October 23, 2015

Mr. Travis Merrigan
Grayl Inc.
610 Maple Heights Rd
Camano Island, WA 98282

Re: Bacterial and viral filtration efficacy testing of the Grayl Travel Purifier+ Filters: BCS ID 1510233 and 1510234.

To whom it may concern,

We have conducted the requested biological filtration efficacy study on the provided filters. The filters were received on October 19th, 2015. The experimental set up and challenge of the water filters was designed to evaluate the filters' bacterial and viral removal efficacy of the filter. The contaminant species and water parameters selected were based on client's request and NSF/ANSI water purifier testing protocols.

Following, you will find our report on the results of the challenge study. 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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WWW.MICROBIOSERVICES.COM
FL DOH #E82924, ISO/IEC 17025:2005 L2422 (L-A-B), EPA# FL01147

Project: Grayl Travel Purifier+ Filters' Efficacy Test
Study Sponsor: Grayl Inc.
Sample(s): BCS 1510233 & 1510234 received October 19th, 2015
Test: Filtration Efficacy
Test Parameter: *Raoultella terrigena* (Bacteria) and Bacteriophage MS-2 (Virus)
Performed and Analyzed by: George Lukasik, Ph.D. & David Sekora; October 19-22, 2015

Filter	Challenge species average concentration	Average percent removal** of the challenge species by filters after the initial challenge and after stagnating for 6 hours			
		Bacteria: *Raoultella terrigena*[1]		Bacteriophage: MS-2[2]	
		Initial challenge	6-Hour stagnation	Initial challenge	6-Hour stagnation
BCS 1510233 Filter A	*Raoultella terrigena*[1] 1.4×10^5 / ml	>99.9999%*	>99.9999%*	>99.9999%*	>99.9999%*
BCS 1510234 Filter B	Bacteriophage MS-2[2] 3.7×10^5 / ml	>99.9999%*	>99.9999%*	>99.9999%*	>99.9999%

[1] *Raoultella terrigena* (ATCC 33257) was obtained from ATCC and propagated on Tryptic Soy Agar (TSA, Becton Dickinson, USA). It is used to evaluate filters' bacterial removal efficacy. Bacteria was enumerated as colony forming units (cfu) following incubation at 36.5°C for 24 hours as per Standard method 9215C (APHA, 2012).
[2]Bacteriophage MS-2 (ATCC 15597-B1) was used as a model for human viruses. It is of similar shape and size to human enteroviruses and thus is used to determine filter's viral capture efficacy. It was enumerated using *E. coli* C3000 (ATCC 15597) as a host using the single layer plaque assay agar procedure as per EPA 1601.
* No species were detected in the filter effluent for the total volume analyzed (<0.45 cfu or pfu/ml). Filter effluent samples were analyzed in duplicates at the minimum following collection.

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****** Filtration Challenge Study Description: Initially, 2 liters of laboratory grade reagent water was passed through the filters using the provided bottle. Reagent water at a pH 7.45 was seeded with *Raoultella terrigena* and bacteriophage MS-2. The solution was homogenized and 500ml was added to the Grayl receiving base. The filtrate reservoir was steadily pushed down using approximately 10 lbs. downward force. A sample from the filtrate was removed and was assayed for the respective species as per standard methods and Lab Standard Operating Procedures (SOP F-1). Following the initial challenge, approximately 80% of the filtered water was decanted and the bottle was allowed to rest for 6 hours. Challenge water was regularly added to the receiving base via a sterile pipet. This was done to test that challenge water was not bypassing the seal around the filter and leaching into the filtered water reservoir. Following 6 hours of stagnation, a sample from the filtrate was removed and was assayed. A sample of the influent challenge water was removed prior to the beginning of the study and at the end. All analysis was conducted in duplicate at minimum. The number of microorganisms was determined in each sample. The respective percent reductions were determined based on the concentration obtained in the filter influent and analyzed effluent sample.

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Study data are summarized in the provided table(s). The results presented pertain only to the study conducted on the test articles/samples provided by the client (or client representative). The study was authorized and commissioned by the client. The results presented pertain only to the samples analyzed and identifier number(s) indicated. The data provided is strictly representative of the study conducted using the material/samples/articles provided by the client (or client's representative) and its (their) condition at the time of test. The study and data are obtained under laboratory conditions and may not be representative or indicative of a real-life process and/or application. Positive, negative, and neutralization controls were performed as outlined in the method and as per Good Laboratory Practices. All analyses were performed in accordance with laboratory practices and procedures set-forth by our NELAP/TNI accreditation standards (ISO 17025) unless otherwise noted. BCS makes no claims with regards to the 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: October 23, 2015

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