

Geometry Defeaturing Effects in CFD Model-based Assessment of an Open-Channel-Type UV Wastewater Disinfection System

Supplement material

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Supporting information on bioassay test

Table S1: Equipment and parameter of bioassay test

Table S2: Summary of bioassay test results

1. Bioassay test parameter

This Supporting information presents the summarized water quality and operating parameters recorded over the duration of bioassay testing, including power, UVT, flow rate, UV intensity reading, and temperature. The equipment and frequency of measurement of parameters is summarized in Table S1. Collimated-beam test of the MS2 stock solutions was performed during the bioassay testing to verify that the MS2 stock used on-site for the validation met quality control requirements. All of the MS2 stock solution used during the testing met the quality control requirements established by UV Guidelines [1]. A summary of the bioassay test results are listed in Table S2.

Table S1. Equipment and parameter of bioassay test

Parameter	Equipment	Frequency of Measurement	Notes
Chlorine [mg L ⁻¹]	LaMotte colorimetric chlorine analyzer	Grab sample taken daily	<ul style="list-style-type: none"> • less than 0.2 [mg L⁻¹] for all sample
Flow rate [gpm]	Omega FMG612 electromagnetic flow meter	Prior to each sampling	<ul style="list-style-type: none"> • Measurement error is $\pm 0.12\%$ • Volume flow rate is converted to mass flow rate in the CFD model based on temperature measurement.
UVT [%]	Real UVT P200	Simultaneous with sampling	<ul style="list-style-type: none"> • Measurement error is $\pm 0.5\%$ • Accuracy checks with Inspect® Patent blue 254 solution.
Power [kW]	Fluke 433-434 Three-phase power analyzer	Prior to each sampling	<ul style="list-style-type: none"> • The power draw was stable and predictable
Sensor reading [mW cm ⁻²]	Calibrated online sensor and reference sensor	Prior to each sampling	<ul style="list-style-type: none"> • The ÖNORM-compliant sensors were used for all test. • Part number are SICONNORMI-1-LP, ONORM M5873 • Sensor accuracy was assessed using one duty sensor and two reference sensors. • For the MS2 tests, the average difference between the reference and duty sensors was 4 % during the test.

Temperature [°C]	Omega CL3515R	Measured during each test	• 26.4 – 29°C during testing
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Table S2. Summary of bioassay test results

Parameter	Notes
Analytical Laboratory	BioVir Laboratories, Inc. in Benicia, California, USA
Method	Adams 1959 [2]
Number of influent/effluent samples for each test	3
UV dose range in collimated beam testing	20 – 151 [mJ cm ⁻²]
Tested range of flow rate	0.567 – 6.678 [kg s ⁻¹] per lamp
Tested range of UVT values	52.7 - 75.9 %
Tested range of sensor intensities	0.2 – 1.57 [mW cm ⁻²]
Average (standard deviation) log concentration of influent/effluent samples with all UV lamps off	Influent: 6.4 (0.06) Effluent: 6.4 (0.06)

References

- [1] National Water Research Institute (NWRI) and American Waste Water Association Research Foundation (AWWARF). *Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse*. 3rd ed.; NWRI: Fountain Valley, California, USA. 2012.
- [2] Adams, M.H. *Bacteriophages*. New York and London: Interscience Publishers, Inc., 1959.