BIOLOGICAL CONSULTING SERVICES
OF NORTH FLORIDA, INC.

2021-05-27

Dave Shanks
Water To Go
The Old Workshops, Stagenhoe Bottom Farm
Hitchin SG4 8JN, United Kingdom
+44 1582 841412
david@watertogo.eu
Client ID: Filter 1, Filter 2, Filter 3

BCS ID: 2104087, 2104088, 2104089

Project Name: W2G 04122021 Microbial Filtration Efficacy Testing

Dear Dave Shanks,

We have completed the filtration efficacy study on the submitted units as outlined below. The contaminant species, study conditions, and water parameters utilized were based on client's request and adaptation of the guidance documents and protocols listed below:

Validation of Water Purifier Microbiological Filtration Efficacy: Screening of performance as per client request; BCS SOP-F1 (ISO17025:2017 accredited)

Report Conclusion: Test Conducted successfully as per Client's Request

Following, you will find our report on the results of the study conducted on the referenced samples. Should you have any questions, please do not hesitate to contact me.

Sincerely,

George Lukasik, Ph.D.
Laboratory Director

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FL DOH E82924, ISO17025:2017 L2422 (ANAB), PA DEP 68-03950, EPA FL01147

Analysis: *R. terrigena Filtration Efficacy* Test Water: General Test Water

Analysis Method: Spread Plating (Standard Method 9215)

Test Point: Initial Efficacy **Test Point Conclusion: Test Notes***

Challenge Date: 2021-04-21 Challenge Analysts: David Sekora M.S.

Initial Pres. (PSI): N/A Temp(C): 24.1

pH: 7.8 Turbidity (NTU): 0.3 TOC (ppm): 0.2 TDS(ppm): 165.2 Hardness(ppm): 129

Alkalinity(ppm): N/A Total Chlorine(ppm): 0.0 Polyphosphate (as ppm phosphorus): N/A

Influent Conc: 4.3E+05 cfu/mL Ambient Temp(C): 26.2

Analysis Date: 2021-04-21 Analysts: David Sekora M.S.

Test Notes: Chlorine residual was not detected (Limit of detection is at 0.01 ppm).
*Units met the performance requirements set in method NSF P231 at the above test point.

BCS Sample ID 1: 2104087 Client ID 1: Filter 1 Flow Rate: 800mL/min

Eff Conc 1: <3.0E-01 cfu/mL % Reduct 1: >99.99993 Log10 Reduct 1: >6.2

BCS Sample ID 2: 2104088 Client ID 2: Filter 2 Flow Rate: 800mL/min

Eff Conc 2: <3.0E-01 cfu/mL % Reduct 2: >99.99993 Log10 Reduct 2: >6.2

BCS Sample ID 3: 2104089 Client ID 3: Filter 3 Flow Rate: 800mL/min

Eff Conc 3: <3.0E-01 cfu/mL % Reduct 3: >99.99993 Log10 Reduct 3: >6.2

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Analysis: *MS-2 Virus Filtration Efficacy* Test Water: General Test Water

Analysis Method: Plaque Assay (BCS SOP V-10)

Test Point: Initial Efficacy **Test Point Conclusion: Test Notes***

Challenge Date: 2021-04-21 Challenge Analysts: David Sekora M.S.

Initial Pres. (PSI): N/A Temp(C): 24.1

pH: 7.8 Turbidity (NTU): 0.3 TOC (ppm): 0.2 TDS(ppm): 165.2 Hardness(ppm): 129

Alkalinity(ppm): N/A Total Chlorine(ppm): 0.0 Polyphosphate (as ppm phosphorus): N/A

Influent Conc: 1.4E+05 pfu/mL Ambient Temp(C): 26.2

Analysis Date: 2021-04-21 Analysts: David Sekora M.S.

Test Notes: Chlorine residual was not detected (Limit of detection is at 0.01 ppm).
*Units failed to meet the performance requirements set in method NSF P231 at the above test point.

BCS Sample ID 1: 2104087 Client ID 1: Filter 1 Flow Rate: 800mL/min

Eff Conc 1: 3.7E+01 pfu/mL % Reduct 1: 99.97 Log10 Reduct 1: 3.6

BCS Sample ID 2: 2104088 Client ID 2: Filter 2 Flow Rate: 800mL/min

Eff Conc 2: 4.4E+01 pfu/mL % Reduct 2: 99.97 Log10 Reduct 2: 3.5

BCS Sample ID 3: 2104089 Client ID 3: Filter 3 Flow Rate: 800mL/min

Eff Conc 3: 3.1E+01 pfu/mL % Reduct 3: 99.98 Log10 Reduct 3: 3.7

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Analysis: *3.0um Microspheres Filtration Efficacy (Cyst)* Test Water: General Test Water

Analysis Method: Fluorescent Microscopic Enumeration (EPA 1623.1)

Test Point: Initial Efficacy **Test Point Conclusion: Test Notes***

Challenge Date: 2021-04-21 Challenge Analysts: David Sekora M.S.

Initial Pres. (PSI): N/A Temp(C): 24.1

pH: 7.8 Turbidity (NTU): 0.3 TOC (ppm): 0.2 TDS(ppm): 165.2 Hardness(ppm): 129

Alkalinity(ppm): N/A Total Chlorine(ppm): 0.0 Polyphosphate (as ppm phosphorus): N/A

Influent Conc: 3.4E+04 microspheres/mL Ambient Temp(C): 26.2

Analysis Date: 2021-04-21 Analysts: David Sekora M.S.

Test Notes: Chlorine residual was not detected (Limit of detection is at 0.01 ppm).
*Units met the performance requirements set in method NSF P231 at the above test point.

BCS Sample ID 1: 2104087 Client ID 1: Filter 1 Flow Rate: 800mL/min

Eff Conc 1: <6.7E-01 microspheres/mL % Reduct 1: >99.998 Log10 Reduct 1: >4.7

BCS Sample ID 2: 2104088 Client ID 2: Filter 2 Flow Rate: 800mL/min

Eff Conc 2: <6.7E-01 microspheres/mL % Reduct 2: >99.998 Log10 Reduct 2: >4.7

BCS Sample ID 3: 2104089 Client ID 3: Filter 3 Flow Rate: 800mL/min

Eff Conc 3: <6.7E-01 microspheres/mL % Reduct 3: >99.998 Log10 Reduct 3: >4.7

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Project: W2G 04122021 Microbial Filtration Efficacy Testing

Date Received: 2021-04-12 12:00 Test Start Date: 2021-04-21 Test End Date: 2021-04-29

System Type: Mouth Drawn Purifier Unit Est. Capacity: N/A

Performance Indicating Device: No Batch Volume: N/A Batch, number per day: N/A

Test Cycle (min): 1 Cycle On/Off (%): 50/50 Restricted Flow Rate: Yes

Test Duration (hr/day): 8 Test Conditioning: Flush with 1 liter of test water

Report Notes:

The purifier units were received from the study sponsor and each was assigned the referenced BCS identifiers. The test set-up was based on methodology described in NSF/ANSI 53 Annex 3 : test method for evaluating mouth drawn water treatment units. The flow rate was maintained at 800 +/-80 mL/min up to a maximum of 20.5 kPa (3 psig) average vacuum. The vacuum was measured continuously and did not exceed -3.0 PSI. The units were conditioned by aspirating 1-liter of General Test Water (GTW (NSF P231); dechlorinated municipal water) through each filter unit. Following the conditioning step, each of the units were tested for initial bacteria, virus, and cyst filtration efficacy as per laboratory protocol. Briefly, aliquots of the challenge species were added to GTW and the water was homogenized. 1-liter of challenge water was aspirated by pump through each of the filter units at the indicated flow rates. Filters' influent and effluent samples were collected in their entirety for immediate analysis. Study & collected influent and effluent samples' analysis was conducted as per laboratory's accredited ISO17025:2017 methodology: bacteria as per SM 9215 (APHA 2012), virus as per BCS SOP V-10 (EPA1602), microspheres as per EPA 1623.1, turbidity was determined as per SM2130B, pH as per SM4500HB, TDS as per SM2540, chlorine as per SM4500-Cl G, Total Organic Carbon (TOC) as per SM5310C, & hardness as per SM2340C (if needed). All analysis was conducted using calibrated and/or validated Instruments to traceable standards (NIST). All method QC was within method acceptance limit. No general environmental conditions are specified in the standard or have been identified that could affect the test results or measurements. END OF REPORT NOTES.

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*I certify that I have examined and I am familiar with the information submitted herein. The results pertain only to the sample(s) tested, associated identifier #(s), and condition at receipt. Based on my inquiry of the individuals responsible for the analysis, I believe the data to be true, accurate, and complete. Unit descriptions and names were obtained from the submitted documents. The analysis was authorized and commissioned by the client or client's representative. The resulting data are representative of the analysis conducted on the collected samples and it's/their condition at the time of analysis. The data provided is strictly representative of the study conducted under laboratory conditions using the material/samples/articles provided by the client (or client's representative) and it's (their) condition at the time of test following receipt. The data obtained may not be representative or indicative of a real-life process and/or application. The sample(s) were analyzed in accordance with the appropriate method, however due to the inherent limitations of methods, microorganisms may avoid detection. BCS Laboratories offers no express or implied warranties concerning the quality, safety, and/or purity of any sample, batch, source, or the process they are derived from. Quality assurance controls were performed as outlined in the method and as per Good Laboratory Practices. Analyses were performed in accordance with laboratory practices and procedures set-forth by ISO 17025-2017 and NELAP/TNI accreditation standards unless otherwise noted. BCS makes no express or implied warranty regarding the ownership, merchantability, safety or fitness for a particular purpose of any such property or product.

Signature of Laboratory Director/Authorized Rep. _____ Date: 2021-05-27

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Pictures:

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*Balance ID: BL-10 Description: Sartorius Practum Precision Balance

Range of Function: 0-3100 g | Instrument Reporting Limit: 0.01g

Last Servive Date: 2020-08-04 | Service Due Date: 2021-08-31

Service Type: Manufacturer Cal | NIST Validation Instrument: Reference Std/Instrument

*pH Meter ID: PH-09 Description: Orion Versa Star Pro Meter w/pH and Conductivity Modules

Range of Function: 0.001-12.000 | Instrument Reporting Limit: 0.001

Last Service Date: 2020-09-14 | Service Due Date: 2021-09-30

Service Type: Validation to NIST | NIST Validation Instrument: NIST Standard Solution

*Conductivity Meter ID: CM-08 Description: Orion Versa Star Pro Meter w/pH and Conductivity Modules

Range of Function: 0.01-2400 ppm | Instrument Reporting Limit: 0.01ppm

Last Service Date: 2020-09-14 | Service Due Date: 2021-09-30

Service Type: Validation to NIST | NIST Validation Instrument: NIST Standard Soutions

*Alkalinity Meter ID: N/A Description:

Range of Function: | Instrument Reporting Limit:

Last Service Date: | Service Due Date:

Service Type: | NIST Validation Instrument:

*Hardness Meter ID: HARD-02 Description: Hach Total Hardness Test Kit 10-4,000 mg/L

Range of Function: 10-4000mg/L | Instrument Reporting Limit: 10 mg/L

Last Service Date: 2020-05-21 | Service Due Date: 2021-05-21

Service Type: Validation to NIST | NIST Validation Instrument: NIST Standard solutions

*Turbidity Meter ID: TM-05 Description: Hach Turbidimeter

Range of Function: 0.00-999NTU | Instrument Reporting Limit: 0.01NTU

Last Service Date: 2020-09-24 | Service Due Date: 2021-09-30

Service Type: Manufacturer OEM | NIST Validation Instrument: NIST Standard Solutions

*Spectrophotometer ID: SPEC-02 Description: Hach DR 3900 Spectrophotometer Colorimeter

Range of Function: 320-1000nm | Instrument Reporting Limit: 0.01nm

Last Service Date: 2021-01-12 | Service Due Date: 2022-01-12

Service Type: Manufacturer service | NIST Validation Instrument: NIST Standard Solutions

Incubator ID: I-20 Description: Thermo Fisher Forma 29 cu. ft. Reach-In Incubator

Range of Function: 10-65C | Instrument Reporting Limit: 0.1C

Last Service Date: 2020-09-14 | Service Due Date: 2021-09-30

Service Type: Annual Service | NIST Validation Instrument: Reference Std./Instrument

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**Flow Meter ID 1: N/A Description:

Range of Function: Instrument Reporting Limit:

Last Service Date: Service Due Date:

Service Type: NIST Validation Instrument:

**Flow Meter ID 2: N/A Description:

Range of Function: Instrument Reporting Limit:

Last Service Date: Service Due Date:

Service Type: NIST Validation Instrument:

**Flow Meter ID 3: N/A Description:

Range of Function: Instrument Reporting Limit:

Last Service Date: Service Due Date:

Service Type: NIST Validation Instrument:

Microscope ID: MIC-03 Description: Olympus BH-2 Microscope

Range of Function: 40X-400X Magnification Instrument Reporting Limit: 0.5 micron

Last Service Date: 2020-08-04 Service Due Date: 2021-08-04

Service Type: Annual Service NIST Validation Instrument: NIST Micrometer

Refrigerator ID: FR-11 Description: Migali B Series Glass Door Refrigerator

Range of Function: 1-8C Instrument Reporting Limit: N/A

Last Service Date: 2020-09-14 Service Due Date: 2021-09-30

Service Type: Annual Service NIST Validation Instrument: Reference Std./Instrument

Centrifuge ID: C-12 Description: Eppendorf centrifuge w/ cell culture package

Range of Function: 0-4400 RPM Instrument Reporting Limit: 1 RPM

Last Service Date: 2020-09-14 Service Due Date: 2021-09-30

Service Type: Annual Service NIST Validation Instrument: TA-01

Pressure Source Pump ID: Pump-60 Description: Masterflex L/S Pump & Pump Drive

Range of Function: N/A Instrument Reporting Limit: N/A

Last Service Date: N/A Service Due Date: N/A

Service Type: N/A NIST Validation Instrument: N/A

Pressure Meter ID: PM-35 Description: Sper pressure transducer (2 bar)

Range of Function: 0.01-29PSI Instrument Reporting Limit: 0.01PSI

Last Service Date: 2021-02-18 Service Due Date: 2022-02-18

Service Type: Validation to NIST NIST Validation Instrument: PM-60 NIST

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Cert. Pressure Meter ID: PM-60 NIST Description: Pressure Transducer 29 PSI

Range of Function: 0.01-29 psi
Instrument Reporting Limit: 0.01 PSI
Last Service Date: 2020-11-11
Service Due Date: 2021-11-11
Service Type: Manufacturer Cal.
NIST Validation Instrument: Reference Std./Instrument

TOC Analyzer ID: TOC-01 Description: GE M5310C Lab TOC Analyzer

Range of Function: 40ppb-50ppm
Instrument Reporting Limit: 0.01ppb
Last Service Date: 2020-05-13
Service Due Date: 2021-05-13
Service Type: Manufacuter Cal.
NIST Validation Instrument: NIST Standard Solutions

Spectrograph ID: N/A Description:

Range of Function:
Instrument Reporting Limit:
Last Service Date:
Service Due Date:
Service Type:
NIST Validation Instrument:

Thermometer ID: IR-11 NIST Description: VWR Traceable Infrared Thermometer Gun

Range of Function: 0-300
Instrument Reporting Limit: N/A
Last Service Date: 2020-09-18
Service Due Date: 2021-09-18
Service Type: Annual calibration
NIST Validation Instrument: N/A

Particle Counter ID: N/A Description:

Range of Function:
Instrument Reporting Limit:
Last Service Date:
Service Due Date:
Service Type:
NIST Validation Instrument:

Timer ID: T-37 Description: Jumbo VWR Traceable Lab-Top Timer

NIST Expiration Date: 2022-02-19

*Validated at each day of use using NIST traceable standards. Other major equipment validated quarterly.
**Validated at each use using traceable volume and time measurements.

All above equipment with completed fields were used from Test Start Date to Test End Date unless otherwise noted. Service Date indicates PM or calibration by accredited service provider. Service Dates reported for latest period. If Last Service Date occurs during study duration, please contact us for the previous period's validation information.

END OF REPORT

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