

## Supporting Information

### Phase Diagrams for Liquid–Liquid Equilibrium of Aqueous Two-Phase System Containing Poly(ethylene glycol) (4000, 6000, or 10 000 g mol<sup>-1</sup> + Sodium Hydrogen Sulfite + Water) at Different Temperatures

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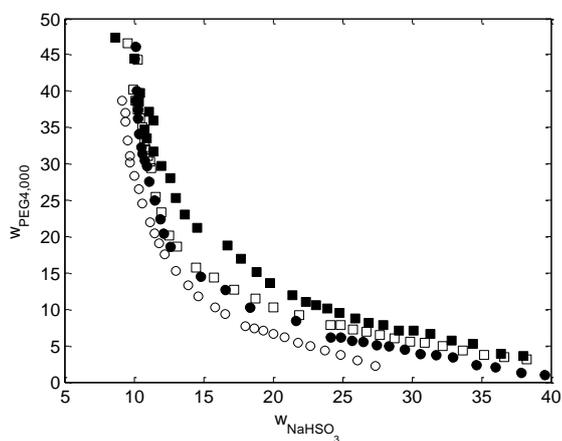
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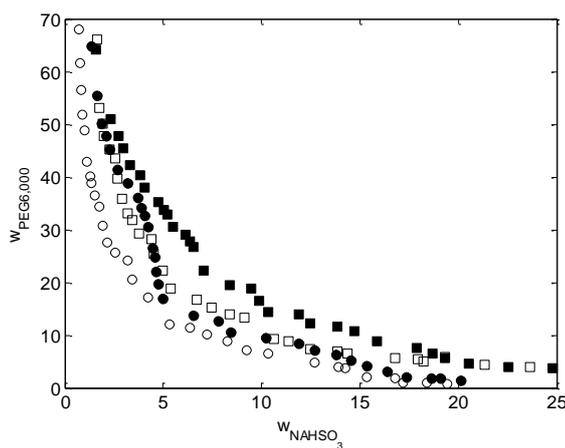
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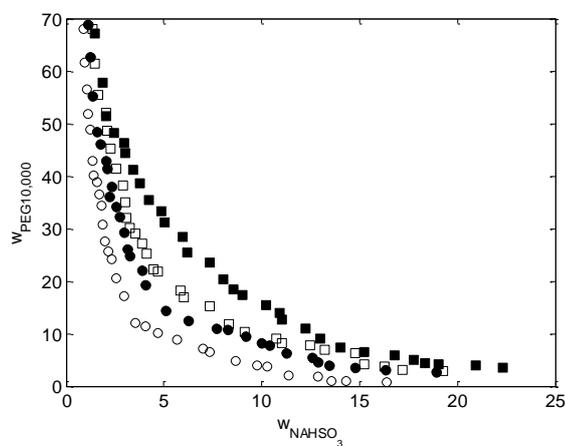
**Figure S1.** The effects of temperature on the experimental binodal curves at (■) 288.15K. (□) 298.15K; (●) 308.15. and (○) 318.15K. for the systems formed by: (a) PEG 4000 g mol<sup>-1</sup> + NaHSO<sub>3</sub> + water. (b) PEG 6000 g mol<sup>-1</sup> + NaHSO<sub>3</sub> + water e (c) PEG 10 000 g mol<sup>-1</sup> + NaHSO<sub>3</sub> + water. All concentrations are expressed in mass fraction percent.



(a)



(b)



(c)

**Table S1.** Values of the parameters of the equation (1) for the **studied** different systems.

Material	Constant	Value	C range (w/w)	$R^2$ *
PEG 4000 g mol <sup>-1</sup>	$a_1$	$1.478 \times 10^{-3}$	0 to 0.15	0.9997
PEG 6000 g mol <sup>-1</sup>	$a_1$	$1.468 \times 10^{-3}$	0 to 0.15	0.9999
PEG 10 000 g mol <sup>-1</sup>	$a_1$	$1.458 \times 10^{-3}$	0 to 0.1	0.9998
NaHSO <sub>3</sub>	$a_2$	$1.469 \times 10^{-3}$	0 to 0.12	0.9999
Water	$a_0$	1.331	-	-

\* where,  $R^2$ , represented the respective determination correlation coefficient value of the linear calibration plot of the refractive index against mass fraction for PEG or NaHSO<sub>3</sub> at the mass fraction range (C range) of each material.

**Table S2.** Values of pH top (T) and bottom (B) phase of APTS formed by PEG 6000  $\text{g mol}^{-1}$  (S1) and 10 000  $\text{g mol}^{-1}$  (S2)+  $\text{NaHSO}_3$  + water at  $T = 298.15\text{K}$  over 78 hours. The compositions of mixtures of the first and fifth tie lines were monitored at atmospheric pressure ( $\approx 94 \text{ kPa}$ ).\*

Time (h)	Phase	pH* (S1)		pH (S2)	
		1 <sup>st</sup> TLL	5 <sup>th</sup> TLL	1 <sup>st</sup> TLL	5 <sup>th</sup> TLL
0.5	<i>T</i>	4.87	4.79	4.85	4.89
	<i>B</i>	4.34	4.25	4.55	4.68
1.0	<i>T</i>	4.88	4.87	4.88	4.95
	<i>B</i>	4.15	4.17	4.34	4.64
1.5	<i>T</i>	4.90	4.98	4.97	4.98
	<i>B</i>	4.10	4.15	4.17	4.44
2.0	<i>T</i>	4.90	4.90	4.96	5.02
	<i>B</i>	4.06	4.05	4.12	4.15
2.5	<i>T</i>	4.90	4.80	4.96	5.03
	<i>B</i>	4.06	4.03	4.11	4.14
3.0	<i>T</i>	4.95	4.80	4.98	5.03
	<i>B</i>	4.04	4.00	4.08	4.13
4.0	<i>T</i>	4.95	4.85	4.99	5.03
	<i>B</i>	4.02	3.97	4.05	4.10
5.0	<i>T</i>	4.95	4.85	4.99	5.03
	<i>B</i>	4.01	3.97	4.05	4.07
6.0	<i>T</i>	4.95	4.95	4.99	5.04
	<i>B</i>	3.99	3.97	4.03	4.06
30	<i>T</i>	4.95	4.70	4.99	5.04
	<i>B</i>	3.99	3.95	4.03	4.06
54	<i>T</i>	4.95	4.96	5.01	5.04
	<i>B</i>	3.98	3.95	4.03	4.06
78	<i>T</i>	4.95	4.96	5.01	5.04
	<i>B</i>	3.98	3.95	4.03	4.06

\* The standard uncertainties  $\sigma$  for temperature, pressure and pH are:  $u(T) = 0.05 \text{ K}$  and  $u(p) = 0.5 \text{ kPa}$  and  $u(pH) = 0.01$ , respectively.

**Table S3.** Values of compositions of the top (T) and bottom (B) phases of ATPS formed by PEG 6000  $\text{g mol}^{-1}$  (S1) and 10 000  $\text{g mol}^{-1}$  (S2) +  $\text{NaHSO}_3$  + water at  $T = 298.15\text{K}$  over 78 hours. The compositions of mixtures of the first and fifth tie lines were monitored at atmospheric pressure ( $\approx 94 \text{ kPa}$ ).<sup>a</sup>

		S1				S2			
		1 TL.		5 TL.		1 TL.		5 TL.	
		$w_1$	$w_2$	$w_1$	$w_2$	$w_1$	$w_2$	$w_1$	$w_2$
0.5h	T.P.	33.78	3.78	43.23	3.28	34.23	2.95	42.98	3.08
	B.P.	1.98	16.03	1.98	21.22	2.93	10.55	2.05	16.03
1h	T.P.	33.55	3.67	43.02	3.17	34.01	2.93	42.97	2.87
	B.P.	2.05	16.34	1.98	21.82	3.01	10.75	2.45	16.34
1.5h	T.P.	33.52	3.55	42.78	2.98	33.65	2.85	42.9	2.67
	B.P.	2.23	16.22	2.34	21.97	3.05	10.85	2.47	16.22
2h	T.P.	33.57	3.43	42.55	2.95	33.64	2.83	42.87	2.55
	B.P.	2.39	16.32	2.34	21.97	3.12	10.99	2.48	16.12
2.5h	T.P.	33.6	3.22	42.54	2.95	33.23	2.75	42.56	2.43
	B.P.	2.44	16.34	2.34	22.12	3.48	11.08	2.56	16.34
3h	T.P.	33.61	3.17	42.54	2.9	33.23	2.68	42.34	2.43
	B.P.	2.54	16.45	2.35	22.14	3.556	11.24	2.66	16.45
4h	T.P.	32.62	3.17	42.54	2.9	33.05	2.65	42.34	2.43
	B.P.	2.54	16.99	2.35	22.14	3.78	11.78	2.75	16.99
5h	T.P.	32.62	3.18	42.54	2.9	33.05	2.66	42.34	2.43
	B.P.	2.54	17.09	2.35	22.14	3.78	11.94	2.75	17.09
6h	T.P.	32.6	3.18	42.54	2.9	33.06	2.65	42.34	2.43
	B.P.	2.54	17.09	2.35	22.14	3.79	11.94	2.75	17.09
30h	T.P.	32.66	3.13	42.54	2.9	33.05	2.65	42.34	2.43
	B.P.	2.54	17.09	2.35	22.14	3.78	11.92	2.75	17.09
54h	T.P.	32.66	3.13	42.54	2.9	33.05	2.65	42.34	2.43
	B.P.	2.54	17.09	2.35	22.14	3.78	11.92	2.75	17.09
78h	T.P.	32.66	3.12	42.54	2.90	33.05	2.66	42.3	2.43
	B.P.	2.54	17.05	2.35	22.14	3.78	11.92	2.75	17.05

<sup>a</sup>The standard uncertainties  $\sigma$  for temperature and pressure are:  $u(T) = 0.05 \text{ K}$  and  $u(p) = 0.5 \text{ kPa}$ , respectively.

<sup>b</sup> $w_1$  and  $w_2$  represented mass fractions percent of PEG 6 000 or 10 000  $\text{g mol}^{-1}$  and  $\text{NaHSO}_3$ , respectively. The errors (e) associated were  $e \leq 3.7$  and  $5.0 \%$ , respectively.