Supplemental Information for:

Insight into the role of water-soluble organic solvents for the Cloud Condensation Nuclei activation of cholesterol

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Abstract: The following document contains supplementary data, analysis and figures that pertain to the calibrations, statistical analysis and experimental set-up.

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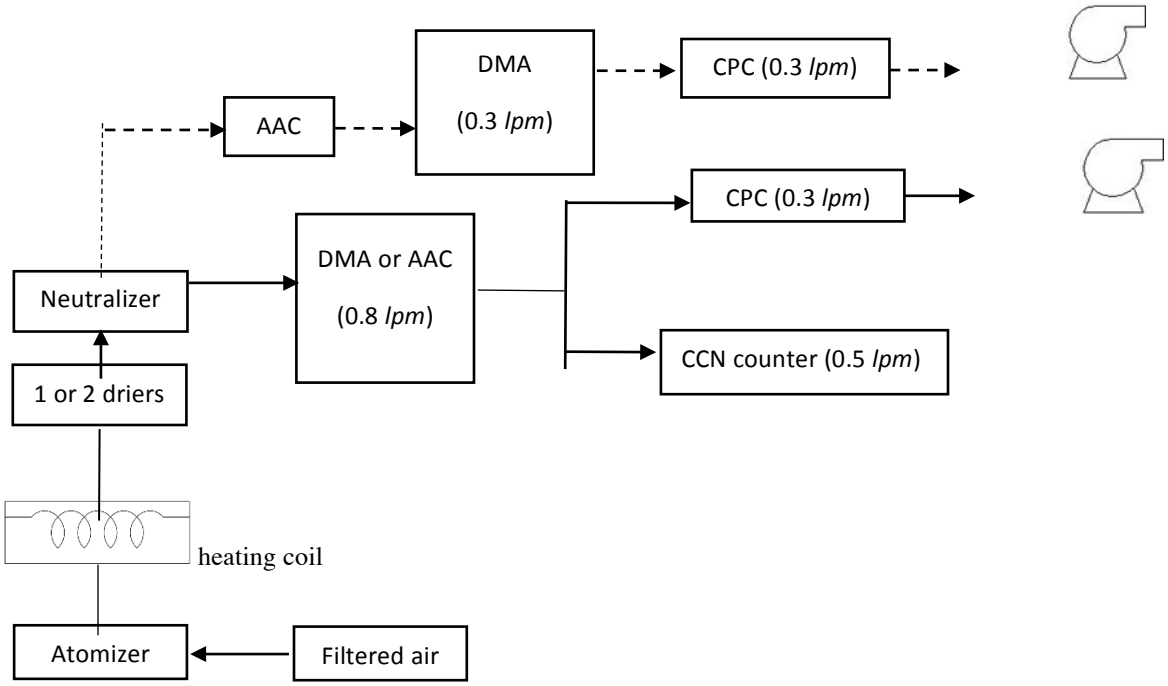

Figure S1. Experimental setup using DMA or AAC as a classifier. Sample flowrates are illustrated inside the parentheses. The setup shown with dashed line corresponds to the setup for shape factor.

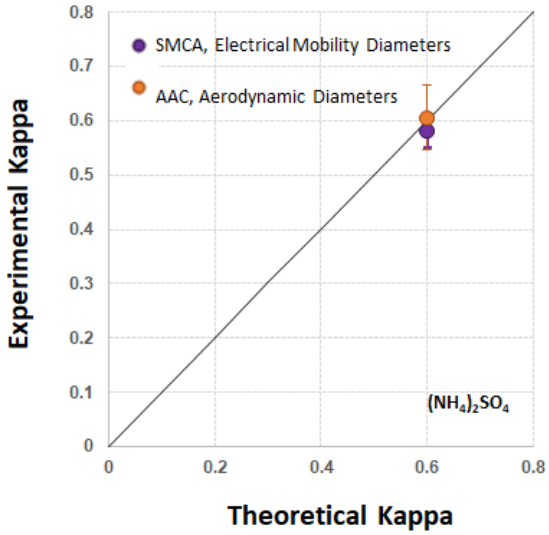

Figure S2. $(NH_4)_2SO_4$ comparison of Electrical Mobility and AAC derived kappa values.

Surface tension measurements

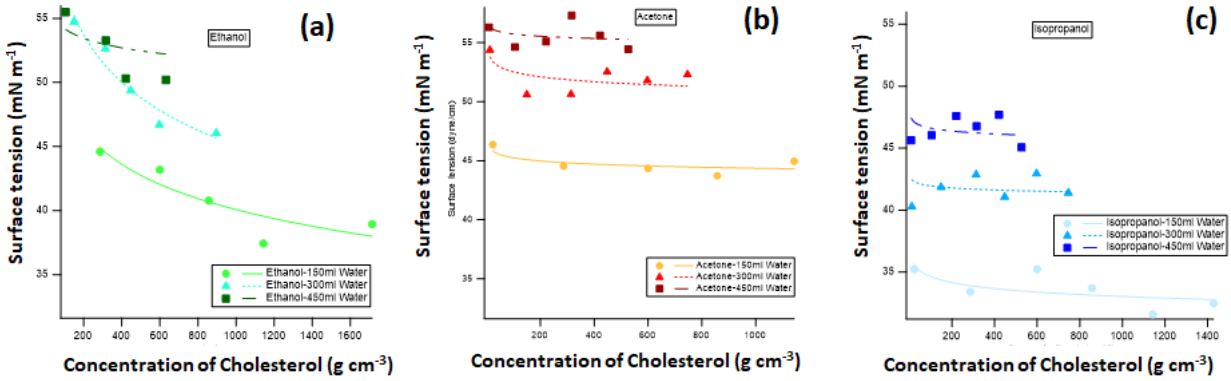

Figure S3. Surface tension vs concentration of cholesterol in a) Ethanol; b) Isopropanol; c) Acetone mixed with three different volumes of water.

CCN Calibration with $(NH_4)_2SO_4$

Table S1. (NH4)2SO4 Calibrated CCN Counter measurement data

Supersaturation setting (%)	Calibrated supersaturation (%)	Critical diameter, D_{a0} (nm)
0.2	0.18	86.42
0.4	0.40 ± 0.02	52.42 ± 1.56
0.6	0.56 ± 0.04	41.34 ± 1.84
0.8	0.74 ± 0.01	34.96 ± 0.39
1	0.95 ± 0.01	29.66 ± 0.23
1.2	1.18 ± 0.05	25.72 ± 0.73
1.4	1.31 ± 0.02	23.97 ± 0.31
1.6	1.64 ± 0.06	20.71 ± 0.54
1.8	1.87 ± 0.02	18.96 ± 0.12

ANOVA (Analysis of variance)

Factors considered in 2^n *Factorial Design for* κ hygroscopicity values:

- Solvent used (Organic Solvent – Ethanol, Isopropanol, Acetone)
- Volume of Water added (Dilution, 150 ml, 300ml, and 450ml of added water)
- Number of Dryers (1 or 2)

To determine which experimental design factor contributes the most variance to changes in the mean an analysis of variance (ANOVA) is performed. It is assumed that sample sizes greater than 40 follow the central limit theorem and normal probability distributions. Thus the mean of a treatment Error the factor will follow normal distributive properties and the probability that the mean of a treatment Error a given factor is different than a second mean can be quantified. The sources of variation describe the experimental design factors considered. SS is the sum of squares for a given factor. *D* is the degrees of freedom. MS is the mean sum of squares approximated as the sum of squares divided by the degrees of freedom. MS for a factor is divided by the MS of the error to define F, the critical F-distribution statistic which is used to find the probability value (p-value) Type I significance. The significance value, $\alpha = 5\%$. *p*-values for both factors are less than 5%; thus, we conclude that the null hypothesis (H_0: factor treatment effects = 0) is rejected.

- **Table S2.** ANOVA statistics for Electrical Mobility Kappa for 1 dryer data

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Sample	0.005661	2	0.00283	4.56187	0.011388	3.034414
Columns	0.036963	2	0.018482	29.78683	2.99E-12	3.034414
Interaction	0.007269	4	0.001817	2.928886	0.021665	2.410222
Within	0.145188	234	0.00062			
Total	0.195081	242				

Table S3. ANOVA statistics for Electrical Mobility Kappa over 1 dryer and 2 dryers

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Dryers	1	0.01247	0.012474	26.30	0.000
Solvent	2	0.01205	0.006027	12.71	0.000
Dilution	2	0.03030	0.015152	31.95	0.000
Error	390	0.18497	0.000474		
Lack-of-Fit	12	0.02335	0.001946	4.55	0.000
Pure Error	378	0.16162	0.000428		
Total	395	0.24477			

Table S4. ANOVA for AAC $\varkappa$ values for 1 dryer

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Solvent	2	0.000001	0.000000	1.79	0.279
Dilution	2	0.000002	0.000001	4.72	0.089
Error	4	0.000001	0.000000		
Total	8	0.000004			

Table S5. ANOVA for AAC $\varkappa$ values for 1 dryer and 2 dryers.

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Dryers	1	0.000021	0.000021	24.27	0.000
Solvent	2	0.000006	0.000003	3.60	0.060
Dilution	2	0.000001	0.000000	0.55	0.592
Error	12	0.000011	0.000001		
Total	17	0.000039			

Table S6. ANOVA for Shape Factor χ, at dae = 100nm

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Dryers	1	0.024642	0.024642	7.97	0.015
Solvent	2	0.001312	0.000656	0.21	0.812
Dilution	2	0.009613	0.004807	1.55	0.251
Error	12	0.037115	0.003093		
Total	17	0.072682			

Table S7. ANOVA statistics for Electrical Mobility Kappa with Shape Factor χ Correction

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Dryers	1	0.11917	0.119172	42.04	0.000
Solvent	2	0.05477	0.027386	9.66	0.000
Dilution	2	0.24326	0.121631	42.91	0.000
Error	390	1.10561	0.002835		
Lack-of-Fit	12	0.12624	0.010520	4.06	0.000
Pure Error	378	0.97937	0.002591		
Total	395	1.46992			

Table S8. Alpha and Beta parameters used to plot Syskowski- Langmuir fit

	Parameter	
Mixture	**Alpha**	**Beta**
Ethanol- 150ml water	0.0132	4.6600
Ethanol- 300ml water	0.0180	0.1606
Ethanol- 450ml water	0.0034	1.71×10^{6}
Isopropanol- 150ml water	0.0027	2.43×10^{18}
Isopropanol- 300ml water	0.0009	1.99×10^{47}
Isopropanol- 450ml water	0.0013	1.71×10^{26}
Acetone- 150ml water	0.0013	1.9×10^{27}
Acetone- 300ml water	0.0025	3.81×10^{9}
Acetone- 450ml water	0.0010	3.92×10^{21}