TEST REPORT

Lishtot TestDrop™ Pro – Performance Testing for Detection of PFOS in Water

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Customer: Lishtot, Ltd.

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2. General Information

2.1 Purpose

Report data and analysis of findings from a study conducted to quantitatively determine the detection performance of Perfluorooctanesulfonic acid (PFOS) in the range of 80 – 1000 parts per billion (ppb) dissolved in pure water using Lishtot TestDrop™ Pro device.

2.2 Scope

The study is designed to demonstrate performance of Lishtot TestDrop™ Pro device in controlled conditions. Pure water was represented by HPLC grade water. Performance with other organic substances and in presence of other contaminants in water may differ.

2.3 Definitions, Acronyms and Abbreviations

HPLC: High Performance Liquid Chromatography

PFOS: Perfluorooctanesulfonic acid (Heptadecafluorooctanesulfonic acid)

ppb: concentration unit, parts per billion

ppm: concentration unit, parts per million

SDS: Safety Data Sheet

TW: Tap Water

2.4 Background

The Lishtot TestDrop™ Pro device is designed to detect impurities in water. In this report we focus on the ability of the device to detect the presence of PFOS in water.

The device operation is based on measurement and analysis of the electrostatic field in the vicinity of a container with tested water. The device reports findings using blue or red indicator lights, and can also transfer the raw time-based measurements of the electrostatic field via a Bluetooth connection with cell phone or a computer for further processing and reporting.

2.5 Point of Contact

Aimee Kestranek; Analiza, Inc., Cleveland, OH

3. Testing Schedule

Test samples were prepared and tested at the laboratories of Analiza, Inc. in Cleveland, Ohio, conducted on 1/7/2018.

4. Testing Characteristics

4.1 Materials and Equipment

- *Lishtot TestDrop Pro device:* Device ID: 00:A0:50:80:49:95
- *Test cup*: "Disposoware" 5 oz. polypropylene cup
- *Water*: Water, HPLC grade, "OmniSolv", EMD Millipore Corp., CAS-No: 7732-18-5, lot 57297, expiration date: 2018/10/31.
- *PFOS*: Heptadecafluorooctanesulfonic acid, ~40% solution in water, Sigma, P/N 77283-10ML, lot 22470.
- *Pipette:* BioHit Single Channel Adjustable Volume Mechanical Pipette m1000
- *Graduated Glass Cylinders:* Pyrex No. 3042 (1000 ml), No. 3046 (50 ml), No. 3046 (25 ml).
- *Glass bottles:* VWR, Cat. No. 89000-236, 200 ml; Wheaton, 500 ml.

4.2 Safety Considerations

The following safety practices were followed during testing:

- Sturdy closed-toe, water-proof shoes must be worn in the laboratory at all times.
- No food, beverages, cosmetics or medications should be consumed or used within the laboratory.
- Review relevant Safety Data Sheets (SDS) for materials being used.
- Be aware of location and use of eye wash stations and emergency showers.

Note: The Lishtot TestDrop Pro device must be used with bare hands (no protective gloves worn), since protective gloves may interfere with electrostatic field near the test object, which may lead to invalid test results.

4.3 Test Design

The following concentrations of PFOS in HPLC grade water were chosen for testing: 1000, 100, and 80 ppb. Pure HPLC grade water was designated as negative control. Each PFOS solution and the negative control were tested consecutively 10 times (which matches the capacity of data storage of the device). Preparation of solutions and testing were performed on the same day.

4.4 Procedure

All solutions were prepared using glass labware. The glass containers for solutions were washed inside with a bottle brush using dish detergent (with no hand moisturizers), then washed with hot tap water until no foam is present, then rinsed with hot tap water minimum 12 times (partially filling and emptying the container), and then rinsed with deionized water minimum of 5 times (partially filling and emptying the container), and then finally rinsed with HPLC grade water 2 times.

Glass cylinders used to handle PFOS solutions were first rinsed with the same solution and only then used to sample the solution. The manual pipette tip was rinsed with the test solution prior to transferring the solution by reverse pipetting technique. This was done to minimize the impact of possible adsorption of PFOS on the surface of the pipette, especially consequential at low PFOS concentrations.

Stock solution (100 ml) of PFOS, 1000 ppm, was prepared. From that stock solution, 250 ml of 1000 ppb of PFOS solution was prepared. From that solution, two other PFOS solutions were prepared: 250 ml of 100 ppb, and 250 ml of 80 ppb. The solutions were prepared according to the following procedure:

1. 100 ml of stock solution of PFOS, 1000 ppm, were prepared by mixing of 0.25 ml of the source 40% PFOS solution and 100 ml of HPLC grade water, in a clean glass bottle.
2. 250 ml of 1000 ppb solution were prepared in a clean bottle by mixing 0.25 ml of the stock solution (1) and 250 ml of HPLC grade water.
3. 250 ml of 100 ppb solution were prepared in a clean bottle by mixing 25 ml of the 1000 ppb solution and 225 ml of HPLC grade water.
4. 250 ml of 80 ppb solution were prepared in a clean bottle by mixing 20 ml of the 1000 ppb solution and 230 ml of HPLC grade water.

All solutions were carefully mixed before further dilutions and before performing tests.

Preparation of all solutions (including the stock solution) was performed on testing day. Testing was performed on a single day.

Before testing, the negative control (i.e. pure HPLC water) was put in a bottle cleaned in the same way as the bottles for other test solutions. This was done to make sure no detectable contaminants are left on the bottle surface after labware cleaning procedure.

Each individual test was performed as follows:

1. A clean 5 oz. polypropylene test cup was placed on a non-metalic (Formica®) laboratory bench.
2. Approximately 80 ml of test solution were poured into the cup.
3. The cup was gently swirled for about 5 seconds, avoiding spills.
4. The Lishtot TestDrop Pro device was positioned at the side of the cup, a few inches away.
5. The TW button on the device was pressed (a yellow LED starts blinking at the tip of the device).
6. The device was moved towards the cup in a single motion, touching the cup about 2 to 5 mm above the liquid level, while still holding a button on the device.
7. Upon touching the cup, and allowing for one extra blink of the yellow LED, the button was released.

To repeat the test with the same sample, steps (3) to (7) were repeated.

A minimum of 5 seconds were allowed between the end of the test and the beginning of the next test.

Each test was repeated 10 consecutive times with the same sample and cup combination. After 10 consecutive tests, the data was transferred from the device to a smartphone (Samsung Galaxy S7) using Lishtot Android app via Bluetooth interface (the device buffer holds data for the last 10 tests).

5. Results

5.1 Data

The following data were transferred from the TestDrop™ Pro device to the smartphone and the data server:

5.1.1 Table 1. Groups of repeat tests for the same solution.

Test #	Time Stamp	Button	PFOS Concentration, ppb*	Sensitivity Setting	LED Color
42	7/1/2018 15:08	TW	0 (Negative Control)	High	BLUE
43	7/1/2018 15:09	TW	0 (Negative Control)	High	BLUE
44	7/1/2018 15:09	TW	0 (Negative Control)	High	BLUE
45	7/1/2018 15:09	TW	0 (Negative Control)	High	BLUE
46	7/1/2018 15:09	TW	0 (Negative Control)	High	BLUE
47	7/1/2018 15:09	TW	0 (Negative Control)	High	BLUE
48	7/1/2018 15:10	TW	0 (Negative Control)	High	BLUE
49	7/1/2018 15:10	TW	0 (Negative Control)	High	BLUE
50	7/1/2018 15:10	TW	0 (Negative Control)	High	BLUE
51	7/1/2018 15:10	TW	0 (Negative Control)	High	BLUE
102	7/1/2018 18:42	TW	100	High	RED
103	7/1/2018 18:42	TW	100	High	RED
104	7/1/2018 18:43	TW	100	High	RED
105	7/1/2018 18:43	TW	100	High	RED
106	7/1/2018 18:43	TW	100	High	RED
107	7/1/2018 18:44	TW	100	High	RED
108	7/1/2018 18:44	TW	100	High	RED
109	7/1/2018 18:44	TW	100	High	RED
110	7/1/2018 18:44	TW	100	High	RED
111	7/1/2018 18:45	TW	100	High	RED
162	7/1/2018 21:39	TW	80	High	RED
163	7/1/2018 21:39	TW	80	High	RED
164	7/1/2018 21:39	TW	80	High	RED
165	7/1/2018 21:39	TW	80	High	RED
166	7/1/2018 21:40	TW	80	High	RED
167	7/1/2018 21:40	TW	80	High	RED
168	7/1/2018 21:40	TW	80	High	RED
169	7/1/2018 21:40	TW	80	High	RED
170	7/1/2018 21:40	TW	80	High	RED
171	7/1/2018 21:41	TW	80	High	RED
172	7/1/2018 21:48	TW	1000	High	RED
173	7/1/2018 21:49	TW	1000	High	RED
174	7/1/2018 21:49	TW	1000	High	RED
175	7/1/2018 21:49	TW	1000	High	RED
176	7/1/2018 21:49	TW	1000	High	RED
177	7/1/2018 21:49	TW	1000	High	RED
178	7/1/2018 21:50	TW	1000	High	RED
179	7/1/2018 21:50	TW	1000	High	RED
180	7/1/2018 21:50	TW	1000	High	RED
181	7/1/2018 21:50	TW	1000	High	RED

*It is noted that since some PFOS may be adsorbed at the inner surface of the glass labware, the nominal reported concentration level should be viewed as upper limit; namely, the actual solution concentration could be lower than the calculated nominal level, particularly at lower concentrations.

Red LED color means that the device positively detects presence of contaminant in the liquid.

Blue LED color means that the device did not detect any contaminant in the liquid.

6. Conclusions

Based on obtained data, the Lishtot TestDrop™ Pro device was able to consistently detect presence of PFOS in pure water (represented by HPLC grade water) at concentration as low as 80 ppb. The device was also able to consistently report the absence of PFOS in pure water.

It is noted that since some PFOS may be adsorbed at the inner surface of the glass labware, the nominal reported concentration level should be viewed as upper limit; namely, the actual solution concentration as tested could be lower than the calculated nominal level, particularly at lower concentrations.

Revision History			
Revision Level	Effective Date	Initiator	DCO Number
A	1-8-2018		DCO-00001
Section Number	Description and Justification of Changes		
All	Initial Release		

Legal Disclaimer

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