LifeStraw®

PEAK SERIES

Performance & Test Reports

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LifeStraw products have a history of use in some of the harshest conditions around the world, from refugee camps to natural disasters to extreme back-country, our products have to work because lives depend on them. Our testing and transparency is unparalleled, as is our commitment to social impact and environmental sustainability.

WHAT SETS LIFESTRAW APART

1. Tough and Minimalist: Our products are made with minimal spare parts and are used in the toughest conditions around the world.

2. LifeStraw is the only water filter brand that owns and operates its own fully equipped ISO certified water laboratory

3. 4-step quality control including microbiological testing over every single batch of filters.

4. We give back: We provide a year of safe water to a child in need for every LifeStraw product sold.

5. Transparent testing: We share all internal and external lab reports publicly, on our website.

6. Optimal flow rates: Optimized to operate off of human sucking & last longer in sandy & silty conditions.

7. Sustainable packaging: All packaging is free of plastic and is fully recyclable or compostable

8. It's all about the 9s: We report log removal (99.999999%) data for all of our microbiological claims.

HOW WE TEST OUR PRODUCTS

LifeStraw's testing and transparency is unparalleled and we use the most trusted performance criteria based on protocols established by the World Health Organization, the US EPA, NSF International and the Water Quality Association.

ALL LIFESTRAW PRODUCTS REMOVE:

- LOG 8 (99.999999%) for bacteria
- LOG 5 (99.999%) for parasites/amoebas/cysts
- LOG 5 (99.999%) for microplastics
- BPA FREE
- FDA Food Grade Materials

4 STEP QUALITY CONTROL

LifeStraw puts 100% of its filters through a rigorous quality control process.

STEP 1: Resistance test at high pressure.
STEP 2: Bubble test to confirm pore size.
STEP 3: Particle test to ensure nothing the size of bacteria or larger can pass through the filters.
STEP 4: We send a sample from every batch for full Bacteria and Protozoa log removal tests.

MICROBIOLOGICAL TESTING – HOW IT'S DONE

The only accepted scientific evaluation of microbiological filtration performance is log values (the number of 9s in 99.999999%). PERIOD. All internationally accepted protocols from ANSI, WQA, NSF International, the US EPA, and the World Health Organization evaluate performance through log removal testing. None of these bodies will certify anyone based on pore size; it is ACTUAL PERFORMANCE that matters. LifeStraw products exceed all log-based performance standards.

LifeStraw is the only water filter brand that owns and operates its own fully equipped ISO certified water laboratory capable of performing cutting age tests on microbiological performance longevity, turbidity and other performance indicators. LifeStraw also tests all products through external internationally recognized labs.

LIFESTRAW PEAK SERIES MEMBRANE MICROFILTER

COMPATIBLE WITH PEAK SOLO, COLLAPSIBLE SQUEEZE WATER BOTTLE FILTER SYSTEMS & GRAVITY WATER FILTER SYSTEMS

PERFORMANCE DATA

LifeStraw water filters are rigorously tested by independent labs and our own ISO certified lab to meet protocols established by the US Environmental Protection Agency (EPA) and NSF International/ANSI.
The LifeStraw Peak Series membrane microfilter uses its pore size of 0.2 micron to meet NSF/ANSI P231 standard for the removal of bacteria and parasites. The membrane microfilter lasts up to 500 gallons (2,000 liters).

FEATURES + PERFORMANCE	NSF/USEPA REMOVAL REQUIREMENT	LS PEAK REMOVAL PERFORMANCE	EXTERNAL LAB CERTIFICATION
Bacteria NSF P231/US EPA Brucella melitensis Campylobacter jejuni Francisella tularensis Pseudomonas aeruginosa Shigella Staphylococcus aureus Vibrio cholerae (Cholera) Vibrio parahaemolyticus Yersinia enterocolitica Yersinia pestis Enteropathogenic Escherichia coli (E. coli) Haemophilus influenzae Klebsiella pneumoniae Legionella pneumophila Mycobacterium tuberculosis Mycoplasma pneumoniae Burkholderia pseudomallei Salmonella enterica Salmonella typhi (Typhoid) Streptococcus pneumoniae Streptococcus pyogenes	**min. 99.9999% reduction**	**min. 99.999999% reduction**	**Aquadiagnostics/IAPMO India** *(WQA Accredited)*
Parasites NSF P231/NSF 53 Ascaris lumbricoides Cryptosporidium spp. Entamoeba histolytica Giardia intestinalis Naegleria gruberi Schistosoma mansoni Taenia saginata	**min. 99.9% reduction**	**min. 99.999% reduction**	**Aquadiagnostics/IAPMO India** *(WQA Accredited)*
Microplastics *(as small as 1um)*	**NSF standard under development**	**min. 99.999% reduction**	**Aquadiagnostics/IAPMO India** *(WQA Accredited)*

Study Report

PHÒNG THÍ NGHIỆM NƯỚC
Water Laboratory

Performance on Longevity of LifeStraw Peak Solo – Mouth Drawn Usage Pattern –

Study Number: LSP.23.2001.1

Attention to: Jean Luc Madier	Date of issuance: 9 March 2023
Issued by: Thuy Tran/Chung Nguyen	Approved by: Le Thu Cao

Overview

LifeStraw (LS) Peak Solo is the water filter product applying Microfiltration (MF) membrane technology for households/outdoor activities to remove the microorganisms in water.

In this study, the longevity (filtration lifetime) of LS Peak Solo was evaluated as mouth drawn usage pattern, and microbiological removal efficacy was tested along the longevity test. The filtration lifetime of product was tested following US EPA (1) and NSF P231 (2) protocols.

Longevity of LS Peak Solo reached 2000L under NSF P231 test conditions. At the beginning, average flowrate of LS Peak Solo was more than 1000 mL/min then decreased slowly over the filtrated volume, maintain flowrate well till 2000 L point. At the end of its lifetime, the average flowrate was still around 350 mL/min.

All tested samples could remove bacteria at higher than 8log reduction and remove protozoa at higher than 5log reduction till 2000L point. The turbidity of filtrated water was lower than 0.5NTU at all sampling points of all tested samples, and it was 0.09 NTU in average. The quality of the filtered water exceeded requirements of WHO (3)/US EPA/NSF P231 on bacteria removal (≥log6), protozoa removal (≥log4), and turbidity removal (≤0.5 NTU).

References

1) US EPA Guide Standard and Protocol for Testing Microbiological Water Purifiers, April 1987.

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2) NSF Protocol P231, Microbiological Water Purifiers, 2014.

3) WHO (2011), Evaluating household water treatment options: Health-based targets and microbiological performance standards, Geneva, World Health Organization.

4) NSF/ANSI 53, Drinking water treatment units – health effects, 2021.

5) WL.SOP.055 - SOP for Normal Aging Procedure of Peak Squeeze Bottle and Peak Gravity.

Procedure/ Testing methods

Following US EPA/ NSF P231 protocols, 4 replicates of LS Peak Solo filters were aged with general test water as mouth drawn usage pattern. At the beginning and after each 500L of longevity, samples were tested with challenge test water to evaluate the microbial removal efficacy (*E.coli* and protozoa) of the product.

Operating the product during testing was done following WL.SOP.055 (5).

Testing water conditions were prepared and controlled following US EPA (1), NSF P231 (2).

Monthly cleaning was applied for all tested samples for every 100L point, following WL.SOP.055 (5).

Results and discussions

1. Longevity performance

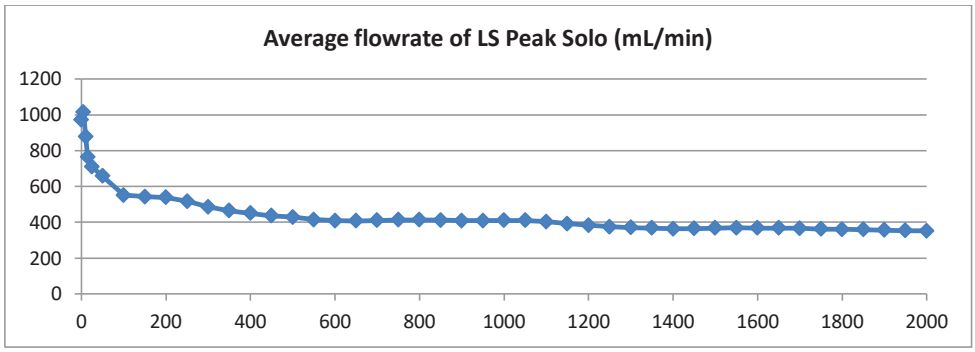

Figure 1: **Flowrate of the tested samples of LS Peak Solo**

- Longevity of all tested samples of LS Peak Solo reached 2000L.
- Flowrate of LS Peak Solo samples was high at the beginning, it was more than 1000 mL/min (60 L/h).
- Over the aging time, flowrate of these samples decreased slowly and be maintained well. Till 2000L point, average flowrate of these samples was still around 350 mL/min.
- Turbidity of effluent water was about 0.09 NTU in average, and lower than 0.5NTU at all sampling points of all tested samples (table 1). This result met NSF 53 (4) and USEPA (1) requirements on turbidity of effluent water.

Table 1: **Summary of turbidity of effluent water of LS Peak Solo**

	Turbidity of effluent water			
	LS.21.486.24	LS.21.486.26	LS.21.486.27	LS.21.486.31
Average	0.09	0.11	0.08	0.08
Min	0.04	0.04	0.05	0.05
Max	0.18	0.26	0.16	0.11

2. Microbial removal efficacy

- LS Peak Solo uses hollow fiber microfiltration technology which can remove microorganisms bigger than its pore size of 0.2µm, thus, it can remove *E.coli* bacteria (ca. 0.5x2µm) and protozoa cysts (minimum 3µm).
- The removal of protozoa was only tested at 2000L point – end of lifetime (as 3 micron microspheres surrogate). Removal of *E.coli* (the smaller tested organisms) guaranteed removal of protozoa.
- The results showed that, microorganism removal efficacy of all LS Peak Solo samples was higher than 8.1 log reduction of *E.coli*, and 5.3 log reduction of 3 micron microspheres.
- LS Peak Solo product exceeded the requirements of WHO (3)/ US EPA (1)/ NSF P231 (2) on bacteria removal (≥log6), protozoa removal (≥log4) (table 2).

Table 2: **Summary of microorganism log reduction of LS Peak Solo samples**

Samples	Log Reduction of *E.coli* and Microspheres at challenging points					
	Beginning	500L	1000L	1500L	2000L	
	E.coli	*E.coli*	*E.coli*	*E.coli*	*E.coli*	Spheres
LS.21.486.24	9.0	8.9	9.1	8.2	8.1	5.3
LS.21.486.26	9.0	8.9	9.1	8.4	8.8	5.3
LS.21.486.27	9.0	8.9	9.1	8.8	8.8	5.3
LS.21.486.31	9.0	8.9	9.1	8.4	8.8	5.3

(*) Protozoa cysts were tested with 3µm microspheres surrogate as alternative.

Summary/ Conclusions

Longevity of LS Peak Solo reached 2000L under NSF P231 test conditions as mouth drawn usage patten.

LS Peak Solo worked well till 2000L. At the beginning, average flowrate of LS Peak Solo was more than 1000 mL/min then decreased slowly over the filtrated volume. Till 2000L point, average flowrate of these samples was still around 350 mL/min.

The LS Peak Solo samples could remove *E.coli* at higher than 8.1 log reduction, and microspheres at 5.3 log reduction at all challenging points. This result exceeded the

requirement of NSF P231, USEPA, WHO in bacterial removal efficacy (6log reduction) and protozoa removal efficacy (4log reduction).

Turbidity of efluent water was about 0.09 NTU in average, lower than 0.5NTU at all sampling points of all tested samples. This result met NSF 53 and USEPA requirements on turbidity of effluent water.

Study Report

PHÒNG THÍ NGHIỆM NƯỚC
Water Laboratory

Validation of LifeStraw Peak Solo

Study Number: LSP.23.2001.2

Attention to: Jean Luc Madier	Date of issuance: 17 April 2023
Issued by: Chung Quang Nguyen/Thuy Tran	Approved by: Le Thu Cao

Purpose

Evaluate the function and durability of LifeStraw (LS) Peak Solo product.

Samples and Material

This trial used samples from different suppliers as below:

- The cap, mouthpiece nut and bottom plug are from the plastic injection supplier.
- The silicon parts (diabolo seal, bottom seal) from silicon supplier
- The filters are from the filter supplier.

Procedure/ Testing Methods

The tests to evaluate the function and durability of LS Peak Solo followed the WL.SOP.063 – SOP Validation LS Peak Solo and included:

- Flowrate checking
- Microorganism removal efficacy
- Leakage test and durability of moving parts
- Drop test
- Aging and weathering test

Results and discussions

1. Flowrate

Flowrate of LS Peak Solo tested with 2NTU water (mL/min), Data of 30 samples			
Tested pressure	0.5 bar	0.15 bar	0.3 bar
Max flowrate	6500	1900	3400
Min flowrate	4300	1100	2050
Average of Flowrate	**5200**	**1500**	**2823**
Criteria			2880 ± 30%

- All 30 tested samples had flowrate met the criteria of flowrate for LS Peak Solo.

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2. Microorganism removal efficacy

Microorganism removal efficacy as NSF P231, data of 30 samples	
	E.coli log reduction
Max log reduction	8.8
Min log reduction	8.7
Average log reduction	**8.8**
Criteria	≥8.0

- All 30 tested samples had *E.coli* log reduction when testing as NSF P231 was higher than 8log. This data passed the LifeStraw claim for bacteria removal efficacy (≥8.0 log) and exceeded the requirement of NSF/ US EPA for bacteria removal (6 log).

3. Leakage and durability of moving part

- 15 samples were tested for leakage with air, there is no leakage on all 4 positions which were the cap, mouthpiece, filter, and welding area.
- 30 samples had been tested for leakage with water at both stationary and shaking conditions, mimicking the real usage condition. There was no leakage.
- The durability of the cap, little plug, and mouthpiece nut (moving parts) was conducted for 10 samples up to 8000times of opening/closing the top cap, and bottom plug, 100times of opening/closing of mouthpiece nut.
- Leakage was conducted during and after the opening/closing process.
- The test result showed that there was no leakage on all parts during and after the opening/closing process.
- **All tested samples passed the leakage test and the durability test**.

4. Drop test

- 20 samples were conducted for drop test with 2 types of testing condition: single product in wet condition, single product in dry condition.
- No breakage happened on all parts of all samples.
- All 20 samples passed MO test (*E.coli*) after the drop testing.

Microorganism removal efficacy as NSF P231, data of 20 samples		
	E.coli log reduction before dropping	*E.coli* log reduction after dropping
Max log reduction	8.8	9.0
Min log reduction	8.8	8.4
Average log reduction	**8.8**	**8.81**
Criteria	**≥8.0 log**	

- **These samples passed the drop test.**

5. Aging and weathering test

- 10 samples were tested.
- 150 cycles (equal to 3years of real usage) of 102min/30% or 80% RH at 50oC + 18min/humidifying by shower were conducted. RH levels at 30% and 80% are switched to each other every 01 day.
- There was no leakage on the cap and mouthpiece of the samples after aging and weathering.
- All 10 samples passed MO test (*E.coli*) after aging and weathering.

Microorganism removal efficacy as NSF P231, data of 10 samples		
	E.coli log reduction before Aging and Weathering	*E.coli* log reduction after Aging and Weathering
Max log reduction	8.8	8.8
Min log reduction	8.8	8.4
Average log reduction	**8.8**	**8.76**
Criteria	**≥8.0 log**	

- **These samples passed the aging and weathering test.**

Summary/ Conclusions

- LifeStraw Peak Solo product passed all the tests to evaluate the function as:
  - Flowrate was about 2880mL/min in average and met the criteria.
  - Bacteria (*E.coli*) removal efficacy was higher than 8log reduction.
  - There was no leakage.
- LifeStraw Peak Solo product passed all the tests to evaluate its durability:
  - Passed the drop test.
  - Passed the opening/closing test for the cap, the mouthpiece nut, and the bottom plug.
  - Passed the aging and weathering test.
- **LifeStraw Peak Solo product passed the validation tests.**

Study Report

PHÒNG THÍ NGHIỆM NƯỚC
Water Laboratory

Performance on Longevity of LifeStraw Peak Collapsible bottle – Finished Goods –

Study Number: LSP.20.2002.3

Attention to: Jean Luc Madier	Date of issuance: 6 June 2022
Issued by: Thuy Tran/Chung Nguyen	Approved by: Le Thu Cao

Overview

LifeStraw (LS) Peak Collapsible Bottle is the water filter product applying Microfiltration (MF) membrane technology for households/outdoor activities to remove the microorganisms in water.

In this study, the longevity (filtration lifetime) of LS Peak Collapsible Bottle was evaluated, and microbiological removal efficacy was tested along the longevity test. The filtration lifetime of product was tested following US EPA (1) and NSF P231 (2) protocols.

Longevity of LS Peak Collapsible Bottle reached 2000L under NSF P231 test conditions. At the beginning, average flowrate of LS Peak Collapsible Bottle was about 3670 mL/min then decreased over the filtrated volume, maintain flowrate well till 2000L point. At the end of its lifetime, the average flowrate was still around 890 mL/min.

All tested samples could remove bacteria at higher than 8log reduction and remove protozoa at higher than 5log reduction till 2000L point. The turbidity of filtrated water was lower than 0.5NTU at all sampling points of all tested samples, and it was 0.09 NTU in average. The quality of the filtered water exceeded requirements of WHO (3)/US EPA/NSF P231 on bacteria removal (≥log6), protozoa removal (≥log4), and turbidity removal (≤0.5 NTU).

References

1) US EPA Guide Standard and Protocol for Testing Microbiological Water Purifiers. April 1987.

2) NSF Protocol P231, Microbiological Water Purifiers. February 2003.

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3) WHO (2011). Evaluating household water treatment options: Health-based targets and microbiological performance standards, Geneva, World Health Organization.

4) WL. SOP.055.v1. SOP for Normal Aging Procedure of Peak Squeeze Bottle and Peak Gravity.

Procedure/ Testing methods

Following US EPA/ NSF P231 protocols, 3 replicates of LS Peak Collapsible Bottle were aged with general test water. At the beginning and after each 500L of longevity, samples were tested with challenge test water to evaluate the microbial removal efficacy (E.coli and protozoa) of the product.

Operating the product during testing was done following WL.SOP.055.v1.

Testing water conditions were prepared and controlled following US EPA (1), NSF P231 (2).

Monthly cleaning was applied for all tested samples for every 100L point, following WL.SOP.055.v1.

Results and discussions

1. Longevity performance

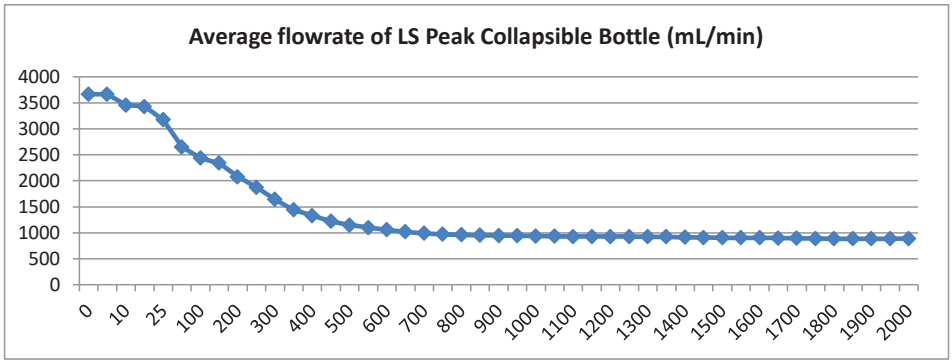

Figure 1: **Flowrate of the tested samples of LS Peak Collapsible Bottle**

- Longevity of all tested samples of LS Peak Collapsible Bottle samples reached 2000L.
- Flowrate of LS Peak Collapsible Bottle samples was high at the beginning, the average flowrate of the tested samples was about 3670 mL/min (220 L/h).
- Over the aging time, flowrate of these samples decreased. In first 700L of lifetime, flowrate reduced from about 3600ml/min to about 1000ml/min. After that point, flowrate of these samples was maintained well. Till 2000L point, the average flowrate of these samples was still around 890 mL/min (53L/h).

- Turbidity of effluent water was about 0.09 NTU in average, and lower than 0.5NTU at all sampling points of all tested samples (table 1). This result met NSF 53 and USEPA requirements on turbidity of effluent water.

Table 1: **Summary of turbidity of effluent water of LS Peak Collapsible Bottle**

	Turbidity of effluent water		
	LS.22.049.32	LS.22.049.33	LS.22.049.34
Min	0.05	0.06	0.05
Max	0.24	0.16	0.18
Average	0.10	0.10	0.09

2. Microbial removal efficacy

- LS Peak Collapsible Bottle uses hollow fiber microfiltration technology which can remove microorganisms bigger than its pore size of 0.2µm, thus, it can remove *E.coli* bacteria (ca. 0.5x2µm) and protozoa cysts (minimum 3µm).
- The removal of protozoa was only tested at 1000L and 2000L point (as 3 micron microspheres surrogate). Removal of *E.coli* (the smaller tested organisms) guaranteed removal of protozoa.
- The results showed that, microorganism removal efficacy of all LS Peak Collapsible Bottle samples was higher than 8.4 log reduction of *E.coli*, and 5.3 log reduction of 3 micron microspheres.
- LS Peak Collapsible Bottle product exceeded the requirements of WHO (3)/US EPA/NSF P231 on bacteria removal (≥log6), protozoa removal (≥log4) (table 2).

Table 2: **Summary of microorganism log reduction of LS Peak Collapsible Bottle samples**

Samples	Log Reduction of E.coli and Microspheres at challenging points						
	Beginning	500L	1000L		1500L	2000L	
	E.coli	*E.coli*	*E.coli*	Spheres	*E.coli*	*E.coli*	Spheres
LS.22.049.32	8.8	8.9	8.8	5.4	8.7	8.4	5.3
LS.22.049.33	8.8	8.9	8.8	5.4	8.7	8.8	5.3
LS.22.049.34	8.8	8.9	8.8	5.4	8.7	8.8	5.3

(*) Protozoa cysts were tested with 3µm microspheres surrogate as alternative.

Summary/ Conclusions

Longevity of LS Peak Collapsible Bottle reached 2000L under NSF P231 test conditions.

LS Peak Collapsible Bottle worked well till 2000L. At the beginning, average flowrate of LS Peak Collapsible Bottle was about 3670 mL/min then decreased over the filtrated volume. Till 2000L point, the average flowrate of these samples was still around 890 mL/min.

The LS Peak Collapsible Bottle samples could remove *E.coli* at higher than 8.4 log reduction, and microspheres at 5.3 log reduction at all challenging points. This result met the requirement

of NSF P231/ NSF 53, USEPA, WHO in bacterial removal efficacy (6log reduction) and protozoa removal efficacy (4log reduction).

Turbidity of efluent water was about 0.09 NTU in average, lower than 0.5NTU at all sampling points of all tested samples. This result met NSF 53 and USEPA requirements on turbidity of effluent water.

Study Report

PHÒNG THÍ NGHIỆM NƯỚC
Water Laboratory

Performance on Longevity of LifeStraw Peak Gravity – Finished Goods –

Study Number: LSP.20.2002.3

Attention to: Jean Luc Madier	Date of issuance: 6 June 2022
Issued by: Thuy Tran/Chung Nguyen	Approved by: Le Thu Cao

Overview

LifeStraw (LS) Peak Gravity is the water filter product applying Microfiltration (MF) membrane technology for outdoor activities to remove the microorganisms in water.

In this study, the longevity (filtration lifetime) of LS Peak Gravity was evaluated, and microbiological removal efficacy was tested along the longevity test. The filtration lifetime of product was tested following US EPA (1) and NSF P231 (2) protocols.

Longevity of LS Peak Gravity reached 2000L under NSF P231 test conditions. At the beginning, average flowrate of LS Peak Gravity was about 1550 ml/min then decreased slowly over the filtrated volume, maintain flowrate well till 2000L point. At the end of its lifetime, the average flowrate was still around 570 ml/min.

All tested samples could remove bacteria at higher than 8log reduction and remove protozoa at higher than 5log reduction till 2000L point. The turbidity of filtrated water was lower than 0.5NTU at all sampling points of all tested samples, and it was 0.09 NTU in average. The quality of the filtered water exceeded requirements of WHO (3)/US EPA/NSF P231 on bacteria removal (≥log6), protozoa removal (≥log4), and turbidity removal (≤0.5 NTU).

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References

1) US EPA Guide Standard and Protocol for Testing Microbiological Water Purifiers. April 1987.

2) NSF Protocol P231, Microbiological Water Purifiers. February 2003.

3) WHO (2011). Evaluating household water treatment options: Health-based targets and microbiological performance standards, Geneva, World Health Organization.

4) WL. SOP.055.v1. SOP for Normal Aging Procedure of Peak Squeeze Bottle and Peak Gravity.

Procedure/ Testing methods

Following US EPA/ NSF P231 protocols, 3 replicates of LS Peak Gravity were aged with general test water. At the beginning and after each 500L of longevity, samples were tested with challenge test water to evaluate the microbial removal efficacy (E.coli and protozoa) of the product.

Operating the product during testing was done following WL.SOP.055.v1.

Testing water conditions were prepared and controlled following US EPA (1), NSF P231 (2).

Monthly cleaning was applied for all tested samples for every 100L point, following WL.SOP.055.v1.

Results and discussions

1. Longevity performance

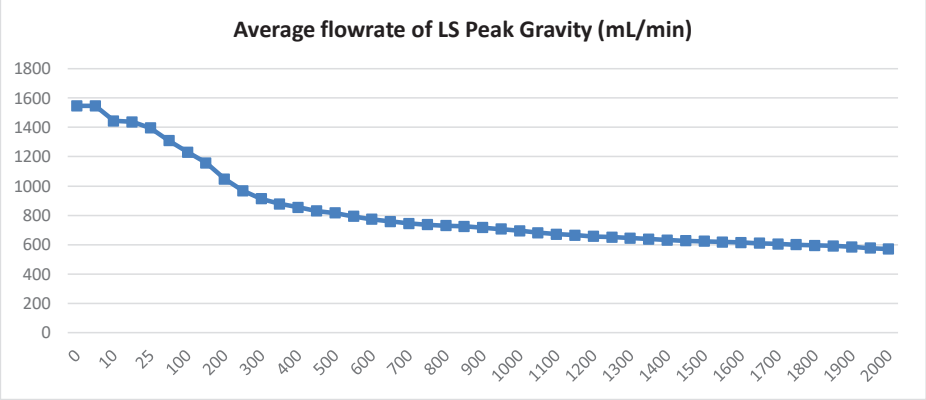

Figure 1: **Flowrate of the tested samples of LS Peak Gravity**

- Longevity of all tested samples of LS Peak Gravity samples reached 2000L.
- Flowrate of LS Peak Gravity samples was high at the beginning, it was about 1550 mL/min (93 L/h).

- Over the aging time, flowrate of these samples decreased slowly and be maintained well. Till 2000L point, the average flowrate of these samples was still around 570 mL/min (34L/min).
- Turbidity of effluent water was about 0.09 NTU in average, and lower than 0.5NTU at all sampling points of all tested samples (table 1). This result met NSF 53 and USEPA requirements on turbidity of effluent water.

Table 1: **Summary of turbidity of effluent water of LS Peak Gravity**

	Turbidity of effluent water		
	LS.22.049.2	LS.22.049.3	LS.22.049.4
Min	0.05	0.05	0.05
Max	0.12	0.11	0.14
Average	0.09	0.08	0.08

2. Microbial removal efficacy

- LS Peak Gravity uses hollow fiber microfiltration technology which can remove microorganisms bigger than its pore size of 0.2µm, thus, it can remove *E.coli* bacteria (ca. 0.5x2µm) and protozoa cysts (minimum 3µm).
- The removal of protozoa was tested at 1000L and 2000L point (as 3 micron microspheres surrogate). Removal of *E.coli* (the smaller tested organisms) guaranteed removal of protozoa.
- The results showed that, microorganism removal efficacy of all LS Peak Gravity samples was higher than 8.2 log reduction of *E.coli*, and 5.3 log reduction of 3 micron microspheres.
- LS Peak Gravity product exceeded the requirements of WHO (3)/US EPA/NSF P231 on bacteria removal (≥log6), protozoa removal (≥log4) (table 2).

Table 2: **Summary of microorganism log reduction of LS Peak Gravity samples**

Samples	Log Reduction of E.coli and Microspheres at challenging points						
	Beginning	500L	1000L		1500L	2000L	
	E.coli	*E.coli*	*E.coli*	Spheres	*E.coli*	*E.coli*	Spheres
LS.22.049.2	8.8	8.7	8.8	5.4	8.8	8.4	5.3
LS.22.049.3	8.8	8.7	8.2	5.4	8.8	8.4	5.3
LS.22.049.4	8.4	8.7	8.8	5.4	8.8	8.4	5.3

(*) Protozoa cysts were tested with 3µm microspheres surrogate as alternative.

Summary/ Conclusions

Longevity of LS Peak Gravity reached 2000L under NSF P231 test conditions.

LS Peak Gravity worked well till 2000L. At the beginning, average flowrate of LS Peak Gravity was about 1550 mL/min then decreased slowly over the filtrated volume. Till 2000L point, average flowrate of these samples was still around 570 mL/min.

The LS Peak Gravity samples could remove *E.coli* at higher than 8.2 log reduction, and microspheres at 5.3 log reduction at all challenging points. This result met the requirement of NSF P231/ NSF 53, USEPA, WHO in bacterial removal efficacy (6log reduction) and protozoa removal efficacy (4log reduction).

Turbidity of efluent water was about 0.09 NTU in average, lower than 0.5NTU at all sampling points of all tested samples. This result met NSF 53 and USEPA requirements on turbidity of effluent water.

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TEST REPORT

Report No: IAPMOILAB/PRTR/19426D/22-23 **Date: 24.06.2022**

CUSTOMER DETAILS	SAMPLE DETAILS	TEST DETAILS
Name & Address : **Ms. Le Thu Cao** **Vestergaard Frandsen Inc 333, W Ostend St. Suite 300 Baltimore, MD 21230,** **USA**	**Sample received: 30.05.2022** **Sample code no: AWRTCL/19426D/22-23** **Sample Description: LS Peak Squeeze bottle** **Sample Quantity for Testing: 1 No.** **Submitted by : Vestergaard Frandsen Inc.** **Date of Analysis started:22.06.2022** **Date of Analysis Completed:24.06.2022** **Subcontract : Not Applicable** **Sample condition when received : Intact**	**Method:** Microplastic reduction (as 1 micron plastic spheres) – black dyed microspheres

EXECUTIVE SUMMARY: Tested sample of LifeStraw Peak Squeeze bottle performed well by reducing microplastics (as 1 micron poly styrene black dyed microspheres) to > 5.87 log at tested flow rate.

Table – 1 : 1 Micron Microsphere Reduction by LS Squeeze bottle : After 12 Liter Filtration

Sample Code	Customer Code	Test Parameter	Influent water concentration microspheres/Liter	Effluent water concentration microspheres/Liter	% Reduction (log)
AWRTCL/ 19426D/ 22-23	LS Peak Squeeze Bottle	1 micron microspheres	1.20×10^8 microspheres/L (8.07 log)	<160 microspheres/L (2.20 log)	>99.9998 (>5.87 log)

Flow Rate of Filtration: 800 ml/min, < 160 /Liter = Below detection limit

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Note:
1. The results pertain only to the tested samples and applicable parameters.
2. Samples will be disposed after 15 days from the issue of test certificate unless otherwise specified, in case of bacteriological tests, the samples will be disposed after 7 days itself from the date of issuing the certificate.
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TEST REPORT

TEST WATER COMPOSITION: GTW#1 (General Test water – 1)

Test water Characteristic	Recommended Concentration	Concentration maintained by the Laboratory
pH	6.5 to 8.5	7.45
TDS mg/L	50 – 500	320
TOC mg/L	>1	>1
Turbidity NTU	0.1 to 5.0	1.0
Temperature ^{0}C	20±5 ^{0}C	24

PICTURE OF TEST SETUP

Dr S.MURALIDHARA RAO
Director – Laboratory

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00---End of the Test Report –00

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Certificate of Analysis

PHÒNG THÍ NGHIỆM NƯỚC/ *Water Laboratory*
ISO/IEC 17025 accredited

Sample Information

Sample	: LifeStraw® Peak series Collapsible bottle 0.65L	**Requested by**	: PARA Membranes Ltd.
Quantity	: 5 pcs	**Description**	: QC finished goods
Date of receipt of test sample (dd/mm/yyyy)			: 26/04/2022

Analysis Result

Parameter			Microbiological log_{10} reduction		Physico-chemical characteristics		Conclusion
			Bacteria (*E.coli*)	Protozoa (3µm spheres surrogate)	Turbidity of effluent water (NTU)	Flow rate (ml/min)	
Reference method			SMEWW 9222I:2017 (*)	US EPA 05/9205/ EPADWC (Modified) (*)	SMEWW 2130B:2017 (*)	WL.SOP.054	
Specification			Min 8	Min 5	Max 0.5	Min 900	PASSED
1	16122A1	Anthracite	>8.7	>5.3	0.28	1920	PASSED
2	16122A1		>8.7	>5.3	0.23	1680	PASSED
3	16122A1		>8.7	>5.3	0.16	1640	PASSED
4	16122A1		>8.7	>5.3	0.27	1680	PASSED
5	16112B1		>8.7	>5.3	<0.12	1840	PASSED

Note: (*) ISO/IEC 17025 accredited methods

I, the undersigned, hereby declare that the findings provide a true and accurate record of the results obtained on samples as received.

Date and signature

13/05/2022

VILAS 751

Cao Thu Le
Water Laboratory Manager

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Certificate of Analysis

PHÒNG THÍ NGHIỆM NƯỚC/ *Water Laboratory*
/ISO/IEC 17025 accredited

Sample Information

Sample	: LifeStraw® Peak series Collapsible bottle 1L	**Requested by**	: PARA Membranes Ltd.
Quantity	: 5 pcs	**Description**	: QC finished goods
Date of receipt of test sample (dd/mm/yyyy)			: 26/04/2022

Analysis Result

Parameter			Microbiological log_{10} reduction		Physico-chemical characteristics		Conclusion
			Bacteria (*E.coli*)	Protozoa (3µm spheres surrogate)	Turbidity of effluent water (NTU)	Flow rate (ml/min)	
Reference method			SMEWW 9222I:2017 (*)	US EPA 05/9205/ EPADWC (Modified) (*)	SMEWW 2130B:2017 (*)	WL.SOP.054	
Specification			Min 8	Min 5	Max 0.5	Min 900	PASSED
1	16102A1	Dark blue	>8.7	>5.3	<0.12	1800	PASSED
2	16102A1		>8.7	>5.3	0.12	1600	PASSED
3	16102A1		>8.7	>5.3	0.19	1600	PASSED
4	16102A1		>8.7	>5.3	0.13	1280	PASSED
5	16102A1		>8.7	>5.3	<0.12	2000	PASSED

Note: (*) ISO/IEC 17025 accredited methods

I, the undersigned, hereby declare that the findings provide a true and accurate record of the results obtained on samples as received.

Date and signature

13/05/2022

Cao Thu Le
Water Laboratory Manager

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