Electronic Supplementary Material (ESI) for ChemComm.


# Very Strong $^{-}$N-X$^{+}$•••$^{-}$O-N$^{+}$ Halogen Bonds

Rakesh Puttreddy, Ondřej Jurček, Sandip Bhowmik, Toni Mäkelä and Kari Rissanen*

*University of Jyvaskyla, Department of Chemistry, P. O. Box 35, FI-40014 University of Jyvaskyla, Finland*

**Supporting Information**

**Table of Contents**

## I General Information

All the solvents used for crystal growth were reagent grade and were used as received. Pyridine *N*-oxide (**1**), 2-methylpyridine *N*-oxide (**2**), 4-phenylpyridine *N*-oxide (**3**) and *N*-iodosuccinimide (NIS) were purchased from Sigma Aldrich while saccharin (NHSac), and *N*-iodosaccharin (NISac) from TCI Europe. 2-Methyl-4-nitropyridine *N*-oxide (**4**) was synthesised as reported.[1] The solvents used for $^{1}H$ NMR and $^{15}N$ NMR analysis were purchased from Sigma Aldrich.

## II Solution Studies

All titrations were performed in either $CDCl_3$ or acetone-$d_6$. Around 10 mM sample solution (volume 600 μl) of NIS and NISac was prepared in NMR tube, and all titrations were performed with minimum 20 data points up to maximum 4.5 equivalents of the guest added, using around 0.15 M stock solutions of **1**, **2**, **3**, and **4** dissolved in $CDCl_3$ or acetone-$d_6$. All the titration experiments were carried out in $CDCl_3$ or acetone-$d_6$ at 298 K either using Bruker Avance 400 MHz spectrometer or Bruker Avance III 500 MHz spectrometer. Titration data was fitted into 1:1 binding model with HypNMR2008,[2] supported by Job plot analysis. The chemical shifts of aliphatic Ha in NIS, and aromatic Ha and Hb in NISac were used to calculate the binding constants.

All the $^{15}N$ NMR spectra were obtained by mixing 1:1 ratio of respective XB donor and acceptor molecules in $CDCl_3$. All the $^{15}N$ NMR spectra were recorded on a Bruker Avance III 500 MHz spectrometer. External $^{15}N$ reference used was 90% $^{15}N$ enriched nitromethane in a sealed tube. The $^{15}N$ spectra could be measured with one scan/increment. The signal was calibrated to 0 ppm, and the same parameters were used then to measure the samples. Only number of scans and receiver gain were changed. In some cases the sealed internal reference tube was measured inside sample, but the signal was too strong from enriched reference, and the smaller signal from sample was too weak. The measured spectral width in $^{15}N$ was 800 ppm (40542 Hz). With 256 increments it gives 316.7 Hz/pt resolution, data was zero filled to give a nominal 1.56 ppm/pt spectral resolution. Sine bell window function with zero shifts was used for apodization before Fourier transformation, and all the measurements were made with 64 or 128 scans.

## 1. $^1$H NMR titration experiments for 1•NIS in $CDCl_3$

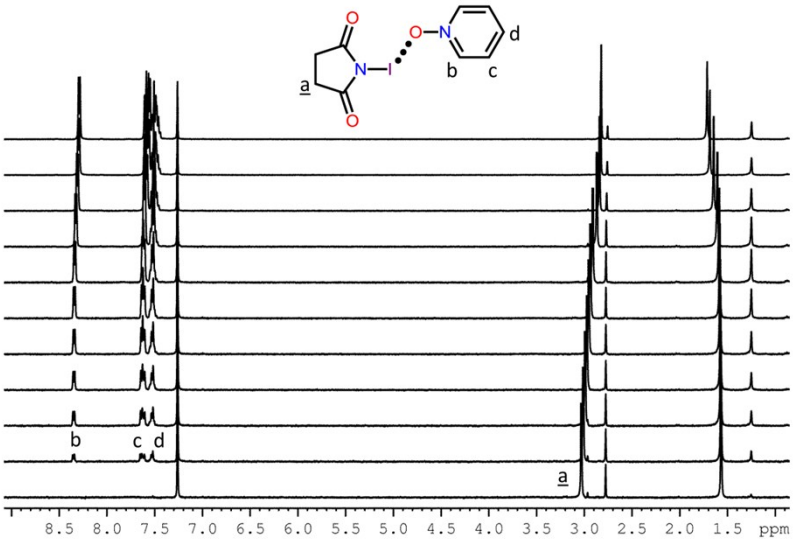


**Figure S1.** $^1$H NMR spectra for titration of NIS with **1** in $CDCl_3$ at 298 K.

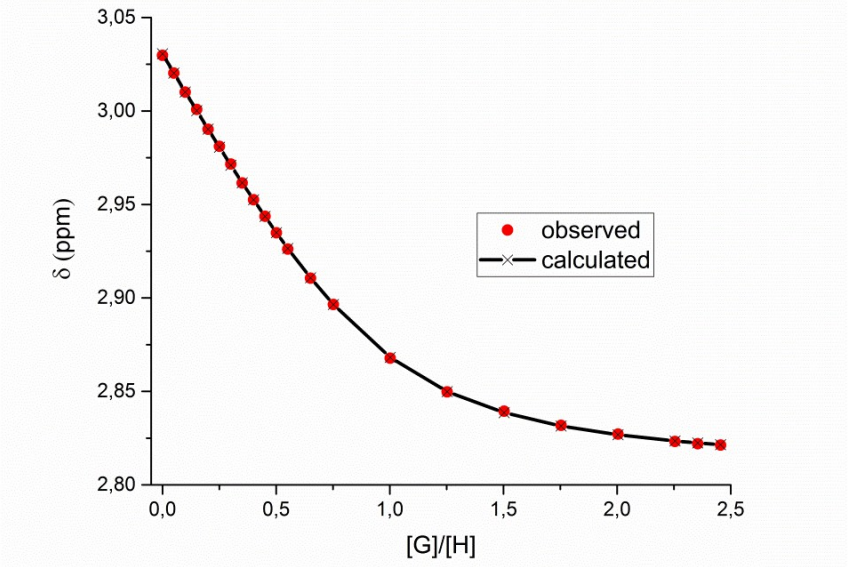


**Figure S2.** Graph showing the fitting curve between the calculated and observed chemical shifts of Ha for titration **1**•NIS (in $CDCl_3$ at 298 K, *K*a = 660 ± 14 $M^{-1}$).

| Species | Log beta | NIS | **1** | |
|---|---|---|---|---|
| 1 | 2,8194 | 1 | 1 | refine |

**Species concentrations/mol $dm^{-3}$**

| Point | T(NIS) | T(**1**) | F(NIS) | F(**1**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 1,4816e-02 | 0,0000e00 | 1,4816e-02 | 5,1912e-90 | 5,0745e-89 |
| 2 | 1,4741e-02 | 7,3856e-04 | 1,4074e-02 | 7,1803e-05 | 6,6675e-04 |
| 3 | 1,4667e-02 | 1,4697e-03 | 1,3347e-02 | 1,4988e-04 | 1,3198e-03 |
| 4 | 1,4593e-02 | 2,1935e-03 | 1,2635e-02 | 2,3495e-04 | 1,9585e-03 |
| 5 | 1,4521e-02 | 2,9101e-03 | 1,1939e-02 | 3,2783e-04 | 2,5822e-03 |

| | | | | | |
|---|---|---|---|---|---|
| 6 | 1,4449e-02 | 3,6195e-03 | 1,1259e-02 | 4,2946e-04 | 3,1901e-03 |
| 7 | 1,4377e-02 | 4,3220e-03 | 1,0596e-02 | 5,4086e-04 | 3,7812e-03 |
| 8 | 1,4307e-02 | 5,0176e-03 | 9,9524e-03 | 6,6315e-04 | 4,3545e-03 |
| 9 | 1,4237e-02 | 5,7064e-03 | 9,3282e-03 | 7,9760e-04 | 4,9088e-03 |
| 10 | 1,4168e-02 | 6,3885e-03 | 8,7249e-03 | 9,4555e-04 | 5,4430e-03 |
| 11 | 1,4099e-02 | 7,0640e-03 | 8,1437e-03 | 1,1084e-03 | 5,9556e-03 |
| 12 | 1,4031e-02 | 7,7330e-03 | 7,5862e-03 | 1,2877e-03 | 6,4453e-03 |
| 13 | 1,3898e-02 | 9,0518e-03 | 6,5473e-03 | 1,7016e-03 | 7,3503e-03 |
| 14 | 1,3766e-02 | 1,0346e-02 | 5,6185e-03 | 2,1980e-03 | 8,1478e-03 |
| 15 | 1,3449e-02 | 1,3476e-02 | 3,8088e-03 | 3,8362e-03 | 9,6399e-03 |
| 16 | 1,3145e-02 | 1,6465e-02 | 2,6586e-03 | 5,9785e-03 | 1,0487e-02 |
| 17 | 1,2856e-02 | 1,9323e-02 | 1,9598e-03 | 8,4268e-03 | 1,0896e-02 |
| 18 | 1,2578e-02 | 2,2057e-02 | 1,5231e-03 | 1,1002e-02 | 1,1055e-02 |
| 19 | 1,2312e-02 | 2,4675e-02 | 1,2348e-03 | 1,3597e-02 | 1,1078e-02 |
| 20 | 1,2058e-02 | 2,7185e-02 | 1,0339e-03 | 1,6161e-02 | 1,1024e-02 |
| 21 | 1,1959e-02 | 2,8161e-02 | 9,6995e-04 | 1,7172e-02 | 1,0989e-02 |
| 22 | 1,1862e-02 | 2,9120e-02 | 9,1319e-04 | 1,8172e-02 | 1,0948e-02 |

**Measured chemical shifts**

| Point | Ha |
|---|---|
| 1 | 3,0298e00 |
| 2 | 3,0203e00 |
| 3 | 3,0101e00 |
| 4 | 3,0008e00 |
| 5 | 2,9902e00 |
| 6 | 2,9811e00 |
| 7 | 2,9716e00 |
| 8 | 2,9615e00 |
| 9 | 2,9525e00 |
| 10 | 2,9437e00 |
| 11 | 2,9348e00 |
| 12 | 2,9261e00 |
| 13 | 2,9106e00 |
| 14 | 2,8965e00 |
| 15 | 2,8678e00 |
| 16 | 2,8497e00 |
| 17 | 2,8394e00 |
| 18 | 2,8318e00 |
| 19 | 2,8272e00 |
| 20 | 2,8232e00 |
| 21 | 2,8220e00 |
| 22 | 2,8213e00 |

**Calculated chemical shifts**

| Point | Ha |
|---|---|
| 1 | 3,0306e00 |
| 2 | 3,0203e00 |
| 3 | 3,0102e00 |
| 4 | 3,0002e00 |
| 5 | 2,9903e00 |
| 6 | 2,9806e00 |
| 7 | 2,9710e00 |
| 8 | 2,9616e00 |
| 9 | 2,9525e00 |
| 10 | 2,9436e00 |
| 11 | 2,9349e00 |
| 12 | 2,9265e00 |
| 13 | 2,9108e00 |
| 14 | 2,8965e00 |
| 15 | 2,8682e00 |
| 16 | 2,8499e00 |
| 17 | 2,8386e00 |
| 18 | 2,8315e00 |
| 19 | 2,8268e00 |
| 20 | 2,8235e00 |
| 21 | 2,8224e00 |
| 22 | 2,8215e00 |

Chemical shifts for each nucleus

| Species | Ha |
|---|---|
| NIS | 3,0306e00 |
| **1** | 0,0000e00 |
| **1**•NIS | 2,8041e00 |

Converged in 5 iterations with sigma = 0,419744

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**1**•NIS) | 2.8194 | 0.0094 | 2.819(9) |

## 2. $^1$H NMR titration experiments for 2•NIS in $CDCl_3$

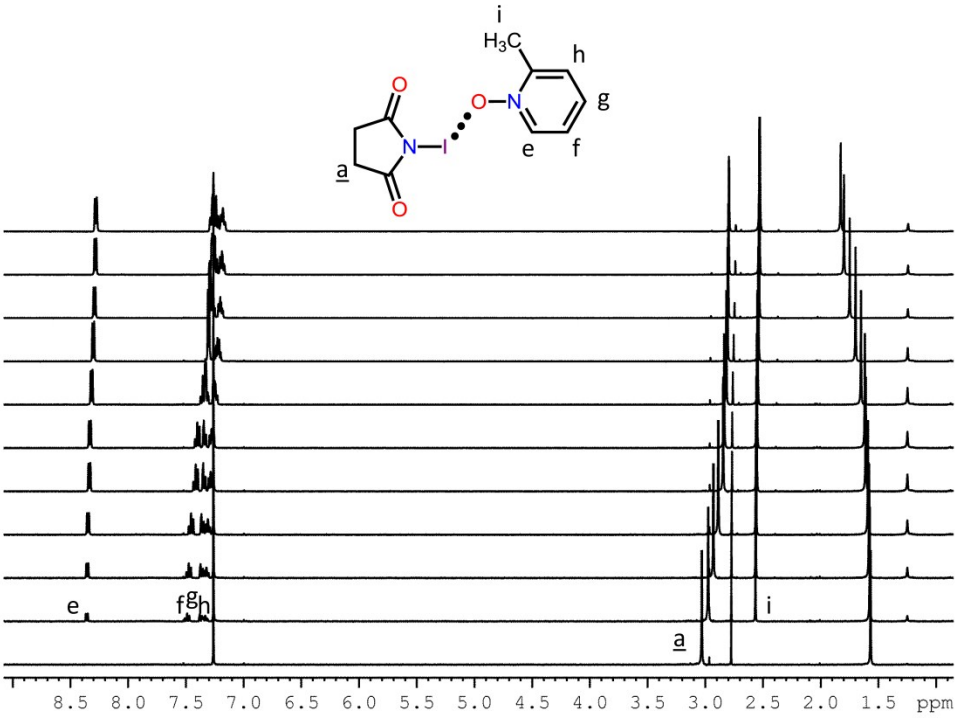


**Figure S3.** $^1$H NMR spectra for titration of NIS with **2** in $CDCl_3$ at 298 K.

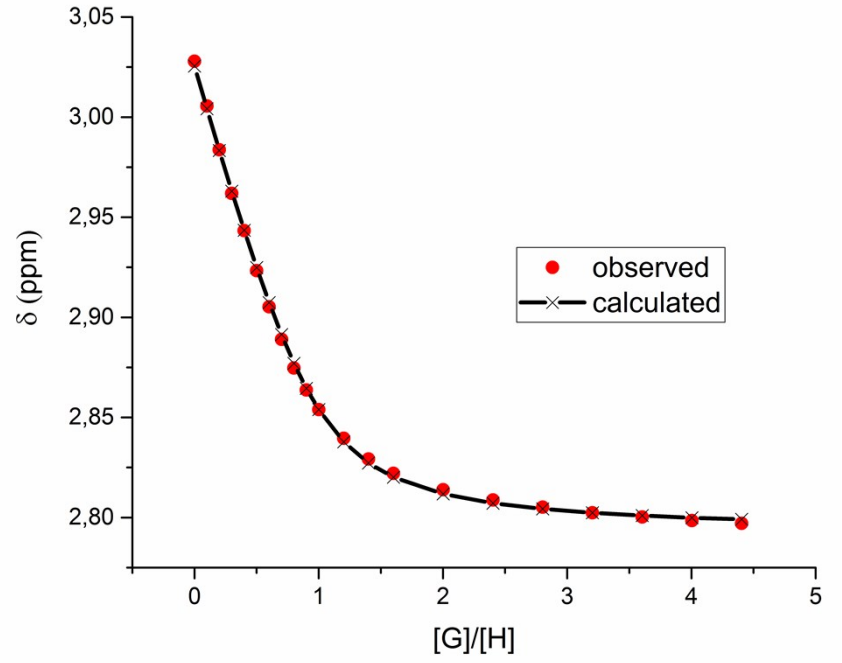


**Figure S4.** Graph showing the fitting curve between the calculated and observed chemical shifts of Ha for titration **2**•NIS (in $CDCl_3$ at 298 K, *K*a = 779 ± 43 $M^{-1}$).

| Species | Log beta | NIS | **2** | |
|---|---|---|---|---|
| 1 | 2,8915 | 1 | 1 | refine |

**Species concentrations/mol dm$^{-3}$**

| Point | T(NIS) | T(**2**) | F(NIS) | F(**2**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 1,4075e-02 | 0,0000e00 | 1,4075e-02 | 4,5130e-90 | 4,9478e-89 |
| 2 | 1,3960e-02 | 1,3974e-03 | 1,2691e-02 | 1,2838e-04 | 1,2690e-03 |
| 3 | 1,3846e-02 | 2,7721e-03 | 1,1356e-02 | 2,8157e-04 | 2,4905e-03 |
| 4 | 1,3735e-02 | 4,1246e-03 | 1,0076e-02 | 4,6613e-04 | 3,6585e-03 |
| 5 | 1,3625e-02 | 5,4555e-03 | 8,8598e-03 | 6,9047e-04 | 4,7650e-03 |
| 6 | 1,3517e-02 | 6,7652e-03 | 7,7165e-03 | 9,6501e-04 | 5,8002e-03 |
| 7 | 1,3410e-02 | 8,0543e-03 | 6,6579e-03 | 1,3020e-03 | 6,7523e-03 |
| 8 | 1,3305e-02 | 9,3232e-03 | 5,6968e-03 | 1,7147e-03 | 7,6086e-03 |
| 9 | 1,3202e-02 | 1,0573e-02 | 4,8446e-03 | 2,2148e-03 | 8,3577e-03 |
| 10 | 1,3101e-02 | 1,1803e-02 | 4,1082e-03 | 2,8102e-03 | 8,9924e-03 |
| 11 | 1,3001e-02 | 1,3014e-02 | 3,4881e-03 | 3,5013e-03 | 9,5126e-03 |
| 12 | 1,2805e-02 | 1,5382e-02 | 2,5604e-03 | 5,1370e-03 | 1,0245e-02 |
| 13 | 1,2615e-02 | 1,7679e-02 | 1,9515e-03 | 7,0155e-03 | 1,0664e-02 |
| 14 | 1,2431e-02 | 1,9910e-02 | 1,5479e-03 | 9,0267e-03 | 1,0883e-02 |
| 15 | 1,2078e-02 | 2,4181e-02 | 1,0724e-03 | 1,3175e-02 | 1,1006e-02 |
| 16 | 1,1745e-02 | 2,8217e-02 | 8,1210e-04 | 1,7284e-02 | 1,0933e-02 |
| 17 | 1,1430e-02 | 3,2036e-02 | 6,5099e-04 | 2,1257e-02 | 1,0779e-02 |
| 18 | 1,1131e-02 | 3,5655e-02 | 5,4232e-04 | 2,5066e-02 | 1,0589e-02 |
| 19 | 1,0847e-02 | 3,9090e-02 | 4,6435e-04 | 2,8707e-02 | 1,0383e-02 |
| 20 | 1,0578e-02 | 4,2354e-02 | 4,0579e-04 | 3,2182e-02 | 1,0172e-02 |
| 21 | 1,0321e-02 | 4,5459e-02 | 3,6025e-04 | 3,5498e-02 | 9,9609e-03 |

**Measured chemical shifts**

| Point | Ha |
|---|---|
| 1 | 3,0279e00 |
| 2 | 3,0056e00 |
| 3 | 2,9837e00 |
| 4 | 2,9619e00 |
| 5 | 2,9433e00 |
| 6 | 2,9233e00 |
| 7 | 2,9053e00 |
| 8 | 2,8890e00 |
| 9 | 2,8747e00 |
| 10 | 2,8637e00 |
| 11 | 2,8539e00 |
| 12 | 2,8396e00 |
| 13 | 2,8292e00 |
| 14 | 2,8221e00 |
| 15 | 2,8139e00 |
| 16 | 2,8088e00 |
| 17 | 2,8052e00 |
| 18 | 2,8024e00 |
| 19 | 2,8003e00 |
| 20 | 2,7985e00 |
| 21 | 2,7971e00 |

**Calculated chemical shifts**

| Point | Ha |
|---|---|
| 1 | 3,0255e00 |
| 2 | 3,0042e00 |
| 3 | 2,9833e00 |
| 4 | 2,9630e00 |
| 5 | 2,9435e00 |
| 6 | 2,9249e00 |
| 7 | 2,9074e00 |
| 8 | 2,8914e00 |

| | | | |
|---|---|---|---|
| 9 | 2,8770e00 | 16 | 2,8071e00 |
| 10 | 2,8645e00 | 17 | 2,8043e00 |
| 11 | 2,8539e00 | 18 | 2,8024e00 |
| 12 | 2,8378e00 | 19 | 2,8010e00 |
| 13 | 2,8272e00 | 20 | 2,7999e00 |
| 14 | 2,8201e00 | 21 | 2,7991e00 |
| 15 | 2,8118e00 | | |

Chemical shifts for each nucleus

| Species | Ha |
|---|---|
| NIS | 3,0255e00 |
| **2** | 0,0000e00 |
| **2**•NIS | 2,7909e00 |

Converged in 1 iterations with sigma = 1,717611

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**2**•NIS) | 2.8915 | 0.0231 | 2.89(2) |

## 3. $^1$H NMR titration experiments for 3•NIS in $CDCl_3$

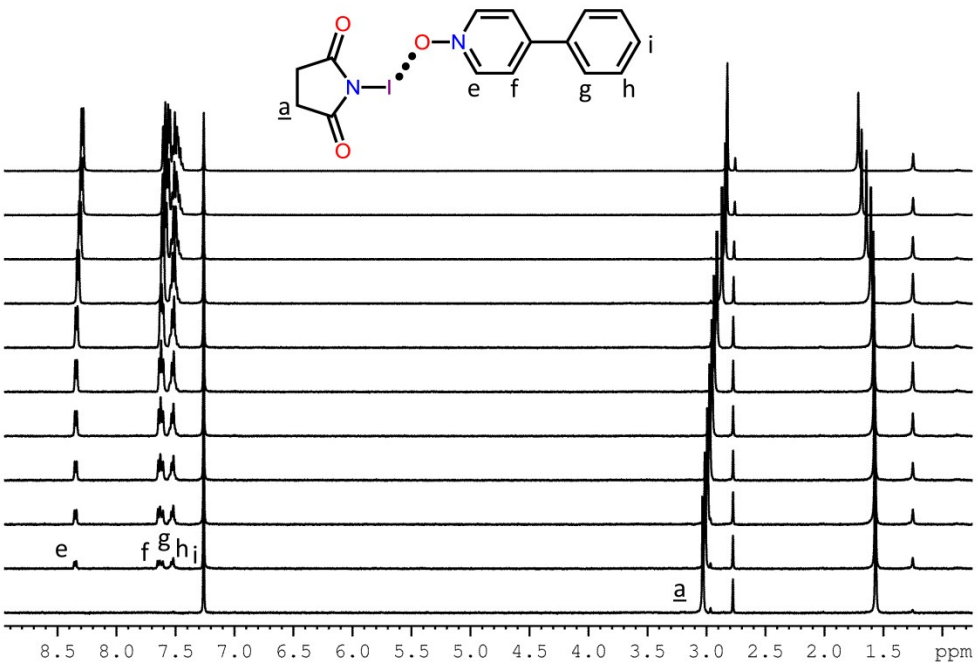


**Figure S5.** $^1$H NMR spectra for titration of NIS with **3** in $CDCl_3$ at 298 K.

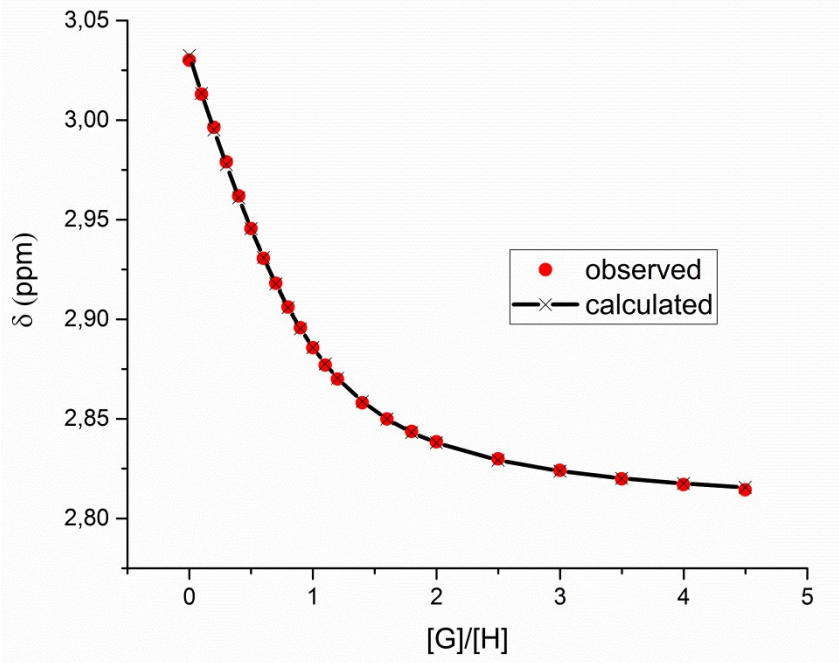


**Figure S6.** Graph showing the fitting curve between the calculated and observed chemical shifts of Ha for titration **3**•NIS (in $CDCl_3$ at 298 K, *K*a = 325 ± 7 $M^{-1}$).

| Species | Log beta | NIS | **3** | |
|---|---|---|---|---|
| 1 | 2,5114 | 1 | 1 | refine |

**Species concentrations/mol dm$^{-3}$**

| Point | T(NIS) | T(**3**) | F(NIS) | F(**3**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 1,4816e-02 | 0,0000e00 | 1,4816e-02 | 8,1976e-90 | 3,9432e-89 |
| 2 | 1,4733e-02 | 1,4726e-03 | 1,3533e-02 | 2,7302e-04 | 1,1996e-03 |
| 3 | 1,4651e-02 | 2,9288e-03 | 1,2308e-02 | 5,8622e-04 | 2,3426e-03 |
| 4 | 1,4570e-02 | 4,3689e-03 | 1,1147e-02 | 9,4586e-04 | 3,4230e-03 |
| 5 | 1,4490e-02 | 5,7931e-03 | 1,0055e-02 | 1,3585e-03 | 4,4346e-03 |
| 6 | 1,4410e-02 | 7,2016e-03 | 9,0388e-03 | 1,8304e-03 | 5,3713e-03 |
| 7 | 1,4332e-02 | 8,5949e-03 | 8,1038e-03 | 2,3671e-03 | 6,2278e-03 |
| 8 | 1,4254e-02 | 9,9730e-03 | 7,2535e-03 | 2,9726e-03 | 7,0004e-03 |
| 9 | 1,4177e-02 | 1,1336e-02 | 6,4895e-03 | 3,6487e-03 | 7,6875e-03 |
| 10 | 1,4101e-02 | 1,2685e-02 | 5,8107e-03 | 4,3946e-03 | 8,2904e-03 |
| 11 | 1,4026e-02 | 1,4019e-02 | 5,2133e-03 | 5,2067e-03 | 8,8126e-03 |
| 12 | 1,3951e-02 | 1,5339e-02 | 4,6915e-03 | 6,0794e-03 | 9,2599e-03 |
| 13 | 1,3878e-02 | 1,6646e-02 | 4,2381e-03 | 7,0058e-03 | 9,6397e-03 |
| 14 | 1,3733e-02 | 1,9217e-02 | 3,5048e-03 | 8,9888e-03 | 1,0228e-02 |
| 15 | 1,3591e-02 | 2,1735e-02 | 2,9528e-03 | 1,1097e-02 | 1,0638e-02 |
| 16 | 1,3452e-02 | 2,4202e-02 | 2,5323e-03 | 1,3282e-02 | 1,0920e-02 |
| 17 | 1,3316e-02 | 2,6619e-02 | 2,2063e-03 | 1,5509e-02 | 1,1109e-02 |
| 18 | 1,2987e-02 | 3,2452e-02 | 1,6531e-03 | 2,1118e-02 | 1,1334e-02 |
| 19 | 1,2674e-02 | 3,8004e-02 | 1,3134e-03 | 2,6643e-02 | 1,1361e-02 |
| 20 | 1,2376e-02 | 4,3295e-02 | 1,0865e-03 | 3,2006e-02 | 1,1289e-02 |
| 21 | 1,2091e-02 | 4,8343e-02 | 9,2515e-04 | 3,7176e-02 | 1,1166e-02 |
| 22 | 1,1820e-02 | 5,3163e-02 | 8,0494e-04 | 4,2149e-02 | 1,1015e-02 |

**Measured chemical shifts**

| Point | Ha |
|---|---|
| 1 | 3,0301e00 |
| 2 | 3,0130e00 |
| 3 | 2,9964e00 |
| 4 | 2,9790e00 |
| 5 | 2,9619e00 |
| 6 | 2,9456e00 |
| 7 | 2,9306e00 |
| 8 | 2,9181e00 |
| 9 | 2,9061e00 |
| 10 | 2,8958e00 |
| 11 | 2,8857e00 |
| 12 | 2,8770e00 |
| 13 | 2,8700e00 |
| 14 | 2,8581e00 |
| 15 | 2,8499e00 |
| 16 | 2,8437e00 |
| 17 | 2,8385e00 |
| 18 | 2,8299e00 |
| 19 | 2,8242e00 |
| 20 | 2,8199e00 |
| 21 | 2,8170e00 |
| 22 | 2,8144e00 |

**Calculated chemical shifts**

| Point | Ha |
|---|---|
| 1 | 3,0322e00 |
| 2 | 3,0133e00 |
| 3 | 2,9950e00 |
| 4 | 2,9776e00 |
| 5 | 2,9610e00 |

| | | | |
|---|---|---|---|
| 6 | 2,9455e00 | 15 | 2,8501e00 |
| 7 | 2,9311e00 | 16 | 2,8433e00 |
| 8 | 2,9179e00 | 17 | 2,8380e00 |
| 9 | 2,9060e00 | 18 | 2,8291e00 |
| 10 | 2,8954e00 | 19 | 2,8236e00 |
| 11 | 2,8860e00 | 20 | 2,8199e00 |
| 12 | 2,8778e00 | 21 | 2,8173e00 |
| 13 | 2,8706e00 | 22 | 2,8153e00 |
| 14 | 2,8589e00 | | |

Chemical shifts for each nucleus

| Species | Ha |
|---|---|
| NIS | 3,0322e00 |
| **3** | 0,0000e00 |
| **3**•NIS | 2,7995e00 |

Converged in 2 iterations with sigma = 0,852856

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**3**•NIS) | 2.5114 | 0.0096 | 2.51(1) |

## 4. $^1$H NMR titration experiments for 4•NIS in $CDCl_3$

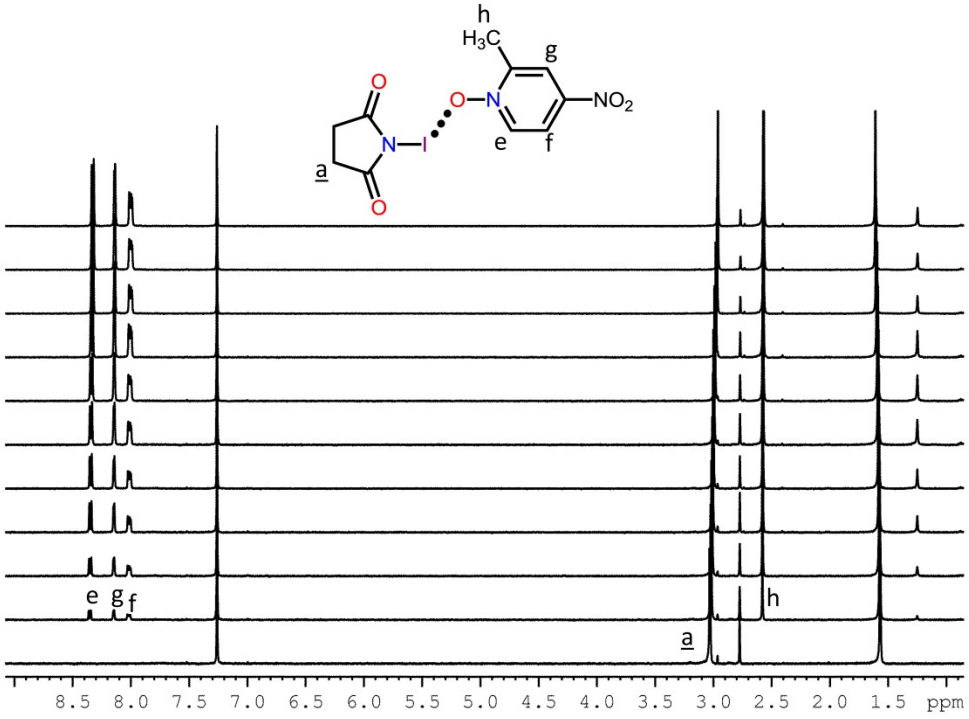


**Figure S7.** $^1$H NMR spectra for titration of NIS with **4** in $CDCl_3$ at 298 K.

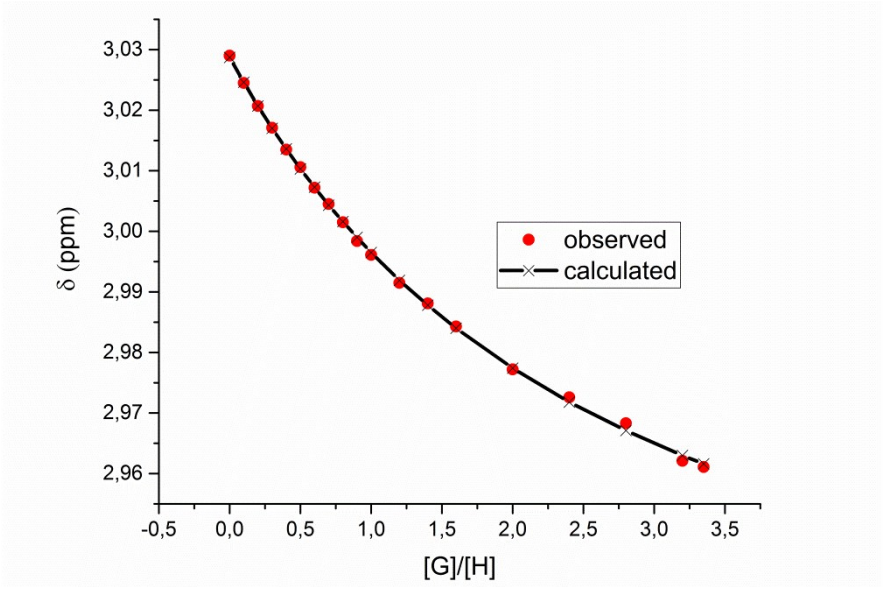


**Figure S8.** Graph showing the fitting curve between the calculated and observed chemical shifts of Ha for titration **4**•NIS (in $CDCl_3$ at 298 K, *K*a = 17 ± 2 $M^{-1}$).

| Species | Log beta | NIS | **4** | |
|---|---|---|---|---|
| 1 | 1,2381 | 1 | 1 | refine |

**Species concentrations/mol dm$^{-3}$**

| Point | T(NIS) | T(**4**) | F(NIS) | F(**4**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 1,6001e-02 | 0,0000e00 | 1,6001e-02 | 2,2011e-89 | 6,0940e-90 |
| 2 | 1,5716e-02 | 1,5716e-03 | 1,5386e-02 | 1,2412e-03 | 3,3041e-04 |
| 3 | 1,5440e-02 | 3,0881e-03 | 1,4810e-02 | 2,4581e-03 | 6,2993e-04 |
| 4 | 1,5174e-02 | 4,5523e-03 | 1,4273e-02 | 3,6507e-03 | 9,0158e-04 |
| 5 | 1,4917e-02 | 5,9669e-03 | 1,3769e-02 | 4,8189e-03 | 1,1481e-03 |
| 6 | 1,4669e-02 | 7,3345e-03 | 1,3297e-02 | 5,9626e-03 | 1,3719e-03 |
| 7 | 1,4429e-02 | 8,6572e-03 | 1,2854e-02 | 7,0821e-03 | 1,5751e-03 |
| 8 | 1,4196e-02 | 9,9372e-03 | 1,2436e-02 | 8,1776e-03 | 1,7597e-03 |
| 9 | 1,3971e-02 | 1,1177e-02 | 1,2044e-02 | 9,2493e-03 | 1,9274e-03 |
| 10 | 1,3753e-02 | 1,2377e-02 | 1,1673e-02 | 1,0298e-02 | 2,0799e-03 |
| 11 | 1,3541e-02 | 1,3541e-02 | 1,1323e-02 | 1,1323e-02 | 2,2184e-03 |
| 12 | 1,3137e-02 | 1,5765e-02 | 1,0679e-02 | 1,3306e-02 | 2,4586e-03 |
| 13 | 1,2757e-02 | 1,7860e-02 | 1,0100e-02 | 1,5203e-02 | 2,6568e-03 |
| 14 | 1,2398e-02 | 1,9836e-02 | 9,5778e-03 | 1,7016e-02 | 2,8200e-03 |
| 15 | 1,1737e-02 | 2,3474e-02 | 8,6738e-03 | 2,0411e-02 | 3,0632e-03 |
| 16 | 1,1143e-02 | 2,6743e-02 | 7,9199e-03 | 2,3520e-02 | 3,2231e-03 |
| 17 | 1,0606e-02 | 2,9698e-02 | 7,2828e-03 | 2,6374e-02 | 3,3235e-03 |
| 18 | 1,0119e-02 | 3,2380e-02 | 6,7380e-03 | 2,8999e-02 | 3,3809e-03 |
| 19 | 9,9475e-03 | 3,3324e-02 | 6,5536e-03 | 2,9930e-02 | 3,3939e-03 |

**Measured chemical shifts**

| Point | Ha |
|---|---|
| 1 | 3,0290e00 |
| 2 | 3,0245e00 |
| 3 | 3,0207e00 |
| 4 | 3,0171e00 |
| 5 | 3,0135e00 |
| 6 | 3,0106e00 |
| 7 | 3,0072e00 |
| 8 | 3,0045e00 |
| 9 | 3,0015e00 |
| 10 | 2,9984e00 |
| 11 | 2,9961e00 |
| 12 | 2,9915e00 |
| 13 | 2,9881e00 |
| 14 | 2,9843e00 |
| 15 | 2,9772e00 |
| 16 | 2,9726e00 |
| 17 | 2,9683e00 |
| 18 | 2,9621e00 |
| 19 | 2,9611e00 |

**Calculated chemical shifts**

| Point | Ha |
|---|---|
| 1 | 3,0287e00 |
| 2 | 3,0246e00 |
| 3 | 3,0207e00 |
| 4 | 3,0170e00 |
| 5 | 3,0136e00 |
| 6 | 3,0103e00 |
| 7 | 3,0073e00 |
| 8 | 3,0043e00 |
| 9 | 3,0016e00 |
| 10 | 2,9990e00 |
| 11 | 2,9965e00 |
| 12 | 2,9919e00 |
| 13 | 2,9878e00 |
| 14 | 2,9840e00 |

| | | | |
|---|---|---|---|
| 15 | 2,9774e00 | 18 | 2,9630e00 |
| 16 | 2,9718e00 | 19 | 2,9616e00 |
| 17 | 2,9671e00 | | |

Chemical shifts for each nucleus

| Species | Ha |
|---|---|
| NIS | 3,0287e00 |
| **4** | 0,0000e00 |
| **4**•NIS | 2,8320e00 |

Converged in 1 iterations with sigma = 0,516038

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**3**•NIS) | 1.2381 | 0.0434 | 1.24(4) |

## 5. $^1$H NMR titration experiments for 1•NIS in acetone-$d_6$

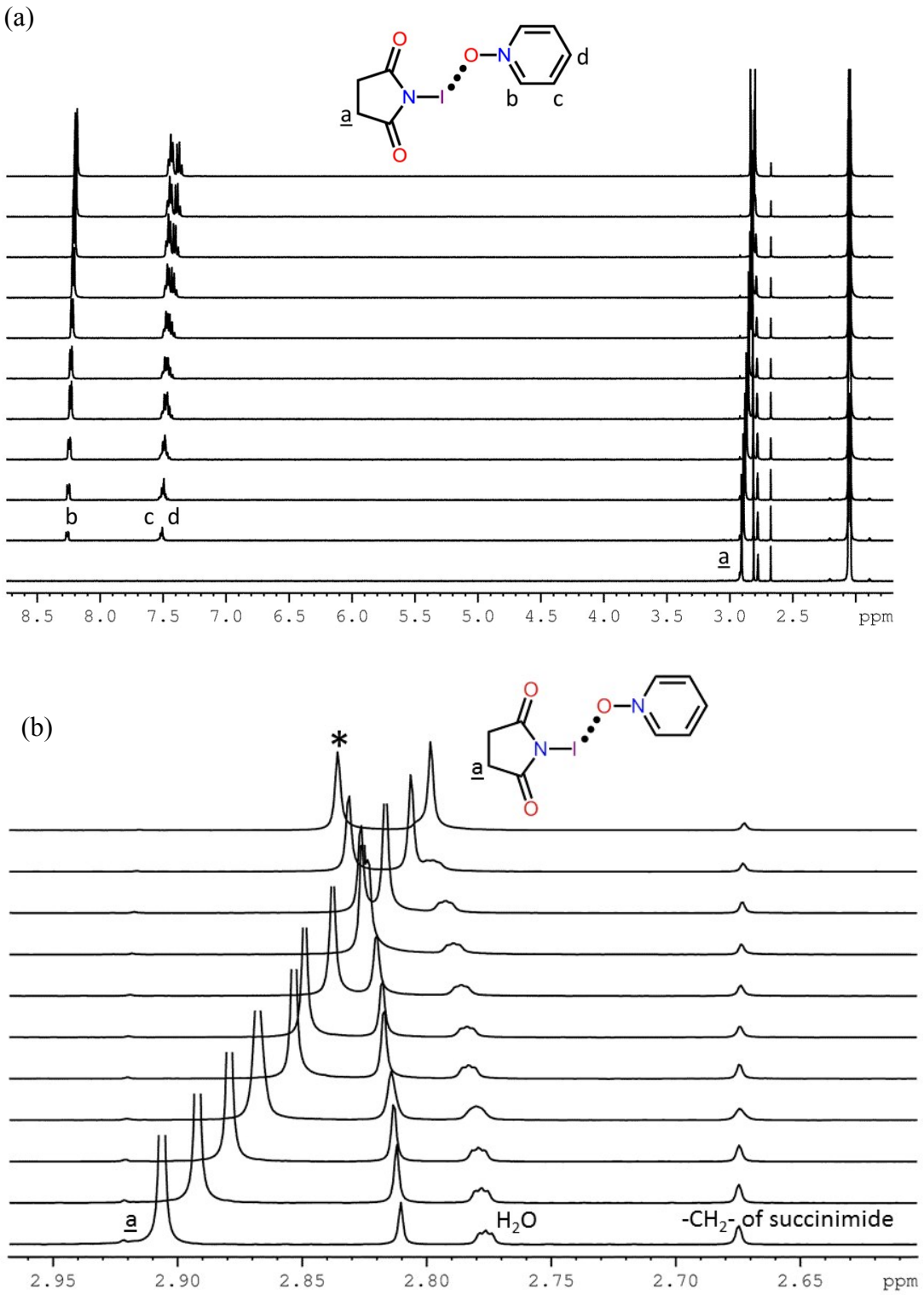


**Figure S9.** $^1$H NMR spectra for titration of NIS with **1** in acetone-$d_6$ at 298 K: a) full spectrum; b) expanded region of the spectrum depicting the shift. (* -$CH_2$- signal of *N*-hydroxysuccinimide, the hydrolysis product of NIS; concentration increases and the signal moves downfield upon additions of **1** due to the hydrogen bonding interactions)

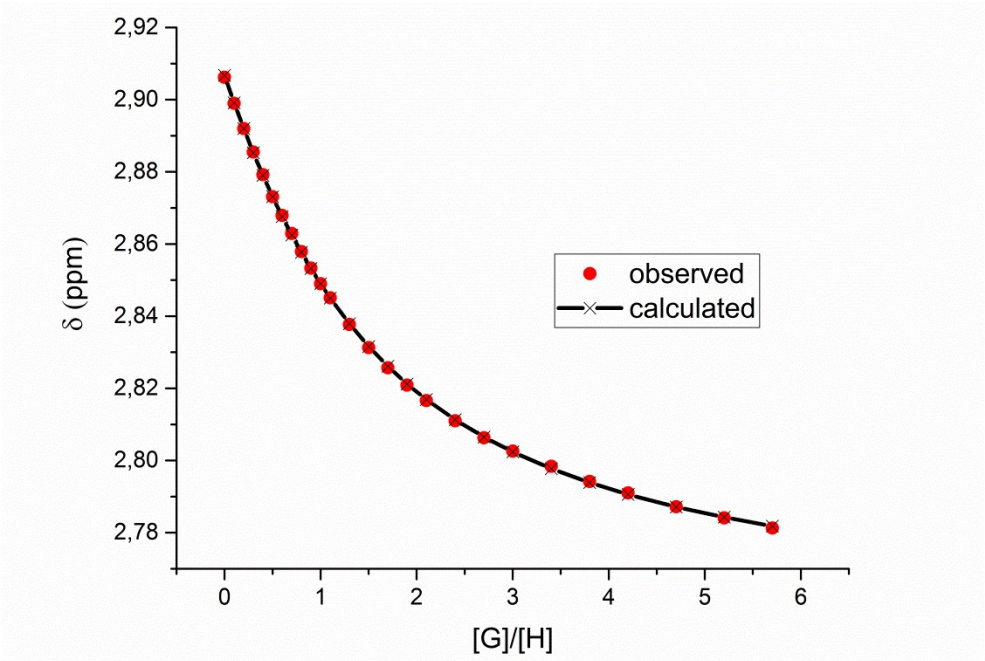


**Figure S10.** Graph showing the fitting curve between the calculated and observed chemical shifts of Ha for titration **1**•NIS (in acetone-$d_6$ at 298 K, *K*a = 54 ± 1 $M^{-1}$).

| Species | Log beta | NIS | **1** | |
|---|---|---|---|---|
| 1 | 1,7286 | 1 | 1 | refine |

**Species concentrations/mol $dm^{-3}$**

| Point | T(NIS) | T(**1**) | F(NIS) | F(**1**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 1,5779e-02 | 0,0000e00 | 1,5779e-02 | 1,6933e-89 | 1,4304e-89 |
| 2 | 1,5630e-02 | 1,5637e-03 | 1,4936e-02 | 8,6894e-04 | 6,9478e-04 |
| 3 | 1,5484e-02 | 3,0982e-03 | 1,4149e-02 | 1,7629e-03 | 1,3353e-03 |
| 4 | 1,5341e-02 | 4,6044e-03 | 1,3417e-02 | 2,6797e-03 | 1,9247e-03 |
| 5 | 1,5201e-02 | 6,0829e-03 | 1,2735e-02 | 3,6170e-03 | 2,4659e-03 |
| 6 | 1,5062e-02 | 7,5345e-03 | 1,2100e-02 | 4,5725e-03 | 2,9620e-03 |
| 7 | 1,4927e-02 | 8,9600e-03 | 1,1511e-02 | 5,5438e-03 | 3,4162e-03 |
| 8 | 1,4794e-02 | 1,0360e-02 | 1,0962e-02 | 6,5287e-03 | 3,8314e-03 |
| 9 | 1,4663e-02 | 1,1735e-02 | 1,0452e-02 | 7,5248e-03 | 4,2106e-03 |
| 10 | 1,4534e-02 | 1,3087e-02 | 9,9779e-03 | 8,5301e-03 | 4,5565e-03 |
| 11 | 1,4408e-02 | 1,4414e-02 | 9,5363e-03 | 9,5426e-03 | 4,8717e-03 |
| 12 | 1,4284e-02 | 1,5719e-02 | 9,1251e-03 | 1,0560e-02 | 5,1588e-03 |
| 13 | 1,4042e-02 | 1,8263e-02 | 8,3843e-03 | 1,2605e-02 | 5,6577e-03 |
| 14 | 1,3808e-02 | 2,0721e-02 | 7,7384e-03 | 1,4651e-02 | 6,0697e-03 |
| 15 | 1,3582e-02 | 2,3099e-02 | 7,1729e-03 | 1,6690e-02 | 6,4090e-03 |
| 16 | 1,3363e-02 | 2,5401e-02 | 6,6755e-03 | 1,8713e-02 | 6,6875e-03 |
| 17 | 1,3151e-02 | 2,7629e-02 | 6,2359e-03 | 2,0714e-02 | 6,9151e-03 |
| 18 | 1,2845e-02 | 3,0844e-02 | 5,6664e-03 | 2,3665e-02 | 7,1788e-03 |
| 19 | 1,2553e-02 | 3,3913e-02 | 5,1850e-03 | 2,6545e-02 | 7,3682e-03 |
| 20 | 1,2274e-02 | 3,6845e-02 | 4,7742e-03 | 2,9345e-02 | 7,5001e-03 |
| 21 | 1,1921e-02 | 4,0555e-02 | 4,3134e-03 | 3,2947e-02 | 7,6080e-03 |
| 22 | 1,1588e-02 | 4,4057e-02 | 3,9301e-03 | 3,6399e-02 | 7,6581e-03 |
| 23 | 1,1273e-02 | 4,7368e-02 | 3,6070e-03 | 3,9702e-02 | 7,6663e-03 |

| | | | | | |
|---|---|---|---|---|---|
| 24 | 1,0902e-02 | 5,1266e-02 | 3,2683e-03 | 4,3632e-02 | 7,6342e-03 |
| 25 | 1,0555e-02 | 5,4915e-02 | 2,9862e-03 | 4,7346e-02 | 7,5691e-03 |
| 26 | 1,0230e-02 | 5,8340e-02 | 2,7479e-03 | 5,0858e-02 | 7,4817e-03 |

**Measured chemical shifts**

| Point | Ha |
|---|---|
| 1 | 2,9062e00 |
| 2 | 2,8990e00 |
| 3 | 2,8920e00 |
| 4 | 2,8855e00 |
| 5 | 2,8792e00 |
| 6 | 2,8731e00 |
| 7 | 2,8679e00 |
| 8 | 2,8629e00 |
| 9 | 2,8579e00 |
| 10 | 2,8533e00 |
| 11 | 2,8490e00 |
| 12 | 2,8451e00 |
| 13 | 2,8377e00 |
| 14 | 2,8313e00 |
| 15 | 2,8257e00 |
| 16 | 2,8209e00 |
| 17 | 2,8166e00 |
| 18 | 2,8110e00 |
| 19 | 2,8063e00 |
| 20 | 2,8026e00 |
| 21 | 2,7984e00 |
| 22 | 2,7942e00 |
| 23 | 2,7910e00 |
| 24 | 2,7872e00 |
| 25 | 2,7841e00 |
| 26 | 2,7813e00 |

**Calculated chemical shifts**

| Point | Ha |
|---|---|
| 1 | 2,9067e00 |
| 2 | 2,8991e00 |
| 3 | 2,8920e00 |
| 4 | 2,8853e00 |
| 5 | 2,8790e00 |
| 6 | 2,8731e00 |
| 7 | 2,8676e00 |
| 8 | 2,8625e00 |
| 9 | 2,8577e00 |
| 10 | 2,8532e00 |
| 11 | 2,8490e00 |
| 12 | 2,8450e00 |
| 13 | 2,8379e00 |
| 14 | 2,8316e00 |
| 15 | 2,8261e00 |
| 16 | 2,8212e00 |
| 17 | 2,8169e00 |
| 18 | 2,8113e00 |
| 19 | 2,8065e00 |
| 20 | 2,8024e00 |
| 21 | 2,7977e00 |
| 22 | 2,7939e00 |
| 23 | 2,7906e00 |
| 24 | 2,7871e00 |
| 25 | 2,7843e00 |
| 26 | 2,7818e00 |

Chemical shifts for each nucleus

| Species | Ha |
|---|---|
| NIS | 2,9067e00 |
| **1** | 0,0000e00 |
| **1**•NIS | 2,7359e00 |

Converged in 1 iterations with sigma = 0,325835

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**1**•NIS) | 1.7286 | 0.0058 | 1.729(6) |

## 6. $^1$H NMR titration experiments for 2•NIS in acetone-$d_6$

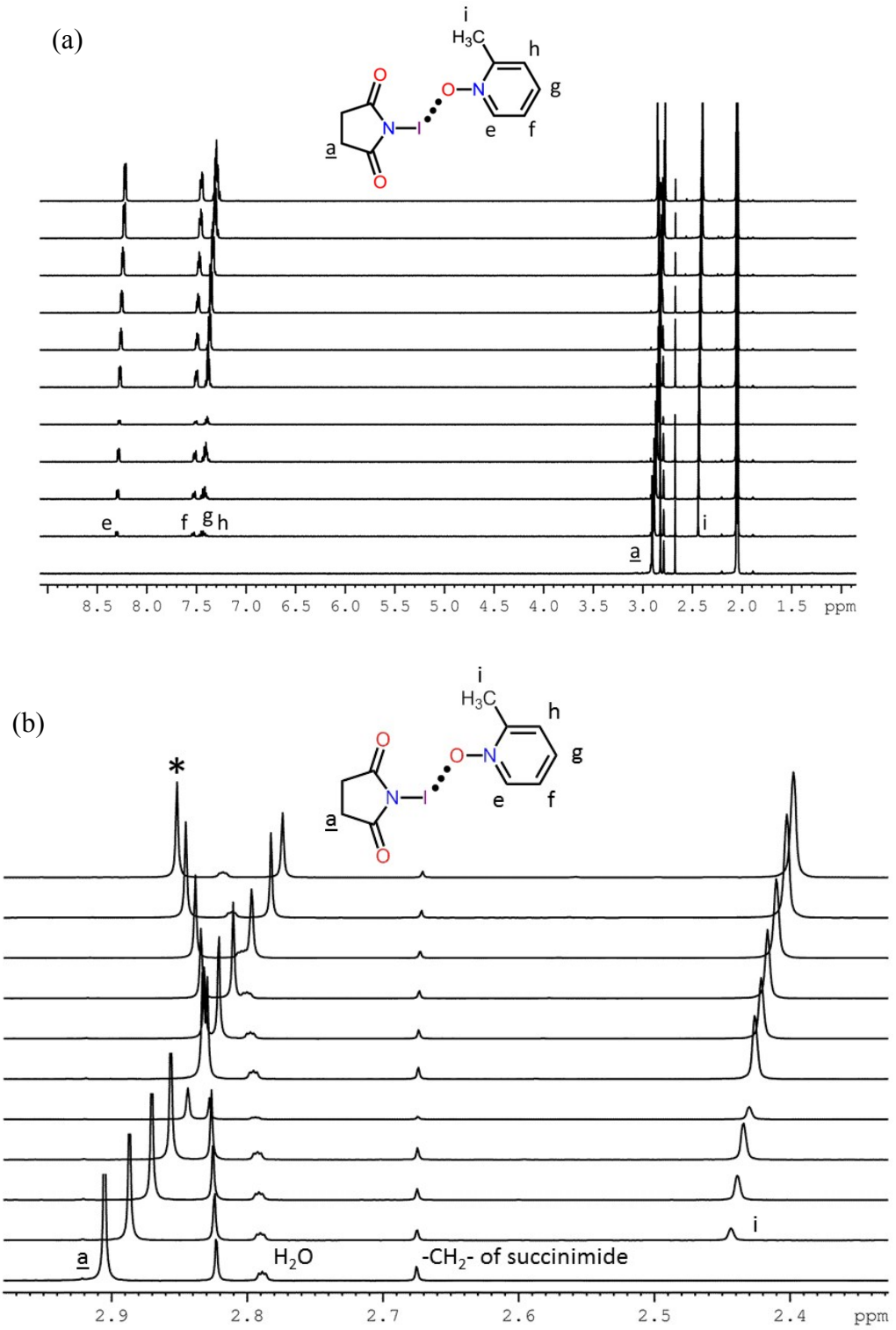


**Figure S11.** $^1$H NMR spectra for titration of NIS with **2** in acetone-$d_6$ at 298 K: a) full spectrum; b) expanded region of the spectrum depicting the shift. (* -$CH_2$- signal of *N*-hydroxysuccinimide, the hydrolysis product of NIS; concentration increases and the signal moves downfield upon additions of **2** due to the hydrogen bonding interactions)

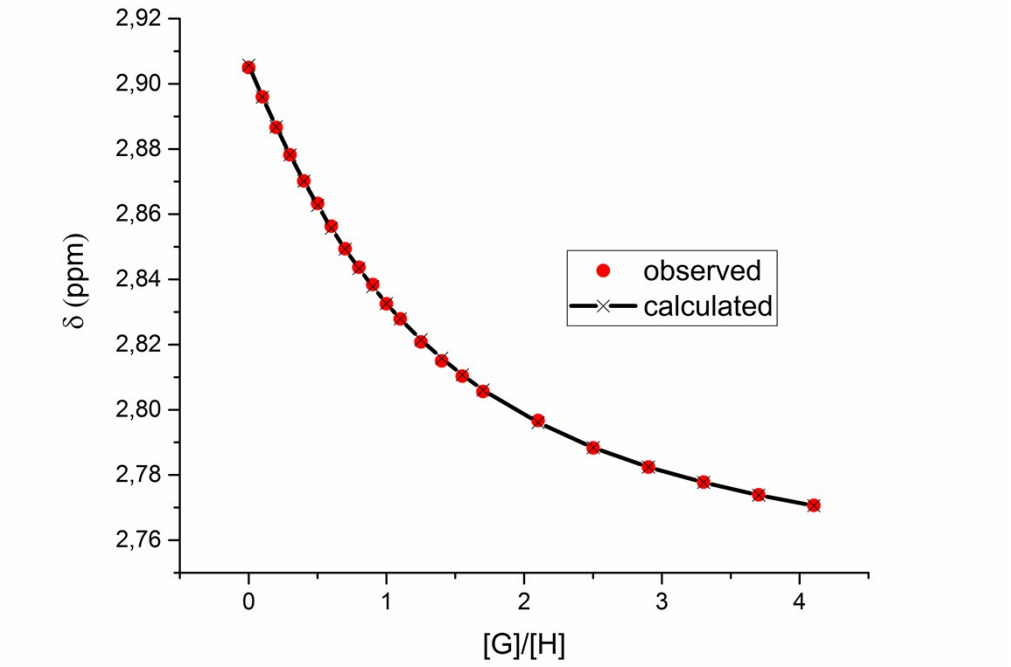


**Figure S12.** Graph showing the fitting curve between the calculated and observed chemical shifts of Ha for titration **2**•NIS (in acetone-$d_6$ at 298 K, *K*a = 65 ± 1 $M^{-1}$).

| Species | Log beta | NIS | **2** | |
|---|---|---|---|---|
| 1 | 1,8129 | 1 | 1 | refine |

**Species concentrations/mol $dm^{-3}$**

| Point | T(NIS) | T(**2**) | F(NIS) | F(**2**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 1,9335e-02 | 0,0000e00 | 1,9335e-02 | 1,8955e-89 | 2,3821e-89 |
| 2 | 1,9139e-02 | 1,9152e-03 | 1,8104e-02 | 8,7989e-04 | 1,0353e-03 |
| 3 | 1,8947e-02 | 3,7920e-03 | 1,6958e-02 | 1,8038e-03 | 1,9882e-03 |
| 4 | 1,8758e-02 | 5,6314e-03 | 1,5897e-02 | 2,7697e-03 | 2,8617e-03 |
| 5 | 1,8574e-02 | 7,4346e-03 | 1,4914e-02 | 3,7751e-03 | 3,6594e-03 |
| 6 | 1,8392e-02 | 9,2026e-03 | 1,4007e-02 | 4,8171e-03 | 4,3855e-03 |
| 7 | 1,8215e-02 | 1,0937e-02 | 1,3171e-02 | 5,8924e-03 | 5,0441e-03 |
| 8 | 1,8041e-02 | 1,2637e-02 | 1,2401e-02 | 6,9974e-03 | 5,6399e-03 |
| 9 | 1,7870e-02 | 1,4306e-02 | 1,1692e-02 | 8,1284e-03 | 6,1773e-03 |
| 10 | 1,7702e-02 | 1,5943e-02 | 1,1041e-02 | 9,2819e-03 | 6,6610e-03 |
| 11 | 1,7537e-02 | 1,7550e-02 | 1,0442e-02 | 1,0454e-02 | 7,0953e-03 |
| 12 | 1,7376e-02 | 1,9127e-02 | 9,8913e-03 | 1,1642e-02 | 7,4846e-03 |
| 13 | 1,7139e-02 | 2,1440e-02 | 9,1457e-03 | 1,3447e-02 | 7,9932e-03 |
| 14 | 1,6908e-02 | 2,3691e-02 | 8,4864e-03 | 1,5269e-02 | 8,4220e-03 |
| 15 | 1,6684e-02 | 2,5882e-02 | 7,9017e-03 | 1,7100e-02 | 8,7822e-03 |
| 16 | 1,6465e-02 | 2,8016e-02 | 7,3818e-03 | 1,8932e-02 | 9,0836e-03 |
| 17 | 1,5910e-02 | 3,3439e-02 | 6,2501e-03 | 2,3779e-02 | 9,6598e-03 |
| 18 | 1,5391e-02 | 3,8508e-02 | 5,3943e-03 | 2,8512e-02 | 9,9964e-03 |
| 19 | 1,4904e-02 | 4,3257e-02 | 4,7310e-03 | 3,3084e-02 | 1,0173e-02 |

| | | | | | |
|---|---|---|---|---|---|
| 20 | 1,4448e-02 | 4,7715e-02 | 4,2053e-03 | 3,7473e-02 | 1,0242e-02 |
| 21 | 1,4018e-02 | 5,1908e-02 | 3,7802e-03 | 4,1670e-02 | 1,0238e-02 |
| 22 | 1,3614e-02 | 5,5859e-02 | 3,4302e-03 | 4,5675e-02 | 1,0183e-02 |

**Measured chemical shifts**

| Point | Ha |
|---|---|
| 1 | 2,9050e00 |
| 2 | 2,8960e00 |
| 3 | 2,8866e00 |
| 4 | 2,8782e00 |
| 5 | 2,8702e00 |
| 6 | 2,8633e00 |
| 7 | 2,8563e00 |
| 8 | 2,8494e00 |
| 9 | 2,8437e00 |
| 10 | 2,8384e00 |
| 11 | 2,8325e00 |
| 12 | 2,8279e00 |
| 13 | 2,8208e00 |
| 14 | 2,8150e00 |
| 15 | 2,8103e00 |
| 16 | 2,8056e00 |
| 17 | 2,7967e00 |
| 18 | 2,7883e00 |
| 19 | 2,7824e00 |
| 20 | 2,7778e00 |
| 21 | 2,7739e00 |
| 22 | 2,7707e00 |

**Calculated chemical shifts**

| Point | Ha |
|---|---|
| 1 | 2,9057e00 |
| 2 | 2,8959e00 |
| 3 | 2,8868e00 |
| 4 | 2,8782e00 |
| 5 | 2,8701e00 |
| 6 | 2,8627e00 |
| 7 | 2,8557e00 |
| 8 | 2,8493e00 |
| 9 | 2,8433e00 |
| 10 | 2,8378e00 |
| 11 | 2,8326e00 |
| 12 | 2,8279e00 |
| 13 | 2,8215e00 |
| 14 | 2,8158e00 |
| 15 | 2,8107e00 |
| 16 | 2,8061e00 |
| 17 | 2,7961e00 |
| 18 | 2,7884e00 |
| 19 | 2,7824e00 |
| 20 | 2,7777e00 |
| 21 | 2,7738e00 |
| 22 | 2,7706e00 |

Chemical shifts for each nucleus

| Species | Ha |
|---|---|
| NIS | 2,9057e00 |
| **2** | 0,0000e00 |
| **2**•NIS | 2,7251e00 |

Converged in 1 iterations with sigma = 0,447277

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**2**•NIS) | 1.8129 | 0.0088 | 1.813(9) |

## 7. $^1$H NMR titration experiments for 3•NIS in acetone-$d_6$

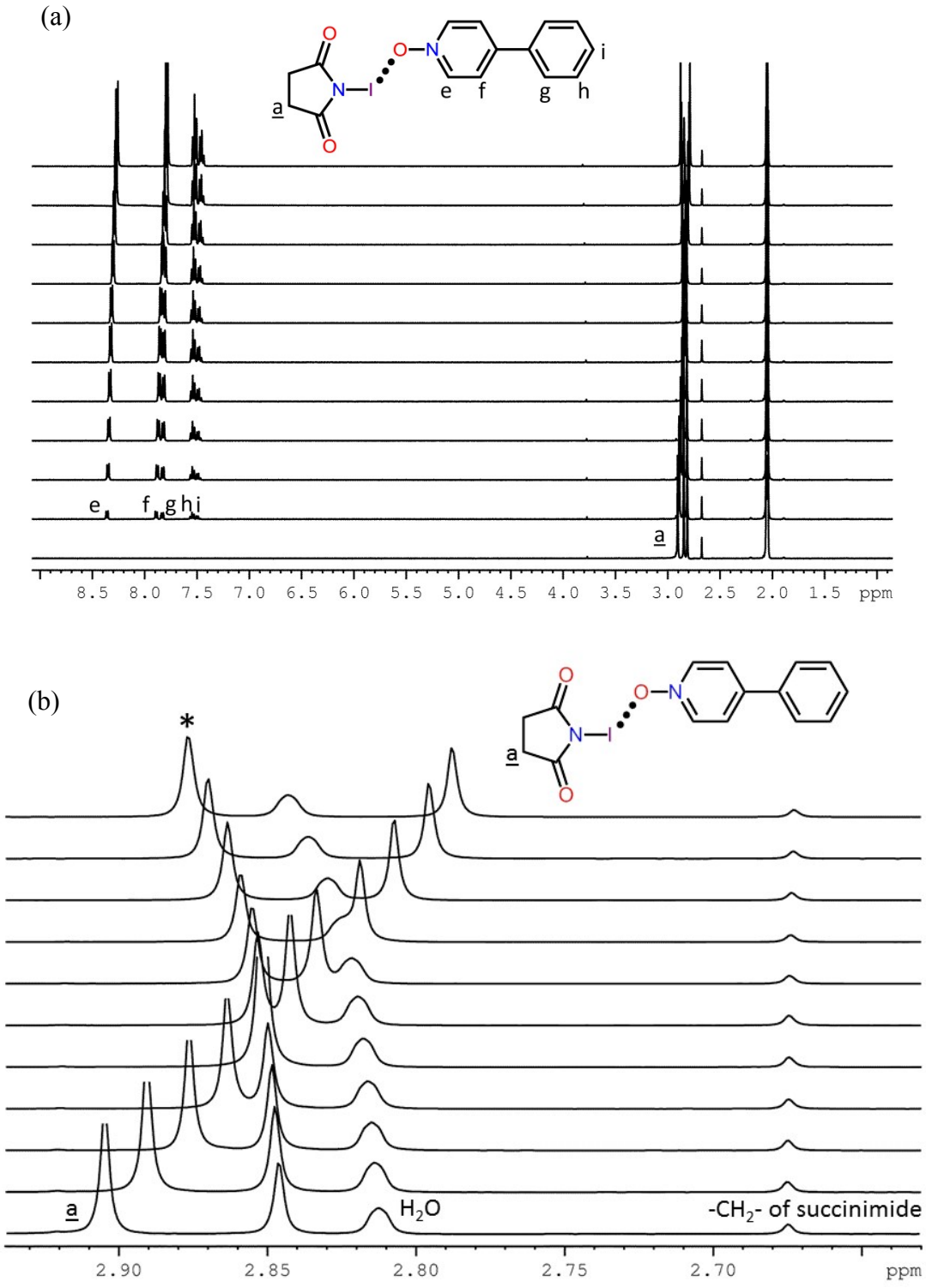


**Figure S13.** $^1$H NMR spectra for titration of NIS with **3** in acetone-$d_6$ at 298 K: a) full spectrum; b) expanded region of the spectrum depicting the shift. (* -$CH_2$- signal of *N*-hydroxysuccinimide, the hydrolysis product of NIS; concentration increases and the signal moves downfield upon additions of **3** due to the hydrogen bonding interactions)

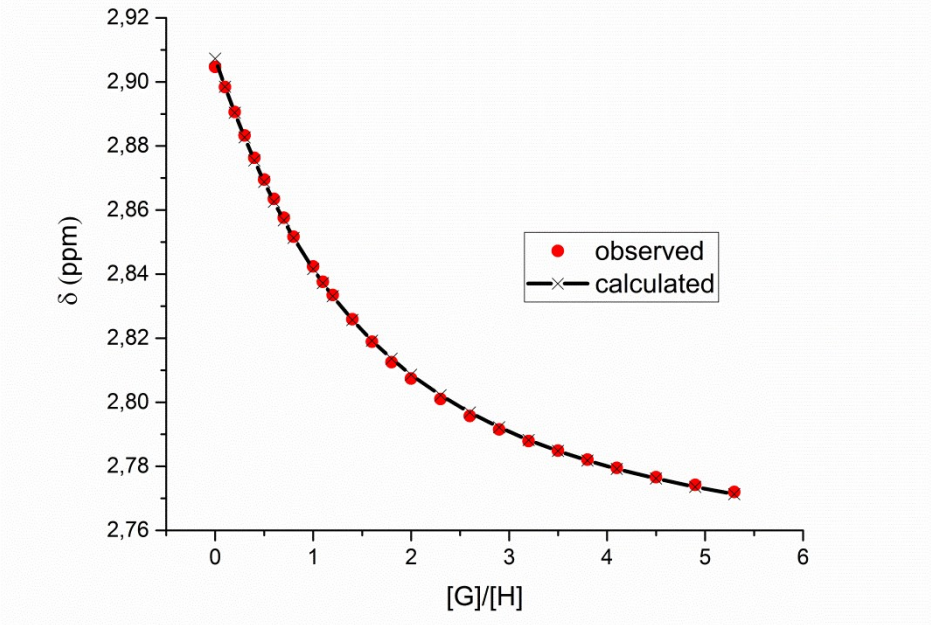


**Figure S14.** Graph showing the fitting curve between the calculated and observed chemical shifts of Ha for titration **3**•NIS (in acetone-$d_6$ at 298 K, *K*a = 42 ± 1 $M^{-1}$).

| Species | Log beta | NIS | **3** | |
|---|---|---|---|---|
| 1 | 1,6245 | 1 | 1 | refine |

**Species concentrations/mol $dm^{-3}$**

| Point | T(NIS) | T(**3**) | F(NIS) | F(**3**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 2,2224e-02 | 0,0000e00 | 2,2224e-02 | 2,5350e-89 | 2,3729e-89 |
| 2 | 2,1985e-02 | 2,1977e-03 | 2,0955e-02 | 1,1674e-03 | 1,0303e-03 |
| 3 | 2,1751e-02 | 4,3486e-03 | 1,9775e-02 | 2,3725e-03 | 1,9761e-03 |
| 4 | 2,1523e-02 | 6,4543e-03 | 1,8680e-02 | 3,6122e-03 | 2,8421e-03 |
| 5 | 2,1298e-02 | 8,5161e-03 | 1,7665e-02 | 4,8830e-03 | 3,6331e-03 |
| 6 | 2,1079e-02 | 1,0535e-02 | 1,6725e-02 | 6,1813e-03 | 4,3542e-03 |
| 7 | 2,0864e-02 | 1,2514e-02 | 1,5854e-02 | 7,5034e-03 | 5,0102e-03 |
| 8 | 2,0653e-02 | 1,4452e-02 | 1,5047e-02 | 8,8457e-03 | 5,6060e-03 |
| 9 | 2,0447e-02 | 1,6351e-02 | 1,4300e-02 | 1,0205e-02 | 6,1464e-03 |
| 10 | 2,0244e-02 | 1,8213e-02 | 1,3609e-02 | 1,1577e-02 | 6,6357e-03 |
| 11 | 2,0046e-02 | 2,0038e-02 | 1,2968e-02 | 1,2960e-02 | 7,0783e-03 |
| 12 | 1,9851e-02 | 2,1828e-02 | 1,2373e-02 | 1,4350e-02 | 7,4782e-03 |
| 13 | 1,9660e-02 | 2,3584e-02 | 1,1821e-02 | 1,5744e-02 | 7,8391e-03 |
| 14 | 1,9290e-02 | 2,6995e-02 | 1,0832e-02 | 1,8538e-02 | 8,4575e-03 |
| 15 | 1,8932e-02 | 3,0280e-02 | 9,9746e-03 | 2,1323e-02 | 8,9579e-03 |
| 16 | 1,8588e-02 | 3,3446e-02 | 9,2276e-03 | 2,4085e-02 | 9,3608e-03 |
| 17 | 1,8256e-02 | 3,6499e-02 | 8,5734e-03 | 2,6816e-02 | 9,6831e-03 |
| 18 | 1,7780e-02 | 4,0879e-02 | 7,7351e-03 | 3,0834e-02 | 1,0045e-02 |
| 19 | 1,7328e-02 | 4,5037e-02 | 7,0346e-03 | 3,4743e-02 | 1,0294e-02 |
| 20 | 1,6899e-02 | 4,8988e-02 | 6,4428e-03 | 3,8532e-02 | 1,0456e-02 |
| 21 | 1,6490e-02 | 5,2748e-02 | 5,9377e-03 | 4,2196e-02 | 1,0552e-02 |
| 22 | 1,6101e-02 | 5,6331e-02 | 5,5023e-03 | 4,5732e-02 | 1,0598e-02 |
| 23 | 1,5729e-02 | 5,9748e-02 | 5,1238e-03 | 4,9143e-02 | 1,0605e-02 |
| 24 | 1,5374e-02 | 6,3011e-02 | 4,7922e-03 | 5,2429e-02 | 1,0582e-02 |

| | | | | | |
|---|---|---|---|---|---|
| 25 | 1,4926e-02 | 6,7140e-02 | 4,4095e-03 | 5,6623e-02 | 1,0516e-02 |
| 26 | 1,4502e-02 | 7,1034e-02 | 4,0818e-03 | 6,0613e-02 | 1,0420e-02 |
| 27 | 1,4102e-02 | 7,4713e-02 | 3,7983e-03 | 6,4409e-02 | 1,0304e-02 |

**Measured chemical shifts**

| Point | Ha |
|---|---|
| 1 | 2,9047e00 |
| 2 | 2,8984e00 |
| 3 | 2,8906e00 |
| 4 | 2,8833e00 |
| 5 | 2,8763e00 |
| 6 | 2,8695e00 |
| 7 | 2,8635e00 |
| 8 | 2,8576e00 |
| 9 | 2,8517e00 |
| 10 | ignore |
| 11 | 2,8424e00 |
| 12 | 2,8376e00 |
| 13 | 2,8335e00 |
| 14 | 2,8259e00 |
| 15 | 2,8189e00 |
| 16 | 2,8125e00 |
| 17 | 2,8074e00 |
| 18 | 2,8010e00 |
| 19 | 2,7957e00 |
| 20 | 2,7915e00 |
| 21 | 2,7879e00 |
| 22 | 2,7849e00 |
| 23 | 2,7821e00 |
| 24 | 2,7795e00 |
| 25 | 2,7766e00 |
| 26 | 2,7742e00 |
| 27 | 2,7720e00 |

**Calculated chemical shifts**

| Point | Ha |
|---|---|
| 1 | 2,9073e00 |
| 2 | 2,8985e00 |
| 3 | 2,8904e00 |
| 4 | 2,8827e00 |
| 5 | 2,8755e00 |
| 6 | 2,8688e00 |
| 7 | 2,8626e00 |
| 8 | 2,8568e00 |
| 9 | 2,8513e00 |
| 10 | ignore |
| 11 | 2,8416e00 |
| 12 | 2,8372e00 |
| 13 | 2,8331e00 |
| 14 | 2,8257e00 |
| 15 | 2,8192e00 |
| 16 | 2,8136e00 |
| 17 | 2,8086e00 |
| 18 | 2,8022e00 |
| 19 | 2,7968e00 |
| 20 | 2,7922e00 |
| 21 | 2,7882e00 |
| 22 | 2,7848e00 |
| 23 | 2,7818e00 |
| 24 | 2,7792e00 |
| 25 | 2,7762e00 |
| 26 | 2,7736e00 |
| 27 | 2,7713e00 |

Chemical shifts for each nucleus

| Species | Ha |
|---|---|
| NIS | 2,9073e00 |
| **3** | 0,0000e00 |
| **3**•NIS | 2,7212e00 |

Converged in 1 iterations with sigma = 0,874726

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**3**•NIS) | 1.6245 | 0.0148 | 1.62(1) |

## 8. $^{1}$H NMR titration experiments for 4•NIS in acetone-$d_6$

No chemical shift observed upon titration.

## 9. $^1$H NMR titration experiments for 1•NISac in $CDCl_3$

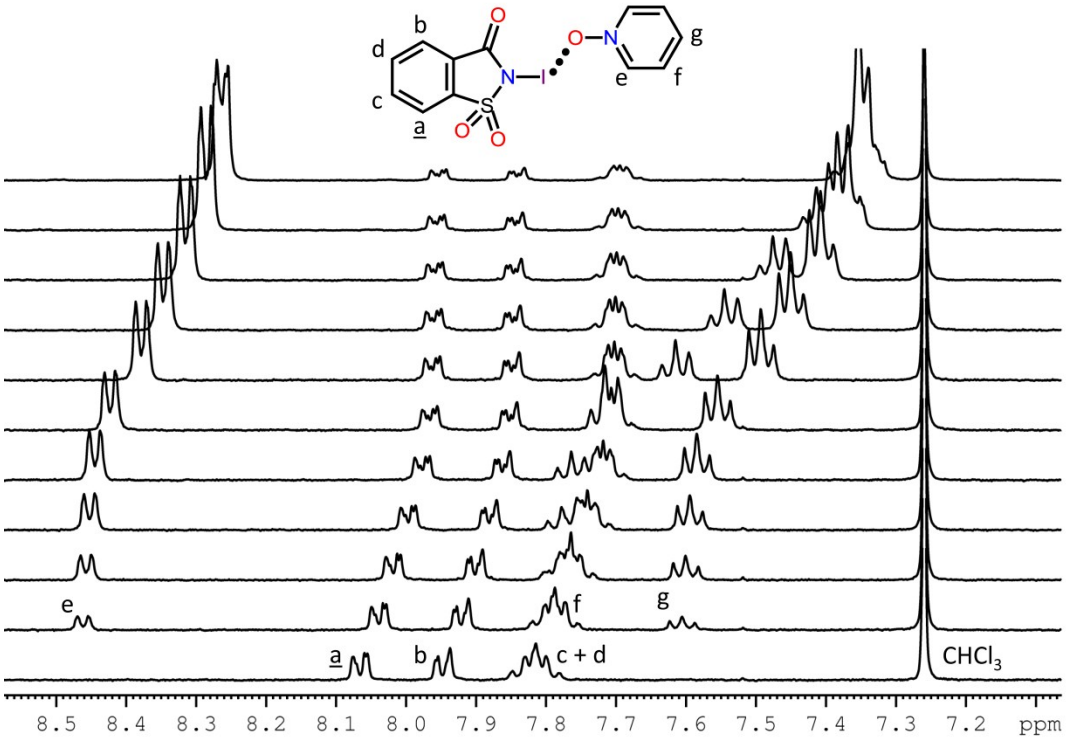


**Figure S15.** $^1$H NMR spectra for titration of NISac with **1** in $CDCl_3$ at 298 K.

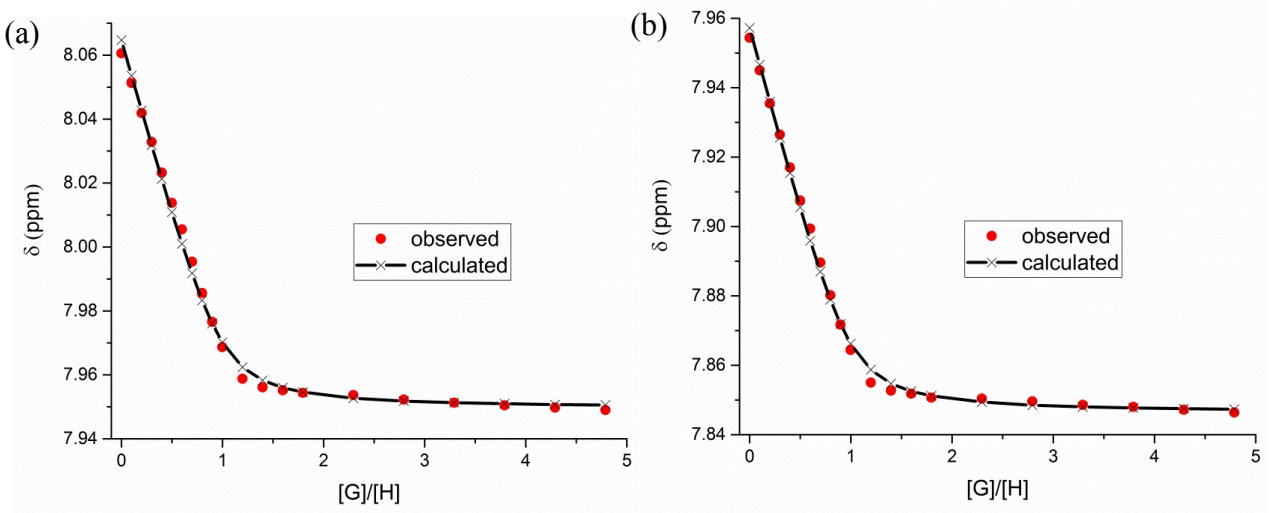


**Figure S16.** Graph showing the fitting curve between the calculated and observed chemical shifts for titration **1**•NISac (in $CDCl_3$ at 298 K, *K*a = 3121 ± 417 $M^{-1}$) following a) Ha and b) Hb signal.

| Species | Log beta | NISac | **1** | |
|---|---|---|---|---|
| 1 | 3,4943 | 1 | 1 | refine |

**Species concentrations/mol dm$^{-3}$**

| Point | T(NISac) | T(**1**) | F(NISac) | F(**1**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 8,4660e-03 | 0,0000e00 | 8,4660e-03 | 1,4788e-90 | 3,9078e-89 |
| 2 | 8,4141e-03 | 8,3942e-04 | 7,6086e-03 | 3,3917e-05 | 8,0550e-04 |
| 3 | 8,3628e-03 | 1,6686e-03 | 6,7696e-03 | 7,5398e-05 | 1,5932e-03 |
| 4 | 8,3122e-03 | 2,4878e-03 | 5,9515e-03 | 1,2708e-04 | 2,3607e-03 |
| 5 | 8,2622e-03 | 3,2970e-03 | 5,1579e-03 | 1,9281e-04 | 3,1042e-03 |
| 6 | 8,2128e-03 | 4,0967e-03 | 4,3945e-03 | 2,7836e-04 | 3,8183e-03 |
| 7 | 8,1639e-03 | 4,8868e-03 | 3,6695e-03 | 3,9238e-04 | 4,4944e-03 |
| 8 | 8,1157e-03 | 5,6675e-03 | 2,9957e-03 | 5,4755e-04 | 5,1200e-03 |
| 9 | 8,0680e-03 | 6,4391e-03 | 2,3900e-03 | 7,6111e-04 | 5,6780e-03 |
| 10 | 8,0208e-03 | 7,2016e-03 | 1,8717e-03 | 1,0525e-03 | 6,1491e-03 |
| 11 | 7,9742e-03 | 7,9554e-03 | 1,4547e-03 | 1,4358e-03 | 6,5195e-03 |
| 12 | 7,8827e-03 | 9,4368e-03 | 9,0769e-04 | 2,4618e-03 | 6,9750e-03 |
| 13 | 7,7932e-03 | 1,0885e-02 | 6,1935e-04 | 3,7108e-03 | 7,1738e-03 |
| 14 | 7,7057e-03 | 1,2300e-02 | 4,5938e-04 | 5,0536e-03 | 7,2463e-03 |
| 15 | 7,6201e-03 | 1,3684e-02 | 3,6189e-04 | 6,4255e-03 | 7,2583e-03 |
| 16 | 7,4144e-03 | 1,7013e-02 | 2,3396e-04 | 9,8323e-03 | 7,1804e-03 |
| 17 | 7,2194e-03 | 2,0167e-02 | 1,7210e-04 | 1,3119e-02 | 7,0473e-03 |
| 18 | 7,0345e-03 | 2,3159e-02 | 1,3592e-04 | 1,6260e-02 | 6,8985e-03 |
| 19 | 6,8588e-03 | 2,6002e-02 | 1,1225e-04 | 1,9255e-02 | 6,7465e-03 |
| 20 | 6,6916e-03 | 2,8706e-02 | 9,5577e-05 | 2,2110e-02 | 6,5960e-03 |
| 21 | 6,5324e-03 | 3,1281e-02 | 8,3204e-05 | 2,4832e-02 | 6,4492e-03 |
| 22 | 6,3806e-03 | 3,3737e-02 | 7,3662e-05 | 2,7430e-02 | 6,3069e-03 |

**Measured chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,0606e00 | 7,9544e00 |
| 2 | 8,0513e00 | 7,9450e00 |
| 3 | 8,0419e00 | 7,9355e00 |
| 4 | 8,0329e00 | 7,9265e00 |
| 5 | 8,0233e00 | 7,9170e00 |
| 6 | 8,0138e00 | 7,9075e00 |
| 7 | 8,0055e00 | 7,8994e00 |
| 8 | 7,9954e00 | 7,8896e00 |
| 9 | 7,9856e00 | 7,8802e00 |
| 10 | 7,9766e00 | 7,8717e00 |
| 11 | 7,9687e00 | 7,8644e00 |
| 12 | 7,9588e00 | 7,8550e00 |
| 13 | 7,9561e00 | 7,8527e00 |
| 14 | 7,9552e00 | 7,8518e00 |
| 15 | 7,9544e00 | 7,8507e00 |
| 16 | 7,9537e00 | 7,8504e00 |
| 17 | 7,9523e00 | 7,8496e00 |
| 18 | 7,9513e00 | 7,8486e00 |
| 19 | 7,9505e00 | 7,8480e00 |
| 20 | 7,9498e00 | 7,8472e00 |
| 21 | 7,9490e00 | 7,8464e00 |

**Calculated chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,0647e00 | 7,9572e00 |
| 2 | 8,0536e00 | 7,9466e00 |
| 3 | 8,0427e00 | 7,9360e00 |
| 4 | 8,0319e00 | 7,9256e00 |
| 5 | 8,0213e00 | 7,9154e00 |
| 6 | 8,0109e00 | 7,9055e00 |
| 7 | 8,0010e00 | 7,8959e00 |

| | | | | | |
|---|---|---|---|---|---|
| 8 | 7,9918e00 | 7,8870e00 | 15 | 7,9546e00 | 7,8512e00 |
| 9 | 7,9833e00 | 7,8789e00 | 16 | 7,9527e00 | 7,8494e00 |
| 10 | 7,9761e00 | 7,8719e00 | 17 | 7,9518e00 | 7,8485e00 |
| 11 | 7,9702e00 | 7,8662e00 | 18 | 7,9513e00 | 7,8480e00 |
| 12 | 7,9624e00 | 7,8587e00 | 19 | 7,9510e00 | 7,8477e00 |
| 13 | 7,9583e00 | 7,8547e00 | 20 | 7,9507e00 | 7,8475e00 |
| 14 | 7,9560e00 | 7,8525e00 | 21 | 7,9506e00 | 7,8473e00 |

Chemical shifts for each nucleus

| Species | Ha | Hb |
|---|---|---|
| NISac | 8,0647e00 | 7,9572e00 |
| **1** | 0,0000e00 | 0,0000e00 |
| **1**•NISac | 7,9491e00 | 7,8459e00 |

Converged in 1 iterations with sigma = 2,105294

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**1**•NISac) | 3.4943 | 0.0545 | 3.49(5) |

## 10. $^1$H NMR titration experiments for 2•NISac in $CDCl_3$

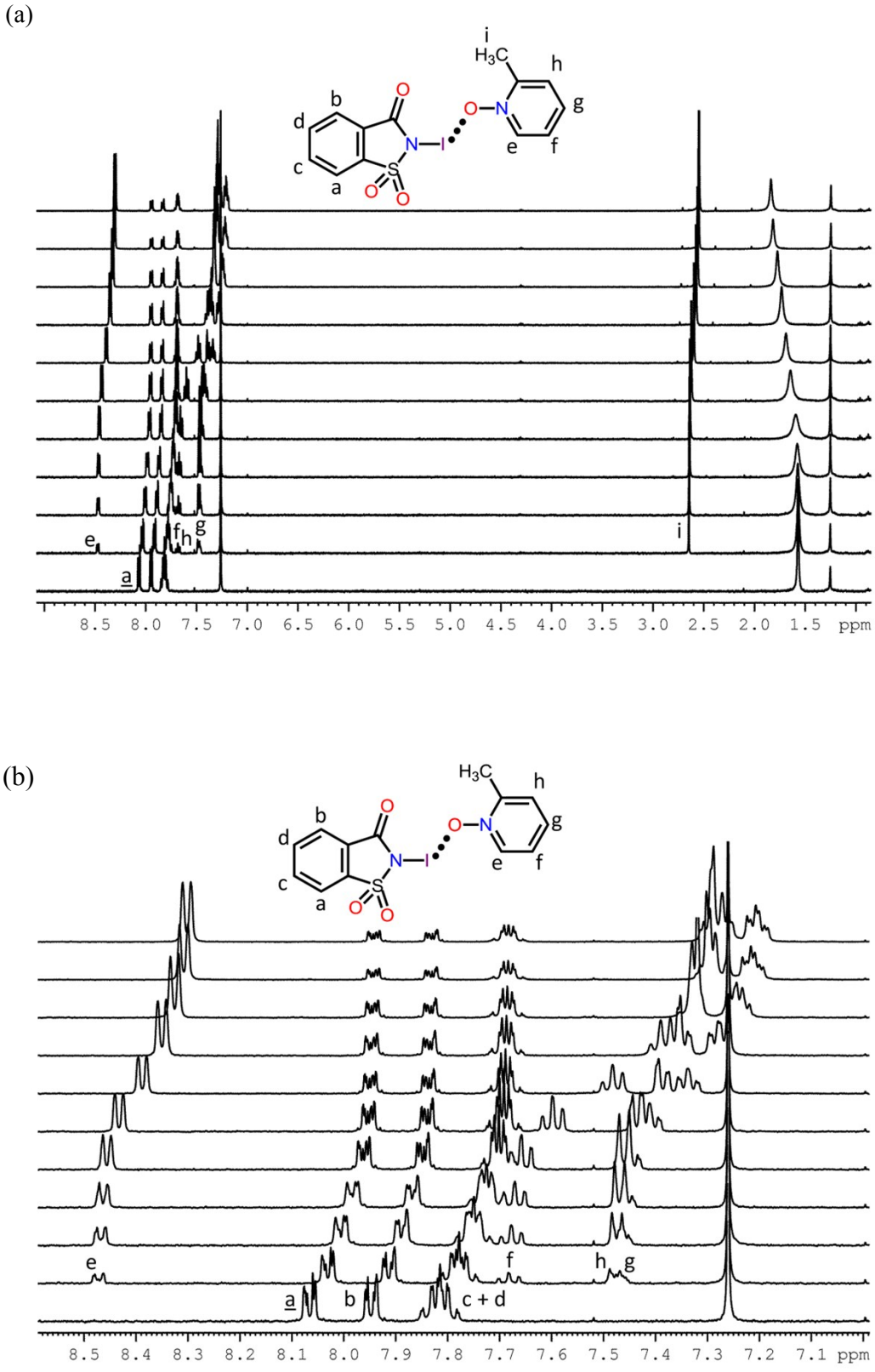


**Figure S17.** $^1$H NMR spectra for titration of NISac with **2** in $CDCl_3$ at 298 K: a) full spectrum; b) expanded region of the spectrum depicting the shift.

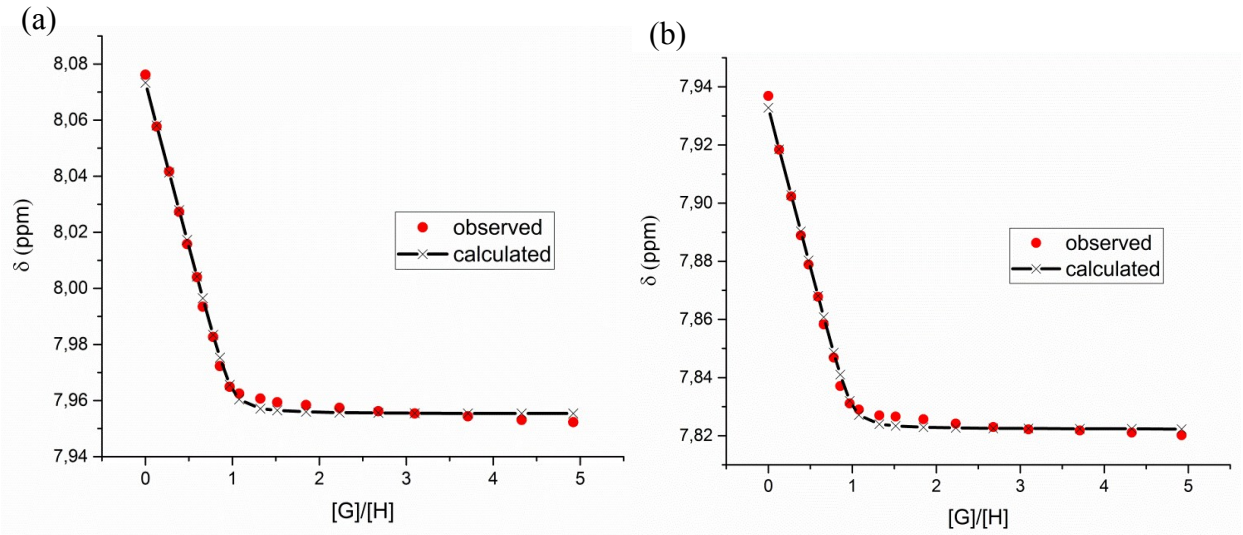


**Figure S18.** Graph showing the fitting curve between the calculated and observed chemical shifts for titration **2**•NISac (in $CDCl_3$ at 298 K, *K*a = 16338 ± 6314 $M^{-1}$) following a) Ha and b) Hb signal.

| Species | Log beta | NISac | **2** | |
|---|---|---|---|---|
| 1 | 4,2132 | 1 | 1 | refine |

**Species concentrations/mol $dm^{-3}$**

| Point | T(NISac) | T(**2**) | F(NISac) | F(**2**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 1,1324e-02 | 0,0000e00 | 1,1324e-02 | 4,6882e-91 | 8,6733e-89 |
| 2 | 1,1256e-02 | 1,4599e-03 | 9,8048e-03 | 9,0569e-06 | 1,4508e-03 |
| 3 | 1,1188e-02 | 3,0510e-03 | 8,1599e-03 | 2,2716e-05 | 3,0283e-03 |
| 4 | 1,1121e-02 | 4,3085e-03 | 6,8512e-03 | 3,8151e-05 | 4,2703e-03 |
| 5 | 1,1056e-02 | 5,2956e-03 | 5,8151e-03 | 5,5160e-05 | 5,2405e-03 |
| 6 | 1,0991e-02 | 6,5130e-03 | 4,5637e-03 | 8,6196e-05 | 6,4268e-03 |
| 7 | 1,0926e-02 | 7,2189e-03 | 3,8211e-03 | 1,1381e-04 | 7,1051e-03 |
| 8 | 1,0863e-02 | 8,4620e-03 | 2,5956e-03 | 1,9495e-04 | 8,2670e-03 |
| 9 | 1,0800e-02 | 9,2597e-03 | 1,8384e-03 | 2,9836e-04 | 8,9613e-03 |
| 10 | 1,0738e-02 | 1,0414e-02 | 9,5221e-04 | 6,2901e-04 | 9,7854e-03 |
| 11 | 1,0676e-02 | 1,1510e-02 | 4,7647e-04 | 1,3103e-03 | 1,0200e-02 |
| 12 | 1,0555e-02 | 1,3959e-02 | 1,7741e-04 | 3,5805e-03 | 1,0378e-02 |
| 13 | 1,0437e-02 | 1,5831e-02 | 1,1470e-04 | 5,5088e-03 | 1,0323e-02 |
| 14 | 1,0265e-02 | 1,8964e-02 | 7,1148e-05 | 8,7699e-03 | 1,0194e-02 |
| 15 | 1,0099e-02 | 2,2533e-02 | 4,9273e-05 | 1,2484e-02 | 1,0049e-02 |
| 16 | 9,8847e-03 | 2,6487e-02 | 3,6230e-05 | 1,6639e-02 | 9,8485e-03 |
| 17 | 9,6797e-03 | 2,9991e-02 | 2,9040e-05 | 2,0341e-02 | 9,6506e-03 |
| 18 | 9,4350e-03 | 3,4994e-02 | 2,2521e-05 | 2,5582e-02 | 9,4125e-03 |
| 19 | 9,2024e-03 | 3,9829e-02 | 1,8344e-05 | 3,0645e-02 | 9,1841e-03 |
| 20 | 8,9810e-03 | 4,4198e-02 | 1,5576e-05 | 3,5232e-02 | 8,9655e-03 |

**Measured chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,0762e00 | 7,9369e00 |
| 2 | 8,0577e00 | 7,9184e00 |
| 3 | 8,0417e00 | 7,9023e00 |
| 4 | 8,0273e00 | 7,8889e00 |
| 5 | 8,0158e00 | 7,8789e00 |
| 6 | 8,0040e00 | 7,8678e00 |
| 7 | 7,9935e00 | 7,8583e00 |
| 8 | 7,9827e00 | 7,8469e00 |
| 9 | 7,9723e00 | 7,8371e00 |
| 10 | 7,9649e00 | 7,8311e00 |
| 11 | 7,9625e00 | 7,8290e00 |
| 12 | 7,9607e00 | 7,8270e00 |
| 13 | 7,9594e00 | 7,8266e00 |
| 14 | 7,9584e00 | 7,8257e00 |
| 15 | 7,9574e00 | 7,8242e00 |
| 16 | 7,9562e00 | 7,8230e00 |
| 17 | 7,9554e00 | 7,8222e00 |
| 18 | 7,9544e00 | 7,8218e00 |
| 19 | 7,9531e00 | 7,8211e00 |
| 20 | 7,9523e00 | 7,8202e00 |

**Calculated chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,0733e00 | 7,9328e00 |
| 2 | 8,0581e00 | 7,9185e00 |
| 3 | 8,0413e00 | 7,9028e00 |
| 4 | 8,0279e00 | 7,8903e00 |
| 5 | 8,0173e00 | 7,8803e00 |
| 6 | 8,0042e00 | 7,8681e00 |
| 7 | 7,9965e00 | 7,8608e00 |
| 8 | 7,9834e00 | 7,8486e00 |
| 9 | 7,9753e00 | 7,8410e00 |
| 10 | 7,9656e00 | 7,8320e00 |
| 11 | 7,9604e00 | 7,8271e00 |
| 12 | 7,9571e00 | 7,8240e00 |
| 13 | 7,9565e00 | 7,8234e00 |
| 14 | 7,9560e00 | 7,8229e00 |
| 15 | 7,9557e00 | 7,8227e00 |
| 16 | 7,9556e00 | 7,8225e00 |
| 17 | 7,9555e00 | 7,8225e00 |
| 18 | 7,9554e00 | 7,8224e00 |
| 19 | 7,9554e00 | 7,8224e00 |
| 20 | 7,9554e00 | 7,8223e00 |

Chemical shifts for each nucleus

| Species | Ha | Hb |
|---|---|---|
| NISac | 8,0733e00 | 7,9328e00 |
| **2** | 0,0000e00 | 0,0000e00 |
| **2**•NISac | 7,9552e00 | 7,8221e00 |

Converged in 8 iterations with sigma = 2,183343

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**2**•NISac) | 4.2132 | 0.1419 | 4.2(1) |

## 11. $^1$H NMR titration experiments for 3•NISac in $CDCl_3$

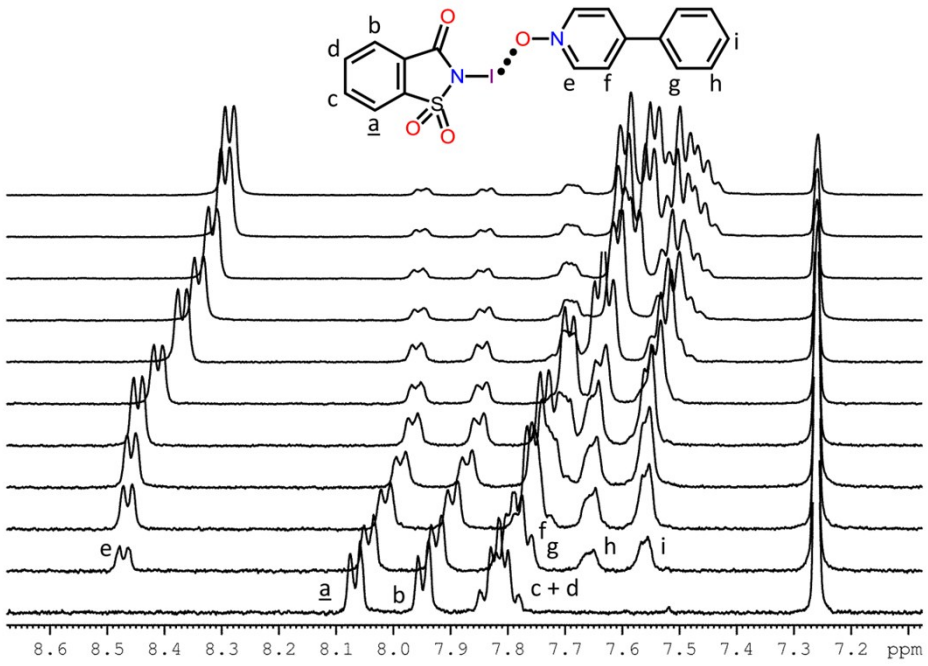


**Figure S19.** $^1$H NMR spectra for titration of NISac with **3** in $CDCl_3$ at 298 K.

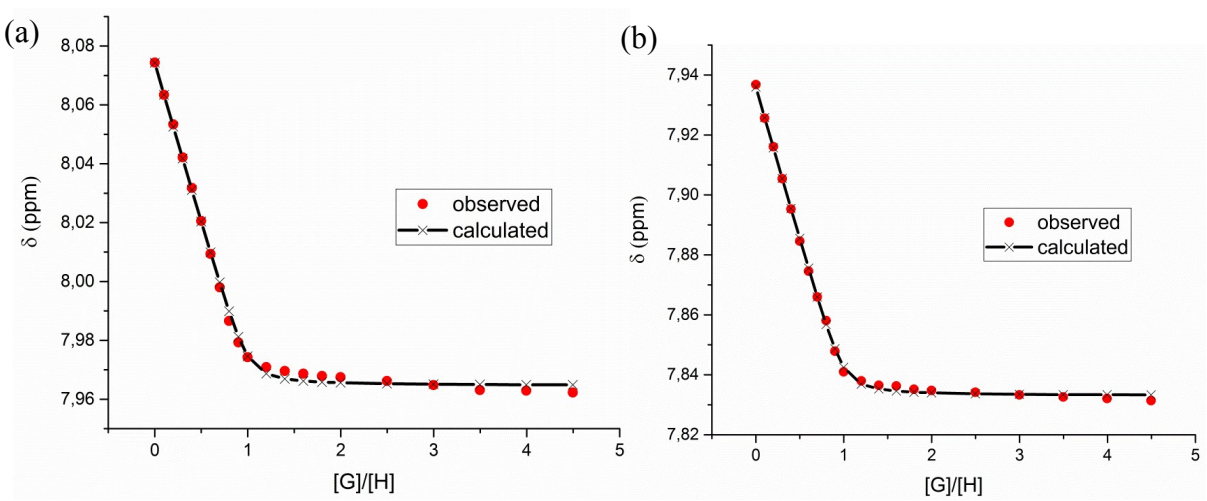


**Figure S20.** Graph showing the fitting curve between the calculated and observed chemical shifts for titration **3**•NISac (in $CDCl_3$ at 298 K, *K*a = 14200 ± 3034 $M^{-1}$) following a) Ha and b) Hb signal.

| Species | Log beta | NISac | **3** | |
|---|---|---|---|---|
| 1 | 4,1523 | 1 | 1 | refine |

**Species concentrations/mol $dm^{-3}$**

| Point | T(NISac) | T(**3**) | F(NISac) | F(**3**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 8,0885e-03 | 0,0000e00 | 8,0885e-03 | 4,9996e-91 | 5,7422e-89 |

| | | | | | |
|---|---|---|---|---|---|
| 2 | 8,0440e-03 | 8,0358e-04 | 7,2482e-03 | 7,7326e-06 | 7,9584e-04 |
| 3 | 8,0000e-03 | 1,5984e-03 | 6,4190e-03 | 1,7346e-05 | 1,5810e-03 |
| 4 | 7,9564e-03 | 2,3845e-03 | 5,6016e-03 | 2,9606e-05 | 2,3549e-03 |
| 5 | 7,9134e-03 | 3,1621e-03 | 4,7970e-03 | 4,5751e-05 | 3,1163e-03 |
| 6 | 7,8708e-03 | 3,9313e-03 | 4,0073e-03 | 6,7897e-05 | 3,8634e-03 |
| 7 | 7,8286e-03 | 4,6923e-03 | 3,2362e-03 | 9,9938e-05 | 4,5924e-03 |
| 8 | 7,7869e-03 | 5,4452e-03 | 2,4914e-03 | 1,4969e-04 | 5,2955e-03 |
| 9 | 7,7456e-03 | 6,1902e-03 | 1,7898e-03 | 2,3434e-04 | 5,9558e-03 |
| 10 | 7,7048e-03 | 6,9272e-03 | 1,1707e-03 | 3,9308e-04 | 6,5341e-03 |
| 11 | 7,6644e-03 | 7,6566e-03 | 7,0408e-04 | 6,9621e-04 | 6,9603e-03 |
| 12 | 7,5849e-03 | 9,0925e-03 | 2,8649e-04 | 1,7941e-03 | 7,2984e-03 |
| 13 | 7,5070e-03 | 1,0499e-02 | 1,6387e-04 | 3,1559e-03 | 7,3431e-03 |
| 14 | 7,4307e-03 | 1,1877e-02 | 1,1303e-04 | 4,5592e-03 | 7,3176e-03 |
| 15 | 7,3559e-03 | 1,3227e-02 | 8,5946e-05 | 5,9571e-03 | 7,2699e-03 |
| 16 | 7,2826e-03 | 1,4550e-02 | 6,9239e-05 | 7,3369e-03 | 7,2133e-03 |
| 17 | 7,1056e-03 | 1,7746e-02 | 4,6519e-05 | 1,0687e-02 | 7,0591e-03 |
| 18 | 6,9370e-03 | 2,0790e-02 | 3,5000e-05 | 1,3888e-02 | 6,9020e-03 |
| 19 | 6,7762e-03 | 2,3692e-02 | 2,8047e-05 | 1,6944e-02 | 6,7481e-03 |
| 20 | 6,6227e-03 | 2,6464e-02 | 2,3397e-05 | 1,9864e-02 | 6,5993e-03 |
| 21 | 6,4760e-03 | 2,9112e-02 | 2,0068e-05 | 2,2656e-02 | 6,4559e-03 |

**Measured chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,0744e00 | 7,9368e00 |
| 2 | 8,0634e00 | 7,9256e00 |
| 3 | 8,0534e00 | 7,9161e00 |
| 4 | 8,0422e00 | 7,9054e00 |
| 5 | 8,0318e00 | 7,8953e00 |
| 6 | 8,0206e00 | 7,8846e00 |
| 7 | 8,0094e00 | 7,8746e00 |
| 8 | 7,9980e00 | 7,8660e00 |
| 9 | 7,9866e00 | 7,8581e00 |
| 10 | 7,9793e00 | 7,8479e00 |
| 11 | 7,9743e00 | 7,8410e00 |
| 12 | 7,9709e00 | 7,8380e00 |
| 13 | 7,9696e00 | 7,8365e00 |
| 14 | 7,9687e00 | 7,8363e00 |
| 15 | 7,9679e00 | 7,8352e00 |
| 16 | 7,9675e00 | 7,8348e00 |
| 17 | 7,9662e00 | 7,8342e00 |
| 18 | 7,9648e00 | 7,8333e00 |
| 19 | 7,9631e00 | 7,8326e00 |
| 20 | 7,9629e00 | 7,8321e00 |
| 21 | 7,9623e00 | 7,8314e00 |

**Calculated chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,0743e00 | 7,9360e00 |
| 2 | 8,0634e00 | 7,9258e00 |
| 3 | 8,0526e00 | 7,9157e00 |
| 4 | 8,0418e00 | 7,9055e00 |
| 5 | 8,0311e00 | 7,8955e00 |
| 6 | 8,0204e00 | 7,8855e00 |
| 7 | 8,0099e00 | 7,8756e00 |
| 8 | 7,9997e00 | 7,8660e00 |
| 9 | 7,9899e00 | 7,8568e00 |
| 10 | 7,9812e00 | 7,8487e00 |
| 11 | 7,9746e00 | 7,8425e00 |
| 12 | 7,9687e00 | 7,8369e00 |
| 13 | 7,9669e00 | 7,8353e00 |
| 14 | 7,9662e00 | 7,8346e00 |
| 15 | 7,9658e00 | 7,8342e00 |
| 16 | 7,9656e00 | 7,8340e00 |
| 17 | 7,9653e00 | 7,8337e00 |
| 18 | 7,9651e00 | 7,8335e00 |
| 19 | 7,9650e00 | 7,8334e00 |
| 20 | 7,9649e00 | 7,8334e00 |
| 21 | 7,9649e00 | 7,8333e00 |

Chemical shifts for each nucleus

| Species | Ha | Hb |
|---|---|---|
| NISac | 8,0743e00 | 7,9360e00 |
| **3**•NISac | 7,9645e00 | 7,8330e00 |

Converged in 9 iterations with sigma = 1,482189

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**3**•NISac) | 4.1523 | 0.0841 | 4.15(8) |

## 12. $^1$H NMR titration experiments for 4•NISac in $CDCl_3$

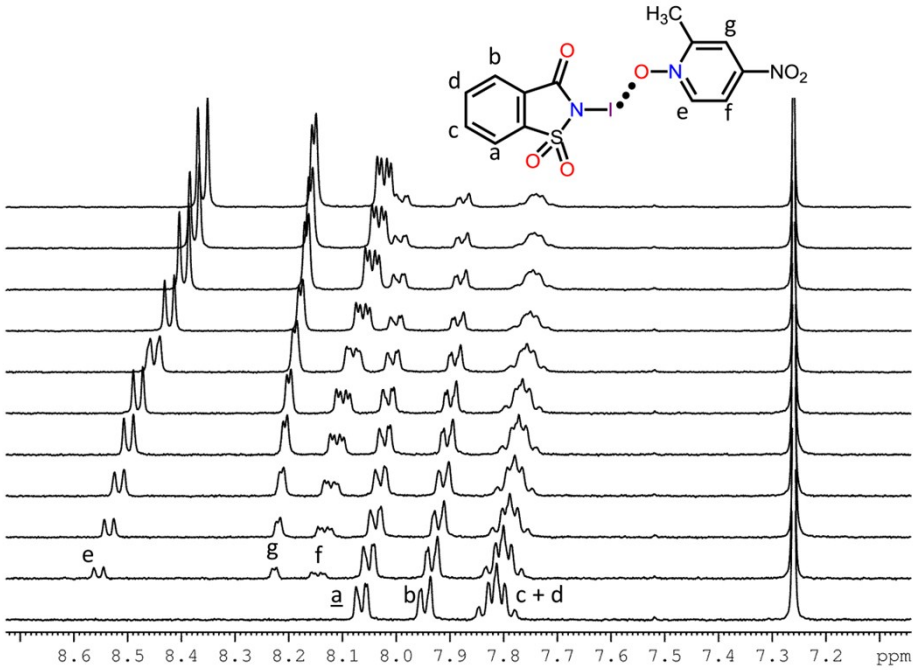


**Figure S21**. $^1$H NMR spectra for titration of NISac with **4** in $CDCl_3$ at 298 K.

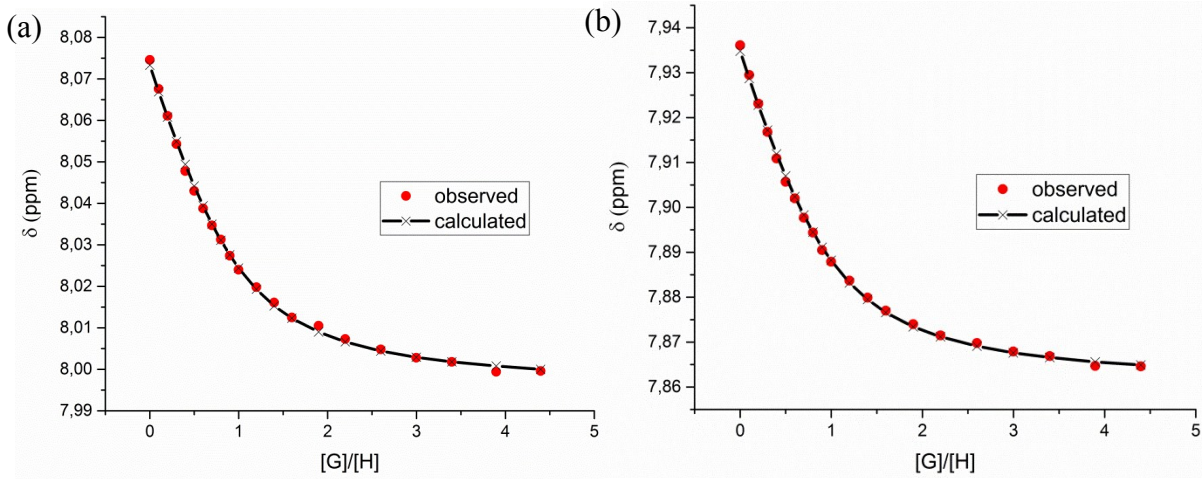


**Figure S22.** Graph showing the fitting curve between the calculated and observed chemical shifts for titration **4**•NISac (in $CDCl_3$ at 298 K, *K*a = 543 ± 26 $M^{-1}$) following a) Ha and b) Hb signal.

| Species | Log beta | NISac | **4** | |
|---|---|---|---|---|
| 1 | 2,7348 | 1 | 1 | refine |

**Species concentrations/mol dm$^{-3}$**

| Point | T(NISac) | T(**4**) | F(NISac) | F(**4**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 8,1424e-03 | 0,0000e00 | 8,1424e-03 | 4,3391e-90 | 1,9183e-89 |
| 2 | 8,0657e-03 | 8,0587e-04 | 7,4201e-03 | 1,6025e-04 | 6,4562e-04 |
| 3 | 7,9904e-03 | 1,5967e-03 | 6,7365e-03 | 3,4281e-04 | 1,2539e-03 |
| 4 | 7,9164e-03 | 2,3729e-03 | 6,0942e-03 | 5,5068e-04 | 1,8222e-03 |
| 5 | 7,8439e-03 | 3,1348e-03 | 5,4959e-03 | 7,8684e-04 | 2,3480e-03 |
| 6 | 7,7726e-03 | 3,8829e-03 | 4,9436e-03 | 1,0539e-03 | 2,8290e-03 |
| 7 | 7,7026e-03 | 4,6176e-03 | 4,4391e-03 | 1,3540e-03 | 3,2635e-03 |
| 8 | 7,6339e-03 | 5,3391e-03 | 3,9830e-03 | 1,6882e-03 | 3,6509e-03 |
| 9 | 7,5664e-03 | 6,0478e-03 | 3,5749e-03 | 2,0564e-03 | 3,9915e-03 |
| 10 | 7,5001e-03 | 6,7442e-03 | 3,2131e-03 | 2,4572e-03 | 4,2869e-03 |
| 11 | 7,4349e-03 | 7,4284e-03 | 2,8949e-03 | 2,8884e-03 | 4,5400e-03 |
| 12 | 7,3079e-03 | 8,7618e-03 | 2,3739e-03 | 3,8279e-03 | 4,9340e-03 |
| 13 | 7,1851e-03 | 1,0050e-02 | 1,9792e-03 | 4,8445e-03 | 5,2060e-03 |
| 14 | 7,0665e-03 | 1,1296e-02 | 1,6791e-03 | 5,9091e-03 | 5,3873e-03 |
| 15 | 6,8955e-03 | 1,3091e-02 | 1,3525e-03 | 7,5482e-03 | 5,5430e-03 |
| 16 | 6,7326e-03 | 1,4801e-02 | 1,1238e-03 | 9,1924e-03 | 5,6089e-03 |
| 17 | 6,5272e-03 | 1,6958e-02 | 9,1178e-04 | 1,1343e-02 | 5,6154e-03 |
| 18 | 6,3339e-03 | 1,8987e-02 | 7,6446e-04 | 1,3418e-02 | 5,5694e-03 |
| 19 | 6,1517e-03 | 2,0900e-02 | 6,5693e-04 | 1,5405e-02 | 5,4948e-03 |
| 20 | 5,9383e-03 | 2,3141e-02 | 5,5792e-04 | 1,7761e-02 | 5,3803e-03 |
| 21 | 5,7391e-03 | 2,5232e-02 | 4,8443e-04 | 1,9977e-02 | 5,2547e-03 |

**Measured chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,0746e00 | 7,9361e00 |
| 2 | 8,0676e00 | 7,9295e00 |
| 3 | 8,0611e00 | 7,9231e00 |
| 4 | 8,0543e00 | 7,9168e00 |
| 5 | 8,0478e00 | 7,9109e00 |
| 6 | 8,0430e00 | 7,9057e00 |
| 7 | 8,0388e00 | 7,9020e00 |
| 8 | 8,0347e00 | 7,8977e00 |
| 9 | 8,0313e00 | 7,8944e00 |
| 10 | 8,0274e00 | 7,8905e00 |
| 11 | 8,0240e00 | 7,8879e00 |
| 12 | 8,0198e00 | 7,8837e00 |
| 13 | 8,0161e00 | 7,8799e00 |
| 14 | 8,0125e00 | 7,8770e00 |
| 15 | 8,0105e00 | 7,8740e00 |
| 16 | 8,0073e00 | 7,8715e00 |
| 17 | 8,0048e00 | 7,8698e00 |
| 18 | 8,0028e00 | 7,8679e00 |
| 19 | 8,0018e00 | 7,8669e00 |
| 20 | 7,9994e00 | 7,8647e00 |
| 21 | 7,9996e00 | 7,8646e00 |

**Calculated chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,0733e00 | 7,9348e00 |
| 2 | 8,0669e00 | 7,9287e00 |
| 3 | 8,0608e00 | 7,9228e00 |
| 4 | 8,0549e00 | 7,9172e00 |
| 5 | 8,0494e00 | 7,9119e00 |

| | | | | | |
|---|---|---|---|---|---|
| 6 | 8,0442e00 | 7,9070e00 | 14 | 8,0123e00 | 7,8766e00 |
| 7 | 8,0394e00 | 7,9024e00 | 15 | 8,0090e00 | 7,8734e00 |
| 8 | 8,0350e00 | 7,8983e00 | 16 | 8,0066e00 | 7,8712e00 |
| 9 | 8,0311e00 | 7,8945e00 | 17 | 8,0044e00 | 7,8691e00 |
| 10 | 8,0276e00 | 7,8911e00 | 18 | 8,0029e00 | 7,8676e00 |
| 11 | 8,0244e00 | 7,8882e00 | 19 | 8,0018e00 | 7,8666e00 |
| 12 | 8,0193e00 | 7,8832e00 | 20 | 8,0008e00 | 7,8656e00 |
| 13 | 8,0153e00 | 7,8795e00 | 21 | 8,0000e00 | 7,8649e0 |

Chemical shifts for each nucleus

| Species | Ha | Hb |
|---|---|---|
| NISac | 8,0733e00 | 7,9348e00 |
| **4** | 0,0000e00 | 0,0000e00 |
| **4**•NISac | 7,9932e00 | 7,8584e00 |

Converged in 1 iterations with sigma = 0,773155

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**4**•NISac) | 2.7348 | 0.02 | 2.73(2) |

## 13. $^1$H NMR titration experiments for 1•NISac in acetone-$d_6$

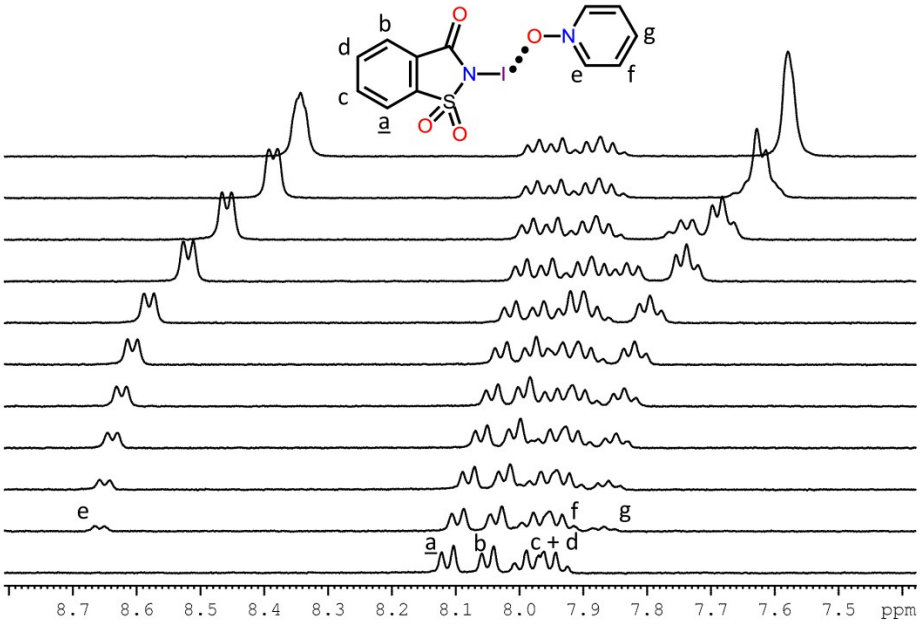


**Figure S23.** $^1$H NMR spectra for titration of NISac with **1** in acetone-$d_6$ at 298 K.

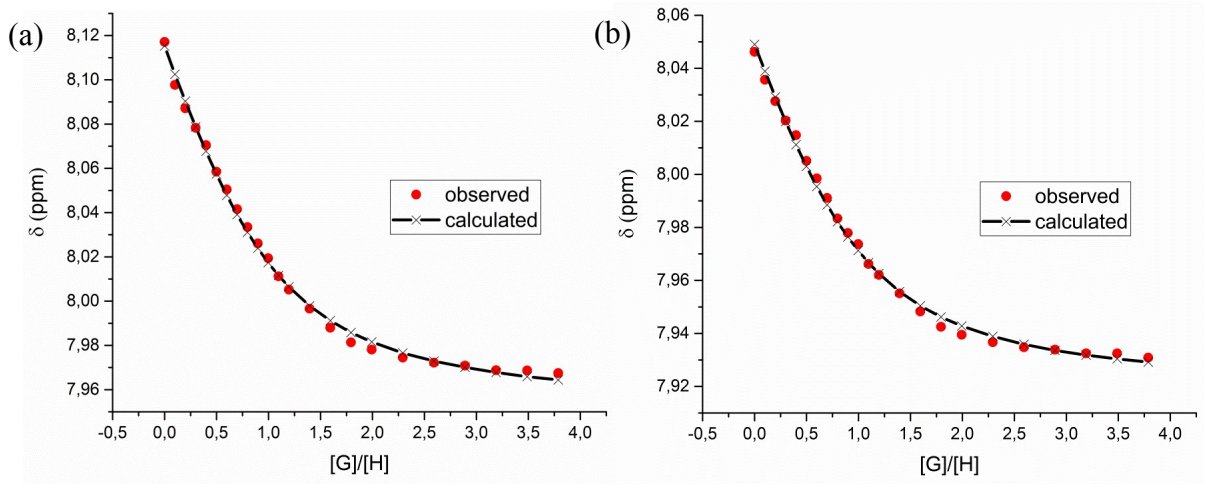


**Figure S24.** Graph showing the fitting curve between the calculated and observed chemical shifts for titration **1**•NISac (in acetone-$d_6$ at 298 K, *K*a = 435 ± 33 $M^{-1}$) following a) Ha and b) Hb signal.

| Species | Log beta | NISac | **1** | |
|---|---|---|---|---|
| 1 | 2,6386 | 1 | 1 | refine |

**Species concentrations/mol dm$^{-3}$**

| Point | T(NISac) | T(**1**) | F(NISac) | F(**1**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 8,0885e-03 | 0,0000e00 | 8,0885e-03 | 4,9241e-90 | 1,7328e-89 |
| 2 | 8,0638e-03 | 8,0370e-04 | 7,4496e-03 | 1,8950e-04 | 6,1420e-04 |
| 3 | 8,0392e-03 | 1,6025e-03 | 6,8398e-03 | 4,0307e-04 | 1,1994e-03 |
| 4 | 8,0148e-03 | 2,3965e-03 | 6,2618e-03 | 6,4346e-04 | 1,7530e-03 |
| 5 | 7,9905e-03 | 3,1856e-03 | 5,7183e-03 | 9,1335e-04 | 2,2723e-03 |
| 6 | 7,9664e-03 | 3,9700e-03 | 5,2114e-03 | 1,2150e-03 | 2,7549e-03 |
| 7 | 7,9424e-03 | 4,7496e-03 | 4,7431e-03 | 1,5504e-03 | 3,1993e-03 |
| 8 | 7,9185e-03 | 5,5246e-03 | 4,3142e-03 | 1,9203e-03 | 3,6043e-03 |
| 9 | 7,8948e-03 | 6,2949e-03 | 3,9248e-03 | 2,3249e-03 | 3,9700e-03 |
| 10 | 7,8713e-03 | 7,0606e-03 | 3,5741e-03 | 2,7635e-03 | 4,2972e-03 |
| 11 | 7,8479e-03 | 7,8218e-03 | 3,2603e-03 | 3,2342e-03 | 4,5876e-03 |
| 12 | 7,8246e-03 | 8,5785e-03 | 2,9809e-03 | 3,7348e-03 | 4,8437e-03 |
| 13 | 7,8014e-03 | 9,3307e-03 | 2,7331e-03 | 4,2623e-03 | 5,0683e-03 |
| 14 | 7,7555e-03 | 1,0822e-02 | 2,3198e-03 | 5,3860e-03 | 5,4358e-03 |
| 15 | 7,7102e-03 | 1,2295e-02 | 1,9958e-03 | 6,5810e-03 | 5,7144e-03 |
| 16 | 7,6654e-03 | 1,3752e-02 | 1,7401e-03 | 7,8266e-03 | 5,9253e-03 |
| 17 | 7,6211e-03 | 1,5192e-02 | 1,5359e-03 | 9,1064e-03 | 6,0852e-03 |
| 18 | 7,5556e-03 | 1,7320e-02 | 1,2996e-03 | 1,1064e-02 | 6,2560e-03 |
| 19 | 7,4912e-03 | 1,9413e-02 | 1,1223e-03 | 1,3044e-02 | 6,3689e-03 |
| 20 | 7,4279e-03 | 2,1470e-02 | 9,8542e-04 | 1,5027e-02 | 6,4425e-03 |
| 21 | 7,3657e-03 | 2,3492e-02 | 8,7711e-04 | 1,7003e-02 | 6,4886e-03 |
| 22 | 7,3045e-03 | 2,5481e-02 | 7,8955e-04 | 1,8966e-02 | 6,5150e-03 |
| 23 | 7,2443e-03 | 2,7437e-02 | 7,1744e-04 | 2,0910e-02 | 6,5269e-03 |

**Measured chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,1171e00 | 8,0462e00 |
| 2 | 8,0977e00 | 8,0357e00 |
| 3 | 8,0871e00 | 8,0276e00 |
| 4 | 8,0783e00 | 8,0203e00 |
| 5 | 8,0705e00 | 8,0148e00 |
| 6 | 8,0585e00 | 8,0051e00 |
| 7 | 8,0505e00 | 7,9985e00 |
| 8 | 8,0416e00 | 7,9911e00 |
| 9 | 8,0335e00 | 7,9834e00 |
| 10 | 8,0261e00 | 7,9779e00 |
| 11 | 8,0194e00 | 7,9737e00 |
| 12 | 8,0112e00 | 7,9662e00 |
| 13 | 8,0052e00 | 7,9621e00 |
| 14 | 7,9966e00 | 7,9551e00 |
| 15 | 7,9880e00 | 7,9483e00 |
| 16 | 7,9814e00 | 7,9425e00 |
| 17 | 7,9781e00 | 7,9395e00 |
| 18 | 7,9745e00 | 7,9367e00 |
| 19 | 7,9722e00 | 7,9348e00 |
| 20 | 7,9709e00 | 7,9339e00 |
| 21 | 7,9688e00 | 7,9325e00 |
| 22 | 7,9687e00 | 7,9325e00 |
| 23 | 7,9675e00 | 7,9309e00 |

**Calculated chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,1153e00 | 8,0490e00 |
| 2 | 8,1025e00 | 8,0389e00 |
| 3 | 8,0903e00 | 8,0292e00 |
| 4 | 8,0787e00 | 8,0199e00 |
| 5 | 8,0677e00 | 8,0112e00 |
| 6 | 8,0574e00 | 8,0030e00 |
| 7 | 8,0478e00 | 7,9954e00 |
| 8 | 8,0391e00 | 7,9885e00 |

| | | | | | |
|---|---|---|---|---|---|
| 9 | 8,0311e00 | 7,9821e00 | 17 | 7,9816e00 | 7,9428e00 |
| 10 | 8,0239e00 | 7,9764e00 | 18 | 7,9766e00 | 7,9389e00 |
| 11 | 8,0174e00 | 7,9713e00 | 19 | 7,9729e00 | 7,9359e00 |
| 12 | 8,0116e00 | 7,9667e00 | 20 | 7,9701e00 | 7,9336e00 |
| 13 | 8,0065e00 | 7,9626e00 | 21 | 7,9678e00 | 7,9318e00 |
| 14 | 7,9979e00 | 7,9558e00 | 22 | 7,9659e00 | 7,9304e00 |
| 15 | 7,9912e00 | 7,9504e00 | 23 | 7,9644e00 | 7,9292e00 |
| 16 | 7,9858e00 | 7,9462e00 | | | |

Chemical shifts for each nucleus

| Species | Ha | Hb |
|---|---|---|
| NISac | 8,1153e00 | 8,0490e00 |
| **1** | 0,0000e00 | 0,0000e00 |
| **1**•NISac | 7,9478e00 | 7,9160e00 |

Converged in 6 iterations with sigma = 2,481943

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**1**•NISac) | 2.6386 | 0.0314 | 2.64(3) |

## 14. $^1$H NMR titration experiments for 2•NISac in acetone-$d_6$

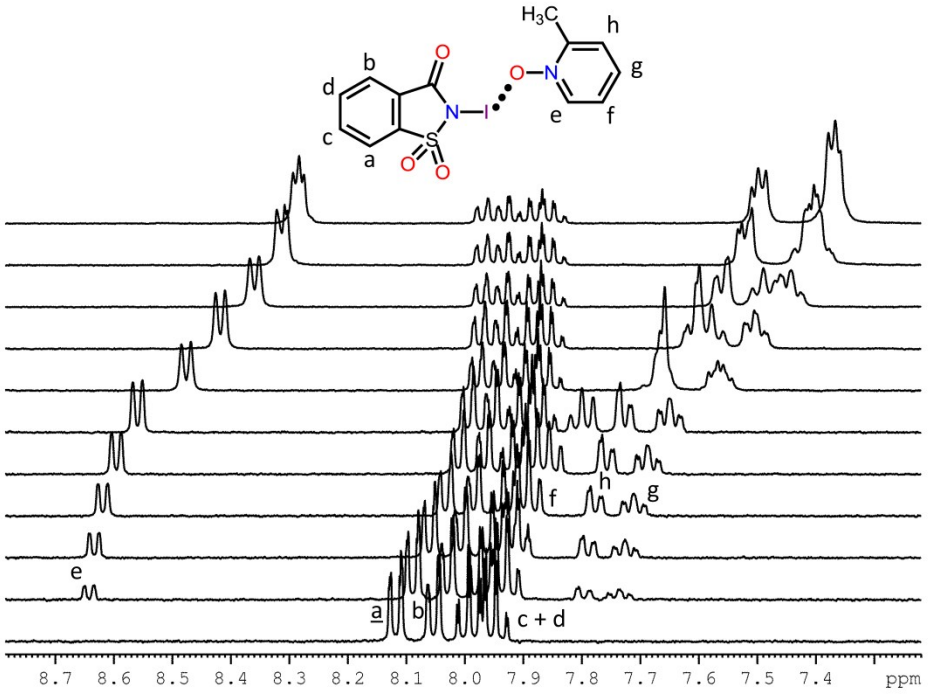


**Figure S25.** $^1$H NMR spectra for titration of NISac with **2** in acetone-$d_6$ at 298 K.

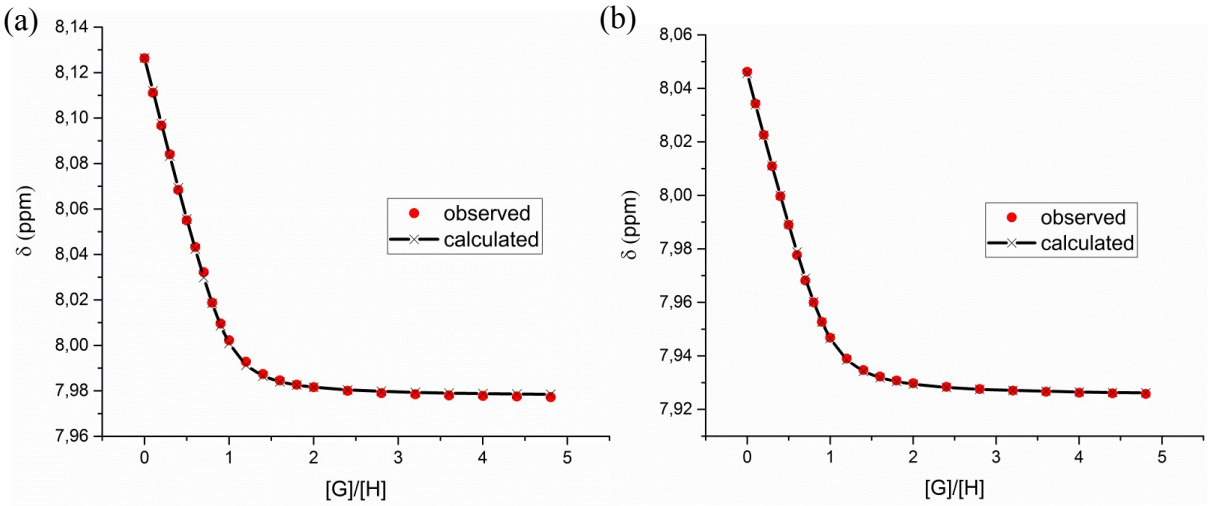


**Figure S26.** Graph showing the fitting curve between the calculated and observed chemical shifts for titration **2**•NISac (in acetone-$d_6$ at 298 K, *K*a = 2774 ± 70 $M^{-1}$) following a) Ha and b) Hb signal.

| Species | Log beta | NISac | **2** | |
|---|---|---|---|---|
| 1 | 3,4431 | 1 | 1 | refine |

**Species concentrations/mol dm$^{-3}$**

| Point | T(NISac) | T(**2**) | F(NISac) | F(**2**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 9,5984e-03 | 0,0000e00 | 9,5984e-03 | 1,6544e-90 | 4,4046e-89 |
| 2 | 9,5280e-03 | 9,5368e-04 | 8,6127e-03 | 3,8318e-05 | 9,1536e-04 |
| 3 | 9,4587e-03 | 1,8935e-03 | 7,6504e-03 | 8,5216e-05 | 1,8083e-03 |
| 4 | 9,3904e-03 | 2,8197e-03 | 6,7144e-03 | 1,4369e-04 | 2,6760e-03 |
| 5 | 9,3230e-03 | 3,7326e-03 | 5,8085e-03 | 2,1814e-04 | 3,5145e-03 |
| 6 | 9,2567e-03 | 4,6326e-03 | 4,9392e-03 | 3,1515e-04 | 4,3174e-03 |
| 7 | 9,1912e-03 | 5,5198e-03 | 4,1160e-03 | 4,4456e-04 | 5,0752e-03 |
| 8 | 9,1267e-03 | 6,3945e-03 | 3,3530e-03 | 6,2083e-04 | 5,7737e-03 |
| 9 | 9,0631e-03 | 7,2571e-03 | 2,6695e-03 | 8,6351e-04 | 6,3936e-03 |
| 10 | 9,0003e-03 | 8,1077e-03 | 2,0869e-03 | 1,1943e-03 | 6,9134e-03 |
| 11 | 8,9384e-03 | 8,9466e-03 | 1,6202e-03 | 1,6284e-03 | 7,3182e-03 |
| 12 | 8,8172e-03 | 1,0590e-02 | 1,0109e-03 | 2,7841e-03 | 7,8063e-03 |
| 13 | 8,6992e-03 | 1,2190e-02 | 6,9053e-04 | 4,1814e-03 | 8,0086e-03 |
| 14 | 8,5843e-03 | 1,3747e-02 | 5,1271e-04 | 5,6759e-03 | 8,0716e-03 |
| 15 | 8,4724e-03 | 1,5264e-02 | 4,0422e-04 | 7,1962e-03 | 8,0682e-03 |
| 16 | 8,3634e-03 | 1,6742e-02 | 3,3238e-04 | 8,7111e-03 | 8,0310e-03 |
| 17 | 8,1536e-03 | 1,9587e-02 | 2,4420e-04 | 1,1677e-02 | 7,9094e-03 |
| 18 | 7,9540e-03 | 2,2292e-02 | 1,9258e-04 | 1,4530e-02 | 7,7614e-03 |
| 19 | 7,7640e-03 | 2,4868e-02 | 1,5884e-04 | 1,7262e-02 | 7,6052e-03 |
| 20 | 7,5829e-03 | 2,7323e-02 | 1,3510e-04 | 1,9876e-02 | 7,4478e-03 |
| 21 | 7,4100e-03 | 2,9667e-02 | 1,1751e-04 | 2,2375e-02 | 7,2925e-03 |
| 22 | 7,2448e-03 | 3,1906e-02 | 1,0396e-04 | 2,4766e-02 | 7,1408e-03 |
| 23 | 7,0868e-03 | 3,4048e-02 | 9,3198e-05 | 2,7054e-02 | 6,9936e-03 |

**Measured chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,1263e00 | 8,0462e00 |
| 2 | 8,1111e00 | 8,0343e00 |
| 3 | 8,0967e00 | 8,0226e00 |
| 4 | 8,0841e00 | 8,0109e00 |
| 5 | 8,0684e00 | 7,9997e00 |
| 6 | 8,0550e00 | 7,9890e00 |
| 7 | 8,0433e00 | 7,9777e00 |
| 8 | 8,0322e00 | 7,9682e00 |
| 9 | 8,0188e00 | 7,9600e00 |
| 10 | 8,0096e00 | 7,9527e00 |
| 11 | 8,0023e00 | 7,9468e00 |
| 12 | 7,9928e00 | 7,9390e00 |
| 13 | 7,9874e00 | 7,9347e00 |
| 14 | 7,9846e00 | 7,9323e00 |
| 15 | 7,9827e00 | 7,9308e00 |
| 16 | 7,9816e00 | 7,9298e00 |
| 17 | 7,9800e00 | 7,9284e00 |
| 18 | 7,9790e00 | 7,9276e00 |
| 19 | 7,9785e00 | 7,9270e00 |
| 20 | 7,9780e00 | 7,9266e00 |
| 21 | 7,9778e00 | 7,9262e00 |
| 22 | 7,9775e00 | 7,9260e00 |
| 23 | 7,9772e00 | 7,9258e00 |

**Calculated chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,1259e00 | 8,0456e00 |
| 2 | 8,1114e00 | 8,0340e00 |
| 3 | 8,0971e00 | 8,0225e00 |
| 4 | 8,0830e00 | 8,0111e00 |
| 5 | 8,0692e00 | 8,0000e00 |
| 6 | 8,0557e00 | 7,9892e00 |
| 7 | 8,0428e00 | 7,9788e00 |
| 8 | 8,0307e00 | 7,9690e00 |
| 9 | 8,0197e00 | 7,9602e00 |
| 10 | 8,0103e00 | 7,9526e00 |
| 11 | 8,0027e00 | 7,9465e00 |
| 12 | 7,9926e00 | 7,9385e00 |
| 13 | 7,9873e00 | 7,9342e00 |
| 14 | 7,9844e00 | 7,9318e00 |
| 15 | 7,9826e00 | 7,9304e00 |
| 16 | 7,9814e00 | 7,9294e00 |
| 17 | 7,9799e00 | 7,9282e00 |
| 18 | 7,9790e00 | 7,9275e00 |
| 19 | 7,9785e00 | 7,9271e00 |
| 20 | 7,9781e00 | 7,9268e00 |
| 21 | 7,9778e00 | 7,9265e00 |
| 22 | 7,9775e00 | 7,9263e00 |
| 23 | 7,9774e00 | 7,9262e00 |

Chemical shifts for each nucleus

| Species | Ha | Hb |
|---|---|---|
| NISac | 8,1259e00 | 8,0456e00 |
| **2** | 0,0000e00 | 0,0000e00 |
| **2**•NISac | 7,9754e00 | 7,9246e00 |

Converged in 4 iterations with sigma = 0,520818

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**2**•NISac) | 3.4431 | 0.0108 | 3.44(1) |

## 15. $^1$H NMR titration experiments for 3•NISac in acetone-$d_6$

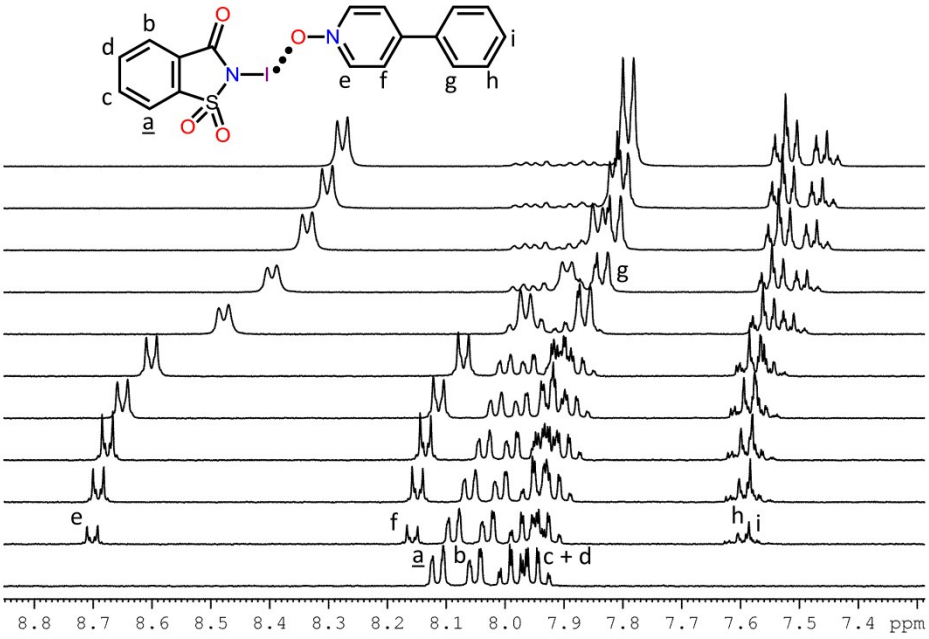


**Figure S27.** $^1$H NMR spectra for titration of NIS with **3** in acetone-$d_6$ at 298 K.

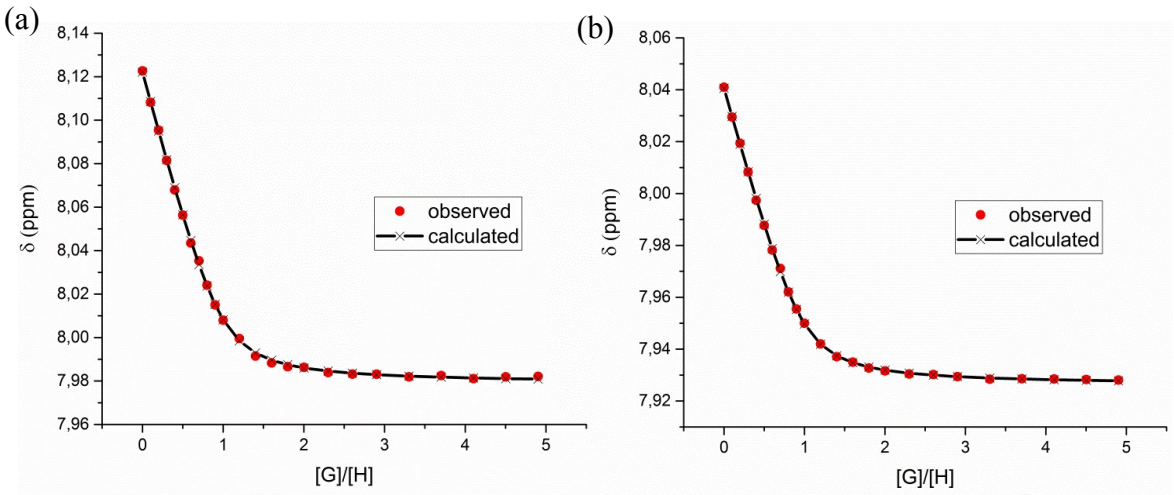


**Figure S28.** Graph showing the fitting curve between the calculated and observed chemical shifts for titration **3**•NISac (in acetone-$d_6$ at 298 K, *K*a = 2099 ± 63 $M^{-1}$) following a) Ha and b) Hb signal.

| Species | Log beta | NISac | **3** | |
|---|---|---|---|---|
| 1 | 3,3219 | 1 | 1 | refine |

**Species concentrations/mol dm$^{-3}$**

| Point | T(NISac) | T(**3**) | F(NISac) | F(**3**) | Species 1 |
|---|---|---|---|---|---|
| 1 | 9,7062e-03 | 0,0000e00 | 9,7062e-03 | 2,0311e-90 | 4,1374e-89 |
| 2 | 9,5986e-03 | 9,6053e-04 | 8,6880e-03 | 4,9942e-05 | 9,1059e-04 |
| 3 | 9,4933e-03 | 1,9000e-03 | 7,7039e-03 | 1,1067e-04 | 1,7893e-03 |
| 4 | 9,3902e-03 | 2,8190e-03 | 6,7569e-03 | 1,8571e-04 | 2,6333e-03 |
| 5 | 9,2894e-03 | 3,7184e-03 | 5,8511e-03 | 2,8002e-04 | 3,4384e-03 |
| 6 | 9,1908e-03 | 4,5986e-03 | 4,9928e-03 | 4,0064e-04 | 4,1980e-03 |
| 7 | 9,0942e-03 | 5,4603e-03 | 4,1913e-03 | 5,5741e-04 | 4,9029e-03 |
| 8 | 8,9996e-03 | 6,3041e-03 | 3,4588e-03 | 7,6333e-04 | 5,5408e-03 |
| 9 | 8,9070e-03 | 7,1306e-03 | 2,8102e-03 | 1,0338e-03 | 6,0968e-03 |
| 10 | 8,8162e-03 | 7,9402e-03 | 2,2591e-03 | 1,3831e-03 | 6,5571e-03 |
| 11 | 8,7273e-03 | 8,7334e-03 | 1,8122e-03 | 1,8183e-03 | 6,9151e-03 |
| 12 | 8,5548e-03 | 1,0273e-02 | 1,2006e-03 | 2,9188e-03 | 7,3541e-03 |
| 13 | 8,3889e-03 | 1,1753e-02 | 8,5191e-04 | 4,2157e-03 | 7,5370e-03 |
| 14 | 8,2293e-03 | 1,3176e-02 | 6,4607e-04 | 5,5929e-03 | 7,5833e-03 |
| 15 | 8,0757e-03 | 1,4547e-02 | 5,1563e-04 | 6,9864e-03 | 7,5601e-03 |
| 16 | 7,9278e-03 | 1,5867e-02 | 4,2721e-04 | 8,3661e-03 | 7,5006e-03 |
| 17 | 7,7156e-03 | 1,7759e-02 | 3,3857e-04 | 1,0382e-02 | 7,3770e-03 |
| 18 | 7,5145e-03 | 1,9554e-02 | 2,7984e-04 | 1,2319e-02 | 7,2347e-03 |
| 19 | 7,3236e-03 | 2,1257e-02 | 2,3824e-04 | 1,4171e-02 | 7,0854e-03 |
| 20 | 7,0839e-03 | 2,3395e-02 | 1,9871e-04 | 1,6510e-02 | 6,8852e-03 |
| 21 | 6,8594e-03 | 2,5398e-02 | 1,7036e-04 | 1,8709e-02 | 6,6890e-03 |
| 22 | 6,6486e-03 | 2,7279e-02 | 1,4905e-04 | 2,0779e-02 | 6,4996e-03 |
| 23 | 6,4505e-03 | 2,9046e-02 | 1,3246e-04 | 2,2728e-02 | 6,3180e-03 |
| 24 | 6,2638e-03 | 3,0712e-02 | 1,1918e-04 | 2,4568e-02 | 6,1446e-03 |

**Measured chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,1227e00 | 8,0410e00 |
| 2 | 8,1082e00 | 8,0295e00 |
| 3 | 8,0954e00 | 8,0194e00 |
| 4 | 8,0815e00 | 8,0083e00 |
| 5 | 8,0679e00 | 7,9974e00 |
| 6 | 8,0563e00 | 7,9877e00 |
| 7 | 8,0435e00 | 7,9782e00 |
| 8 | 8,0353e00 | 7,9711e00 |
| 9 | 8,0241e00 | 7,9621e00 |
| 10 | 8,0150e00 | 7,9555e00 |
| 11 | 8,0080e00 | 7,9500e00 |
| 12 | 7,9995e00 | 7,9420e00 |
| 13 | 7,9915e00 | 7,9371e00 |
| 14 | 7,9883e00 | 7,9350e00 |
| 15 | 7,9866e00 | 7,9327e00 |
| 16 | 7,9863e00 | 7,9316e00 |
| 17 | 7,9839e00 | 7,9304e00 |
| 18 | 7,9832e00 | 7,9302e00 |
| 19 | 7,9831e00 | 7,9294e00 |
| 20 | 7,9819e00 | 7,9284e00 |
| 21 | 7,9825e00 | 7,9286e00 |
| 22 | 7,9811e00 | 7,9285e00 |
| 23 | 7,9819e00 | 7,9283e00 |
| 24 | 7,9821e00 | 7,9281e00 |

**Calculated chemical shifts**

| Point | Ha | Hb |
|---|---|---|
| 1 | 8,1221e00 | 8,0407e00 |
| 2 | 8,1085e00 | 8,0298e00 |
| 3 | 8,0950e00 | 8,0190e00 |
| 4 | 8,0818e00 | 8,0084e00 |
| 5 | 8,0689e00 | 7,9981e00 |
| 6 | 8,0564e00 | 7,9882e00 |
| 7 | 8,0445e00 | 7,9787e00 |
| 8 | 8,0335e00 | 7,9699e00 |
| 9 | 8,0236e00 | 7,9620e00 |
| 10 | 8,0151e00 | 7,9552e00 |
| 11 | 8,0081e00 | 7,9496e00 |

| | | | | | |
|---|---|---|---|---|---|
| 12 | 7,9984e00 | 7,9419e00 | 19 | 7,9829e00 | 7,9295e00 |
| 13 | 7,9928e00 | 7,9374e00 | 20 | 7,9822e00 | 7,9289e00 |
| 14 | 7,9895e00 | 7,9347e00 | 21 | 7,9818e00 | 7,9286e00 |
| 15 | 7,9874e00 | 7,9331e00 | 22 | 7,9814e00 | 7,9283e00 |
| 16 | 7,9859e00 | 7,9319e00 | 23 | 7,9811e00 | 7,9281e00 |
| 17 | 7,9845e00 | 7,9308e00 | 24 | 7,9809e00 | 7,9279e00 |
| 18 | 7,9835e00 | 7,9300e00 | | | |

Chemical shifts for each nucleus

| Species | Ha | Hb |
|---|---|---|
| NISac | 8,1221e00 | 8,0407e00 |
| **3** | 0,0000e00 | 0,0000e00 |
| **3**•NISac | 7,9782e00 | 7,9257e00 |

Converged in 2 iterations with sigma = 0,655155

| | Value | Standard deviation | Comments |
|---|---|---|---|
| log beta(**3**•NISac) | 3.3219 | 0.0128 | 3.32(1) |

## 16. $^{1}$H NMR titration experiments for 4•NISac in acetone-$d_6$

No chemical shift observed upon titration.

## 17. Job plots for *N*-oxide NIS complexes

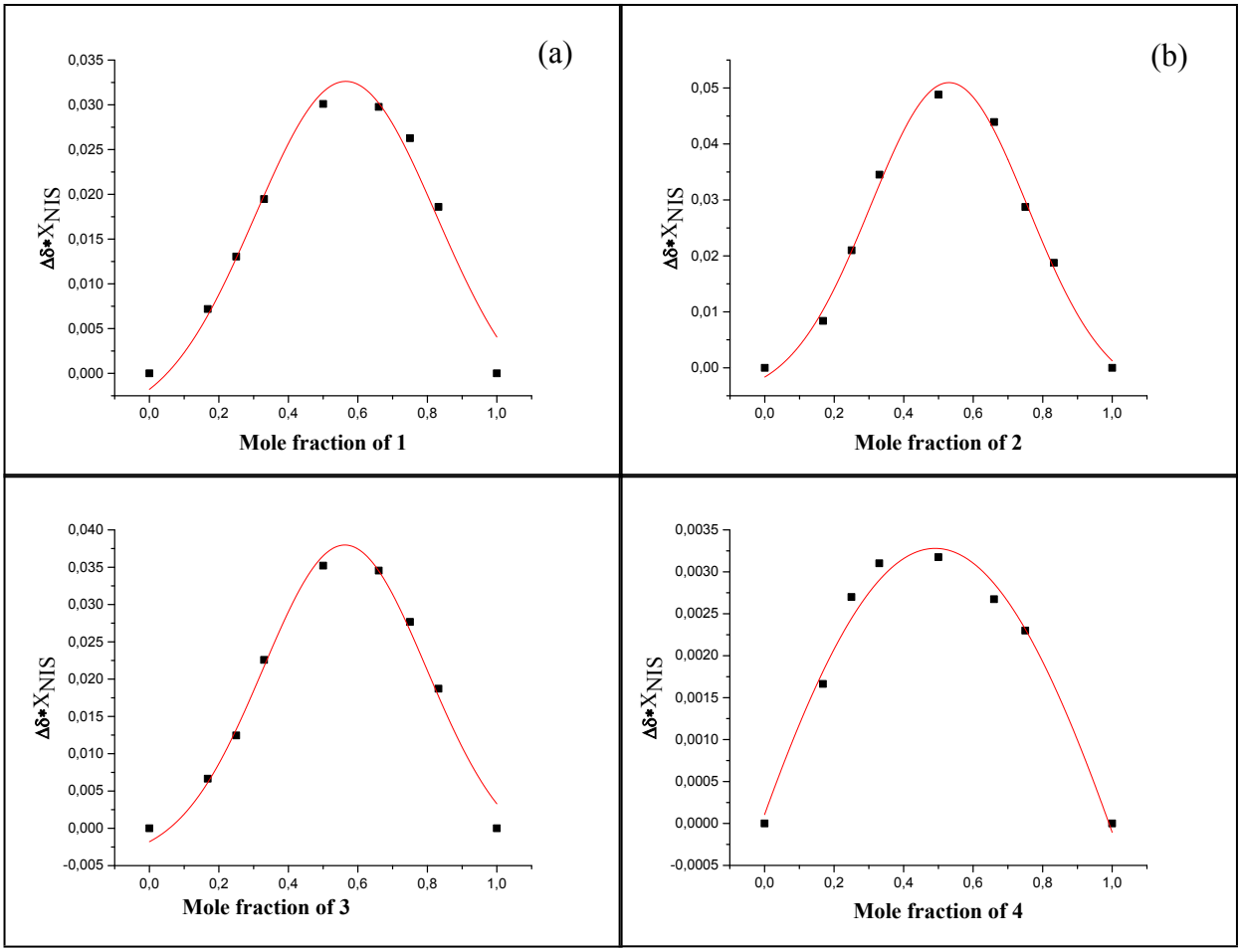


**Figure S29.** Job plots of NIS with **1** (a), **2** (b), **3** (c) and **4** (d) in $CDCl_3$. The results indicate 1:1 binding mode.

**18. Job plots for *N*-oxide NISac complexes**

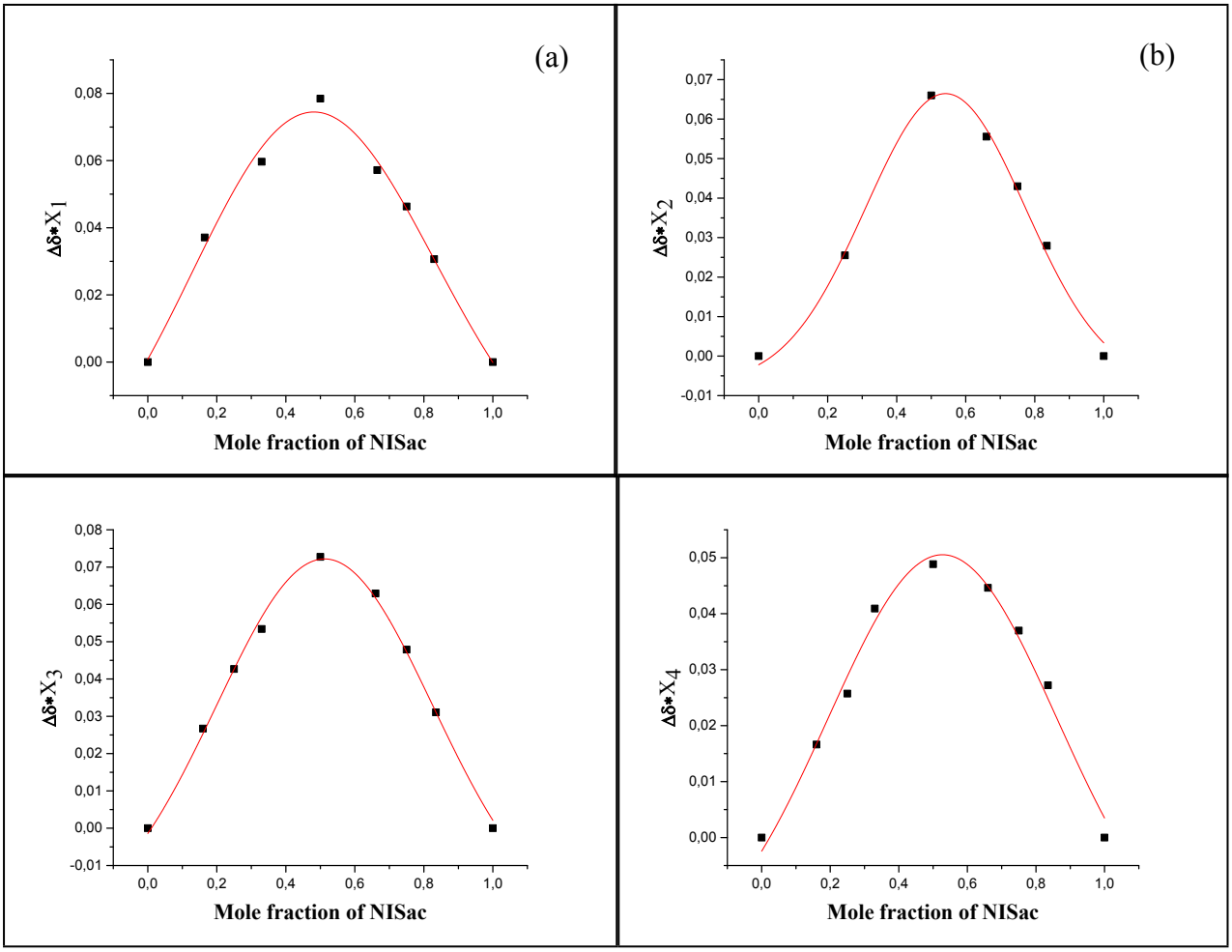


**Figure S30.** Job plots of NISac with a) **1** (a), **2** (b), **3** (a) and **4** (d) in $CDCl_3$. The results indicate 1:1 binding mode.

## 19. HMBC-$^{15}$N NMR spectra for acceptors, donor and their XB complexes

Table S1. HMBC-$^{15}$N NMR chemical shifts for XB complexes

| HMBC-$^{15}$N NMR chemical shifts (ppm)[#] | | | HMBC-$^{15}$N NMR chemical shifts (ppm) for | | HMBC-$^{15}$N NMR chemical shift differences (Δδ ppm) for | |
|---|---|---|---|---|---|---|
| | | Complex | Donor[#] | Acceptor | Donor | Acceptor |
| **1** | -90.1 | **1**•NIS | -257.4 | -99.3 | 25.6 | 9.2 |
| **2** | -92.7 | **2**•NIS | -257.5 | -104.7 | 25.5 | 12.0 |
| **3** | -93.4 | **3**•NIS | -262.7 | -105.8 | 19.5 | 12.4 |
| **4** | -77.6, -19.6($NO_2$) | **4**•NIS | -270.4 | -81.6 | 12.6 | 4.0 |
| | | **1**•NISac | N/A | -102.6 | -- | 12.5 |
| | | **2**•NISac | N/A | -101.5 | -- | 8.8 |
| | | **3**•NISac | N/A | -101.6 | -- | 8.2 |
| | | **4**•NISac | N/A | -88.6 | -- | 11.0 |

[#]HMBC-15N NMR shifts (ppm) for NIS [-283.0]. N/A: The HMBC-15N NMR chemical shifts for NISac are not available due to lack of protons at 3-position from nitrogen.

As the halogen bonding is expected to induce some changes in the chemical environment of the *N*-oxide group, both in the O and N atoms, but due to the extremely low sensitivity of the $^{17}$O NMR the changes in the $^{-}$N-X$^{+}$•••$^{-}$O-N$^{+}$ motif was monitored using Heteronuclear Multiple Bond Correlation (HMBC) $^{15}$N NMR. As shown in below Figures S31-S43 and Table S1, the nitrogen atom of the *N*-oxide experiences a shielding effect causing upfield shifts in between 4.0-12.4 ppm and 8.2-12.5 ppm in the NIS and NISac complexes, respectively. Simultaneously, the nitrogen atom in NIS donor molecule experiences a corresponding deshielding effect by 12.6 - 25.6 ppm. The $^{15}$N chemical shifts in NISac could not be obtained due to lack of protons at the 3-position from the N atom.

The observed $^{15}$N NMR chemical shift changes in $CDCl_3$ do not follow the trend observed via the $^{1}$H NMR titrations suggesting additional effects on the *N*-oxide group, especially for the NISac complexes, where the binding is too strong to be reliable measured. It seems that the *N*-oxide nitrogen is especially sensitive to chemical shift changes and does not seem to correlate solely with the halogen bonds observed. This may also be due to the fact that the XB donor is the N-oxide oxygen, not the formally positively charged nitrogen atom and thus other effects like solvent or concentration effects, pi-pi interactions or other secondary interactions might influence and perturb the $^{15}$N chemical shifts and will make it difficult or impossible to reliably rationalize and correlate the $^{1}$H NMR based XB association constants with the observed $^{15}$N NMR Δδ values.

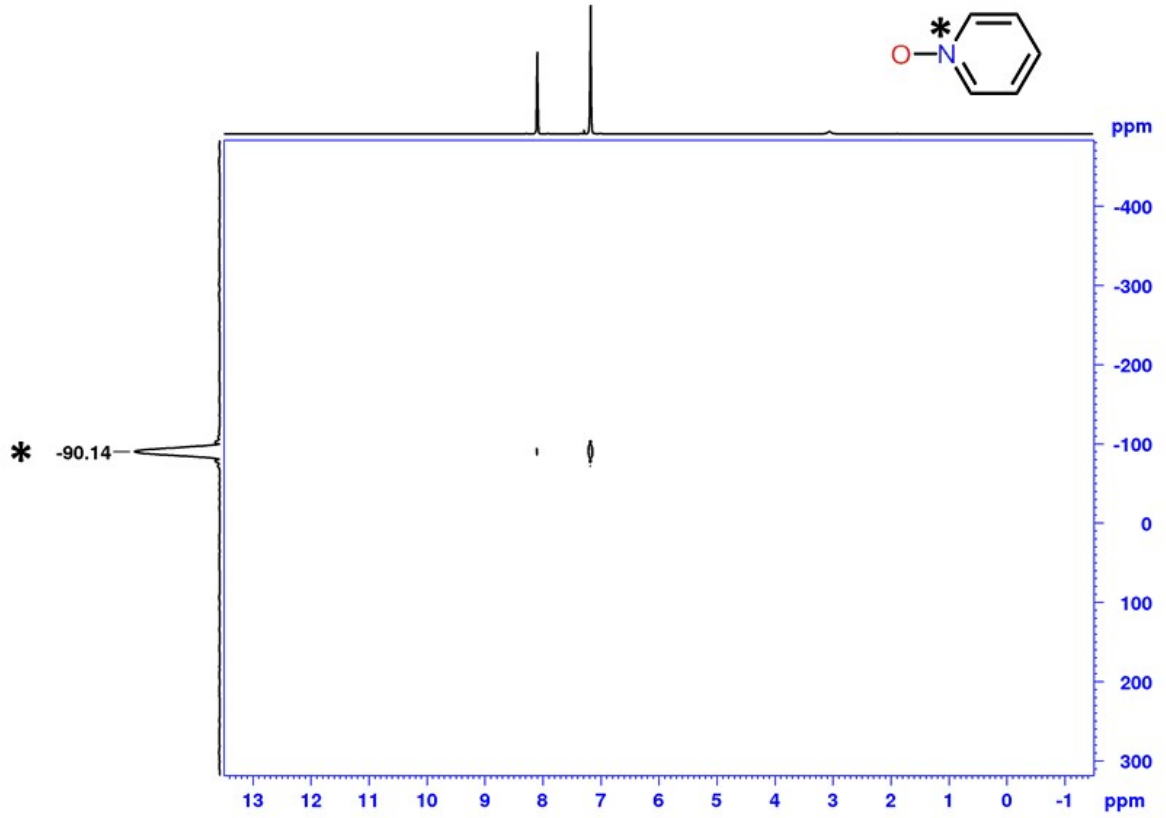


**Figure S31**. HMBC-$^{15}$N NMR spectra for **1** in $CDCl_3$.

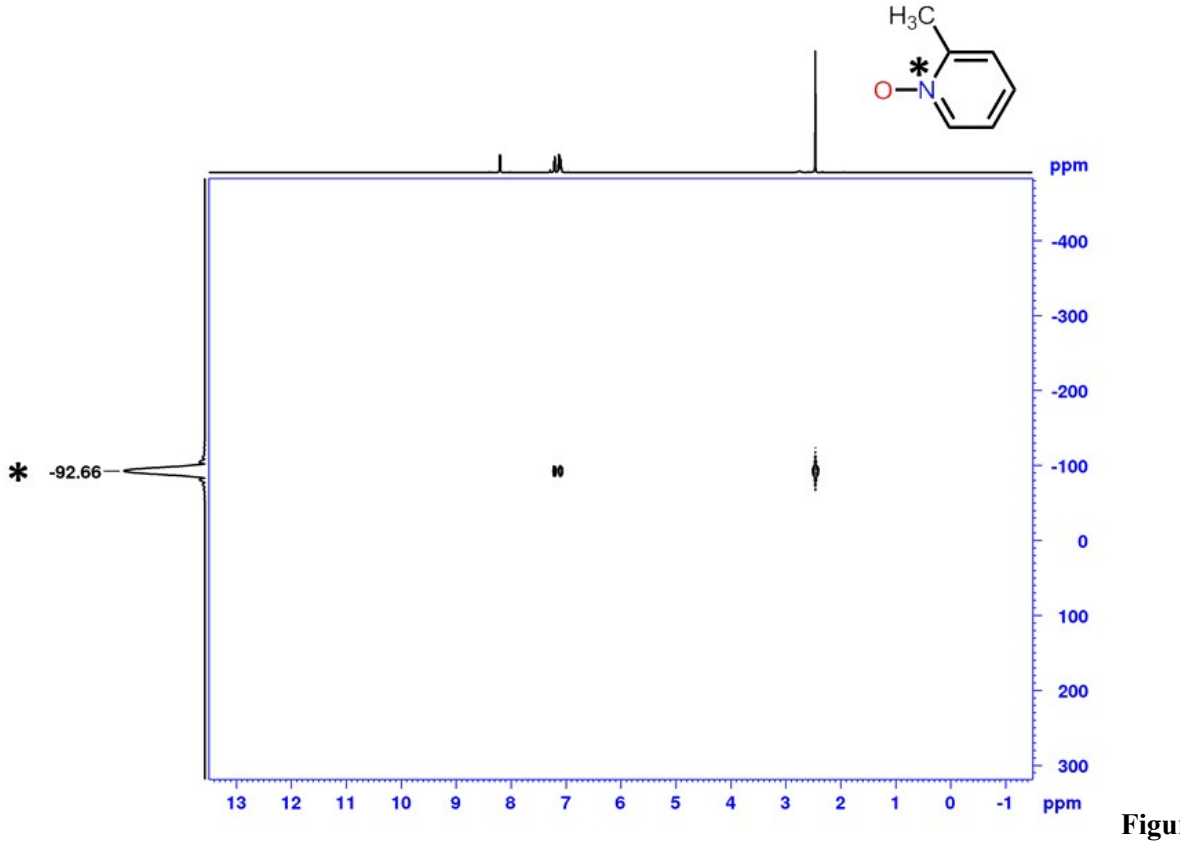


**Figure S32**. HMBC-$^{15}$N NMR spectra for **2** in $CDCl_3$.

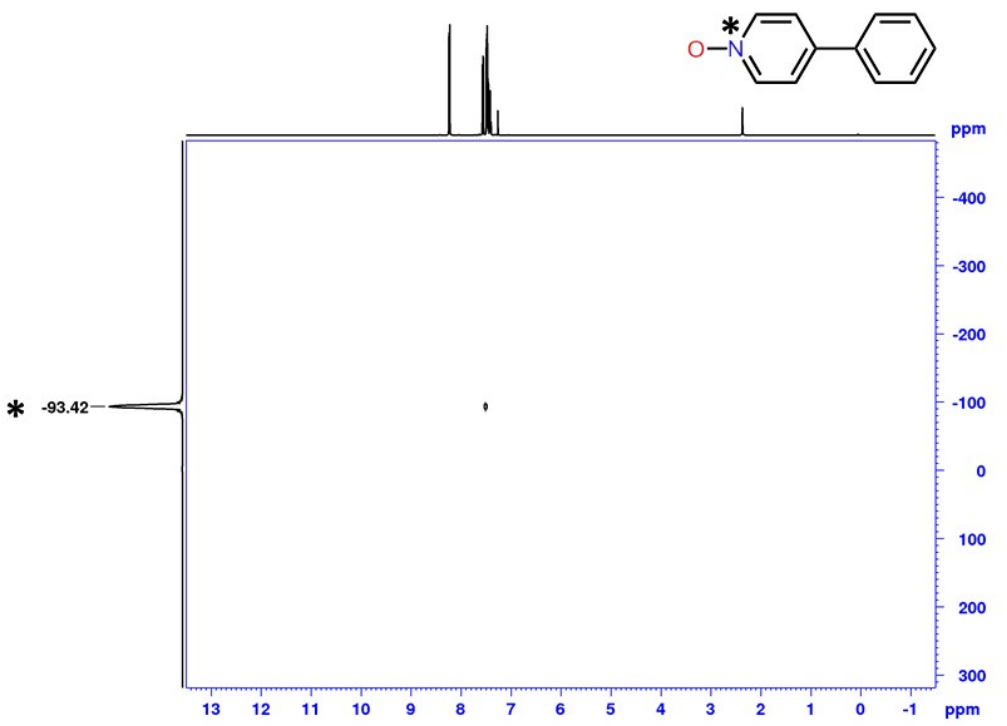


**Figure S33**. HMBC-$^{15}$N NMR spectra for **3** in $CDCl_3$.

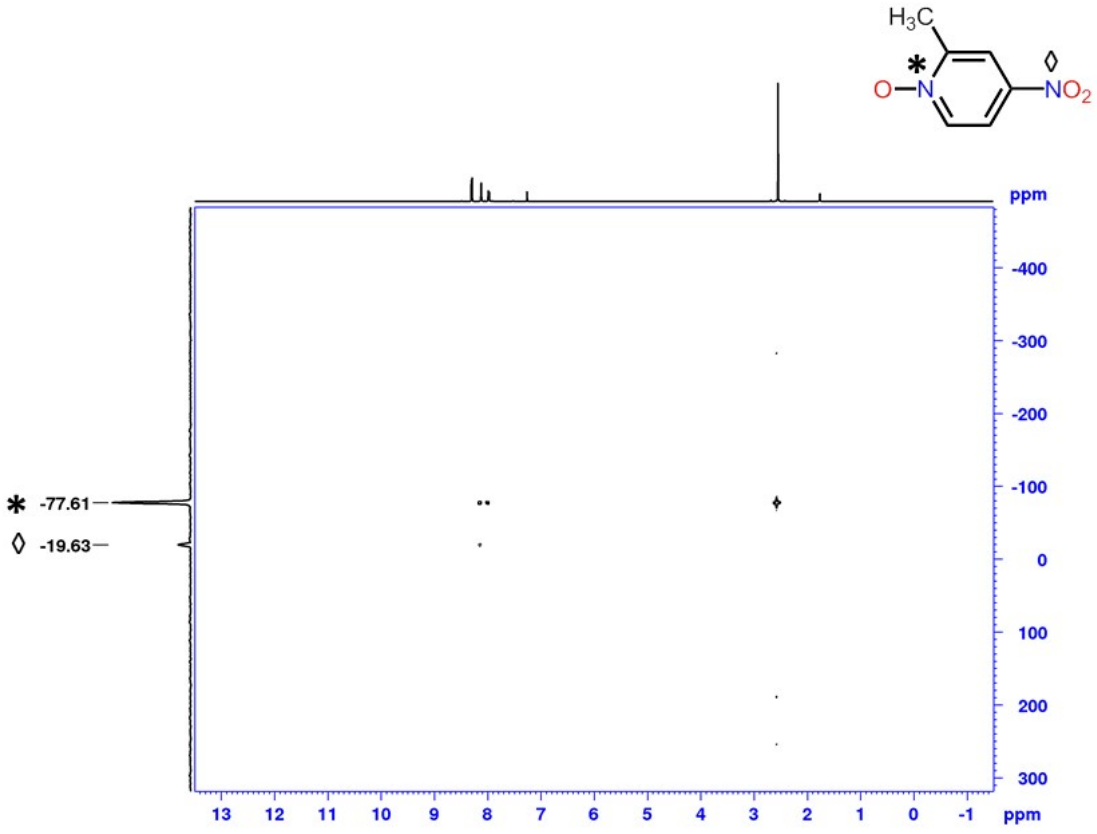


**Figure S34**. HMBC-$^{15}$N NMR spectra for **4** in $CDCl_3$.

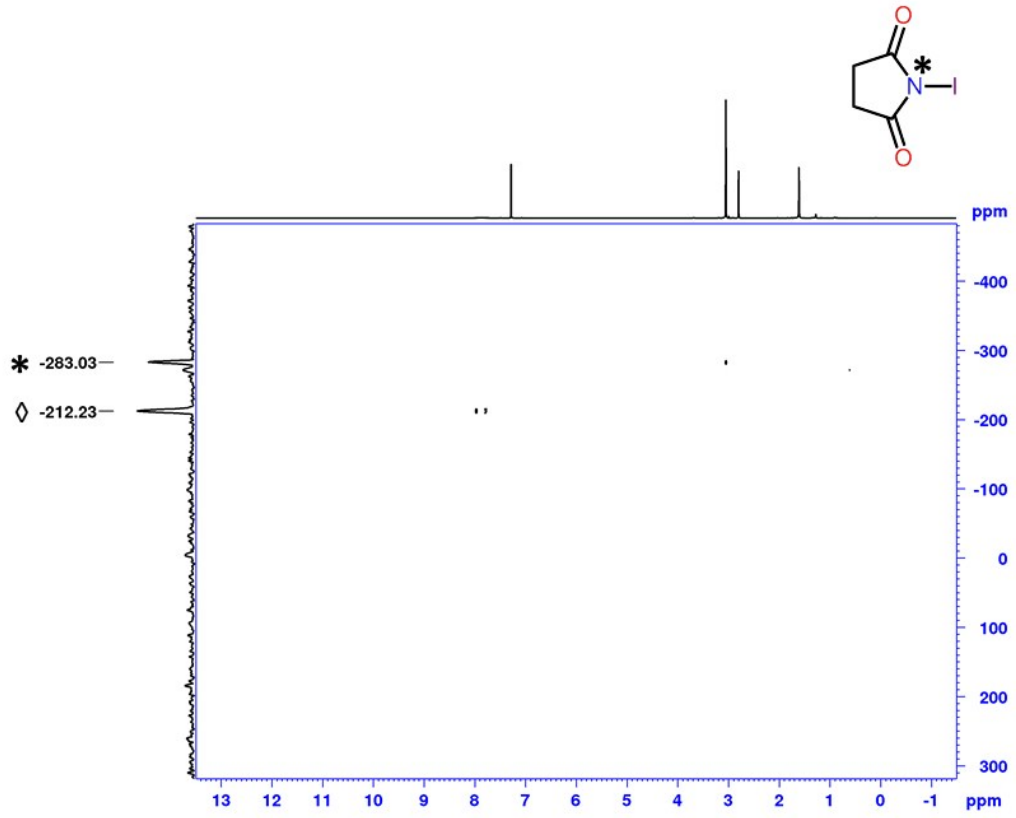


**Figure S35**. HMBC-$^{15}$N NMR spectra for NIS in $CDCl_3$. (**Note:** ◊ degradation of NIS to SNH)

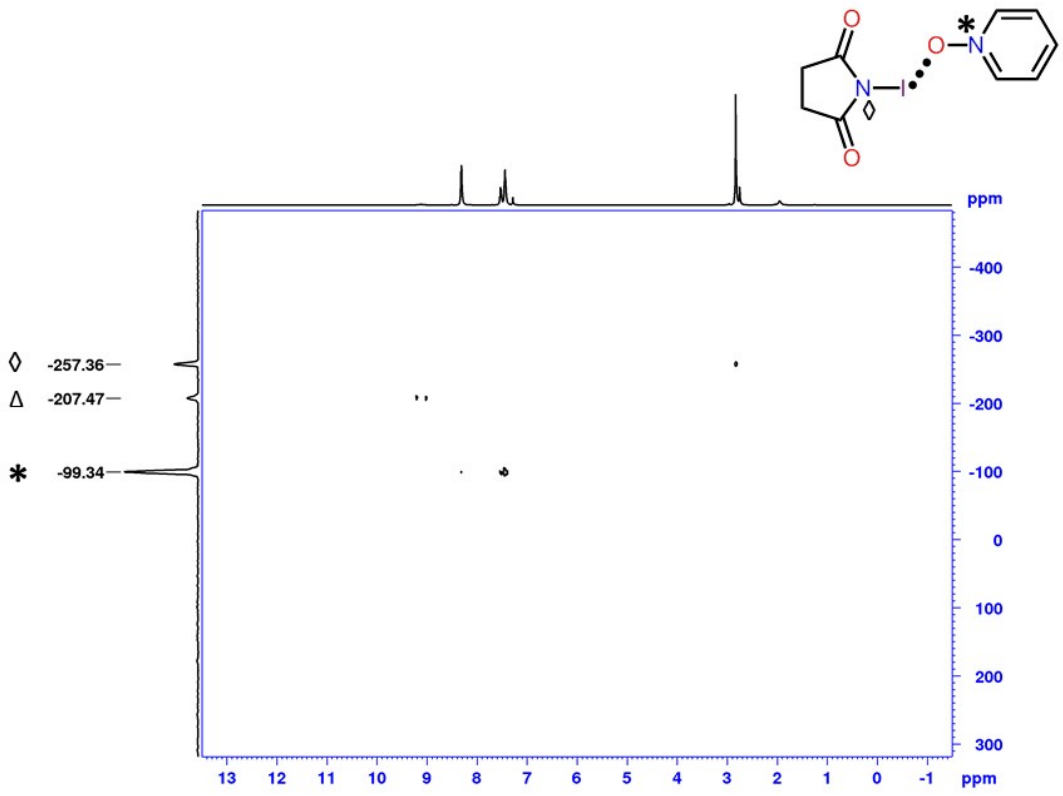


**Figure S36**. HMBC-$^{15}$N NMR spectra for **1**•NIS in $CDCl_3$. (**Note:** Δ degradation of NIS to SNH)

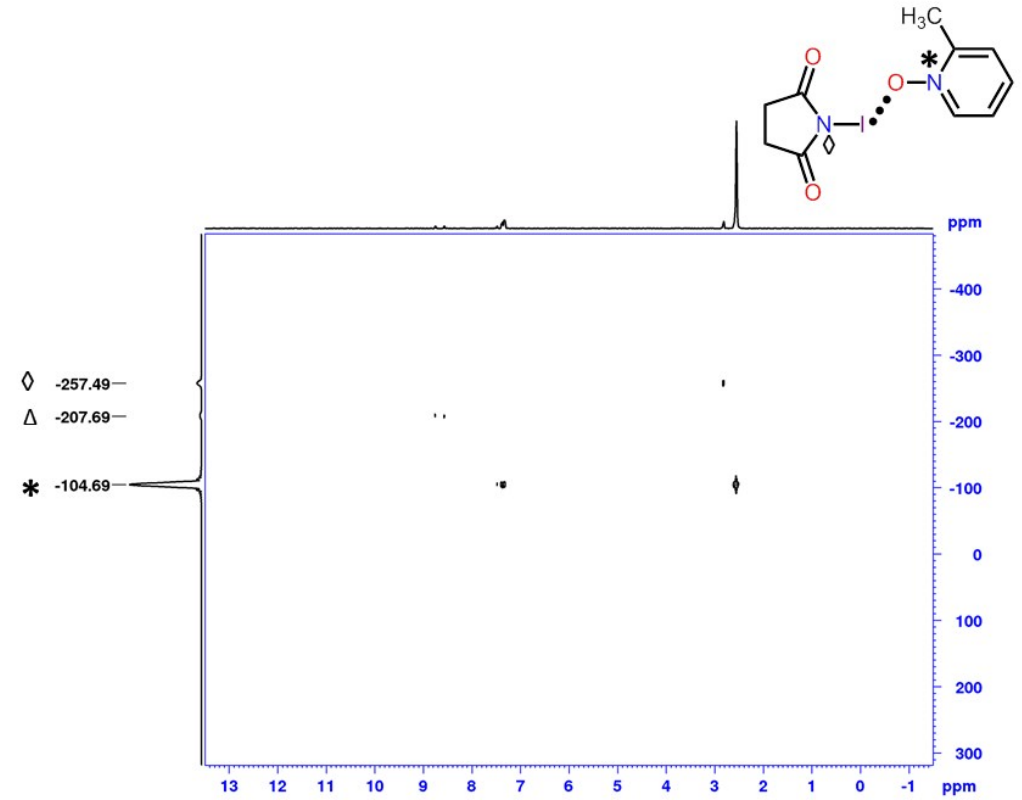


**Figure S37**. HMBC-$^{15}$N NMR spectra for **2**•NIS in $CDCl_3$. (**Note:** Δ degradation of NIS to SNH)

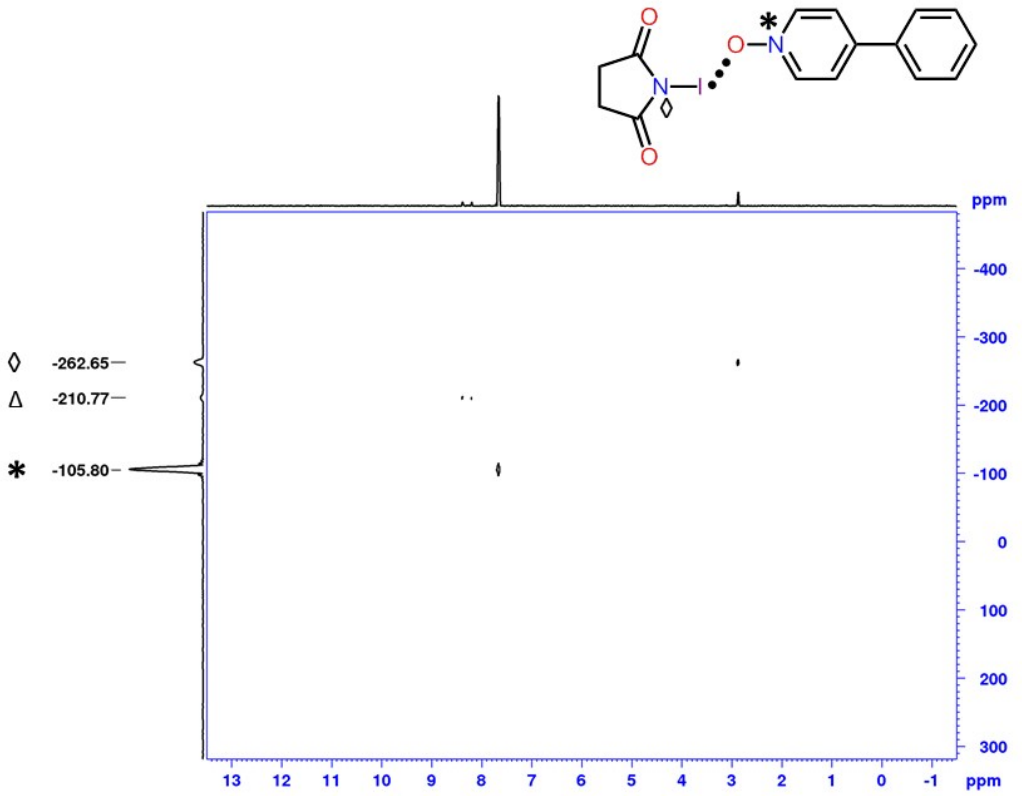


**Figure S38**. HMBC-$^{15}$N NMR spectra for **3**•NIS in $CDCl_3$. (**Note:** Δ degradation of NIS to SNH)

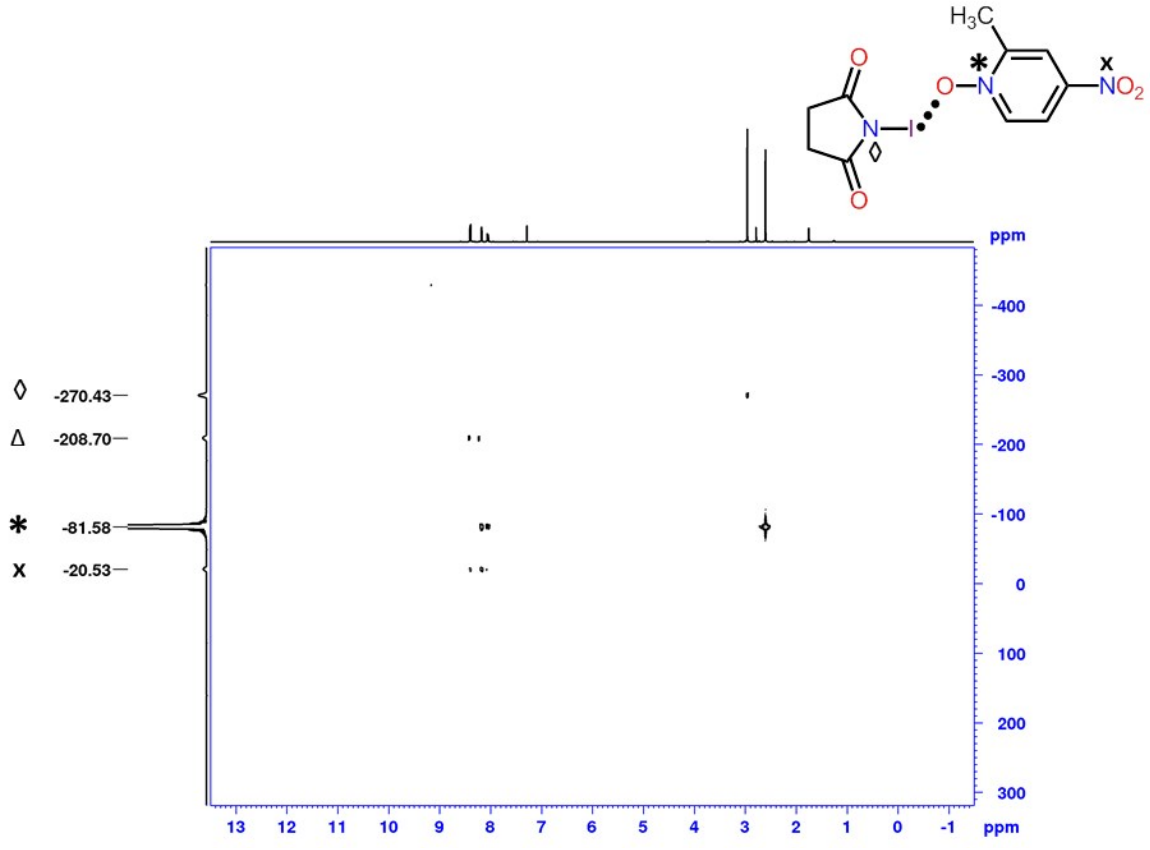


**Figure S39**. HMBC-$^{15}$N NMR spectra for **4**•NIS in $CDCl_3$. (**Note:** Δ degradation of NIS to SNH)

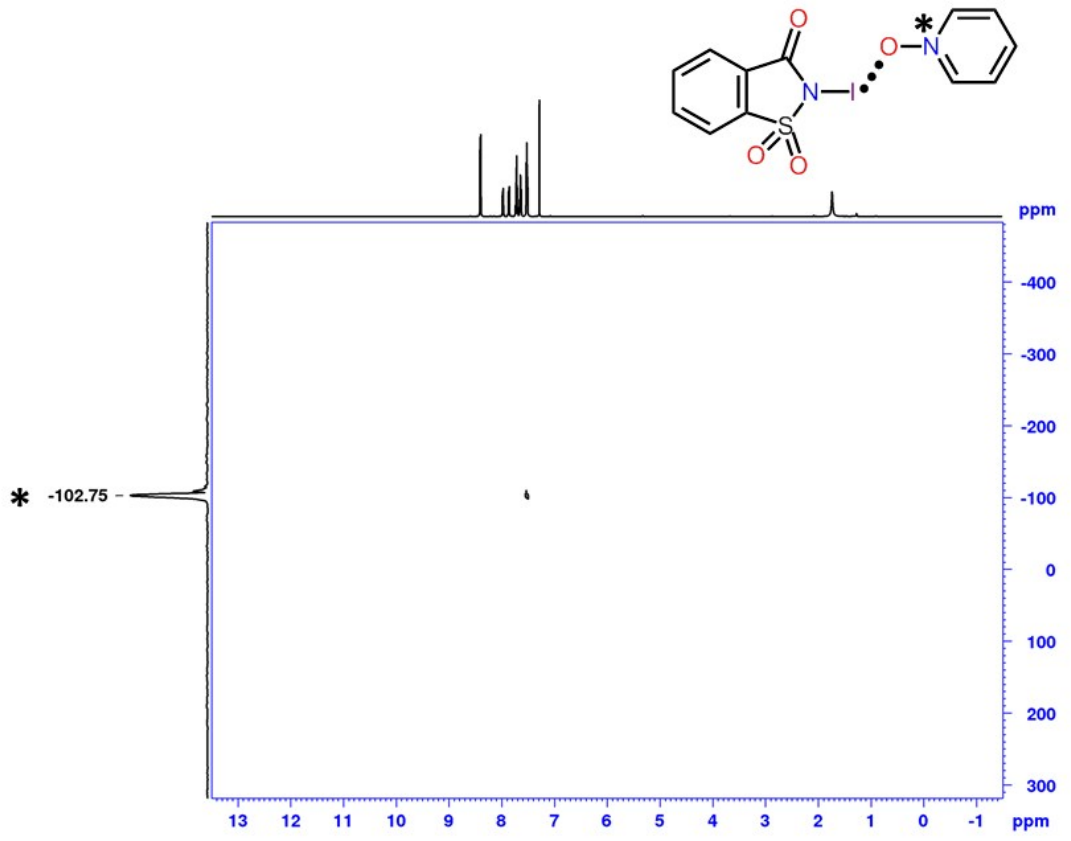


**Figure S40**. HMBC-$^{15}$N NMR spectra for **1**•NISac in $CDCl_3$.

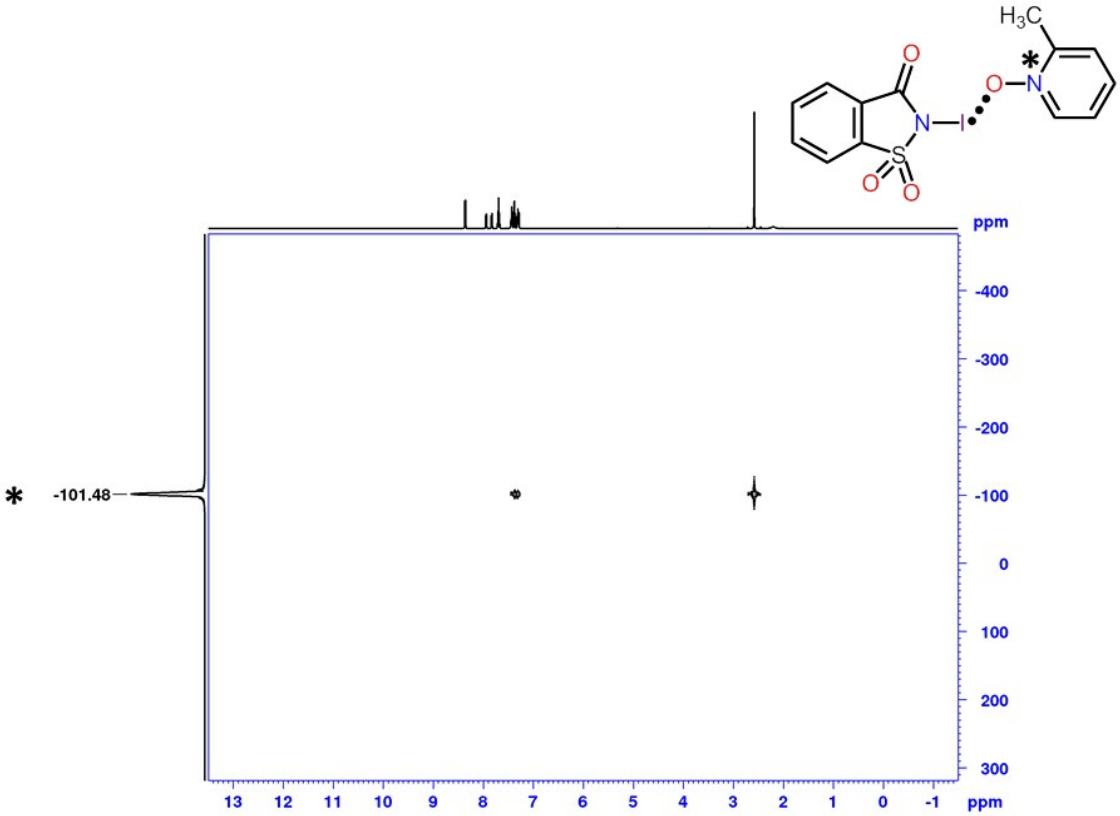


**Figure S41**. HMBC-$^{15}$N NMR spectra for **2**•NISac in $CDCl_3$.

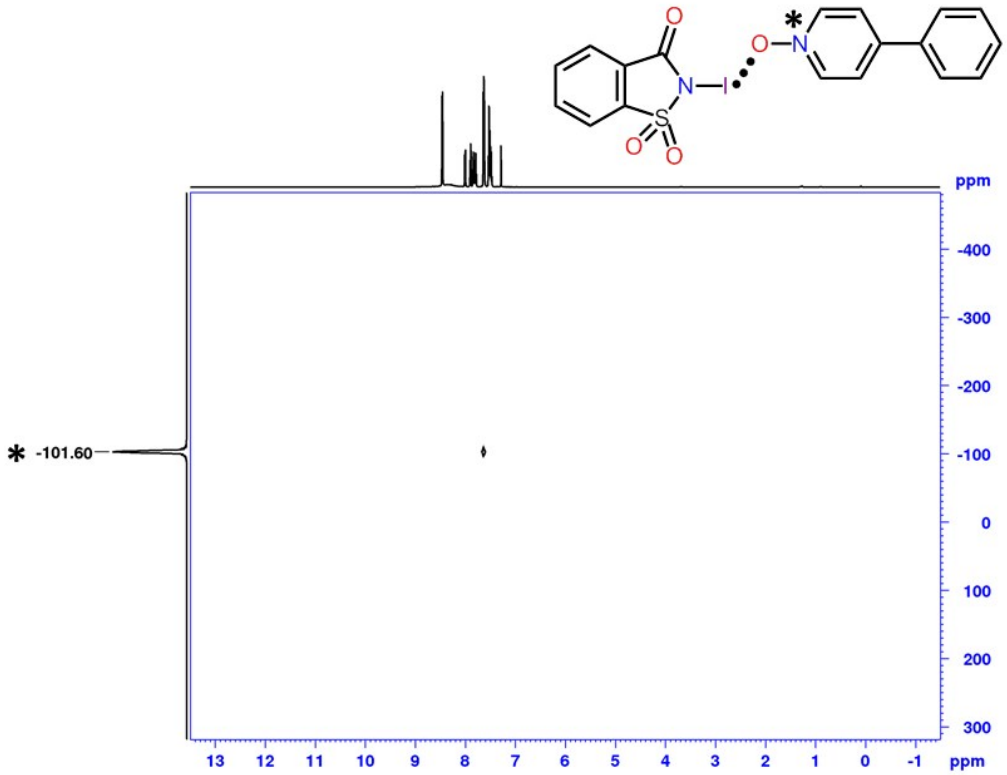


**Figure S42**. HMBC-$^{15}$N NMR spectra for **3**•NISac in $CDCl_3$.

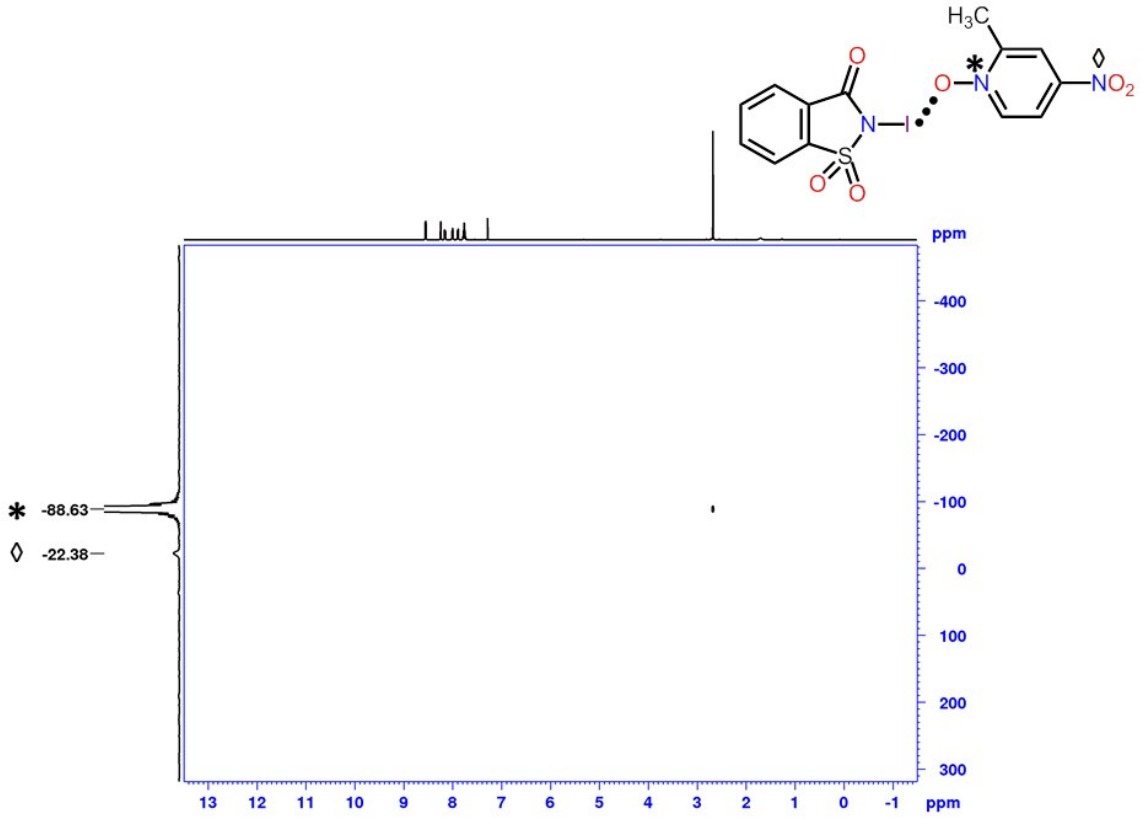


**Figure S43**. HMBC-$^{15}$N NMR spectra for **4**•NISac in $CDCl_3$.

## III X-ray Crystallography

### X-ray experimental

Single crystal X-ray data for **1**•NIS**, 2**•NIS**, 3**•NIS**, 1**•NISac**, 2**•NISac and **3**•NISac were collected at 170 K using a Bruker-Nonius Kappa CCD diffractometer with an APEX-II detector and graphite monochromatized Mo-Kα (λ = 0.71073 Å) radiation; the data for **1**•NHSac and **2**•NHSac was measured either at 123K or 120 K with Agilent SuperNova single-source diffractometer equipped with an Atlas EoS CCD detector using mirror-monochromated Mo-*K*α (λ = 0.71073 Å) radiation. The data collection and reduction for **1**•NIS**, 2**•NIS**, 3**•NIS**, 1**•NISac**, 2**•NISac and **3**•NISac were performed using the program *COLLECT*[3] and *HKL DENZO AND SCALEPACK*[4]. The data collection and reduction for **1**•NHSac and **2**•NHSac are performed using the program *CrysAlisPro*[5]. For **1**•NIS**, 2**•NIS**, 3**•NIS**, 1**•NISac**, 2**•NISac and **3**•NISac, the intensities were corrected for absorption using *SADABS*[6] with multi-scan absorption correction type method, and Gaussian face index absorption correction method[5] was used for **1**•NHSac and **2**•NHSac. All the structures were solved with direct methods (*SHELXS*[7]) and refined by full-matrix least squares on $F^2$ using the *OLEX2*[8], which utilizes the *SHELXL*-2013 module[7]. Constraints (EADP) and restraints (DFIX and ISOR) are used where appropriate.

**Table S2a.** Crystallographic details for structures **1**•NIS, **2**•NIS, **3**•NIS, and **1**•NISac

| Complex | **1**•NIS | **2**•NIS | **3**•NIS | **1**•NISac |
|---|---|---|---|---|
| CCDC depos. No. | 1426136 | 1426137 | 1426138 | 1426139 |
| Empirical formula | $C_9H_9IN_2O_3$ | $C_{20}H_{24}I_2N_4O_7$ | $C_{15}H_{13}IN_2O_3$ | $C_{12}H_9IN_2O_4S$ |
| Formula weight | 320.08 | 686.23 | 396.17 | 404.17 |
| Temperature (K) | 170.0 | 170.0 | 170.0 | 170.0 |
| Crystal system | Triclinic | Triclinic | Orthorhombic | Monoclinic |
| Space group | *P*-1 | *P*-1 | $P2_12_12_1$ | $P2_1/c$ |
| Unit cell dimensions: a (Å) | 8.154(2) | 9.729(2) | 5.7923(12) | 7.1370(14) |
| b (Å) | 11.633(2) | 11.427(2) | 8.4216(17) | 22.707(5) |
| c (Å) | 12.467(3) | 11.566(2) | 29.710(6) | 8.8248(18) |
| α (°) | 67.55(3) | 90.02(3) | 90 | 90 |
| β (°) | 76.11(3) | 110.88(3) | 90 | 90.68(3) |
| γ (°) | 76.47(3) | 93.06(3) | 90 | 90 |
| Volume / Å$^3$ | 1047.5(5) | 1199.4(5) | 1449.2(5) | 1430.1(5) |
| Z | 4 | 2 | 4 | 4 |
| Density (calculated) Mg/m$^3$ | 2.030 | 1.900 | 1.816 | 1.877 |
| Absorption Coefficient mm$^{-1}$ | 3.046 | 2.670 | 2.221 | 2.398 |
| F(000) | 616 | 668 | 776 | 784 |
| Crystal size (mm$^3$) | 0.25×0.23×0.23 | 0.48×0.36×0.30 | 0.19×0.18×0.11 | 0.14 x 0.13 x 0.13 |
| θ range for data collection (°) | 2.61 to 25.25 | 1.80 to 25.24 | 2.51 to 25.24 | 1.79 to 25.25 |
| Reflections collected [R(int)] | 10999[0.0218] | 12583[0.0269] | 24654[0.0363] | 8791 [0.0642] |
| Observed reflections [I>2σ(I)] | 3465 | 3893 | 2544 | 1946 |
| Data completeness (%) | 99.34 | 99.9 | 99.99 | 99.90 |
| Data/ restraints/ parameters | 3754/0/271 | 4354/0/303 | 2592/0/190 | 2576/18/170 |
| Goodness-of-fit on $F^2$ | 1.043 | 1.044 | 1.163 | 1.048 |
| Final $R_1$ indices [I>2σ(I)] | $R_1$ = 0.0187, $wR_2$ = 0.0415 | $R_1$ = 0.0229, $wR_2$ = 0.0478 | $R_1$ = 0.0383, $wR_2$ = 0.1368 | $R_1$ = 0.0614, $wR_2$ = 0.1111 |
| Final R indices [all data] | $R_1$ = 0.0210, $wR_2$ = 0.0425 | $R_1$ = 0.0273, $wR_2$ = 0.0493 | $R_1$ = 0.0396, $wR_2$ = 0.1375 | $R_1$ = 0.0891, $wR_2$ = 0.1217 |
| Largest diff. peak/hole (e.Å$^{-3}$) | 0.411/ -0.505 | 0.405/-0.471 | 0.695/-1.388 | 0.797/ -0.779 |

**Table S2b.** Crystallographic details for structures **2**•NISac, **3**•NISac, **1**•NHSac, and **2**•NHSac

| Complex | **2**•NISac | **3**•NISac | **1**•NHSac | **2**•NHSac |
|---|---|---|---|---|
| CCDC depos. No. | 1426140 | 1426141 | 1426142 | 1426143 |
| Empirical formula | $C_{13}H_{11}IN_2O_4S$ | $C_{18}H_{13}IN_2O_4S$ | $C_{12}H_{10}N_2O_4S$ | $C_{13}H_{12}N_2O_4S$ |
| Formula weight | 418.20 | 480.26 | 278.28 | 292.31 |
| Temperature (K) | 170.0 | 170.0 | 123.0 | 120.0 |
| Crystal system | Triclinic | Monoclinic | Triclinic | Monoclinic |
| Space group | *P*-1 | $P2_1/c$ | *P*-1 | $P2_1/c$ |
| Unit cell dimensions: a (Å) | 7.271(2) | 12.277(3) | 6.8571(4) | 14.1204(10) |
| b (Å) | 8.763(2) | 10.283(2) | 8.4482(5) | 6.8482(4) |
| c (Å) | 12.765(3) | 14.972(3) | 11.3117(6) | 14.7897(13) |
| α (°) | 109.12(3) | 90 | 98.755(5) | 90 |
| β (°) | 99.97(3) | 106.71(3) | 106.766(5) | 112.860(10) |
| γ (°) | 90.54(3) | 90 | 93.582(5) | 90 |
| Volume / Å$^3$ | 754.9(3) | 1810.3(7) | 616.19(6) | 1317.83(19) |
| Z | 2 | 4 | 2 | 4 |
| Density (calculated) Mg/m$^3$ | 1.840 | 1.762 | 1.500 | 1.473 |
| Absorption Coefficient mm$^{-1}$ | 2.275 | 1.910 | 0.274 | 0.260 |
| F(000) | 408 | 944 | 288 | 608 |
| Crystal size (mm$^3$) | 0.27 x 0.17 x 0.16 | 0.22 x 0.17 x 0.13 | 0.23×0.09×0.05 | 0.31 x 0.05 x 0.04 |
| θ range for data collection (°) | 1.72 to 25.25 | 1.73 to 25.25 | 3.12 to 25.25 | 3.33 to 25.25 |
| Reflections collected [R(int)] | 7107 [0.0266] | 16159 [0.0636] | 4086 [0.0300] | 4484 [0.0364] |
| Observed reflections [I>2σ(I)] | 2489 | 2144 | 1968 | 1695 |
| Data completeness (%) | 99.70 | 99.99 | 99.88 | 99.12 |
| Data/ restraints/ parameters | 2738/0/191 | 3276/0/235 | 2224/0/176 | 2377/0/186 |
| Goodness-of-fit on F$^2$ | 1.063 | 1.010 | 1.162 | 1.073 |
| Final $R_1$ indices [I>2σ(I)] | $R_1$ = 0.0264, $wR_2$ = 0.0593 | $R_1$ = 0.0392, $wR_2$ = 0.0637 | $R_1$ = 0.0373, $wR_2$ = 0.0969 | $R_1$ = 0.0528, $wR_2$ = 0.1303 |
| Final R indices [all data] | $R_1$ = 0.0307, $wR_2$ = 0.0606 | $R_1$ = 0.0785, $wR_2$ = 0.0734 | $R_1$ = 0.0433, $wR_2$ = 0.1015 | $R_1$ = 0.0780, $wR_2$ = 0.1483 |
| Largest diff. peak/hole (e.Å$^{-3}$) | 0.378/ -0.286 | 0.468/ -0.321 | 0.240/-0.593 | 0.268/ -0.656 |

## VI References


1. Olivo, G.; Lanzalunga, O.; Mandolini, L.; Di Stefano, S. *J. Org. Chem.* **2013**, *78*, 11508–11512.
2. Frassineti, C.; Ghelli, S.; Gans, P.; Sabatini, A.; Moruzzi, M. S.; Vacca, A. *Anal. Biochem.* **1995**, *231*, 374–382.
3. Bruker AXS BV, Madison, WI, USA; 1997–2004.
4. Otwinowski, Z.; Minor, W. *Methods Enzymol.* **1997**, *276*, 307–326.
5. *CrysAlisPro* **2014**, Agilent Technologies. Version 1.171.36.35.
6. Blessing, *J. Appl. Cryst.* **1997**, *30*, 421–426.
7. Sheldrick, G. M. *Acta Cryst. A* **2008**, *64*, 112–122.
8. Dolomanov, O. V.; Bourhis, L. J.; Gildea, R. J.; Howard, J. A. K.; Puschmann, H. *J. Appl. Cryst.* **2009**, *42*, 339–341.