

LifeStraw® *personal*

Summary of test data received from the University of North Carolina School of Public Health, Department of Environmental Sciences and Engineering

The University of North Carolina evaluated the performance of LifeStraw® *personal* water purifier with regard to reduction of bacteria and viruses as well as level of iodine release and silver concentration in the filtered water.

LifeStraw® *personal* was tested on the following micro organisms:

Bacteria : Escherichia coli B (gram-negative bacterial indicator of faecal contamination)
Enterococcus faecalis (gram-positive bacterial indicator of faecal contamination)

Virus : MS-2 coliphage (~25 nM diameter viral indicator of human enteric viruses)

Various samples of the LifeStraw® *personal* were tested. The following pages highlight the results in the form of tables and graphs and also provide an overall summary of the evaluations.

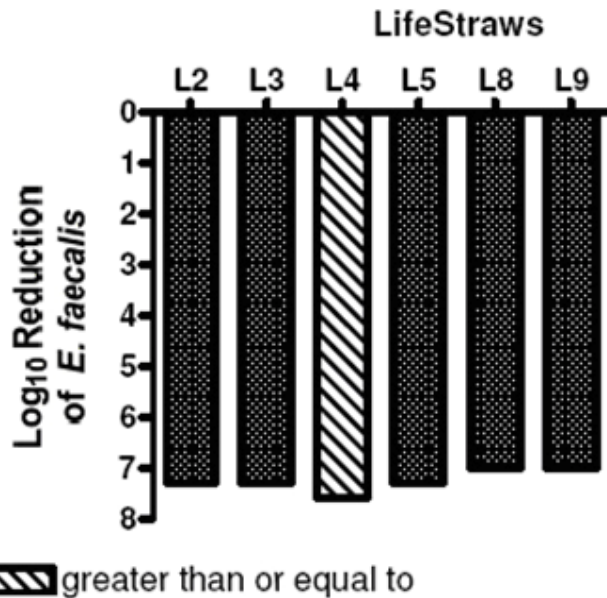
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Analysis of the reduction of *Enterococcus faecalis* in filtered water

Log₁₀ reductions of *E. faecalis*

Aged Volume at Challenge (L)	L2	L3	L4	L5	L8	L9
10	≥6.8	≥6.8	≥6.8	≥6.8	≥6.7	≥6.7
100	≥6.8	≥6.8	≥6.8	≥6.8	≥6.8	6.7
200	≥7.0	≥7.0	≥7.0	6.9	6.8	≥6.8
300	6.5	6.5	≥6.5	≥6.5	≥6.6	≥6.6
400	6.9	≥7.0	≥7.0	≥7.0	7	7
500	≥6.9	6.8	≥6.9	≥6.9	6.9	6.5
700	≥5.9	≥5.9	≥5.9	5.9	5.8	5.8

Ageing: L2 – L5: performed with dechlorinated tap water
L8 – L9: performed with dechlorinated tap water containing 1% pasteurized settled sewage



Overall log₁₀ reductions of *E. faecalis* for 700 liters of water filtered
(or for the volume filtered if the LifeStraw clogged before 700 liters was filtered)

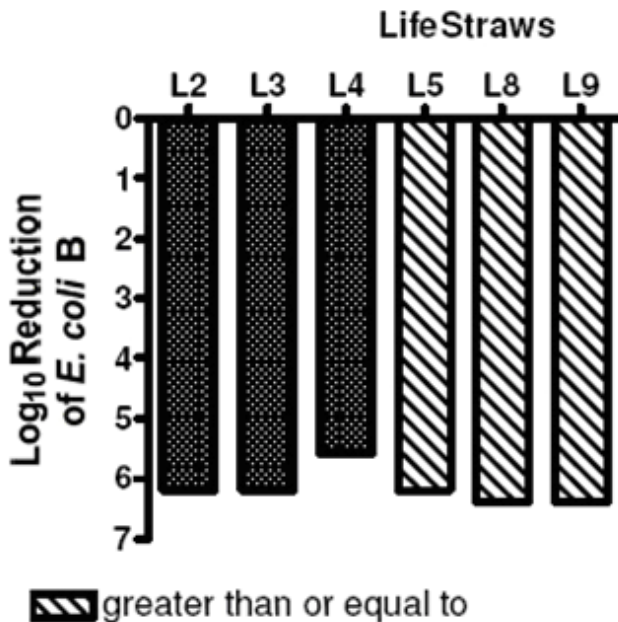
Analysis of the reduction of *Escherichia coli B* in filtered water

Log₁₀ reductions of *E. coli B*

Aged Volume at Challenge (L)	L2	L3	L4	L5	L8	L9
10	ND	ND	ND	ND	ND	ND
100	ND	ND	ND	ND	ND	ND
200	≥2.0*	≥2.0*	≥2.0*	≥2.0*	≥2.8*	≥2.8*
300	6.0	≥6.1	5.4	≥6.1	≥6.1	≥6.1
400	≥4.2*	≥4.2*	≥4.2*	≥4.2*	≥4.3*	≥4.3*
500	≥4.8*	≥4.8*	≥4.8*	≥4.8*	≥5.6*	≥5.6*
700	≥5.9*	≥5.9*	≥5.9*	5.9*	≥5.7*	≥5.7*

ND: no data

* The detection limit was smaller for these challenges because of a technical error. The actual log₁₀ *E. coli* reductions are greater than those recorded, especially because above 6 log₁₀ *E. coli* reductions were achieved for most of these LifeStraw at other challenge volumes. The LifeStraw performance on *E. coli* is not affected by this error and is systematically greater than or equal to 6 log₁₀ reductions.



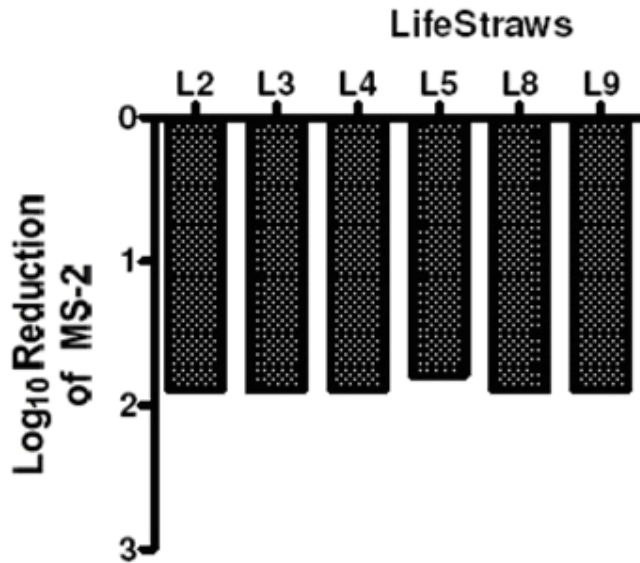
Overall log₁₀ reductions of *E. coli B* for 700 liters of water filtered (or for the volume filtered if the LifeStraw clogged before 700 liters was filtered)

Analysis of the reduction of MS-2 in filtered water

Log₁₀ reductions of MS-2

Aged Volume at Challenge (L)	L2	L3	L4	L5	L8	L9
10	2.4	2.2	2.2	2.1	2	2
100	1.7	1.7	1.7	1.6	1.6	1.6
200	1.4	1.7	1.8	1.2	1.5	1.6
300	1.6	1.8	1.5	1.9	1.6	1.7
400	2.6	2.7	2.8	2.5	2	2
500	1.9	1.7	1.9	1.8	1.6	1.6
700	1	1.1	1.1	1	1.1	1.1

Ageing: L2 – L5: performed with dechlorinated tap water
L8 – L9: performed with dechlorinated tap water containing 1% pasteurized settled sewage



Overall log₁₀ reductions of MS-2 for 700 liters of water filtered

Overall analysis of the reduction of *E. faecalis*, *E. coli B* and MS-2 in filtered water

Overall log₁₀ reductions (% reductions) for each LifeStraw tested

	<i>E. faecalis</i>	<i>E. coli B</i>	MS-2
L2	7.3 (99.999995)	6.2 (99.99994)	1.9 (98.7)
L3	7.3 (99.999995)	6.2 (99.99994)	1.9 (98.7)
L4	≥7.6 (≥99.999997)	5.6 (99.99975)	1.9 (98.7)
L5	7.3 (99.999995)	≥6.2 (≥99.99994)	1.8 (98.4)
L8	7.0 (99.999990)	≥6.4 (≥99.99996)	1.9 (98.7)
L9	7.0 (99.999990)	≥6.4 (≥99.99996)	1.9 (98.7)

Conclusion

“The LifeStraw models tested were able to reduce bacteria such as *E. faecalis* and *E. coli* by at least 6 log₁₀ (99.9999%) and viruses by about 1.8 (99.8%) to 2.0 log₁₀ (99%) over the 700 liter volume of water tested. These results indicate highly efficacious performance to meet US EPA and NSF-International requirements for bacteria reduction. Although virus reductions did not meet the US EPA and NSF-International performance requirement of 4 log₁₀, the approximately 2 log₁₀ (99%) reduction achieved is quite substantial. This magnitude of virus reduction would appreciably reduce human exposure to waterborne viruses by 99% and thereby reduce the risk of waterborne viral infection and illness” – Prof. Mark Sobsey

Analysis of the concentration of Iodine in filtered water

Iodine concentrations (ppm) in effluent waters

Aged Volume at Challenge (L)	L2	L3	L4	L5	L8	L9
10	ND	ND	ND	ND	ND	ND
100	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
200	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
300	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
400	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
500	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
700	BMDL	1.5	0.6	BMDL	BMDL	BMDL

ND: no data

BMDL: below method detection limit (0.2 mg/L)

Ageing: L2 – L5: performed with dechlorinated tap water

L8 – L9: performed with dechlorinated tap water containing 1% pasteurized settled sewage

Conclusion

“Iodine is not present at all or only rarely and at very low concentrations in effluents collected over the intended volume lifetime of these LifeStraws (700 L). The occasional low iodine levels observed in LifeStraw effluents do not constitute a health risk from the treated water” – Prof. Mark Sobsey

Analysis of the concentration of Silver in filtered water

Average residual silver levels over 700 litres are below WHO guideline value and the US EPA MCL of 100 ppb.

Conclusion

“Silver is present in LifeStraw-treated water at concentrations ranging from low (<25 ppb) to high (up to 200 ppb) in effluents collected over the intended lifetime of the device (700 L). The average effluent silver concentrations of LifeStraws over the course of device use to the intended maximum volume of 700 liters are below the WHO guideline value and the US EPA MCL of 100 ppb. Therefore, the occasional higher silver levels (100+ to 200 ppb) sometimes observed in LifeStraw effluents do not constitute a health risk from the treated water. This is because adverse health effects from silver require long-term (decades of) exposure to silver levels far higher than those detected in the LifeStraw effluents of this study” – Prof. Mark Sobsey