

Supplement of

Measuring Light Absorption by Organic Aerosols: Correction Factors for Solvent Extraction-Based Photometry Techniques

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S1. Experimental methods

The combusted fuels along with the organic carbon (OC) to total carbon (TC) mass ratios, single scattering albedo (SSA) values, and absorption Ångström exponents (AÅE), are listed in Table S1.

Table S1: List of the fuels burnt in this study along with the number of filter samples collected for each fuel type. The optical properties along with the range of observed OC/TC ratios are also given

Fuel	Number of burns	Number of filters collected	OC/TC ratio	SSA			AÅE ₃₇₅₋₄₀₅
				375	405	1047	
Cattle dung	6	7	1	0.85 – 0.87	0.94 – 0.95	0.98	10.8 – 12.3
Sage	9	19	0.55 – 1	0.55 – 0.87	0.7 – 0.95	0.85 – 0.98	3.37 – 12.54
Grass	4	9	0.77 – 0.99	0.72 – 0.76	0.84 – 0.89	0.95 – 0.97	5.63 – 8.82
Ponderosa pine	3	6	0.6 – 0.89	0.61 – 0.83	0.73 – 0.9	0.59 – 0.91	3.36 – 5.08
Lodgepole pine	4	7	0.9 – 1	0.83 – 0.87	0.91 – 0.95	0.95 – 0.98	5.88 – 10.08
Douglas fir	2	5	0.76 – 0.95	0.81 – 0.83	0.89 – 0.94	0.9 – 0.97	6.39 – 12.86

S2. Number concentration and size distribution calculations

To perform Mie theory calculations, a proxy size distribution for the organics dissolved in water was obtained using size distribution data from the scanning mobility particle sizer (SMPS) and the total organic carbon (TOC) analyzer. The proxy size distribution was assumed to follow a lognormal distribution with the geometric mean size and standard deviation assumed to be the same as that of the distribution measured by the SMPS.

The lognormal size distribution of the measured aerosol can be written as:

$$n_d(d_p) = \frac{N_{tot}}{2\pi^{1/2} d_p \ln(\sigma_g)} \cdot \exp \left[-\frac{(\ln d_p - \ln(d_{pg}))^2}{2 \ln^2(\sigma_g)} \right] \quad (S1)$$

Here, d_p is the mobility size of particles measured by the SMPS, d_{pg} is the geometric mean size of the particles in the distribution, σ_g is the geometric standard deviation, and N_{tot} is the total number concentration of particles in the aerosol stream. The frequency distribution function for the same would simply be:

$$f(d_p) = \frac{n(d_p)}{N_{tot}} \quad (S2)$$

Thus, the mass concentration for dissolved organics can be given as:

$$M = N_{tot,sol} * \sum_{d_{p,1}}^{d_{p,n}} \rho * \frac{\pi}{6} * d_{p,x}^3 * f(d_{p,x}) * (d_{p,x+1} - d_{p,x}) \quad (S3)$$

Here, M is the mass concentration of organics dissolved in water obtained from the TOC analyzer, ρ is the density of dissolved organics which is 1.6 g/cc, and $N_{tot,sol}$ is the number concentration of the proxy size distribution for the dissolved organics. Eq. S3 can be rearranged to find a value for $N_{tot,sol}$, and this value can then be used to generate the substitute size distribution for dissolved organics using Eq. S1. The surrogate size distribution was then used as an input for the Mie calculations.

S3. Correction factor as a function of EC/OC ratio

Fig. S1 depicts the variation in $b_{abs,OA}/b_{abs,bulk}$ with changing EC/OC ratios. The error bars account for uncertainties in photoacoustic spectrometer measurements, UV-Vis spectrophotometer measurements, flowrates for filter sampling, and extract volume measurements. An exponential function ($b_{abs,OA}/b_{abs,bulk} = k_0 + k_1 * (1 - \exp(-EC/OC)/k_2)$) was used to fit the data in Fig. S1, and the corresponding fit parameters along with the root mean square error values are listed in Table S2.

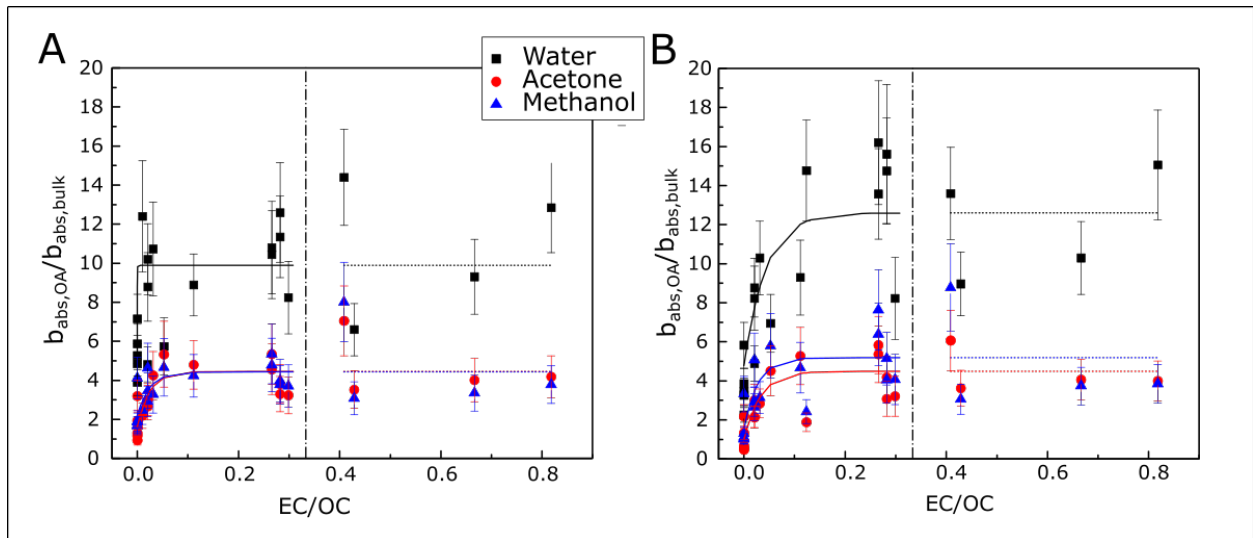


Fig. S1: Variation in $b_{\text{abs,OA}}/b_{\text{abs,bulk}}$ with change in the EC/OC ratio at A) 375 nm and B) 405 nm. The error bars represent one standard deviation from the mean. The perforated lines separate points at higher EC/OC values, which have high fluctuations with changing BC AÅE, from the data at low EC/OC ratios.

Table S2: Fit coefficients for $b_{\text{abs,OA}}(\lambda)/b_{\text{abs,bulk}}(\lambda)$ as a function of EC/OC ($y = k_0 + k_1 * (1 - \exp(-(EC/OC)/k_2))$) for tested solvents and the fuels analyzed in this study along with the RMSE value for each fit.

	Wavelength (nm)	Solvent	Fit Parameters			RMSE
			k ₀	k ₁	k ₂	
$\frac{b_{\text{abs,OA}}}{b_{\text{abs,bulk}}}$	375	Water	5.41	4.47	7E-6	2.31
		Acetone	1.62	2.84	0.024	1.04
		Methanol	2.22	2.21	0.024	2.07
	405	Water	4.78	7.82	0.043	2.41
		Acetone	0.98	3.51	0.032	0.98
		Methanol	1.53	3.65	0.027	1.51