2023-02-11

Project Manager
Sawyer Products, Inc.
605 7th Ave.
Safety Harbor, FL 34695

RE: Squeeze Water Filtration System

Client ID: Squeeze 3, Squeeze 4, Squeeze 5

BCS ID: 2212370, 2212371, 2301019

Project Name: Sawyer 122822 Squeeze Microbial Filtration Efficacy Testing

Dear Project Manager,

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: Testing of initial of bacterial and cyst filtration 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

BCS LABORATORIES, INC. – GAINESVILLE
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FL DOH E82924, ISO17025:2017 L2422 (ANAB), PA DEP 68-03950, EPA FL01147

Analysis: *R. terrigena Filtration Efficacy (Bacteria)* Test Water: General Test Water

Analysis Method: Membrane Filtration (Standard Method 9215C) **Test Point Conclusion: Test Notes***

Test Point: Initial Performance

Challenge Date: 2023-01-06 Challenge Analysts: Trystan A. Bordeau, B.S.

Initial Pres. (PSI): N/A Temp(C): 22.8

pH: 7.3 Turbidity (NTU): 0.2 TOC (ppm): 0.4 TDS(ppm): 196.5 Hardness(ppm): 156

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

Influent Conc: 3.9E+05 cfu/mL Ambient Temp(C): 24.1

Analysis Date: 2023-01-06 Analysts: Trystan A. Bordeau, B.S.

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

BCS Sample ID 1: 2212370 Client ID 1: Squeeze 3 Flow Rate: 800mL/min

Eff Conc 1: <5.0E-03 cfu/mL % Reduct 1: >99.999999 Log10 Reduct 1: >8.0

BCS Sample ID 2: 2212371 Client ID 2: Squeeze 4 Flow Rate: 800mL/min

Eff Conc 2: <5.0E-03 cfu/mL % Reduct 2: >99.999999 Log10 Reduct 2: >8.0

BCS Sample ID 3: 2301019 Client ID 3: Squeeze 5 Flow Rate: 800mL/min

Eff Conc 3: <5.0E-03 cfu/mL % Reduct 3: >99.999999 Log10 Reduct 3: >8.0

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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 Conclusion: Test Notes***

Test Point: Initial Performance

Challenge Date: 2023-01-06 Challenge Analysts: Trystan A. Bordeau, B.S.

Initial Pres. (PSI): N/A Temp(C): 22.8

pH: 7.3 Turbidity (NTU): 0.2 TOC (ppm): 0.4 TDS(ppm): 196.5 Hardness(ppm): 156

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

Influent Conc: 2.2E+04 microspheres/mL Ambient Temp(C): 24.1

Analysis Date: 2023-01-06 Analysts: Trystan A. Bordeau, B.S.

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

BCS Sample ID 1: 2212370 Client ID 1: Squeeze 3 Flow Rate: 800mL/min

Eff Conc 1: <1.3E-01 microspheres/mL % Reduct 1: >99.9994 Log10 Reduct 1: >5.2

BCS Sample ID 2: 2212371 Client ID 2: Squeeze 4 Flow Rate: 800mL/min

Eff Conc 2: <1.3E-01 microspheres/mL % Reduct 2: >99.9994 Log10 Reduct 2: >5.2

BCS Sample ID 3: 2301019 Client ID 3: Squeeze 5 Flow Rate: 800mL/min

Eff Conc 3: <1.3E-01 microspheres/mL % Reduct 3: >99.9994 Log10 Reduct 3: >5.2

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Project: Sawyer 122822 Squeeze Microbial Filtration Efficacy Testing

Date Received: 2022-12-28 10:00 Test Start Date: 2023-01-06 Test End Date: 2023-01-11

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 (sec): 8 Cycle On/Off (%): 37.5/62.5 Restricted Flow Rate: No

Test Duration (hr/day): N/A Test Conditioning: See Report Notes

Report Notes:

The purifier units were received from the study sponsor and each was assigned the referenced BCS identifiers. The units were tested for their initial bacterial and cyst filtration efficacy. The test set-up was based on methodology described in NSF 42:2021 "Squeeze bottle drinking water treatment units" protocol units and in NSF P231 (Microbiological Water Purifiers). The flow rate was maintained at 800 +/-80 mL/min up to a maximum of 20.5 kPa (3 psig) vacuum. The units were conditioned by passing General Test Water (GTW; dechlorinated municipal water) through each filter unit for 5-minutes at 800 mL/min. Following the conditioning step, each of the units were tested for initial bacteria and cyst filtration efficacy as per laboratory protocol. Briefly, aliquots of the challenge species were added to GTW and the water was homogenized. 1L of challenge water was passed through each of the filter units at the indicated flow rates. Filters' 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 was analyzed as per SM 9215C (APHA 2012), 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, and hardness as per SM2340C 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: 2023-01-11

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Pictures:

Client: Sawyer Products, Inc.

Project: Sawyer 122822 Squeeze Microbial Filtration Efficacy Testing

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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 Service Date: 2022-08-09 | Service Due Date: 2023-08-09

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: 2022-09-02 | Service Due Date: 2023-09-30

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: 2022-09-02 | Service Due Date: 2023-09-30

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

*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: 2022-10-24 | Service Due Date: 2023-10-24

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: 2022-10-04 | Service Due Date: 2023-10-04

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: 2022-01-18 | Service Due Date: 2023-01-18

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: 2022-09-02 | Service Due Date: 2023-09-30

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

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**Flow Meter ID 1: FM-155 Description: Cole Parmer 100-1500 mL/min Flow Meter

Range of Function: 100-1500 mL/min
Instrument Reporting Limit: 100 mL/min
Last Service Date: 2023-01-06
Service Due Date: 2023-01-11
Service Type: Validation to NIST
NIST Validation Instrument: GC-5G-C

**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: 2022-09-15
Service Due Date: 2023-09-15
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: 2022-09-02
Service Due Date: 2023-09-30
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: 2022-09-02
Service Due Date: 2023-09-30
Service Type: Annual Service
NIST Validation Instrument: TA-01

Pressure Source Pump ID: Pump-93 Description: Master Flex L/S Digital Modular Drive Pump

Range of Function: 10-600 rpm
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: 2023-01-04
Service Due Date: 2024-01-04
Service Type: Validation to NIST
NIST Validation Instrument: PM-60 NIST

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

Range of Function: 0.01-29 psi
Instrument Reporting Limit: 0.01 PSI
Last Service Date: 2022-11-18
Service Due Date: 2023-11-18
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: 2022-04-27
Service Due Date: 2023-04-27
Service Type: Manufacturer 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 C
Instrument Reporting Limit: 0.1 C
Last Service Date: 2022-09-12
Service Due Date: 2023-09-12
Service Type: Annual calibration
NIST Validation Instrument: Manufactuer calibration

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-45 NIST Description: VWR Traceable Lap-Top Timer

NIST Expiration Date: 2024-01-04

*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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