

## REFERENCES

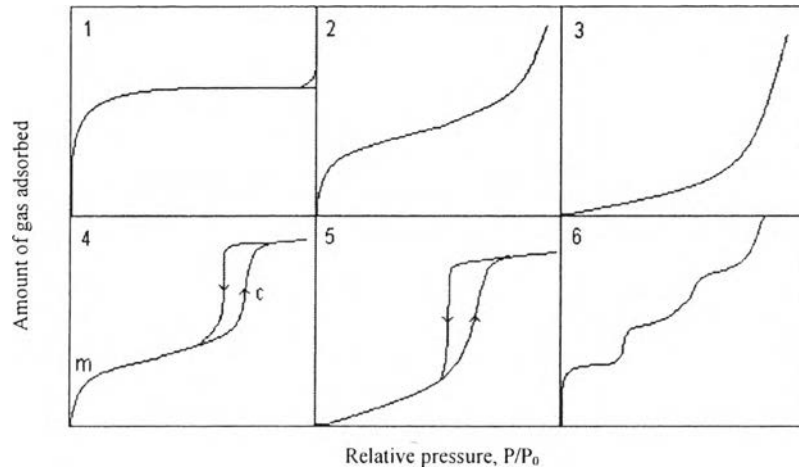
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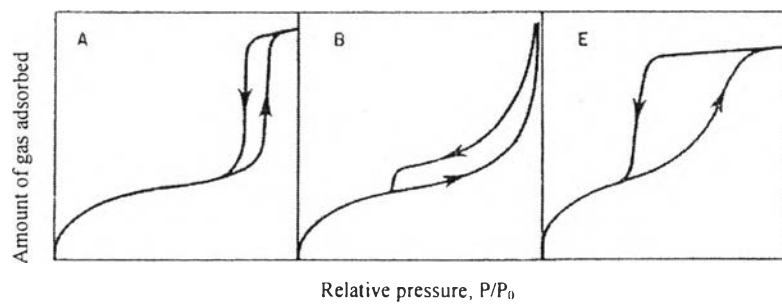
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## APPENDICES

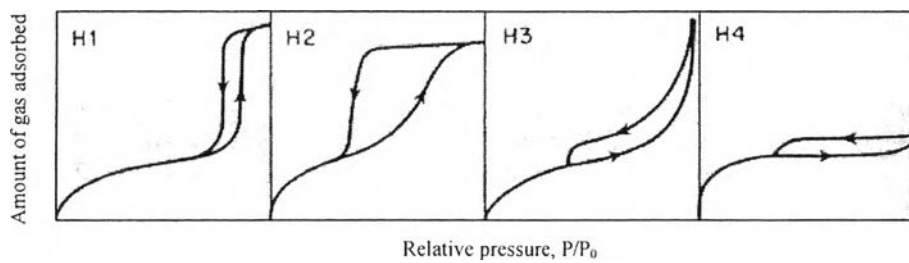
### Appendix A Types of Adsorption Isotherm and Hysteresis Loop



**Figure A1** Types of adsorption isotherm according to BDDT classification.



**Figure A2** Types of hysteresis loop according to De Boer classification.



**Figure A3** Types of hysteresis loop according to IUPAC classification.

## Appendix B Supplementary Results

**Table B1 Volume adsorbed for SDCC0 and SDCC10 filled with different % total surfactant (%wt)**

Sample	5 wt%		7 wt%		8.5 wt%		10 wt%		12 wt%	
	P/P <sub>0</sub>	Volume (cc/g)	P/P <sub>0</sub>	Volume (cc/g)	P/P <sub>0</sub>	Volume (cc/g)	P/P <sub>0</sub>	Volume (cc/g)	P/P <sub>0</sub>	Volume (cc/g)
SDCC0	0.051734	84.5905	0.050506	96.7772	0.050252	68.4688	0.52932	41.0822	0.052793	23.3287
	0.075874	93.2551	0.076343	110.216	0.073260	76.7524	0.77713	46.4106	0.079251	26.7486
	0.097534	99.9397	0.10023	119.030	0.099834	84.4709	0.10382	51.1307	0.099231	28.9659
	0.14968	112.322	0.15290	134.884	0.15387	97.3566	0.15154	58.1707	0.15365	33.7888
	0.20245	123.250	0.19779	146.927	0.19969	106.570	0.20402	64.8045	0.20552	37.8370
	0.24891	131.224	0.24954	158.632	0.24918	116.220	0.25412	70.9564	0.24841	40.9424
	0.29849	139.548	0.30176	169.267	0.30261	124.851	0.30396	77.0025	0.30602	45.3071
SDCC10	0.052146	59.2969	0.048746	88.3680	0.049343	77.9480	0.050147	131.806	0.049729	111.188
	0.073007	65.2895	0.075515	98.3536	0.073438	85.8966	0.074496	144.072	0.075294	122.312
	0.098043	71.4708	0.098506	105.183	0.10115	92.6836	0.10140\	154.638	0.097962	130.075
	0.15314	81.4365	0.15133	117.570	0.14861	102.188	0.14985	170.021	0.15082	144.408
	0.19879	88.7114	0.19770	126.783	0.19989	111.163	0.20181	183.699	0.20358	156.936
	0.25026	95.7577	0.24840	135.912	0.25226	119.118	0.24740	194.428	0.24943	166.149
	0.30093	102.448	0.29919	144.538	0.30234	126.868	0.30377	207.598	0.29849	176.066

**Table B2 Load (N), Extension (mm), Stress (MPa), and Percentage Strain of SDCC0 and SDCC10 filled with different % total surfactant (%wt)**

SDCC0 filled with 7 wt% of % total surfactant

Load	Extension	Stress	Percentage Strain	Load	Extension	Stress	Percentage Strain
0.031803	0.13391	0.000062763	-4.6053	104.46	6.5131	0.20614	20.509
0.004992	0.32691	9.8511E-06	-3.8454	100.01	6.7045	0.19737	21.263
0.046886	0.52053	0.00009253	-3.0831	95.773	6.8982	0.18901	22.026
0.092005	0.71257	0.00018157	-2.3271	88.197	7.0912	0.17406	22.786
0.082916	0.90745	0.00016364	-1.5598	86.554	7.286	0.17082	23.553
0.065499	1.1003	0.00012926	-0.8006	83.429	7.4785	0.16465	24.31
0.38982	1.2938	0.00076932	-0.038887	81.978	7.6701	0.16178	25.065
1.0148	1.4822	0.0020027	0.70298	79.862	7.8638	0.15761	25.827
1.9826	1.6768	0.0039127	1.4692	78.426	8.0581	0.15478	26.592
3.0359	1.8704	0.0059915	2.2313	73.952	8.2527	0.14595	27.358
3.1789	2.062	0.0062737	2.9855	69.967	8.4466	0.13808	28.122
4.9243	2.2555	0.0097182	3.7473	67.032	8.6389	0.13229	28.879
6.8028	2.4509	0.013425	4.5166	64.725	8.8301	0.12774	29.632
9.0029	2.6431	0.017767	5.2733	64.119	9.0254	0.12654	30.4
11.531	2.837	0.022757	6.0368	63.381	9.2177	0.12508	31.158
13.823	3.0314	0.02728	6.802	63.33	9.412	0.12498	31.923
16.194	3.2221	0.031959	7.5528	63.883	9.6063	0.12608	32.688
19.159	3.4167	0.03781	8.3191	64.216	9.7984	0.12673	33.444
22.529	3.6111	0.044461	9.0845	64.264	9.9933	0.12683	34.211
27.179	3.8035	0.053638	9.8419	64.54	10.186	0.12737	34.969
32.634	3.9976	0.064403	10.606	64.34	10.38	0.12698	35.733
37.926	4.1901	0.074847	11.364	64.77	10.572	0.12783	36.489
43.372	4.3836	0.085597	12.126	64.992	10.767	0.12826	37.256
48.873	4.5764	0.096451	12.885	64.997	10.96	0.12827	38.018
53.823	4.7707	0.10622	13.65	64.294	11.154	0.12689	38.781
58.271	4.9626	0.115	14.405	63.354	11.347	0.12503	39.54
64.27	5.1572	0.12684	15.171	62.469	11.541	0.12328	40.305
70.672	5.3506	0.13947	15.933	62.582	11.733	0.12351	41.06
78.805	5.545	0.15552	16.698	63.569	11.927	0.12545	41.823
86.452	5.7369	0.17062	17.454	64.725	12.12	0.12774	42.582
93.89	5.931	0.1853	18.218	66.089	12.314	0.13043	43.347
99.872	6.1236	0.1971	18.976	66.418	12.507	0.13108	44.106
103.13	6.3172	0.20354	19.738	67.612	12.7	0.13343	44.869



SDCC0 filled with 10 wt% of % total surfactant

Load	Extension	Stress	Percentage Strain	Load	Extension	Stress	Percentage Strain
0.003309	0.14458	6.5293E-06	-9.2556	75.432	7.7404	0.14887	20.649
-0.03035	0.34828	-0.00005990	-8.4536	74.856	7.9453	0.14773	21.456
-0.01679	0.55399	-0.00003313	-7.6437	73.752	8.1516	0.14555	22.268
-0.0116	0.75992	0.00002289	-6.833	73.542	8.3568	0.14514	23.076
-0.00646	0.96453	-0.00001275	-6.0275	73.79	8.5615	0.14563	23.882
-0.00227	1.1708	-4.4722E-06	-5.2153	74.841	8.7682	0.1477	24.696
-0.05168	1.376	-0.00010199	-4.4075	74.833	8.9738	0.14768	25.505
0.001082	1.5799	2.1353E-06	-3.6047	75.435	9.1788	0.14887	26.312
0.007182	1.7883	0.000014174	-2.7843	76.721	9.3836	0.15141	27.119
0.020568	1.9918	0.000040592	-1.983	77.849	9.5883	0.15364	27.925
-0.00429	2.198	-8.4625E-06	-1.1712	78.504	9.794	0.15493	28.734
0.15787	2.4038	0.00031156	-0.36112	79.622	9.9996	0.15714	29.544
0.90918	2.6034	0.0017943	0.42487	80.066	10.207	0.15801	30.361
2.3172	2.8089	0.0045731	1.2337	79.458	10.411	0.15681	31.165
5.1531	3.015	0.01017	2.0451	79.707	10.617	0.1573	31.974
9.2721	3.2196	0.018299	2.8508	79.784	10.824	0.15746	32.79
13.39	3.4237	0.026426	3.6544	80.461	11.028	0.15879	33.593
17.501	3.6315	0.034539	4.4723	81.358	11.235	0.16056	34.407
22.658	3.8359	0.044717	5.2772	82.745	11.44	0.1633	35.215
28.943	4.0414	0.05712	6.0862	84.01	11.644	0.1658	36.017
36.629	4.2481	0.072288	6.9	84.91	11.852	0.16757	36.835
43.786	4.4525	0.086413	7.7048	86.353	12.057	0.17042	37.642
53.093	4.6575	0.10478	8.5119	86.278	12.263	0.17027	38.453
65.41	4.8626	0.12909	9.3191	86.475	12.466	0.17066	39.256
79.47	5.07	0.15684	10.136	87.122	12.672	0.17194	40.064
92.269	5.2746	0.1821	10.941	87.436	12.877	0.17256	40.873
104.35	5.4793	0.20595	11.747	88.425	13.084	0.17451	41.686
110.73	5.6852	0.21852	12.558	88.873	13.288	0.17539	42.491
109.28	5.8904	0.21567	13.366	89.757	13.494	0.17714	43.3
103.02	6.0966	0.2033	14.177	90.536	13.701	0.17867	44.116
96.815	6.3023	0.19107	14.987	91.885	13.904	0.18134	44.915
90.58	6.5068	0.17876	15.792	92.107	14.109	0.18177	45.723
86.936	6.7127	0.17157	16.603	93.17	14.315	0.18387	46.534
83.633	6.9202	0.16505	17.42	94.527	14.521	0.18655	47.343
79.046	7.1256	0.156	18.229	94.286	14.726	0.18608	48.151
77.931	7.3301	0.1538	19.034	96.279	14.931	0.19001	48.961
76.699	7.5346	0.15137	19.839	97.129	15.136	0.19169	49.767





SDCC0 filled with 12 wt% of % total surfactant

Load	Extension	Stress	Percentage Strain	Load	Extension	Stress	Percentage Strain
0.008294	0.158	0.000016369	-13.004	76.478	8.1128	0.15093	18.314
0.028182	0.37274	0.000055619	-12.159	73.533	8.3284	0.14512	19.162
0.05293	0.58655	0.00010446	-11.317	69.749	8.543	0.13765	20.007
0.063664	0.80291	0.00012564	-10.465	65.841	8.759	0.12994	20.858
0.055297	1.0175	0.00010913	-9.6207	65.875	8.9751	0.13001	21.709
0.008863	1.2336	0.000017492	-8.7698	63.642	9.1886	0.1256	22.549
0.087418	1.4488	0.00017252	-7.9227	62.149	9.4044	0.12265	23.399
0.090716	1.6637	0.00017903	-7.0764	62.335	9.6192	0.12302	24.245
0.028555	1.8782	0.000056354	-6.2321	62.295	9.8345	0.12294	25.092
0.091875	2.0932	0.00018132	-5.3854	61.432	10.05	0.12124	25.941
0.066337	2.3091	0.00013092	-4.5355	57.694	10.266	0.11386	26.791
0.027829	2.5244	0.00005492	-3.6878	56.684	10.481	0.11187	27.636
0.023111	2.7394	0.000045611	-2.8413	56.688	10.696	0.11188	28.483
0.058125	2.954	0.00011471	-1.9965	56.447	10.911	0.1114	29.331
0.042142	3.1698	0.000083169	-1.1471	56.086	11.128	0.11069	30.183
0.054058	3.3859	0.00010668	-0.2961	55.411	11.343	0.10936	31.03
1.5407	3.5931	0.0030406	0.51953	54.206	11.557	0.10698	31.875
3.6558	3.8094	0.0072148	1.3711	53.98	11.772	0.10653	32.721
6.7539	4.0239	0.013329	2.2156	51.726	11.988	0.10208	33.571
10.317	4.2387	0.020361	3.0613	50.827	12.202	0.10031	34.415
14.901	4.4554	0.029407	3.9144	50.065	12.419	0.098804	35.267
22.361	4.6701	0.04413	4.7597	49.395	12.633	0.097483	36.11
33.51	4.8849	0.066133	5.6053	47.907	12.849	0.094545	36.961
44.265	5.1005	0.087358	6.4541	47.997	13.063	0.094724	37.804
54.99	5.3163	0.10852	7.3039	46.724	13.278	0.092212	38.651
65.38	5.5303	0.12903	8.1464	47.123	13.493	0.092998	39.497
72.846	5.7459	0.14376	8.9951	48.233	13.709	0.095188	40.346
80.413	5.9619	0.1587	9.8455	48.98	13.923	0.096664	41.189
85.423	6.1766	0.16858	10.691	49.89	14.14	0.09846	42.044
87.077	6.3919	0.17185	11.538	50.693	14.355	0.10004	42.888
87.096	6.6063	0.17189	12.383	52.008	14.569	0.10264	43.731
84.472	6.8224	0.16671	13.233	53.43	14.785	0.10545	44.582
82.309	7.0375	0.16244	14.08	55.098	15	0.10874	45.428
80.314	7.2527	0.1585	14.927	56.833	15.215	0.11216	46.277
80.068	7.4675	0.15802	15.773	58.569	15.431	0.11559	47.124
79.935	7.6826	0.15775	16.62	60.32	15.646	0.11904	47.97
78.223	7.8985	0.15438	17.47	62.118	15.862	0.12259	48.822



SDCC10 filled with 7 wt% of % total surfactant

Load	Extension	Stress	Percentage Strain	Load	Extension	Stress	Percentage Strain
0.16964	0.13955	0.00033478	-8.5107	91.416	7.6656	0.18041	21.119
0.041201	0.3429	0.000081312	-7.7102	89.563	7.8684	0.17676	21.918
0.067753	0.54826	0.00013371	-6.9017	89.012	8.0709	0.17567	22.715
0.051519	0.75104	0.00010167	-6.1033	87.838	8.2749	0.17335	23.518
0.068365	0.95394	0.00013492	-5.3045	86.441	8.4799	0.17059	24.325
0.10946	1.1584	0.00021603	-4.4994	85.326	8.682	0.16839	25.121
0.092179	1.3629	0.00018192	-3.6946	86.432	8.8869	0.17057	25.928
0.11231	1.5655	0.00022165	-2.8966	86.329	9.0898	0.17037	26.726
0.13346	1.7693	0.00026338	-2.0946	86.394	9.2923	0.1705	27.524
0.1035	1.972	0.00020427	-1.2963	87.026	9.4962	0.17175	28.326
0.23615	2.1759	0.00046604	-0.49364	88.513	9.7018	0.17468	29.136
0.93312	2.3725	0.0018415	0.28018	90.041	9.9046	0.1777	29.934
5.374	2.5765	0.010606	1.0834	91.388	10.107	0.18036	30.731
11.363	2.7797	0.022426	1.8837	92.816	10.31	0.18317	31.531
18.111	2.9833	0.035743	2.6851	94.618	10.515	0.18673	32.336
26.858	3.1868	0.053005	3.4864	96.45	10.72	0.19035	33.145
36.635	3.3903	0.072301	4.2875	97.453	10.921	0.19233	33.936
48.805	3.5939	0.096318	5.0892	98.45	11.126	0.19429	34.744
63.022	3.7981	0.12438	5.893	99.854	11.329	0.19706	35.54
72.513	4.0021	0.14311	6.6962	101.11	11.531	0.19953	36.339
79.897	4.2045	0.15768	7.4928	101	11.736	0.19932	37.145
80.971	4.408	0.1598	8.2943	101.07	11.939	0.19947	37.942
84.385	4.6117	0.16654	9.0961	100.76	12.142	0.19884	38.743
86.166	4.8157	0.17005	9.8995	100.94	12.346	0.19921	39.548
84.726	5.0188	0.16721	10.699	101.1	12.549	0.19953	40.345
84.256	5.2222	0.16628	11.5	102.7	12.754	0.20268	41.151
87.086	5.4259	0.17187	12.302	105.58	12.957	0.20837	41.953
88.822	5.6287	0.17529	13.1	108.36	13.161	0.21386	42.753
90.464	5.8336	0.17853	13.907	110.55	13.363	0.21817	43.551
90.326	6.0361	0.17826	14.704	111.97	13.567	0.22098	44.355
90.411	6.2405	0.17843	15.509	114.39	13.77	0.22575	45.154
90.106	6.4448	0.17783	16.313	115.86	13.973	0.22866	45.953
87.42	6.6468	0.17253	17.108	117.32	14.178	0.23153	46.76
88.442	6.8503	0.17454	17.909	118.17	14.382	0.23322	47.561
89.152	7.0533	0.17594	18.709	119.16	14.584	0.23517	48.359
90.406	7.2564	0.17842	19.508	120.37	14.788	0.23755	49.16
91.089	7.4604	0.17977	20.311	121.64	14.992	0.24007	49.965



SDCC10 filled with 10 wt% of % total surfactant

Load	Extension	Stress	Percentage Strain	Load	Extension	Stress	Percentage Strain
0.10894	0.13561	0.00021499	-5.7771	68.073	7.4007	0.13434	22.825
0.14788	0.33084	0.00029184	-5.0085	67.927	7.5977	0.13406	23.601
0.096635	0.52839	0.00019071	-4.2308	66.365	7.7927	0.13097	24.369
0.070425	0.72534	0.00013899	-3.4554	64.982	7.9903	0.12824	25.147
0.12653	0.92193	0.00024971	-2.6814	63.715	8.1866	0.12574	25.919
0.14239	1.1172	0.00028102	-1.9125	62.378	8.3832	0.12311	26.694
0.10152	1.3142	0.00020035	-1.137	61.334	8.5796	0.12104	27.467
0.07379	1.5114	0.00014563	-0.36078	60.268	8.776	0.11894	28.24
1.4006	1.7034	0.002764	0.39543	57.619	8.9728	0.11371	29.015
6.3446	1.8989	0.012521	1.1651	57.246	9.1695	0.11298	29.789
13.248	2.0949	0.026144	1.9367	57.723	9.3652	0.11392	30.56
21.715	2.2907	0.042856	2.7074	58.222	9.5617	0.1149	31.334
29.536	2.4877	0.058291	3.483	58.794	9.7595	0.11603	32.112
38.766	2.6847	0.076505	4.2585	59.011	9.956	0.11646	32.886
53.023	2.881	0.10464	5.0315	60.469	10.151	0.11934	33.653
68.493	3.0778	0.13517	5.8061	61.193	10.348	0.12077	34.431
82.696	3.2739	0.1632	6.5783	62.697	10.544	0.12373	35.2
93.239	3.4704	0.18401	7.3518	64.034	10.742	0.12637	35.98
98.815	3.6676	0.19501	8.1283	65.013	10.938	0.1283	36.75
102.25	3.8629	0.20179	8.8972	65.464	11.134	0.12919	37.524
102.15	4.0592	0.20159	9.6702	65.179	11.331	0.12863	38.3
101.26	4.2562	0.19984	10.446	66.587	11.527	0.13141	39.07
98.53	4.4536	0.19445	11.223	67.85	11.724	0.1339	39.846
92.644	4.6493	0.18283	11.993	69.013	11.92	0.1362	40.617
90.632	4.8455	0.17887	12.766	69.203	12.116	0.13657	41.388
88.348	5.0437	0.17436	13.546	71.179	12.313	0.14047	42.167
82.14	5.24	0.1621	14.319	71.631	12.509	0.14136	42.937
81.331	5.435	0.16051	15.087	73.368	12.705	0.14479	43.707
79.557	5.6316	0.15701	15.861	72.843	12.903	0.14376	44.486
75.239	5.8283	0.14849	16.635	74.954	13.099	0.14792	45.262
74.528	6.0255	0.14708	17.411	76.984	13.295	0.15193	46.031
72.315	6.2222	0.14272	18.186	77.897	13.493	0.15373	46.81
69.926	6.4182	0.138	18.957	80.012	13.688	0.15791	47.579
69.111	6.6132	0.13639	19.725	82.185	13.884	0.16219	48.351
68.126	6.8104	0.13445	20.501	84.335	14.081	0.16644	49.126
68.025	7.0082	0.13425	21.28	86.991	14.278	0.17168	49.901
68.231	7.2034	0.13466	22.049	88.652	14.475	0.17496	50.677



SDCC10 filled with 12 wt% of % total surfactant

Load	Extension	Stress	Percentage Strain	Load	Extension	Stress	Percentage Strain
0.087187	0.14812	0.00017206	-10.012	80.619	7.8167	0.1591	20.179
0.040344	0.35633	0.00007962	-9.1922	80.295	8.0242	0.15846	20.996
0.069739	0.56322	0.00013763	-8.3777	79.25	8.2317	0.1564	21.813
0.095144	0.77057	0.00018777	-7.5613	78.356	8.4385	0.15464	22.627
0.077906	0.97843	0.00015375	-6.743	76.516	8.6474	0.15101	23.45
0.07792	1.1856	0.00015378	-5.9274	77.309	8.8541	0.15257	24.264
0.006793	1.3936	0.000013406	-5.1085	78.867	9.0621	0.15565	25.082
0.065509	1.601	0.00012928	-4.292	75.02	9.2676	0.14805	25.892
0.095927	1.8073	0.00018932	-3.4799	71.13	9.477	0.14038	26.716
0.040218	2.0158	0.000079371	-2.659	70.426	9.6827	0.13899	27.526
0.094697	2.2235	0.00018689	-1.8411	69.964	9.8917	0.13808	28.349
0.085002	2.4304	0.00016775	-1.0268	68.8	10.098	0.13578	29.16
0.024714	2.6391	0.000048774	-0.20498	67.953	10.306	0.13411	29.98
2.6847	2.8388	0.0052982	0.58145	66.935	10.514	0.1321	30.8
6.4323	3.047	0.012694	1.4008	64.412	10.721	0.12712	31.613
11.343	3.2544	0.022386	2.2174	62.151	10.93	0.12266	32.437
17.421	3.4613	0.03438	3.0322	60.835	11.138	0.12006	33.254
25.269	3.668	0.049869	3.846	57.753	11.345	0.11398	34.071
34.195	3.877	0.067485	4.6686	56.951	11.55	0.11239	34.876
43.817	4.0824	0.086473	5.4775	58.054	11.759	0.11457	35.699
57.228	4.2915	0.11294	6.3004	59.082	11.967	0.1166	36.518
70.225	4.498	0.13859	7.1138	60.035	12.173	0.11848	37.33
81.532	4.7061	0.1609	7.933	60.602	12.382	0.1196	38.153
89.341	4.9142	0.17632	8.7523	60.722	12.589	0.11984	38.967
95.296	5.1205	0.18807	9.5643	62.048	12.796	0.12245	39.781
98.358	5.3287	0.19411	10.384	63.544	13.002	0.1254	40.595
97.598	5.535	0.19261	11.196	61.288	13.211	0.12095	41.418
96.301	5.7414	0.19005	12.009	60.403	13.419	0.11921	42.235
92.311	5.9515	0.18218	12.836	61.95	13.625	0.12226	43.046
91.228	6.1566	0.18004	13.644	63.427	13.831	0.12517	43.858
85.531	6.3652	0.1688	14.465	64.242	14.04	0.12678	44.682
84.302	6.5721	0.16637	15.279	65.959	14.248	0.13017	45.498
84.553	6.781	0.16687	16.102	67.358	14.454	0.13293	46.312
82.821	6.9874	0.16345	16.914	68.616	14.662	0.13542	47.129
80.014	7.1956	0.15791	17.734	69.234	14.871	0.13663	47.951
80.158	7.4014	0.15819	18.544	70.667	15.079	0.13946	48.77
80.61	7.6098	0.15909	19.365	71.452	15.286	0.14101	49.585





ต้นฉบับ หน้าขาดหาย