Supplementary Information for

Evaluation of low-cost optical particle counters for monitoring individual indoor aerosol sources

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Table S1. Summary of the low-cost PM sensors performance evaluation results from previous studies

Test sensor	Study type	Reference sensor	Test particles	Sensor performance compared to the reference sensor				
				Linearity*	R^{2}**	Dependence*** on		
						Particle	Size	Concentration
OPC-N2	lab (Sousan et al. 2016a)	SMPS (TSI), APS 3321 (TSI), PAS-1.108 (Grimm Technologies)	salt aerosols generated with 0.9% NaCl solution, welding fume, Arizona road dust	0.03-2.7	0.94-0.99	0.05-1.6	high	not analyzed
Speck (DSM501A)	lab (Manikonda et al. 2016)	Grimm1.109 (Grimm Technologies), APS 3321 (TSI), FMPS 3091 (TSI)	cigarette smoke, Arizona test dust	0.6-300	0.58-0.97	0.0023-210.2 [2]	not analyzed	not analyzed
	lab (Northcross et al. 2013)	SidePak (TSI), SMPS (TSI), AirAssure (TSI)	incense, NaCl, sucrose, NH_4NO_3, PSL (300,600,900 nm)	59.7-159	0.88-0.90	significant	significant	59.7-159 [5]
	lab (Sousan et al. 2017)	SMPS (TSI) + APS (TSI)	salt aerosols generated with 0.9% NaCl solution, welding fume, Arizona road dust	0.1-0.58	not analyzed	significant [3]	not analyzed	not analyzed
Dylos (DC1700)	Lab (Sousan et al. 2016b)	SMPS (TSI) + APS (TSI)	salt aerosols generated with 0.9% NaCl solution, welding fume, Arizona road dust, diesel exhaust	0.018-0.385[1]	0.91-0.99	high	high [4]	high [6]
	lab & field (Northcross et al. 2013)	DustTrak (TSI), Met-One (E-bam beta attenuation monitor)	PSL (0.49 µm), ammonium sulphate (0.01 M (NH4)2SO4), wood smoke, urban ambient particles	0.953-55.556	0.97-0.99	significant	not significant	not significant
	Lab (Manikonda et al. 2016)	Grimm1.109 (Grimm Technologies), APS 3321 (TSI), FMPS 3091 (TSI)	cigarette smoke, Arizona test dust	0.1-15	0.65-0.95	0.052-0.44 [2]	not analyzed	not analyzed
Dylos (DC100 Pro)	lab (Manikonda et al. 2016)	Grimm1.109 (Grimm Technologies), APS 3321 (TSI), FMPS 3091 (TSI)	cigarette smoke, Arizona test dust	0.1-15	0.87-0.94	0.054-0.41 [2]	not analyzed	not analyzed

*: comparison between test sensor and reference measurements, regression fit slope.
**: comparison between test sensor and reference measurements, regression fit R^2 (coefficient of determination).
***: difference between low and high slope values under different test conditions.
1: regression equations refer to number concentrations (particles/cm^3) measured by DC1700 versus mass concentration (µg/m^3) measured by reference sensor for particle concentration levels below 106 (particles/cm^3).
2: regression fit slope of number counts of test sensor versus reference sensor (APS 3321).
3: non-linear response for salt, logarithmic curve for ARD, and fairly linear response for welding fume.
4: detection efficiency changed for different particle sizes; <5% for 0.3 µm, 60% for 1.3 µm, and ~100% for 3 µm particles.
5: slope of linear regression between the test sensor and the reference sensor (SidePak) under 100 and 1000 µg/m^3 concentration levels, respectively.
6: linear and nonlinear responses were observed for particle number concentrations below and above 106 (particles/cm^3), respectively.

Table S2. The size-resolved uncertainty of the reference sensor based on manufacturer calibration.

Nominal particle size (μm)	Expanded uncertainty (%)
0.3	4.1
0.5	3.9
1	3.9
3	3.7
5	3.6
10	3.7

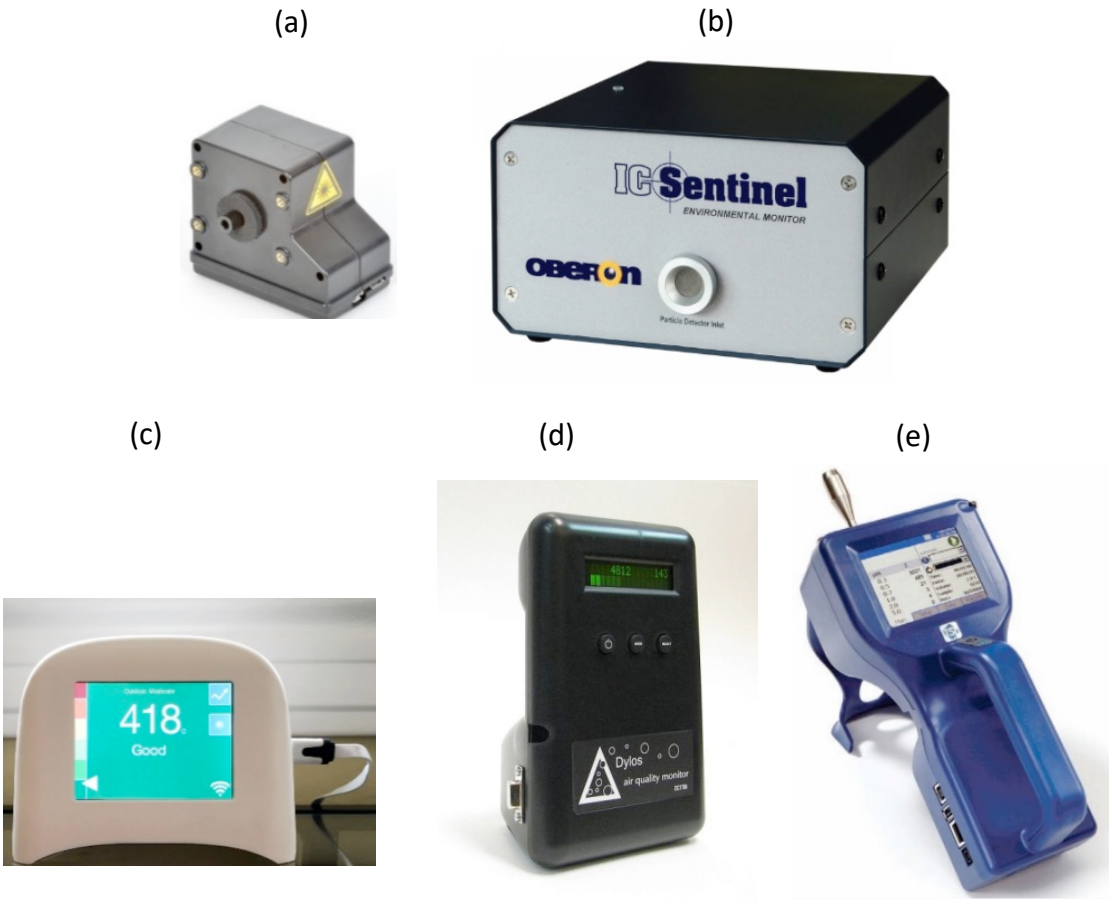

Figure S1. Sensors examined in this study: a) OPC N2 (Alphasense Ltd., Essex, United Kingdom), b) IC Sentinel (Oberon Inc., State College, PA), c) Speck (Airviz Inc., Pittsburgh, PA), d) Dylos (Dylos, Riverside, CA), and e) AeroTrak (TSI, Inc., Shoreview, MN), reference sensor.

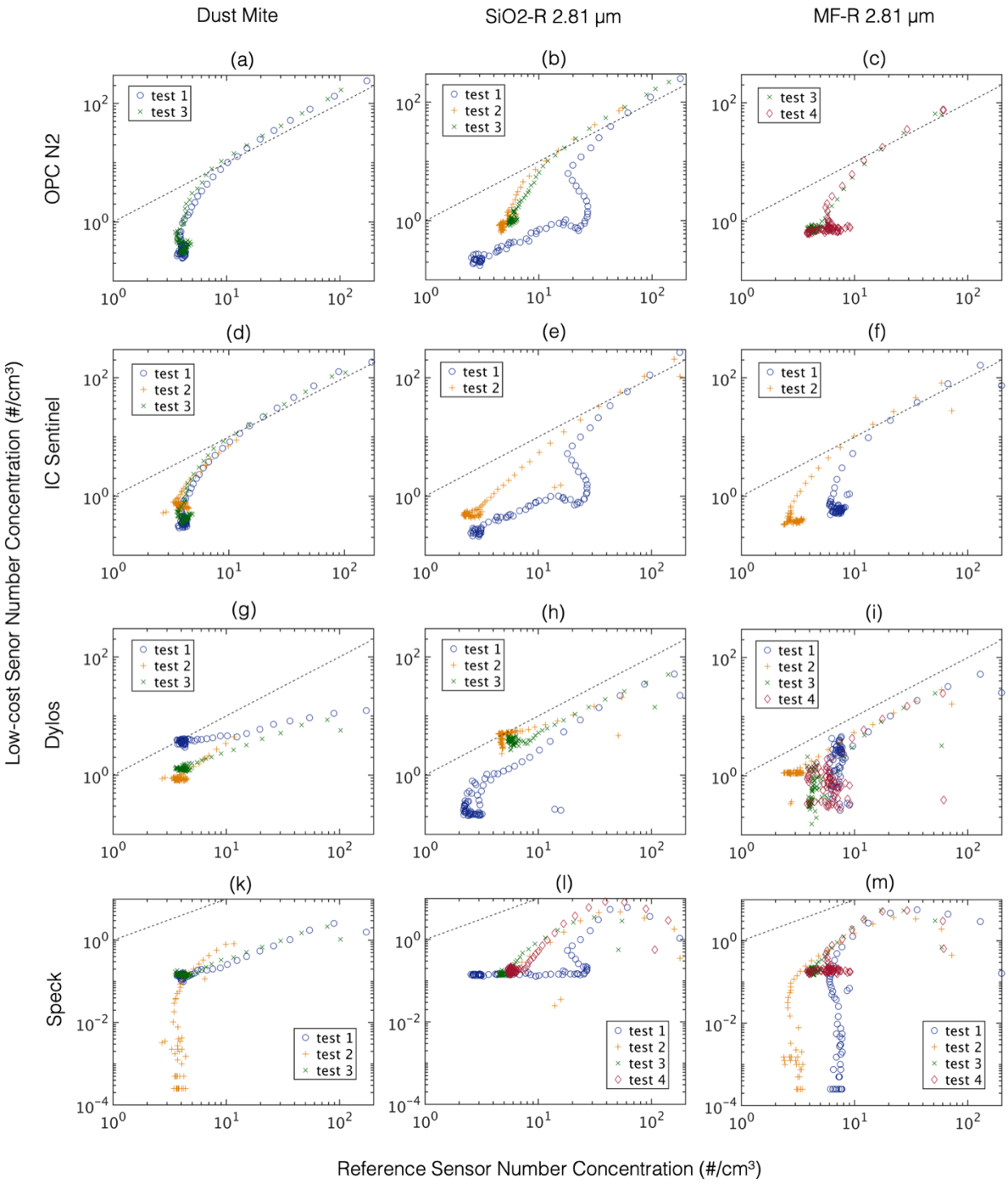

Figure S2. Repetition tests for three test particles of dust mite (a, d, g, and k), SiO_2-R in 2.81 µm (b, e, h, and l), and MF-R in 2.81 µm (c, f, i, and m).

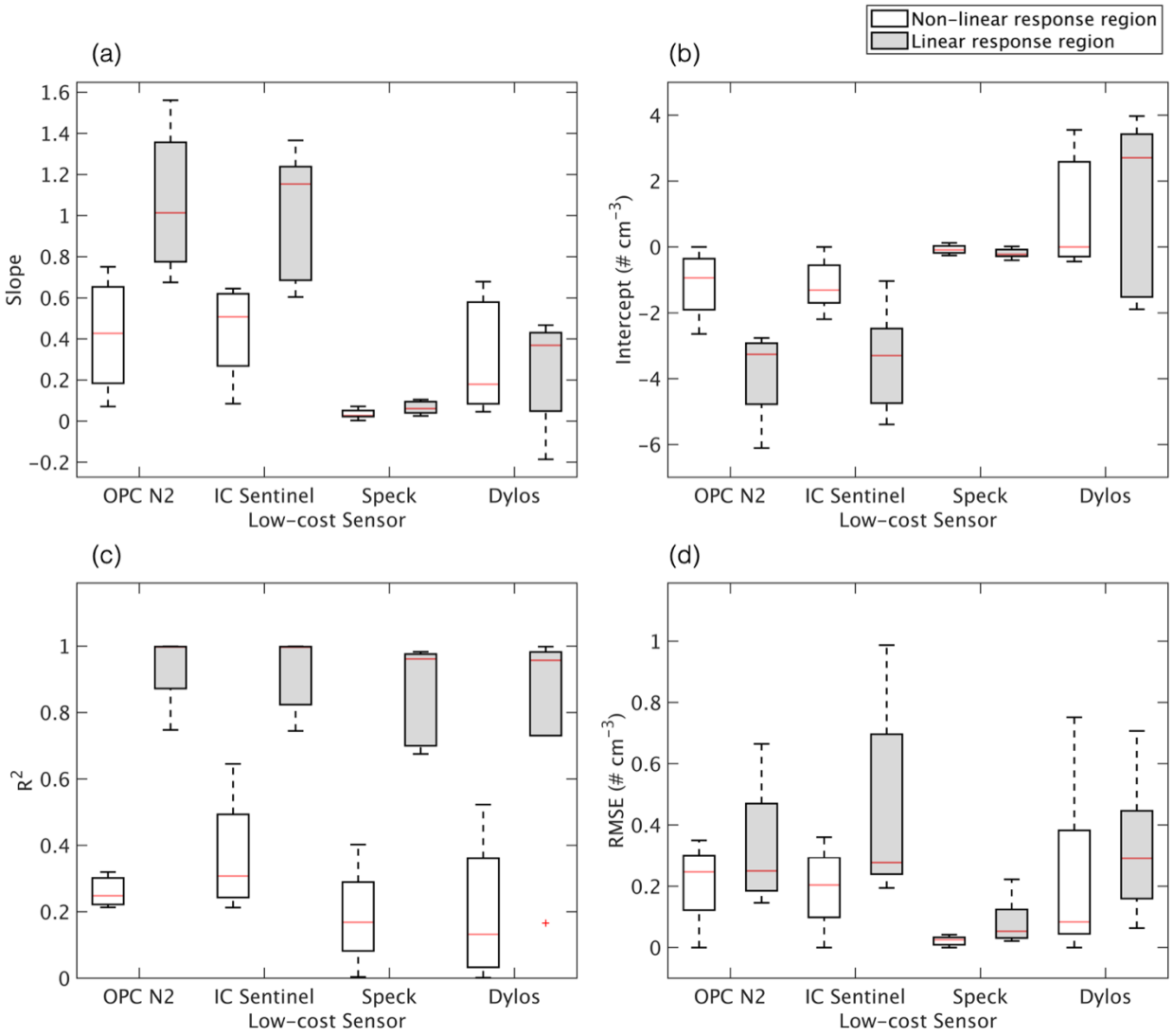

Figure S3. Regression analysis results of the low-cost sensors with respect to the reference sensor under exposure to common indoor bioaerosols. (a) slope (proportional bias), (b) intercept (fixed bias), (c) R^2 (linearity), and (d) RMSE (calibration precision). Please note that this plot includes 2 repetition tests for dust mite particle.

References

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