

Supplementary Information

Solid-Liquid Equilibria in the Aqueous Chiral Homophenylalanine System and Solid State Characterisation of the Racemic Species

Axel Schultheis^a, Klaus Merz^b, Vico Tenberg^{a,c}, and Heike Lorenz^{a,*}

^aMax Planck Institute for Dynamics of Complex Technical Systems, Sandtorstrasse 1, 39106 Magdeburg, Germany. ^bRuhr-Universität Bochum, Universitätsstr. 150, 44801 Bochum, Germany. ^cOtto von Guericke University, Universitätsplatz 2, 39106 Magdeburg, Germany. *E-mail: lorenz@mpi-magdeburg.mpg.de

Table S 1 Measured enthalpies of the main endothermic peak of DL-HPA samples. Conversion from J g^{-1} to kJ mol^{-1} was conducted assuming a molar mass of $179.22 \text{ g mol}^{-1}$. The enthalpy of $145 \pm 4 \text{ kJ mol}^{-1}$ reported in the article is the average of experimental runs 2 to 5 and the respective standard deviation of the population.

DSC Run	Δh J g^{-1}	m mg	Δh kJ mol^{-1}	remarks
1	814.1	3.08	145.9	as received, not considered
2	793.5	9.19	142.2	obtained in binary solubility experiments
3	790.2	9.74	141.6	obtained in binary solubility experiments
4	797.6	10.19	142.9	obtained in binary solubility experiments
5	848.7	8.36	152.1	obtained in binary solubility experiments

Table S 2 Measured temperature dependent solubilities of DL-HPA in water - individual data points.

T $^{\circ}\text{C}$	Initial Weights		Equilibrated liquid			obtained phase
	m_{DL-HPA} g	m_{water} g	w_{D-HPA} g/g _{liquid}	w_{L-HPA} g/g _{liquid}	$w_{D-HPA+L-HPA}$ g/g _{liquid}	
15	0.01717	10.02003	0.000186	0.000182	0.000368	DL-HPA
	0.01717	10.02003	0.000183	0.000183	0.000366	DL-HPA
	0.01729	9.97658	0.000183	0.000181	0.000365	DL-HPA
	0.01729	9.97658	0.000182	0.000183	0.000365	DL-HPA
	0.01798	9.99704	0.000184	0.000181	0.000365	DL-HPA
	0.01798	9.99704	0.000181	0.000185	0.000367	DL-HPA
	0.01803	9.99668	0.000179	0.000182	0.000361	DL-HPA
	0.01803	9.99668	0.000185	0.000182	0.000367	DL-HPA
25	0.01777	9.98825	0.000247	0.000244	0.000491	DL-HPA
	0.01777	9.98825	0.000247	0.000243	0.000490	DL-HPA
	0.01754	9.98046	0.000251	0.000244	0.000495	DL-HPA
	0.01754	9.98046	0.000252	0.000245	0.000497	DL-HPA
	0.01786	10.0943	0.000256	0.000244	0.000500	DL-HPA
	0.01786	10.0943	0.000254	0.000247	0.000501	DL-HPA
	0.01795	9.99318	0.000229	0.000235	0.000464	DL-HPA
	0.01795	9.99318	0.000230	0.000230	0.000460	DL-HPA
34.9	0.01675	9.97054	0.000331	0.000325	0.000656	DL-HPA
	0.01675	9.97054	0.000337	0.000324	0.000661	DL-HPA
	0.01725	9.98062	0.000332	0.000318	0.000650	DL-HPA
	0.01725	9.98062	0.000330	0.000326	0.000656	DL-HPA
	0.01792	9.96631	0.000333	0.000320	0.000653	DL-HPA
	0.01792	9.96631	0.000327	0.000327	0.000654	DL-HPA
	0.01788	9.98064	0.000338	0.000324	0.000662	DL-HPA
	0.01788	9.98064	0.000325	0.000316	0.000641	DL-HPA
44.9	0.01635	10.05703	0.000444	0.000435	0.000878	DL-HPA
	0.01635	10.05703	0.000441	0.000426	0.000868	DL-HPA
	0.01772	10.07448	0.000436	0.000433	0.000869	DL-HPA
	0.01772	10.07448	0.000442	0.000432	0.000874	DL-HPA
	0.01606	10.06214	0.000434	0.000425	0.000859	DL-HPA
	0.01606	10.06214	0.000440	0.000430	0.000870	DL-HPA
	0.01707	10.01207	0.000437	0.000422	0.000859	DL-HPA
	0.01707	10.01207	0.000438	0.000429	0.000868	DL-HPA
55.1	0.01581	9.99297	0.000590	0.000567	0.001157	DL-HPA
	0.01581	9.99297	0.000592	0.000568	0.001160	DL-HPA
	0.01801	9.9888	0.000565	0.000543	0.001109	DL-HPA
	0.01801	9.9888	0.000567	0.000547	0.001114	DL-HPA
	0.01856	9.99328	0.000570	0.000551	0.001121	DL-HPA
	0.01856	9.99328	0.000570	0.000551	0.001121	DL-HPA
	0.01609	10.03679	0.000551	0.000533	0.001085	DL-HPA
	0.01609	10.03679	0.000551	0.000529	0.001080	DL-HPA

Table S 3 Averaged temperature dependent solubilities of DL-HPA in water. Uncertainty is represented by the standard deviation of the population

T °C	Equilibrated liquid	obtained phase
	$w_{D-HPA+L-HPA}$ g/g _{liquid} g/g _{liquid}	
15	0.000365 ± 0.000002	DL-HPA
25	0.000487 ± 0.000015	DL-HPA
34.9	0.000654 ± 0.000006	DL-HPA
44.9	0.000868 ± 0.000006	DL-HPA
55.1	0.001118 ± 0.000027	DL-HPA

Table S 4 Experimental details in the test on the stable phase in equilibrium at 25 °C.

T °C	Initial Weights				Equilibrated liquid		Equilibrated solid		obtained phase
	m_{L-HPA} g	m_{DL-HPA} g	m_{D-HPA} g	m_{water} g	w_{D-HPA} g/g _{liquid}	w_{L-HPA} g/g _{liquid}	w_{D-HPA} g/g _{solid}	w_{L-HPA} g/g _{solid}	
25	0.000	0.035	0.000	30.191	0.00024	0.00023	0.51	0.49	DL-HPA
25	0.018	0.000	0.019	30.526	0.00032	0.00020	0.51	0.49	DL-HPA

Table S 5 SLE data in the D-HPA /L-HPA /water system at 25 °C and 55 °C. Note the column w_{L-HPA}^* , where the respective unit is g/g_{solvent-free-liquid}, and the sample marked with ⁺ where an experimental error is likely due to two solid phases while only pure L-HPA was determined in the respective HPLC measurement of the solid. Further, note the value marked with [◊], where the not enough solid for solid phase analysis was obtained after equilibration. Therefore, this data point was excluded from further interpretation.

T °C	Initial Weights				Equilibrated liquid			Equilibrated solid		obtained phases
	m_{L-HPA} g	m_{DL-HPA} g	m_{D-HPA} g	m_{water} g	w_{D-HPA} g/g _{liquid}	w_{L-HPA} g/g _{liquid}	w_{L-HPA}^* g/g _{sl}	w_{D-HPA} g/g _{solid}	w_{L-HPA} g/g _{solid}	
25	0.0251	0.0000	0.0000	10.0576	0.00000	0.00073	1.00	0.00	1.00	L-HPA
	0.0241	0.0000	0.0038	10.1095	0.00011	0.00076	0.88	0.18	0.82	L-HPA + DL-HPA
	0.0215	0.0000	0.0060	10.0091	0.00009	0.00074	0.89	0.26	0.74	L-HPA + DL-HPA
	0.0170	0.0000	0.0071	10.1038	0.00014	0.00076	0.84	0.41	0.59	L-HPA + DL-HPA
	0.0134	0.0000	0.0090	10.0972	0.00015	0.00060	0.80	0.50	0.50	DL-HPA
	0.0080	0.0000	0.0081	10.0083	0.00028	0.00027	0.49	0.49	0.51	DL-HPA
	0.0092	0.0000	0.0129	10.1159	0.00048	0.00016	0.25	0.50	0.50	DL-HPA
	0.0067	0.0000	0.0170	10.1156	0.00082	0.00011	0.12	0.59	0.41	DL-HPA + D-HPA
	0.0049	0.0000	0.0206	10.1260	0.00076	0.00011	0.12	0.74	0.26	DL-HPA + D-HPA
	0.0029	0.0000	0.0243	10.0460	0.00080	0.00011	0.12	0.86	0.14	DL-HPA + D-HPA
	0.0000	0.0000	0.0251	10.1463	0.00070	0.00000	0.00	1.00	0.00	D-HPA
	0.0234	0.0000	0.0000	10.0219	0.00000	0.00075	1.00	0.00	1.00	L-HPA
	0.0187	0.0039	0.0000	7.9881	0.00006	0.00081	0.93	0.03	0.97	L-HPA + DL-HPA
	0.0207	0.0069	0.0000	9.7140	0.00008	0.00074	0.91	0.11	0.89	L-HPA + DL-HPA
	0.0151	0.0132	0.0000	9.9582	0.00006	0.00077	0.93	0.23	0.77	L-HPA + DL-HPA
	0.0156	0.0113	0.0000	9.9776	0.00008	0.00079	0.91	0.20	0.80	L-HPA + DL-HPA
	0.0091	0.0157	0.0000	9.9680	0.00007	0.00080	0.92	0.40	0.60	L-HPA + DL-HPA
	0.0119	0.0186	0.0000	9.9616	0.00006	0.00076	0.93	0.32	0.68	L-HPA + DL-HPA
	0.0085	0.0203	0.0000	10.0403	0.00005	0.00077	0.94	0.43	0.57	L-HPA + DL-HPA
	0.0000	0.0267	0.0000	9.9689	0.00023	0.00024	0.51	0.48	0.52	DL-HPA
54.9	0.0250	0.0000	0.0000	10.0166	0.00000	0.00148	1.00	0.00	1.00	L-HPA
	0.0240	0.0000	0.0032	10.0004	0.00031	0.00149	0.83	0.00	1.00	L-HPA + DL-HPA ⁺
	0.0213	0.0000	0.0049	10.3324	0.00027	0.00166	0.86	0.30	0.70	L-HPA + DL-HPA
	0.0175	0.0000	0.0072	10.0188	0.00035	0.00138	0.80	0.52	0.48	L-HPA + DL-HPA
	0.0129	0.0000	0.0089	10.0308	0.00046	0.00089	0.66	0.49	0.51	DL-HPA
	0.0090	0.0000	0.0135	9.9969	0.00086	0.00044	0.34	0.49	0.51	DL-HPA + D-HPA
	0.0073	0.0000	0.0171	10.0509	0.00123	0.00032	0.21	0.48	0.52	DL-HPA
	0.0049	0.0000	0.0210	10.0213	0.00149	0.00030	0.17	0.77	0.23	DL-HPA + D-HPA
	0.0030	0.0000	0.0240	10.0174	0.00155	0.00029	0.16	0.98	0.02	D-HPA
	0.0000	0.0000	0.0253	10.0149	0.00143	0.00000	0.00	1.00	0.00	D-HPA
55	0.0210	0.0000	0.0000	9.9953	0.00000	0.00160	1.00	0.00	1.00	L-HPA
	0.0188	0.0035	0.0000	10.0085	0.00014	0.00164	0.92	0.00	1.00	L-HPA
	0.0132	0.0100	0.0000	10.0419	0.00025	0.00157	0.86	0.36	0.64	L-HPA + DL-HPA
	0.0127	0.0112	0.0000	9.9642	0.00026	0.00155	0.86	0.46	0.54	L-HPA + DL-HPA
	0.0083	0.0152	0.0000	9.9855	0.00032	0.00119	0.79	0.45	0.55	L-HPA + DL-HPA
	0.0085	0.0170	0.0000	10.0211	0.00029	0.00124	0.81	0.47	0.53	DL-HPA
	0.0063	0.0190	0.0000	10.0196	0.00034	0.00102	0.75	0.49	0.51	L-HPA + DL-HPA
	0.0000	0.0260	0.0000	10.0120	0.00056	0.00060	0.51	0.47	0.53	DL-HPA
	0.0000	0.0207	0.0000	10.0272	0.00057	0.00057	0.50	0.49	0.51	DL-HPA
54.9	0.0082	0.0000	0.0079	10.0099	0.00068	0.00076	0.53			◊

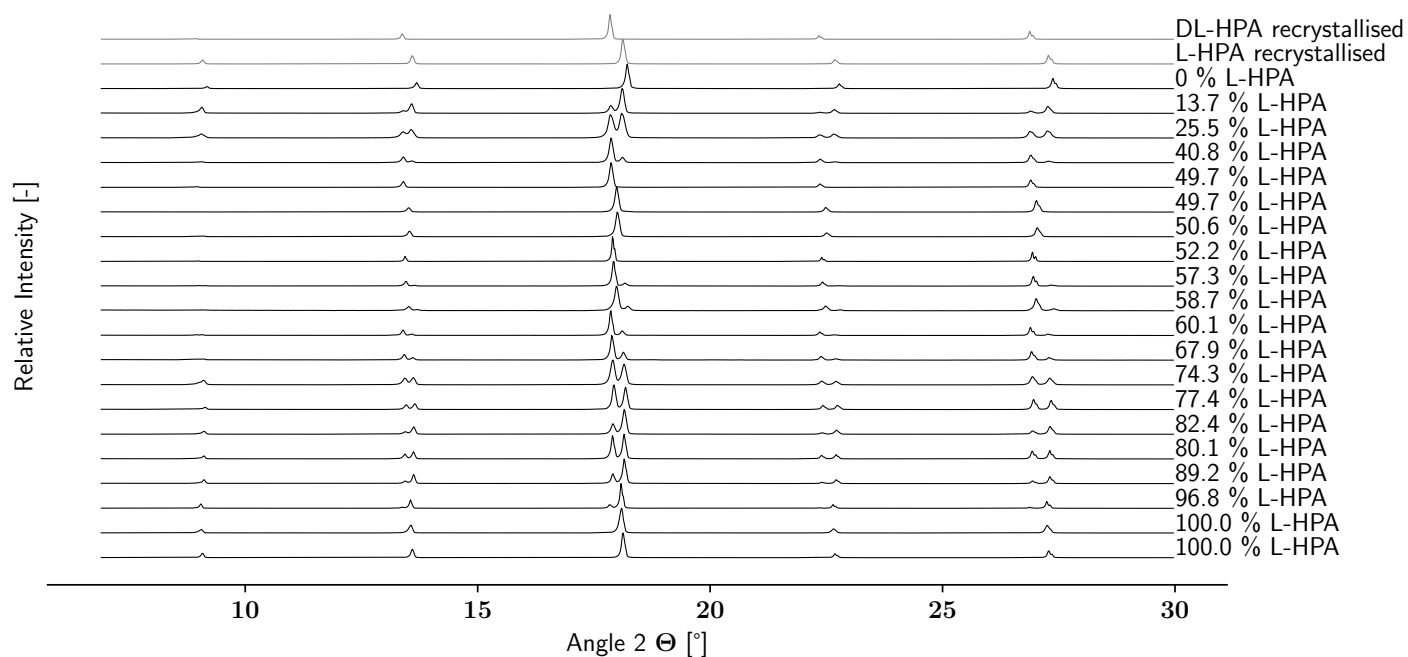


Figure S 1 PXR D patterns of solid phase samples from the SLE determination at 25 °C. Concentrations are given as wt.% in the solid

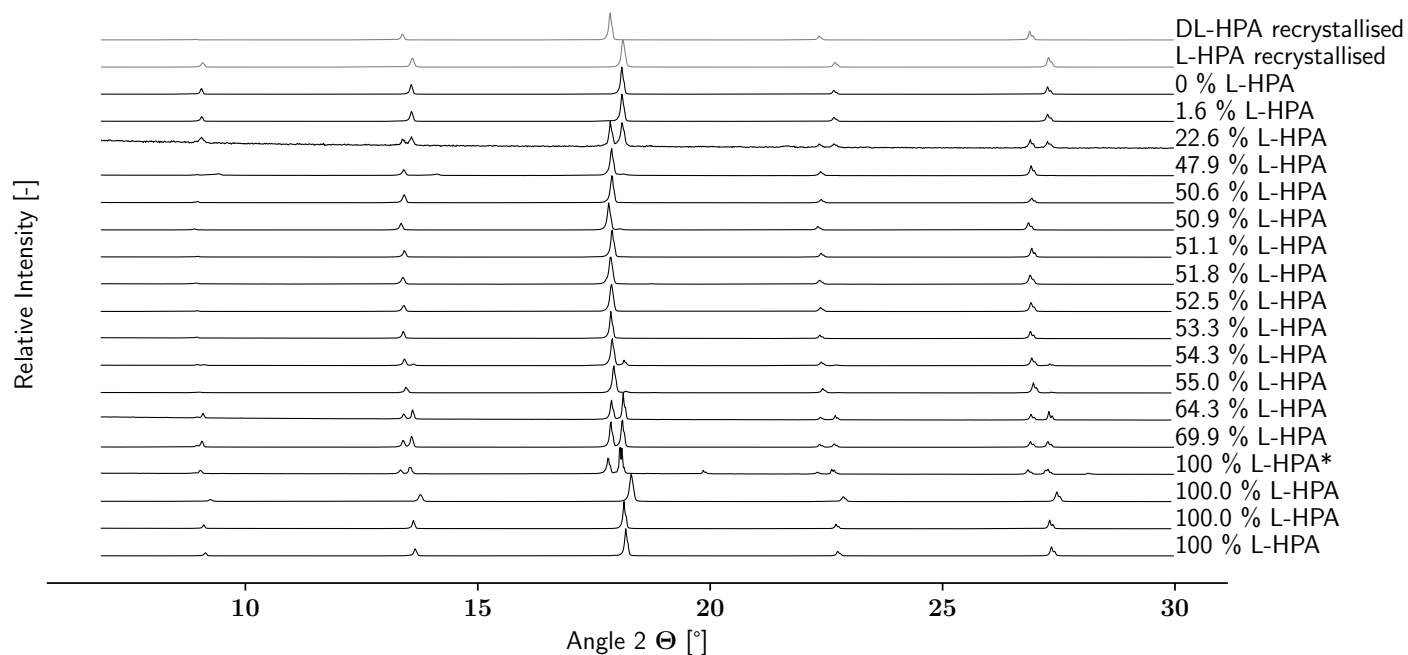


Figure S 2 PXR D patterns of solid phase samples from the SLE determination at 55 °C. Concentrations are given as wt.% in the solid. Note the line marked with *: only L-HPA was found in the HPLC analysis of the solid, while the pattern shows a mechanical mixture between L-HPA and DL-HPA. The respective sample had an initial solvent-free D-HPA content of around 12 wt.%. We assume an experimental error and have excluded this datapoint from further interpretation.