

Model Parameters and Validation

Tables S1 and S2 summarize group interaction parameters a_{mn} and van der Waals volume and surface parameters for functional groups examined in this work, respectively. These parameters were compiled from Hansen et al. (1991), Raatikainen and Laaksonen (2005), and Compennolle et al. (2009). An instance of the model was executed for the mixtures ethanol/water and acetone/water using parameters from Hansen et al. (1991) only. For these mixtures UNIFAC predictions are available from the Dortmund Data Bank Software & Separation GmbH (DDBST) online tool for prediction of activity coefficients (<http://ddbonline.ddbst.com/UNIFAC/Calculation/UNIFACCalculationCGI.exe>). Calculations were also compared against the software package xIUNIFAC (Randhol and Engelién, 2000, <http://www.pvv.org/~randhol/xlunifac/>). Figure 1 shows a benchmark comparison for the activity coefficients predicted for the two mixtures. Agreement between this work and DDBST prediction is taken as indication for correct implementation of the UNIFAC model.

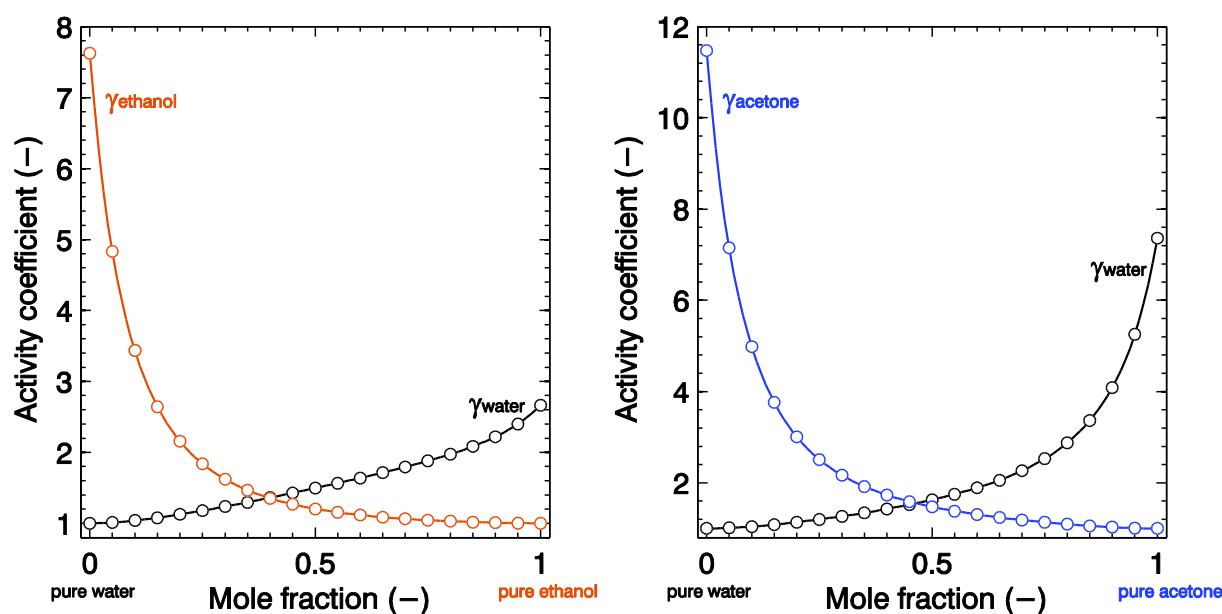


Figure S1. Activity coefficients γ_{water} and γ_{solute} (ethanol or acetone) vs. mole fraction of solute. Symbols are from the DDBST online calculator. Solid lines are computed from the code using a_{mn} interaction parameter values from Hansen (1991). The Q_k parameter for the $\text{CH}_3\text{C}(=\text{O})$ was taken from xIUNFAC (Table 2).

Experimental Data for Model Evaluation

Tables S3- S7 summarize selected data from the literature to evaluate predictions by the proposed modelling approach. These include model compounds for primary organic aerosol (Table S3), functionalized hydroperoxy ethers (Table S4), hydroxynitrates (Table S5), carboxylic acids (Table S6), and carbohydrates (Table S7). These compounds represent a mix of the functional groups that were evaluated in this work, i.e. alkane [CH_n], alcohol [OH], carbonyl [$\text{CH}_n\text{C}(=\text{O})$], aldehyde [$\text{HC}(=\text{O})$], ether [$\text{CH}_n(\text{O})$], carboxyl [$\text{C}(=\text{O})\text{OH}$], nitrate [CH_nONO_2], and hydroperoxide [$\text{CH}_n(\text{OOH})$]. Data in Table S3 are taken from Raymond and Pandis (2002) and Shilling et al., (2007). Data in Tables S4 and S5 are taken from the supplement of Suda et al. (2014). Data in Tables S6 and S7 are from various sources and are summarized in the supplement of Petters et al. (2009). Values were updated with new compounds from Christensen and Petters (2012), and were re-screened for data quality based on a summary provided by Kuwata et al. (2013).

The tables include the following information. Chemical name, elemental formula, molecular structure, decomposition into functional groups for UNIFAC, molecular weight, density, molar volume ($1/\text{density}$), solubility in water, observed CCN activity, and apparent κ -value. The abbreviations *obs* denotes observed value, *mod* denotes model predicted value, *insoluble* denotes that the compound is insoluble in water and precise solubility value is unknown, N/A denotes that information is not available. The UNIFAC representation lists the groups used to initialize the activity coefficient calculation. Note that the alpha-olefin group ($\text{H}_x\text{C}=\text{CH}_x$) was not implemented and the double bonded carbon for oleic acid and maleic acid was approximated as alkane group. For sufficiently soluble compounds the relationship between critical supersaturation and dry diameter follows a $-3/2$ slope when graphed in log-log coordinates and these compounds are well characterized using a single κ -value (Petters and Kreidenweis, 2008). For compounds that are sparingly soluble, this is not the case. Therefore, the supersaturation and dry diameter of the CCN data are included under the CCN column. For example, myristic acid (Table S3, column 1) did not show CCN activation at $s_c = 1\%$ and $D < 200$ nm. This data pair is used to compute an upper bound apparent κ -value for this substance, i.e. $\kappa_{\text{app}} < 2 \times 10^{-5}$. Apparent κ values were calculated numerically seeking the κ that reproduces the s_c , D_d data pair using Eq. (6) in Petters and Kreidenweis (2007). For sufficiently soluble compounds the supersaturation and dry diameter for which the CCN activity the compounds are marked as *dissolved*. Maleic acid (Table S6) falls into that category. For many compounds, two entries are listed for observed κ -values. These denote the observed range and were derived from measurement uncertainty in a single study, the range between multiple studies, or the range of observation from differences between isomers. More details about the data can be found in the previous data compilations (Petters et al., 2009, Kuwata et al., 2013, Suda et al., 2014, and references therein).

Tables

Table S1. Group interaction parameters a_{mn} . Grey shaded entries are from Table 8 in Raatikainen and Laaksonen (2005). Purple entries are from Table 5, blue entries are from Table 6, and orange entries from Table 7 in Compennolle et al. (2009). The remaining entries are from Table 2, supporting information in Hansen et al. (1991).

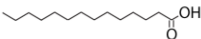
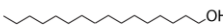
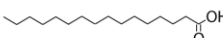
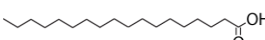
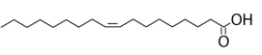
	CH _n	OH	H ₂ O	CH _n C(=O)	HC(=O)	CH _n (O)	C(=O)OH	CH _n ONO ₂	CH _n (OOH)
CH _n	0	143.480	2650.80	586.570	644.590	649.800	-150.91	500.950	977.56
OH	19.236	0	-407.50	84.000	-203.600	28.060	-492.09	37.631	-330.28
H ₂ O	170.220	-1.393	0	-195.400	-116.000	540.500	-437.73	142.650	-341.18
CH _n C(=O)	-180.670	164.500	472.50	0	-37.360	-103.600	669.40	-197.930	-350.58
HC(=O)	474.880	529.000	480.80	128.000	0	304.100	497.50	402.000	-387.63
CH _n (O)	-272.450	237.700	-314.70	191.100	-7.838	0	664.60	1133.100	-438.74
C(=O)OH	2693.300	238.130	271.04	-297.800	-165.500	-338.500	0	-100.170	-501.23
CH _n ONO ₂	-75.718	818.970	681.78	188.720	-179.380	-289.810	1173.30	0	545.66
CH _n (OOH)	-23.233	342.920	795.55	380.940	408.880	490.360	1479.00	-86.279	0

Table S2. Van der Waals volume and surface parameters for groups used in the work. Entries are from from Table 1, supporting information in Hansen (1991) except for CH_nONO_2 and $\text{CH}_n(\text{OOH})$ which are taken from Table 1 in Compennolle et al., (2009).

Main Group		Subgroup			
		CH ₃	CH ₂	CH	C
CH _n	R _k	0.9011	0.6744	0.4469	0.2195
	Q _k	0.8480	0.5400	0.2280	0
OH		OH			
	R _k	1.0			
	Q _k	1.2			
H ₂ O		H ₂ O			
	R _k	0.92			
	Q _k	1.40			
CH _n C(=O)		CH ₃ C(=O)	CH ₂ C(=O)		
	R _k	1.6724	1.4457		
	Q _k	1.4880 ^(*)	1.1800		
HC(=O)		HC(=O)			
	R _k	0.998			
	Q _k	0.948			
CH _n (O)		CH ₃ (O)	CH ₂ (O)	CH(O)	THF
	R _k	1.145	0.9183	0.6908	0.9183
	Q _k	1.088	0.7800	0.46800	1.100
C(=O)OH		C(=O)OH	HC(=O)OH		
	R _k	1.3013	1.5280		
	Q _k	1.2240	1.5320		
CH _n ONO ₂		CH ₂ (ONO ₂)	CH(ONO ₂)	C(ONO ₂)	
	R _k	2.1246	1.8971	1.6697	
	Q _k	1.8682	1.5562	1.3282	
CH _n (OOH)		CH ₂ (OOH)	CH(OOH)	C(OOH)	
	R _k	1.5869	1.3594	1.1320	
	Q _k	1.4370	1.1250	0.8970	

^(*)Hansen et al. (1991) report $Q_k = 1.448$. The table used in xIUNIFAC gives 1.488. Using $Q_k = 1.488$ results in exact agreement between this code and output for acetone/water from the DDBST online calculator.

Table S3. Data for primary organic aerosol model compounds

#	Name	Formula	Structure	UNIFAC representation		MW	ρ	Molar volume		Solubility (v/v)	CCN		Apparent κ	
				#	Subgroup			obs	mod		s_c (%)	obs	model	
														D_d (nm)
POA model compounds	Myristic acid	C ₁₄ H ₂₈ O ₂		1	CH ₃	228.4	0.866	264	272.7	<2.3e-5	1%	<2e-5	<1e-6	
				12	CH ₂									
				1	C(=O)OH									
	Cetyl alcohol	C ₁₆ H ₃₄ O		1	CH ₃	242.5	0.830	292	309.1	1.2e-9	1%	<2e-5	<1e-6	
				15	CH ₂									
				1	OH									
	Palmitic acid	C ₁₆ H ₃₂ O ₂		1	CH ₃	256.4	0.853	301	309.1	Insoluble	1%	<2e-5	<1e-6	
				14	CH ₂									
				1	C(=O)OH									
	Stearic acid	C ₁₈ H ₃₆ O ₂		1	CH ₃	284.5	0.847	336	345.5	3.5e-6	1%	<2e-5	<1e-6	
				16	CH ₂									
				1	C(=O)OH									
	Oleic acid	C ₁₈ H ₃₄ O ₂		1	CH ₃	282.5	0.890	317	336.4	insoluble	0.66%	<1e-5	<1e-6	
				14	CH ₂									
				2	CH									
				1	C(=O)OH									

Notes: Myristic acid κ -values are taken from Raymond and Pandis (2002), density and molecular weight are from Petters et al. (2009). The upper κ limits from Kuwata et al. (2013). Oleic acid κ -values are based on Shilling et al. (2007) and are imported from supplement of Kuwata et al. (2013). Density and molecular weight are from Petters et al. (2009).

Table S4. Data for functionalized hydroperoxide ethers. Apparent κ -values are identical to those reported in Suda et al. (2014).

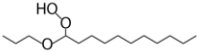
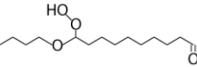
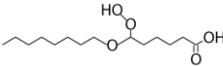
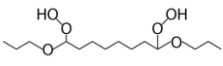
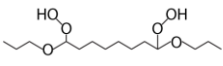
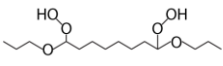
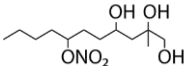
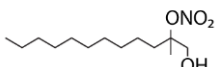
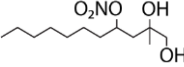
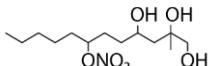
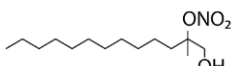
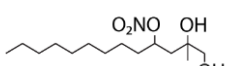
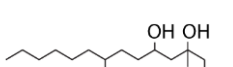
#	Name	Formula	Structure	UNIFAC representation		MW	ρ	Molar volume		Solubility (v/v)	CCN	Apparent κ	
				#	Subgroup			obs	mod		s_c (%)	obs	model
Functionalized hydroperoxide ethers	Peroxide-ether	$C_{14}H_{30}O_3$		2	CH ₃	246.4	N/A	N/A	320	N/A	0.59%	2.5e-3	<1e-6
				10	CH ₂								
				1	CH ₂ (O)								
				1	CH(OOH)								
	Peroxide-ether with aldehyde	$C_{14}H_{28}O_4$		1	CH ₃	260.4	N/A	N/A	320	N/A	0.53%	9.2e-4	8.3e-5
				10	CH ₂								
				1	CH ₂ (O)								
				1	CH(OOH)								
	Peroxide-ether with acid	$C_{14}H_{28}O_5$		1	CH ₃	276.4	N/A	N/A	300	N/A	0.83%	1.2e-2	8.5e-5
				10	CH ₂								
				1	CH ₂ (O)								
				1	CH(OOH)								
	Diperoxide-diether	$C_{14}H_{30}O_6$		1	C(=O)OH	276.4	N/A	N/A	300	N/A	123 nm	2.8e-2	8.5e-5
				2	CH ₃								
				8	CH ₂								
				2	CH ₂ O								
	Diperoxide-diether	$C_{14}H_{30}O_6$		2	CH(OOH)	294.4	N/A	N/A	350	N/A	0.31	1.0-e2	<1e-6
				2	CH ₂ O								
				2	CH(OOH)								
				2	CH(OOH)								
	Diperoxide-diether	$C_{14}H_{30}O_6$		2	CH ₃	294.4	N/A	N/A	350	N/A	205 nm	1.1e-2	<1e-6
				8	CH ₂								
				2	CH ₂ O								
				2	CH(OOH)								

Table S5. Data for hydroxynitrates. Apparent κ -values are identical to those reported in Suda et al. (2014).

	Name	Formula	Structure	UNIFAC representation		MW	ρ	Molar volume		Solubility	CCN	Apparent κ	
				#	Subgroup			obs	mod		obs	s_c (%)	obs
										D_d (nm)			
Hydroxynitrates	Dihydroxynitrate	C ₁₀ H ₂₁ O ₅ N		2	CH ₃	235.3	N/A	N/A	220.8	N/A	0.35%	9.8e-2	7.5e-2
				6	CH ₂						100 nm		
				1	C								
				1	CH(ONO ₂)								
				2	OH								
	Trihydroxynitrate	C ₁₀ H ₂₁ O ₆ N		2	CH ₃	251.3	N/A	N/A	211.5	N/A	0.36%	1.5e-1	8.6e-2
				5	CH ₂						88 nm		
				1	CH								
				1	C								
				1	CH(ONO ₂)								
	Dihydroxynitrate	C ₁₁ H ₂₃ O ₅ N		2	CH ₃	249.3	N/A	N/A	237.5	N/A	0.85%	2.4e-2	2.8e-2
				7	CH ₂						100 nm		
				1	C								
				1	CH(ONO ₂)								
				2	OH								
	Trihydroxynitrate	C ₁₁ H ₂₃ O ₆ N		2	CH ₃	265.3	N/A	N/A	226.9	N/A	0.35%	1.7e-1	7.8e-1
				6	CH ₂						88 nm		
				1	CH								
				1	C								
				1	CH(ONO ₂)								
	Dihydroxynitrate	C ₁₂ H ₂₅ O ₅ N		2	CH ₃	263.3	N/A	N/A	263.3	N/A	0.3%	1.8e-2	8.0e-3
				8	CH ₂						222 nm		
				1	C								
				1	CH(ONO ₂)								
				2	OH								

Hydroxynitrates	Trihydroxynitrate	C ₁₂ H ₂₅ O ₆ N		2 CH ₃ 7 CH ₂ 1 CH 1 C 1 CH(ONO ₂) 3 OH	279.3	N/A	N/A	242.3	N/A	0.3%	100 nm	1.8e-1	7.2e-2
	Hydroxynitrate	C ₁₃ H ₂₇ O ₄ N		2 CH ₃ 10 CH ₂ 1 OH 1 C(ONO ₂)	261.4	N/A	N/A	286.4	N/A	0.35%	302 nm	2.7e-3	<1e-6
	Dihydroxynitrate	C ₁₃ H ₂₇ O ₅ N		2 CH ₃ 9 CH ₂ 1 C 1 CH(ONO ₂) 2 OH	277.4	N/A	N/A	270.8	N/A	0.21%	222 nm	2.8e-2	1.9e-3
	Trihydroxynitrate	C ₁₃ H ₂₇ O ₆ N		2 CH ₃ 8 CH ₂ 1 CH 1 C 1 CH(ONO ₂) 3 OH	293.4	N/A	N/A	257.7	N/A	0.3%	111 nm	1.0e-1	6.6e-2
	Hydroxynitrate	C ₁₄ H ₂₉ O ₄ N		2 CH ₃ 11 CH ₂ 1 C(ONO ₂) 1 OH	275.4	N/A	N/A	304.5	N/A	0.7%	302 nm	4.8e-5	1.1e-4
	Dihydroxynitrate	C ₁₄ H ₂₉ O ₅ N		2 CH ₃ 10 CH ₂ 1 C 1 CH(ONO ₂) 2 OH	291.4	N/A	N/A	291.4	N/A	0.22%	222 nm	2.6e-2	2.7e-4
	Trihydroxynitrate	C ₁₄ H ₂₉ O ₆ N		2 CH ₃ 9 CH ₂ 1 CH 1 C 1 CH(ONO ₂) 3 OH	307.4	N/A	N/A	273.1	N/A	0.3%	111 nm	1.0e-1	5.9e-2

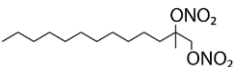
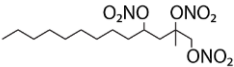
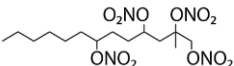
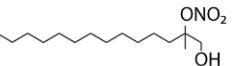
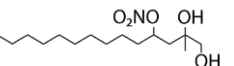
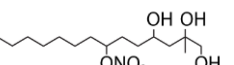
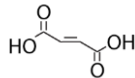
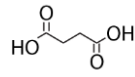
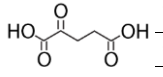
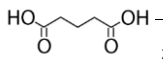
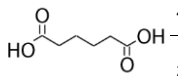
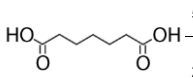
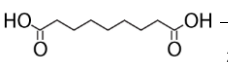
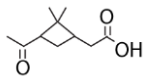
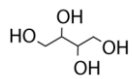
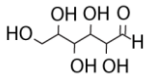
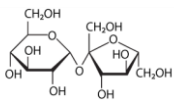
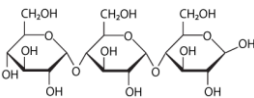
Hydroxynitrates	Dinitrate	$C_{14}H_{28}O_6N_2$		2 CH ₃ 10 CH ₂ 1 CH ₂ (ONO ₂) 1 C(ONO ₂)	320.4	N/A	N/A	360	N/A	0.7% 220 nm	3.6e-3	<1e-6
	Trinitrate	$C_{14}H_{27}O_9N_3$		2 CH ₃ 9 CH ₂ 1 CH ₂ (ONO ₂) 1 CH(ONO ₂) 1 C(ONO ₂)	381.4	N/A	N/A	395	N/A	0.46% 332 nm	2.9e-4	<1e-6
	Tetranitrate	$C_{14}H_{26}O_{12}N_4$		2 CH ₃ 8 CH ₂ 1 CH ₂ (ONO ₂) 2 CH(ONO ₂) 1 C(ONO ₂)	442.4	N/A	N/A	430	N/A	0.37% 332 nm	1.2e-3	<1e-6
	Hydroxynitrate	$C_{15}H_{31}O_4N$		2 CH ₃ 12 CH ₂ 1 OH 1 C(ONO ₂)	289.4	N/A	N/A	322.7	N/A	0.6% 302 nm	8.4e-4	<1e-6
	Dihydroxynitrate	$C_{15}H_{31}O_5N$		2 CH ₃ 11 CH ₂ 1 C 1 CH(ONO ₂) 2 OH	305.4	N/A	N/A	304.2	N/A	0.23% 223 nm	2.2e-2	5.3e-5
	Trihydroxynitrate	$C_{15}H_{31}O_6N$		2 CH ₃ 10 CH ₂ 1 CH 1 C 1 CH(ONO ₂) 3 OH	321.4	N/A	N/A	288.5	N/A	0.35% 111 nm	8.1e-2	5.3e-2

Table S6. Data for carboxylic acids.

	Name	Formula	Structure	UNIFAC representation		MW (g mol ⁻¹)	ρ (g cm ⁻³)	Molar volume		Solubility (v/v)	CCN s _c (%)	Apparent κ	
				#	Subgroup			obs	mod			obs	model
Carboxylic acids	Maleic acid	C ₄ H ₄ O ₄		2	CH	116.1	1.63	63.8	83.3	9.1e-1	dissolved	3.3e-1	2.2e-1
				2	C(=O)OH							3.8e-1	
	Succinic acid	C ₄ H ₆ O ₄		2	CH ₂	118.1	1.552	76.1	91.7	5.7e-2	dissolved	1.7e-1	2.0e-1
				2	C(=O)OH							3.0e-1	
	α -ketoglutaric acid	C ₅ H ₆ O ₅		1	CH ₂	146.1	1.499	102.2	108.3	Soluble	dissolved	2.7e-1	1.7e-1
				1	CH ₂ C(=O)							3.5e-1	
				2	C(=O)OH								
	Glutaric acid	C ₅ H ₈ O ₄		3	CH ₂	132.1	1.429	92.5	108.3	8.1e-1	dissolved	5.4e-2	1.7e-1
				2	C(=O)OH							1.6e-1	
	Adipic acid	C ₆ H ₁₀ O ₄		4	CH ₂	146.2	1.352	107	125.0	1.8e-2	~0.6%	1e-3	1.4e-1
				2	C(=O)OH						~200m	1e-2	
	Pimelic acid	C ₇ H ₁₂ O ₄		5	CH ₂	160.2	1.321	121	141.7	5.1e-2	dissolved	1.4e-1	1.3e-1
				2	C(=O)OH							1.6e-1	
	Azelaic acid	C ₉ H ₁₆ O ₄		7	CH ₂	188.2	1.251	150	175.0	4.0e-3	0.73%	2e-2	1.2e-2
				2	C(=O)OH						113 nm	4e-2	
	Cis-pinonic acid	C ₁₀ H ₁₆ O ₃		2	CH ₃	184.2	1.169	157	190.9	5.5e-3	1% 115 nm	5e-3	5.3e-5
				2	CH ₂								
				2	CH								
				1	C								
				1	CH ₃ C(=O)								
				1	C(=O)OH								

Notes: The range for cis-pinonic acid is taken from the atomized alcohol solution data, which is thought to be the most pure (Huff Hartz et al., 2006). Overall results range from 0.1 (Raymond and Pandis, 2002), 0.005-0.04 (Huff-Hartz), and ~0.009 (Kuwata et al., 2013).

Table S7. Data for carbohydrates.

Name	Formula	Structure	UNIFAC representation		MW (g mol ⁻¹)	ρ (g cm ⁻³)	Molar volume		Solubility (v/v)	CCN s_c (%)	Apparent κ	
			#	Subgroup			obs	mod			obs	model
Carbohydrates	Threitol		2	CH ₂	122.1	1.451	84.2	100.0	4.4e-1	dissolved	1.2e-1	2.1e-1
			2	CH							1.6e-1	
			4	OH								
	Glucose		1	CH ₂	180.2	1.556	115.8	138.5	5.8e-1	dissolved	1.4e-1	1.7e-1
			4	CH							2.0e-1	
			5	OH								
			1	C(=O)H								
	Sucrose		3	CH ₂	342.3	1.589	215.4	261.5	1.3e-0	dissolved	7.0e-2	1.1e-1
			6	CH								
			8	OH							1.1e-1	
			2	CH(O)								
			1	C(O)								
	Maltotriose		3	CH ₂	504.4	N/A	N/A	384.6	soluble	dissolved	3e-2	9.1e-1
			10	CH							7e-2	
			11	OH								
			5	CH(O)								

References

- Christensen, S. I. and Petters, M. D.: The role of temperature in cloud droplet activation, *J. Phys. Chem. A.*, 116(39), 9706-9717, doi:10.1021/jp3064454, 2012.
- Compernelle, S., Ceulemans, K., and Müller, J.-F.: Influence of non-ideality on condensation to aerosol, *Atmos. Chem. Phys.*, 9, 1325-1337, doi:10.5194/acp-9-1325-2009, 2009.
- Hansen, H. K., Rasmussen, P., Fredenslund, A., Schiller, M., and Gmehling, J.: Vapor-liquid equilibria by UNIFAC group contribution. 5. Revision and extension, *Ing. Eng. Chem. Res.*, 30(10), 2352-2355, doi:10.1021/ie00058a017, 1991.
- Huff Hartz, K. E., Tischuk, J. E., Chan, M. N., Chan, C. K., Donahue, N. M., and Pandis, S. N.: Cloud condensation nuclei activation of limited solubility organic aerosol, *Atmos. Environ.*, 40, 605–617, 2006.
- Kuwata, M., Shao, W., Lebouteiller, R., and Martin, S. T.: Classifying organic materials by oxygen-to-carbon elemental ratio to predict the activation regime of Cloud Condensation Nuclei (CCN), *Atmos. Chem. Phys.*, 13, 5309-5324, doi:10.5194/acp-13-5309-2013, 2013.
- Petters, M. D. and Kreidenweis, S. M.: A single parameter representation of hygroscopic growth and cloud condensation nucleus activity, *Atmos. Chem. Phys.*, 7, 1961-1971, doi:10.5194/acp-7-1961-2007, 2007.
- Petters, M. D. and Kreidenweis, S. M.: A single parameter representation of hygroscopic growth and cloud condensation nucleus activity – Part 2: Including solubility, *Atmos. Chem. Phys.*, 8, 6273-6279, doi:10.5194/acp-8-6273-2008, 2008.
- Petters, M. D., Kreidenweis, S. M., Prenni, A. J., Sullivan, R. C., Koehler, K. A., Ziemann, P. J.: Role of molecular size in cloud droplet activation, *Geophys. Res. Lett.*, 36, L22801, doi:10.1029/2009GL040131, 2009.
- Raatikainen, T. and Laaksonen, A.: Application of several activity coefficient models to water-organic-electrolyte aerosols of atmospheric interest, *Atmos. Chem. Phys.*, 5, 2475-2495, doi:10.5194/acp-5-2475-2005, 2005.
- Raymond, T. M. and Pandis, S. N.: Cloud activation of single-component organic aerosol particles, *J. Geophys. Res.*, 107(D24), 4787, doi:10.1029/2002JD002159, 2002.
- Shilling, J. E., King, S. M., Mochida, M., and Martin, S. T.: Mass spectral evidence that small changes in composition caused by oxidative aging processes alter aerosol CCN properties, *J. Phys. Chem.*, 111, 3358–3368, doi:10.1021/jp068822r, 2007.
- Suda, S. R., Petters, M. D., Yeh, G. K., Strollo, C., Matsunaga, A., Faulhaber, A., Ziemann, P. J., Carrico, C. M., Sullivan, R. C., Kreidenweis, S. M.: Influence of functional groups on organic

aerosol cloud condensation nucleus activity, *Environ. Sci. & Technol.*, 48(17), 10182-10190, doi:10.1021/es502147y, 2014.