Supplementary material (ESI) for Organic & Biomolecular Chemistry

Selective binding of L-glutamate derivative in aqueous solvents

Sandra Bartoli, Tariq Mahmood, Abdul Malik, Sally Dixon and Jeremy D. Kilburn

Electronic supplementary information

NMR and ITC Titration data for all binding studies reported in manuscript

NMR titration of macrocycle **3** with *N*-Boc-D-Glu in D_6-DMSO.

Starting volume/μL: 600

[Host]/mM: 1.30

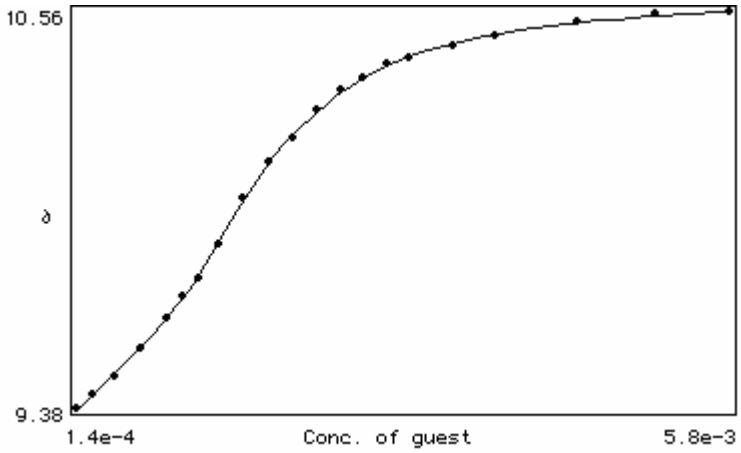
[Guest]/mM: 29

$K_a^{1:1}/M^{-1}$: ~ 10^3

$K_a^{1:2}/M^{-1}$: >10^4

δH_{sat} (1:1) (ppm) 9.70

δH_{sat} (1:2) (ppm) 10.60



Volume added/μL	δ (ppm) Amide - NH
3	9.38
6	9.41
10	9.47
15	9.55
20	9.64
23	9.71
26	9.76
30	9.86
35	10.00
40	10.11
45	10.18
50	10.26
55	10.32
60	10.36
70	10.42
80	10.45
90	10.49
110	10.53
130	10.55
150	10.56

ITC titration of macrocycle **3** with *N*-Boc-D-Glu in DMSO/H_2O (50:50):

[Host]/mM: 0.6

[Guest]/mM: 40

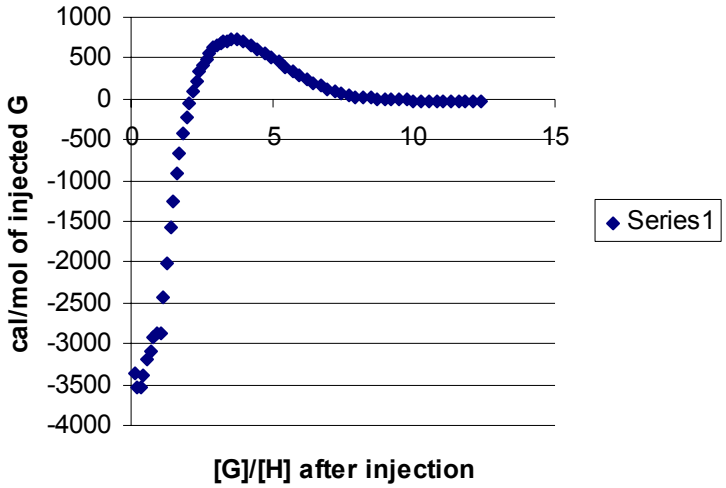
$K_a^{1:1} = 2.9 \times 10^3\ M^{-1}$

$K_a^{1:2} = 1.386 \times 10^4\ M^{-1}$

$\Delta G^{1:2} = -23.99\ kJmol^{-1}$;

$\Delta H^{1:2} = -22.54\ kJmol^{-1}$;

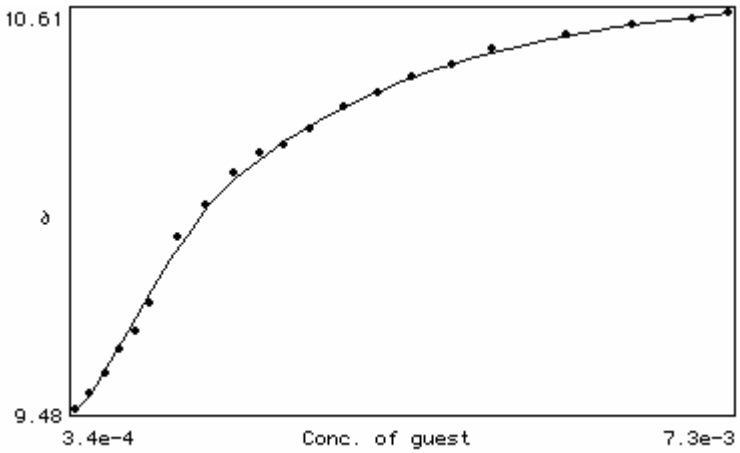
$T\Delta S^{1:2} = 1.45\ kJmol^{-1}$



[G]/[H] after injection	Cal/mol of injected G	[G]/[H] after injection	Cal/mol of injected G
0.11414	-3355.66	4.23207	662.9078
0.22848	-3526.07	4.4746	617.2797
0.34302	-3532.1	4.71791	561.6873
0.45774	-3376.05	4.962	500.7993
0.57267	-3200	5.20687	451.355
0.68779	-3102.68	5.45252	398.1656
0.8031	-2919.18	5.69895	340.0665
0.91861	-2874.01	5.94617	284.9229
1.03431	-2872.94	6.19416	230.8527
1.15021	-2422.61	6.44293	191.8997
1.26631	-2009.08	6.69248	159.643
1.3826	-1563.36	6.94281	124.1329
1.49908	-1254.65	7.19393	93.60179
1.61576	-912.507	7.44582	72.87404
1.73264	-655.315	7.6985	48.89727
1.84971	-416.778	7.95195	28.51008
1.96697	-219.6	8.20618	22.09132
2.08443	-64.3888	8.4612	13.4103
2.20209	86.65335	8.717	3.92107
2.31994	216.2006	8.97357	-2.66737
2.43798	327.6942	9.23093	-8.89121
2.55622	416.5443	9.48906	-15.2892
2.67466	496.8475	9.74798	-13.932
2.79329	550.8273	10.00768	-26.4139
2.91212	640.9916	10.26816	-25.8848
3.03114	667.3715	10.52942	-26.2386
3.15035	687.8918	10.79145	-22.9669
3.26976	707.417	11.05427	-26.4832
3.38937	700.8218	11.31787	-28.2323
3.50917	737.5929	11.58225	-26.1691
3.74936	725.2349	11.84741	-31.1196
3.99033	695.8546	12.11335	-26.8388

NMR titration of macrocyle **3** with *N*-Boc-L-Glu in D_6-DMSO.

Starting volume/μL:	600
[Host]/mM:	1.75
[Guest]/mM:	20.7
$K_a^{1:1}/M^{-1}$:	$>10^4$
$K_a^{1:2}/M^{-1}$:	$\sim 2\times10^3$
δH_{sat} (1:1) (ppm)	10.16
δH_{sat} (1:2) (ppm)	10.82



Volume added/μL	δ (ppm) Amide - NH
10	9.48
15	9.52
20	9.58
25	9.65
30	9.70
35	9.78
45	9.97
55	10.06
65	10.15
75	10.21
85	10.23
95	10.28
110	10.34
125	10.38
140	10.43
160	10.46
180	10.51
220	10.55
260	10.58
300	10.60
325	10.61

ITC titration of macrocycle **3** with *N*-Boc-L-Glu in DMSO/H_2O(50:50):

[Host]/mM 0.6

[Guest]/mM 40

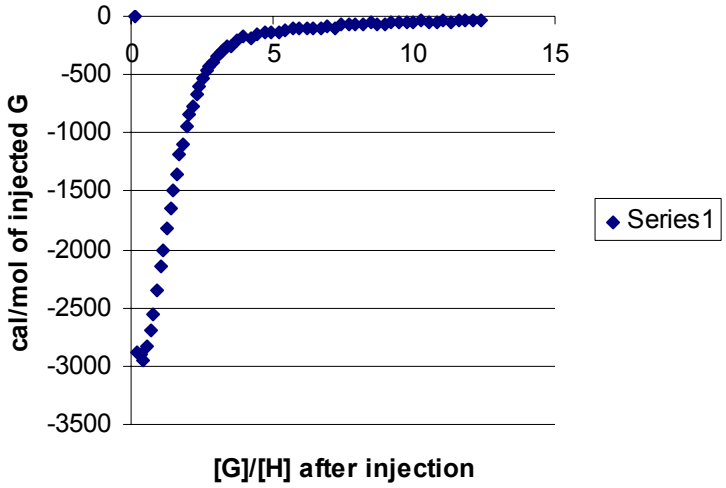
$K_a^{1:1} = 3.836 \times 10^4\ M^{-1}$

$\Delta G^{1:1} = -26.26\ kJmol^{-1}$;

$\Delta H^{1:1} = -18.11\ kJmol^{-1}$;

$T\Delta S^{1:1} = 8.15\ kJmol^{-1}$

$K_a^{1:2} \sim 2.3 \times 10^3\ M^{-1}$



[G]/[H] after injection	Cal/mole of injected G	[G]/[H] after injection	Cal/mole of injected G
0.11414	--	4.4746	-155.307
0.22848	-2884.65	4.71791	-143.315
0.34302	-2893.81	4.962	-145.45
0.45774	-2955.37	5.20687	-131.565
0.57267	-2833.86	5.45252	-122.731
0.68779	-2694.16	5.69895	-102.677
0.8031	-2553.21	5.94617	-108.988
0.91861	-2345.63	6.19416	-100.925
1.03431	-2152.92	6.44293	-98.9603
1.15021	-2005.64	6.69248	-96.7874
1.26631	-1819.81	6.94281	-87.8393
1.3826	-1639.91	7.19393	-98.9305
1.49908	-1496.8	7.44582	-73.5456
1.61576	-1347.86	7.6985	-68.8272
1.73264	-1189.68	7.95195	-67.3557
1.84971	-1096.97	8.20618	-70.6713
1.96697	-946.425	8.4612	-58.3215
2.08443	-842.62	8.717	-61.4923
2.20209	-766.995	8.97357	-64.0233
2.31994	-669.547	9.23093	-54.8148
2.43798	-601.746	9.48906	-44.1976
2.55622	-532.499	9.74798	-52.2389
2.67466	-468.131	10.00768	-46.9484
2.79329	-428.838	10.26816	-42.5249
2.91212	-391.947	10.52942	-46.7527
3.03114	-337.061	10.79145	-54.6954
3.15035	-304.089	11.05427	-41.7812
3.26976	-287.784	11.31787	-47.3425
3.38937	-257.253	11.58225	-34.6939
3.50917	-252.906	11.84741	-35.9903
3.74936	-205.89	12.11335	-35.937
3.99033	-172.282	12.38007	-36.4915
4.23207	-182.465		

4.4746	-155.307

ITC titration of macrocycle **3** with *N*-Boc-D-Asp in DMSO/H_2O (50:50)

[Host]/mM 0.6

[Guest]/mM 40

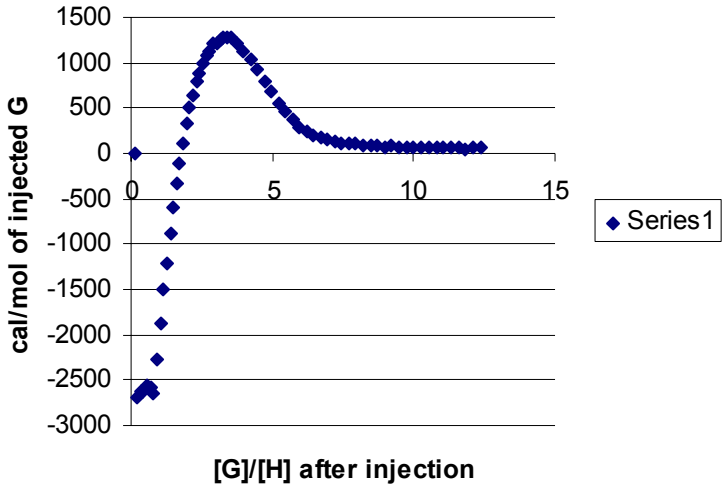
$K_a^{1:1} = 1.1 \times 10^3\ M^{-1}$

$K_a^{1:2} = 1.338 \times 10^4\ M^{-1}$

$\Delta G^{1:2} = -23.91\ kJmol^{-1}$;

$\Delta H^{1:2} = -19.53\ kJmol^{-1}$;

$T\Delta S^{1:2} = 4.38\ kJmol^{-1}$



[G]/[H] after injection	Cal/mol of injected G	[G]/[H] after injection	Cal/mol of injected G
0.11414	--	4.4746	918.1353
0.22848	-2691.08	4.71791	799.5772
0.34302	-2623.67	4.962	674.8711
0.45774	-2633.72	5.20687	561.5557
0.57267	-2554.48	5.45252	454.1763
0.68779	-2578.89	5.69895	369.3327
0.8031	-2637.87	5.94617	292.7432
0.91861	-2261.99	6.19416	246.6456
1.03431	-1883.09	6.44293	208.2474
1.15021	-1509.81	6.69248	169.8643
1.26631	-1211.23	6.94281	150.4235
1.3826	-884.455	7.19393	126.6673
1.49908	-598.89	7.44582	119.8977
1.61576	-337.045	7.6985	107.4058
1.73264	-113.3	7.95195	101.8245
1.84971	110.9895	8.20618	91.80192
1.96697	321.188	8.4612	88.291
2.08443	500.9081	8.717	83.37363
2.20209	645.1768	8.97357	75.98111
2.31994	796.2412	9.23093	78.81821
2.43798	875.4387	9.48906	74.29964
2.55622	992.1877	9.74798	68.88109
2.67466	1076.528	10.00768	66.82945
2.79329	1123.499	10.26816	64.54006
2.91212	1203.964	10.52942	58.57675
3.03114	1217.832	10.79145	64.75749
3.15035	1252.377	11.05427	56.10618
3.26976	1274.005	11.31787	59.40451
3.38937	1271.895	11.58225	56.33862
3.50917	1282.772	11.84741	54.50839
3.74936	1223.76	12.11335	56.65716
3.99033	1131.051	12.38007	57.8307

4.23207	1036.597

ITC titration of macrocycle **3** with *N*-Boc-L-Asp in DMSO/H2O (50:50):

[Host]/mM 0.6

[Guest]/mM 40

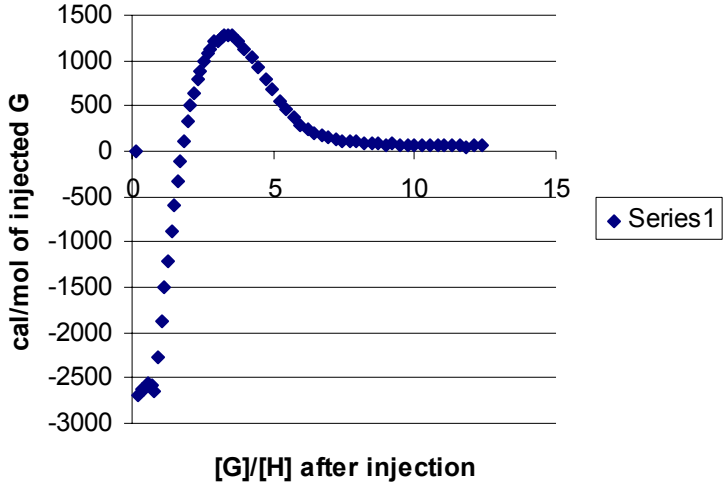
$K_a^{1:1} = 2.5 \times 10^3\ M^{-1}$

$K_a^{1:2} = 1.067 \times 10^4\ M^{-1}$

$\Delta G^{1:2} = -23.34\ kJmol^{-1}$;

$\Delta H^{1:2} = -19.25\ kJmol^{-1}$;

$T\Delta S^{1:2} = 4.09\ kJmol^{-1}$



[G]/[H] after injection	cal/mol of injected G	[G]/[H] after injection	cal/mol of injected G
0.11414	--	4.71791	799.5772
0.22848	-2691.08	4.962	674.8711
0.34302	-2623.67	5.20687	561.5557
0.45774	-2633.72	5.45252	454.1763
0.57267	-2554.48	5.69895	369.3327
0.68779	-2578.89	5.94617	292.7432
0.8031	-2637.87	6.19416	246.6456
0.91861	-2261.99	6.44293	208.2474
1.03431	-1883.09	6.69248	169.8643
1.15021	-1509.81	6.94281	150.4235
1.26631	-1211.23	7.19393	126.6673
1.3826	-884.455	7.44582	119.8977
1.49908	-598.89	7.6985	107.4058
1.61576	-337.045	7.95195	101.8245
1.73264	-113.3	8.20618	91.80192
1.84971	110.9895	8.4612	88.291
1.96697	321.188	8.717	83.37363
2.08443	500.9081	8.97357	75.98111
2.20209	645.1768	9.23093	78.81821
2.31994	796.2412	9.48906	74.29964
2.43798	875.4387	9.74798	68.88109
2.55622	992.1877	10.00768	66.82945
2.67466	1076.528	10.26816	64.54006
2.79329	1123.499	10.52942	58.57675
2.91212	1203.964	10.79145	64.75749
3.03114	1217.832	11.05427	56.10618
3.15035	1252.377	11.31787	59.40451
3.26976	1274.005	11.58225	56.33862
3.38937	1271.895	11.84741	54.50839
3.50917	1282.772	12.11335	56.65716
3.74936	1223.76	12.38007	57.8307
3.99033	1131.051		

4.23207	1036.597
4.4746	918.1353