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(510) 887-8885 | info@harrenslab.com
3860 BAY CENTER PLACE | HAYWARD, CA 94545

Client: LARQ, 3980 Trust Way, Hayward, CA 94545
Order Number: IN201804033
Sample Number: HR20180490108

Study: Antimicrobial efficacy of the LARQ Bottle against *Salmonella enterica* subsp. *Typhimurium*
Method: ASTM E2315

Report Date: 5/30/2018

Certificate of Analysis

Experimental Summary:

The objective of this experiment was to test the efficacy of LARQ's UV-C LED technology within the application of the LARQ Bottle against water samples enriched with *Salmonella enterica* subsp. *Typhimurium*. The testing procedure was designed after discussions between LARQ and Harrens Lab and based on ASTM E2315 ("Standard Guide for Assessment of Antimicrobial Activity Using a Time-Kill Procedure.") testing guidelines and was conducted at Harrens Lab Inc. in Hayward, CA.

Materials and Methods:

LARQ provided 4 stainless steel bottles and one UV-C LED cap for the testing. LARQ provided Sterile Deionized water that was used to spike the samples and treat. *Salmonella Typhimurium* (ATCC 14028) was used as the testing organism in this experiment with a starting solution of about 1.00 x 10^7 CFU/mL. Testing was done in 3 replicates for 2-min tests, and 6 replicates for 1-min and 3-min tests. Inoculated volumes for each run was 500 mL, out of which 50 mL was collected for LARQ internal purposes, and 450 mL was tested in a stainless bottle with UV cap (provided by LARQ) for designated run-times. Pre and post treatment aliquots were plated in serial dilutions ranging from 10^{-1} to 10^{-9} on APC Media using a pour plate technique. Plates were incubated for 48-hr at 35°C.

Figure 1: LARQ Bottle with UV cap on and off

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Results:

Table 1: Experimental results using 1-min light treatment against *Salmonella Typhimurium*

Replicate	Initial Population	T-1 min	Log Reduction (T1)	% Reduction (T1)
1	9.00E+06	4.00E+05	1.35	95.5556
2	1.30E+07	2.10E+05	1.79	98.3846
3	2.80E+07	3.00E+05	1.97	98.9286
4	3.50E+07	4.50E+05	1.89	98.7143
5	3.20E+07	3.90E+05	1.91	98.7813
6	2.80E+07	3.30E+05	1.93	98.8214
Average	**2.42E+07**	**3.47E+05**	**1.81**	**98.1976**

Table 2: Experimental results using 2-min light treatment against *Salmonella Typhimurium*

Replicate	Initial Population	T-2 min	Log Reduction (T2)	% Reduction (T2)
1	3.20E+07	1.42E+04	3.35	99.9556
2	2.50E+07	4.30E+03	3.76	99.9828
3	2.00E+07	3.70E+03	3.73	99.9815
Average	**2.57E+07**	**7.40E+03**	**3.62**	**99.9733**

Table 3: Experimental results using 3-min light treatment against *Salmonella Typhimurium*

Replicate	Initial Population	T-3 min	Log Reduction (T3)	% Reduction (T3)
1	2.80E+07	1.00E+01	6.45	99.9999
2	1.10E+07	1.00E+01	6.04	99.9999
3	4.50E+07	1.00E+01	6.65	99.9999
4	6.90E+07	1.00E+01	6.84	99.9999
5	7.00E+07	1.00E+01	6.85	99.9999
6	7.50E+07	1.00E+01	6.88	99.9999
Average	**4.97E+07**	**1.00E+01**	**6.62**	**99.9999**

Comment: No growth was detected on 3-min treated plates so a value of 10 was used to indicate the detection limit (<10 CFU).

Conclusions:

This purpose of this study was to determine how effective a LARQ bottle was at killing *Salmonella Typhimurium* at 1-min, 2-min, and 3-min treatments. Tables 1, 2, and 3 shows that the LARQ bottle produced detectable log reductions of *Salmonella Typhimurium* at 1-min, 2-min and 3-min treatments. Table 1 shows that at 1-min treatments, the LARQ bottle yielded a log reduction of 1.81 and killed 98.1976% of *Salmonella Typhimurium*. Table 2 shows that at 2-min treatments, the LARQ device yielded a

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log reduction of 3.62 and killed 99.9733% of *Salmonella Typhimurium*. Table 3 shows that at 3-min treatments, the LARQ bottle yielded a log reduction of 6.62 and killed 99.9999% of *Salmonella Typhimurium*. The 3-min treatment produced the greatest log reduction and percent reduction against *Salmonella Typhimurium*.

Respectfully Submitted,

Ming Li
General Manager
Harrens Lab Inc.