

Environmental and Body Contamination from Cleaning of Vomitus:
A Simulation Study

Supplementary Materials

Table of Contents

1. Sponge Stick Extraction and Sampling Efficiency	1
2. PTFE Filter Extraction Efficiency	4
3. Additional Details of Null Results	5
4. Additional Tables with Detailed Results	6

1. Sponge Stick Extraction and Sampling Efficiency

We found the Sponge Stick (3M, Minneapolis, MN) to contain some fluorescent material. Four sponges squeezed with 100 mL of buffer for 2 min were found to contain, on average, the equivalent of 13.69 µg/L fluorescein (Table 1).

Table 1. Fluorescent content of four Sponge Sticks, measured in triplicate.

Sponge Stick	Repeated Measurement (µg/L)			Mean (µg/L)
	1	2	3	
1	13.38	13.48	13.50	13.45
2	13.44	13.87	13.99	13.77
3	13.94	14.13	14.06	14.04
4	13.68	13.53	13.24	13.48
Mean (µg/L):				13.69
CV (%):				2.0

The fluorescein extraction efficiency of Sponge Sticks was measured as follows. Three sponges spiked with 1 mL of 500 µg/L fluorescein, 0.5 µg fluorescein, were squeezed with 100 mL of buffer for 2 min and found to contain, on average, 18.36 µg/L fluorescein (Table 2). The concentration of the spiked fluorescein should be 4.95 µg/L in the volume of 101 mL. The

extraction efficiency is the difference between the blank corrected concentration (Table 2) divided by the spiked concentration of 4.95 µg/L, multiplied by 100%. The extraction efficiency was 94.3% on average (Table 2).

Table 2. Extraction efficiency of Sponge Sticks spiked with fluorescein.

Sponge Stick	Repeated Measurement (µg/L)			Mean (µg/L)	Blank (µg/L)	Blank Corrected (µg/L)	Extraction Efficiency (%)
	1	2	3				
1	18.13	18.92	18.42	18.49		4.80	96.9
2	18.60	18.22	19.14	18.65	13.69	4.96	100
3	18.15	17.97	17.66	17.93		4.24	85.6
			Mean:	18.36		4.67	94.3
			CV (%):	2.0		8.1	8.1

The fluorescein sampling efficiency of Sponge Sticks was measured as follows. Four plastic surfaces (laboratory bench covered with plastic sheeting) and four laboratory bench surfaces were cleaned with Healthcare Bleach Germicidal Wipes (Clorox, Oakland, CA), and marked into 1 ft² areas. One mL of 500 µg/L fluorescein in buffer was dribbled onto three surfaces of each type. For each surface, one sponge was used. One side of the sponge was wiped across the area horizontally, and the other side of the sponge was wiped across the area vertically. After sampling, sponges were squeezed with 100 mL of buffer for 2 min.

The plastic surface and laboratory bench surface swabbed with the Sponge Sticks, but not spiked with fluorescein, served as experimental blanks. The measured fluorescein concentration measured in these swabbed Sponge Sticks, mean of 14.58 µg/L (Table 3) is higher than the (unswabbed) Sponge Sticks, mean 13.69 µg/L (Table 1). This difference may indicate a low level of surface contamination with fluorescent material, or that additional fluorescent material is dislodged from the Sponge Stick during swabbing. Owing the similarity of results for the two surfaces, the mean value, 14.58 µg/L, will be used for blank correction in the calculation of sampling efficiency.

Table 3. Fluorescent content of Sponge Sticks swabbed on plastic and laboratory bench surfaces.

Surface Type	Repeated Measurement (µg/L)			Mean (µg/L)
	1	2	3	
Plastic	14.15	14.25	14.21	14.20
Laboratory Bench	15.10	14.85	14.93	14.96
			Mean (µg/L):	14.58
			CV (%):	3.7

The sampling efficiency is calculated as the extraction efficiency. The sampling efficiency was 57.3% on plastic surfaces and 87.5% on laboratory bench surfaces, on average; and 72.5% overall (Table 4). The reason for the differences between the surfaces is not clear, but we observed that the material tends to smear across the plastic, which may impede sample pick-up by the Sponge Stick.

Variability in the sampling efficiency is relatively high on both surfaces, indicated by the CV. Percent deviation from the mean value ranged from -18% to 17% for samples on the plastic surface, and from -16% to 28% for samples on the laboratory bench surface.

Table 4. Sampling efficiency of Sponge Sticks on plastic and laboratory bench top surfaces spiked with fluorescein.

Sponge Stick	Repeated Measurement (µg/L)			Mean (µg/L)	Blank (µg/L)	Blank Corrected (µg/L)	Extraction Efficiency (%)
	1	2	3				
Plastic Surface							
1	17.98	17.80	17.94	17.91		3.33	67.3
2	16.96	16.96	16.79	16.90	14.58	2.32	46.9
3	17.55	17.50	17.31	17.45		2.87	57.9
			Mean:	17.42		2.84	57.3
			CV (%):	2.9		18	18
Laboratory Bench Surface							
4	18.10	18.30	18.26	18.22		3.64	73.5
5	20.21	19.92	20.22	20.12	14.58	5.54	112
6	18.73	18.22	18.25	18.40		3.82	77.2
			Mean:	18.91		4.33	87.5
			CV (%):	5.5		24	24
All Surfaces							
						Mean (µg/L):	72.5
						CV (%):	31

The sampling efficiency reflects the ability of the Sponge Sticks to pick up fluorescein from surfaces and to release fluorescein from the Sponge Sticks, and should therefore be lower than the extraction efficiency. Herein we observed an extraction efficiency of 94.3%, on average (Table 2), and a sampling efficiency of 57.3% and 87.5% on plastic and laboratory bench surfaces, respectively, on average (Table 3).

2. PTFE Filter Extraction Efficiency

The fluorescein extraction efficiency of 25 mm and 37 mm PTFE filters (SKC Inc, Eighty Four, PA) was measured as follows. Three filters of each size were spiked with 1 mL of 250 $\mu\text{g/L}$ fluorescein, and then agitated in 10 mL of buffer in a Ziploc bag for 2 minutes. Note that the liquid did not penetrate the filters. The concentration of the spiked fluorescein should be 22.73 $\mu\text{g/L}$ in a volume of 11 mL.

One filters of each size was agitated in 10 mL of buffer in a Ziploc bag for 2 minutes to serve as blanks. The fluorescein concentration in each sample was measured in triplicate and found to have an average of 0.00 $\mu\text{g/L}$.

The extraction efficiency is the difference between measured concentration and the spiked concentration of 22.73 $\mu\text{g/L}$, multiplied by 100%. The extraction efficiency was 98.5 % for the 37 mm filters and 99.4% for the 25 mm filters, or 98.95 % on average, overall (Table 5).

Table 5. Extraction efficiency of fluorescein from 37 mm and 25 mm PTFE filters.

Filters	Repeated Measurement (µg/L)			Mean (µg/L)	Blank (µg/L)	Blank Corrected (µg/L)	Extraction Efficiency (%)
	1	2	3				
37 mm filter							
1	22.74	20.96	21.57	21.76		21.76	95.7
2	22.59	22.16	22.60	22.45	0.00	22.45	99.8
3	22.81	22.78	22.56	22.72		22.72	100
			Mean:	22.31		22.31	98.5
			CV (%):	2.2		2.2	2.43
25 mm filters							
1	22.92	23.00	23.19	23.04		23.04	101.4
2	22.91	21.43	22.00	22.11	0.00	22.11	97.3
3	22.92	22.80	22.12	22.61		22.61	99.5
			Mean:	22.59		22.59	99.4
			CV (%):	2.06		2.06	2.06
All Filters							
					Mean (µg/L):		99.0
					CV (%):		0.64

3. Additional Details of Null Results

The fluorescein mass on gloves was not associated with total number of contacts ($\rho = -0.340$, $p = 0.132$) or contact frequency ($\rho = -0.101$, $p = 0.661$); or to the environmental surface contact number ($\rho = -0.303$, $p = 0.182$) or frequency ($\rho = 0.119$, $p = 0.605$).

The mass of fluorescein on gloves was not associated with the area or radius of initial visible floor contamination ($\rho = -0.226$, $p = 0.325$; $\rho = -0.147$, $p = 0.525$), the mean fluorescein mass on the floor after cleaning ($\rho = 0.004$, $p = 0.988$), or cleaning quality category (KW $p = 0.066$).

The fluorescein concentration in air was not associated with the area or radius of initial visible floor contamination ($\rho = -0.144$, $p = 0.546$; $\rho = -0.248$, $p = 0.292$), mean fluorescein contamination on the floor after cleaning ($\rho = 0.054$, $p = 0.821$), or cleaning quality category (KW $p = 0.138$).

4. Additional Tables with Detailed Results

Table 6. Size-selective fluorescein concentration in aerosol

Trial	Fluorescein Mass (ng)					Volume of Air Sampled (m ³)	Fluorescein Concentration (ng/m ³)
	Stage (Particle Aerodynamic Diameter) of Size-Selective Sampler						
	A (>2.5 μm)	B (1.0-2.5 μm)	C (0.5-1.0 μm)	D (0.25-0.5 μm)	E (<0.25 μm)		
1-A1	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	0.082	≤ 22.3
1-B1	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	0.046	≤ 41.7
1-B2	≤ 0.38	2.70	≤ 0.38	≤ 0.38	≤ 0.38	0.036	≤ 116
2-A1	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	0.082	≤ 23.3
2-A2	≤ 0.38	0.60	≤ 0.38	≤ 0.38	≤ 0.38	0.045	≤ 46.9
2-B1	≤ 0.38	0.50	≤ 0.38	≤ 0.38	≤ 0.38	0.064	≤ 31.8
2-B2	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	0.054	≤ 34.9
3-A1	- ¹	- ¹	- ¹	- ¹	- ¹	0.082	-
3-A2	- ¹	- ¹	- ¹	- ¹	- ¹	0.236	-
3-B1	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	0.082	≤ 23.5
3-B2	2.90	≤ 0.38	≤ 0.38	≤ 0.38	0.60	0.063	≤ 73.7
4-A1 ³	- ²	350	310	88	16.1	0.181	4,270
4-A2 ³	2.80	0.90	3.70	0.92	≤ 0.38	0.163	≤ 98.1
5-A1	≤ 0.38	≤ 0.38	≤ 0.38	0.40	≤ 0.38	0.118	≤ 16.3
5-A2	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	0.081	≤ 23.3
6-A1	0.50	≤ 0.38	≤ 0.38	0.90	≤ 0.38	0.054	≤ 46.6
6-A2	≤ 0.38	0.40	0.60	≤ 0.38	≤ 0.38	0.063	≤ 33.8
7-A1	- ²	- ²	- ²	- ²	- ²	-	- ²
7-A2	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	0.027	≤ 70.2
7-B1	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	0.027	≤ 69.6
7-B2	0.80	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	0.027	≤ 85.1
Median	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38	≤ 0.38		≤ 45.3

¹ Samples from this day of experiments were excluded due to gross contamination of the filters detected in laboratory and field blanks

² Sample was not collected or lost

³ These samples were blank corrected, based on experimental blank values: 0.80, 2.70, 4.70, 0.38 and 1.30 ng for filter stages A, B, C, D and E.

Table 7. Fluorescein Contamination on Participants' Bodies. Visible contamination was classified as: none (N), low (L, > 0 and $\leq 25\%$), medium (M, $> 25\%$ and $\leq 50\%$) or high (H, $> 50\%$).

	Gloves						Shoe Covers			
	Visible Contamination						Visible Contamination			
	Left Gloved Hand			Right Gloved Hand			Left Foot		Right Foot	
	Palm	Fingers	Back	Palm	Fingers	Back	Sole	Top	Sole	Top
1-A1	M	M	M	M	M	M	H	L	H	L
1-B1	M	M	M	M	M	M	H	L	H	L
1-B2	L	M	L	M	M	L	H	N	H	N
2-A1	N	N	N	M	M	M	H	N	H	N
2-A2	L	N	N	L	M	L	N	N	N	N
2-B1	L	L	L	L	M	M	H	N	H	N
2-B2	L	M	L	M	M	M	H	N	H	N
3-A1	L	L	L	L	L	L	H	L	H	L
3-A2	M	M	L	M	M	L	H	N	H	L
3-B1	N	L	N	N	L	L	H	N	H	M
3-B2	N	L	L	N	M	L	H	N	H	N
4-A1	M	M	H	M	M	H	H	L	H	L
4-A2	M	M	M	M	M	L	H	N	H	N
5-A1	L	L	L	L	N	L	L	N	L	N
5-A2	L	L	L	L	M	L	H	N	H	L
6-A1	L	L	L	L	L	L	N	N	L	L
6-A2	L	L	L	M	M	L	H	L	H	M
7-A1	L	M	L	L	L	L	H	N	H	N
7-A2	M	M	M	M	M	M	H	M	H	M
7-B1	M	M	M	M	M	H	H	N	H	L
7-B2	N	M	M	M	M	M	H	L	H	N