Supplemental information for

Measurement of Henry's law and liquid-phase loss rate constants of peroxypropionic nitric anhydride (PPN) in deionized water and in n-octanol

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for *Atmos. Chem. Phys.*

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Table S1. Schedule of experiments: PAN in DI water.

Internal reference	**GC-ECD**	T **(°C)**	V_l **(mL)**	Φ **(mL min^{-1})**	$\frac{\Phi}{V_l}$ **(min^{-1})**	$\frac{\mathrm{d}}{\mathrm{d}t}\ln\left(\frac{c_{\mathrm{g},0}}{c_{\mathrm{g},t}}\right)$ **(min^{-1})**
KN 211026	HP	20.0±0.1	140±2	317±3	2.26±0.04	0.0532±0.0006
KN 211028	HP	20.0±0.1	140±2	532±6	3.80±0.07	0.0592±0.0010
AM 211108	Varian	20.00±0.01	140±2	124±1	0.89±0.02	0.0302±0.0001
HO 211108	HP	5.0±0.1	100±2	240±3	2.40±0.05	0.0190±0.0003
AM 211116	Varian	5.00±0.01	50.0±0.4	481±5	9.6±0.1	0.0466±0.0001
KN 211118	HP	5.0±0.1	75.0±0.4	541±6	7.21±0.09	0.0394±0.0003
KN 211104	HP	5.0±0.1	30.0±0.4	433±5	14.4±0.2	0.0639±0.0004
KN 211116	HP	5.0±0.1	100±2	481±5	4.81±0.11	0.0299±0.0002
KN 211118	HP	20.0±0.1	140±2	177±2	1.27±0.02	0.0299±0.0002
KN 211123	HP	20.0±0.1	140±2	570±6	4.07±0.07	0.0654±0.0011
AM 211123	Varian	5.00±0.01	75.0±0.4	451±5	6.01±0.07	0.0309±0.0001
KN 211125	HP	20.0±0.1	100±2	697±8	6.97±0.16	0.0899±0.0023

Table S2. Schedule of experiments: PPN in DI water. Experiments were conducted with the Varian GC-ECD.

Internal reference	T **(°C)**	V_l **(mL)**	Φ **(mL min^{-1})**	$\frac{\Phi}{V_l}$ **(min^{-1})**	$\frac{\mathrm{d}}{\mathrm{d}t}\ln\left(\frac{c_{\mathrm{g},0}}{c_{\mathrm{g},t}}\right)$ **(min^{-1})**
MV 220301	20.00±0.01	100±2	125±15	1.25±0.15	0.043±0.005
MV 220308	20.00±0.01	100±2	433±52	4.33±0.53	0.085±0.002
MV 220315-1	20.00±0.01	150±2	496±5	3.33±0.06	0.0706±0.0010
MV 220315-2	20.00±0.01	100±2	620±7	6.23±0.14	0.1235±0.0018
MV 220317-1	5.00±0.01	150±2	118±1	0.79±0.01	0.01098±0.00004
MV 220317-2	5.00±0.01	150±2	294±3	1.97±0.03	0.01818±0.00005
MV 220322-1	5.00±0.01	150±2	235±3	1.58±0.02	0.01533±0.00005
MV 220322-2	5.00±0.01	150±2	353±4	2.37±0.04	0.01932±0.00005
MV 220324-1	5.00±0.01	150±2	176±2	1.18±0.02	0.01357±0.00002

Table S2 (continued). Schedule of experiments: PPN in DI water. Experiments were conducted with the Varian GC-ECD.

Internal reference	$\boldsymbol{T}$ **(°C)**	$\boldsymbol{V_l}$ **(mL)**	$\boldsymbol{\Phi}$ **(mL min^{-1})**	$\boldsymbol{\frac{\Phi}{V_l}}$ **(min^{-1})**	$\boldsymbol{\frac{\mathrm{d}}{\mathrm{d}t}\ln\left(\frac{c_{\mathrm{g},0}}{c_{\mathrm{g},t}}\right)}$ **(min^{-1})**
MV 220324-2	12.50±0.01	150±2	121±1	0.81±0.01	0.0204±0.00018
MV 220329-1	12.50±0.01	150±2	243±3	1.62±0.03	0.0288±0.0001
MV 220329-2	12.50±0.01	150±2	365±4	2.43±0.04	0.0373±0.0001
MV 220331-1	12.50±0.01	150±2	182±2	1.22±0.02	0.0251±0.0001
MV 220321-2	12.50±0.01	150±2	304±3	2.03±0.04	0.0332±0.0002
MV 220405-1	20.00±0.01	150±2	375±4	2.50±0.04	0.0665±0.0001
MV 220405-2	8.50±0.01	150±2	240±3	1.60±0.03	0.0212±0.0001
MV 220405-3	8.50±0.01	150±2	481±5	3.20±0.06	0.0345±0.0001
MV 220407-1	8.50±0.01	150±2	353±4	2.35±0.04	0.0285±0.0001
MV 220407-2	8.50±0.01	150±2	530±6	3.54±0.06	0.0388±0.0002
MV 220407-3	5.00±0.01	150±2	408±4	2.72±0.05	0.0231±0.0001
HO 220411-1	16.00±0.01	150±2	430±5	2.87±0.05	0.0567±0.0003
HO 220411-2	16.00±0.01	150±2	246±3	1.64±0.03	0.03744±0.00004
HO 220412-1	16.00±0.01	150±2	213±2	1.42±0.02	0.03453±0.00005
HO 220412-3	20.00±0.01	150±2	246±3	1.64±0.03	0.0487±0.0001
HO 220414-1	16.00±0.01	150±2	336±4	2.24±0.04	0.0451±0.0001
HO 220414-2	16.00±0.01	150±2	580±6	3.87±0.07	0.0665±0.0001
KE 220531-1	25.00±0.01	100.0±0.4	312±3	3.12±0.04	0.1122±0.0006
KE 220531-2	25.00±0.01	100.0±0.4	125±1	1.25±0.01	0.0628±0.0001
KE 220531-3	25.00±0.01	100.0±0.4	281±3	2.81±0.03	0.1048±0.0006
KE 220531-4	25.00±0.01	100.0±0.4	344±4	3.44±0.04	0.125±0.002
KE 220603-1	25.00±0.01	100.0±0.4	189±2	1.89±0.02	0.0810±0.0003

Table S3. Schedule of experiments: PPN in n-octanol. Experiments were conducted with the Varian GC-ECD.

Internal reference	T (°C)	V_l (mL)	Φ (mL min^{-1})	$\frac{\Phi}{V_l}$ (min^{-1})	$\frac{\mathrm{d}}{\mathrm{d}t}\ln\left(\frac{c_{g,0}}{c_{g,t}}\right)$ (min^{-1})
KE 220607-1c	20.00±0.01	50.0±0.4	277±3	5.54±0.08	0.00255±0.00004
KE 220607-1d	20.00±0.01	50.0±0.4	339±4	6.78±0.09	0.00381±0.00003
KE 220609-1b	20.00±0.01	50.0±0.4	186±2	3.73±0.05	0.00242±0.00005
KE 220609-1c	20.00±0.01	50.0±0.4	373±4	7.46±0.10	0.00413±0.00002
KE 220609-1d	20.00±0.01	50.0±0.4	311±3	6.22±0.08	0.00374±0.00005
KE 220609-1e	20.00±0.01	50.0±0.4	125±1	2.49±0.03	0.00221±0.00002
KE 220609-1f	20.00±0.01	50.0±0.4	100±1	2.00±0.03	0.0018152±0.0000009
KE 220610-1	20.00±0.01	50.0±0.4	281±3	5.62±0.08	0.00363±0.00002
KE 220621-2a	20.00±0.01	50.0±0.4	259±3	5.17±0.07	0.00317±0.00002
KE 220621-2b	20.00±0.01	50.0±0.4	401±4	8.02±0.11	0.004642±0.000009
KE 220621-2c	20.00±0.01	50.0±0.4	130±1	2.60±0.04	0.002091±0.000001
KE 220622-1	20.00±0.01	50.0±0.4	223±2	4.47±0.06	0.00346±0.00005
KE 220622-2b	5.00±0.01	50.0±0.4	384±4	7.68±0.10	0.00152±0.00001
KE 220622-2c	5.00±0.01	50.0±0.4	118±1	2.37±0.03	0.000562±0.000001
KE 220623-1	5.00±0.05	50.0±0.4	177±2	3.54±0.05	0.0008265±0.0000009
KE 220624-1a	5.00±0.05	50.0±0.4	234±3	4.68±0.06	0.00144±0.00003
KE 220624-1b	5.00±0.05	50.0±0.4	321±4	6.42±0.09	0.00176±0.00004
KE 220624-1c	5.00±0.05	50.0±0.4	350±4	7.00±0.10	0.00202±0.00005
KE 220627-1a	25.00±0.01	50.0±0.4	312±3	6.25±0.09	0.00533±0.00009
KE 220627-1b	25.00±0.01	50.0±0.4	125±1	2.50±0.03	0.00379±0.00003
KE 220627-1c	25.00±0.01	50.0±0.4	282±3	5.64±0.08	0.00543±0.00002
KE 220627-1d	25.00±0.01	50.0±0.4	188±2	3.76±0.05	0.00439±0.00001
KE 220627-1e	25.00±0.01	50.0±0.4	345±4	6.89±0.09	0.005763±0.000005
KE 220628-1a	16.00±0.01	50.0±0.4	304±3	6.09±0.08	0.0027±0.0001
KE 220628-1c	16.00±0.01	50.0±0.4	275±3	5.49±0.07	0.00263±0.00003
KE 220628-1d	16.00±0.01	50.0±0.4	183±2	3.67±0.05	0.00192±0.00003
KE 220628-1e	16.00±0.01	50.0±0.4	337±4	6.74±0.09	0.002889±0.000001
KE 220629-2c	5.00±0.01	50.0±0.4	200±2	4.01±0.05	0.00095±0.00001

Table S3 (continued). Schedule of experiments: PPN in n-octanol. Experiments were conducted with the Varian GC-ECD.

Internal reference	T **(°C)**	V_l **(mL)**	Φ **(mL min⁻¹)**	$\frac{\Phi}{V_l}$ **(min⁻¹)**	$\frac{\mathrm{d}}{\mathrm{d}t}\ln\left(\frac{c_{g,0}}{c_{g,t}}\right)$ **(min⁻¹)**
KE 220711-1b	8.50±0.01	50.0±0.4	118±1	2.37±0.03	0.000843±0.000009
KE 220711-1c	8.50±0.01	50.0±0.4	267±3	5.34±0.07	0.00155±0.00001
KE 220711-1d	8.50±0.01	50.0±0.4	178±2	3.56±0.05	0.0010546±0.0000009
KE 220712-1a	8.50±0.01	50.0±0.4	327±4	6.55±0.09	0.00197±0.00002
KE 220712-1b	8.50±0.01	50.0±0.4	238±3	4.77±0.06	0.00162±0.00002
KE 220712-1c	8.50±0.01	50.0±0.4	358±4	7.16±0.10	0.00223±0.00004
KE 220712-2b	12.50±0.01	50.0±0.4	121±1	2.43±0.03	0.001046±0.000002
KE 220713-1a	12.50±0.01	50.0±0.4	273±3	5.46±0.07	0.00214±0.00002
KE 220713-1b	12.50±0.01	50.0±0.4	182±2	3.64±0.05	0.00168±0.00002
KE 220713-1c	12.50±0.01	50.0±0.4	334±4	6.68±0.09	0.0025±0.0001
KE 220713-1d	12.50±0.01	50.0±0.4	152±2	3.03±0.04	0.00161±0.00008
KE 220713-1e	12.50±0.01	50.0±0.4	243±3	4.86±0.07	0.00206±0.00007
KE 220713-2	5.00±0.01	50.0±0.4	147±2	2.94±0.04	0.000682±0.000001
KE 220714-1a	5.00±0.01	50.0±0.4	252±3	5.05±0.07	0.00127±0.00002
KE 220714-1b	5.00±0.01	50.0±0.4	211±2	4.23±0.06	0.00105±0.00004
KE 220714-1c	5.00±0.01	50.0±0.4	382±4	7.64±0.10	0.00181±0.00003
KE 220714-1d	5.00±0.01	50.0±0.4	265±3	5.29±0.07	0.00129±0.00003
KE 220714-1e	5.00±0.01	50.0±0.4	306±3	6.12±0.08	0.00167±0.00006
KE 220718-1b	5.00±0.01	50.0±0.4	354±4	7.09±0.10	0.00122±0.00003
KE 220718-1c	5.00±0.01	50.0±0.4	331±4	6.62±0.09	0.00142±0.00001
KE 220718-1d	5.00±0.01	50.0±0.4	401±4	8.02±0.11	0.001641±0.000001
KE 220719-1a	5.00±0.01	50.0±0.4	318±3	6.36±0.09	0.00167±0.00002
KE 220719-1b	5.00±0.01	50.0±0.4	365±4	7.30±0.10	0.00195±0.00004
KE 220719-1c	5.00±0.01	50.0±0.4	413±5	8.26±0.11	0.00206±0.00006
KE 220719-2	5.00±0.01	100.0±0.6	94±1	0.94±0.01	0.000285±0.000001
KE 220720-1a	5.00±0.01	100.0±0.6	176±2	1.76±0.02	0.00062±0.00001
KE 220720-1b	5.00±0.01	100.0±0.6	129±1	1.29±0.02	0.000466±0.000007
KE 220720-1c	5.00±0.01	100.0±0.6	188±2	1.88±0.02	0.000667±0.000008

Table S3 (continued). Schedule of experiments: PPN in n-octanol. Experiments were conducted with the Varian GC-ECD.

Internal reference	T **(°C)**	V_l **(mL)**	Φ **(mL min^{-1})**	$\frac{\Phi}{V_l}$ **(min^{-1})**	$\frac{\mathrm{d}}{\mathrm{d}t}\ln\left(\frac{c_{g,0}}{c_{g,t}}\right)$ **(min^{-1})**
KE 220720-1d	5.00±0.05	100.0±0.6	153±2	1.53±0.02	0.000444±0.000001
KE 220721-1b	16.00±0.01	50.0±0.4	257±3	5.14±0.07	0.00235±0.00004
KE 220721-1c	16.00±0.01	50.0±0.4	153±2	3.06±0.04	0.001639±0.000007
KE 220721-1d	16.00±0.01	50.0±0.4	221±2	4.42±0.06	0.00219±0.00002
KE 220725-1a	20.00±0.01	100.0±0.4	148±2	1.48±0.02	0.00140±0.00006
KE 220725-1b	20.00±0.01	100.0±0.4	432±5	4.32±0.05	0.00372±0.00009
KE 220725-1c	20.00±0.01	100.0±0.4	99±1	0.99±0.01	0.00149±0.00003
KE 220725-1d	20.00±0.01	100.0±0.4	185±2	1.85±0.02	0.00206±0.00001
KE 220725-1e	20.00±0.01	100.0±0.4	463±5	4.63±0.05	0.00325±0.00003
KE 220725-1f	20.00±0.01	100.0±0.4	111±1	1.11±0.01	0.001492±0.000001
KE 220726-1a	25.00±0.01	100.0±0.4	150±2	1.50±0.02	0.00350±0.00009
KE 220726-1b	25.00±0.01	100.0±0.4	100±1	1.00±0.01	0.00307±0.00007
KE 220726-1c	25.00±0.01	100.0±0.4	451±5	4.51±0.05	0.0050±0.0001
KE 220726-1d	25.00±0.01	100.0±0.4	201±2	2.01±0.02	0.0033±0.0001
KE 220726-1e	25.00±0.01	100.0±0.4	502±6	5.02±0.06	0.00513±0.00006
KE 220726-2	12.50±0.01	100.0±0.4	102±1	1.02±0.01	0.000622±0.000002
KE 220727-1a	12.50±0.01	100.0±0.4	204±2	2.04±0.02	0.00115±0.00001
KE 220727-1b	12.50±0.01	100.0±0.4	450±5	4.50±0.05	0.00190±0.00002
KE 220727-1c	12.50±0.01	100.0±0.4	144±2	1.44±0.02	0.00088±0.00003
KE 220727-1d	12.50±0.01	100.0±0.4	390±4	3.90±0.05	0.00174±0.00007
KE 220727-1e	12.50±0.01	100.0±0.4	240±3	2.40±0.03	0.00131±0.00003
KE 220727-2	8.50±0.01	100.0±0.4	101±1	1.01±0.01	0.000438±0.000001
KE 220728-1a	8.50±0.01	100.0±0.4	296±3	2.96±0.03	0.00118±0.00004

Table S4. Schedule of experiments: PPN in n-octanol containing ~(0.6±0.2) mM of α-tocopherol. Experiments were conducted with the Varian GC-ECD.

Internal reference	$\boldsymbol{T}$ **(°C)**	$\boldsymbol{V_l}$ **(mL)**	$\boldsymbol{\Phi}$ **(mL min^{-1})**	$\boldsymbol{\frac{\Phi}{V_l}}$ **(min^{-1})**	$\boldsymbol{\frac{\mathrm{d}}{\mathrm{d}t}\ln\left(\frac{c_{\mathrm{g},0}}{c_{\mathrm{g},t}}\right)}$ **(min^{-1})**
KE 220809-1b	20.00±0.01	100.0±0.4	123±1	1.23±0.01	0.0027±0.0002
KE 220809-1c	20.00±0.01	100.0±0.4	278±3	2.78±0.03	0.00345±0.00002
KE 220809-1d	20.00±0.01	100.0±0.4	185±2	1.85±0.02	0.003015±0.000004
KE 220810-1a	20.00±0.01	100.0±0.4	339±4	3.39±0.04	0.0033±0.0001
KE 220810-1b	20.00±0.01	100.0±0.4	197±2	1.97±0.02	0.00310±0.00009
KE 220810-1c	20.00±0.01	100.0±0.4	247±3	2.47±0.03	0.00341±0.00005
KE 220810-1d	20.00±0.01	100.0±0.4	370±4	3.70±0.04	0.00404±0.00003
KE 220810-1e	20.00±0.01	100.0±0.4	123±1	1.23±0.01	0.003100±0.000007

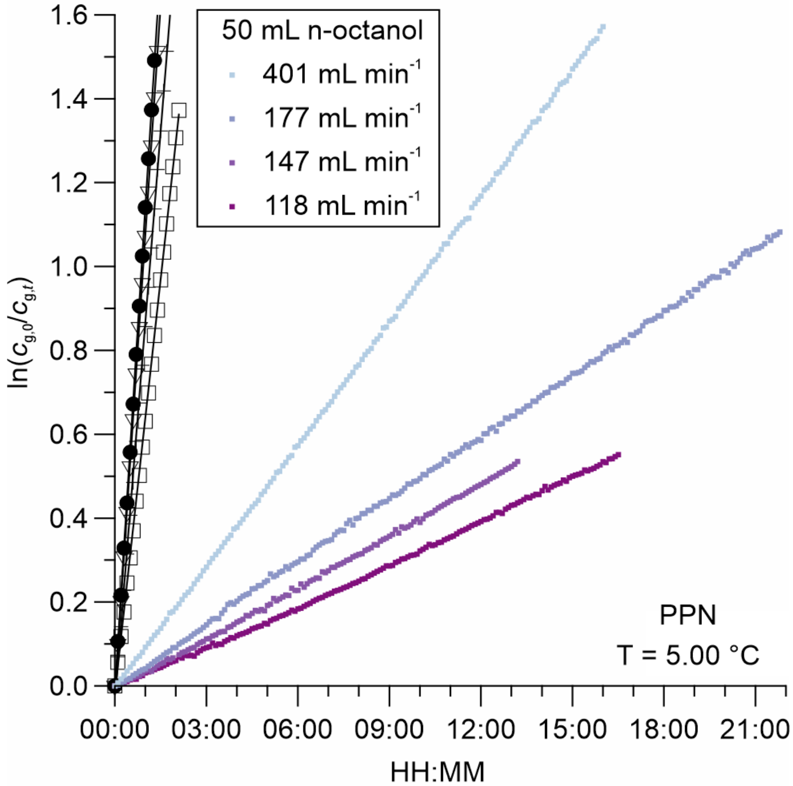

Figure S1. Plots of $\ln(c_{g,0}/c_{g,t})$ versus t for PPN, observed in overnight experiments downstream from 50 mL of n-octanol at 5.00 °C for four different volumetric flow rates. Each data point shown is derived from the peak area of an individual chromatogram, of which there were between 119 and 219 at each flow rate. The data from Figure 3 are superimposed in black colour.

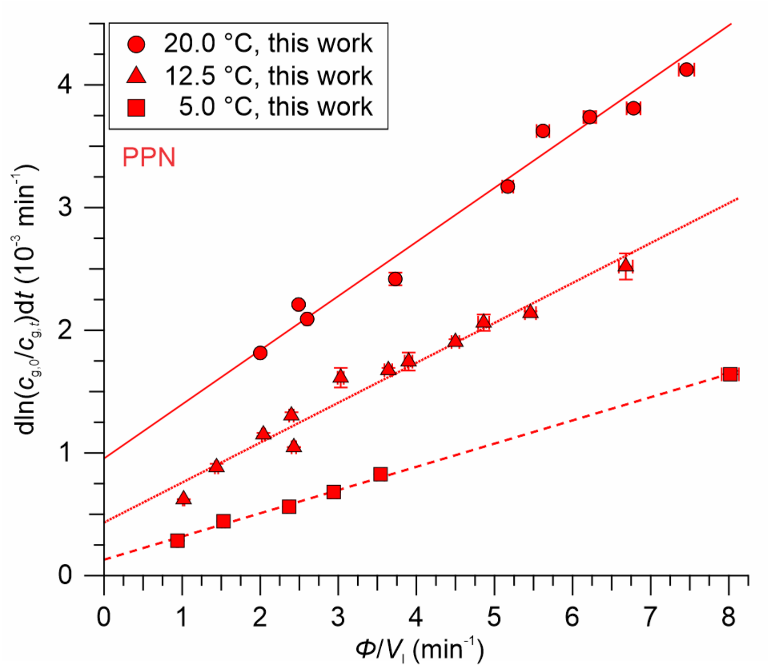

Figure S2. Plots of dln($c_{g,0}$/$c_{g,t}$)/dt versus Φ/V_l for PPN in n-octanol at 20.00 °C (●), 12.50 °C (▲), and 5.00 °C (■).

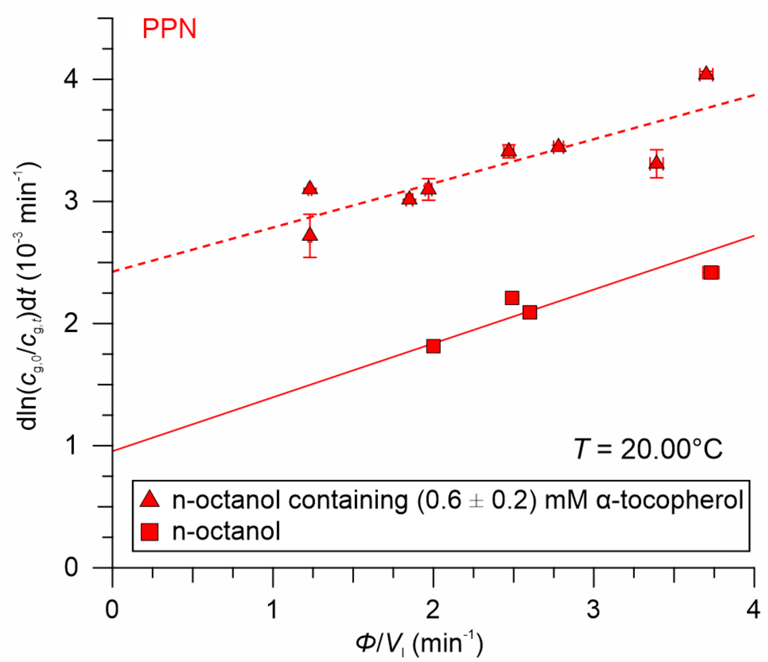

Figure S3. Effect of adding Vitamin E on plots of dln($c_{g,0}$/$c_{g,t}$)/dt versus Φ/V_l for PPN in n-octanol at 20.00 ºC. Results with unadulterated n-octanol are shown as (■), whereas results with n-octanol containing ~(0.6±0.2) mM of α-tocopherol are shown as (▲).

Table S5. Dimensionless Henry's law constants of PAN in deionized water, $H^{CC}_{\mathrm{S,aq}}(\mathrm{PAN})$. N/A = not available. n/d = not determined.

	$\boldsymbol{H^{CC}_{\mathrm{S,aq}}}(\mathbf{PAN})$ **(unitless)**	
Reference	**293.15 K**	**278.15 K**
(Lee, 1984)	98.3±4.8 (295 K)	n/d
(Kames et al., 1991)	97.4±3.6	N/A
(Kames and Schurath, 1995)	97.9±2.0	N/A
This work	101±10	269±13

Table S6. Dimensionless Henry's law constants of PPN in deionized water, $H^{CC}_{\mathrm{S,aq}}(\mathrm{PPN})$. N/A = not available.

	$\boldsymbol{H^{CC}_{\mathrm{S,aq}}}(\mathbf{PPN})$ **(unitless)**					
Reference	**298.15**	**293.15 K**	**289.15 K**	**285.65 K**	**281.65 K**	**278.15 K**
(Kames and Schurath, 1995)	N/A	70.8±1.5	N/A	N/A	N/A	N/A
This work	36.5±1.1	64.2±4.4	74.5±4.5	96.4±1.7	114.7±7.1	160.1±5.6

Table S7. Dimensionless Henry's law constants of PPN in n-octanol, $H^{CC}_{\mathrm{S,oct}}(\mathrm{PPN})$.

	$\boldsymbol{H^{CC}_{\mathrm{S,oct}}}(\mathbf{PPN})$ **(unitless)**					
Reference	**298.15 K**	**293.15 K**	**289.15 K**	**285.65 K**	**281.65 K**	**278.15 K**
This work	(2.15±0.11) $\times10^{3}$	(2.35±0.21) $\times10^{3}$	(2.98±0.19) $\times10^{3}$	(3.07±0.18) $\times10^{3}$	(3.62±0.26) $\times10^{3}$	(4.65±0.36) $\times10^{3}$

Table S8. Loss rate constants of PPN at 293.15 K.

Compound and solvent / medium	$\boldsymbol{k}$ ($\mathbf{10^{-4}\ s^{-1}}$)
PPN in DI water	3.8±0.6
PPN in n-octanol	0.18±0.03
PPN in n-octanol containing ~(0.6±0.2) mM α-tocopherol	0.40±0.04
PPN in air (Kabir et al., 2014)	1.7

Table S9a. Estimated lifetimes of PAN with respect to wet deposition in the atmosphere at 293 K.

Type	$\boldsymbol{L}$ ($\mathbf{g\ m^{-3}}$)	$\boldsymbol{H_S^{CC}}(\mathbf{PAN}) \times \boldsymbol{L}$	$\boldsymbol{k}_{\mathbf{l,aq}}(\mathbf{PAN})$ ($\mathbf{10^{-4}\ s^{-1}}$)	$\boldsymbol{\tau}_{\mathbf{wet}}(\mathbf{PAN}) = \left(\boldsymbol{k}_{\mathbf{l,aq}} \times \boldsymbol{H_S^{CC}} \times \boldsymbol{L}\right)^{-1}$
Aerosol (low load)	2.4×10^{-6} (Nenes et al., 2021)	2.4×10^{-10}	3.8 (this work)	350 ky
Aerosol (high load)	1.0×10^{-4} (Nenes et al., 2021)	1.0×10^{-8}	3.8 (this work)	8.3 ky
Stratus clouds (continental)	0.28 (Hess et al., 1998)	2.8×10^{-5}	3.8 (this work)	3.0 y
Stratus clouds (maritime)	0.30 (Hess et al., 1998)	3.0×10^{-5}	44 (Kames and Schurath, 1995)	87 d
Cumulus clouds (continental, clean)	0.26 (Hess et al., 1998)	2.6×10^{-5}	3.8 (this work)	3.2 y
Cumulus clouds (continental, polluted)	0.30 (Hess et al., 1998)	3.0×10^{-5}	3.8 (this work)	2.8 y
Cumulus clouds (maritime)	0.44 (Hess et al., 1998)	4.4×10^{-5}	44 (Kames and Schurath, 1995)	59 d
Cumulonimbus clouds (Java)	3.0 (Rosenfeld and Lensky, 1998)	3.0×10^{-4}	3.8 (this work)	101 d
Fog	0.058 (Hess et al., 1998)	5.8×10^{-6}	3.8 (this work)	14 y
Fog (Po Valley)	0.3 (Wobrock et al., 1992)	3.0×10^{-5}	3.8 (this work)	2.8 y
Fog (maritime)	0.058 (Hess et al., 1998)	5.8×10^{-6}	44 (Kames and Schurath, 1995)	1.2 y
Fog (maritime)	0.8 (Dimitrova et al., 2021)	8.1×10^{-5}	44 (Kames and Schurath, 1995)	33 d
Fog (maritime)	1.8 (Osthoff et al., 2006)	1.8×10^{-4}	44 (Kames and Schurath, 1995)	14 d

Table S9b. Estimated lifetimes of PPN with respect to wet deposition in the atmosphere at 293 K.

Type	$\boldsymbol{L}$ **(g m^{-3})**	$\boldsymbol{H_S^{CC}(\mathrm{PPN}) \times L}$	$\boldsymbol{k_{l,aq}}$**(PPN) (10^{-4} s^{-1})**	$\boldsymbol{\tau_{wet}}$ **(PPN)** $\boldsymbol{= \left(k_{l,aq} \times H_S^{CC} \times L\right)^{-1}}$
Aerosol (low load)	2.4×10^{-6} (Nenes et al., 2021)	1.5×10^{-10}	3.8 (this work)	540 ky
Aerosol (high load)	1.0×10^{-4} (Nenes et al., 2021)	6.4×10^{-9}	3.8 (this work)	13 ky
Stratus clouds (continental)	0.28 (Hess et al., 1998)	1.8×10^{-5}	3.8 (this work)	4.6 y
Stratus clouds (maritime)	0.30 (Hess et al., 1998)	1.9×10^{-5}	44 (Kames and Schurath, 1995)	137 d
Cumulus clouds (continental, clean)	0.26 (Hess et al., 1998)	1.7×10^{-5}	3.8 (this work)	5.0 y
Cumulus clouds (continental, polluted)	0.30 (Hess et al., 1998)	1.9×10^{-5}	3.8 (this work)	4.3 y
Cumulus clouds (maritime)	0.44 (Hess et al., 1998)	2.8×10^{-5}	44 (Kames and Schurath, 1995)	93 d
Cumulonimbus clouds (Java)	3.0 (Rosenfeld and Lensky, 1998)	1.9×10^{-4}	3.8 (this work)	158 d
Fog	0.058 (Hess et al., 1998)	3.7×10^{-6}	3.8 (this work)	22 y
Fog (Po Valley)	0.3 (Wobrock et al., 1992)	1.9×10^{-5}	3.8 (this work)	4.3 y
Fog (maritime)	0.058 (Hess et al., 1998)	3.7×10^{-6}	44 (Kames and Schurath, 1995)	1.9 y
Fog (maritime)	0.8 (Dimitrova et al., 2021)	5.1×10^{-5}	44 (Kames and Schurath, 1995)	51 d
Fog (maritime)	1.8 (Osthoff et al., 2006)	1.2×10^{-4}	44 (Kames and Schurath, 1995)	23 d

Table S10a. Estimated lifetimes of PAN with respect to wet deposition in the atmosphere at 278 K.

Type	$\boldsymbol{L}$ **(g m^{-3})**	$\boldsymbol{H_S^{cc}(\mathrm{PAN}) \times L}$	$\boldsymbol{k_{l,aq}}$**(PAN) (10^{-4} s^{-1})**	$\boldsymbol{\tau_{wet}}$**(PAN)** $\boldsymbol{= (k_{l,aq} \times H_S^{cc} \times L)^{-1}}$
Aerosol (low load)	2.4×10^{-6} (Nenes et al., 2021)	6.4×10^{-10}	1.8 (this work)	274 ky
Aerosol (high load)	1.0×10^{-4} (Nenes et al., 2021)	2.7×10^{-8}	1.8 (this work)	6.5 ky
Stratus clouds (continental)	0.28 (Hess et al., 1998)	7.5×10^{-5}	1.8 (this work)	2.3 y
Stratus clouds (maritime)	0.30 (Hess et al., 1998)	8.1×10^{-5}	44 (Kames and Schurath, 1995)	33 d
Cumulus clouds (continental, clean)	0.26 (Hess et al., 1998)	7.0×10^{-5}	1.8 (this work)	2.5 y
Cumulus clouds (continental, polluted)	0.30 (Hess et al., 1998)	8.1×10^{-5}	1.8 (this work)	2.2 y
Cumulus clouds (maritime)	0.44 (Hess et al., 1998)	1.2×10^{-4}	44 (Kames and Schurath, 1995)	22 d
Cumulonimbus clouds (Java)	3.0 (Rosenfeld and Lensky, 1998)	8.1×10^{-4}	1.8 (this work)	80 d
Fog	0.058 (Hess et al., 1998)	1.6×10^{-5}	1.8 (this work)	11 y
Fog (Po Valley)	0.3 (Wobrock et al., 1992)	8.1×10^{-5}	1.8 (this work)	2.2 y
Fog (maritime)	0.058 (Hess et al., 1998)	1.6×10^{-5}	44 (Kames and Schurath, 1995)	168 d
Fog (maritime)	0.8 (Dimitrova et al., 2021)	2.2×10^{-4}	44 (Kames and Schurath, 1995)	12 d
Fog (maritime)	1.8 (Osthoff et al., 2006)	4.8×10^{-4}	44 (Kames and Schurath, 1995)	5 d

Table S10b. Estimated lifetimes of PPN with respect to wet deposition in the atmosphere at 278 K.

Type	$\boldsymbol{L}$ **(g m^{-3})**	$H_S^{CC}(\mathrm{PPN}) \times L$	$k_{\mathrm{l,aq}}$**(PPN) (10^{-4} s^{-1})**	τ_{wet}**(PPN)** $= \left(k_{\mathrm{l,aq}} \times H_S^{CC} \times L\right)^{-1}$
Aerosol (low load)	2.4×10^{-6} (Nenes et al., 2021)	3.8×10^{-10}	1.0 (this work)	840 ky
Aerosol (high load)	1.0×10^{-4} (Nenes et al., 2021)	1.6×10^{-8}	1.0 (this work)	20 ky
Stratus clouds (continental)	0.28 (Hess et al., 1998)	4.5×10^{-5}	1.0 (this work)	7.2 y
Stratus clouds (maritime)	0.30 (Hess et al., 1998)	4.8×10^{-5}	44 (Kames and Schurath, 1995)	55 d
Cumulus clouds (continental, clean)	0.26 (Hess et al., 1998)	4.2×10^{-5}	1.0 (this work)	7.7 y
Cumulus clouds (continental, polluted)	0.30 (Hess et al., 1998)	4.8×10^{-5}	1.0 (this work)	6.7 y
Cumulus clouds (maritime)	0.44 (Hess et al., 1998)	7.0×10^{-5}	44 (Kames and Schurath, 1995)	37 d
Cumulonimbus clouds (Java)	3.0 (Rosenfeld and Lensky, 1998)	4.8×10^{-4}	1.0 (this work)	244 d
Fog	0.058 (Hess et al., 1998)	9.3×10^{-6}	1.0 (this work)	35 y
Fog (Po Valley)	0.3 (Wobrock et al., 1992)	4.8×10^{-5}	1.0 (this work)	6.7 y
Fog (maritime)	0.058 (Hess et al., 1998)	9.3×10^{-6}	44 (Kames and Schurath, 1995)	283 d
Fog (maritime)	0.8 (Dimitrova et al., 2021)	1.3×10^{-4}	44 (Kames and Schurath, 1995)	21 d
Fog (maritime)	1.8 (Osthoff et al., 2006)	2.9×10^{-4}	44 (Kames and Schurath, 1995)	9 d

Table S11. Reactive uptake probabilities of PAN and PPN calculated using Eq. (9-10). The water viscosities were obtained from Korson et al. (1969) and those for n-octanol were calculated by linear extrapolation of the above-room temperature data by Venkatesan et al. (2020). Molar volume data were obtained using the PhysChem module of the ACD/Labs percepta platform via the Royal Society of Chemistry's Chemspider web site (2022).

Compound and solvent	T **(K)**	μ **(mPa s)**	D_l **(10^{-9} m^2 s^{-1})**	k_l **(10^{-5} s^{-1})**	ω **(m s^{-1})**	H_S^{cc}	γ **(10^{-5})**
PAN and DI water	278.15	1.5192	0.88	18	221	269	0.2
PAN and DI water	293.15	1.0020	1.4	38	226	101	0.1
PPN and DI water	278.15	1.5192	0.86	10	209	160	0.09
PPN and DI water	293.15	1.0020	1.4	38	214	64	0.09
PAN and n-octanol	278.15	12.2	2.3	0.5	221	1920	0.4
PAN and n-octanol	293.15	9.3	3.2	0.3	226	1010	0.2
PPN and n-octanol	278.15	12.2	2.3	0.3	209	4652	0.7
PPN and n-octanol	293.15	9.3	3.2	1.8	214	2351	1.1

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