

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 edge 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 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
<p>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</p>	<p>min. 99.9999% reduction</p>	<p>min. 99.999999% reduction</p>	<p>Aquadiagnostics/IAPMO India (WQA Accredited)</p>
<p>Parasites NSF P231/NSF 53 Ascaris lumbricoides Cryptosporidium spp. Entamoeba histolytica Giardia intestinalis Naegleria gruberi Schistosoma mansoni Taenia saginata</p>	<p>min. 99.9% reduction</p>	<p>min. 99.9999% reduction</p>	<p>Aquadiagnostics/IAPMO India (WQA Accredited)</p>
<p>Microplastics (as small as 1um)</p>	<p>NSF standard under development</p>	<p>min. 99.9999% reduction</p>	<p>Aquadiagnostics/IAPMO India (WQA Accredited)</p>

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 ($\geq \log 6$), protozoa removal ($\geq \log 4$), 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.



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

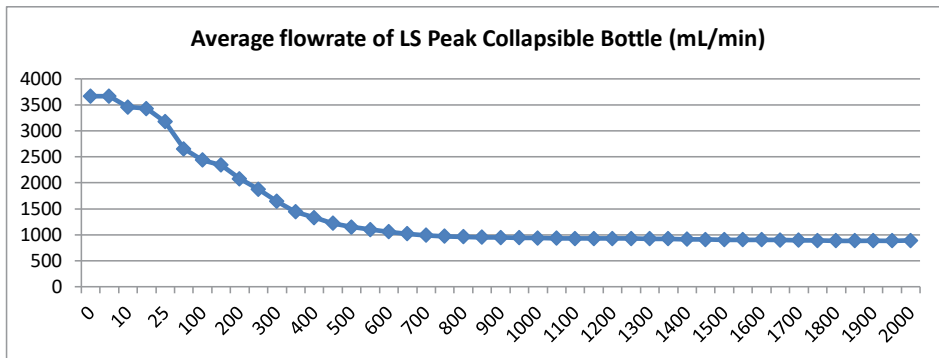


Figure 1: Flowrate of the tested samples of LS Peak Collapsible Bottle

- 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 <i>E.coli</i> and Microspheres at challenging points						
	Beginning	500L	1000L		1500L	2000L	
	<i>E.coli</i>	<i>E.coli</i>	<i>E.coli</i>	Spheres	<i>E.coli</i>	<i>E.coli</i>	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 effluent 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 ($\geq \log 6$), protozoa removal ($\geq \log 4$), and turbidity removal (≤ 0.5 NTU).



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IMPACTING PEOPLE

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

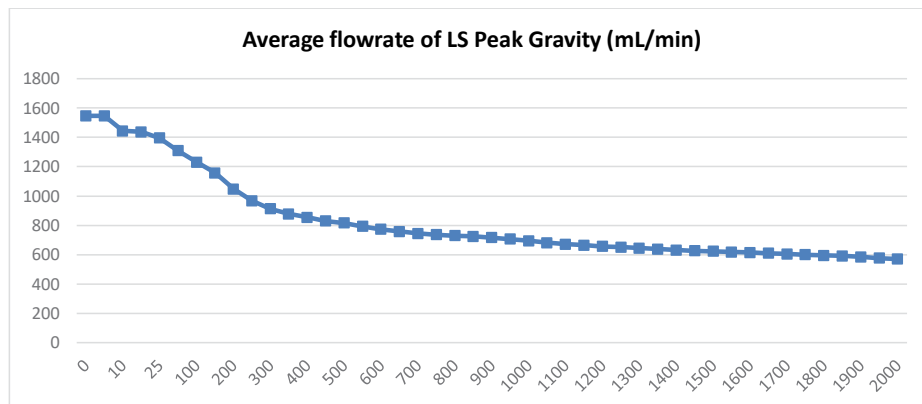


Figure 1: Flowrate of the tested samples of LS Peak Gravity

- 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 0.2 μ m, thus, it can remove *E.coli* bacteria (ca. 0.5x2 μ m) and protozoa cysts (minimum 3 μ m).
- 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 (\geq log6), protozoa removal (\geq log4) (table 2).

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

Samples	Log Reduction of <i>E.coli</i> and Microspheres at challenging points						
	Beginning	500L	1000L		1500L	2000L	
	<i>E.coli</i>	<i>E.coli</i>	<i>E.coli</i>	Spheres	<i>E.coli</i>	<i>E.coli</i>	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 3 μ m 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 effluent 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.



**IAPMO INDIA PRIVATE LIMITED
LABORATORY**

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GSTIN:29AABC18589C1Z7
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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	Method: Microplastic reduction (as 1 micron plastic spheres) – black dyed microspheres
	Sample code no: AWRCL/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	

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)
AWRCL/19426D/22-23	LS Peak Squeeze Bottle	1 micron microspheres	1.20 x 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

Report No: IAPMOILAB/PRTR/19426D/21-22, Date: 24.06.2022, Page 1 of 2

RECOGNIZED BY IAPMO R&T – USA

We undertake analytical job for water, food, biocidal resins, detergents & sanitizers and soil. We carry out performance evaluation of drinking water treatment units as per NSF/ANSI specifications. Based on performance we can arrange for certification from IAPMO – USA

Note:

- The results pertain only to the tested samples and applicable parameters.
- 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.
- This report is not to be reproduced either wholly or in parts and cannot be used as evidence in the court of Law and should not be used in any advertising media without prior written permission.
- In case, any recommendation of contents of this certificate is required please contact our office.



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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 °C	20±5 °C	24

PICTURE OF TEST SETUP



Dr S.MURALIDHARA RAO
 Director – Laboratory

Report No: IAPMOILAB/PRTR/19426D/22-23, Date: 24.06.2022, Page 2 of 2

00---End of the Test Report –00

RECOGNIZED BY IAPMO R&T – USA

We under take analytical job for water, food, biocidal resins, detergents & sanitizers and soil. We carry out performance evaluation of drinking water treatment units as per NSF/ANSI specifications. Based on performance we can arrange for certification from IAPMO – USA

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4. In case, any recommendation of contents of this certificate is required please contact our office.

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 (<i>E.coli</i>)	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




Cao Thu Le

Water Laboratory Manager

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 (<i>E.coli</i>)	Protozoa (3µm spheres surrogate)	Turbidity of effluent water (NTU)	Flow rate (ml/min)			
Reference method	SMEWW 92221:2017 (*)	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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