

# Micellar Parameters of Aqueous Solutions of Tween 20 and 60 at Different Temperatures: Volumetric and Viscometric Study

Katarzyna Szymczyk\*, Magdalena Szaniawska, Anna Taraba

Department of Interfacial Phenomena, Faculty of Chemistry, Maria Curie-Skłodowska University, Maria Curie-Skłodowska Sq. 3, 20-031 Lublin, Poland

\*e-mail: [katarzyna.szymczyk@poczta.umcs.lublin.pl](mailto:katarzyna.szymczyk@poczta.umcs.lublin.pl); Phone: (48-81) 537-5538; fax: (48-81) 533-3348

Running title: Micellar parameters of aqueous solutions of Tween 20 and 60

**Table S1.** Values of  $\bar{V}$ ,  $C_1$ ,  $\bar{\beta}$ ,  $X$ ,  $S_0$ ,  $F$ ,  $X'$ ,  $\Gamma$ ,  $f$ ,  $\Gamma_p$ ,  $K$  and  $K''$  for the aqueous solutions of T20 and T60 at the temperature equal to 293, 303 and 313 K.

	C	T20			T60		
		T=293 K	T=303 K	T=313 K	T=293 K	T=303 K	T=313 K
$\bar{V}$	$10^{-5}$	1.0871	1.0934	1.0999	1.0859	1.0923	1.0988
	$2 \times 10^{-5}$	1.0870	1.0934	1.0998	1.0859	1.0923	1.0988
	$5 \times 10^{-5}$	1.0869	1.0932	1.0997	1.0859	1.0923	1.0988
	$8 \times 10^{-5}$	1.0868	1.0931	1.0996	1.0859	1.0923	1.0988
	$10^{-4}$	1.0867	1.0930	1.0995	1.0859	1.0923	1.0988
	$2 \times 10^{-4}$	1.0866	1.0928	1.0992	1.0860	1.0923	1.0988
	$5 \times 10^{-4}$	1.0862	1.0924	1.0988	1.0860	1.0923	1.0989
	$8 \times 10^{-4}$	1.0858	1.0920	1.0985	1.0861	1.0924	1.0990
	$10^{-3}$	1.0855	1.0917	1.0982	1.0863	1.0926	1.0993
	$2 \times 10^{-3}$	1.0844	1.0906	1.0970	1.0882	1.0947	1.1014
	$5 \times 10^{-3}$	1.0826	1.0887	1.0949	1.0900	1.0967	1.1035
	$8 \times 10^{-3}$	1.0808	1.0867	1.0928	1.0907	1.0974	1.1044
	$10^{-2}$	1.0796	1.0852	1.0911	1.0859	1.0977	1.1046
$C_1$	$10^{-5}$	17.1785	16.3954	15.7039	17.3303	16.5332	15.8207
	$2 \times 10^{-5}$	17.1851	16.4046	15.7136	17.3300	16.5332	15.8203
	$5 \times 10^{-5}$	17.2018	16.4215	15.7288	17.3299	16.5327	15.8195
	$8 \times 10^{-5}$	17.2128	16.4350	15.7397	17.3293	16.5323	15.8187
	$10^{-4}$	17.2198	16.4430	15.7470	17.3288	16.5323	15.8183
	$2 \times 10^{-4}$	17.2414	16.4711	15.7724	17.3237	16.5301	15.8135
	$5 \times 10^{-4}$	17.2990	16.5205	15.8200	17.3157	16.5257	15.8035
	$8 \times 10^{-4}$	17.3496	16.5662	15.8518	17.3094	16.5187	15.7924
	$10^{-3}$	17.3886	16.5949	15.8827	17.2831	16.4930	15.7673
	$2 \times 10^{-3}$	17.5372	16.7271	16.0031	17.0332	16.2546	15.5595
	$5 \times 10^{-3}$	17.8032	16.9716	16.2308	16.8054	16.0419	15.3600
	$8 \times 10^{-3}$	18.0637	17.2213	16.4679	16.7205	15.9642	15.2808
	$10^{-2}$	18.2468	16.3954	16.6687	17.3303	15.9321	15.2576
$\bar{\beta}$	$10^{-5}$	4.19557	4.32632	4.46239	4.17262	4.30168	4.43783
	$2 \times 10^{-5}$	4.19455	4.32465	4.46032	4.17266	4.30168	4.43791
	$5 \times 10^{-5}$	4.19200	4.32160	4.45711	4.17268	4.30176	4.43808
	$8 \times 10^{-5}$	4.19033	4.31917	4.45479	4.17277	4.30184	4.43825
	$10^{-4}$	4.18925	4.31772	4.45325	4.17285	4.30184	4.43833
	$2 \times 10^{-4}$	4.18597	4.31269	4.44790	4.17360	4.30222	4.43933
	$5 \times 10^{-4}$	4.17730	4.30392	4.43798	4.17480	4.30300	4.44140

	$8 \times 10^{-4}$	4.16975	4.29590	4.43141	4.17574	4.30424	4.44373
	$10^{-3}$	4.16400	4.29089	4.42507	4.17968	4.30880	4.44897
	$2 \times 10^{-3}$	4.14246	4.26824	4.40082	4.21821	4.35229	4.49373
	$5 \times 10^{-3}$	4.10547	4.22802	4.35678	4.25513	4.39316	4.53888
	$8 \times 10^{-3}$	4.07103	4.18903	4.31327	4.26935	4.40859	4.55746
	$10^{-2}$	4.04782	4.15745	4.27818	4.17262	4.41505	4.56296
$X$	$10^{-5}$	-0.55152	-0.53965	-0.52785	-0.55366	-0.54185	-0.52994
	$2 \times 10^{-5}$	-0.55162	-0.53980	-0.52803	-0.55366	-0.54185	-0.52994
	$5 \times 10^{-5}$	-0.55186	-0.54007	-0.52830	-0.55366	-0.54184	-0.52992
	$8 \times 10^{-5}$	-0.55201	-0.54029	-0.52850	-0.55365	-0.54184	-0.52991
	$10^{-4}$	-0.55211	-0.54042	-0.52863	-0.55364	-0.54184	-0.52990
	$2 \times 10^{-4}$	-0.55242	-0.54087	-0.52909	-0.55357	-0.54180	-0.52982
	$5 \times 10^{-4}$	-0.55323	-0.54165	-0.52993	-0.55346	-0.54173	-0.52964
	$8 \times 10^{-4}$	-0.55393	-0.54237	-0.53049	-0.55337	-0.54162	-0.52944
	$10^{-3}$	-0.55447	-0.54282	-0.53104	-0.55300	-0.54121	-0.52899
	$2 \times 10^{-3}$	-0.55650	-0.54486	-0.53313	-0.54943	-0.53736	-0.52521
	$5 \times 10^{-3}$	-0.56003	-0.54853	-0.53696	-0.54605	-0.53379	-0.52146
	$8 \times 10^{-3}$	-0.56335	-0.55213	-0.54081	-0.54476	-0.53245	-0.51993
	$10^{-2}$	-0.56561	-0.55509	-0.54396	-0.55366	-0.53190	-0.51947
	$S_0$	$10^{-5}$	0.91386	0.89980	0.88560	0.91638	0.90241
$2 \times 10^{-5}$		0.91398	0.89997	0.88582	0.91637	0.90241	0.888124
$5 \times 10^{-5}$		0.91426	0.90030	0.88615	0.91637	0.90240	0.888106
$8 \times 10^{-5}$		0.91444	0.90055	0.88638	0.91636	0.90240	0.888089
$10^{-4}$		0.91456	0.90071	0.88654	0.91635	0.90240	0.888081
$2 \times 10^{-4}$		0.91491	0.90124	0.88709	0.91627	0.90236	0.887978
$5 \times 10^{-4}$		0.91587	0.90218	0.88812	0.91614	0.90227	0.887764
$8 \times 10^{-4}$		0.91669	0.90303	0.88880	0.91604	0.90214	0.887524
$10^{-3}$		0.91733	0.90356	0.88945	0.91560	0.90165	0.886983
$2 \times 10^{-3}$		0.91970	0.90599	0.89197	0.91140	0.89705	0.8824
$5 \times 10^{-3}$		0.92381	0.91033	0.89658	0.90740	0.89277	0.877824
$8 \times 10^{-3}$		0.92767	0.91458	0.90118	0.90587	0.89116	0.875955
$10^{-2}$		0.93029	0.91805	0.90493	0.91638	0.89049	0.875404
$F$		$10^{-5}$	1.44687	1.42808	1.40936	1.45025	1.43156
	$2 \times 10^{-5}$	1.44702	1.42832	1.40964	1.45025	1.43156	1.41267
	$5 \times 10^{-5}$	1.44740	1.42875	1.41007	1.45025	1.43155	1.41264
	$8 \times 10^{-5}$	1.44764	1.42909	1.41038	1.45023	1.43154	1.41262
	$10^{-4}$	1.44780	1.42929	1.41059	1.45022	1.43154	1.41261
	$2 \times 10^{-4}$	1.44828	1.43000	1.41131	1.45011	1.43148	1.41247
	$5 \times 10^{-4}$	1.44956	1.43124	1.41266	1.44993	1.43137	1.41219
	$8 \times 10^{-4}$	1.45068	1.43238	1.41355	1.44979	1.43120	1.41188
	$10^{-3}$	1.45153	1.43309	1.41441	1.44921	1.43055	1.41117
	$2 \times 10^{-3}$	1.45474	1.43633	1.41773	1.44356	1.42444	1.40516
	$5 \times 10^{-3}$	1.46030	1.44213	1.42382	1.43821	1.41878	1.39918
	$8 \times 10^{-3}$	1.46555	1.44783	1.42992	1.43617	1.41666	1.39675
	$10^{-2}$	1.46911	1.45250	1.43491	1.45025	1.41578	1.39603
	$X'$	$10^{-5}$	-1.15698	-1.16736	-1.17774	-1.15512	-1.16543
$2 \times 10^{-5}$		-1.15690	-1.16723	-1.17759	-1.15512	-1.16543	-1.17591
$5 \times 10^{-5}$		-1.15669	-1.16699	-1.17735	-1.15512	-1.16544	-1.17592
$8 \times 10^{-5}$		-1.15655	-1.16680	-1.17718	-1.15513	-1.16544	-1.17593
$10^{-4}$		-1.15647	-1.16669	-1.17706	-1.15513	-1.16544	-1.17594

	$2 \times 10^{-4}$	-1.15620	-1.16629	-1.17666	-1.15520	-1.16547	-1.17601
	$5 \times 10^{-4}$	-1.15550	-1.16561	-1.17591	-1.15529	-1.16553	-1.17617
	$8 \times 10^{-4}$	-1.15488	-1.16498	-1.17541	-1.15537	-1.16563	-1.17634
	$10^{-3}$	-1.15441	-1.16458	-1.17494	-1.15569	-1.16599	-1.17674
	$2 \times 10^{-3}$	-1.15265	-1.16280	-1.17309	-1.15881	-1.16937	-1.18008
	$5 \times 10^{-3}$	-1.14959	-1.15959	-1.16972	-1.16176	-1.17251	-1.18341
	$8 \times 10^{-3}$	-1.14671	-1.15645	-1.16634	-1.16288	-1.17369	-1.18477
	$10^{-2}$	-1.14475	-1.15388	-1.16358	-1.15512	-1.17418	-1.18517
$\Gamma$	$10^{-5}$	5.57590	5.47314	5.38223	5.59580	5.49123	5.39760
	$2 \times 10^{-5}$	5.57677	5.47435	5.38350	5.59576	5.49123	5.39755
	$5 \times 10^{-5}$	5.57895	5.47657	5.38550	5.59575	5.49117	5.39744
	$8 \times 10^{-5}$	5.58039	5.47834	5.38694	5.59567	5.49112	5.39733
	$10^{-4}$	5.58132	5.47940	5.38790	5.59560	5.49112	5.39728
	$2 \times 10^{-4}$	5.58415	5.48308	5.39125	5.59494	5.49083	5.39665
	$5 \times 10^{-4}$	5.59170	5.48957	5.39751	5.59388	5.49025	5.39534
	$8 \times 10^{-4}$	5.59833	5.49556	5.40169	5.59306	5.48933	5.39387
	$10^{-3}$	5.60344	5.49933	5.40576	5.58961	5.48595	5.39057
	$2 \times 10^{-3}$	5.62292	5.51669	5.42159	5.55685	5.45465	5.36321
	$5 \times 10^{-3}$	5.65776	5.54877	5.45151	5.52696	5.42668	5.33693
	$8 \times 10^{-3}$	5.69189	5.58150	5.48266	5.51583	5.41647	5.32648
	$10^{-2}$	5.71587	5.60930	5.50902	5.59580	5.41224	5.32343
$f$	$10^{-5}$	0.15207	0.15448	0.15669	0.15161	0.15405	0.15631
	$2 \times 10^{-5}$	0.15205	0.15446	0.15665	0.15161	0.15405	0.15631
	$5 \times 10^{-5}$	0.15200	0.15440	0.15660	0.15161	0.15406	0.15631
	$8 \times 10^{-5}$	0.15197	0.15436	0.15657	0.15161	0.15406	0.15632
	$10^{-4}$	0.15195	0.15434	0.15655	0.15162	0.15406	0.15632
	$2 \times 10^{-4}$	0.15188	0.15425	0.15646	0.15163	0.15406	0.15633
	$5 \times 10^{-4}$	0.15171	0.15409	0.15631	0.15166	0.15408	0.15636
	$8 \times 10^{-4}$	0.15155	0.15395	0.15621	0.15167	0.15410	0.15640
	$10^{-3}$	0.15144	0.15386	0.15611	0.15175	0.15418	0.15648
	$2 \times 10^{-3}$	0.15099	0.15345	0.15572	0.15251	0.15493	0.15715
	$5 \times 10^{-3}$	0.15020	0.15270	0.15500	0.15321	0.15560	0.15781
	$8 \times 10^{-3}$	0.14943	0.15194	0.15426	0.15347	0.15585	0.15807
	$10^{-2}$	0.14890	0.15130	0.15363	0.15161	0.15595	0.15814
$\Gamma_p$	$10^{-5}$	8.42258	8.03105	7.68529	8.49849	8.09993	7.74369
	$2 \times 10^{-5}$	8.42589	8.03565	7.69013	8.49835	8.09993	7.74349
	$5 \times 10^{-5}$	8.43424	8.04409	7.69771	8.49830	8.09971	7.74309
	$8 \times 10^{-5}$	8.43972	8.05082	7.70318	8.49798	8.09949	7.74269
	$10^{-4}$	8.44324	8.05485	7.70683	8.49773	8.09949	7.74249
	$2 \times 10^{-4}$	8.45404	8.06890	7.71955	8.49519	8.09839	7.74009
	$5 \times 10^{-4}$	8.48283	8.09360	7.74334	8.49117	8.09620	7.73509
	$8 \times 10^{-4}$	8.50815	8.11641	7.75924	8.48803	8.09269	7.72951
	$10^{-3}$	8.52763	8.13077	7.77470	8.47488	8.07981	7.71699
	$2 \times 10^{-3}$	8.60194	8.19689	7.83490	8.34995	7.96066	7.61307
	$5 \times 10^{-3}$	8.73491	8.31916	7.94872	8.23604	7.85427	7.51335
	$8 \times 10^{-3}$	8.86517	8.44396	8.06728	8.19361	7.81542	7.47372
	$10^{-2}$	8.95673	8.54998	8.16766	8.49849	7.79936	7.46214
$K$	$10^{-5}$	8.08924	7.69772	7.35195	8.16516	7.76659	7.41036
	$2 \times 10^{-5}$	8.09256	7.70232	7.35680	8.16501	7.76659	7.41016
	$5 \times 10^{-5}$	8.10091	7.71076	7.36438	8.16497	7.76637	7.40976

	$8 \times 10^{-5}$	8.10639	7.71749	7.36985	8.16464	7.76615	7.40936
	$10^{-4}$	8.10991	7.72152	7.37350	8.16440	7.76615	7.40916
	$2 \times 10^{-4}$	8.12071	7.73557	7.38622	8.16186	7.76506	7.40675
	$5 \times 10^{-4}$	8.14950	7.76026	7.41000	8.15784	7.76286	7.40176
	$8 \times 10^{-4}$	8.17481	7.78308	7.42591	8.15470	7.75936	7.39618
	$10^{-3}$	8.19429	7.79744	7.44137	8.14155	7.74648	7.38365
	$2 \times 10^{-3}$	8.26861	7.86355	7.50157	8.01662	7.62732	7.27974
	$5 \times 10^{-3}$	8.40158	7.98582	7.61538	7.90271	7.52093	7.18002
	$8 \times 10^{-3}$	8.53184	8.11063	7.73394	7.86027	7.48209	7.14039
	$10^{-2}$	8.62340	8.21664	7.83433	8.16516	7.46603	7.12881
$K'$	$10^{-5}$	-2.51335	-2.22458	-1.96973	-2.56936	-2.27536	-2.01276
	$2 \times 10^{-5}$	-2.51579	-2.22797	-1.97330	-2.56925	-2.27536	-2.01261
	$5 \times 10^{-5}$	-2.52195	-2.23419	-1.97888	-2.56922	-2.27520	-2.01232
	$8 \times 10^{-5}$	-2.52599	-2.23915	-1.98291	-2.56898	-2.27504	-2.01202
	$10^{-4}$	-2.52859	-2.24212	-1.98560	-2.56880	-2.27504	-2.01187
	$2 \times 10^{-4}$	-2.53656	-2.25248	-1.99497	-2.56692	-2.27423	-2.01010
	$5 \times 10^{-4}$	-2.55780	-2.27069	-2.01250	-2.56396	-2.27261	-2.00642
	$8 \times 10^{-4}$	-2.57648	-2.28752	-2.02422	-2.56164	-2.27003	-2.00231
	$10^{-3}$	-2.59085	-2.29811	-2.03561	-2.55194	-2.26053	-1.99308
	$2 \times 10^{-3}$	-2.64569	-2.34687	-2.07997	-2.45977	-2.17267	-1.91653
	$5 \times 10^{-3}$	-2.74381	-2.43705	-2.16387	-2.37574	-2.09425	-1.84309
	$8 \times 10^{-3}$	-2.83995	-2.52913	-2.25129	-2.34445	-2.06562	-1.81390
	$10^{-2}$	-2.90753	-2.60734	-2.32531	-2.56936	-2.05378	-1.80538