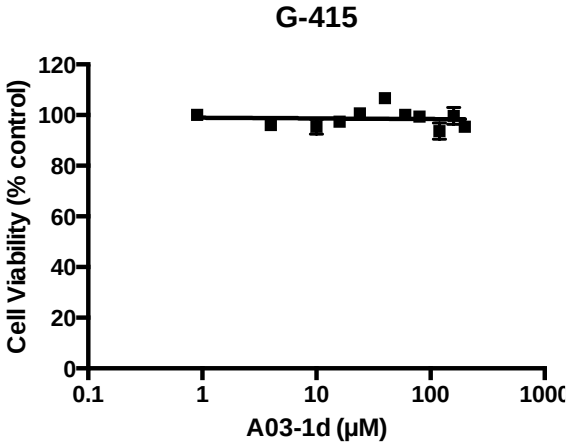


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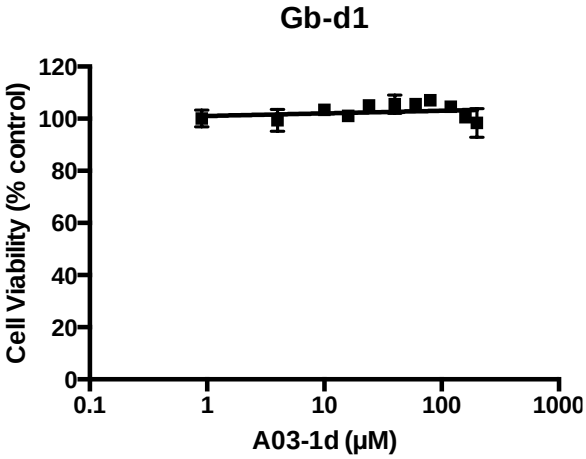


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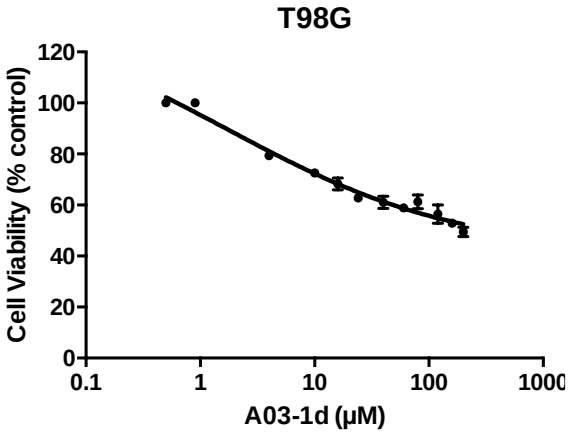


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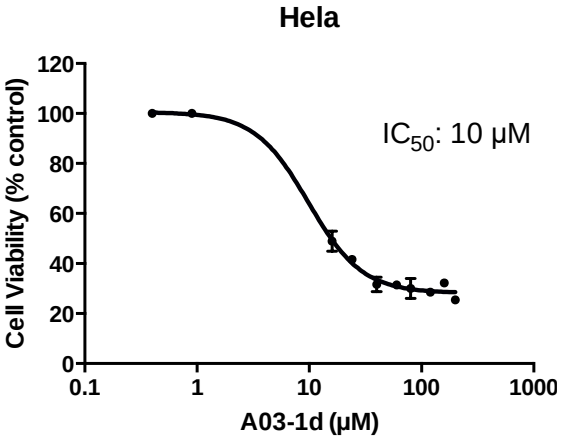


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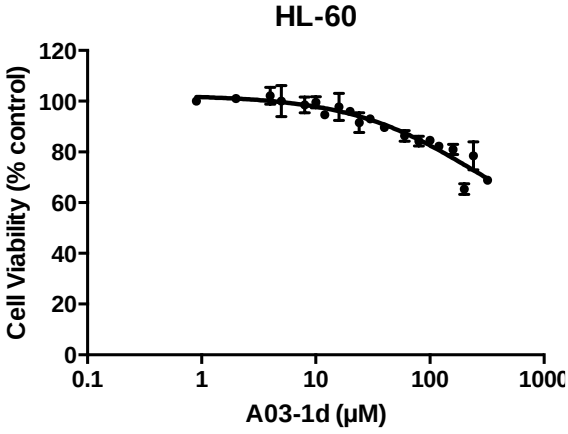


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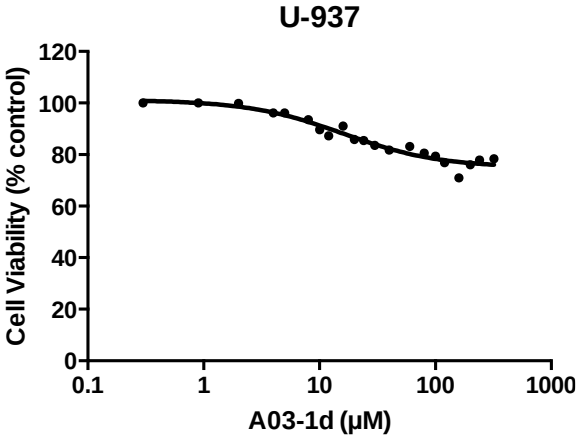

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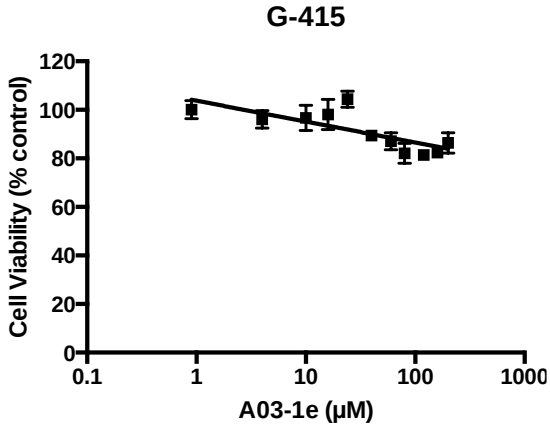


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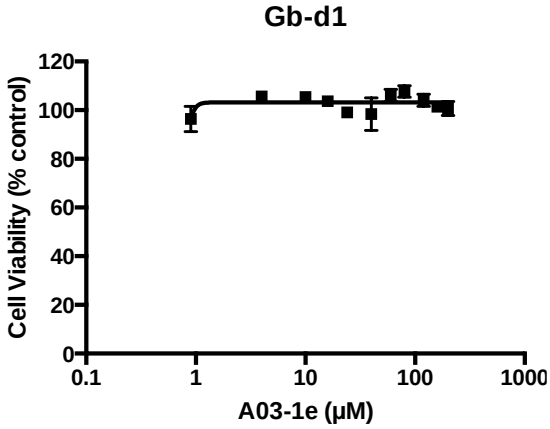


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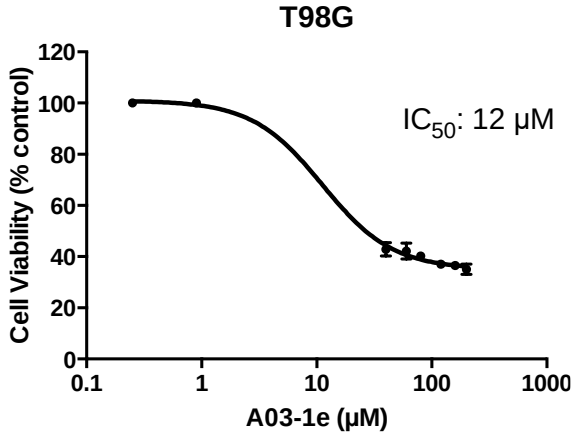


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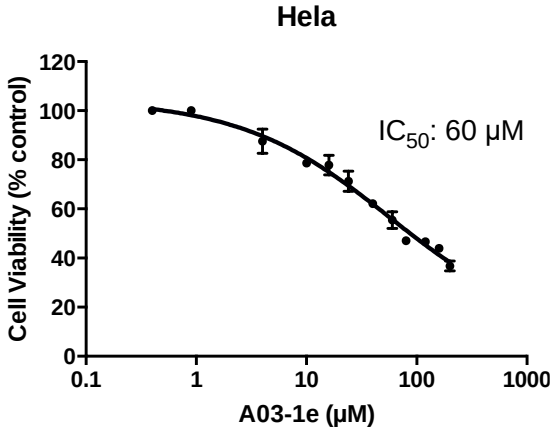


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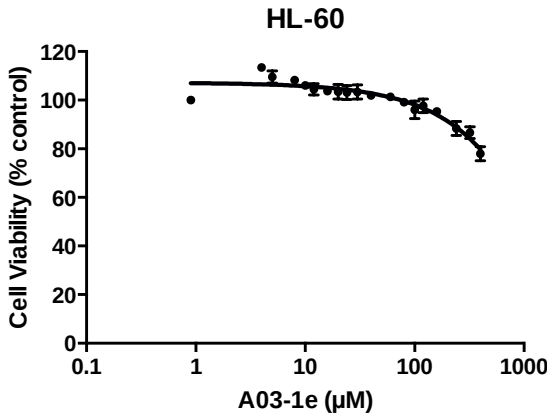


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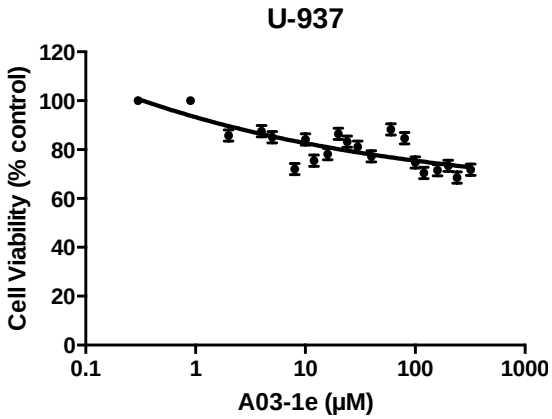

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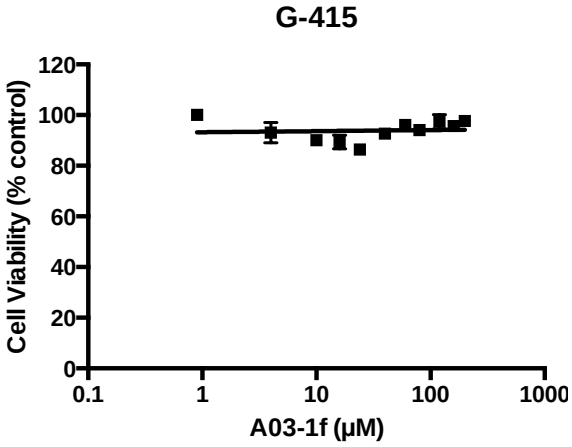


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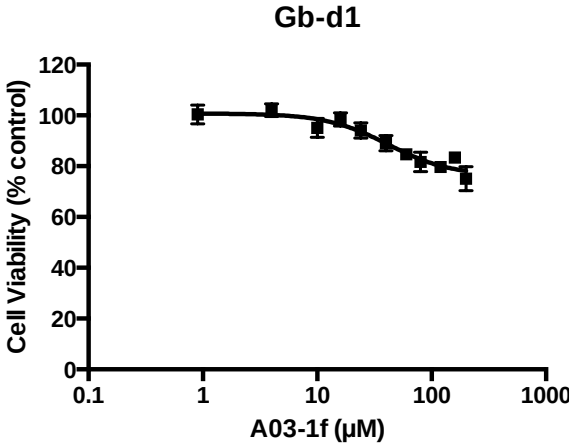


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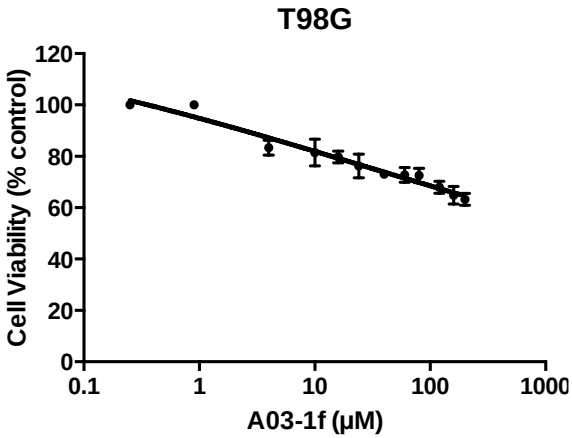


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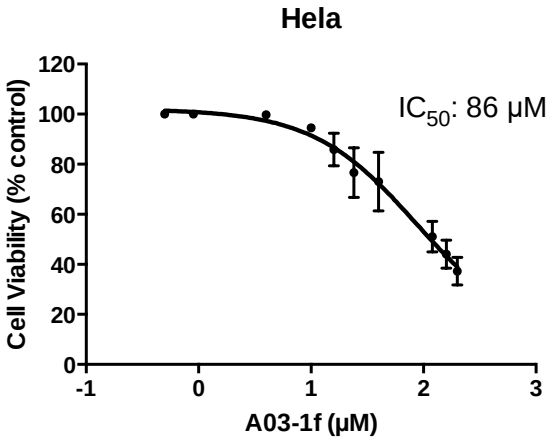


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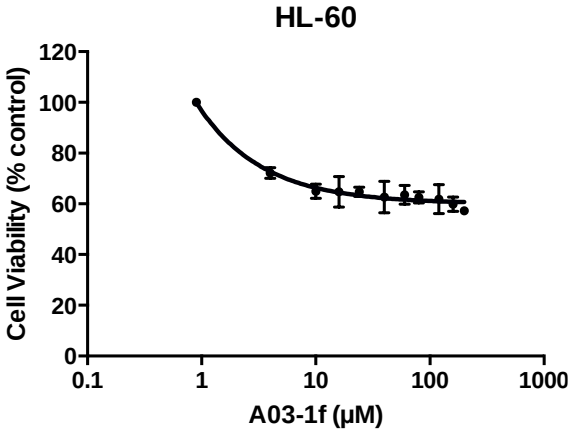


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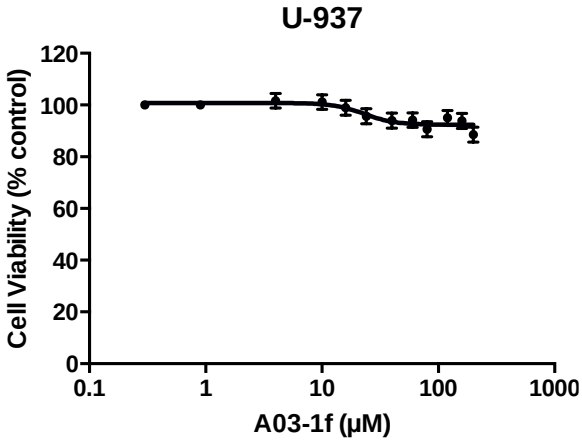

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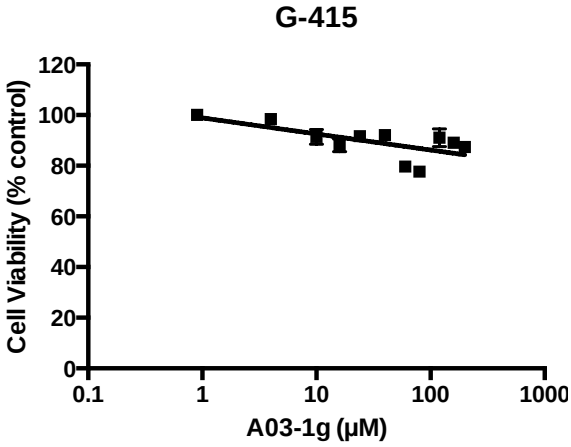


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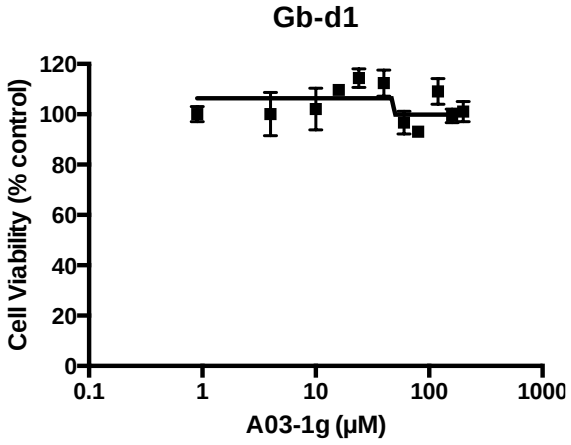
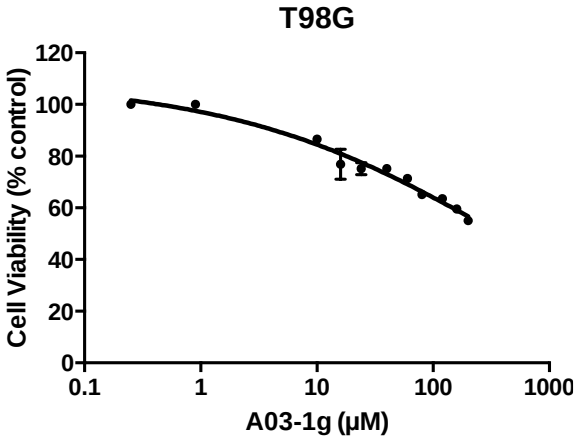



**T98G**

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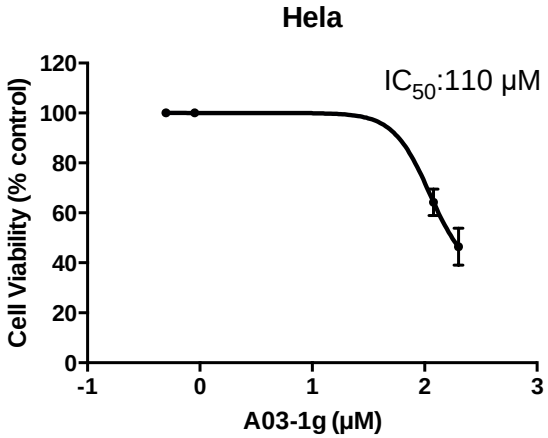


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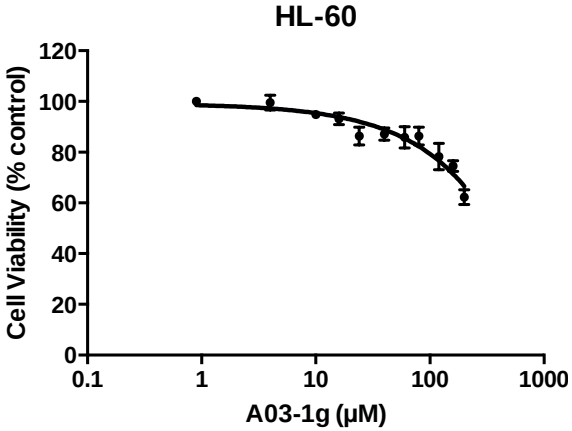


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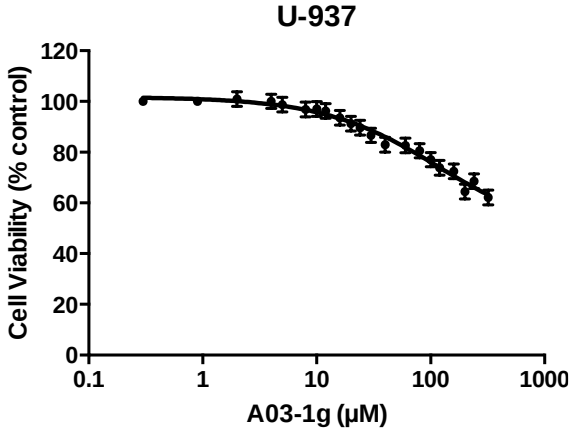

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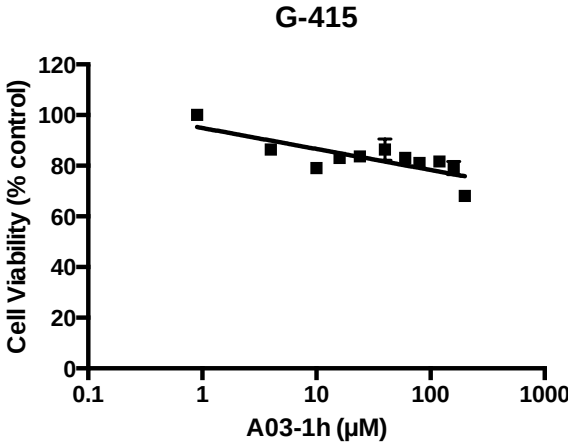


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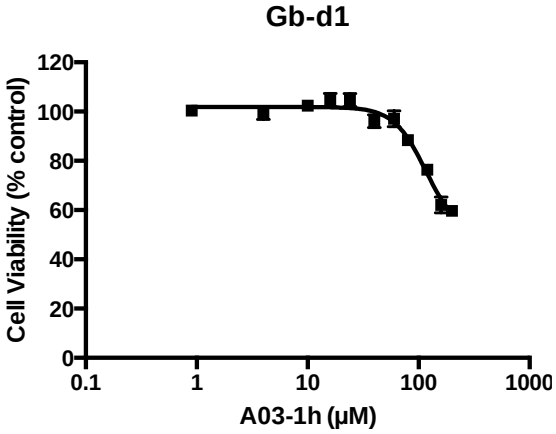


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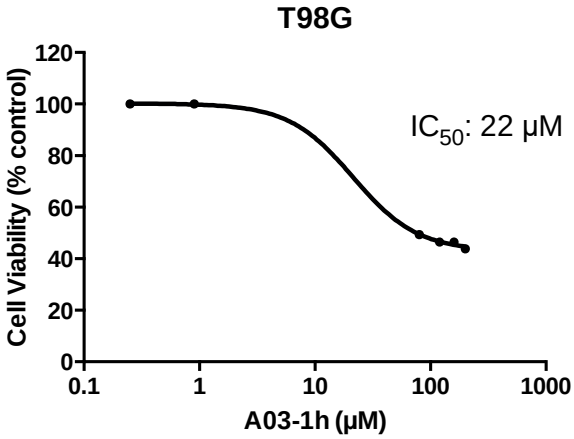


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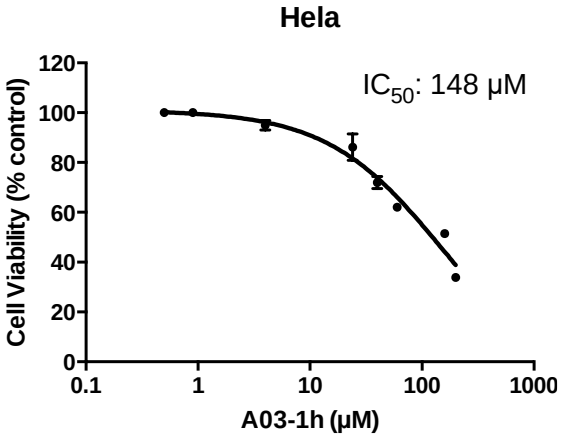


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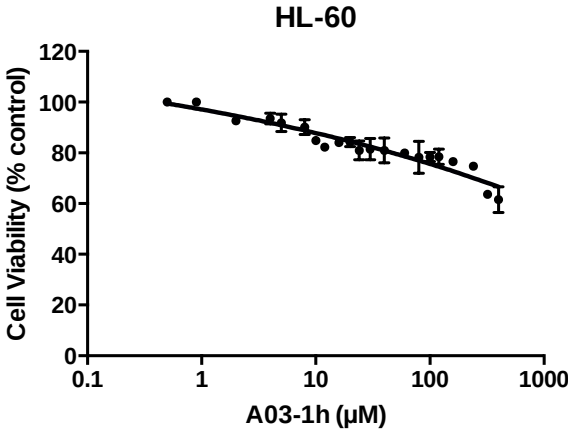


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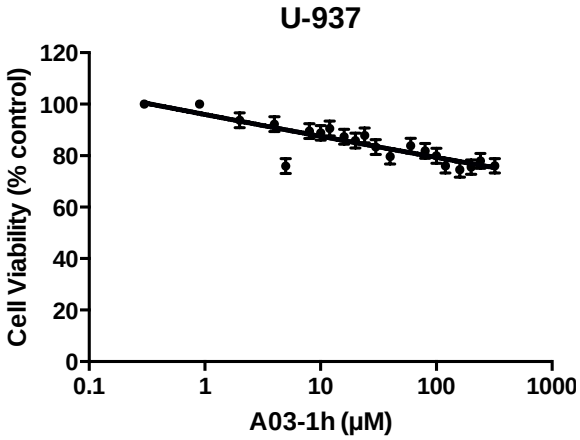

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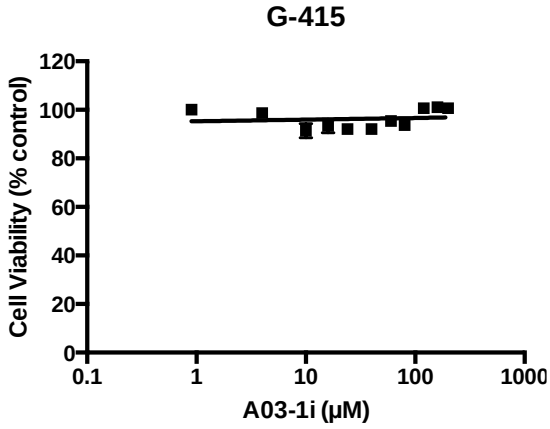


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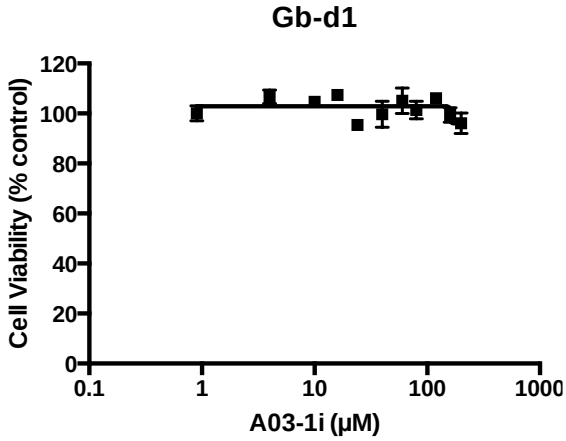


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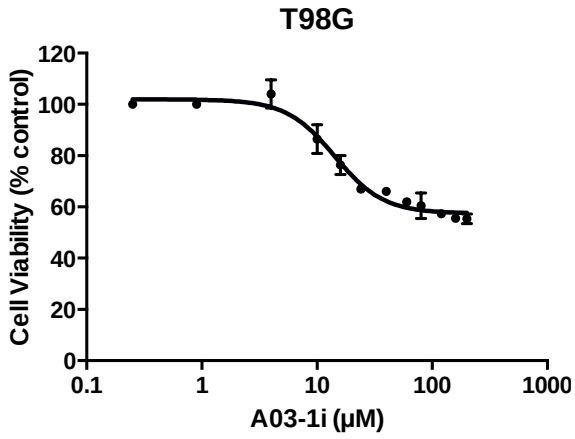


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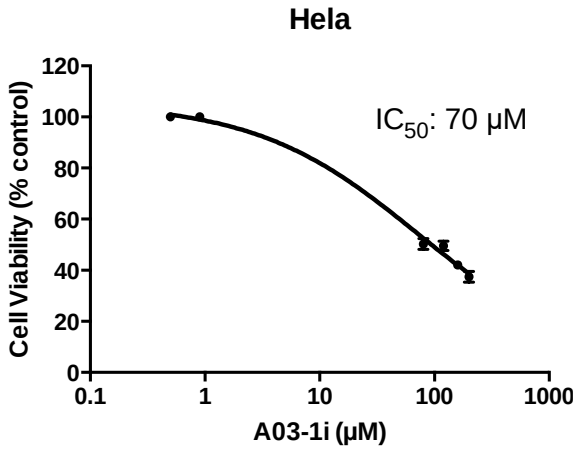


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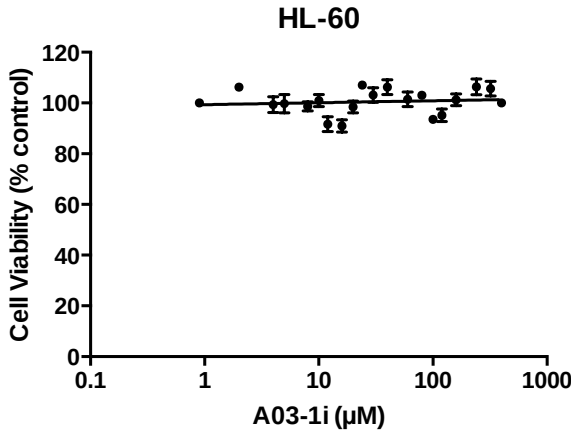


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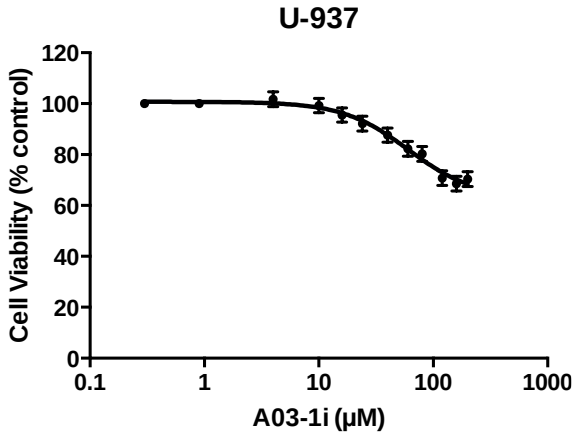

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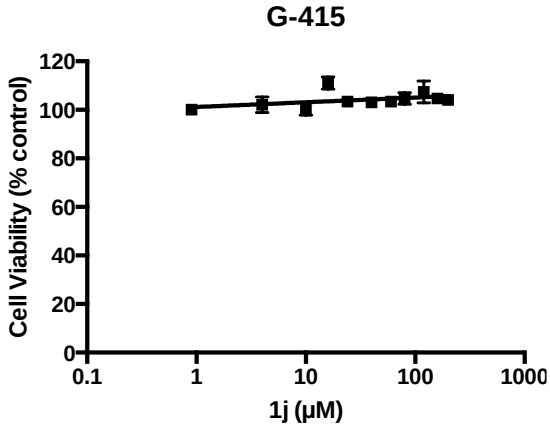


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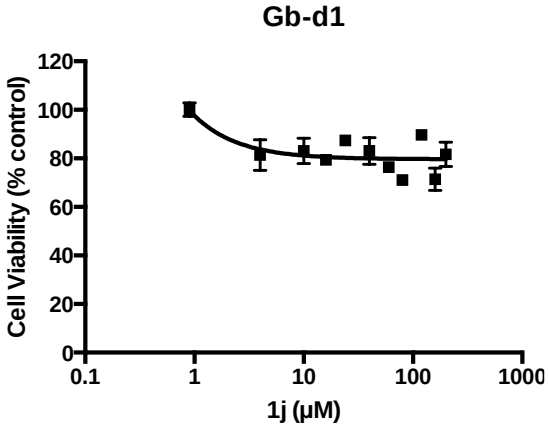


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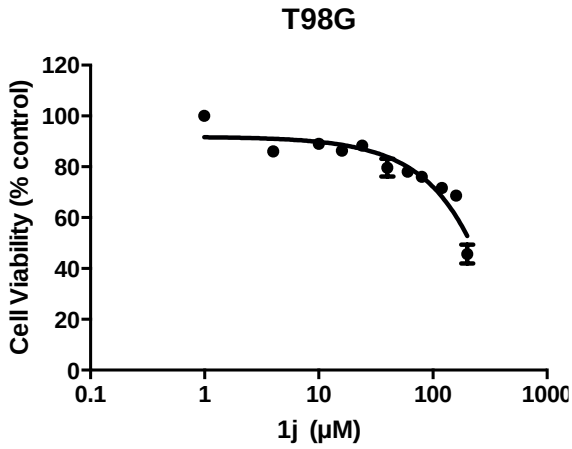


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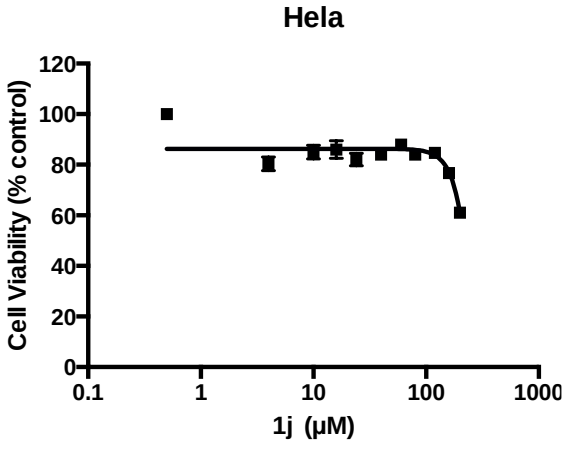


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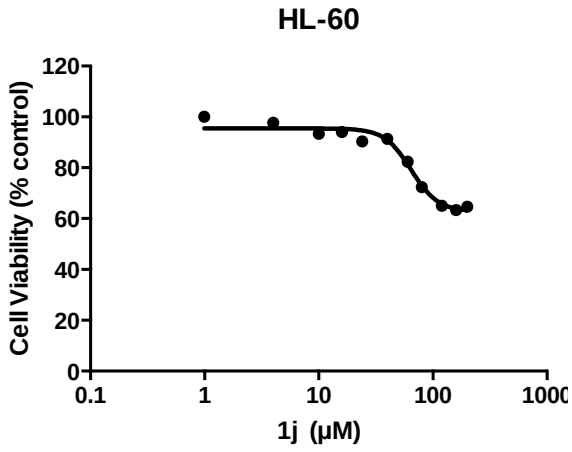


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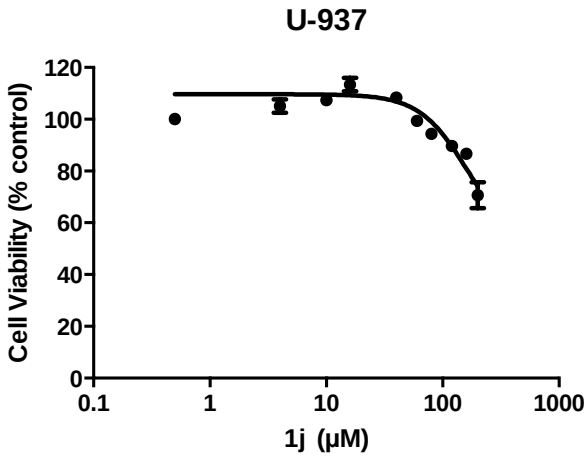

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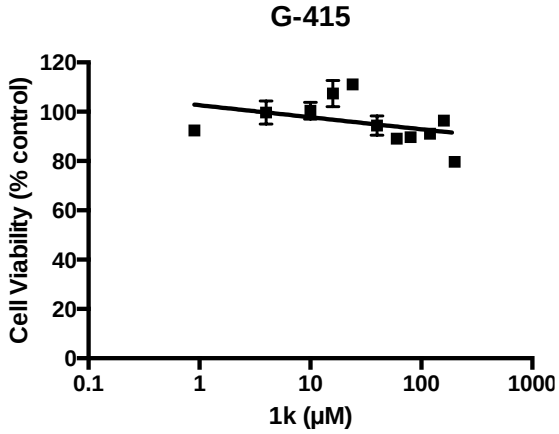


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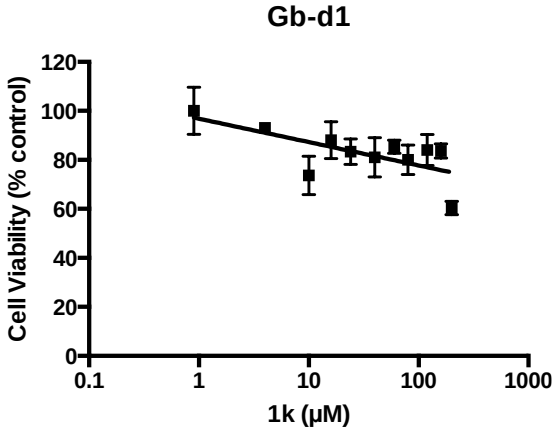


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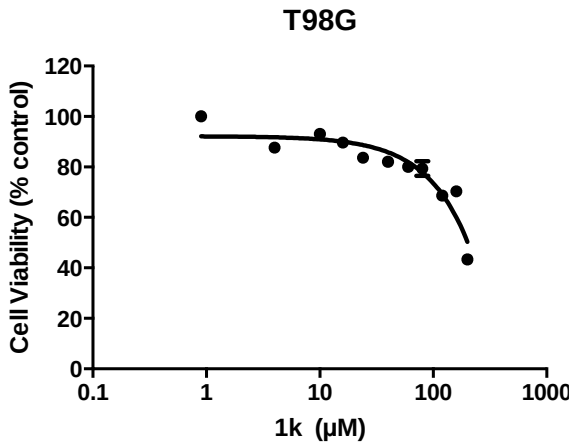


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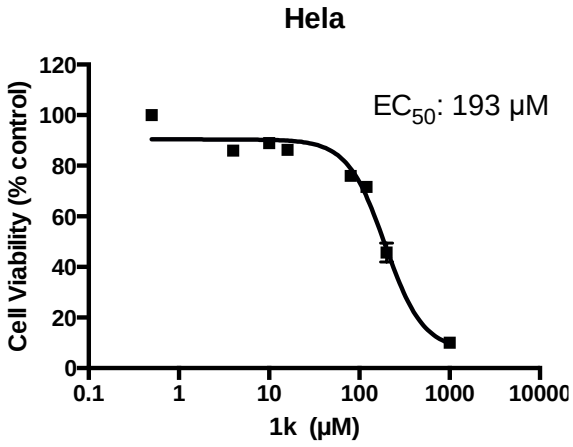


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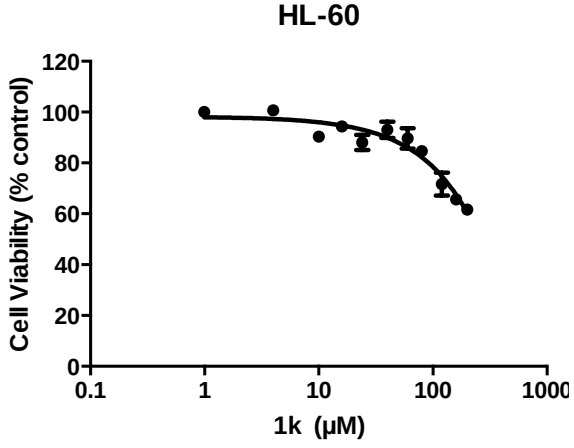


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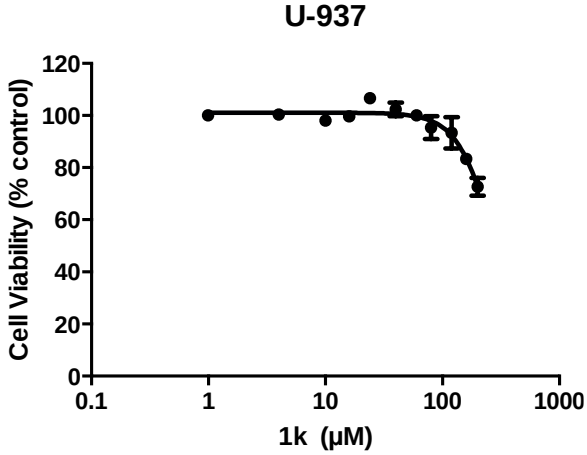

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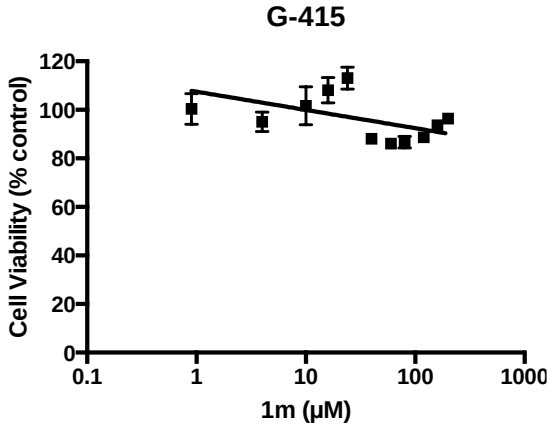


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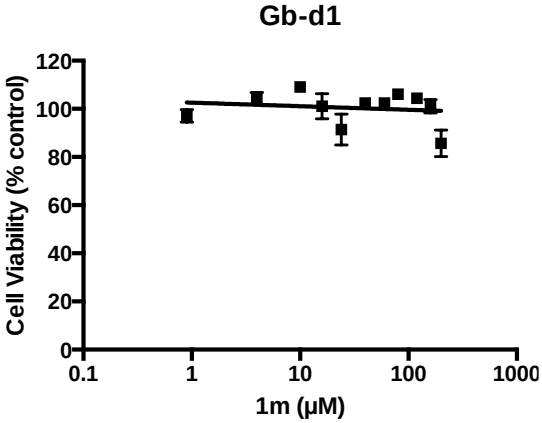


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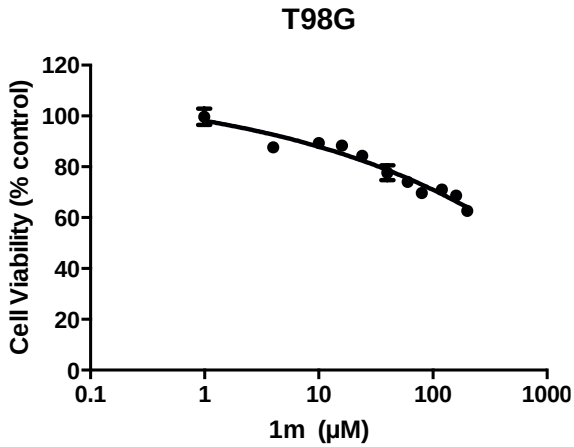


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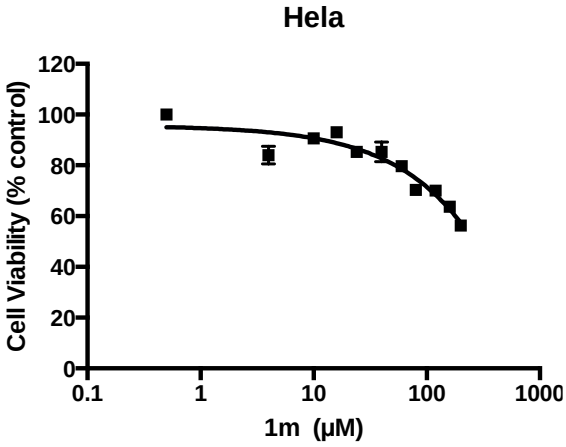


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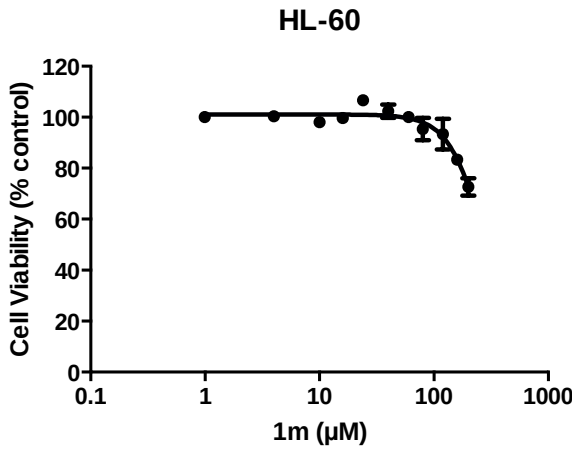


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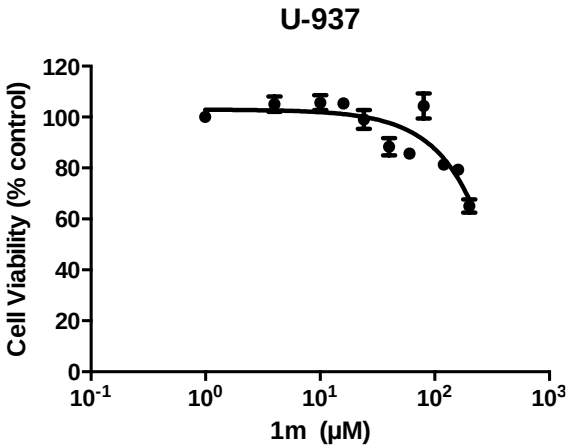

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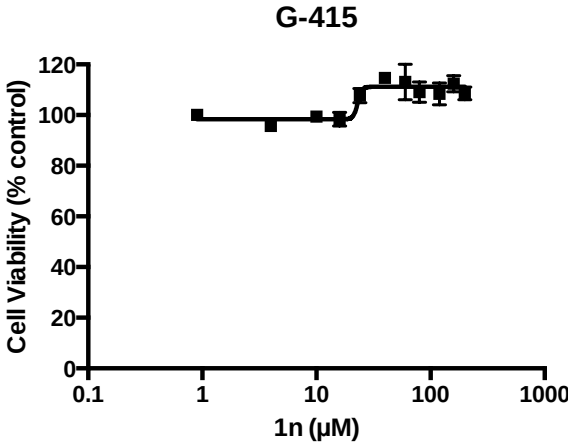


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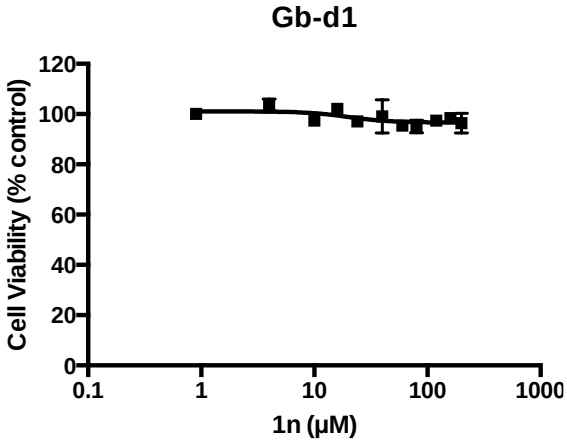


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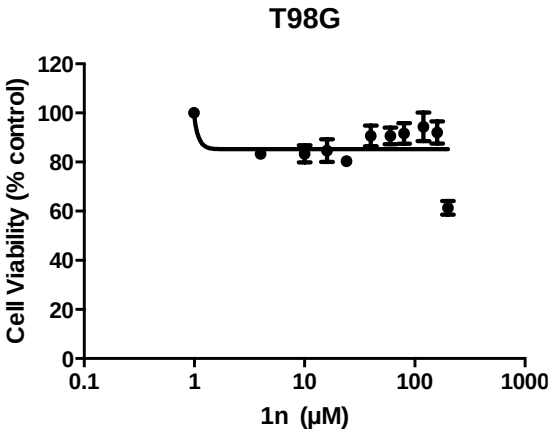


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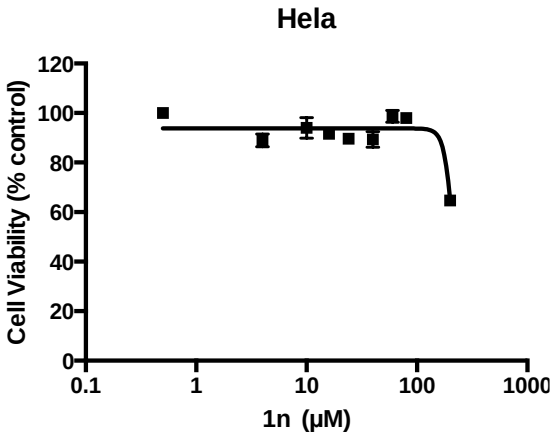


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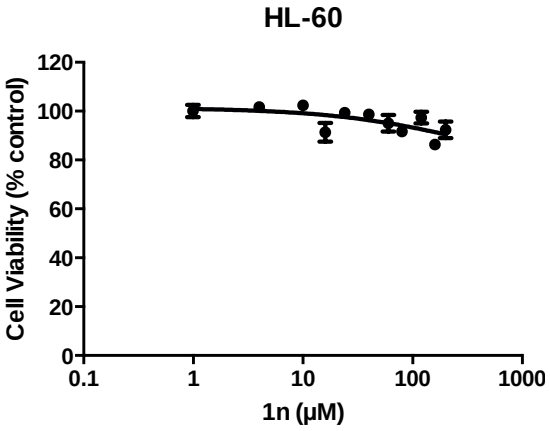


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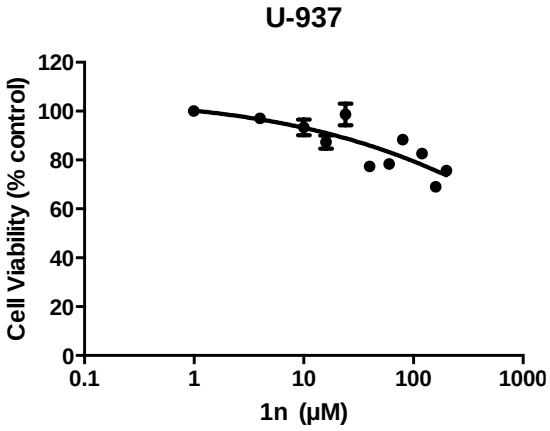

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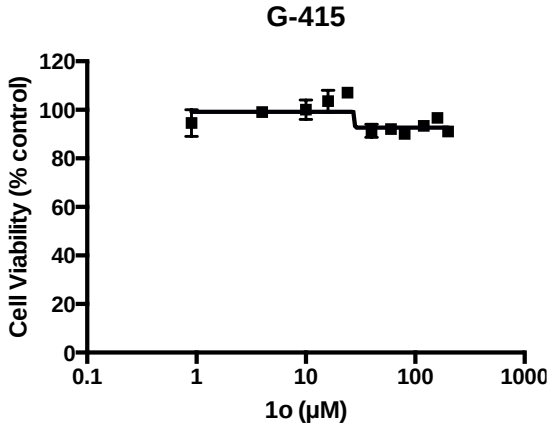


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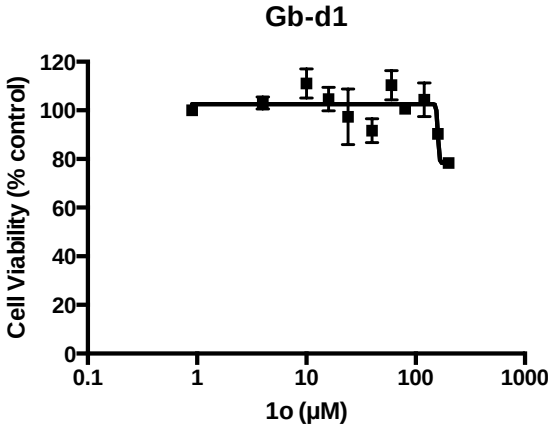


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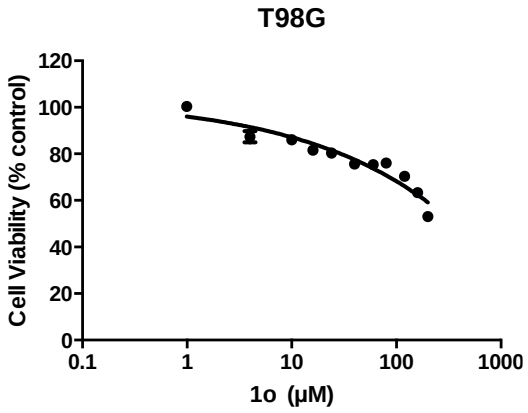


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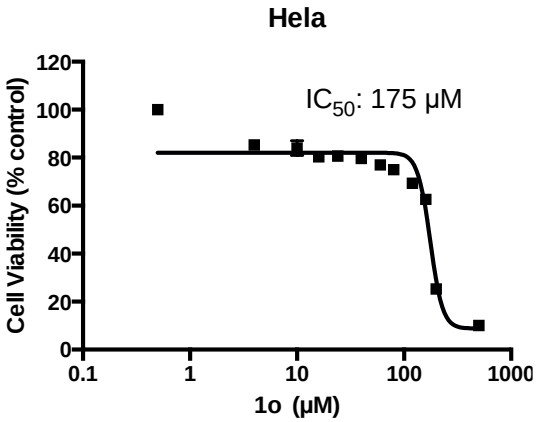


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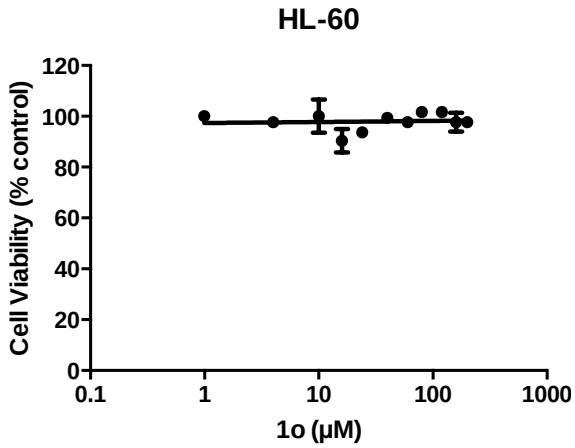


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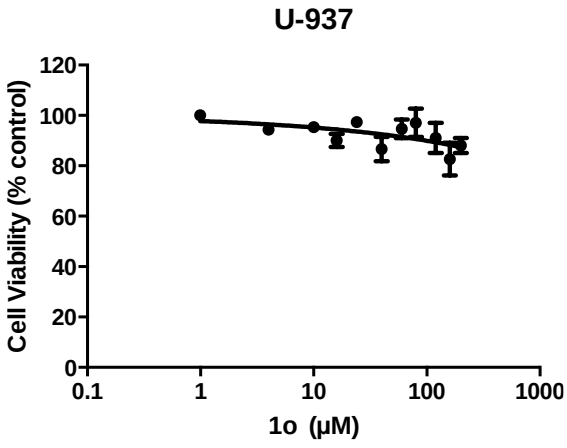
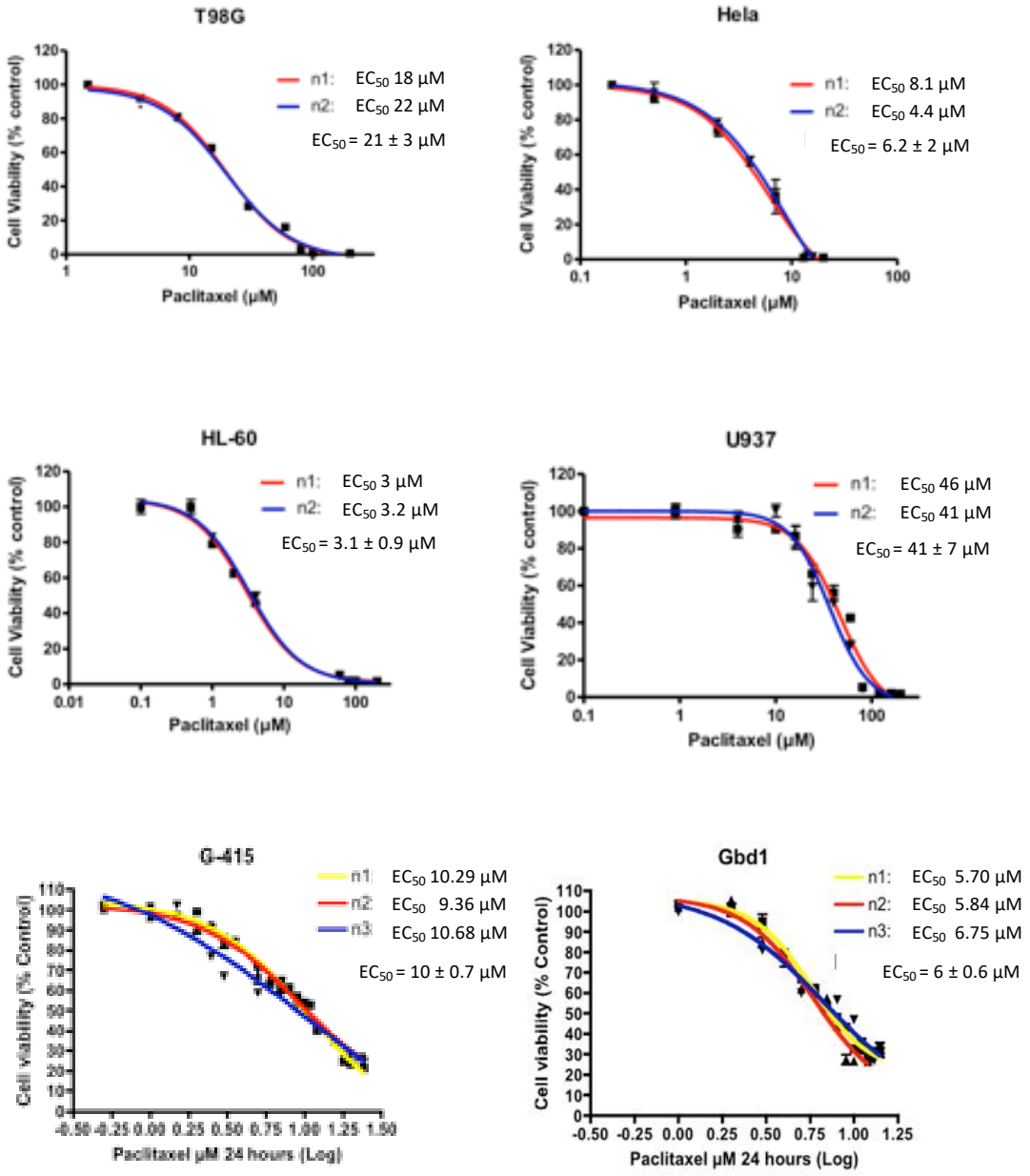
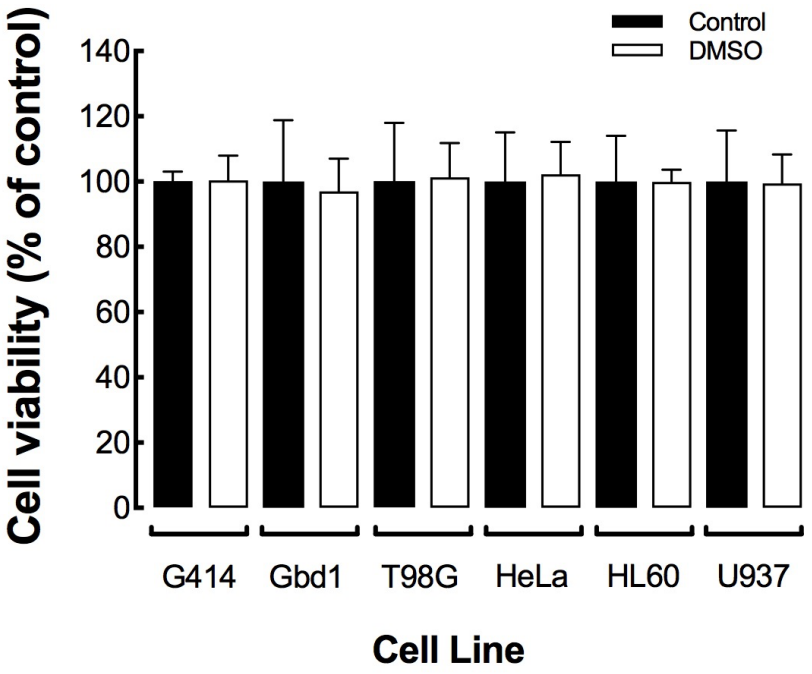


**Paclitaxel (positive control)**




**Effect of paclitaxel on cell viability of T98G, HeLa, HL-60, U937, G-415 and Gbd1 cells.** The treatments were performed by 24 h. The results are expressed as viability percentage change compared to the control sample (untreated cells). The $IC_{50}$ values were obtained from dose-response curves by no-linear regression using *GraphPad Prism* software. Results shown for each cell line correspond to two or three independent experiments each in triplicate, and the $IC_{50}$ values are presented as mean ± SD.

**DMSO (negative control)**




**Effect of DMSO on viability of cancer cell lines.** Cells were seeded in a 96-well microtiter plate at a density of 5 x $10^5$/mL and incubated for 24 hours. Next, the cells were treated with culture medium (Control) or culture medium plus 1% DMSO and incubated by 24 h. After incubation, cells were subjected to the MTT assay for viability, similarly to that previously described. Sixfold assays were used for each of the cell lines (n=6). From the absorbance readings of the MTT assay, the mean and standard deviation (SD) were obtained. Finally, the data obtained were normalized with the means of their respective controls. To determine statistical differences between the control and the respective treatment with DMSO, a t-student test was applied using a confidence level with $p<0.05$. The figure shows mean ± SD. No statistically significant differences were obtained.

## 3. Pathak's structures for 3D-QSAR study

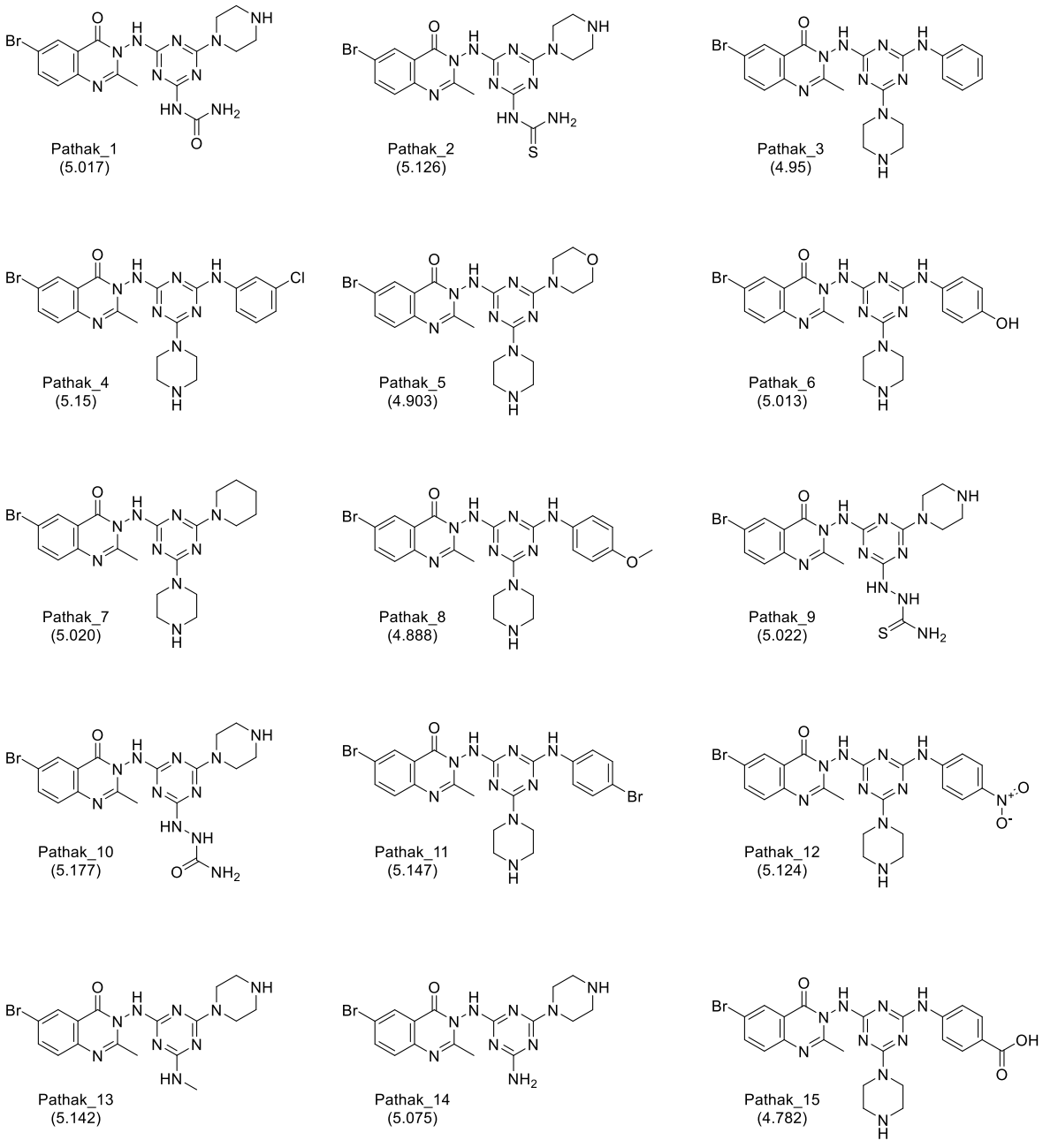



Figure S1. Pathak's structures (15 molecules) and experimental pIC50 in parentheses.

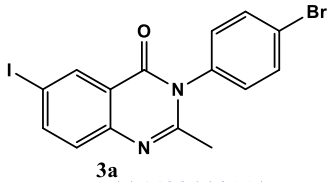
## 4. Principal spectroscopy data

Principal spectroscopy data of the 6-iodo-2-methylquinazolin-4(3*H*)-one derivatives.[a]

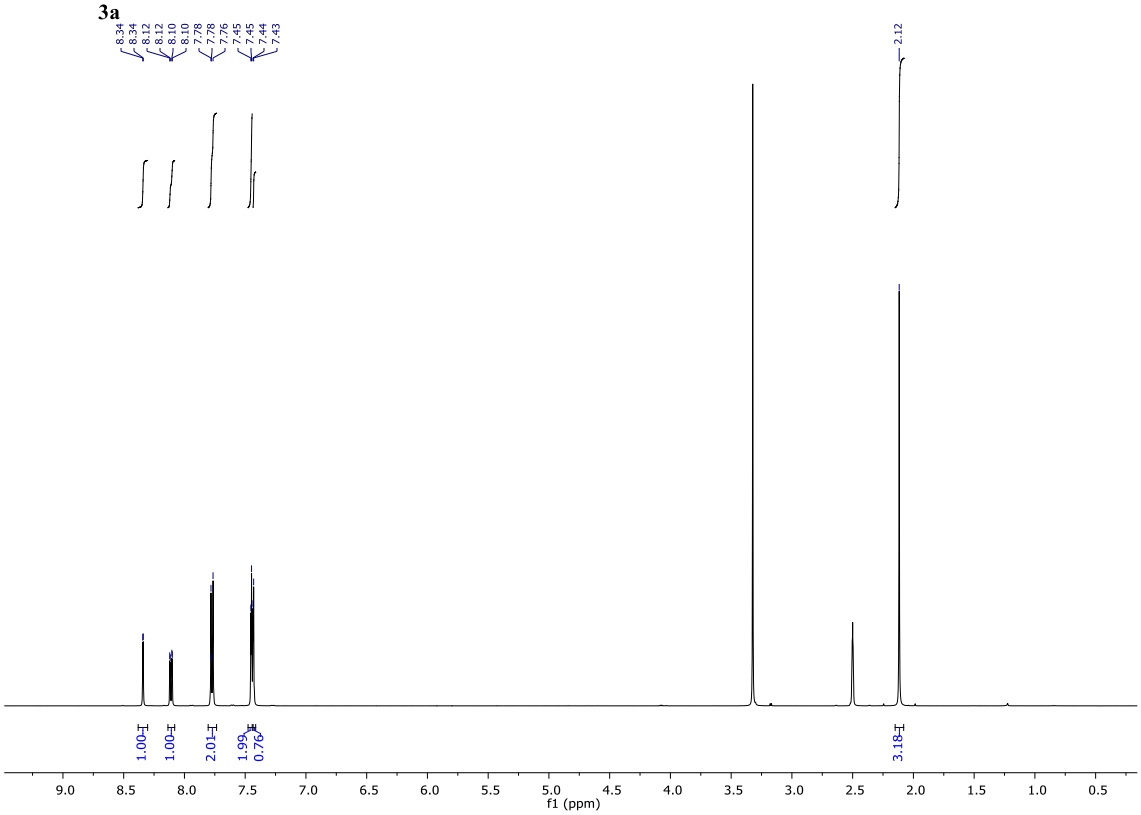
| Comp. | IR ($cm^{-1}$) | | $^1$H NMR (ppm) | | $^{13}$C NMR (ppm) | |
|---|---|---|---|---|---|---|
| | C=O | C=N | Me ($H_{12}$) | C=O ($C_4$) | $C_2$ | C-I ($C_6$) |
| **3a** | 1685 | 1598 | 2.12 | 159.9 | 154.9 | 91.1 |
| **3b** | 1676 | 1604 | 2.12 | 159.9 | 154.9 | 91.1 |
| **3c** | 1672 | 1610 | 2.12 | 160.2 | 159.3 | 90.9 |
| **3d** | 1671 | 1603 | 2.15 | 159.9 | 154.7 | 91.2 |
| **3e** | 1675 | 1609 | 2.14 | 160.2 | 155.5 | 91.0 |
| **3f** | 1673 | 1608 | 2.16 | 160.1 | 155.9 | 90.9 |
| **3g** | 1679 | 1602 | 2.13 | 159.9 | 154.3 | 91.3 |
| **3h** | 1671 | 1603 | 2.14 | 160.0 | 157.3 | 91.1 |
| **3i** | 1672 | 1600 | 2.49 | 158.9 | 158.5 | 91.3 |
| **3j** | 1673 | 1616 | 2.13 | 160.1 | 154.6 | 91.2 |
| **3k** | 1667 | 1596 | 2.12 | 160.0 | 155.5 | 90.9 |
| **3l** | 1656 | 1616 | 2.45 | 159.9 | 155.9 | 91.0 |
| **3m** | 1652 | 1613 | 2.11 | 160.3 | 157.7 | 91.0 |
| **3n** | 1681 | 1603 | 2.23 | 159.6 | 154.3 | 91.8 |

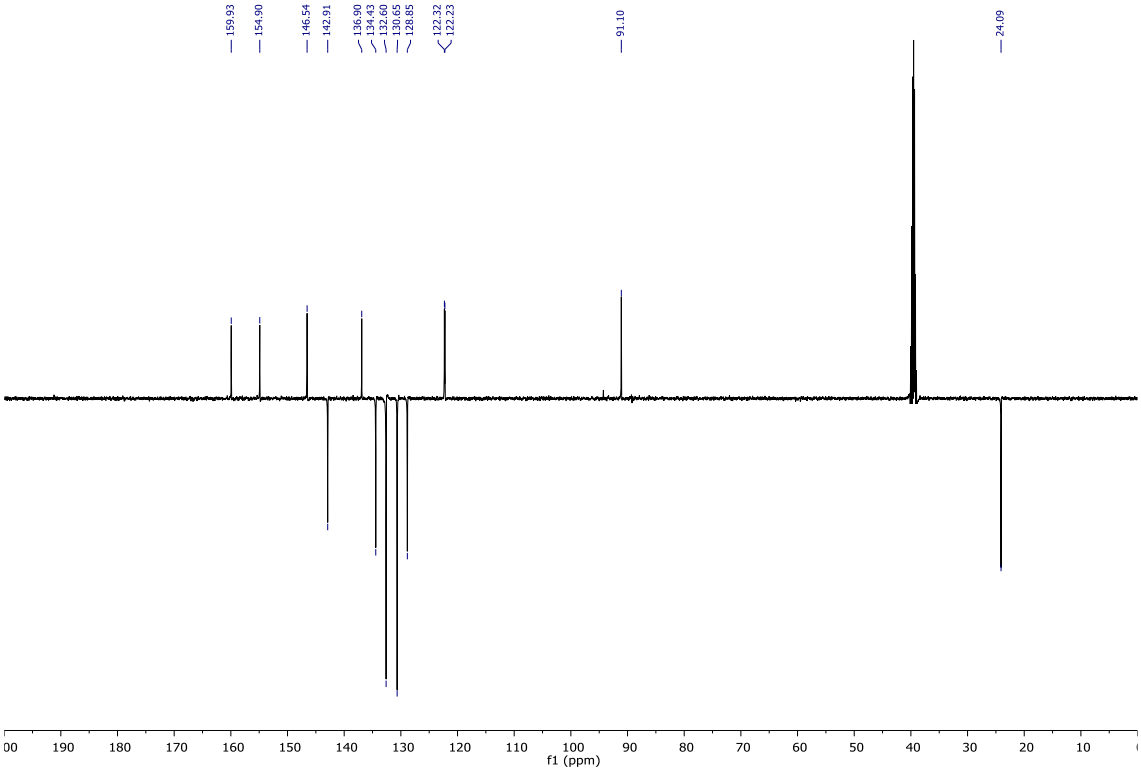
[a] NMR carried out in DMSO-$d_6$

## 5. $^{1}$H NMR, $^{13}$C NMR-APT, FT-IR and HRESIMS spectra of compounds

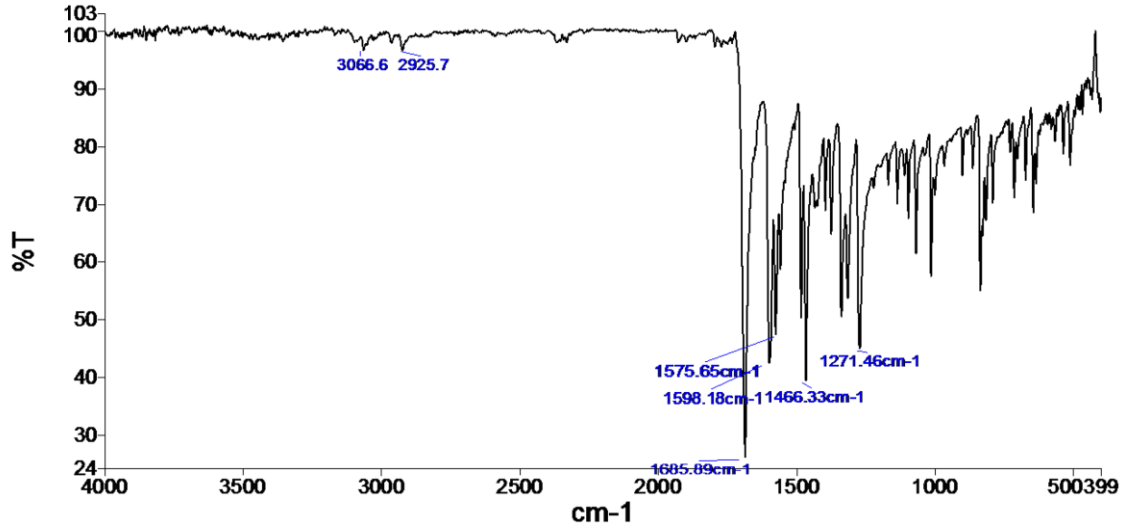


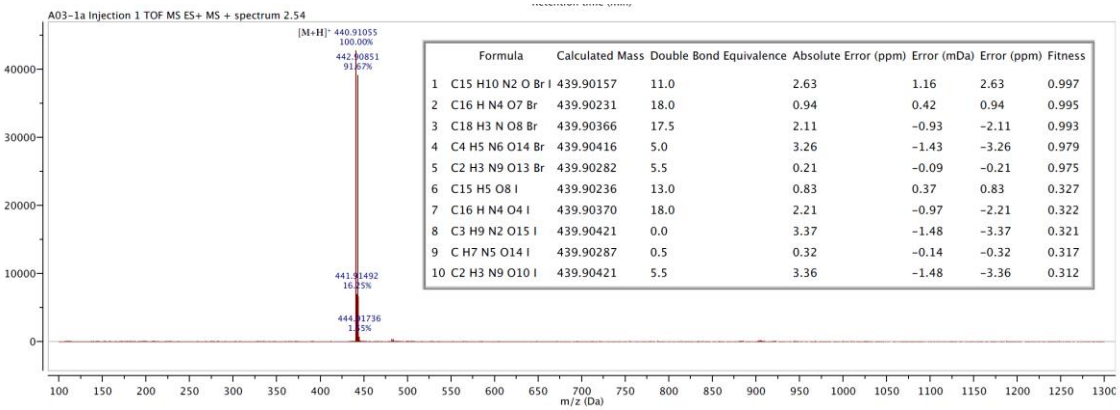

**3a**



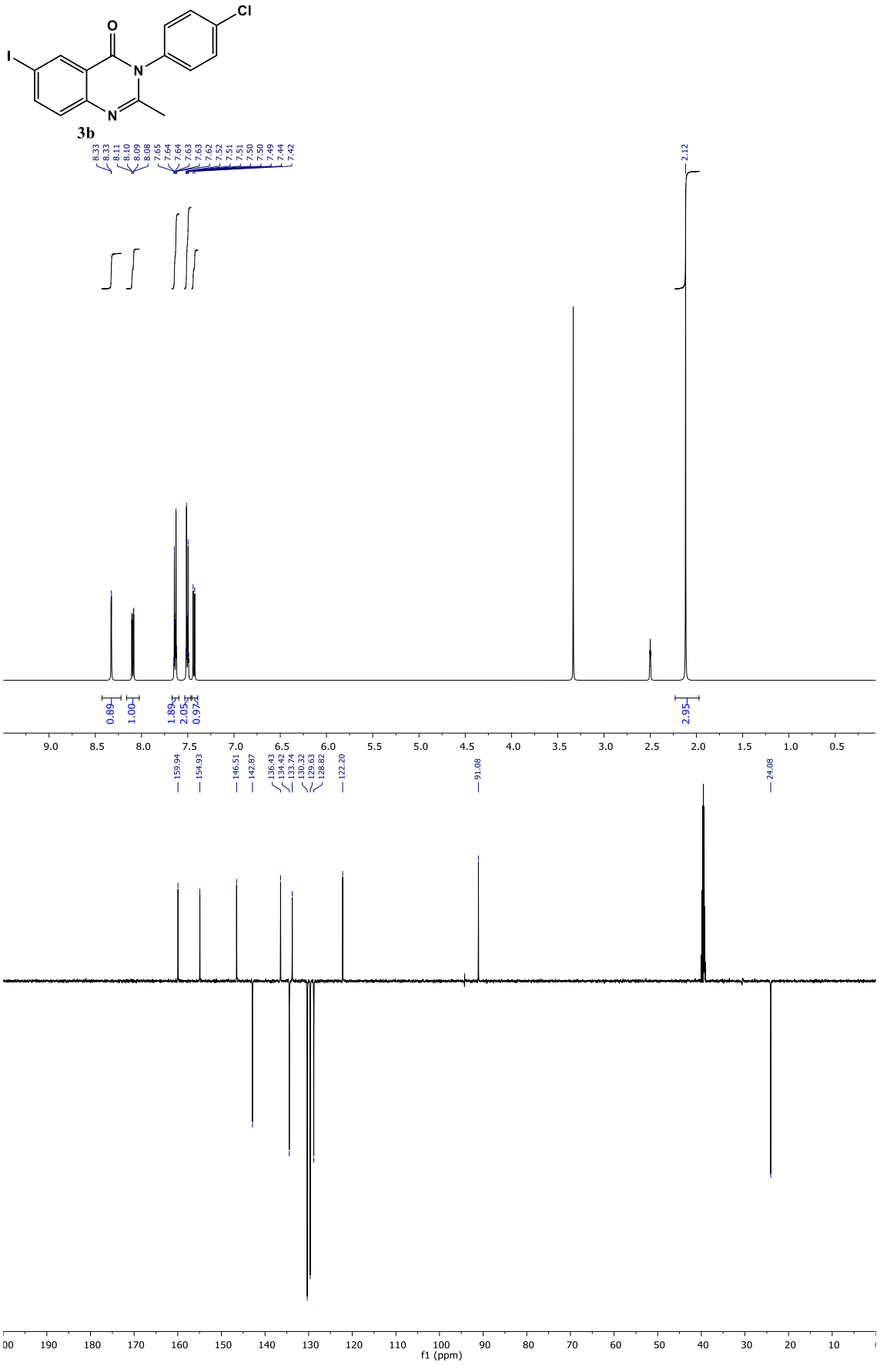



## Spectrum

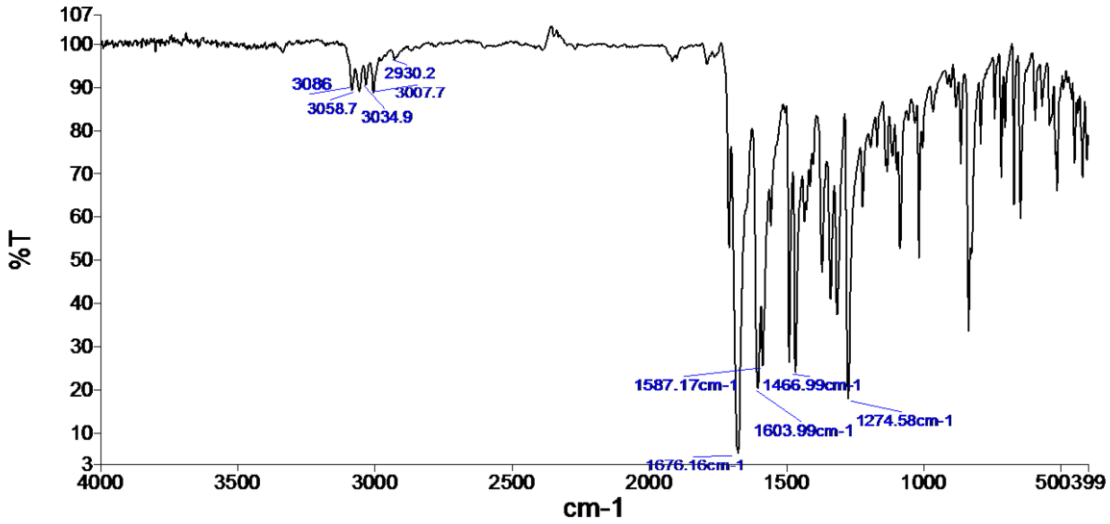


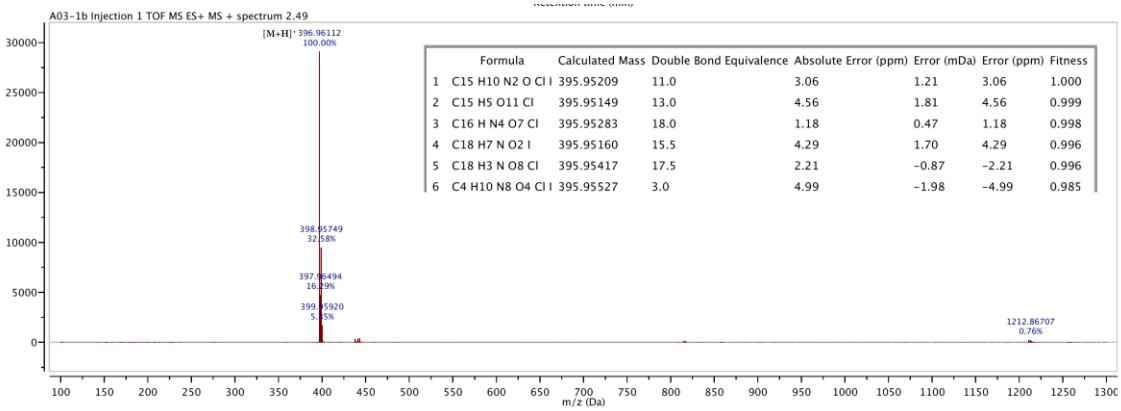




| | Formula | Calculated Mass | Double Bond Equivalence | Absolute Error (ppm) | Error (mDa) | Error (ppm) | Fitness |
|---|---|---|---|---|---|---|---|
| 1 | C15 H10 N2 O Br I | 439.90157 | 11.0 | 2.63 | 1.16 | 2.63 | 0.997 |
| 2 | C16 H N4 O7 Br | 439.90231 | 18.0 | 0.94 | 0.42 | 0.94 | 0.995 |
| 3 | C18 H3 N O8 Br | 439.90366 | 17.5 | 2.11 | -0.93 | -2.11 | 0.993 |
| 4 | C4 H5 N6 O14 Br | 439.90416 | 5.0 | 3.26 | -1.43 | -3.26 | 0.979 |
| 5 | C2 H3 N9 O13 Br | 439.90282 | 5.5 | 0.21 | -0.09 | -0.21 | 0.975 |
| 6 | C15 H5 O8 I | 439.90236 | 13.0 | 0.83 | 0.37 | 0.83 | 0.327 |
| 7 | C16 H N4 O4 I | 439.90370 | 18.0 | 2.21 | -0.97 | -2.21 | 0.322 |
| 8 | C3 H9 N2 O15 I | 439.90421 | 0.0 | 3.37 | -1.48 | -3.37 | 0.321 |
| 9 | C H7 N5 O14 I | 439.90287 | 0.5 | 0.32 | -0.14 | -0.32 | 0.317 |
| 10 | C2 H3 N9 O10 I | 439.90421 | 5.5 | 3.36 | -1.48 | -3.36 | 0.312 |

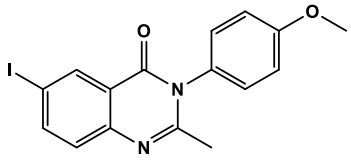

O
Cl
I
N
N
3b
8.33
8.33
8.11
8.10
8.09
8.08
7.65
7.64
7.64
7.63
7.63
7.62
7.52
7.51
7.51
7.50
7.50
7.49
7.44
7.42
2.12
0.89
1.00
1.89
2.05
0.97
2.95
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
159.94
154.93
146.51
142.87
136.43
134.42
134.34
130.32
129.63
128.82
122.20
91.08
24.08
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

## Spectrum

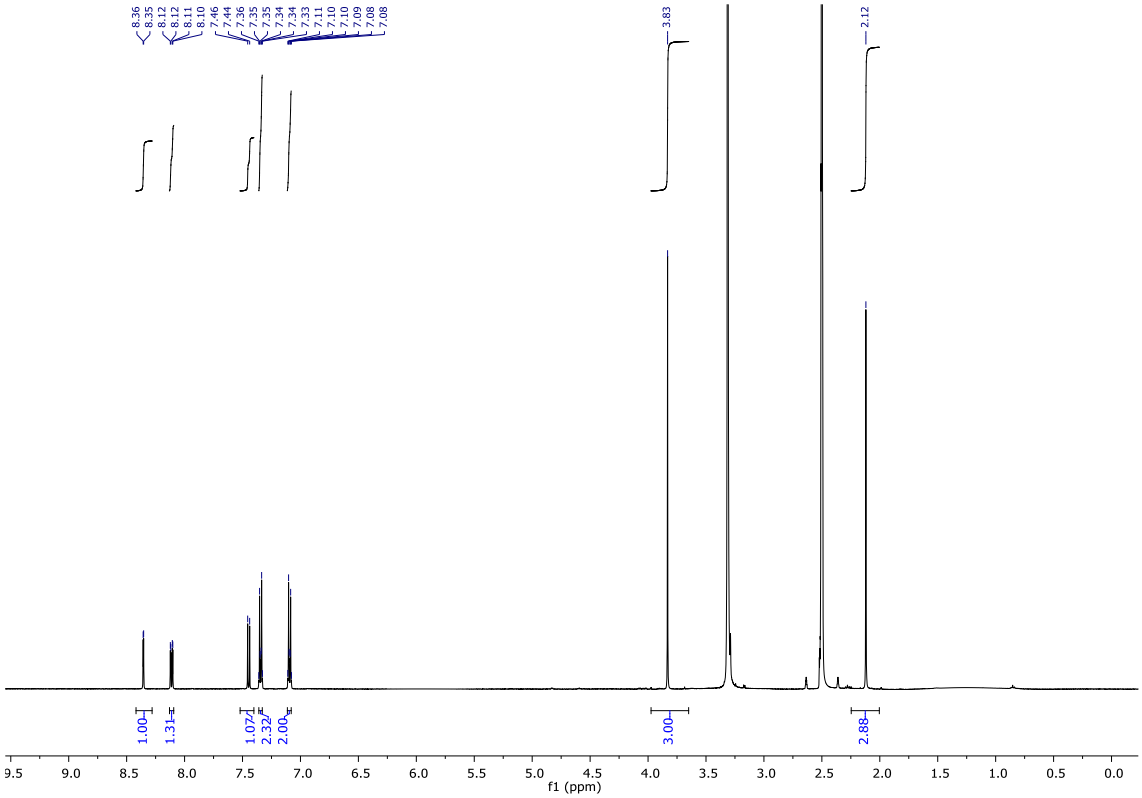


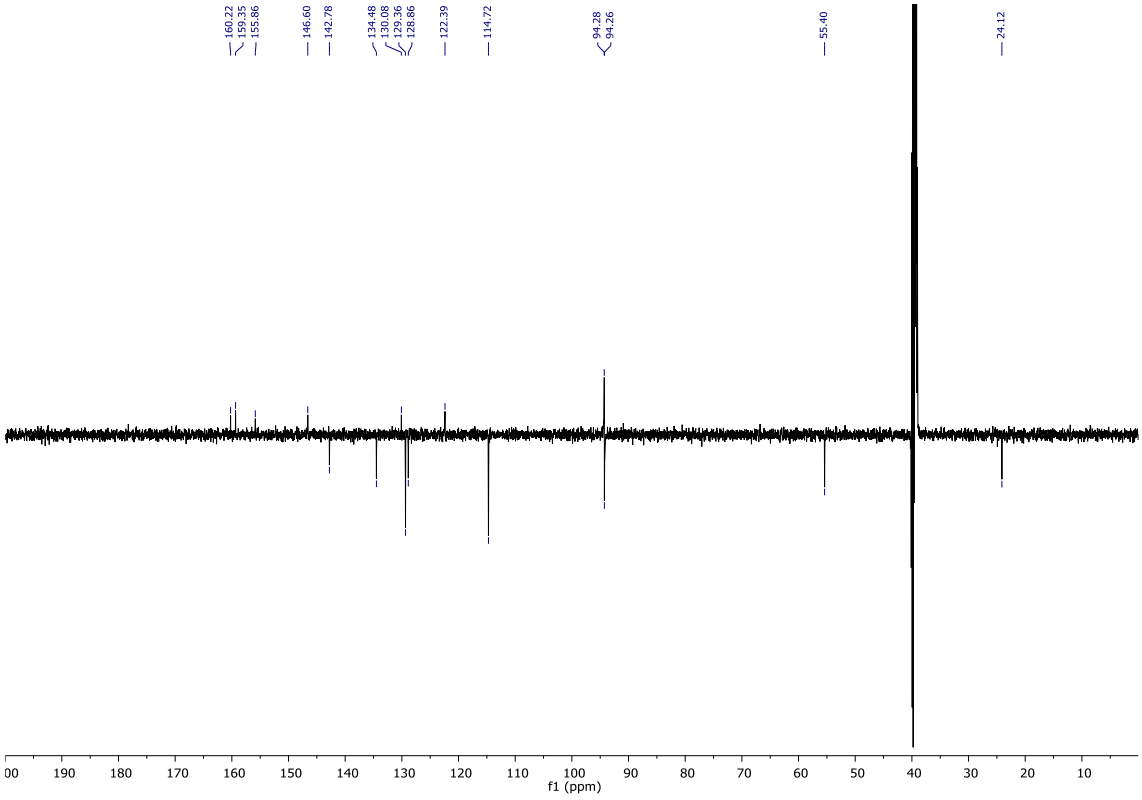




| | Formula | Calculated Mass | Double Bond Equivalence | Absolute Error (ppm) | Error (mDa) | Error (ppm) | Fitness |
|---|---|---|---|---|---|---|---|
| 1 | C15 H10 N2 O Cl I | 395.95209 | 11.0 | 3.06 | 1.21 | 3.06 | 1.000 |
| 2 | C15 H5 O11 Cl | 395.95149 | 13.0 | 4.56 | 1.81 | 4.56 | 0.999 |
| 3 | C16 H N4 O7 Cl | 395.95283 | 18.0 | 1.18 | 0.47 | 1.18 | 0.998 |
| 4 | C18 H7 N O2 I | 395.95160 | 15.5 | 4.29 | 1.70 | 4.29 | 0.996 |
| 5 | C18 H3 N O8 Cl | 395.95417 | 17.5 | 2.21 | -0.87 | -2.21 | 0.996 |
| 6 | C4 H10 N8 O4 Cl I | 395.95527 | 3.0 | 4.99 | -1.98 | -4.99 | 0.985 |

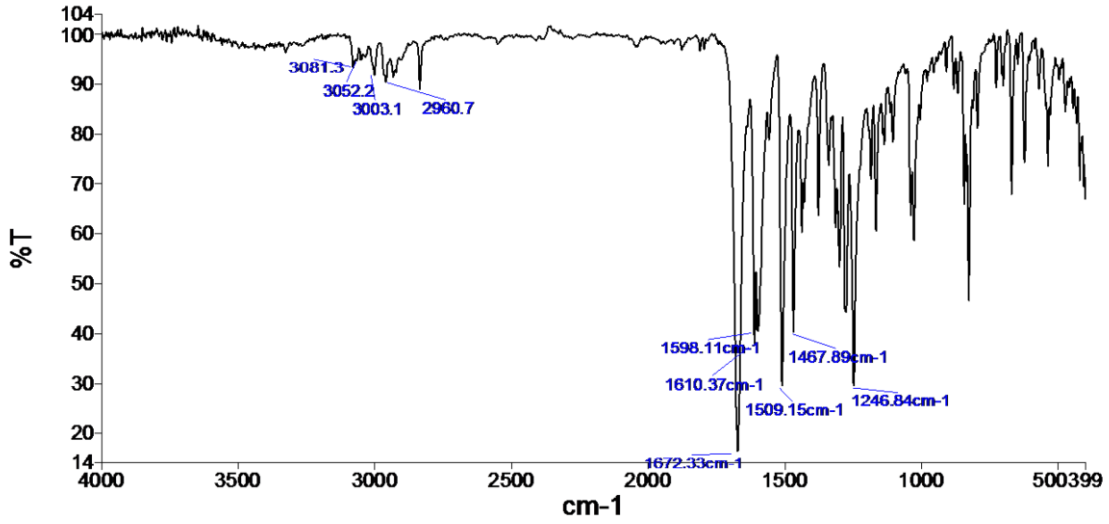

O
O
I
N
N

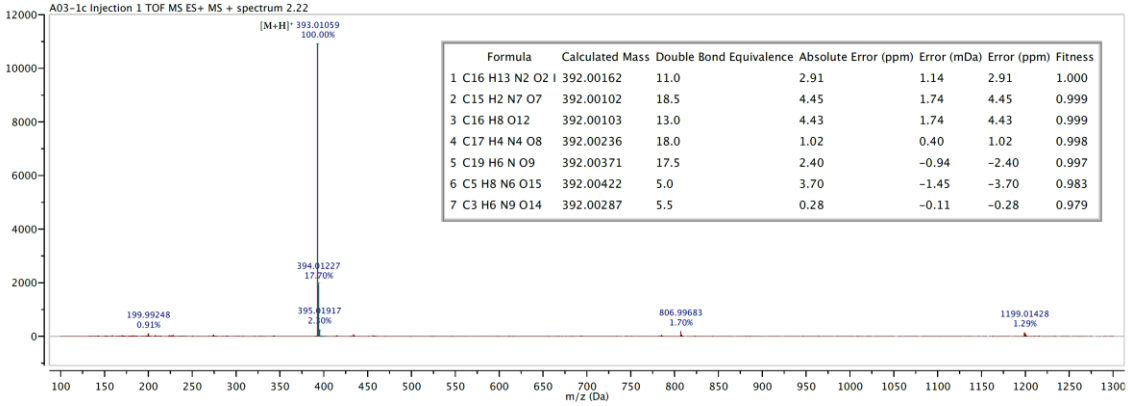
3c


8.36
8.35
8.12
8.12
8.11
8.10
7.46
7.44
7.36
7.35
7.35
7.34
7.34
7.33
7.11
7.10
7.10
7.09
7.08
7.08
3.83
2.12
1.00
1.31
1.07
2.32
2.00
3.00
2.88
f1 (ppm)

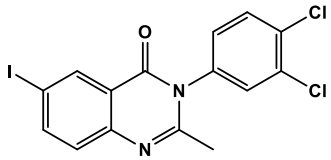

160.22
159.35
155.86
146.60
142.78
134.48
130.08
129.36
128.86
122.39
114.72
94.28
94.26
55.40
24.12
f1 (ppm)

## Spectrum

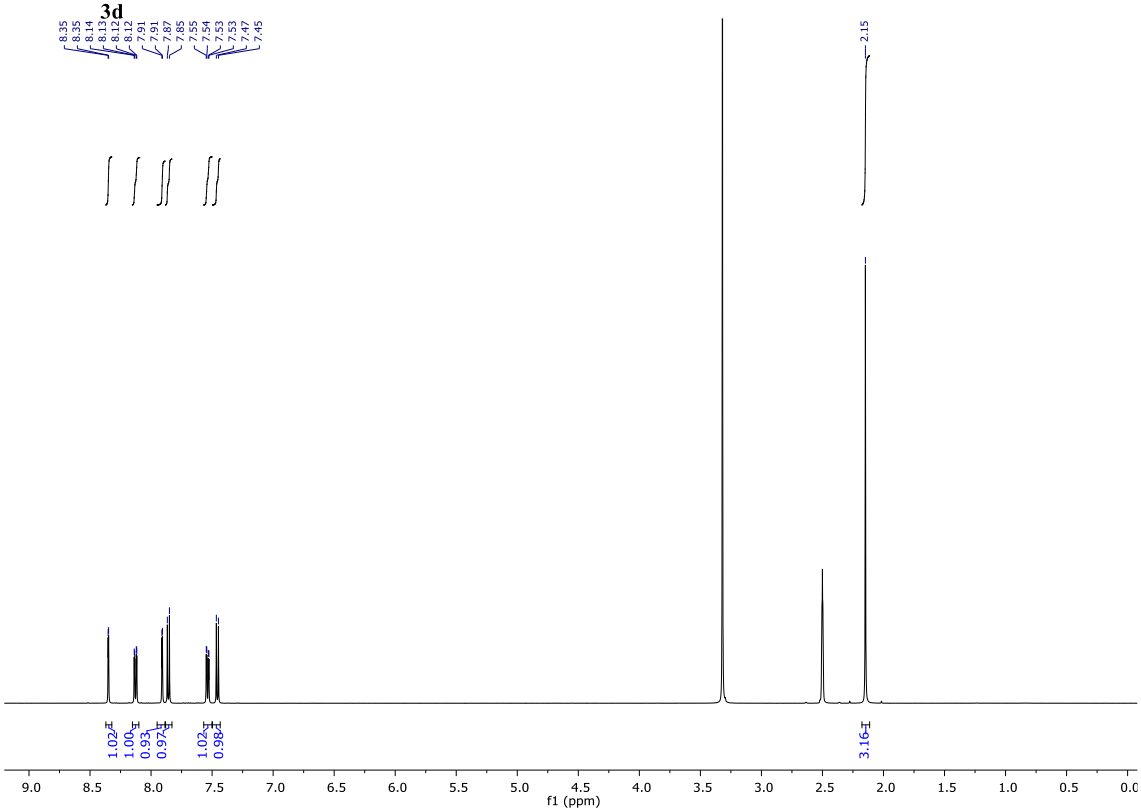


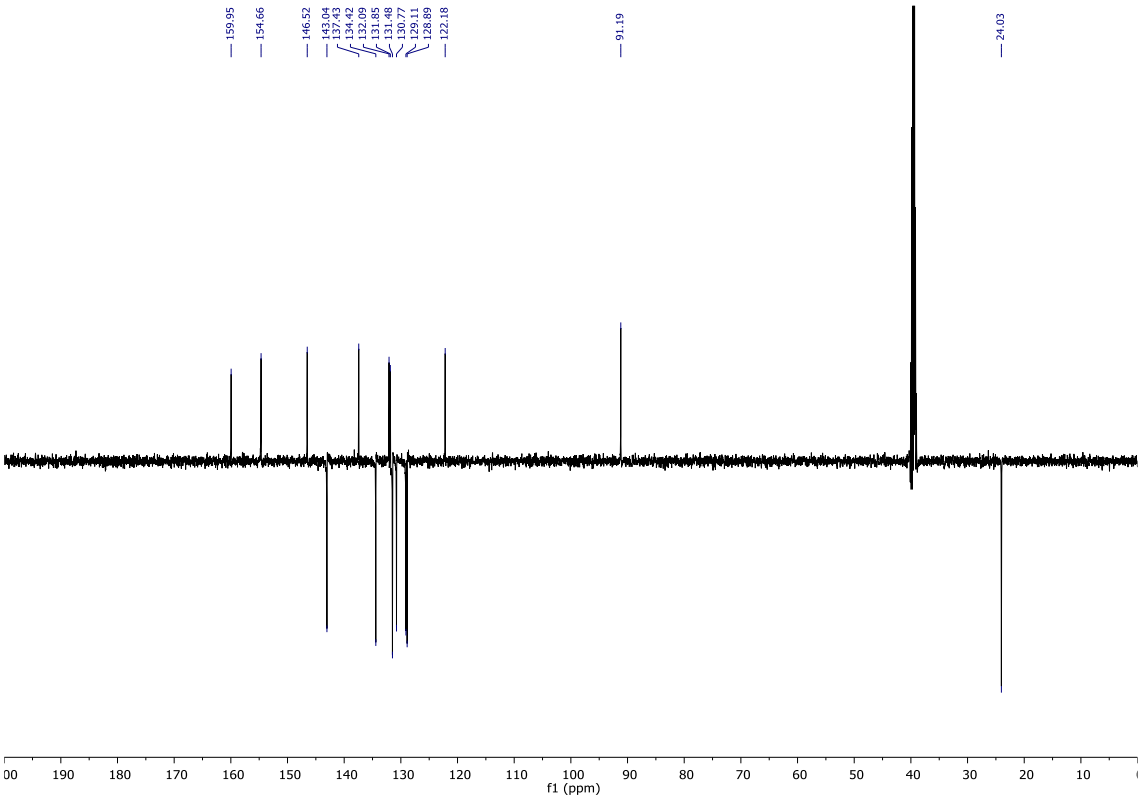




| | Formula | Calculated Mass | Double Bond Equivalence | Absolute Error (ppm) | Error (mDa) | Error (ppm) | Fitness |
|---|---|---|---|---|---|---|---|
| 1 | C16 H13 N2 O2 I | 392.00162 | 11.0 | 2.91 | 1.14 | 2.91 | 1.000 |
| 2 | C15 H2 N7 O7 | 392.00102 | 18.5 | 4.45 | 1.74 | 4.45 | 0.999 |
| 3 | C16 H8 O12 | 392.00103 | 13.0 | 4.43 | 1.74 | 4.43 | 0.999 |
| 4 | C17 H4 N4 O8 | 392.00236 | 18.0 | 1.02 | 0.40 | 1.02 | 0.998 |
| 5 | C19 H6 N O9 | 392.00371 | 17.5 | 2.40 | −0.94 | −2.40 | 0.997 |
| 6 | C5 H8 N6 O15 | 392.00422 | 5.0 | 3.70 | −1.45 | −3.70 | 0.983 |
| 7 | C3 H6 N9 O14 | 392.00287 | 5.5 | 0.28 | −0.11 | −0.28 | 0.979 |

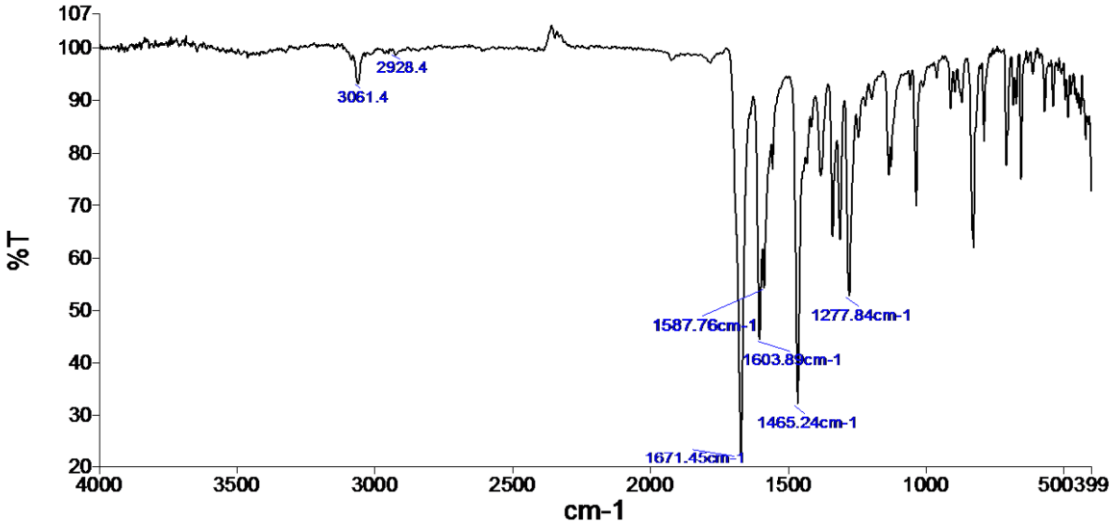

O
I
N
N
Cl
Cl

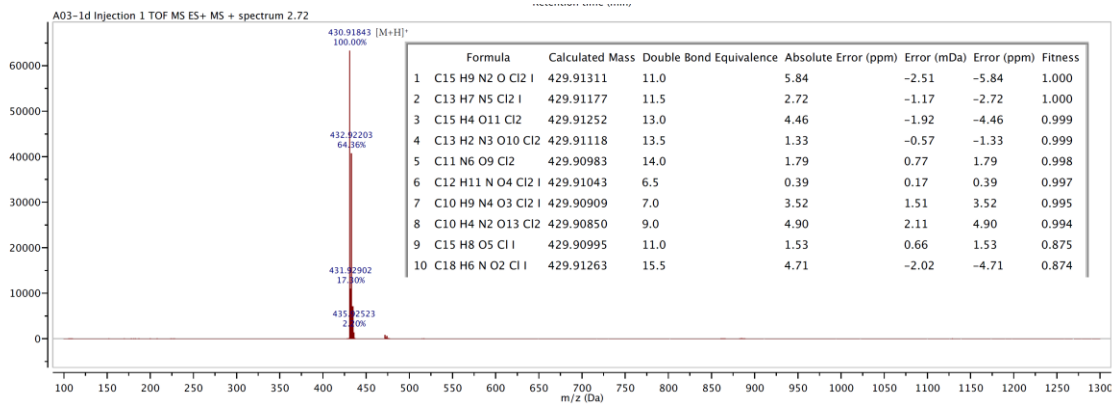
**3d**


8.35
8.35
8.14
8.13
8.12
8.12
7.91
7.91
7.87
7.85
7.55
7.54
7.53
7.53
7.47
7.45
2.15
1.02
1.00
0.93
0.97
1.02
0.98
3.16
f1 (ppm)

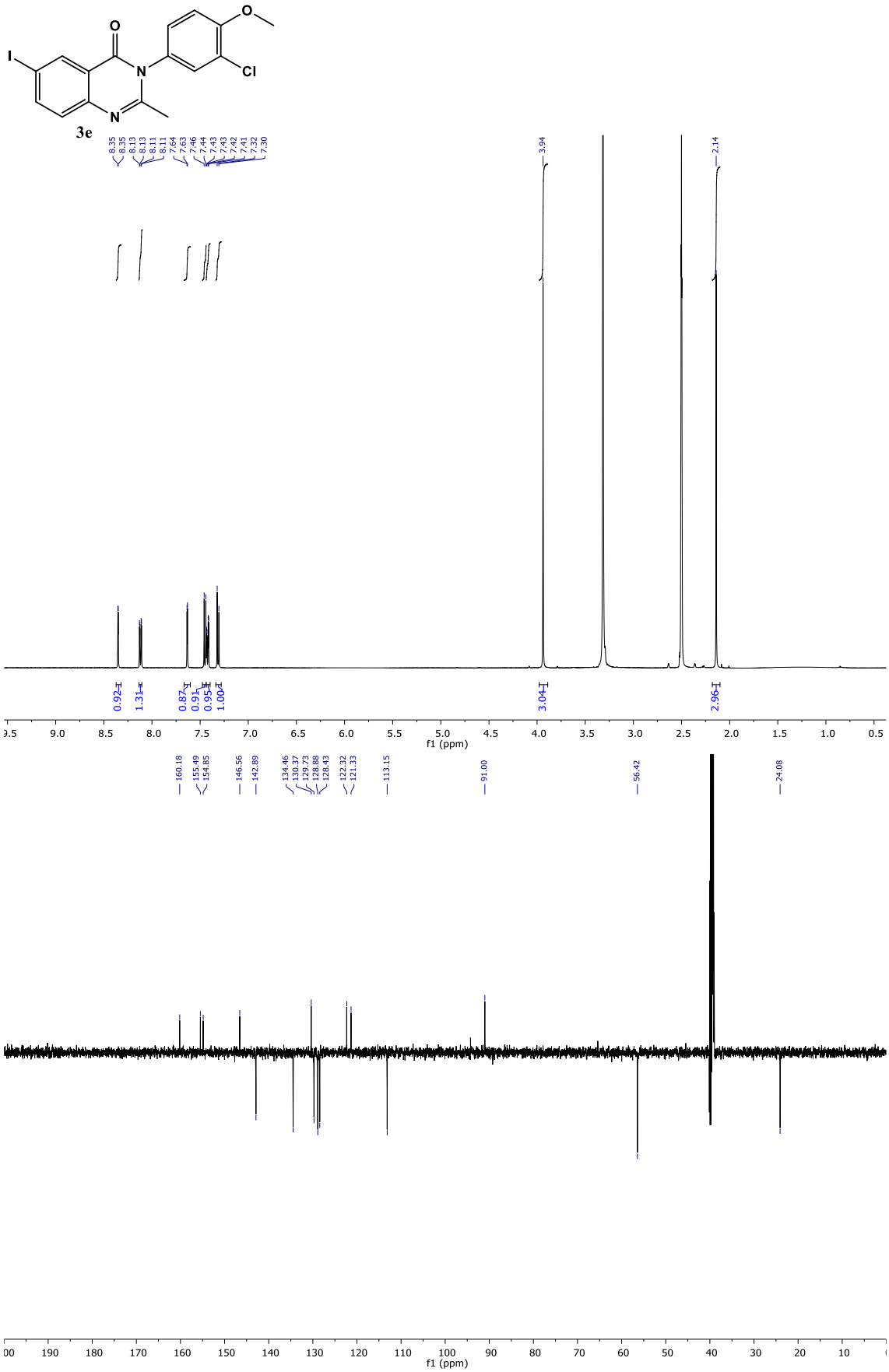

159.95
154.66
146.52
143.04
137.43
134.42
132.09
131.85
131.48
130.77
129.11
128.89
122.18
91.19
24.03
f1 (ppm)

## Spectrum

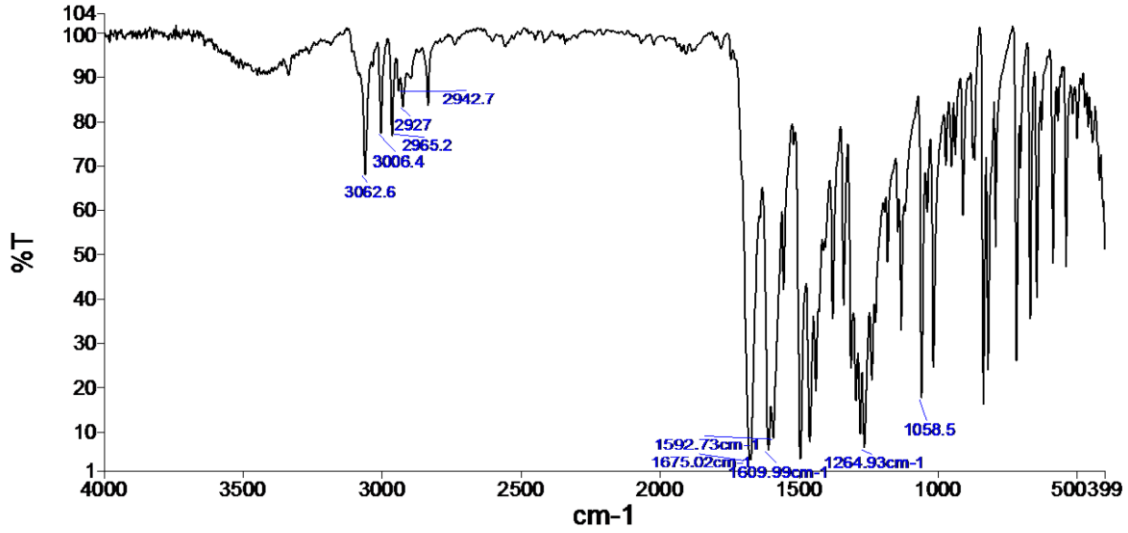


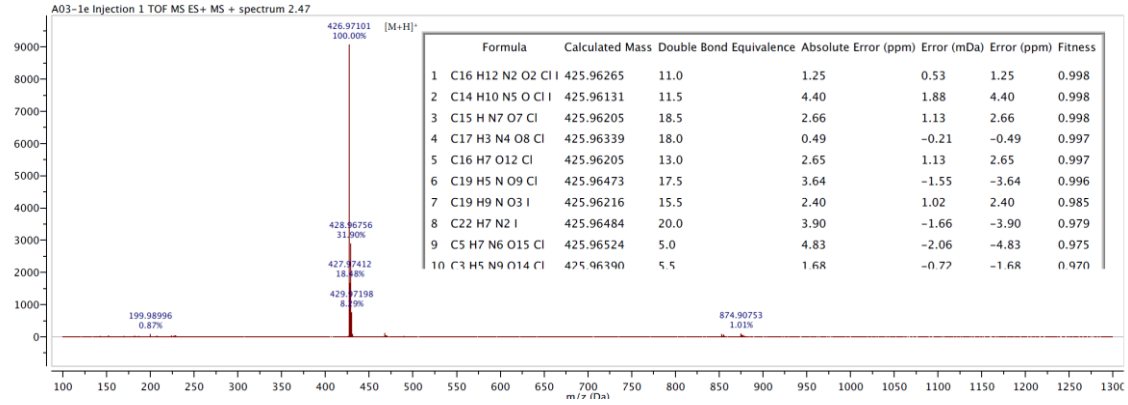




| | Formula | Calculated Mass | Double Bond Equivalence | Absolute Error (ppm) | Error (mDa) | Error (ppm) | Fitness |
|---|---|---|---|---|---|---|---|
| 1 | C15 H9 N2 O Cl2 I | 429.91311 | 11.0 | 5.84 | -2.51 | -5.84 | 1.000 |
| 2 | C13 H7 N5 Cl2 I | 429.91177 | 11.5 | 2.72 | -1.17 | -2.72 | 1.000 |
| 3 | C15 H4 O11 Cl2 | 429.91252 | 13.0 | 4.46 | -1.92 | -4.46 | 0.999 |
| 4 | C13 H2 N3 O10 Cl2 | 429.91118 | 13.5 | 1.33 | -0.57 | -1.33 | 0.999 |
| 5 | C11 N6 O9 Cl2 | 429.90983 | 14.0 | 1.79 | 0.77 | 1.79 | 0.998 |
| 6 | C12 H11 N O4 Cl2 I | 429.91043 | 6.5 | 0.39 | 0.17 | 0.39 | 0.997 |
| 7 | C10 H9 N4 O3 Cl2 I | 429.90909 | 7.0 | 3.52 | 1.51 | 3.52 | 0.995 |
| 8 | C10 H4 N2 O13 Cl2 | 429.90850 | 9.0 | 4.90 | 2.11 | 4.90 | 0.994 |
| 9 | C15 H8 O5 Cl I | 429.90995 | 11.0 | 1.53 | 0.66 | 1.53 | 0.875 |
| 10 | C18 H6 N O2 Cl I | 429.91263 | 15.5 | 4.71 | -2.02 | -4.71 | 0.874 |

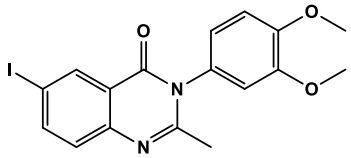

O
O
I
N
Cl
N
3e
8.35
8.35
8.13
8.13
8.11
8.11
7.64
7.63
7.46
7.44
7.43
7.43
7.42
7.41
7.32
7.30
3.94
2.14
0.92
1.31
0.87
0.91
0.95
1.00
3.04
2.96
f1 (ppm)
160.18
155.49
154.85
146.56
142.89
134.46
130.77
129.73
128.88
128.43
122.32
121.33
113.15
91.00
56.42
24.08
f1 (ppm)

## Spectrum

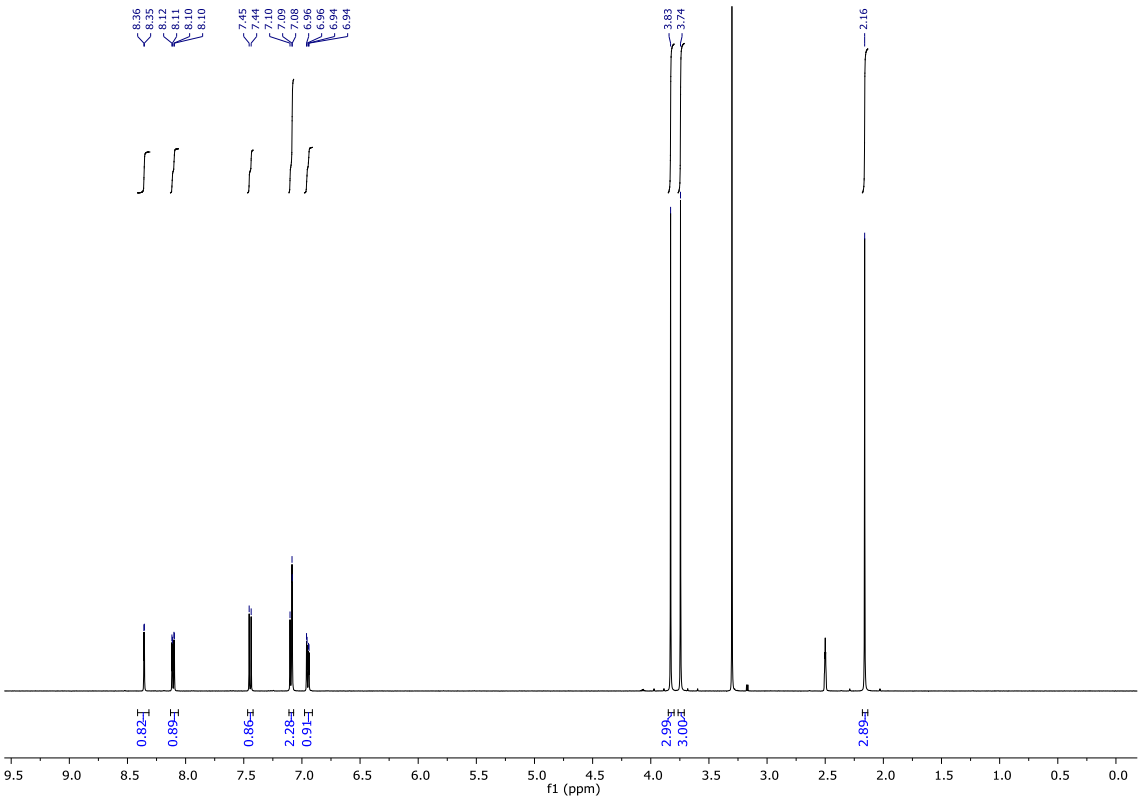


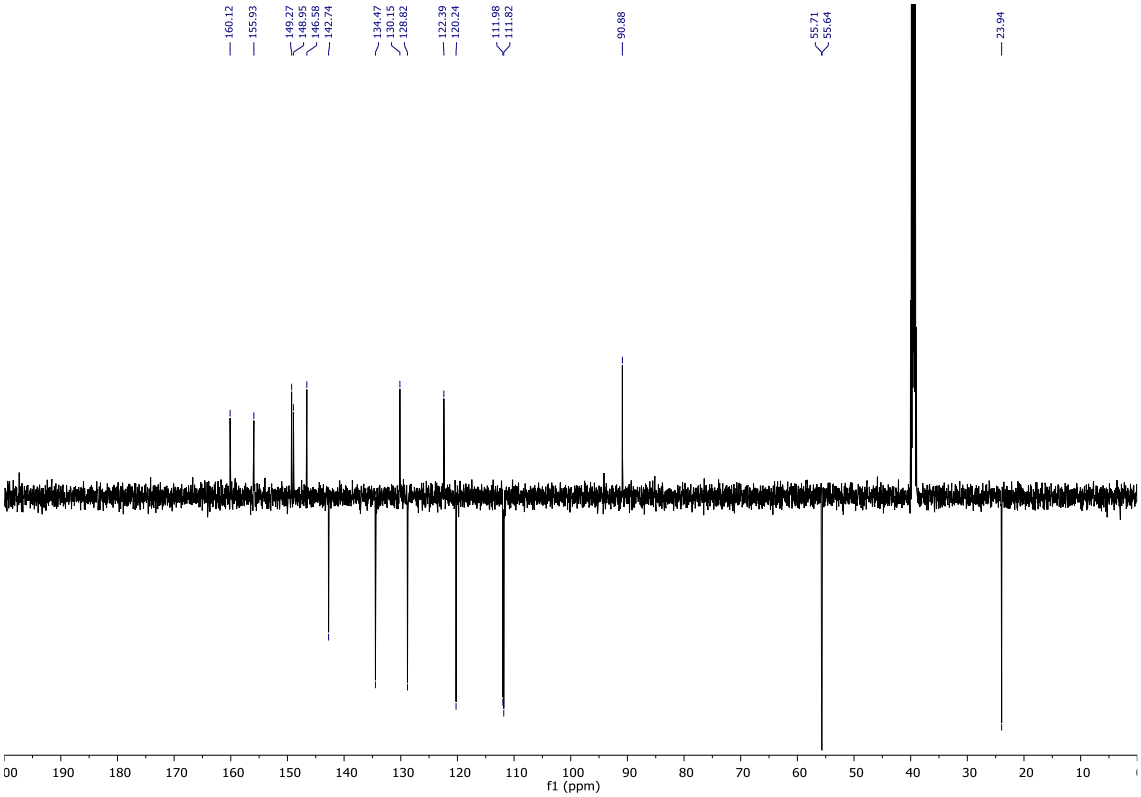




| | Formula | Calculated Mass | Double Bond Equivalence | Absolute Error (ppm) | Error (mDa) | Error (ppm) | Fitness |
|---|---|---|---|---|---|---|---|
| 1 | C16 H12 N2 O2 Cl I | 425.96265 | 11.0 | 1.25 | 0.53 | 1.25 | 0.998 |
| 2 | C14 H10 N5 O Cl I | 425.96131 | 11.5 | 4.40 | 1.88 | 4.40 | 0.998 |
| 3 | C15 H N7 O7 Cl | 425.96205 | 18.5 | 2.66 | 1.13 | 2.66 | 0.998 |
| 4 | C17 H3 N4 O8 Cl | 425.96339 | 18.0 | 0.49 | -0.21 | -0.49 | 0.997 |
| 5 | C16 H7 O12 Cl | 425.96205 | 13.0 | 2.65 | 1.13 | 2.65 | 0.997 |
| 6 | C19 H5 N O9 Cl | 425.96473 | 17.5 | 3.64 | -1.55 | -3.64 | 0.996 |
| 7 | C19 H9 N O3 I | 425.96216 | 15.5 | 2.40 | 1.02 | 2.40 | 0.985 |
| 8 | C22 H7 N2 I | 425.96484 | 20.0 | 3.90 | -1.66 | -3.90 | 0.979 |
| 9 | C5 H7 N6 O15 Cl | 425.96524 | 5.0 | 4.83 | -2.06 | -4.83 | 0.975 |
| 10 | C3 H5 N9 O14 Cl | 425.96390 | 5.5 | 1.68 | -0.72 | -1.68 | 0.970 |

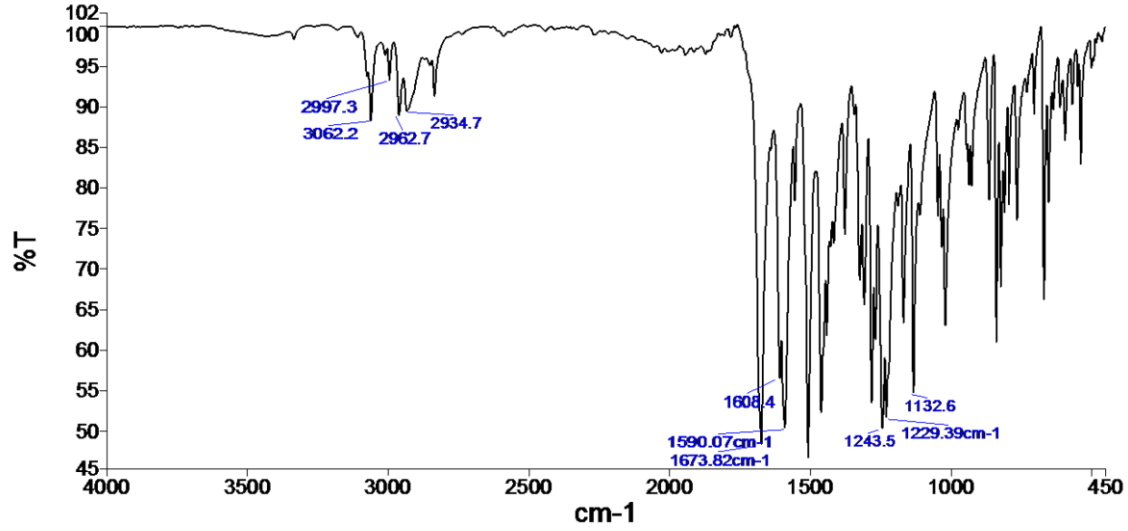

O
I
N
O
O
N

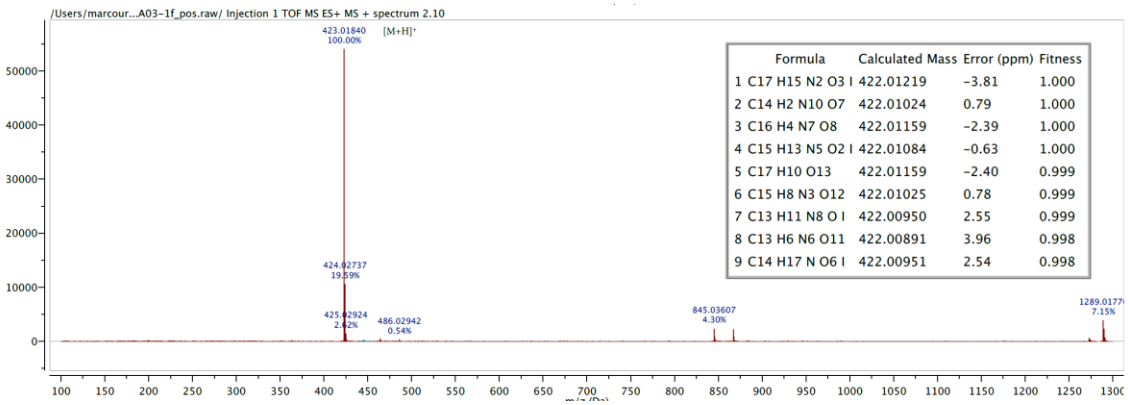
3f

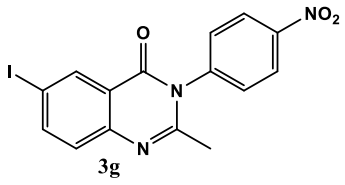

8.36
8.35
8.12
8.11
8.10
8.10
7.45
7.44
7.10
7.09
7.08
6.96
6.96
6.94
6.94
3.83
3.74
2.16
0.82
0.89
0.86
2.28
0.91
2.99
3.00
2.89
f1 (ppm)


160.12
155.93
149.27
148.95
146.58
142.74
134.47
130.15
128.82
122.39
120.24
111.98
111.82
90.88
55.71
55.64
23.94
f1 (ppm)

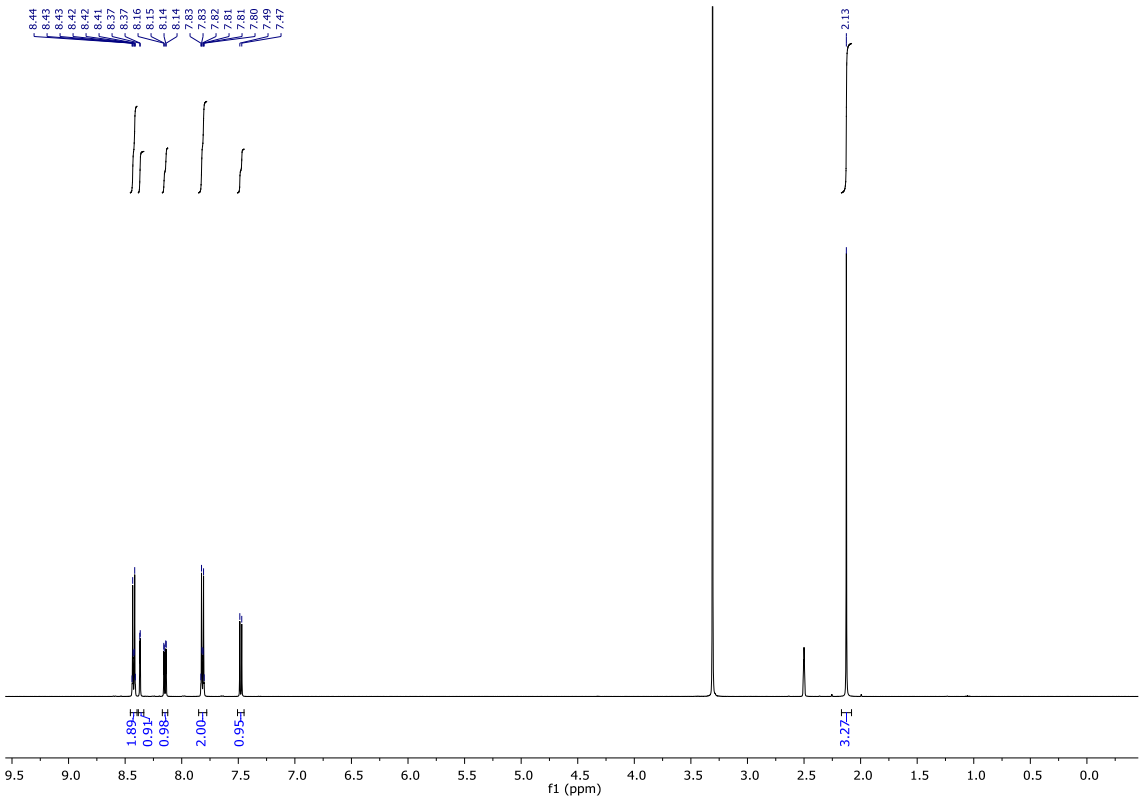
## Spectrum

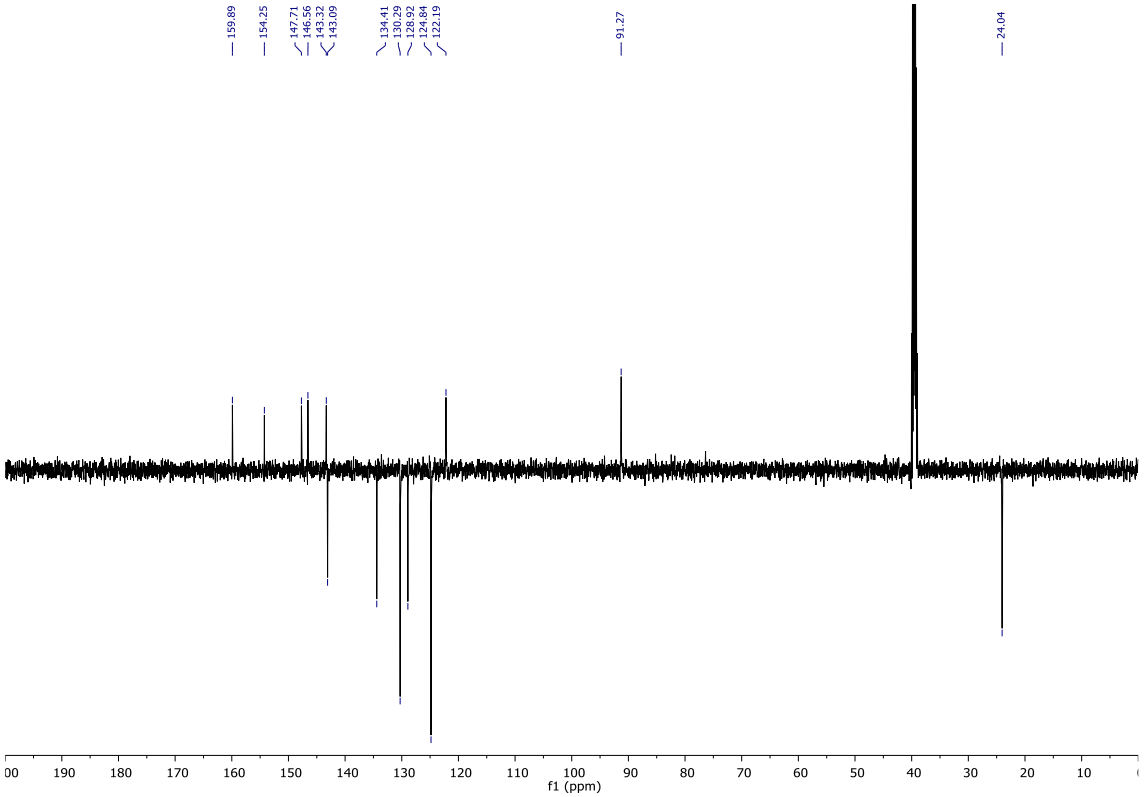

%T
cm-1
2997.3
3062.2
2962.7
2934.7
1608.4
1590.07cm-1
1673.82cm-1
1132.6
1243.5
1229.39cm-1


/Users/marcour...A03-1f_pos.raw/ Injection 1 TOF MS ES+ MS + spectrum 2.10
423.01840 100.00% [M+H]+
424.02737 19.59%
425.02924 2.62%
486.02942 0.54%
845.03607 4.30%
1289.0177 7.15%
Formula Calculated Mass Error (ppm) Fitness
1 C17 H15 N2 O3 I 422.01219 -3.81 1.000
2 C14 H2 N10 O7 422.01024 0.79 1.000
3 C16 H4 N7 O8 422.01159 -2.39 1.000
4 C15 H13 N5 O2 I 422.01084 -0.63 1.000
5 C17 H10 O13 422.01159 -2.40 0.999
6 C15 H8 N3 O12 422.01025 0.78 0.999
7 C13 H11 N8 O I 422.00950 2.55 0.999
8 C13 H6 N6 O11 422.00891 3.96 0.998
9 C14 H17 N O6 I 422.00951 2.54 0.998

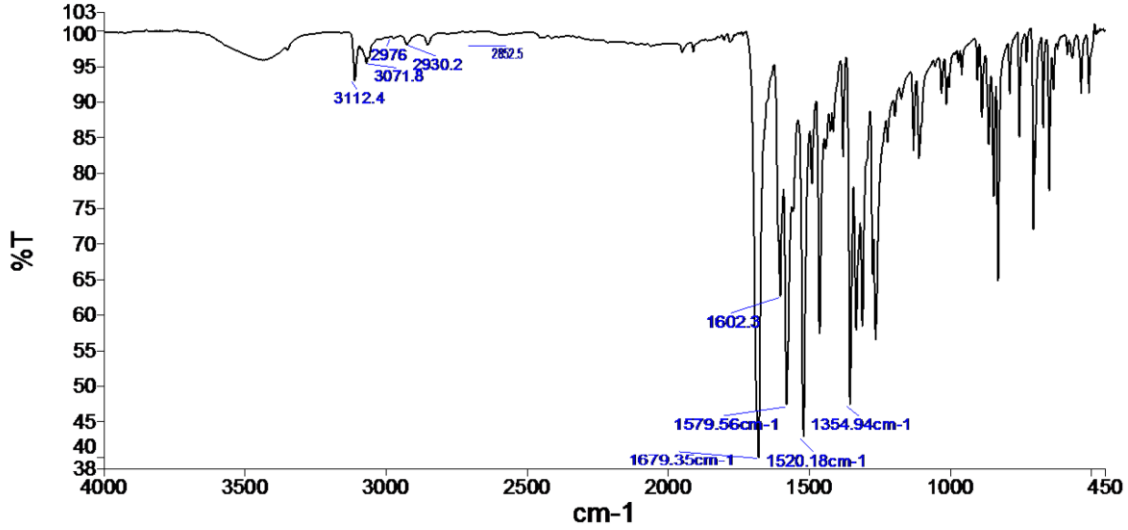

O
NO2
I
N
N

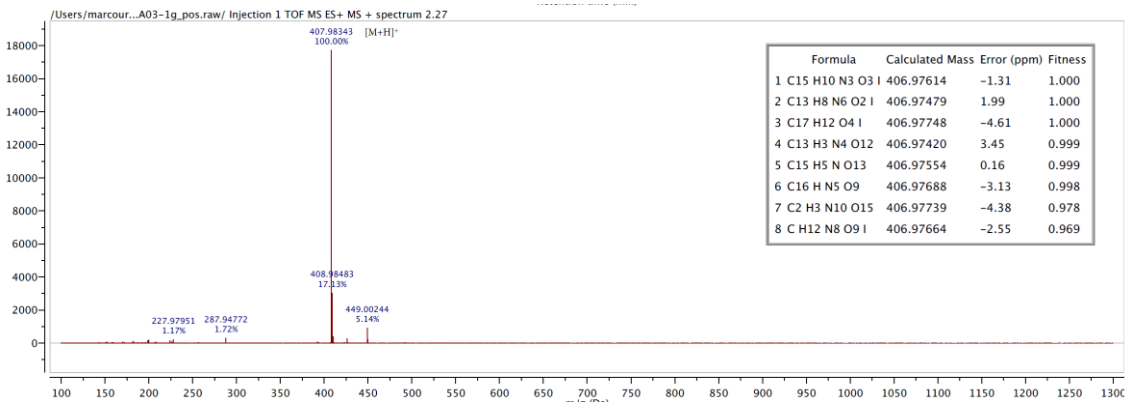
3g

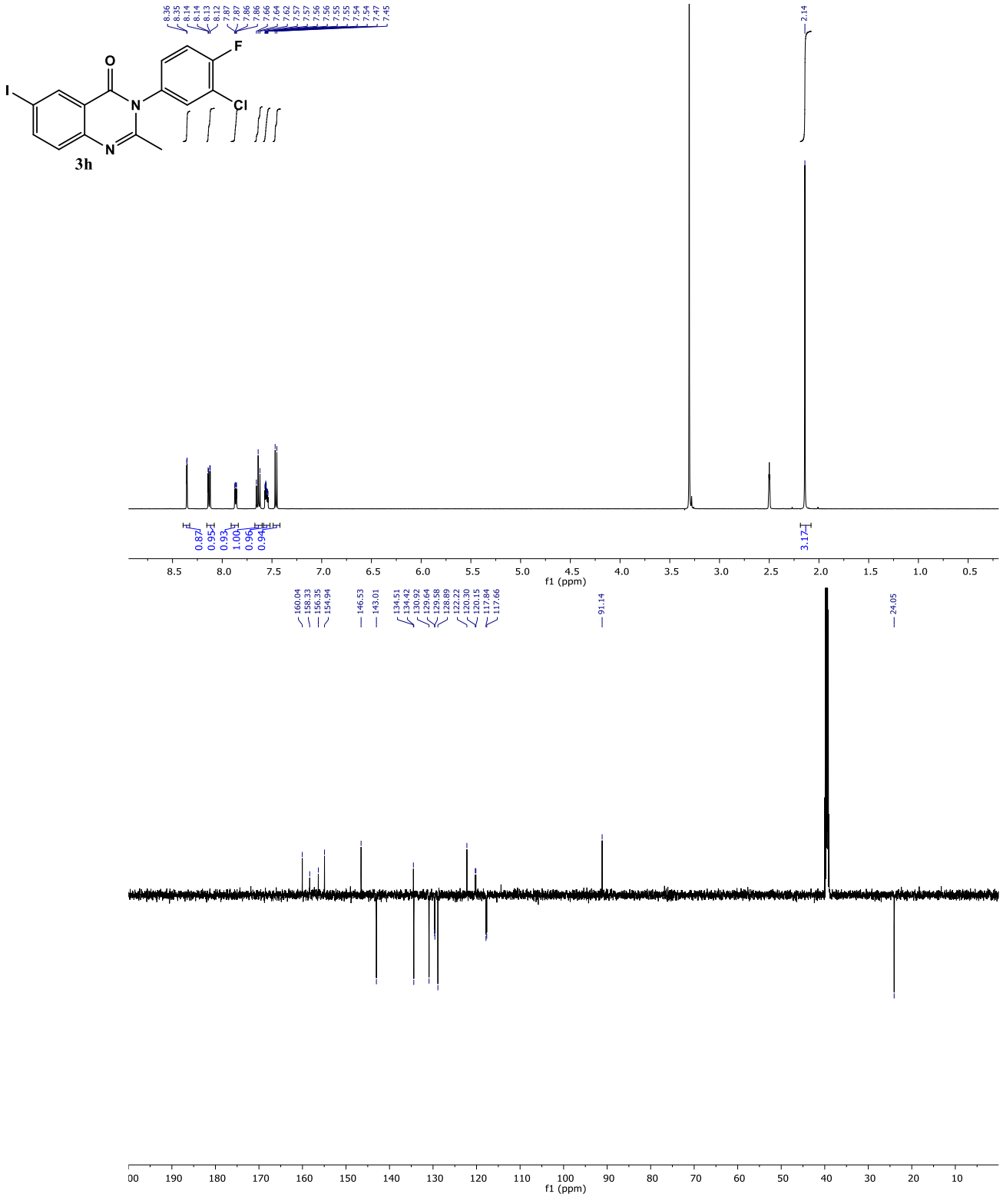

8.44
8.43
8.43
8.42
8.42
8.41
8.37
8.37
8.16
8.15
8.14
8.14
7.83
7.83
7.82
7.81
7.81
7.80
7.49
7.47
2.13
1.89
0.91
0.98
2.00
0.95
3.27
f1 (ppm)


159.89
154.25
147.71
146.56
143.32
143.09
134.41
130.29
128.92
124.64
122.19
91.27
24.04
f1 (ppm)

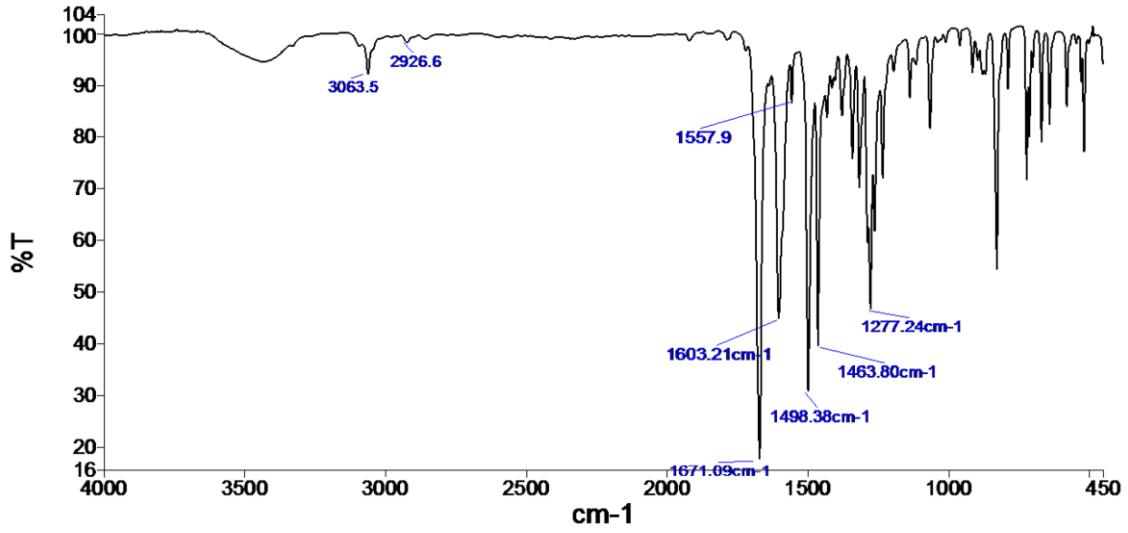
## Spectrum

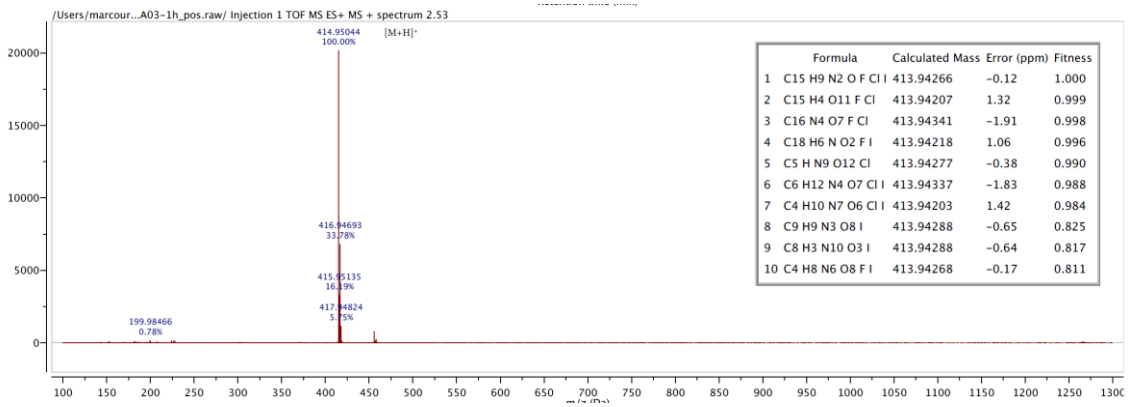

%T
cm-1
3112.4
3071.8
2976
2930.2
2852.5
1602.3
1579.56cm-1
1679.35cm-1
1520.18cm-1
1354.94cm-1


/Users/marcour...A03-1g_pos.raw/ Injection 1 TOF MS ES+ MS + spectrum 2.27
407.98343 [M+H]+
100.00%
408.98483
17.13%
449.00244
5.14%
227.97951
1.17%
287.94772
1.72%
Formula Calculated Mass Error (ppm) Fitness
1 C15 H10 N3 O3 I 406.97614 -1.31 1.000
2 C13 H8 N6 O2 I 406.97479 1.99 1.000
3 C17 H12 O4 I 406.97748 -4.61 1.000
4 C13 H3 N4 O12 406.97420 3.45 0.999
5 C15 H5 N O13 406.97554 0.16 0.999
6 C16 H N5 O9 406.97688 -3.13 0.998
7 C2 H3 N10 O15 406.97739 -4.38 0.978
8 C H12 N8 O9 I 406.97664 -2.55 0.969

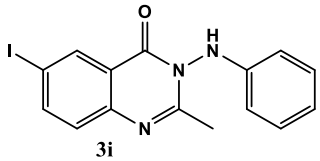

3h
8.36
8.35
8.14
8.14
8.13
8.12
7.87
7.87
7.86
7.86
7.66
7.64
7.62
7.57
7.57
7.56
7.56
7.55
7.55
7.54
7.54
7.47
7.45
2.14
0.87
0.95
0.93
1.00
0.96
0.94
3.17
f1 (ppm)
160.04
158.33
156.35
154.94
146.53
143.01
134.51
134.42
130.92
130.64
129.58
128.89
122.22
120.30
120.15
117.84
117.66
91.14
24.05
f1 (ppm)

## Spectrum

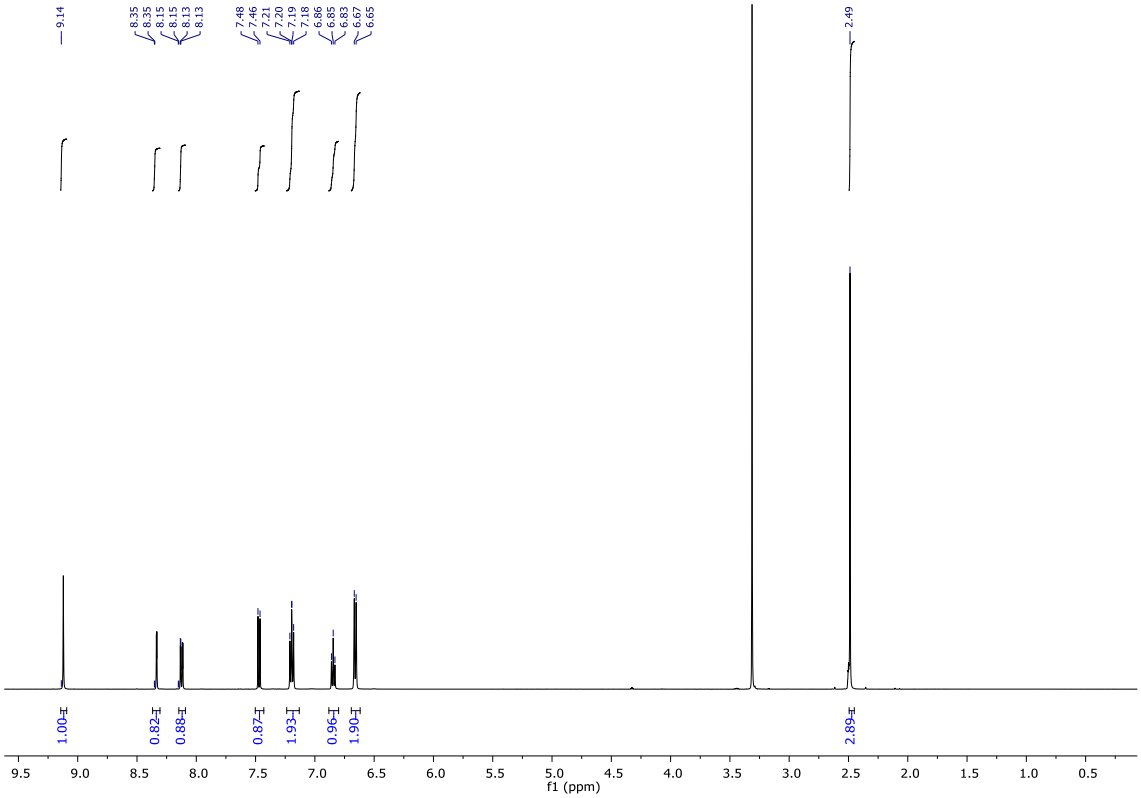


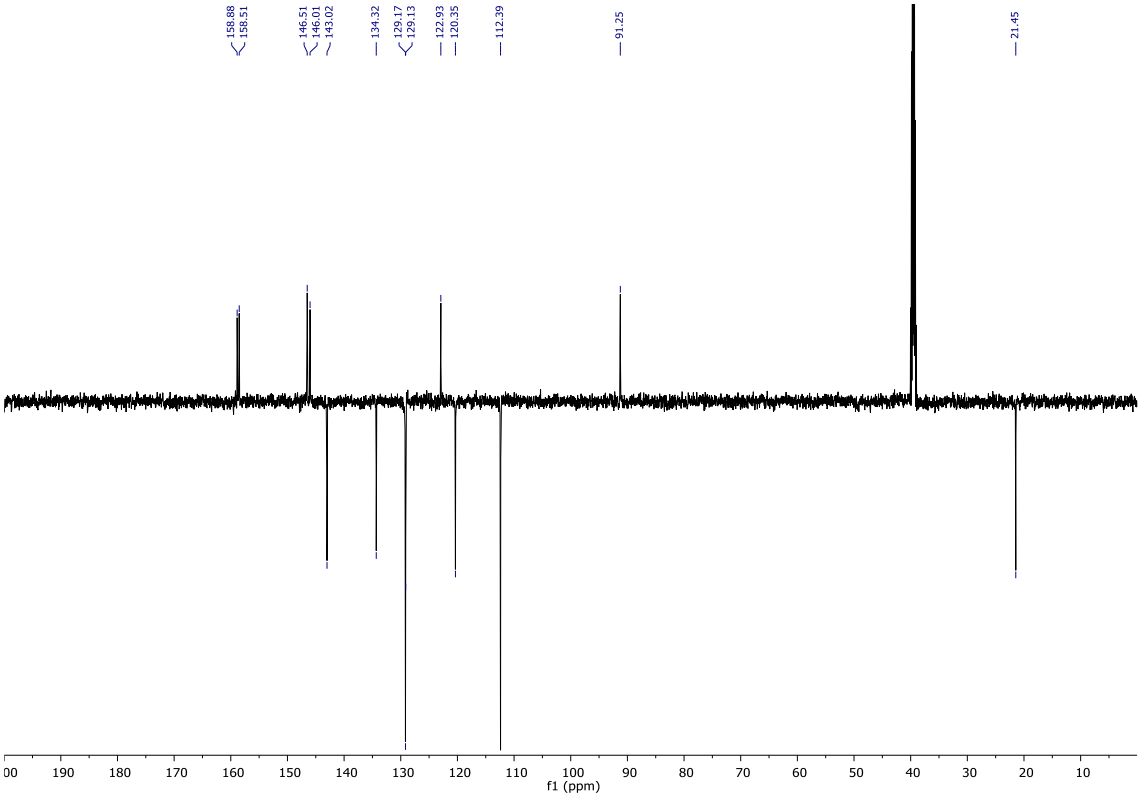




| | Formula | Calculated Mass | Error (ppm) | Fitness |
|---|---|---|---|---|
| 1 | C15 H9 N2 O F Cl I | 413.94266 | -0.12 | 1.000 |
| 2 | C15 H4 O11 F Cl | 413.94207 | 1.32 | 0.999 |
| 3 | C16 N4 O7 F Cl | 413.94341 | -1.91 | 0.998 |
| 4 | C18 H6 N O2 F I | 413.94218 | 1.06 | 0.996 |
| 5 | C5 H N9 O12 Cl | 413.94277 | -0.38 | 0.990 |
| 6 | C6 H12 N4 O7 Cl I | 413.94337 | -1.83 | 0.988 |
| 7 | C4 H10 N7 O6 Cl I | 413.94203 | 1.42 | 0.984 |
| 8 | C9 H9 N3 O8 I | 413.94288 | -0.65 | 0.825 |
| 9 | C8 H3 N10 O3 I | 413.94288 | -0.64 | 0.817 |
| 10 | C4 H8 N6 O8 F I | 413.94268 | -0.17 | 0.811 |

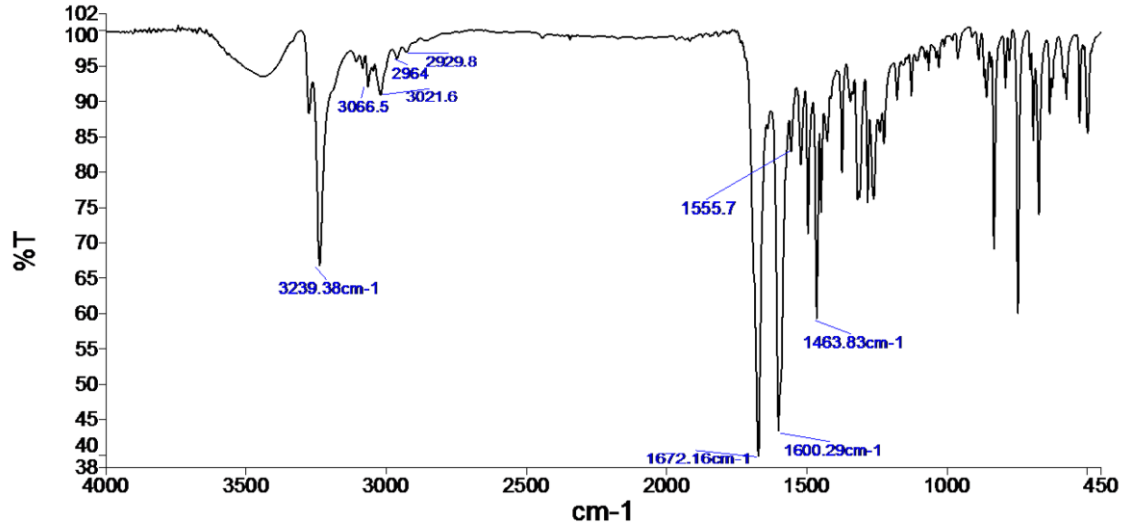

O
H
N
I
N
N

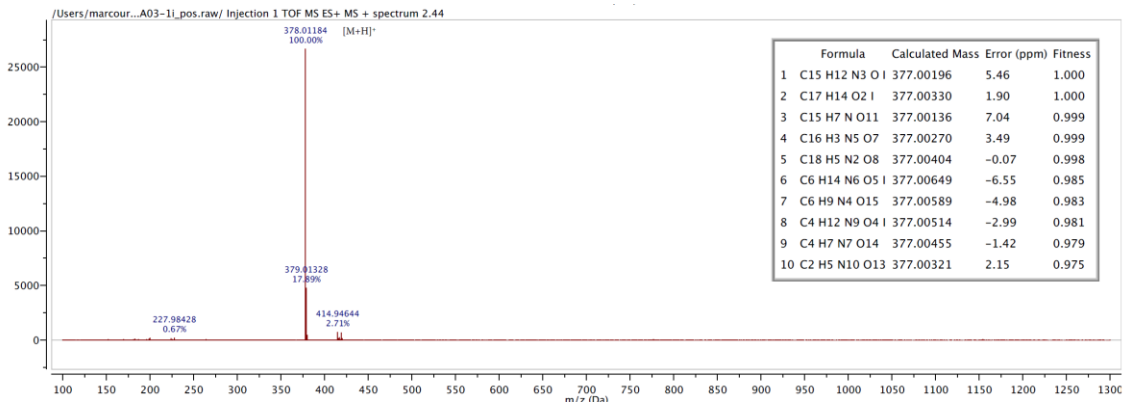
3i


9.14
8.35
8.35
8.15
8.15
8.13
8.13
7.48
7.46
7.21
7.20
7.19
7.18
6.86
6.85
6.83
6.67
6.65
2.49
1.00
0.82
0.88
0.87
1.93
0.96
1.90
2.89
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)

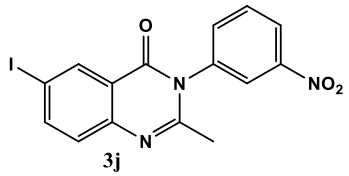

158.88
158.51
146.51
146.01
143.02
134.32
129.17
129.13
122.93
120.35
112.39
91.25
21.45
00 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

## Spectrum

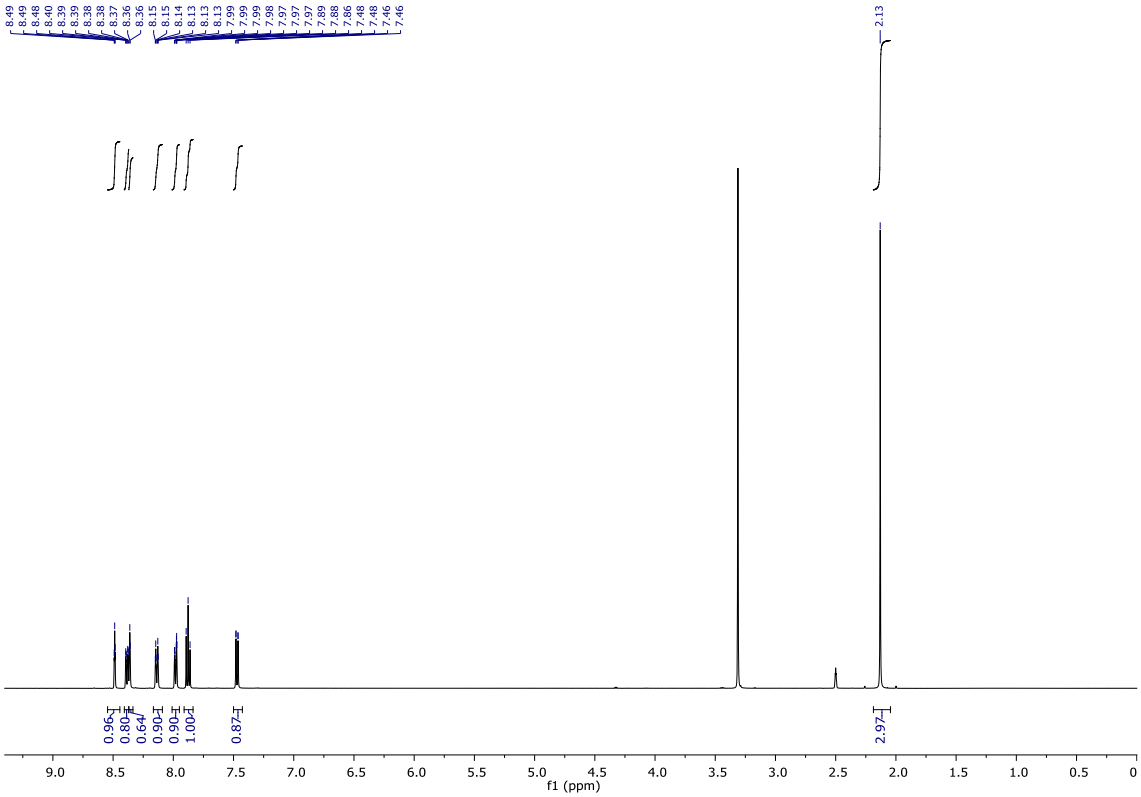


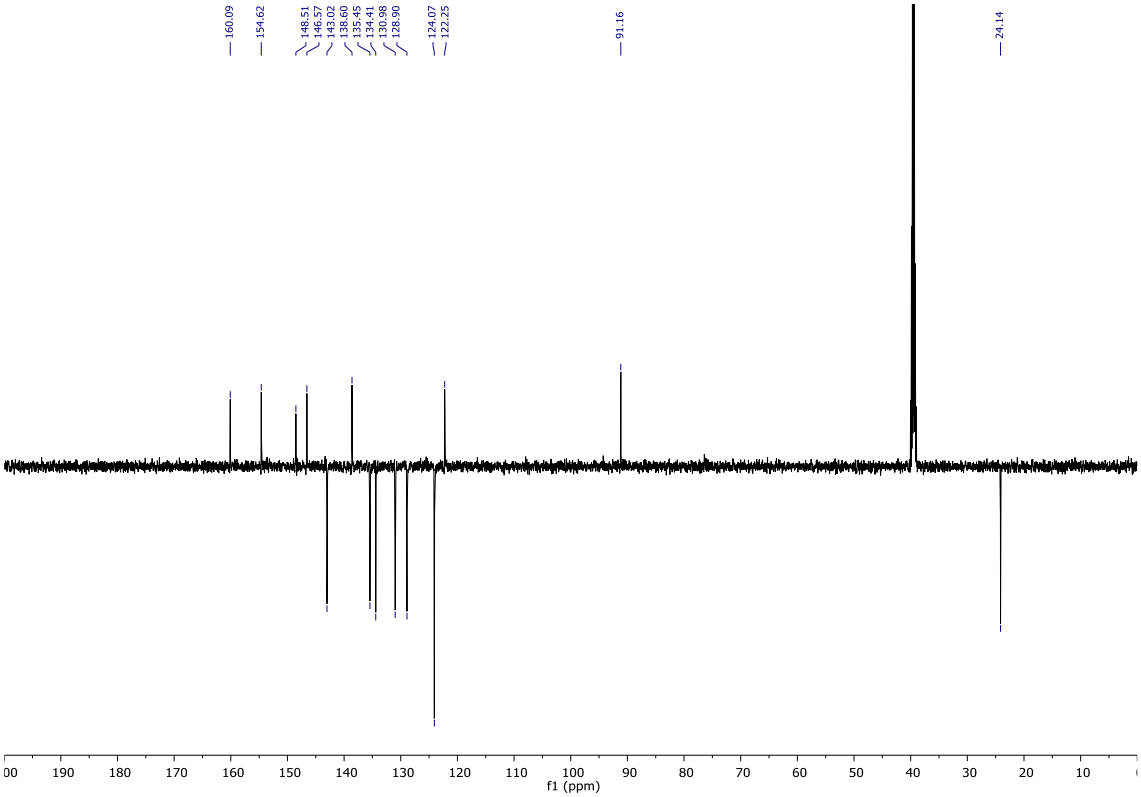




| | Formula | Calculated Mass | Error (ppm) | Fitness |
|---|---|---|---|---|
| 1 | C15 H12 N3 O I | 377.00196 | 5.46 | 1.000 |
| 2 | C17 H14 O2 I | 377.00330 | 1.90 | 1.000 |
| 3 | C15 H7 N O11 | 377.00136 | 7.04 | 0.999 |
| 4 | C16 H3 N5 O7 | 377.00270 | 3.49 | 0.999 |
| 5 | C18 H5 N2 O8 | 377.00404 | -0.07 | 0.998 |
| 6 | C6 H14 N6 O5 I | 377.00649 | -6.55 | 0.985 |
| 7 | C6 H9 N4 O15 | 377.00589 | -4.98 | 0.983 |
| 8 | C4 H12 N9 O4 I | 377.00514 | -2.99 | 0.981 |
| 9 | C4 H7 N7 O14 | 377.00455 | -1.42 | 0.979 |
| 10 | C2 H5 N10 O13 | 377.00321 | 2.15 | 0.975 |

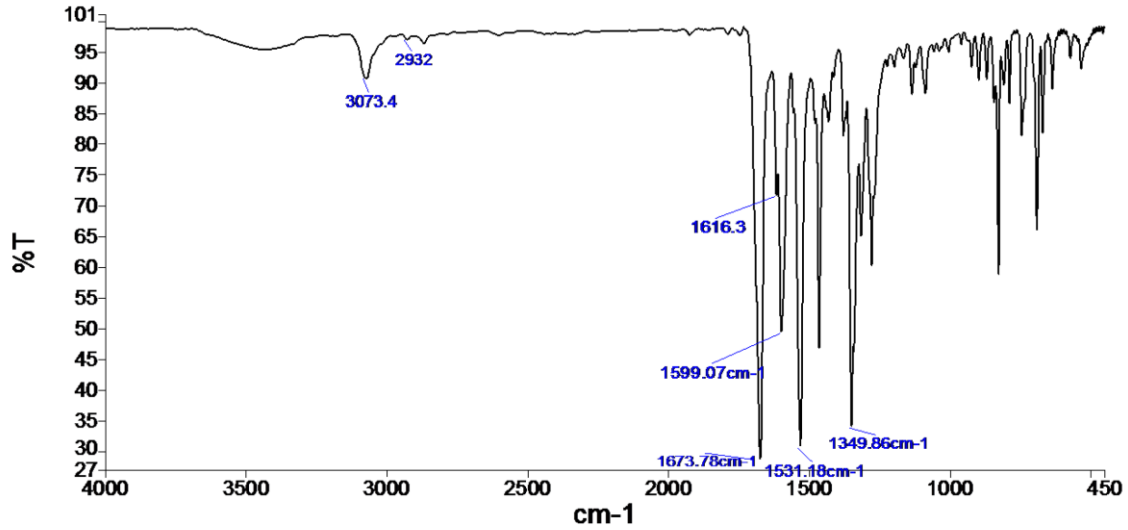

O
I
N
NO2
N

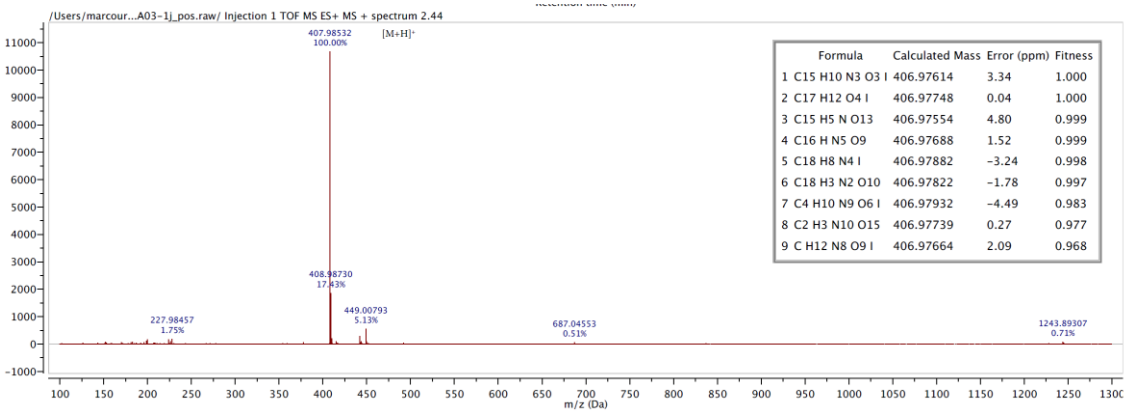
3j


8.49
8.49
8.48
8.40
8.39
8.39
8.38
8.38
8.37
8.36
8.36
8.15
8.15
8.14
8.13
8.13
8.13
7.99
7.99
7.99
7.98
7.97
7.97
7.97
7.89
7.88
7.86
7.48
7.48
7.46
7.46
2.13
0.96
0.80
0.64
0.90
0.90
1.00
0.87
2.97
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
f1 (ppm)

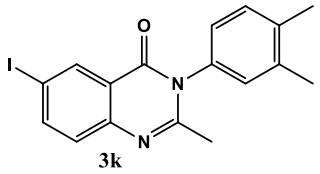

160.09
154.62
148.51
146.57
143.02
138.60
135.45
134.41
130.98
128.90
124.07
122.25
91.16
24.14
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

## Spectrum

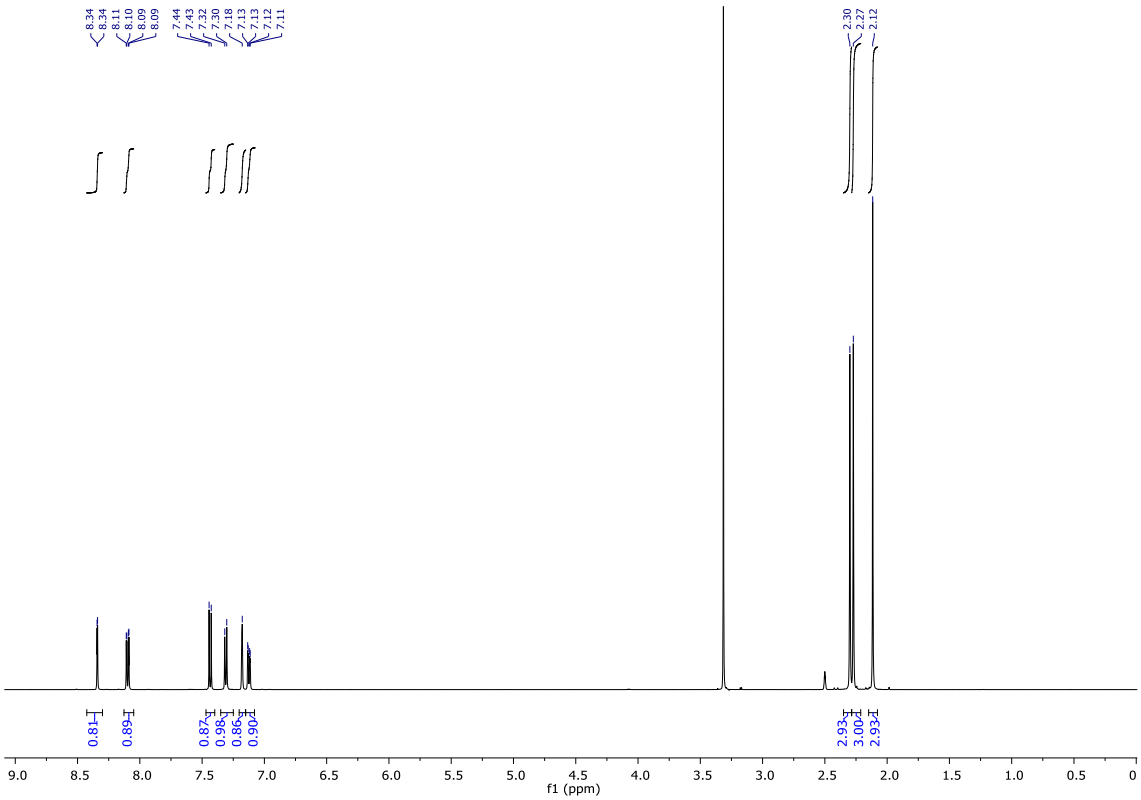


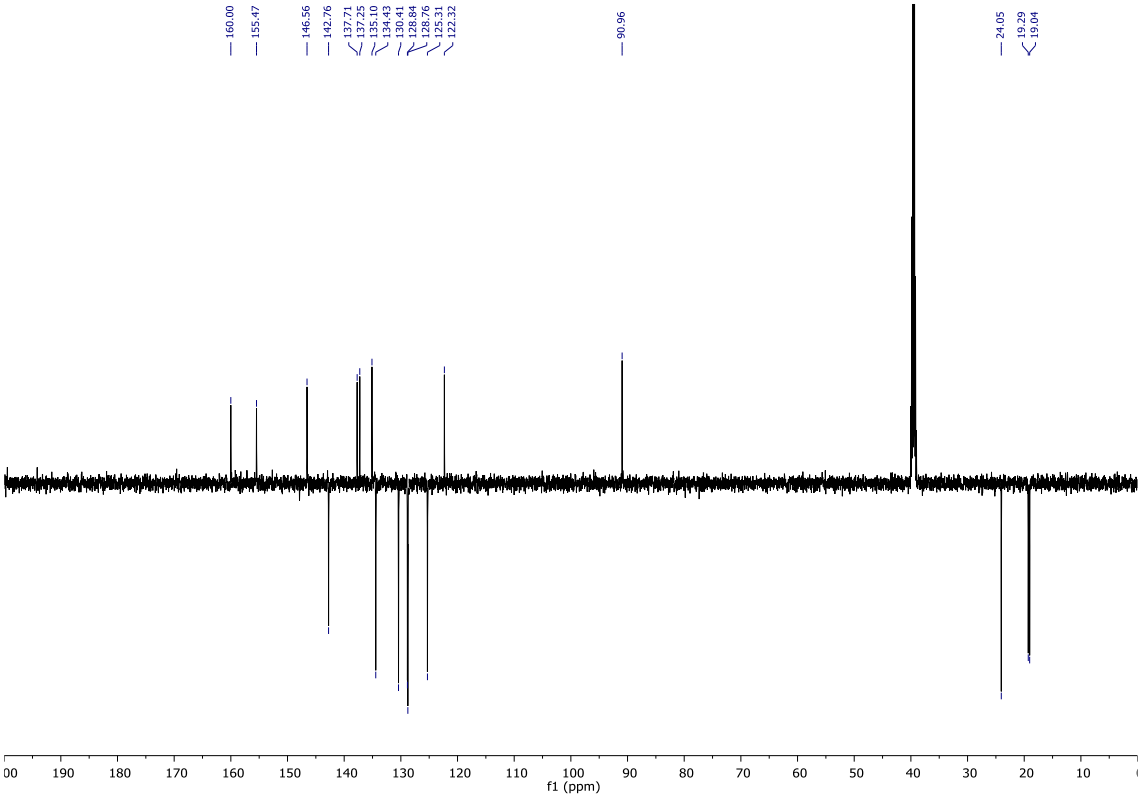




| | Formula | Calculated Mass | Error (ppm) | Fitness |
|---|---|---|---|---|
| 1 | C15 H10 N3 O3 I | 406.97614 | 3.34 | 1.000 |
| 2 | C17 H12 O4 I | 406.97748 | 0.04 | 1.000 |
| 3 | C15 H5 N O13 | 406.97554 | 4.80 | 0.999 |
| 4 | C16 H N5 O9 | 406.97688 | 1.52 | 0.999 |
| 5 | C18 H8 N4 I | 406.97882 | -3.24 | 0.998 |
| 6 | C18 H3 N2 O10 | 406.97822 | -1.78 | 0.997 |
| 7 | C4 H10 N9 O6 I | 406.97932 | -4.49 | 0.983 |
| 8 | C2 H3 N10 O15 | 406.97739 | 0.27 | 0.977 |
| 9 | C H12 N8 O9 I | 406.97664 | 2.09 | 0.968 |

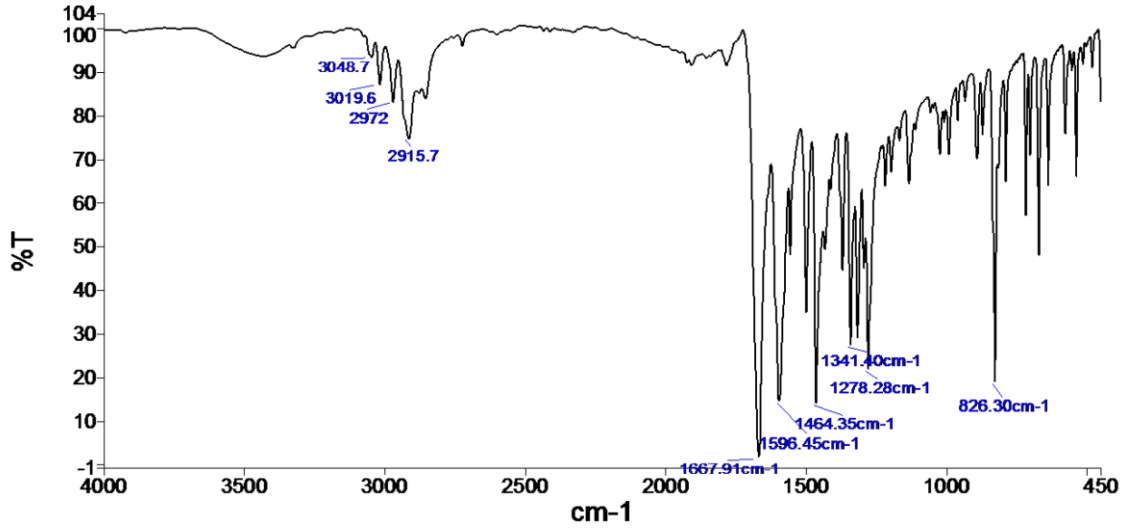

O
I
N
N

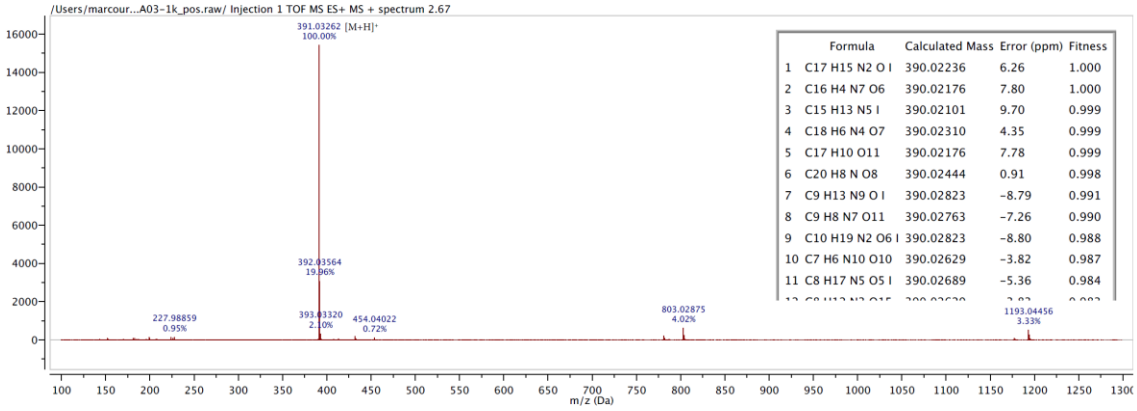
3k


8.34
8.34
8.11
8.10
8.09
8.09
8.09
7.44
7.43
7.32
7.30
7.18
7.13
7.13
7.12
7.11
2.30
2.27
2.12
0.81
0.89
0.87
0.98
0.86
0.90
2.93
3.00
2.93
f1 (ppm)

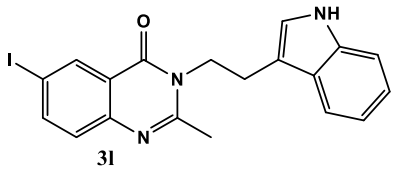

160.00
155.47
146.56
142.76
137.71
137.25
135.10
134.43
130.41
128.84
128.76
125.31
122.32
90.96
24.05
19.29
15.04
f1 (ppm)

## Spectrum

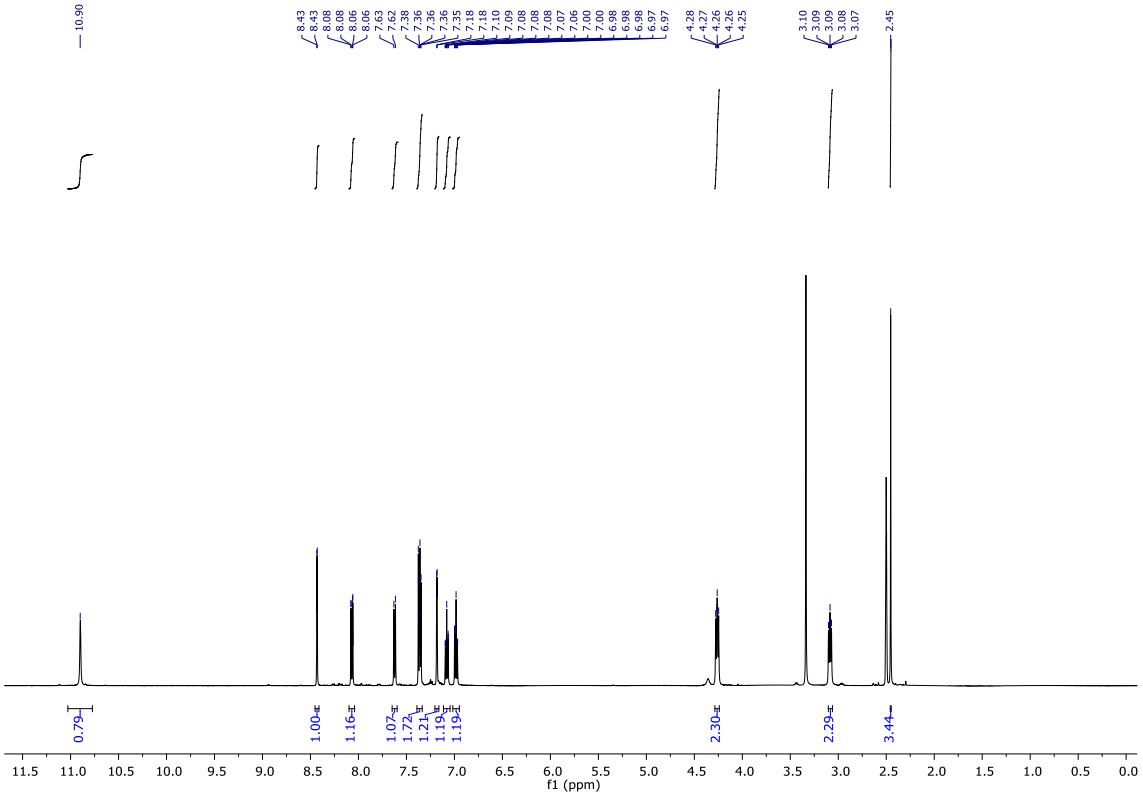


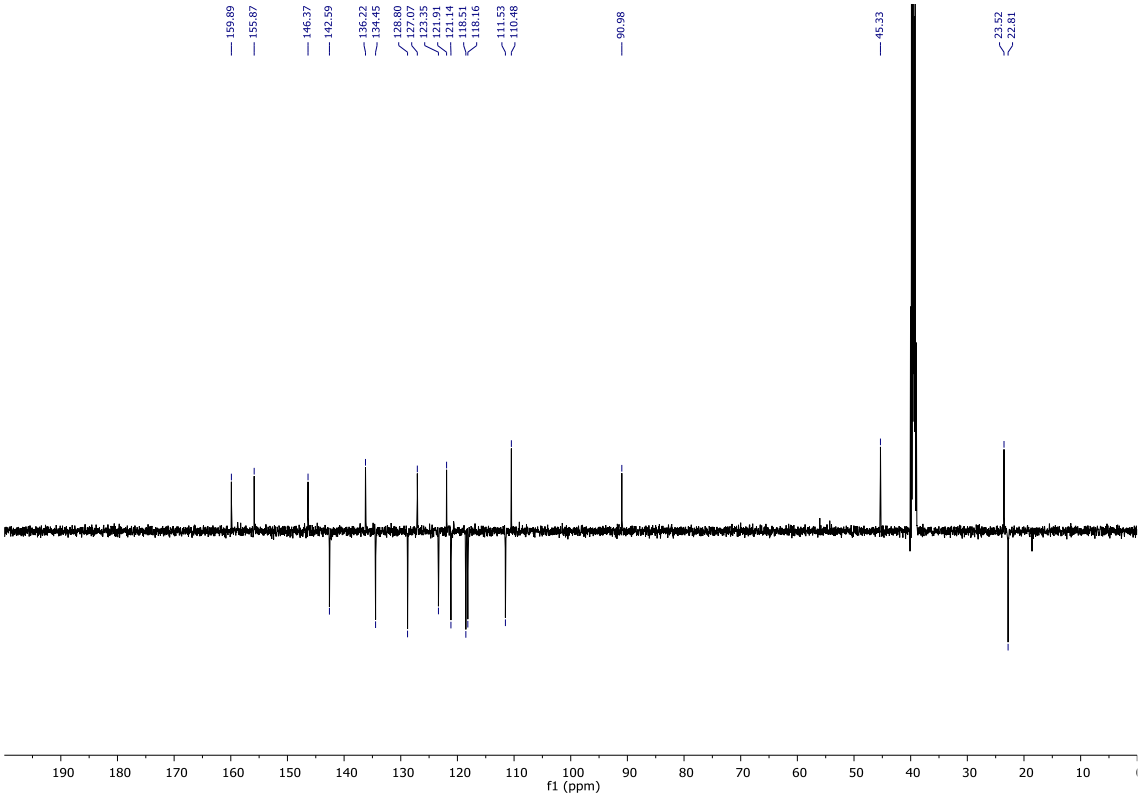




| | Formula | Calculated Mass | Error (ppm) | Fitness |
|---|---|---|---|---|
| 1 | C17 H15 N2 O I | 390.02236 | 6.26 | 1.000 |
| 2 | C16 H4 N7 O6 | 390.02176 | 7.80 | 1.000 |
| 3 | C15 H13 N5 I | 390.02101 | 9.70 | 0.999 |
| 4 | C18 H6 N4 O7 | 390.02310 | 4.35 | 0.999 |
| 5 | C17 H10 O11 | 390.02176 | 7.78 | 0.999 |
| 6 | C20 H8 N O8 | 390.02444 | 0.91 | 0.998 |
| 7 | C9 H13 N9 O I | 390.02823 | -8.79 | 0.991 |
| 8 | C9 H8 N7 O11 | 390.02763 | -7.26 | 0.990 |
| 9 | C10 H19 N2 O6 I | 390.02823 | -8.80 | 0.988 |
| 10 | C7 H6 N10 O10 | 390.02629 | -3.82 | 0.987 |
| 11 | C8 H17 N5 O5 I | 390.02689 | -5.36 | 0.984 |

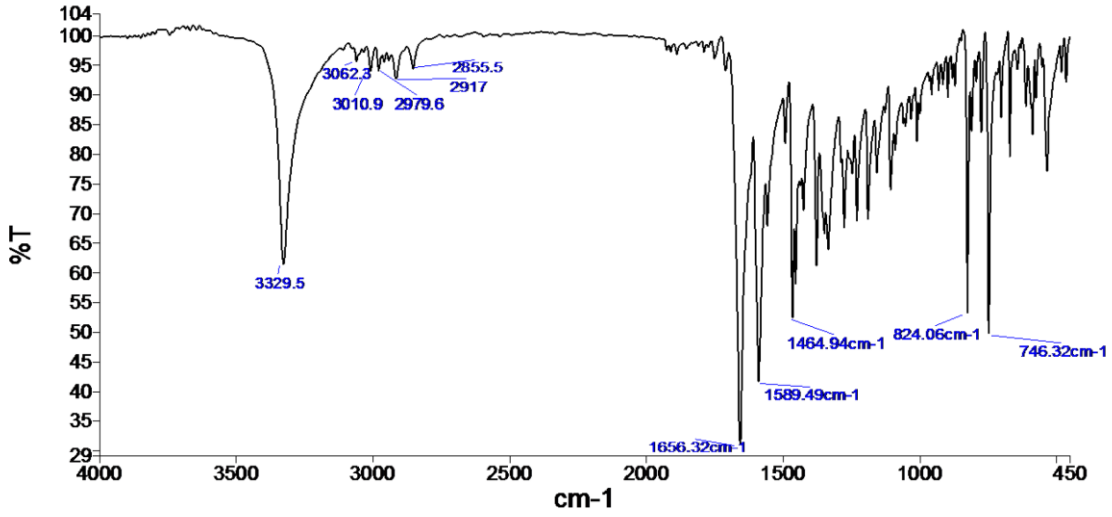

O
NH
I
N
N

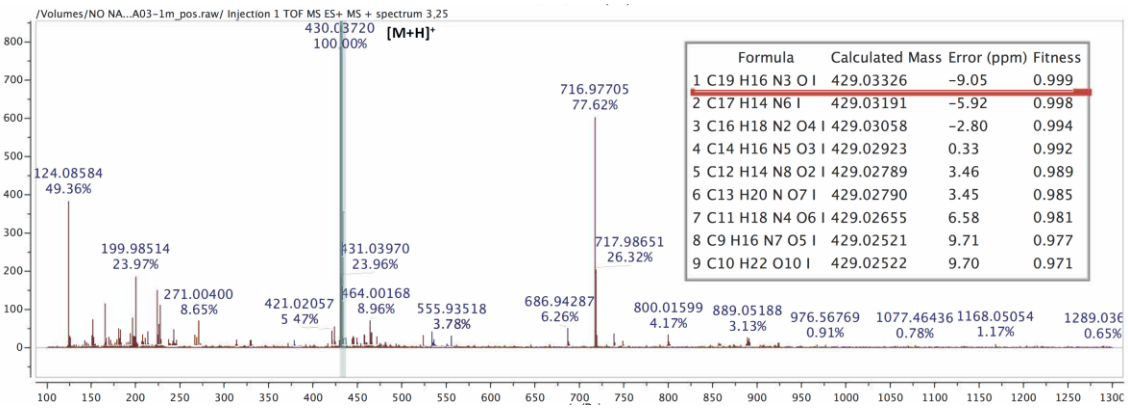
**3l**

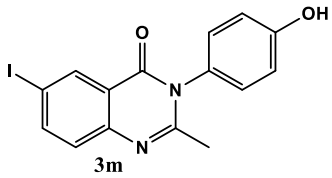

10.90
8.43
8.43
8.08
8.08
8.06
8.06
7.65
7.62
7.38
7.36
7.36
7.35
7.18
7.18
7.10
7.09
7.08
7.08
7.08
7.07
7.06
7.00
7.00
6.98
6.98
6.97
6.97
4.28
4.27
4.26
4.26
4.25
3.10
3.09
3.09
3.08
3.07
2.45
0.79
1.00
1.16
1.07
1.72
1.21
1.19
1.19
2.30
2.29
3.44
11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


159.89
155.87
146.37
142.59
136.22
134.45
128.80
127.07
123.35
121.91
121.14
119.51
118.16
111.53
110.48
90.98
45.33
23.52
22.81
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

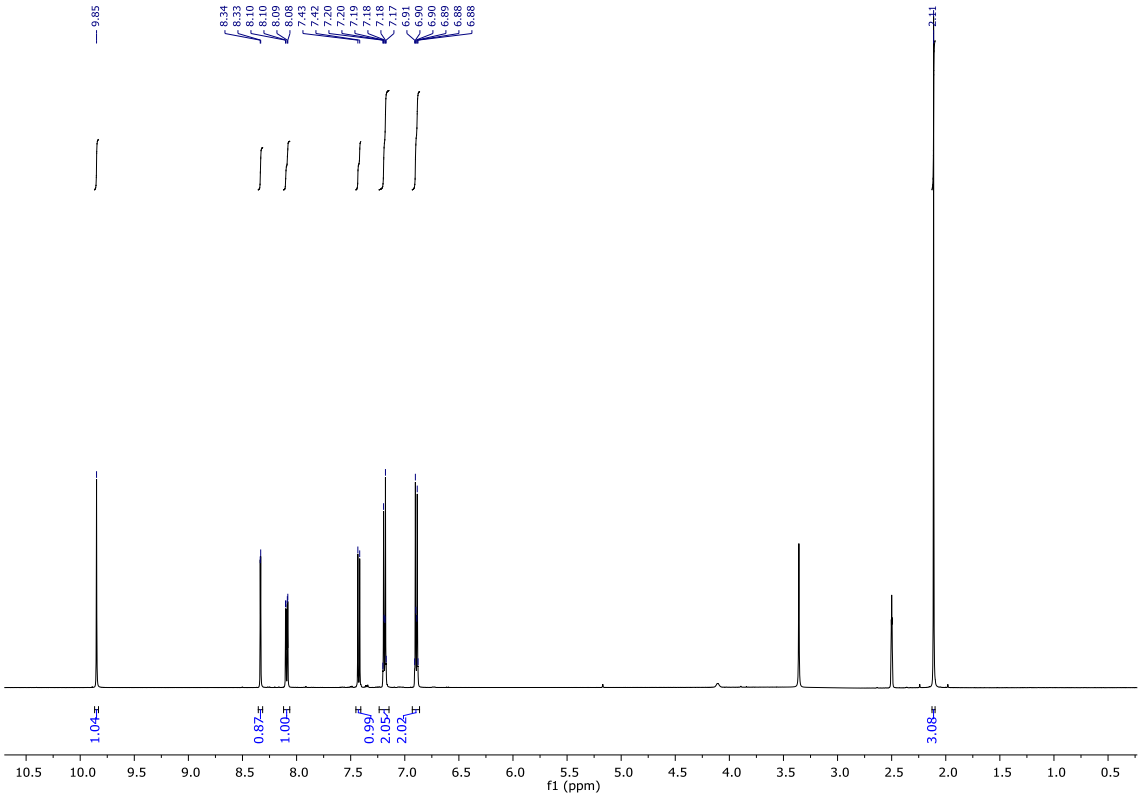
**Spectrum**

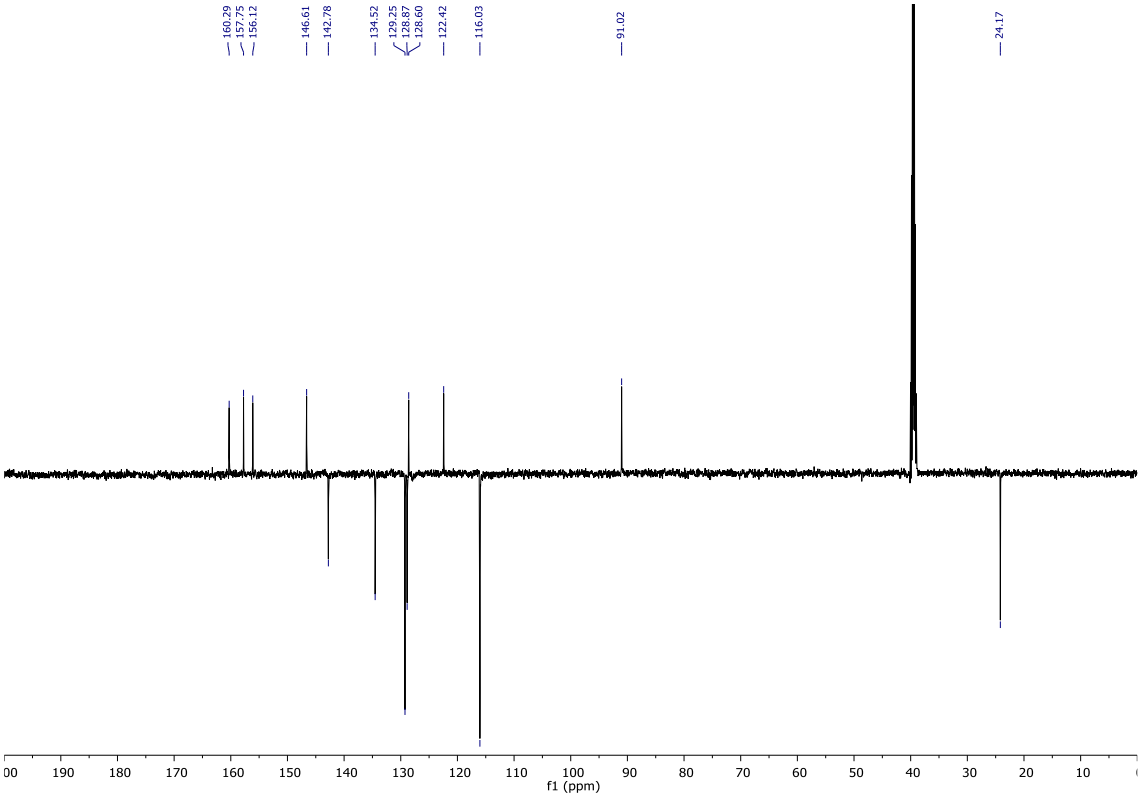

%T
cm-1
3329.5
3062.3
3010.9
2979.6
2855.5
2917
1656.32cm-1
1589.49cm-1
1464.94cm-1
824.06cm-1
746.32cm-1


/Volumes/NO NA...A03-1m_pos.raw/ Injection 1 TOF MS ES+ MS + spectrum 3,25
430.03720 100.00% [M+H]+
716.97705 77.62%
124.08584 49.36%
199.98514 23.97%
331.03970 23.96%
271.00400 8.65%
421.02057 5 47%
464.00168 8.96%
555.93518 3.78%
686.94287 6.26%
717.98651 26.32%
800.01599 4.17%
889.05188 3.13%
976.56769 0.91%
1077.46436 0.78%
1168.05054 1.17%
1289.036 0.65%
Formula Calculated Mass Error (ppm) Fitness
1 C19 H16 N3 O I 429.03326 -9.05 0.999
2 C17 H14 N6 I 429.03191 -5.92 0.998
3 C16 H18 N2 O4 I 429.03058 -2.80 0.994
4 C14 H16 N5 O3 I 429.02923 0.33 0.992
5 C12 H14 N8 O2 I 429.02789 3.46 0.989
6 C13 H20 N O7 I 429.02790 3.45 0.985
7 C11 H18 N4 O6 I 429.02655 6.58 0.981
8 C9 H16 N7 O5 I 429.02521 9.71 0.977
9 C10 H22 O10 I 429.02522 9.70 0.971

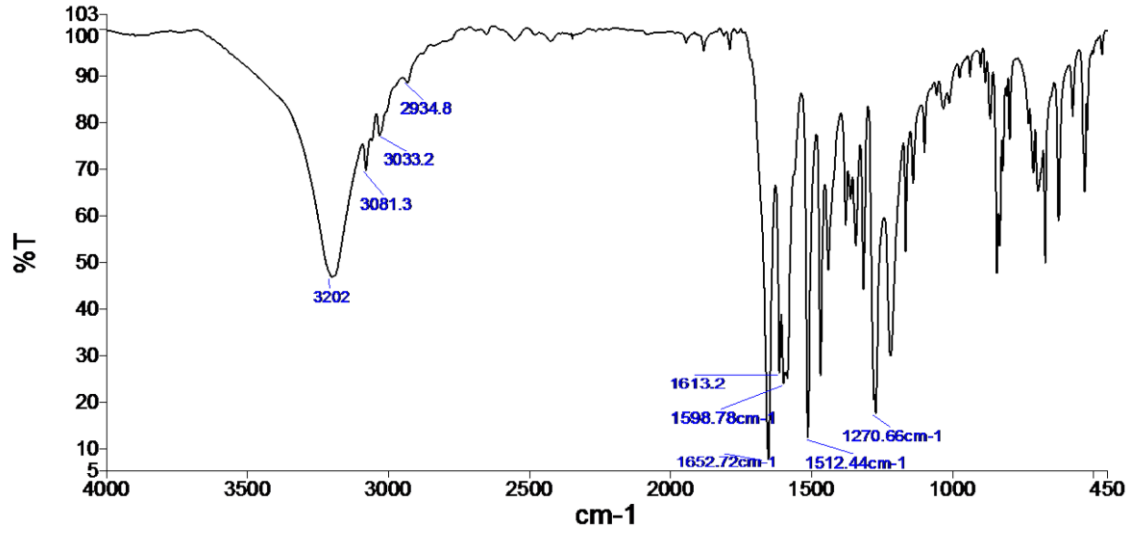

O
OH
I
N
N

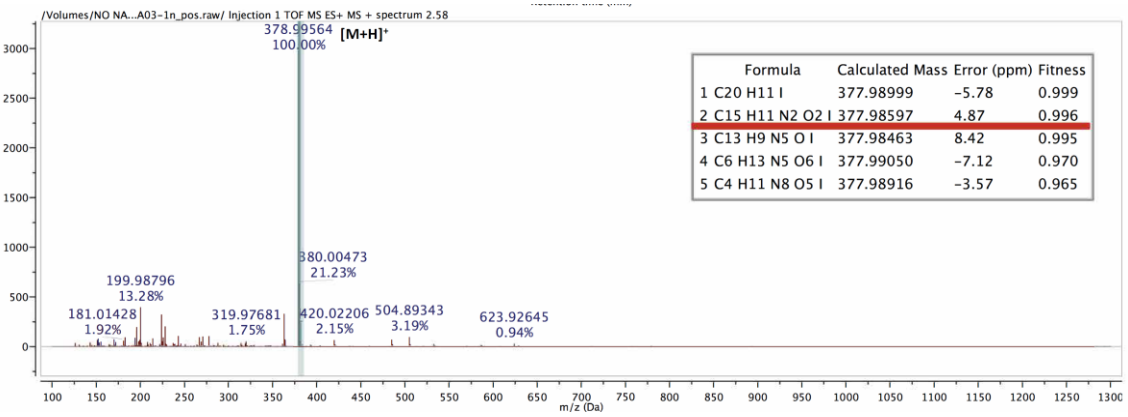
3m

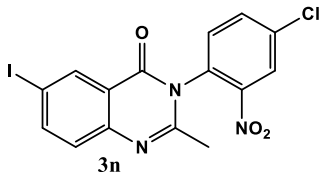

9.85
8.34
8.33
8.10
8.10
8.09
8.08
7.43
7.42
7.20
7.20
7.19
7.18
7.18
7.17
6.91
6.90
6.90
6.89
6.88
6.88
2.11
1.04
0.87
1.00
0.99
2.05
2.02
3.08
f1 (ppm)


160.29
157.75
156.12
146.61
142.78
134.52
129.35
128.87
128.60
122.42
116.03
91.02
24.17
f1 (ppm)

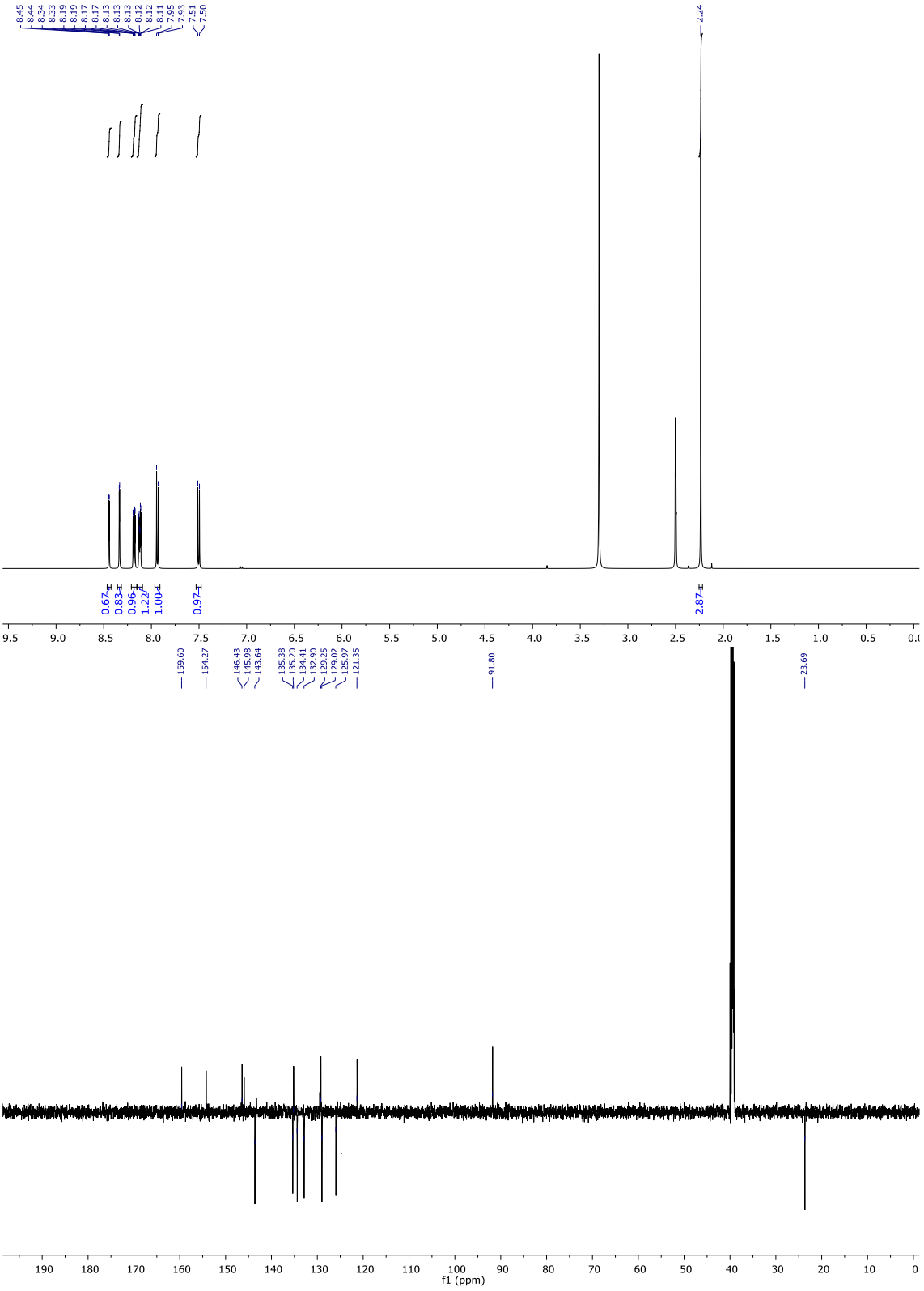
## Spectrum


%T
cm-1
2934.8
3033.2
3081.3
3202
1613.2
1598.78cm-1
1652.72cm-1
1512.44cm-1
1270.66cm-1

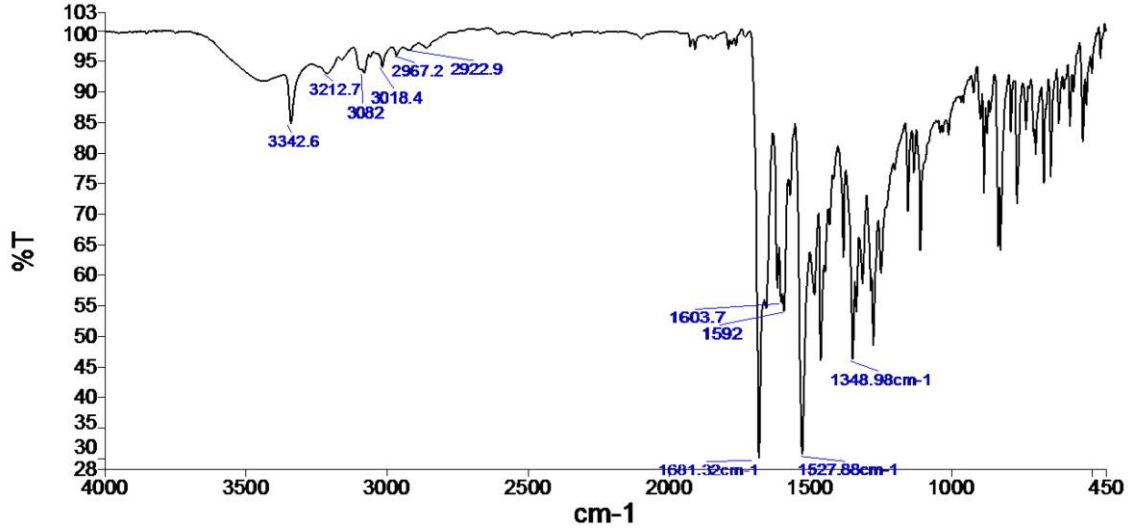

/Volumes/NO NA...A03-1n_pos.raw/ Injection 1 TOF MS ES+ MS + spectrum 2.58
378.99564
100.00%
[M+H]+
380.00473
21.23%
199.98796
13.28%
181.01428
1.92%
319.97681
1.75%
420.02206
2.15%
504.89343
3.19%
623.92645
0.94%
m/z (Da)
Formula | Calculated Mass | Error (ppm) | Fitness
1 C20 H11 I | 377.98999 | -5.78 | 0.999
2 C15 H11 N2 O2 I | 377.98597 | 4.87 | 0.996
3 C13 H9 N5 O I | 377.98463 | 8.42 | 0.995
4 C6 H13 N5 O6 I | 377.99050 | -7.12 | 0.970
5 C4 H11 N8 O5 I | 377.98916 | -3.57 | 0.965

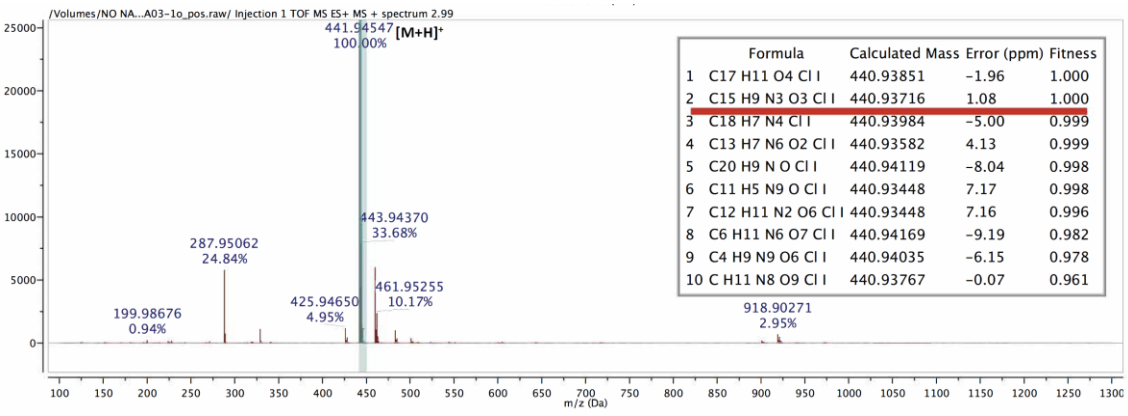

O
Cl
I
N
NO2
N

3n


8.45
8.44
8.34
8.33
8.19
8.19
8.17
8.17
8.13
8.13
8.13
8.12
8.12
8.11
7.95
7.93
7.51
7.50
2.24
0.67
0.83
0.96
1.22
1.00
0.97
2.87
159.60
154.27
146.43
145.98
143.64
135.38
135.20
134.41
132.90
129.25
129.02
125.97
121.35
91.80
23.69
f1 (ppm)

## Spectrum




| | Formula | Calculated Mass | Error (ppm) | Fitness |
|---|---|---|---|---|
| 1 | C17 H11 O4 Cl I | 440.93851 | -1.96 | 1.000 |
| 2 | C15 H9 N3 O3 Cl I | 440.93716 | 1.08 | 1.000 |
| 3 | C18 H7 N4 Cl I | 440.93984 | -5.00 | 0.999 |
| 4 | C13 H7 N6 O2 Cl I | 440.93582 | 4.13 | 0.999 |
| 5 | C20 H9 N O Cl I | 440.94119 | -8.04 | 0.998 |
| 6 | C11 H5 N9 O Cl I | 440.93448 | 7.17 | 0.998 |
| 7 | C12 H11 N2 O6 Cl I | 440.93448 | 7.16 | 0.996 |
| 8 | C6 H11 N6 O7 Cl I | 440.94169 | -9.19 | 0.982 |
| 9 | C4 H9 N9 O6 Cl I | 440.94035 | -6.15 | 0.978 |
| 10 | C H11 N8 O9 Cl I | 440.93767 | -0.07 | 0.961 |