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APPENDICES

Appendix A: Experimental Data of Transient Capillary Rise

Table A.1 Transient capillary rise of SDS at concentration 1 mM

Time (min)	Liquid height in a capillary tube (mm)			
	Batch 1	Batch 2	Batch 3	Batch 4
0	79.00	79.29	78.90	79.00
1	79.01	79.28	78.93	79.01
3	78.97	79.28	78.93	79.05
5	79.01	79.28	78.96	79.07
7	79.01	79.32	78.99	79.10
10	79.03	79.32	78.96	79.08
15	79.06	79.33	79.02	79.12
20	79.08	79.34	79.02	79.14
30	79.11	79.40	79.04	79.18
40	79.14	79.43	79.11	79.24
50	79.17	79.45	79.12	79.25
60	79.21	79.48	79.16	79.26
90	79.26	79.52	79.22	79.34
120	79.27	79.53	79.24	79.35
150	79.28	79.54	79.25	79.37
180	79.28	79.55	79.25	79.37
240	79.29	79.56	79.27	79.38
300	79.29	79.57	79.28	79.40
360	79.30	79.57	79.28	79.40

Table A.2 Transient capillary rise of SDS at concentration 2 mM

Time (min)	Liquid height in a capillary tube (mm)				
	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5
0	72.93	72.71	72.67	72.16	72.12
3	72.92	72.76	72.66	72.22	72.15
5	72.93	72.77	72.73	72.27	72.17
10	73.03	72.87	72.73	72.28	72.20
20	73.09	72.89	73.00	72.48	72.40
30	73.15	72.94	73.04	72.54	72.49
40	73.16	72.96	73.08	72.62	72.53
50	73.18	73.02	73.14	72.67	72.59
60	73.20	73.01	73.15	72.70	72.64
70	73.21	73.02	-	-	-
75	-	-	73.22	72.78	72.70
80	73.22	73.03	-	-	-
90	73.21	73.03	73.27	72.84	72.75
105	73.24	73.08	73.31	72.88	72.80
120	73.26	73.13	73.32	72.89	72.78
135	73.26	73.16	73.34	72.91	72.84
150	73.28	73.18	73.34	72.92	72.90
165	-	-	73.35	72.93	72.96
180	73.29	73.22	73.35	72.93	72.96
195	-	-	73.36	72.95	72.98
210	73.32	73.27	73.37	72.95	73.00
225	-	-	73.37	72.94	73.00
240	73.35	73.28	73.36	72.94	73.01
270	73.30	73.29	73.37	72.96	73.02
300	73.31	73.29	73.38	72.97	73.03
330	73.33	73.31	73.38	72.97	73.05

Table A.3 Transient capillary rise of SDS at concentration 3 mM

Time (min)	Liquid height in a capillary tube (mm)		
	Batch 1	Batch 2	Batch 3
0	64.76	65.04	65.24
1	64.77	65.05	65.26
3	64.83	65.07	65.31
5	64.90	65.15	65.37
10	65.03	65.26	65.50
20	65.14	65.39	65.63
30	65.25	65.56	65.80
42	65.35	65.60	65.88
50	65.42	65.63	65.91
60	65.46	65.67	65.97
70	65.51	65.69	65.99
80	65.54	65.75	66.05
90	65.58	65.79	66.10
100	65.58	65.80	66.11
110	65.59	65.81	66.11
120	65.60	65.82	66.13
130	65.61	65.82	66.14
145	65.62	65.82	66.15
165	65.63	65.83	66.15
185	65.63	65.83	66.16
195	65.64	65.84	66.17
210	65.65	65.84	66.17
225	65.65	65.85	66.17
240	65.66	65.86	66.18
255	65.68	65.87	66.18
270	65.68	65.87	66.18

Table A.4 Transient capillary rise of SDS at concentration 4 mM

Time (min)	Liquid height in a capillary tube (mm)			
	Batch 1	Batch 2	Batch 3	Batch 4
0	58.66	58.31	58.86	59.39
3	58.64	58.35	58.94	59.44
5	58.68	58.37	58.98	59.46
10	58.78	58.41	59.00	59.52
20	58.80	58.48	59.09	59.56
30	58.87	58.54	59.18	59.62
40	58.96	58.61	59.22	59.66
50	58.97	58.63	59.25	59.71
60	59.00	58.69	59.32	59.80
70	59.03	58.76	59.35	59.82
80	59.10	58.76	59.37	59.85
90	59.13	58.80	59.40	59.88
100	59.15	58.82	59.45	59.93
110	59.18	58.88	59.51	59.98
120	59.22	58.92	59.51	59.99
130	59.25	58.94	59.53	60.00
140	59.24	58.95	59.55	59.99
150	59.26	58.95	59.56	60.00
160	59.27	58.96	59.57	60.01
170	59.28	58.98	59.57	60.02
180	59.28	59.00	59.59	60.03
195	59.30	58.99	59.60	60.05
210	59.32	59.00	59.61	60.06
225	59.34	59.01	59.63	60.07
245	59.33	59.03	59.65	60.08
260	59.35	59.03	59.64	60.09
280	59.37	59.03	59.67	60.10
300	59.38	59.05	59.67	60.10

Table A.5 Transient capillary rise of SDS at concentration 5 mM

Time (min)	Liquid height in a capillary tube (mm)			
	Batch 1	Batch 2	Batch 3	Batch 4
0	55.52	54.98	56.05	56.29
3	55.64	55.02	56.12	56.34
5	55.66	55.01	56.18	56.42
10	55.77	55.15	56.24	56.46
21	55.86	55.21	56.36	56.66
26	55.92	55.35	56.40	56.68
30	55.90	55.25	56.43	56.65
35	55.99	55.35	56.46	56.78
40	56.02	55.36	56.52	56.78
70	56.12	55.47	56.69	56.92
100	56.23	55.58	56.85	57.06
120	56.23	55.61	56.84	57.08
150	56.25	55.61	56.92	57.13
186	56.33	55.65	56.95	57.15

Table A.6 Transient capillary rise of SDS at concentration 12 mM

Time (min)	Liquid height in a capillary tube (mm)			
	Batch 1	Batch 2	Batch 3	Batch 4
0	45.96	45.75	45.80	46.17
1	45.99	45.79	45.85	46.22
3	46.02	45.78	45.89	46.22
6	46.03	45.86	45.94	46.27
10	46.10	45.87	46.02	46.32
22	46.16	45.93	46.09	46.41
30	46.18	46.01	46.10	46.43
40	46.19	45.97	46.12	46.44
50	46.23	45.99	46.12	46.47
60	46.23	46.02	46.15	46.50
75	46.24	46.03	46.15	46.49
90	46.24	46.03	46.16	46.52
105	46.23	46.03	46.16	46.52
120	46.23	46.03	46.16	46.52
150	46.24	46.03	46.16	46.53
180	46.24	46.03	46.16	46.52
220	46.24	46.05	46.16	46.53
280	46.24	46.03	46.16	46.52
305	46.23	46.03	46.17	46.51
365	46.24	46.03	46.16	46.51
400	46.24	46.03	46.16	46.51

Table A.7 Transient capillary rise of SDS at concentration 16 mM

Time (min)	Liquid height in a capillary tube (mm)			
	Batch 1	Batch 2	Batch 3	Batch 4
0	45.06	45.32	44.89	45.45
1	45.07	45.33	44.90	45.46
3	45.08	45.39	44.93	45.46
5	45.11	45.41	44.98	45.48
10	45.15	45.45	45.03	45.52
20	45.17	45.51	45.11	45.61
30	45.20	45.52	45.13	45.64
40	45.21	45.56	45.16	45.65
50	45.24	45.59	45.22	45.70
60	45.27	45.61	45.24	45.72
70	45.28	45.63	45.27	45.75
80	45.29	45.66	45.28	45.76
90	45.32	45.67	45.30	45.78
105	45.34	45.70	45.36	45.82
120	45.37	45.73	45.39	45.83
135	45.38	45.73	45.40	45.86
150	45.40	45.73	45.41	45.85
165	45.40	45.73	45.40	45.86
180	45.38	45.74	45.40	45.86
195	45.38	45.73	45.40	45.86
210	45.40	45.73	45.40	45.86
240	45.38	45.73	45.40	45.86
270	45.38	45.72	45.40	45.86
300	45.38	45.73	45.40	45.86
330	45.38	45.73	45.40	45.86
360	45.38	45.73	45.40	45.86
390	45.38	45.73	45.40	45.86

Appendix B: Gibbs Plot

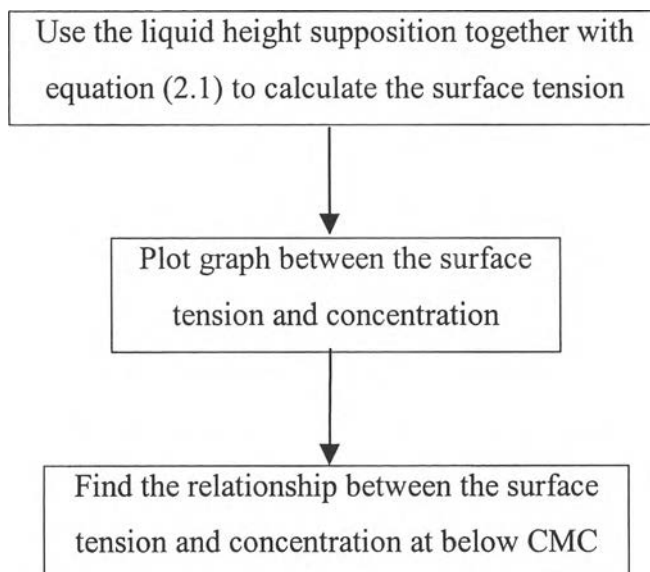


Figure B.1 Diagram of Gibbs plot determination.

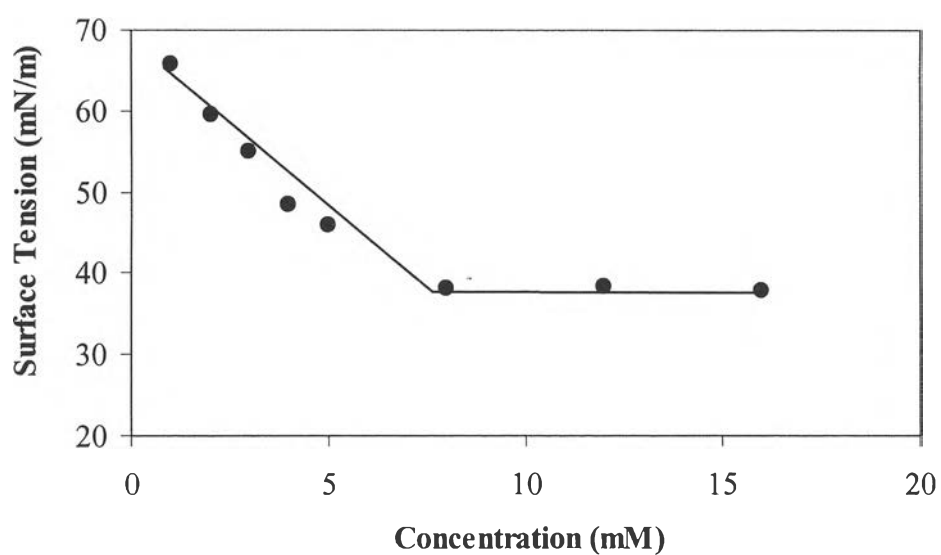
Sample of Calculation

$$\gamma = \frac{gr\rho}{2} Z \quad (2.1)$$

where $g = 9.81 \quad \text{m/s}^2$
 $r = 0.00017 \quad \text{m}$
 $\rho = 995.872 \quad \text{kg/m}^3$

Table B.1 Result of surface tension calculation

Concentration (mM)	Liquid Height (mm)	Surface tension (mN/m)
1	79.07	65.6624
2	71.59	59.4489
3	66.10	54.8927
4	58.14	48.2799
5	55.38	45.9901
8	45.76	37.9995
12	46.08	38.2673
16	45.46	37.7503

**Figure B.2** Gibbs plot (Surface tension versus concentration).

From the Gibbs plot, a linear relationship between surface tension and concentration below CMC is shown in equation (1)

$$\gamma = aC_{SDS} + b \quad (1)$$

(2)

$$\gamma = 5.12C_{SDS} + 71.84$$

Appendix C: Calculation Method for SDS Diffusivity

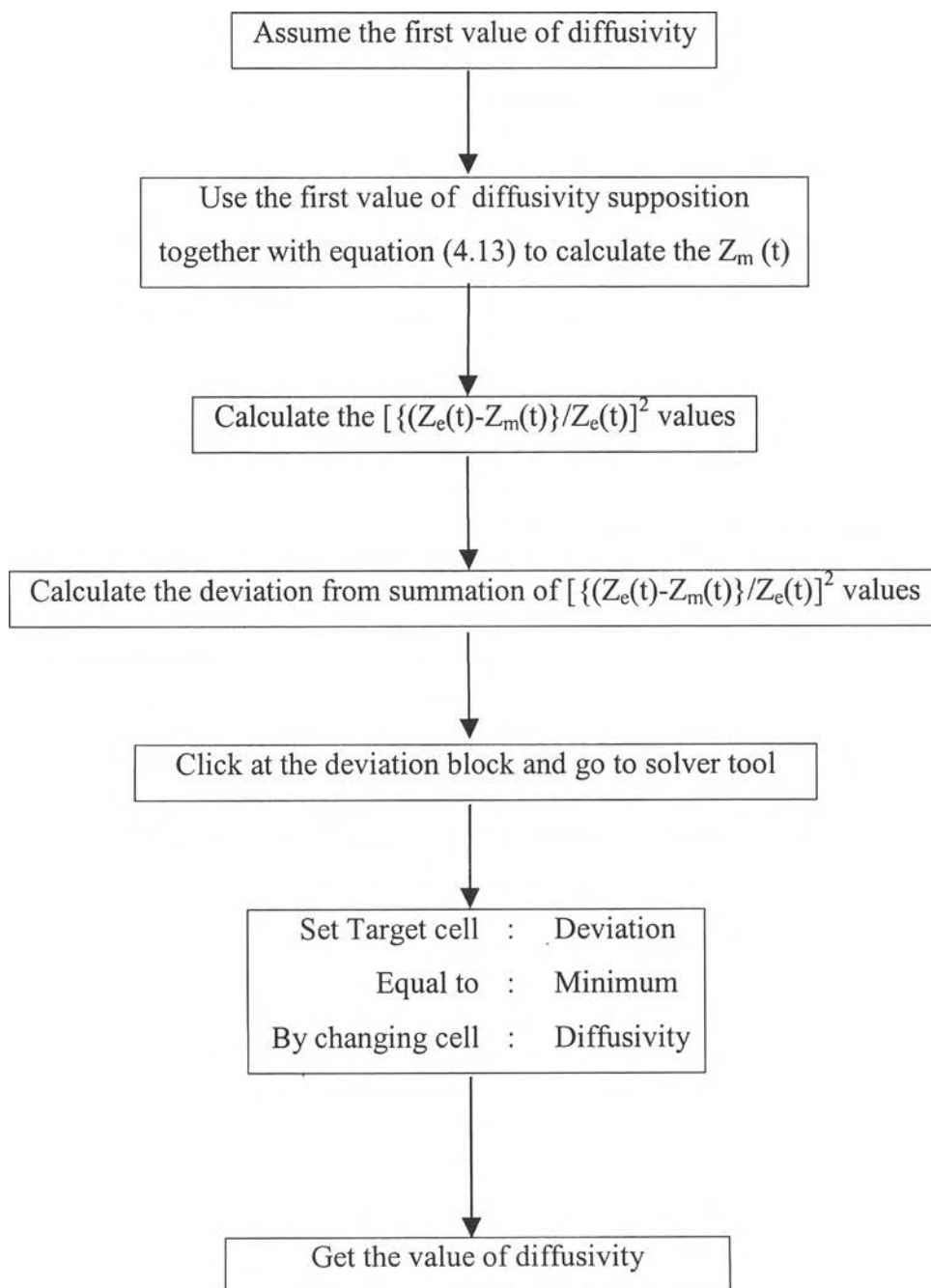


Figure C.1 Diagram of diffusivity determination.

Sample of Calculation

For SDS concentration 3mM

$$Z_t^3 - Z_{t_0}^3 = \frac{-6aCD_{SDS/H_2O}y_{SDS,2}}{rg\rho}(t - t_0) \quad (4.13)$$

where	a	=	-5.12	kg.l/mol.s ²
	C	=	55.55555556	mol/l
	D	=	1.33e-01	mm ² /min
	r	=	1.70e-01	mm
	g	=	9810	mm/s ²
	ρ	=	9.97442e-07	kg/mm ³
	$y_{SDS,2}$	=	(0.003/(1000/18))	
	$y_{SDS,2}$	=	0.000054	

Table C.1 Result of calculation for SDS concentration 3mM

Time (min)	Liquid Height (mm)		$\{(Z_e(t)-Z_m(t))/Z_e(t)\}^2$
	$Z_e(t)$	$Z_m(t)$	
0	65.58	65.5800	0.0000000000
10	65.58	65.5857	0.0000000075
20	65.59	65.5914	0.0000000005
30	65.60	65.5971	0.0000000020
40	65.61	65.6028	0.0000000121
55	65.62	65.6113	0.0000000175
75	65.63	65.6227	0.0000000123
95	65.63	65.6341	0.0000000039
105	65.64	65.6398	0.0000000000
120	65.65	65.6483	0.0000000007
135	65.65	65.6568	0.0000000109
150	65.66	65.6654	0.0000000067
165	65.66	65.6654	0.0000000067
165	65.68	65.6739	0.0000000087
180	65.68	65.6824	0.0000000013
		Deviation	0.0000000840

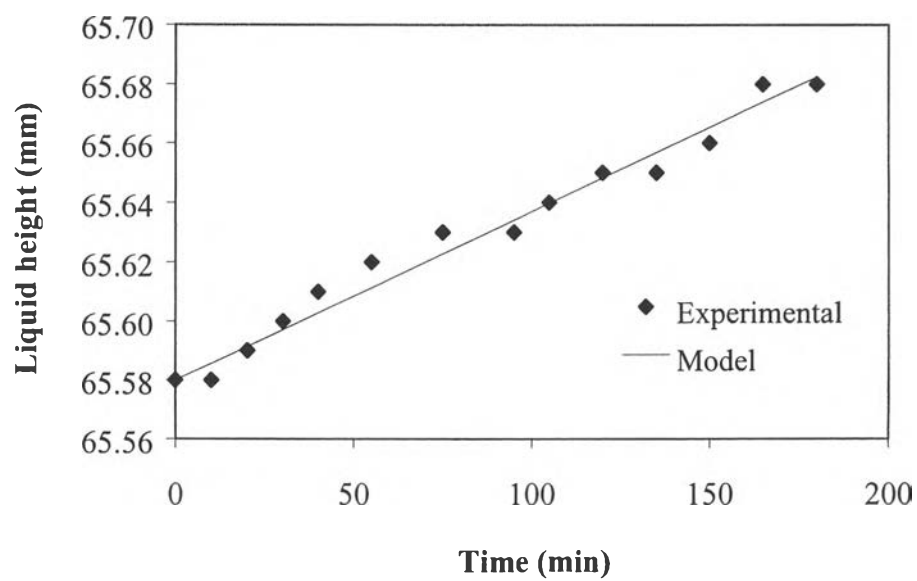


Figure C.2 Liquid height varied with time from experimental and model at 3 mM.

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