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TIMILON TECHNOLOGY TEST REPORT

SCOPE OF WORK
VOC Reduction by EnviroKlenz

REPORT NUMBER
104321905GRR-002

ISSUE DATE
09-June-2020

PAGES
9

DOCUMENT CONTROL NUMBER
Per GFT-OP-10 (6-March-2017)

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TEST REPORT FOR TIMILON TECHNOLOGY ACQUISITIONS, LLC

Report No.: 104321905GRR-002
Date: 09-June-2020
P.O.: 2781

SECTION 1

CLIENT INFORMATION

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Project Engineer

Jesse Ondersma, Ph.D.
Project Reviewer

SECTION 2
SUMMARY

Date Received:	20-May-2020
Dates Tested:	03-June-2020 to 04-June-2020

DESCRIPTION OF SAMPLES

Part Name:	EnviroKlenz
Model Number:	Not Specified
Materials Submitted:	One (1) Filtration Unit & Three (3) Filter Cartridges
Condition of Samples:	Not Specified
Shipping Condition:	Good Condition

WORK REQUESTED/APPLICABLE DOCUMENTS

VOC Reduction Testing:	Referencing NRCC-54013
Intertek Quote:	Qu-01068866-2

TEST SUMMARY

The purpose of this testing is to determine the efficacy of the filtration unit to remove challenge VOCs. The air purifier was challenged with one VOC representative of what are found in homes: Hydrogen sulfide.

SAMPLE DISPOSITION

At the completion of testing, samples were returned to Timilon Technology Acquisitions.

SECTION 3

NRCC-54013 SECTION 5.1.2.2.

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TEST PROCEDURE:

VOC removal testing was performed referencing NRCC-54013 (April 2011): Method for Testing Portable Air Cleaners sections 3.2 and 5.1.2.

Natural system decay for the challenge chemical is performed prior to the test. The unit was placed in the center of a chamber which was sealed. Per clients request the HEPA filter and replacement filter cartridge were adhered together. The challenge chemical (hydrogen sulfide) was injected and allowed to circulate for 30 minutes during which an air sample was taken. An additional enclosure fan was operated to ensure air mixing. The system was then turned on using the highest fan speed beginning the test timing.

VOC samples were collected every 5 minutes for 4 hours after starting the system. Samples analyzed for hydrogen sulfide was performed using a Jerome 631-X analyzer. Table 1 indicates the range and accuracy of the analyzer used.

Table 1: Gas Analyzer Range and Accuracy

ANALYZER MODEL	GAS	RANGE	INCREMENT	ACCURACY[1]
Jerome 631-X	H_2S	0.003 - 50 ppm	0.001 ppm	Range 0: ±0.003 ppm at 0.050 ppm Range 1: ±0.03 ppm at 0.50 ppm Range 2: ±0.3 ppm at 5.0 ppm Range 3: ±2 ppm at 25 ppm

TEST NOTES OR DEVIATIONS:

Testing performed without deviation unless noted below.

TEST PARAMETERS:

Table 2: Chamber Conditions During Test Period

PARAMETER		SYMBOL	VALUE	UNITS
Chamber Volume		*V*	30	m^3
Testing Duration		t	4	h
Test Conditions	Average Temperature (Range)	T	24.2 (23.9-24.3)	°C
	Average Humidity (Range)	RH	48.3 (47.5-51.8)	% RH

TEST RESULTS:

Table 3: Concentration of challenge chemical decay through test.

Time (min)	H_2S (ppm)	Time (min)	H_2S (ppm)
5	5.2	**125**	0.44
10	4.6	**130**	0.40
15	4.0	**135**	0.36
20	3.7	**140**	0.32
25	3.4	**145**	0.28
30	3.0	**150**	0.27
35	2.8	**155**	0.23
40	2.4	**160**	0.21
45	2.2	**165**	0.18
50	2.1	**170**	0.17
55	1.9	**175**	0.15
60	1.7	**180**	0.13
65	1.6	**185**	0.12
70	1.4	**190**	0.11
75	1.3	**195**	0.10
80	1.2	**200**	0.09
85	0.94	**205**	0.08
90	0.85	**210**	0.07
95	0.77	**215**	0.06
100	0.72	**220**	0.06
105	0.65	**225**	0.05
110	0.59	**230**	0.05
115	0.54	**235**	0.04
120	0.49	**240**	0.04

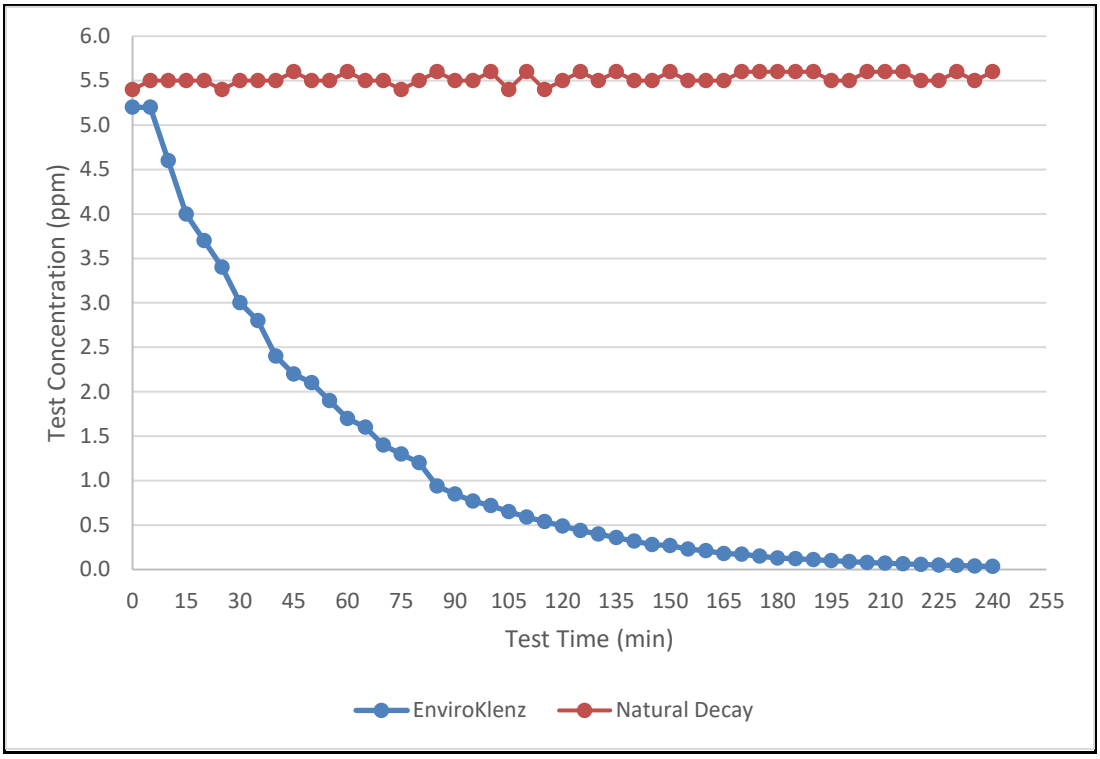

Figure 1: Concentration change throughout test for challenge chemicals

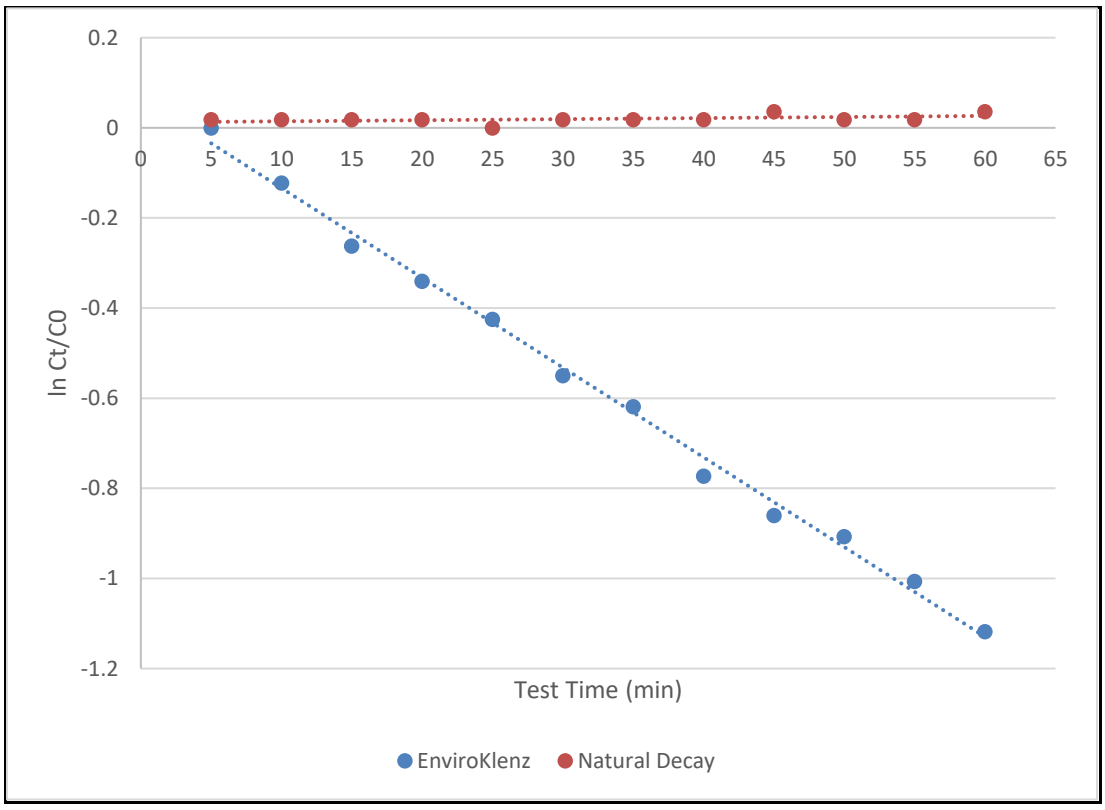

Figure 2: Removal rate of challenge chemicals.

The clean air delivery rate (CADR) is calculated according to equation 1:

$$ln\left(\frac{C_t}{C_0}\right) = -\left(k_n + \frac{CADR}{V}\right)t \qquad \text{Eq. 1}$$

where:

C_t: chemical concentration at time t (µg/m^3)
C_0: chemical concentration at time t_0 (µg/m^3)
V: volume of the test chamber (m^3)
t: time (h)
$CADR$: Clean Air Delivery Rate (m^3/h)
k_n: first order decay constant with PAC turned off

The single pass efficiency (SPE) is calculated according to equation 2:

$$SPE = \frac{CADR}{Q} \qquad \text{Eq. 2}$$

where:

Q: purifier flow rate (425 m^3/h).

Table 2: Purifier efficiency – calculation of clean air delivery rate and single pass efficiency.

VOC	CAS No.	CADR (m^3/h)	SPE (%)
Hydrogen Sulfide	7783-06-4	36	9

*CADR and SPE cannot be determined due to correlation coefficient being below 0.9

PHOTOGRAPHS:

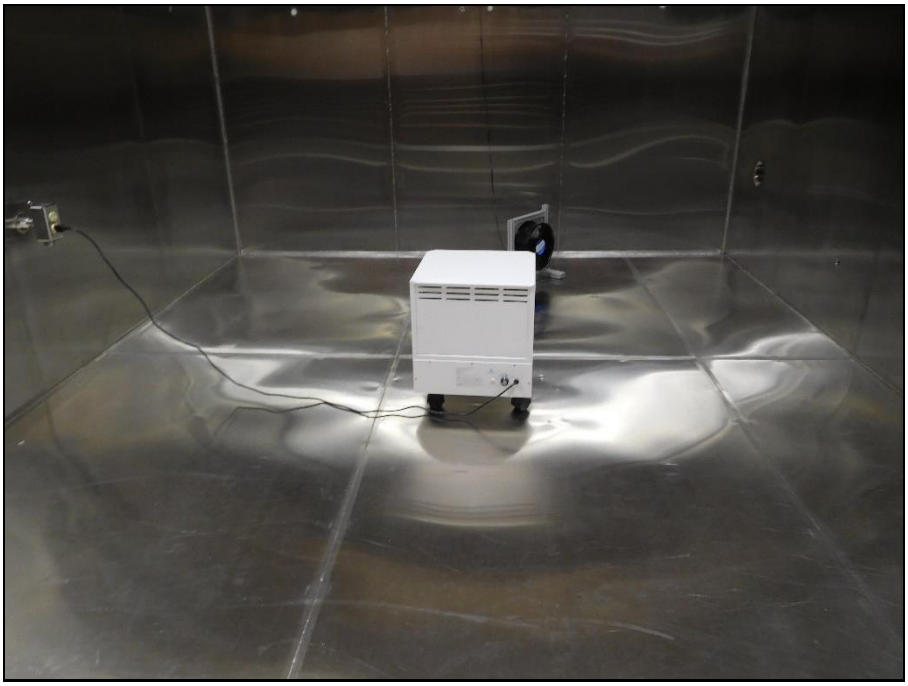

Figure 3: Photograph of sample in Large Scale Test Chamber.

Figure 4: Photograph of sample as received.

SECTION 4

FACILITIES AND EQUIPMENT:

HYDROGEN SULFIDE ANALYZER

INSTRUMENTATION USED:	Jerome 631-X-H2S Analyzer Sensor 12-5-22-R2A