



inc. BIOLOGICAL CONSULTING SERVICES
OF NORTH FLORIDA, INC.

February 25, 2016

Sagan, LLC
11035 Technology Place, Suite 100
San Diego, CA 92127
858-675-7017 ext. 2000

RE: Simulated swimming pool water filtration efficacy test study of the provided Sagan® DuraFlo 550 filter unit; BCS ID 1601039.

To whom it may concern,

We have conducted the requested filtration efficacy study on the filter unit received on January 12th, 2016. The experimental set up and challenge of the water filter was designed to evaluate the filter's chemical removal efficacy of disinfectant species commonly used in residential swimming pools. Soluble copper is commonly used as an algaecide. Total chlorine (including Chloramines) is used as a biocide. The filter challenge study test was based on client's request to demonstrate the filter's capacity to remove the stated species from residential swimming pool simulated water. The test demonstrated that the DuraFlo 550 filter cartridge that was tested effectively removed copper and chlorine species from simulated swimming pool water.

In the following pages, you will find a summary of the methodology used and the results of our analysis. Should you have any questions or concerns, please do not hesitate to contact me.

Best Regards,

George Lukasik, Ph.D.
Laboratory Director

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FL DOH #E82924, ISO/IEC 17025:2005 L2422 (L-A-B), EPA# FL01147
FILE: SAGAN DURAFLO 550 CHLORINE AND COPPER REMOVAL STUDY BCS 1601039 02.25.2016
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Test Article(s):

On January 12th, 2016, 2 Sagan DuraFlo 550 filter units were received from Sagan LLC.

The two filter units were issued BCS identifiers 1601038 and 1601039 respectively.

BCS IDs 1601039 was selected for the study and 1601038 was kept in reserve.

Study Date:

The study was initiated on January 22nd, 2016 and completed on January 30th, 2016.

Performed by: David Sekora, M.S.

Analyzed by: David Sekora, M.S.

Study Supervisor: George Lukasik, Ph.D.

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Physical parameter measuring devices and critical equipment utilized:

Equipment and Measurement Parameter	Manufacturer	BCS Lab ID
Balance	Sartorius Laboratory Instruments	BL-4
Digital Colorimeter; DPD-02	Hach DR 890	COL-03/DPD-02
CP Masterflex Pump	Masterflex, A11004683	Pump 11
Timer	VWR Traceable 62344-910	T-06
1-Liter standardized graduated cylinder	Nalgene	GC-1L-A

Test Matrix; Simulated Residential Pool Water:

Carbon block dechlorinated municipal water was used throughout the study. A measured aliquot of HTH Shock n' Swim (Arch Chemicals, USA; Buffered 52% Calcium Hypochlorite) was added to 550 gallons of dechlorinated municipal water to create and maintain a total chlorine content of 2.10 ppm +/- 0.1 ppm throughout the study. All In One Algacide (SunCoast Chemical Co, USA; 60% Poly[oxyethylene (dimethyliminio) ethylene (dimethyliminio) ethylene dichloride]) was added to the water as per label instructions. Additionally, Super Green Algaecide (Suncoast Chemical Co, USA: 23.5% Copper Triethanolamine Complex (7.1% Metallic copper equivalent)) was added to the water as per label instructions. Lastly, Silver Algaecide (Suncoast Chemical Co, USA:

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0.8% Colloidal Silver as elemental) was also added to the water as per manufacturers instructions. The additives were used in order to create water similar in composition to that found in a residential pool.

Challenge study Description / Methodology:

The provided filter was fitted into the inside of a 5-gallon plastic container (Lowe's Hardware Store, USA) bucket. The container was continuously fed with the prepared water so as it filled with water, it would drain out through the filter at the bottom of the container. A peristaltic pump supplied the simulated residential pool water via a peristaltic to maintained a constant water level submerging the filter with simulated swimming pool water. After the passage of specified volume of the simulated residential swimming pool water, a sample of the filter's influent and effluent was removed. This was repeated at the various volumes indicated in the following tables. The samples were analyzed for total chlorine immediately following collection. Additionally the samples were sent out for metallic species analysis to XENCO Laboratories (Tampa, FL). The study continued until the filter flow was reduced significantly .

Study data are summarized in the provided table(s). The results presented pertain only to the study conducted on the test articles/samples/units provided by the client (or client representative). The study was authorized and commissioned by the client. The

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analytical results pertain only to the samples analyzed relating to the respective 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 it's (their) condition at the time of test. The study and data obtained under the laboratory conditions 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 ISO 17025-2005 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.

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Project: Sagan, LLC DuraFlo 550 Efficacy Test
Sample(s): BCS 1601039 received January 12th, 2016
Test: Filtration Efficacy
Test Parameter: Total Chlorine
Test Dates: January 22nd, 2016-January 29th,2016

Sample Type	Total Chlorine content, in ppm following the passage of indicated volume of simulated residential pool water									
	1 Gallon	100 Gallons	150 Gallons	200 Gallons	250 Gallons	300 Gallons	350 Gallons	400 Gallons	450 Gallons	500 Gallons
Simulated Residential Pool Water	2.06	2.00	2.18	2.20	2.18	2.17	2.02	2.02	2.00	2.09
DuraFlo 550 Filter Effluent	0.04	0.65	0.67	0.72	0.84	0.70	0.77	0.73	0.83	0.81
Percent Removal*	98%	67.5%	69.3%	67.2%	61.5%	67.7%	61.9%	63.8%	58.5%	61.2%

* The respective percent reductions were determined based on the concentration obtained in the filter influent and effluent samples. NSF Standard 42 requires water purifiers to remove chlorine by >50%.

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Project: Sagan, LLC DuraFlo 550 Efficacy Test
Sample(s): BCS 1601039 received January 12th, 2016
Test: Filtration Efficacy
Test Parameter: Elemental Copper
Test Dates: January 22nd, 2016-January 29th,2016

Sample Type	Copper content, in ppm following the passage of indicated volume of simulated residential pool water									
	1 Gallon	100 Gallons	150 Gallons	200 Gallons	250 Gallons	300 Gallons	350 Gallons	400 Gallons	450 Gallons	500 Gallons
Simulated Residential Pool Water	0.239	0.232	N/A	N/A	N/A	0.172	1.54	0.150	0.163	0.167
DuraFlo 550 Filter Effluent	< 0.05	0.0025	0.0027	0.0085	0.0063	0.0167	0.0351	0.0531	0.0731	0.0930
Percent Removal*	>79.1%	98.9%	>90%	>90%	>90%	90.2%	77.2%	64.6%	55.1%	44.3%

*The respective percent reductions were determined based on the concentration obtained in the filter influent and effluent samples. NSF Standard 53 requires water purifiers to remove copper by >43%.

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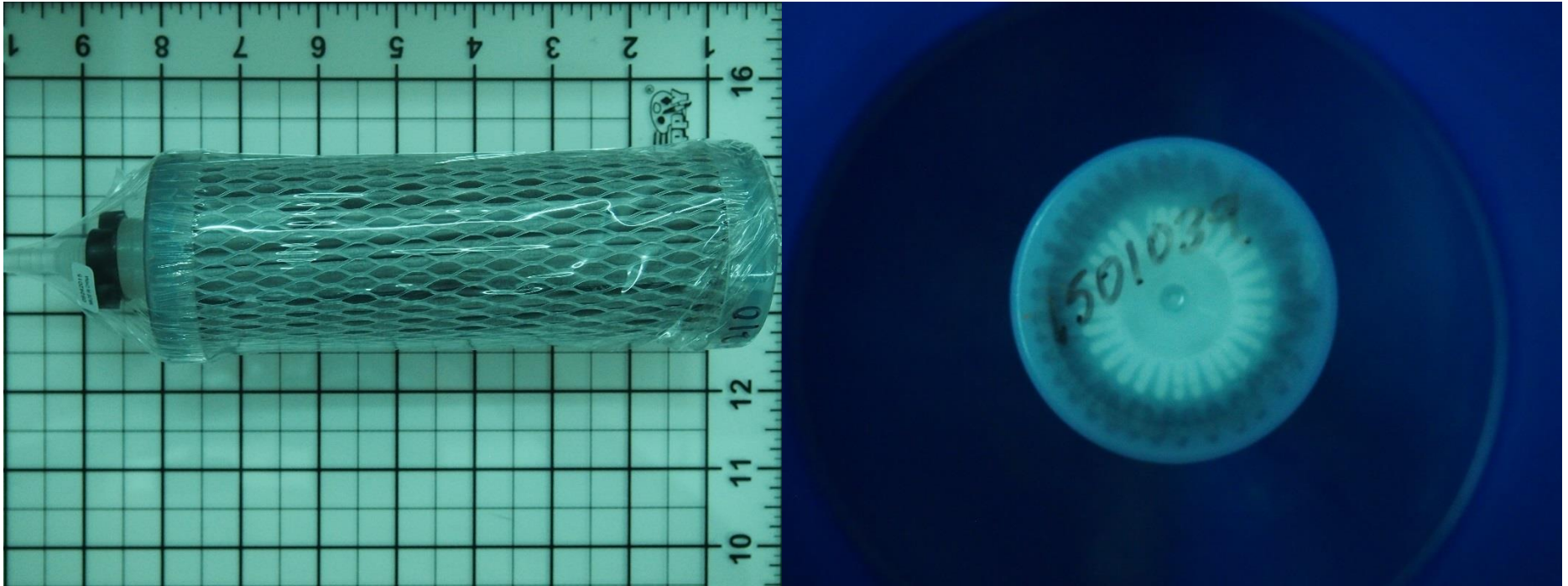


Figure 1. Sagan DuraFlo 550 filter cartridge upon receipt and placed in plastic 5-gallon container

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I hereby certify to the accuracy, quality, and data integrity of the reported study. I also certify that the study was appropriately executed and is fully defensible. All physical measurements and their source have been documented. Measurements were obtained using approved protocols and NIST traceable and/or validated instruments. Analysis execution and results were fully documented. Analytical methods used to produce the study's raw data are within the laboratory's ISO 17025 accreditation. The results and conclusions of the study accurately reflect the real raw data obtained in the study.

Signature of Sr. Analyst _____
David Sekora, M.S.

Date: 02/25/2016

George Lukasik

George Lukasik, Ph.D.

Date: 02/25/2016

I certify that I have personally examined and am familiar with the information submitted herein. Based on my inquiry of the individuals immediately responsible for obtaining the information, I certify the submitted information to be true, accurate, and complete. The data provided is solely representative of the analysis conducted on the material/samples/articles provided by the client (or client's representative) it's (their) condition at the time of study. They may not be representative of a process or product. The sample(s) were analyzed in accordance with the method described for each analyte. Due to the inherent limitation(s) of analytical method(s), 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. The species analysis and presented results in this report meet the requirements of The NELAC Institute (TNI), ISO 17025, and The State of Florida Department of Public Health's Laboratory Certification Program, as applicable unless otherwise noted.

Signature of Study Director _____
George Lukasik, Ph.D.

Date: 02/25/2016

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