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INTRODUCTION

Acuva's Eco 1.5 recently became the first UV-LED water purifier to be certified against NSF 55-Class B by The International Association of Plumbing and Mechanical Officials (IAPMO). As the primary standard for ultraviolet microbiological water treatment systems, NSF 55 verifies claims regarding disinfection capability of water treatment devices. In addition, the scope of this standard includes material safety and structural integrity of the water purifier. As part of the certification process, the production facility is audited to evaluate the quality control process within the production facility.

The NSF 55 certification process is indeed a very valuable and demanding exercise to assure the effectiveness and safety of the water treatment system for microbial disinfection, with respect to the fact that currently no other standard is available specific to UV-LED water treatment devices; however, considering NSF 55 has primarily been developed based on the utilization of UV mercury lamps in water disinfection systems, there are challenges involved in following the standard protocols for UV-LED based water purification systems.

In this presentation, the certification process of Acuva's Eco 1.5 against NSF 55 with IAPMO will be explained, including the detail of the bioassay, material extraction and pressure tests along with the official test results. In addition, the overall NSF 55- Class B standard will be evaluated in respect to UV-LED based water treatment systems. We will share our learnings within the certification process and offer an insight on improving the current protocols or establishing an alternative approach for global validation of UV-LED water disinfection systems for different industries and markets.

METHODS

Certification against NSF/ANSI 55 Class B was requested by an OEM customer within a regulated industry

The 5 main accredited product certification bodies (WQA, UL, CSA, IAPMO and NSF) were contacted regarding product assessment and IAPMO was selected based on their proposed timeline and budget.

Samples were submitted to IAPMO R&T laboratories as follows

- For material safety according to NSF 55 and NSF 372
- For microbial bio-assay testing
- For structural integrity testing (pressure testing)

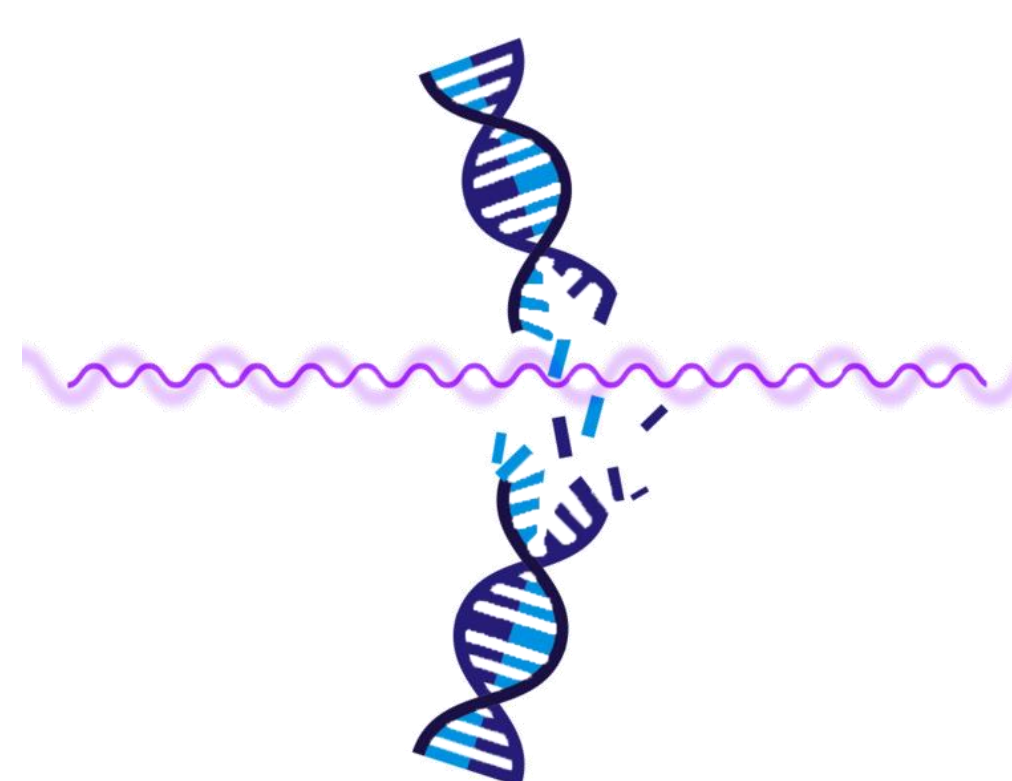


RESULTS

Microbial Test Protocol

- Eco 1.5 tested based on NSF/ANSI 55 Class B protocol [1]
- T1 coliphage was used as the target microorganism
- Dose of 16mJ/cm² was required as determined by the percent reduction of the T1 coliphage at the various test points in challenge study.
- Systems were tested @70% UV out-put for 7 consecutive days as per section 7.2.2.7 of NSF 55
- A chlorine free water with following characteristics was used

	System 1 Start-up	System 1 4 hr	System 2 Start-up	System 2 4 hr
Day 1	>99.999%	>99.999%	>99.999%	>99.999%
Day 2	>99.999%	>99.999%	>99.999%	>99.999%
Day 3	>99.999%	>99.999%	>99.999%	>99.999%
Day 4	>99.999%	>99.999%	>99.999%	>99.999%
Day 5	Stagnation			
Day 6	No sampling			
Day 7	>99.999%	>99.999%	>99.999%	>99.999%



Pressure Test

Structural Integrity Testing was performed in accordance to section 5 of ANSI/NSF 55

Sample	Rated Pressure (psi)	Pressure Criteria (Table 5.1)	Applied Pressure (psi)	Result	Compliance
Eco 1.5	100	2.4 x maximum working pressure or 1,654 kPa (240 psig)	240	The sample withstood the applied pressure for 15 minutes without any signs of leakage	Complied

Sample	Testing Criteria (Table 5.1)	Cyclic Test Pressure (psi)	Result	Compliance
Eco 1.5	10,000 cycles at 0 to 345 kPa (0 to 50 psig)	50	No signs of leakage were observed during or at the end of 10,000 test cycles	Complied

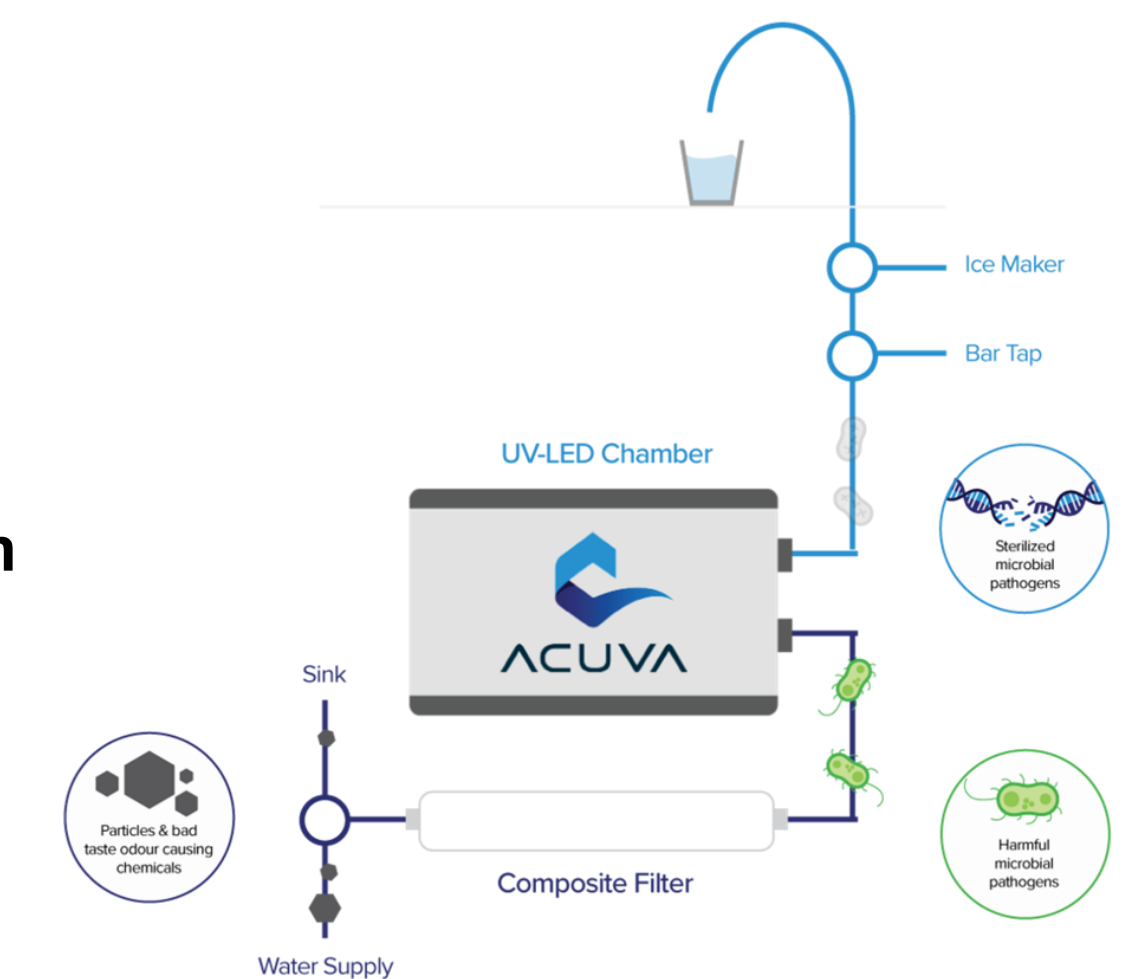
Material Extraction

Material Testing was performed in accordance to section 4 of ANSI/NSF 55 regarding

- Metal content
- Volatile Organic Contamination
- Semi-Volatile Contaminants
- Other organics

Quality Audit for Listee's Quality Assurance System

- Product Identification
- Inspection measuring and test documents
- Inspection and test status
- Control of nonconforming products
- Complaint record
- etc



CONCLUSIONS

- The combination of disinfection performance, material and pressure testing provides a high-level of confidence from NSF 55 certified products
- Considering UV-LEDs are available in variety of peak wavelengths, transitioning from disinfection Dose to Log basis performance evaluation is recommended
- UV-LED systems certified for NSF/ANSI 55-Class A are not out of reach considering recent advancements in LED's output

