



Water Purification  
UVC LED Sterilizer  
Aquatech Amsterdam 2025



**Junglin Tsai**

2025.03.05

Cristal Materials Corporation



# Innovation of the Year



CRISTAL

Innovation 2025: **120 GPM UV-C LED** solution for waste water







## UV-C water purification modules

To drink a glass of purified water  
Is not unreachable any more

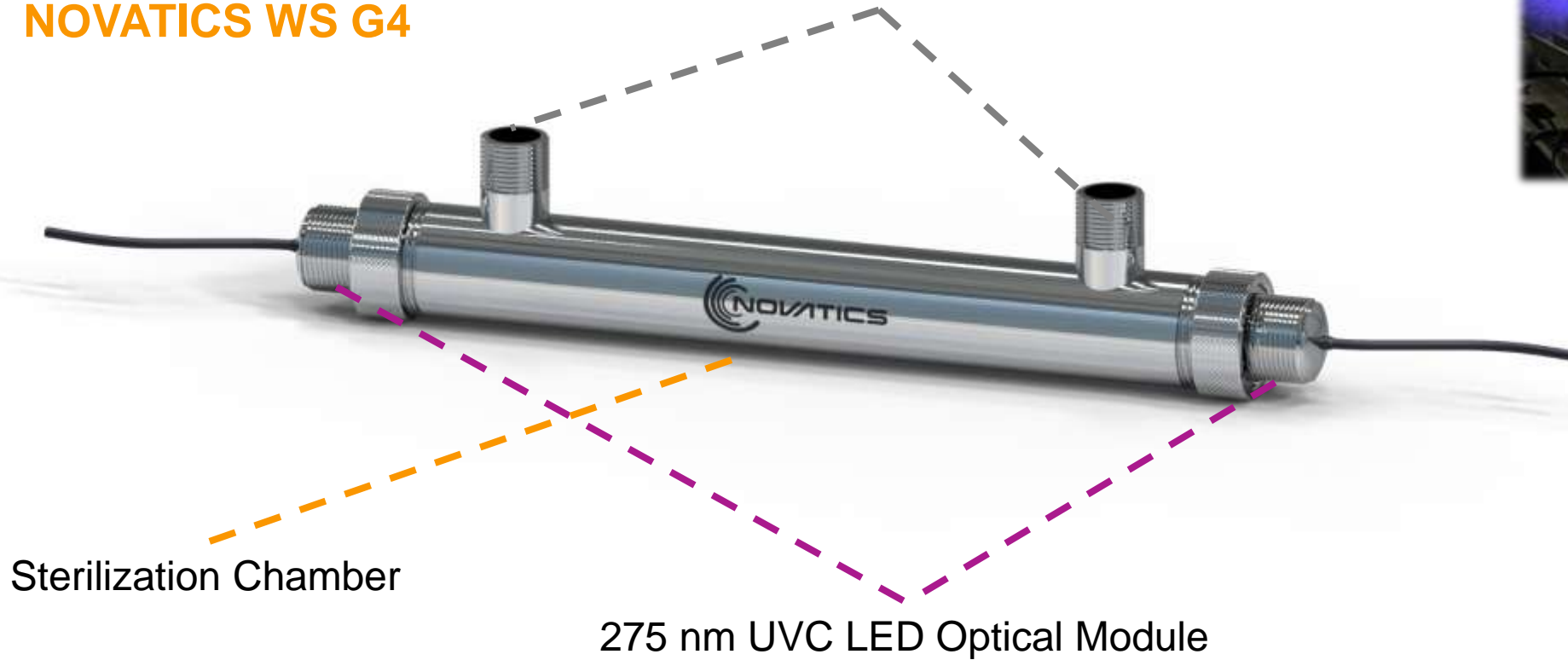


# NOVATICS WS Series



**NOVATICS WS G4**

1/2" Inlet & Outlet



Sterilization Chamber

275 nm UVC LED Optical Module



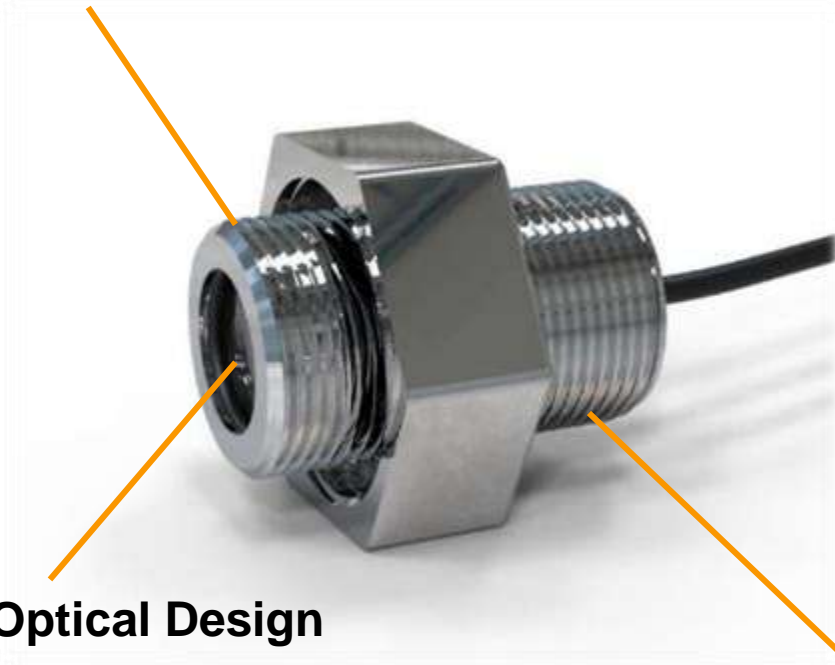
Industrial Type WS



# NOVATICS UVC LED Module



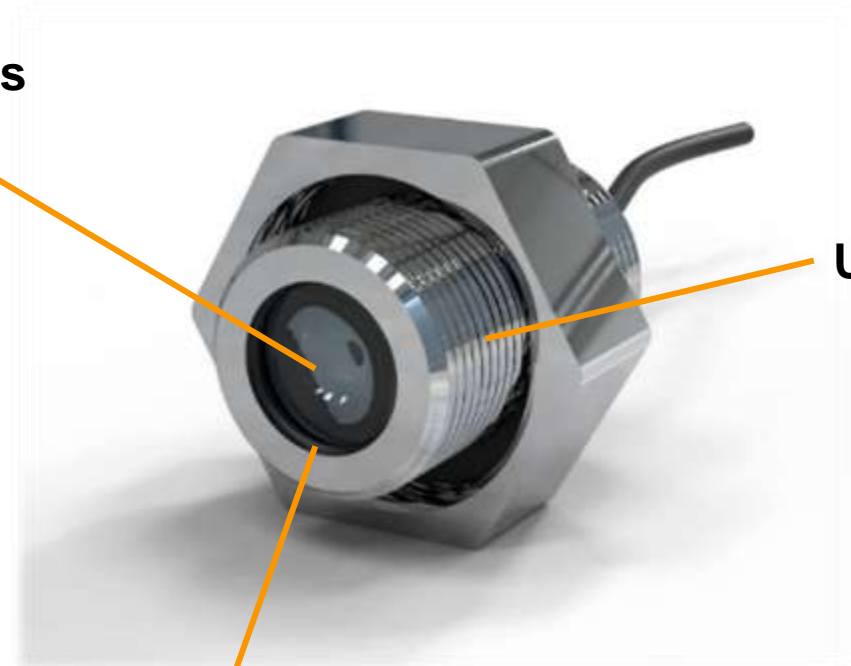
**Water Cooling System**



**Patented Optical Design**

**Food Grade SUS  
316**

**Silica Optics**



**UVC LED**

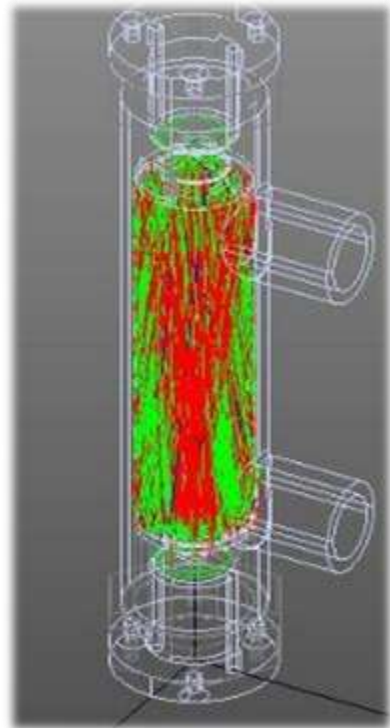
**Water Proof Module**



# Patented Optical Design



CRISTAL



  
**中華民國專利證書**  
發明第 I761197 號

發明名稱: 紫外光陣列模組

專利權人: 晶盛材料股份有限公司

發明人: 蔡榮霖、蔡爾賢

專利權期間: 自2022年4月11日至2041年4月28日止


上開發明業經專利權人依專利法之規定取得專利權

經濟部智慧財產局 局長 **洪淑敏**

中華民國 111 年 4 月 11 日



注意: 專利權人應依法辦理年費, 若專利權未依法繳納年費將導致專利權失效。

  
**中華民國專利證書**  
發明第 I766670 號

發明名稱: 具紫外光殺菌功能的管件模組及管件組

專利權人: 晶盛材料股份有限公司



發明人: 蔡榮霖、蔡爾賢

專利權期間: 自2022年6月1日至2041年4月28日止

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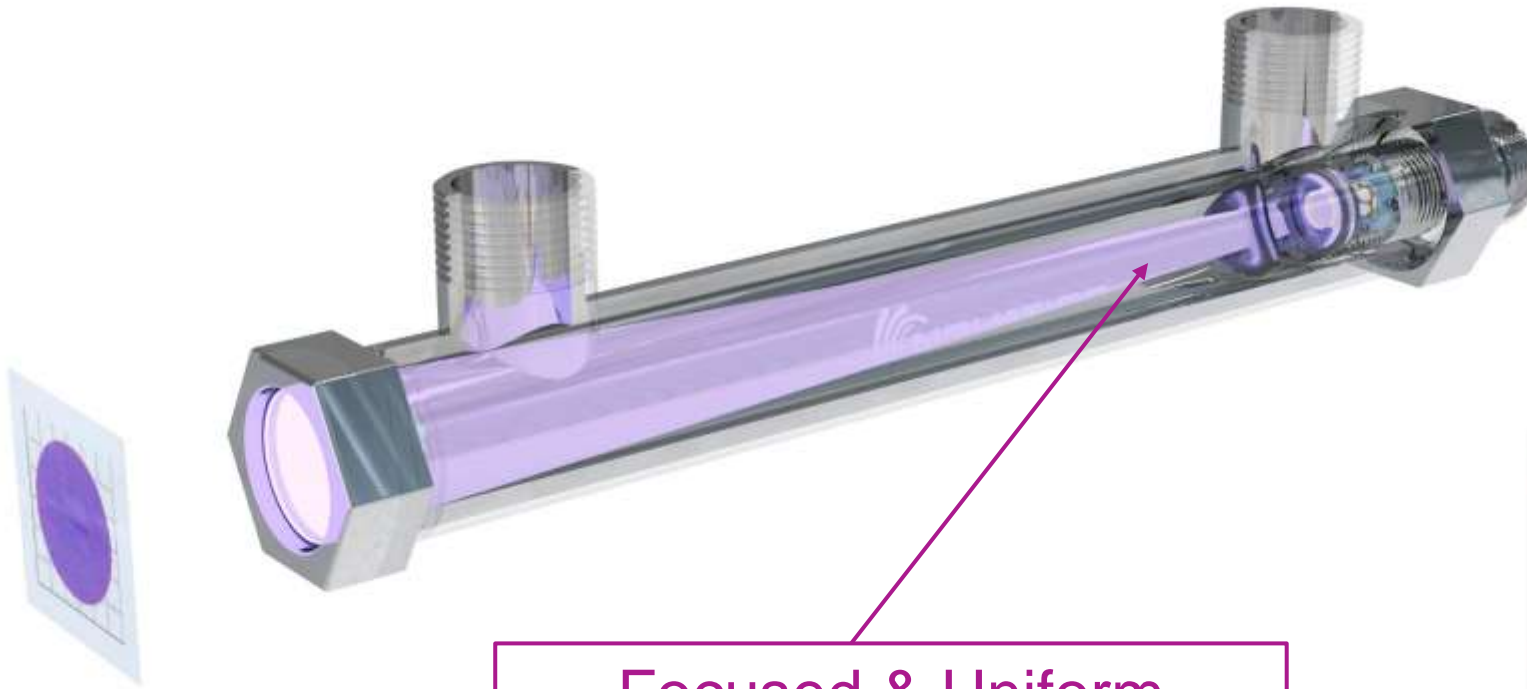


# Optimized Optical Design

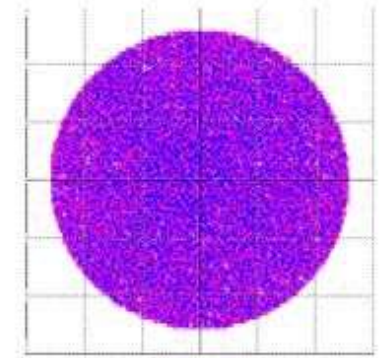




# Optimized Optical Design



Focused & Uniform  
UV-C LED Beam

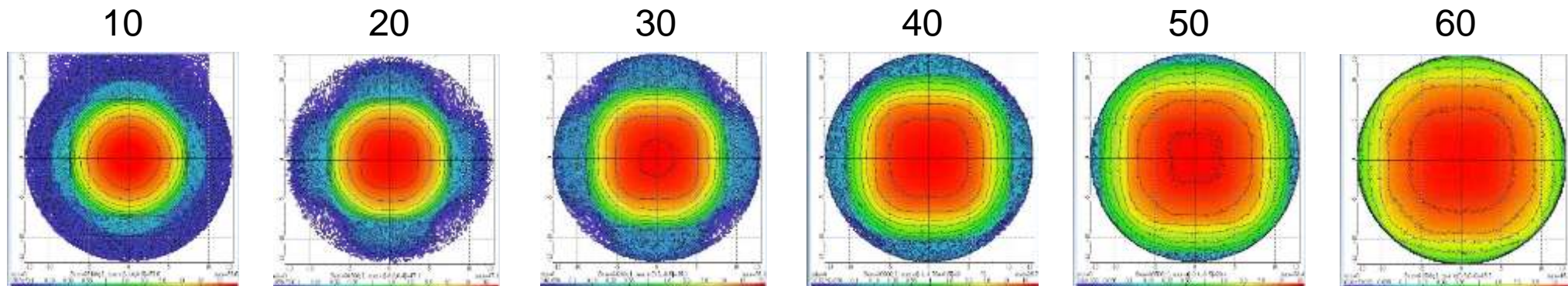




# Optimized Optical Design



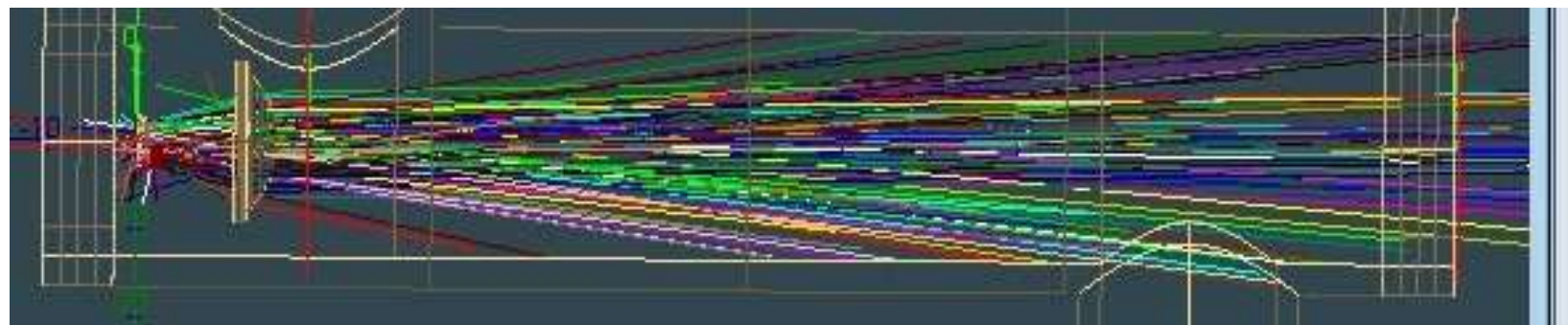
CRISTAL



10 20 30 40 50 60 mm



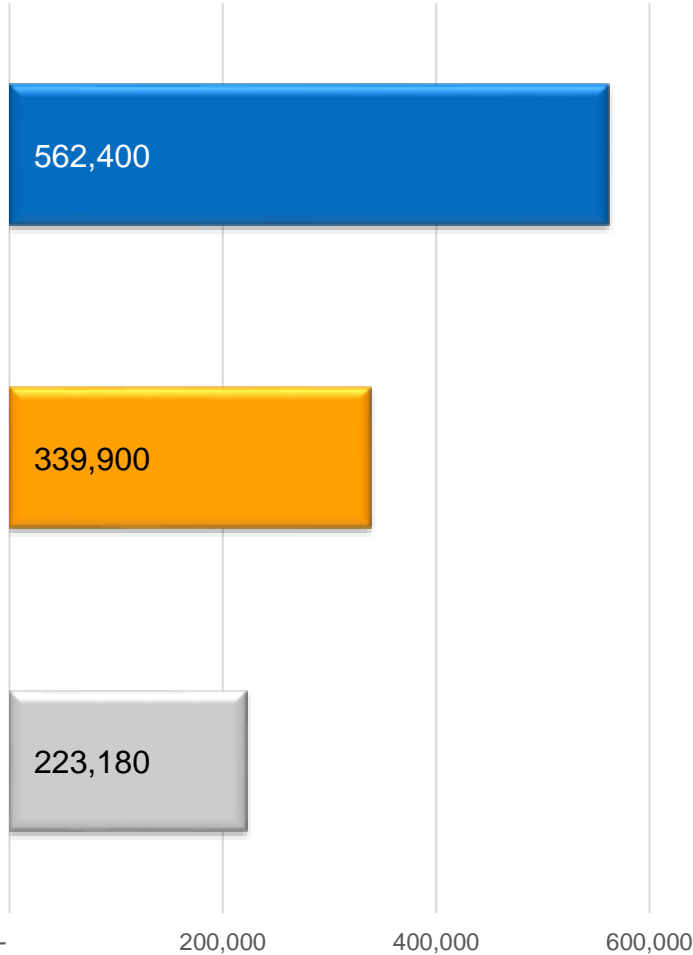
Optical  
Simulation  
in  
Sterilization  
Chamber



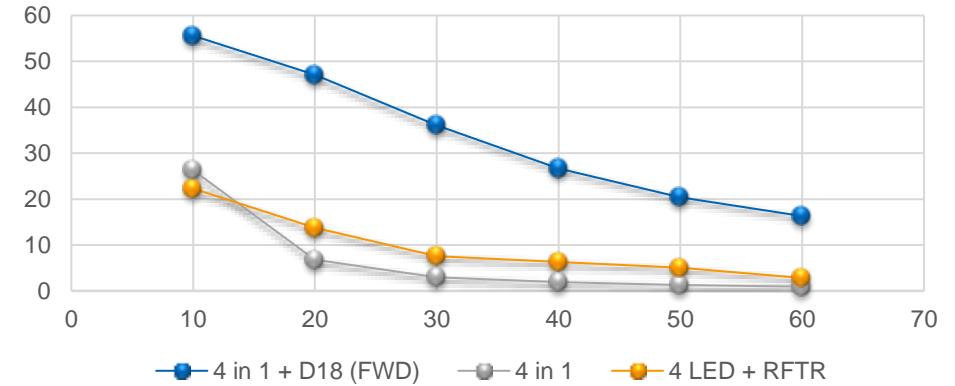
# Optimized Optical Design



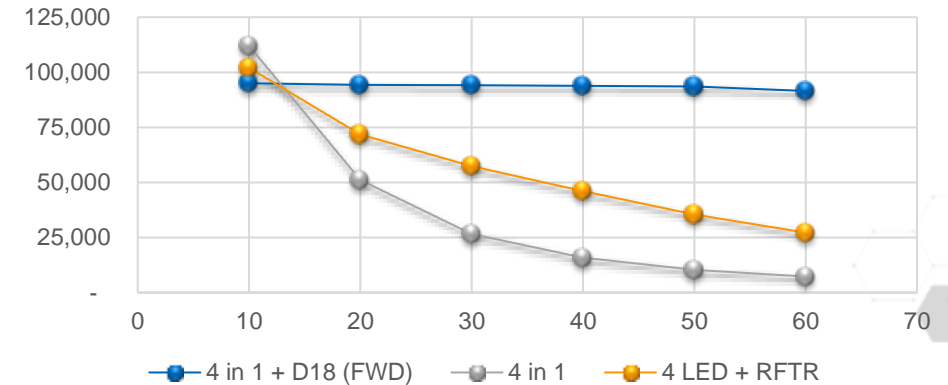
### Total Power



### Max Power



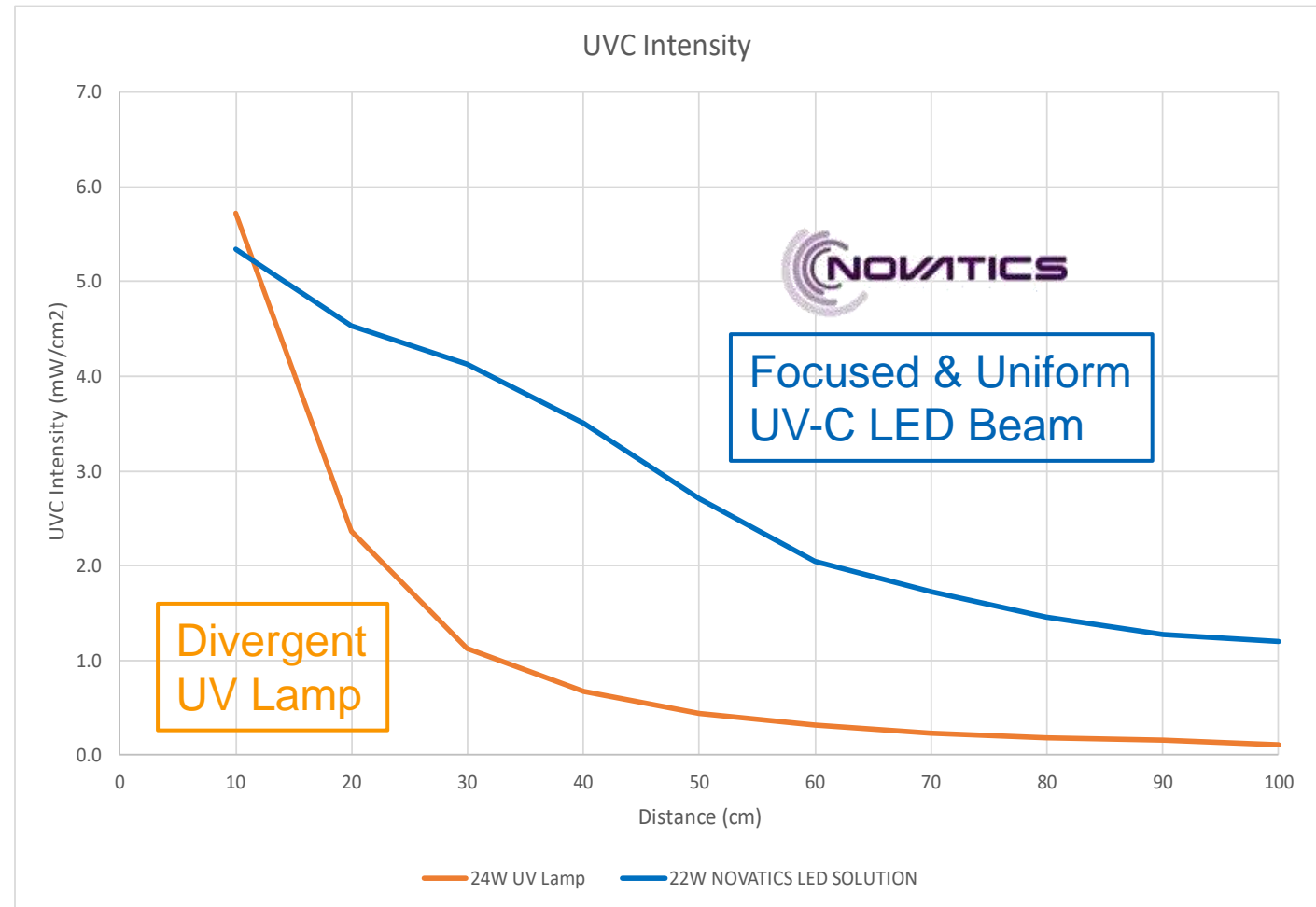
### Area Power



# Optimized Optical Design



- NOVATICS WS is highly focused UV-C optical solution for long distance projection in limited channel
- Born for fluid system such as water purification and industrial air conditioner





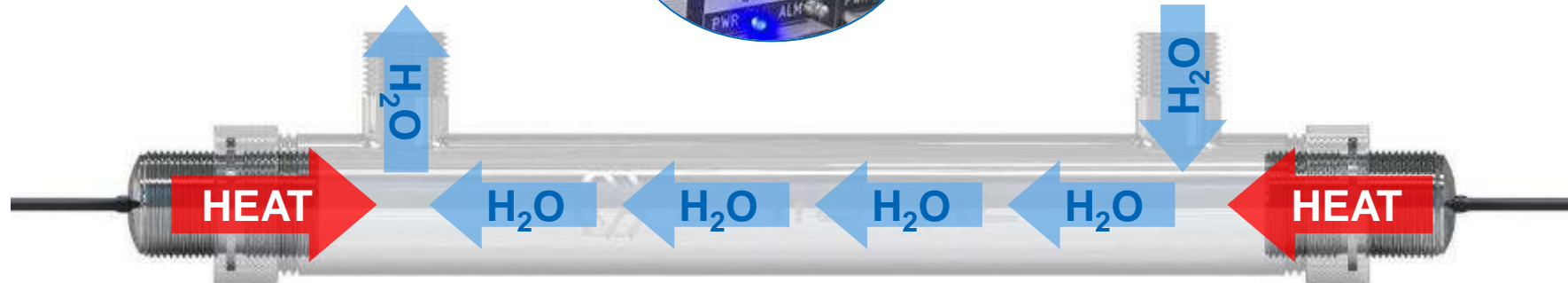
# Water Cooling Design



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Real time temperature monitoring

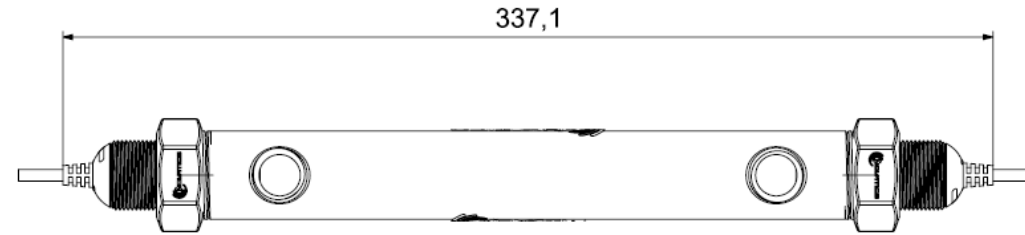


Water cooling LED module

Born for high flow rate water purification



# Compact Design



UV Lamp 4 GPM

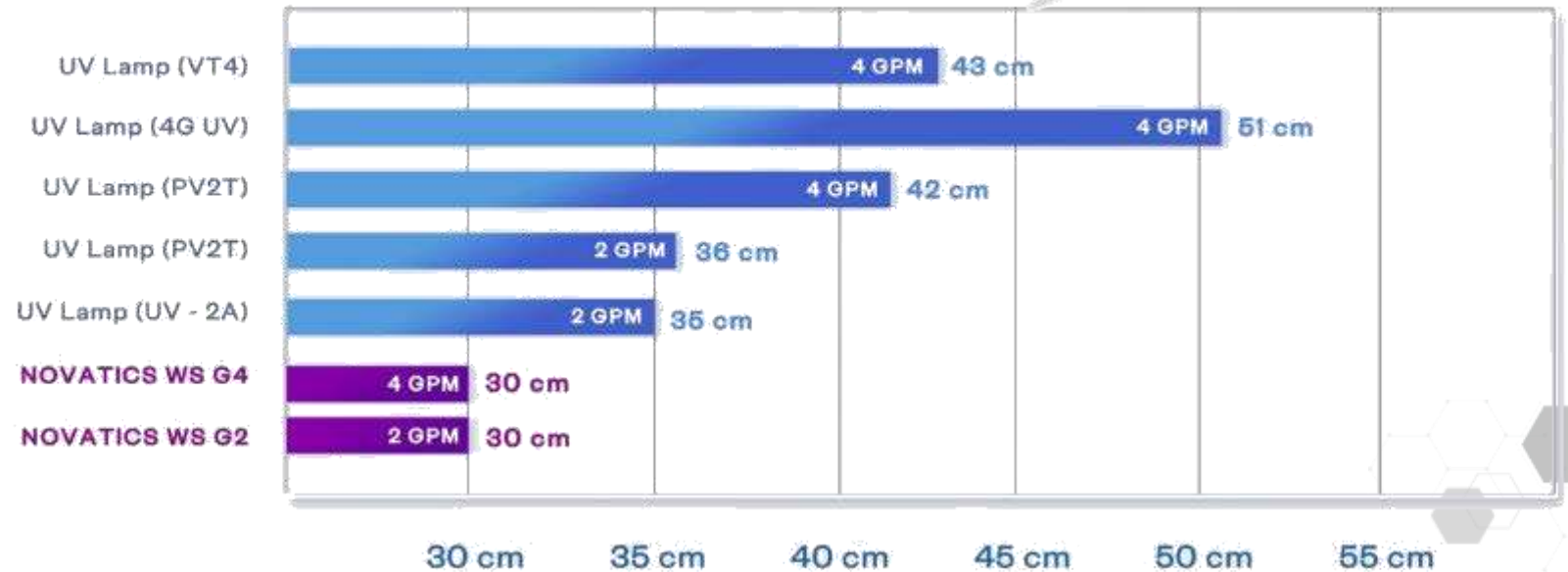


UV Lamp 2 GPM

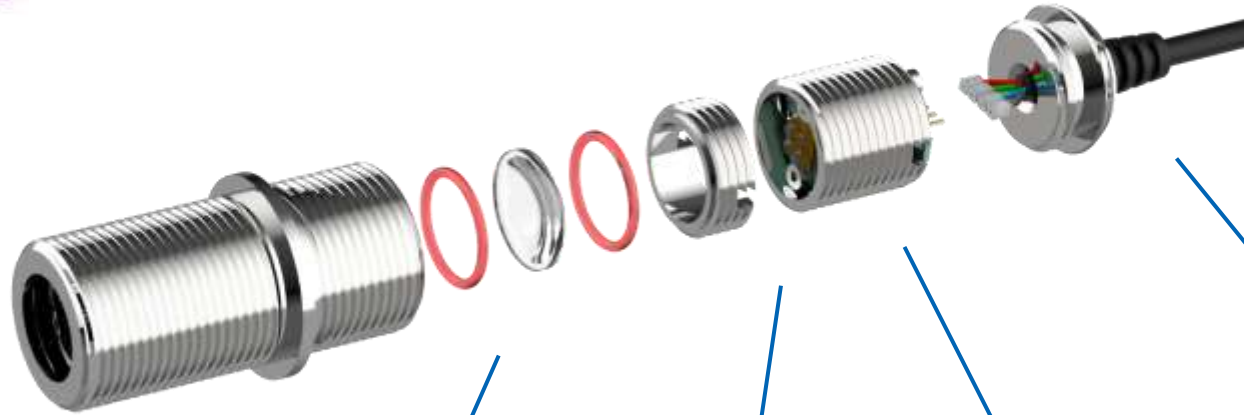


UV Lamp 4 GPM

**LENGTH**



# Eco Friendly Design



REUSABLE MATERIALS



Stainless Steel



Silica Lens



UV-C LED



Aluminum



Recyclable Wire





# ESG compliant product



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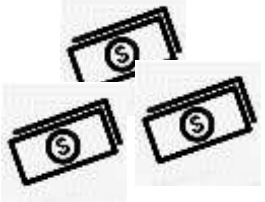
Reusable Materials



Mercury Free



Eco Product

Image	Power Consumption	Size	Lifetime	Toxic Material	Recycling Cost
 NOVATICS WS CORE					
 Mercury UV Lamp					



# NOVATICS WS Features



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- UV-C LED technology
- Waterproof LED module
- Min power consumption
- Mercury (Hg) free
- Intelligent functions
- Compact Design



**Mobile Food  
Truck**



**Food Industry  
Central Kitchen**



**Drinking  
Water**

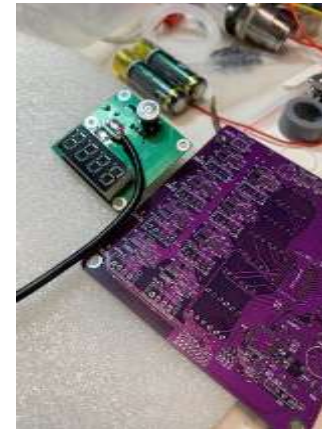
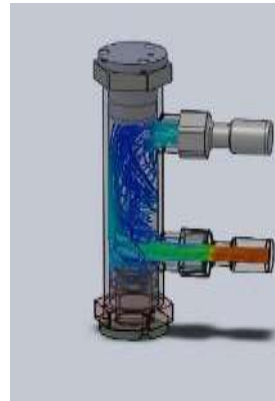
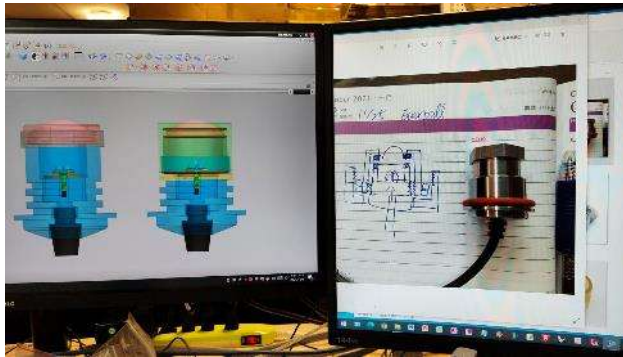


**Confinement  
Center**



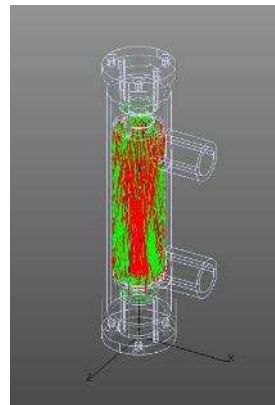
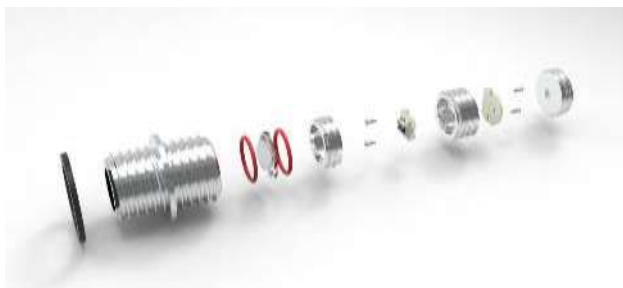
**Fish  
Fank**





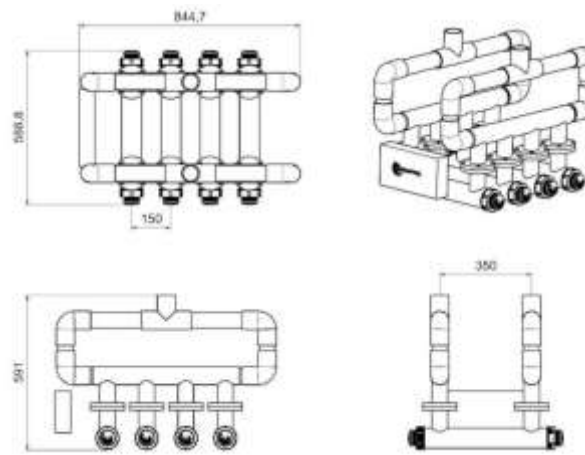
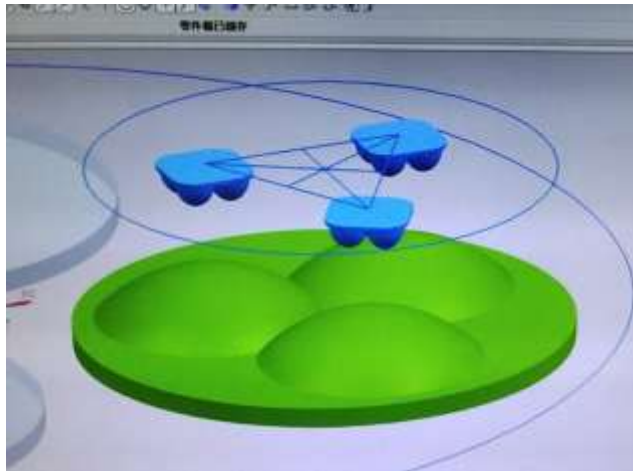
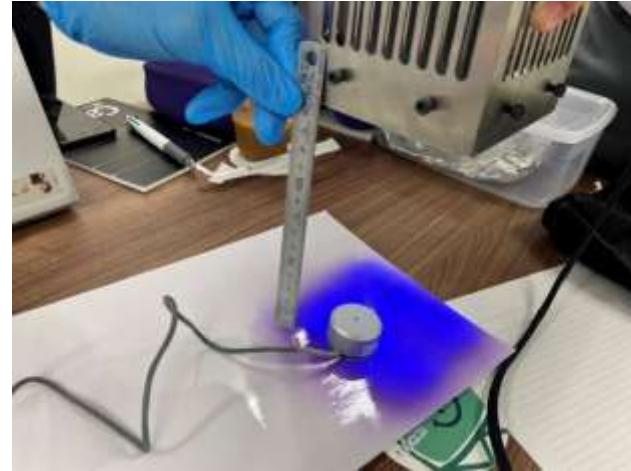
## NOVATICS Service

- Optical Design
- Optics Manufacturing
- Fluid Dynamics
- Mechatronics Design
- Module Design
- System Integration

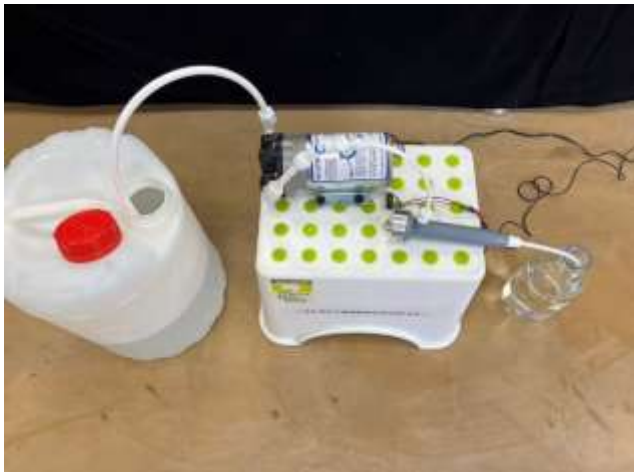




# NOVATICS Team Work



# NOVATICS in the Lab

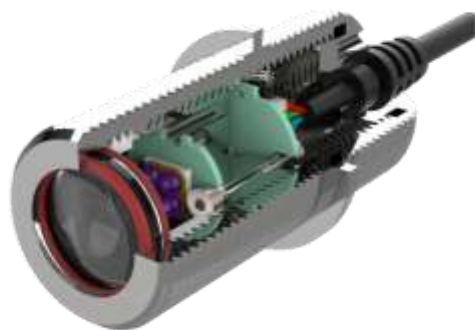




# NOVATICS Team Design



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# Performance Results





# Laboratory test result



Concentration:  $10^5$  CFU/100mL

Model	Flow Rate	<i>E.Coli</i>	Staphylococcus	<i>Pseudomonas</i>
WS G4	7.5 LPM	99.99%	99.95%	99.94%
4WS T5	75 LPM	98.85%	N/A	N/A

E.coli



Staphylococcus



Pseudomonas



# Sterilization Report



## E. Coli sterilization test



Flow Rate (LPM)	Before Sterilization (CFU/100 mL)	After Sterilization (CFU/100 mL)	Sterilization Efficiency
2.0	$4 \times 10^5$	<1	99.98%
7.5	$2 \times 10^5$	60	99.97%

財團法人食品工業發展研究所  
生物資源保存及研究中心

afaq Quality Commission

SGS TEST REPORT

Report Number : NPX23A00124001  
Received Date : Oct.18, 2023  
Report Date : Nov.01, 2023  
The number of Page : 1 / OF : 1

Following Test Sample is provided and confirmed by client  
Client : Cristal Materials Corporation  
Product Name : NOVATICS UV-C LED Station  
Model Type : WS 04  
Sample Number : NPX23A00124001-002

Test Item and Method: Performance test

- The test solution was prepared in SGS laboratories.
- The test solution was analyzed before and after processing through the product with stable flow rate of 2.0 L/min for 1 minutes.

Test Result :

Test Item	Unit	Before processing	After processing	Elimination ratio(%)
Coliform	CFU/100mL	$3.5 \times 10^5$	<1	>99.9
Escherichia coli	CFU/100mL	$3.5 \times 10^5$	<1	>99.9
Pseudomonas aeruginosa	CFU/mL	$3.6 \times 10^5$	<1	>99.9

REMARK : 1. This test report is only responsible for supplied sample(s). Any partial copy or use of advertisement will not be permitted.  
2. Unless otherwise stated, the results shown in this test report refer only to the sample(s) tested.  
3. The client entrusts the product or trademark of the examination, belonging to the client all, or have already get the ownership person's authorization.

SGS TAIWAN LTD. TAIWAN  
SGS TAIWAN LTD.  
T-C8-011

# SGS Test Result



## Lab test results of WS G4

Target	Performance
Coliform	99.9%
E.Coli	99.9%
P.Aeruginosa	99.9%



## TEST REPORT

Report  
Receiv  
Report  
The nu

Following Test Sample is provided and confirmed by client

**Client:** Cristal Materials Corporation  
**Product Name:** NOVATICS UV-C LED Sterilizer  
**Model/Type :** WS G4  
**Sample Number :** NPX23A00124001~002  
**Test Item and Method:** Performance test

1. The test solution was prepared in SGS laboratory.
2. The test solution was analyzed before and after processing through the product at a flow rate of 3.6L/min for 5 minutes.

### Test Result :

Test Item	Unit	Before processing	After processing	Elimination ratio(%)
Coliform	CFU/100mL	$3.8 \times 10^3$	<1	>99.9
Esherichia coli	CFU/100mL	$3.5 \times 10^3$	<1	>99.9
Pseudomonas Aeruginosa	CFU/mL	$5.6 \times 10^3$	<5	>99.9

**SGS** SGS TAIWAN LTD.  
**Client:** Cristal Materials Corporation  
**Product Name:** NOVATICS UV-C LED Sterilizer  
**Model/Type :** WS G4  
**Sample Number :** NPX23A00124001~002





# JP Lab Test Result



## Test Conditions

Target: *E. coli*

Concentration:  $10^5$  CFU/mL

Flow Rate: 2 GPM

Test in Japan

## 2GPM test results of WS G4

Model	Performance
WS G4	99.95%

## Sterilization Test(G2, G4)

Sample arrival date	August . 1
Sterilization Test	August . 3 ~ 10
Bacteria	E.Coli
Flow Rate	7.5 L/min (2 G/min)
Operating Condition	Use attached power supply



## Result

		Sterilization[CFU/mL]	LRV	Fig.	
				Before	After
G2	Before	7.9E+05	1.5		
	After	2.2E+04			
G4	Before	7.2E+05	3.3		
	After	3.2E+02			

# WS G4 Lab Performance



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## WS G4 performance test in Taiwan University Lab

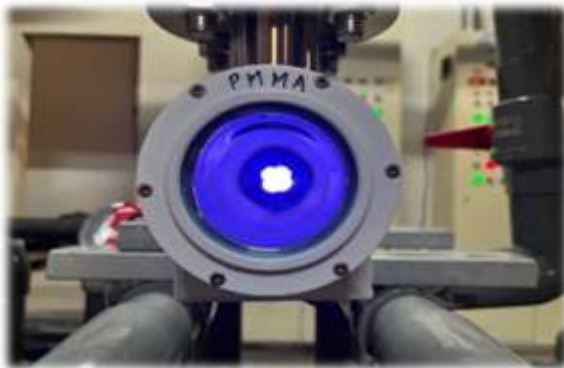


### Lab test results of WS G4

Flow Rate	Performance
2 GPM	99.98%



# 4WS T5 Lab Performance



Lab test results of 4WS T5

**4WS T5 Concept** designed for industrial applications



Flow Rate	Performance
20 GPM	98.85%



# TIR 2LPM Lab Performance



TIR 2LPM Concept designed for drinking machines



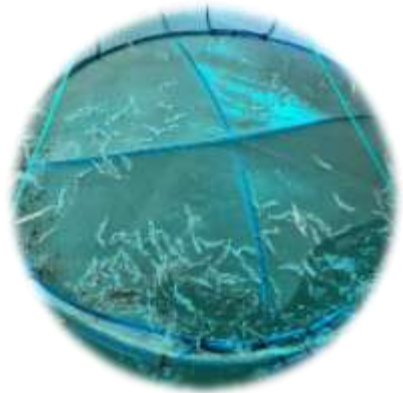
Lab test results of WS TIR

Chip	Performance
2 LPM	99.9%





# Shrimp Farm Test

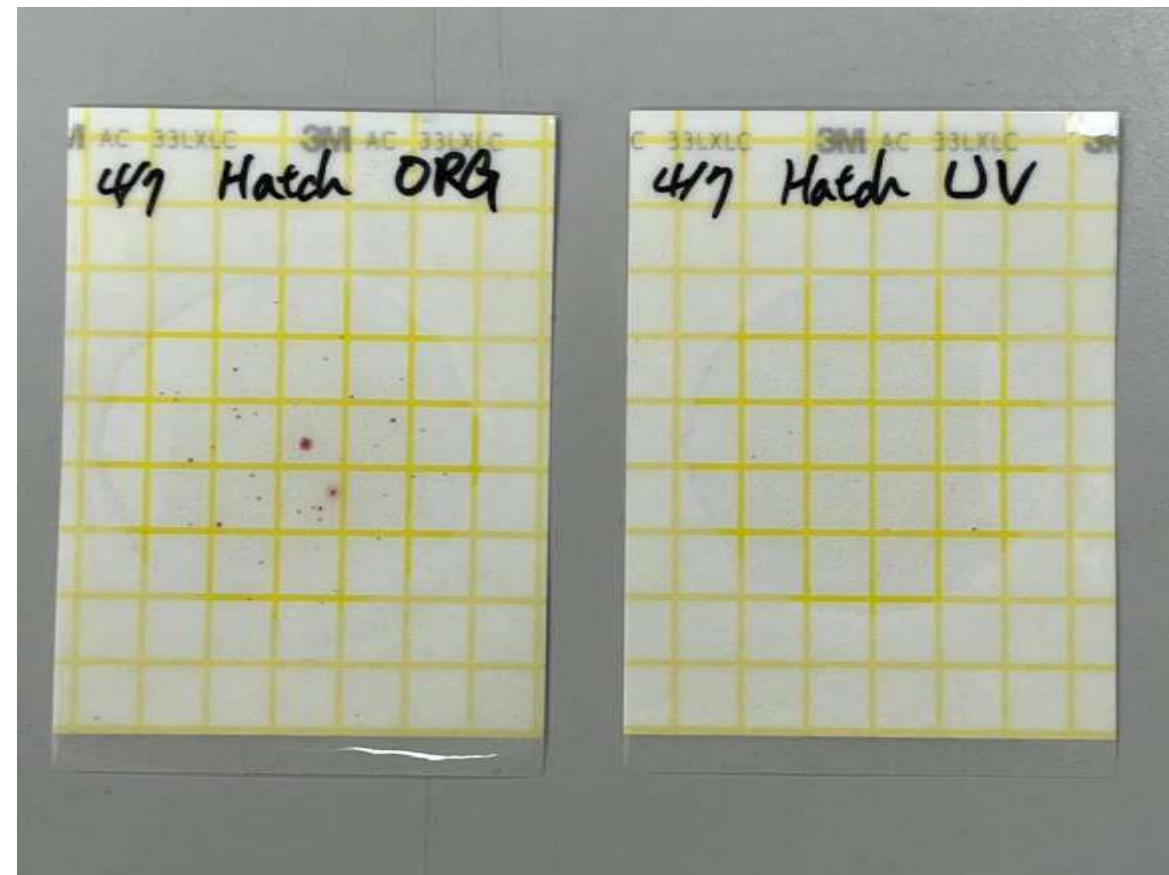


Model: WS T10 Matrix

Flow Rate: 5 m<sup>3</sup>/hr



# Murry Cod Hatchery Test





# Murry Cod Hatchery Test





## Murry Cod Hatchery

Flow Rate: 5 m<sup>3</sup> / hr



Model: 4WS T5 Concept  
Flow Rate: 3.5 m<sup>3</sup>/hr

YEAR	CONDITION	EGGS	HATCHES	HATCH RATE	PERFORMANCE
2022	NO UV TREATMENT	10,000 (rough)	353	3.5%	
2023	NOVATICS 4WS TEST	10,000 (rough)	1,178	11.8%	

NOVATICS 4WS Concept enhances hatch rate by 3 times



# Murry Cod Hatchery



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4WS T5



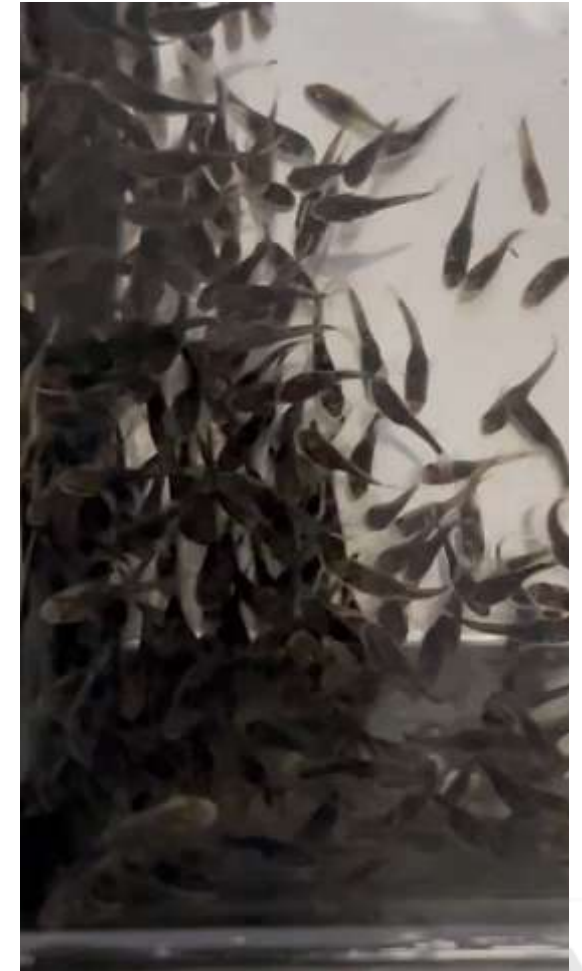
May 2023



Jun 2023



Aug 2023





# SPA Pool Test



Model: WS T10 Matrix

Flow Rate: 9 m<sup>3</sup>/hr



# SPA Pool Test Comparison



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No treatment in water for 12 hrs



$3 \times 10^6$  CFU/mL



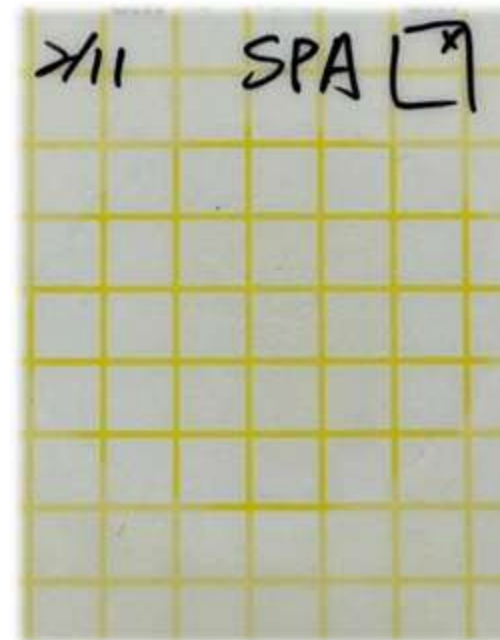
UV circulation only for 24 hrs



146 CFU/mL



UV circulation + 0.5 ppm Cl



1 CFU/mL

(Reference)

Regular Cl 1.5 ppm



2 CFU/mL

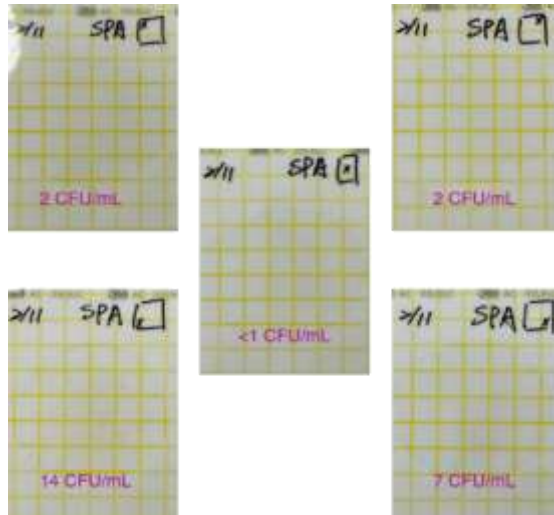


# Continuous Test Results

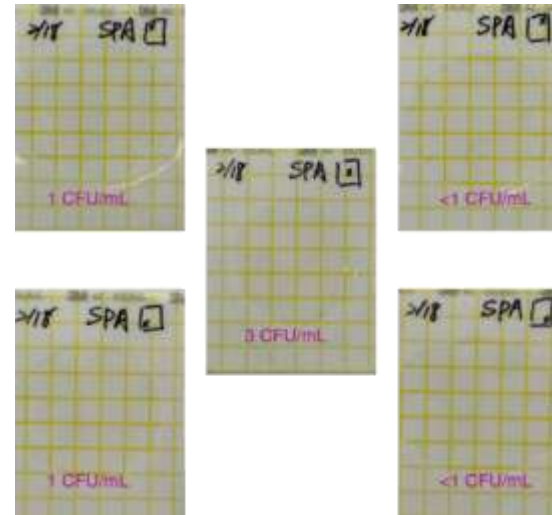


UV circulation  
with 0.5 ppm Chlorine

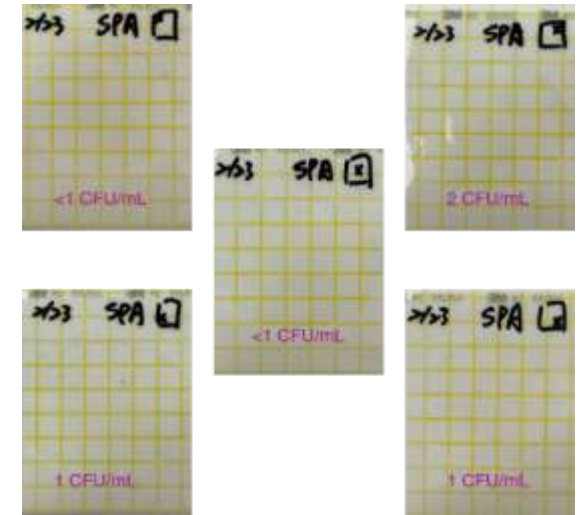
2/11



2/18



2/23





# Effective Algae Control



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Before Treatment



24 hours



48 hours



72 hours



96 hours



# Effective Algae Control



CRISTAL

Before Treatment



24 hours



48 hours



72 hours



96 hours





# Arowana Aquatank



CRISTAL





# Fish Pond Algae Control



Before treatment

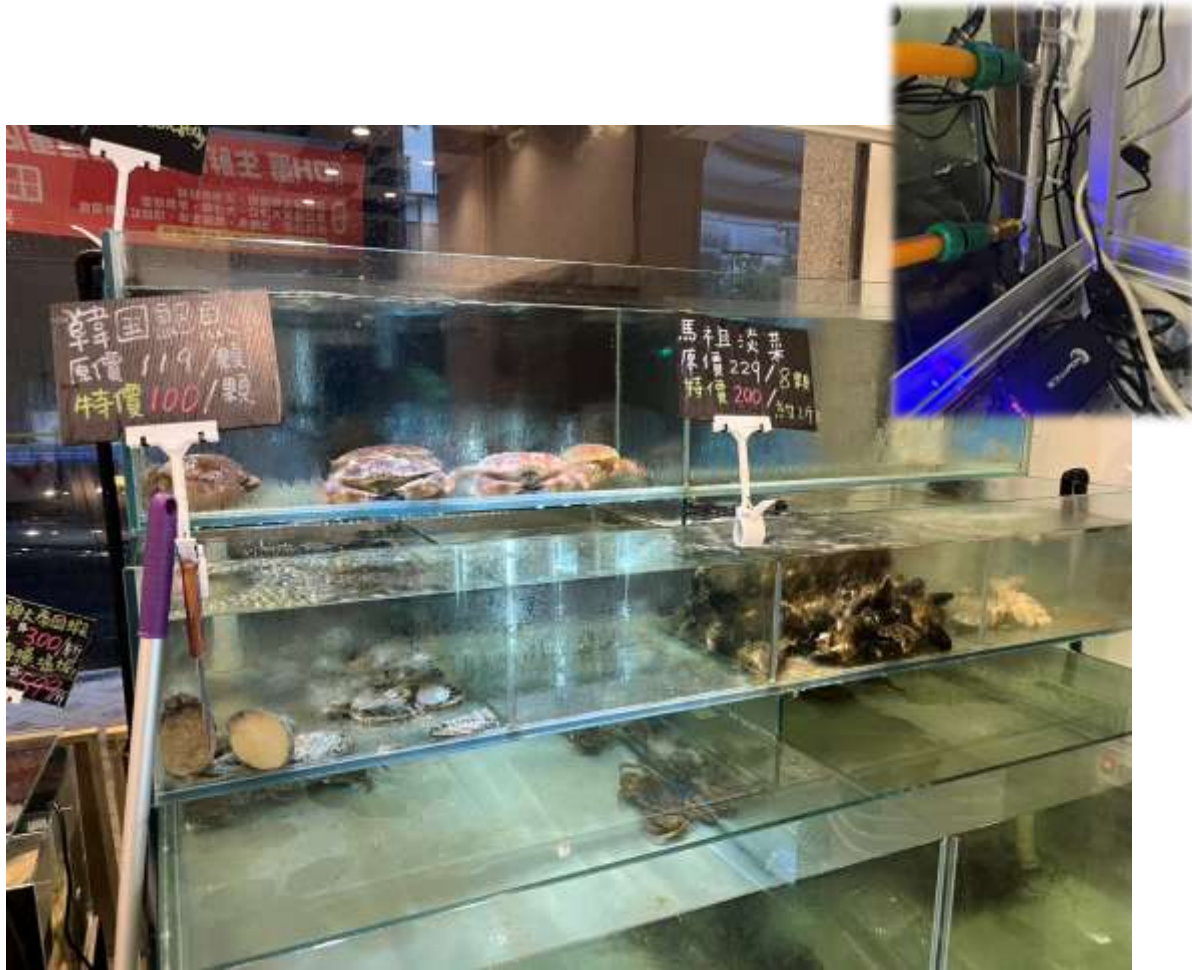
Treatment for 1 week



# Seafood Tank



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# Algae Removal for Aquarium



Greenish algae water to be removed in 3 days by NOVATICS WS G2 (3 ft tank)





# Algae Removal Test



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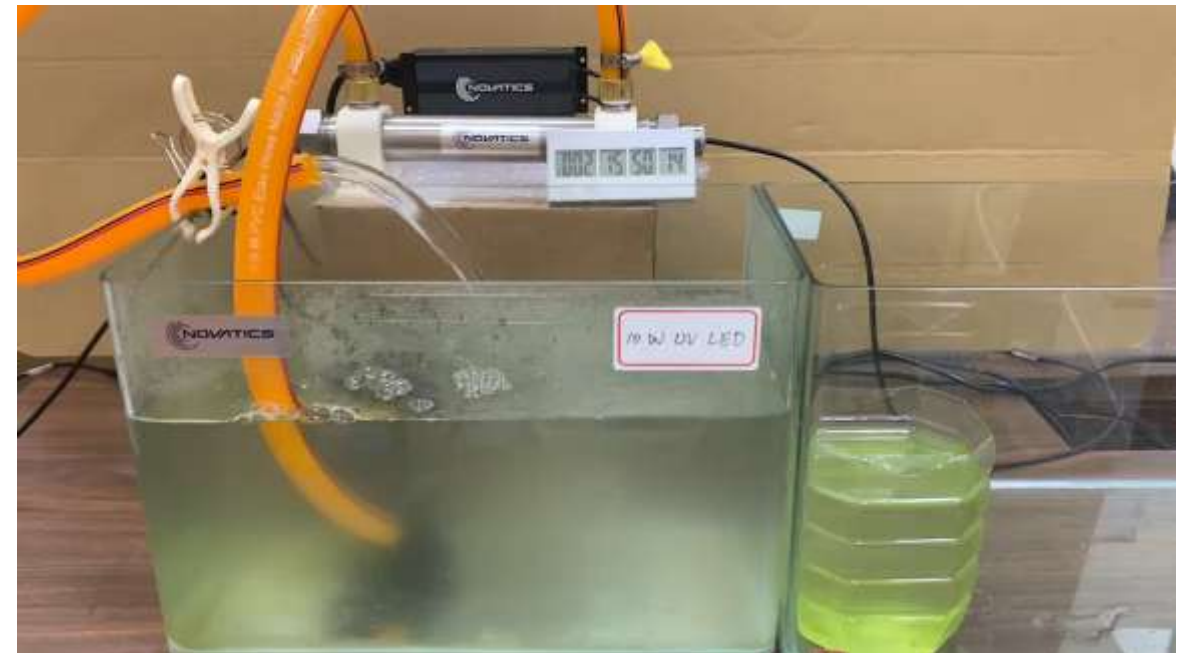
NOVATICS WS G4

Greenish Water Test for 60 hrs



NOVATICS WS G4

Crystal Clear Water in 60 hrs



# NOVATICS WS Specs

# NOVATICS WS Series



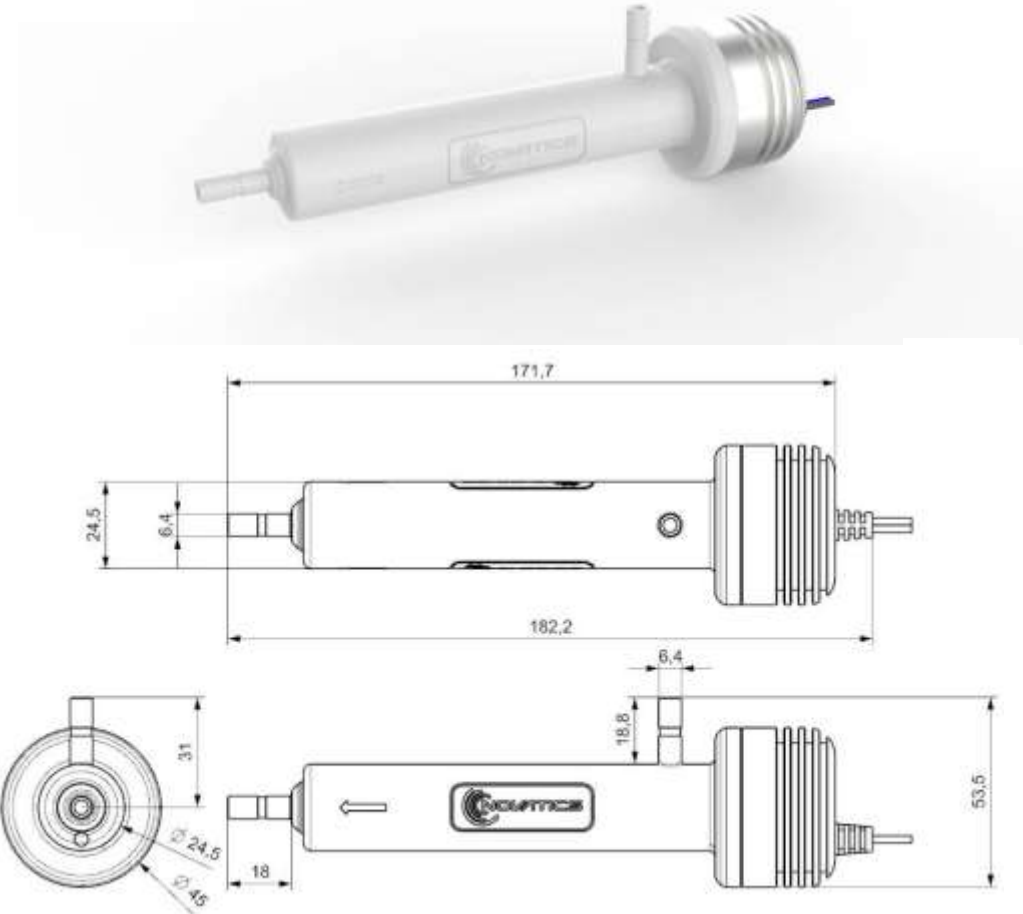
CRISTAL



NOVATICS WS Series	WS G4	WS T5	WS T30
Max Flow Rate	4 GPM	20 GPM	120 GPM
LED Wavelength	275 nm		
LED Lifespan	10,000 hrs		
Inlet Diameter	½" male	1½" flange	3" flange
Input Voltage	100 – 240 VAC		
System Power	10 W	50 W	360 W
System Weight	1.5 kg	12 kg	75 kg
Applicable Temperature	5 – 45 °C		







## NOVATICS WS TIR

- Max Flow Rate 2 LPM
- Power 2.7 W
- Dimension 182 mm
- Lifetime 10,000 hrs

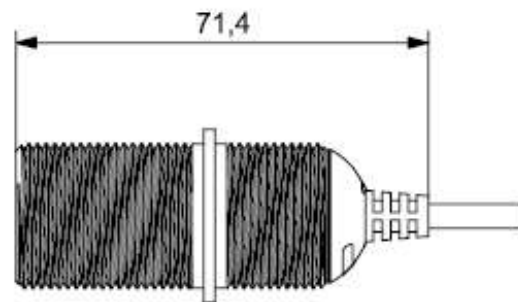
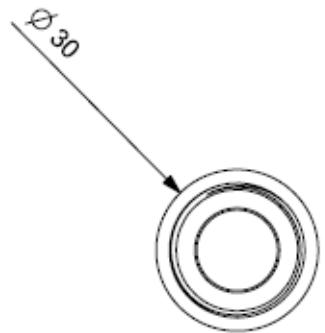




## NOVATICS WS CORE



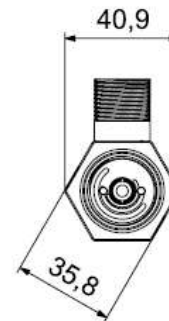
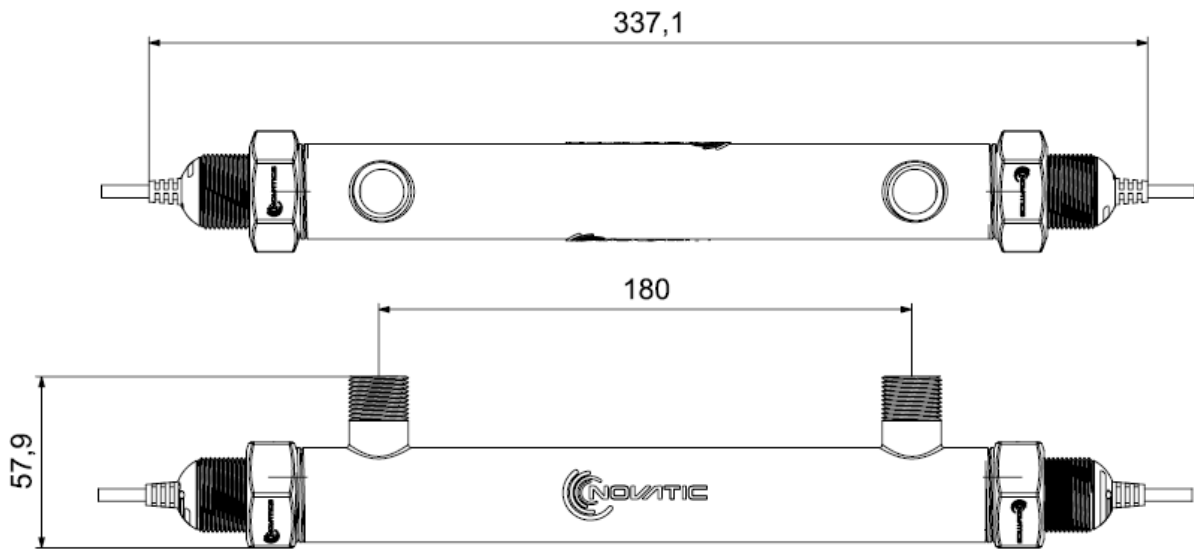
- Max Flow Rate 2 GPM
- Power 5 W
- Dimension 71.4 mm
- Lifetime 10,000 hrs





## NOVATICS WS G4

- Max Flow Rate 4 GPM
- Power 10 W
- Dimension 337 mm
- Inlet Diameter ½ in

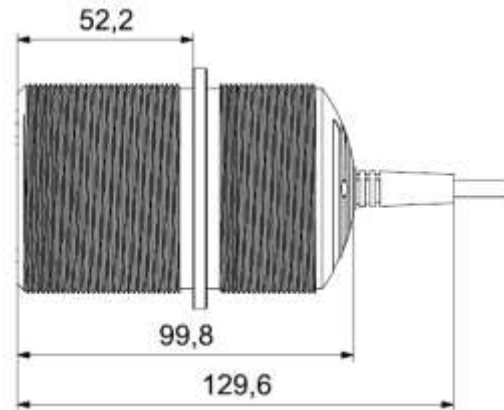
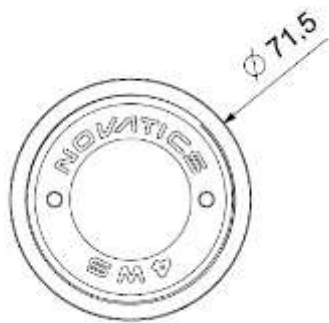


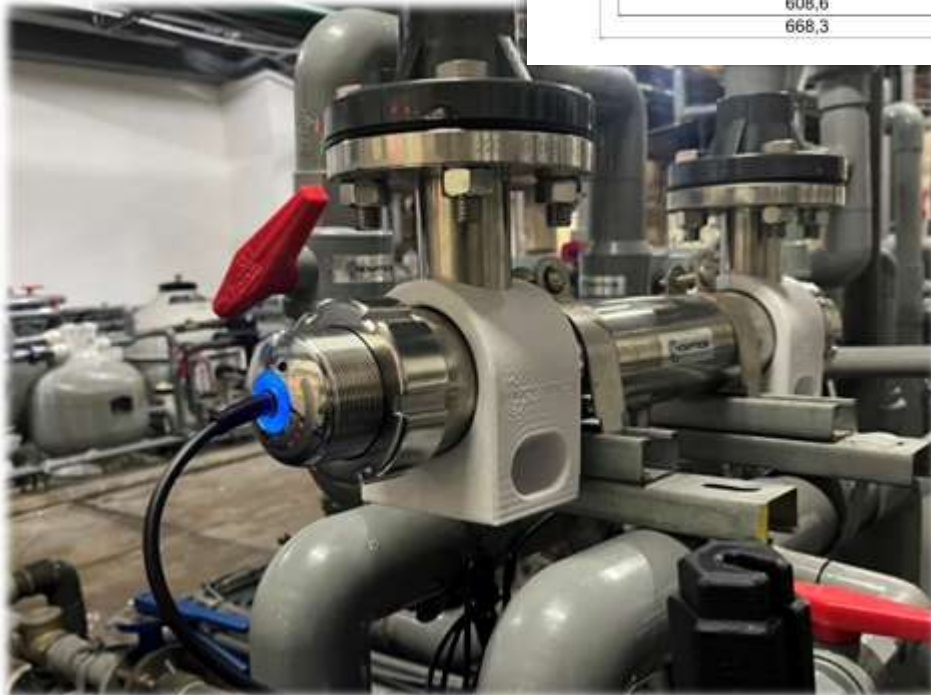
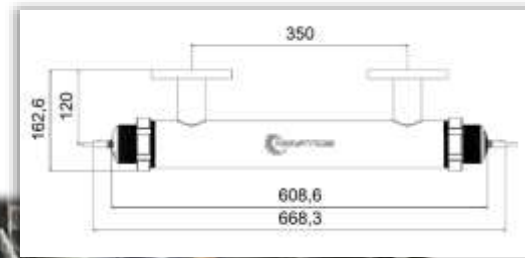




## NOVATICS 4WS CORE

- Max Flow Rate 10 GPM
- Power 25 W
- Dimension 99.8 mm
- Lifetime 10,000 hrs



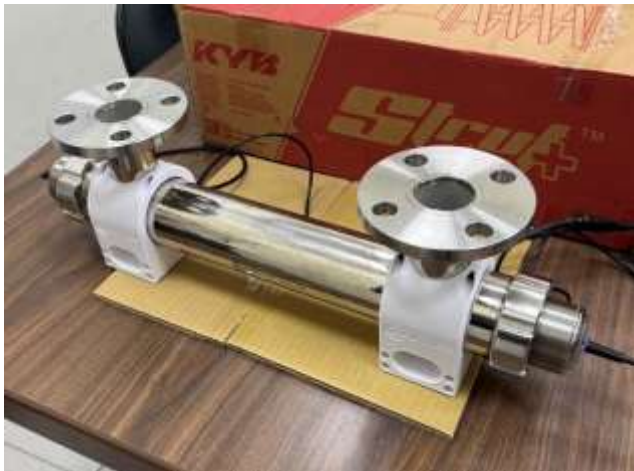


## NOVATICS 4WS T5

- Max Flow Rate 20 GPM
- Power 50 W
- Height 162 mm
- Width 668 mm
- Depth 90 mm
- Inlet Diameter 1½ in
- Control Panel Option
- Power Supply Standard



# 4WS T5



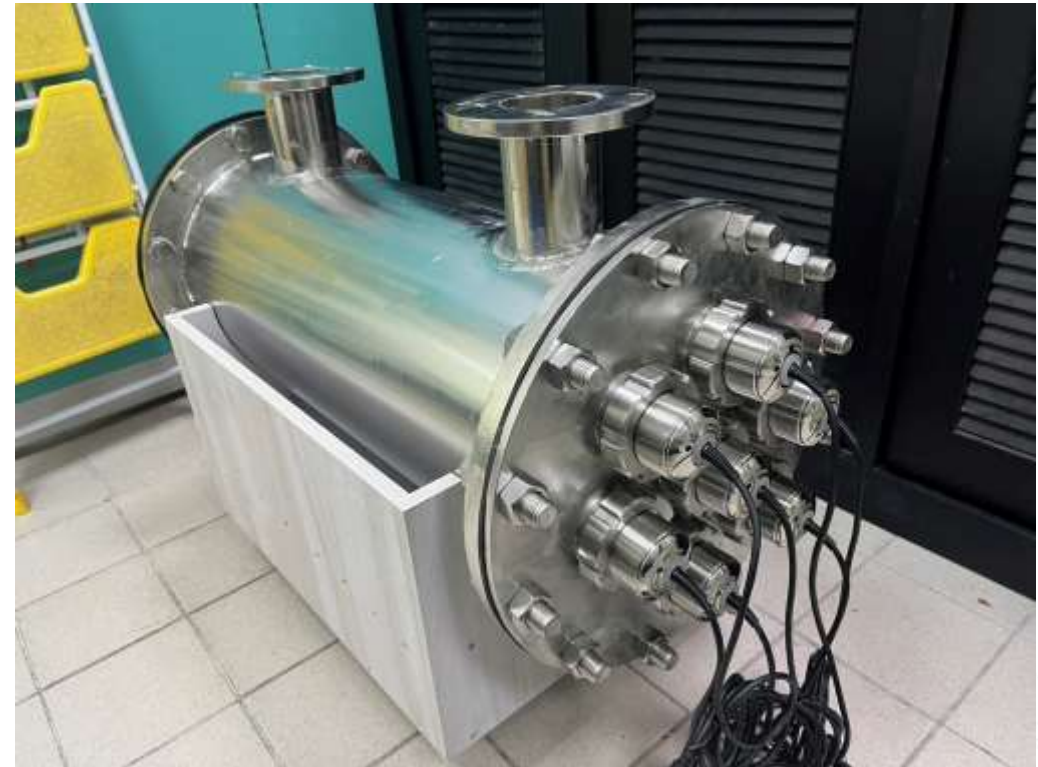


# New Arrival WS T30



UV-C LED waste water treatment  
Capacity: **30 m<sup>3</sup>/hr**      Power: 360 W

Innovation of the year  
Released in March 2025

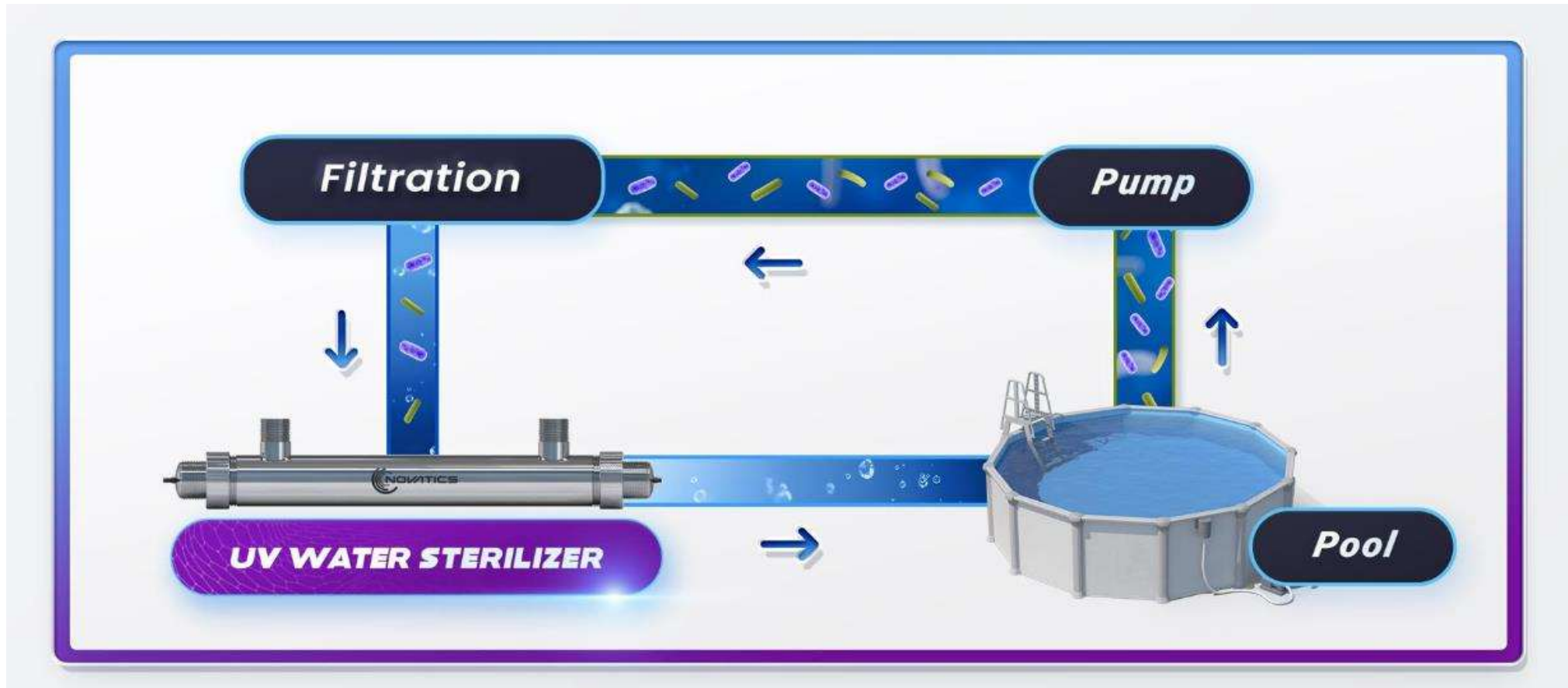


# Real Site Achievements

# Connection Example

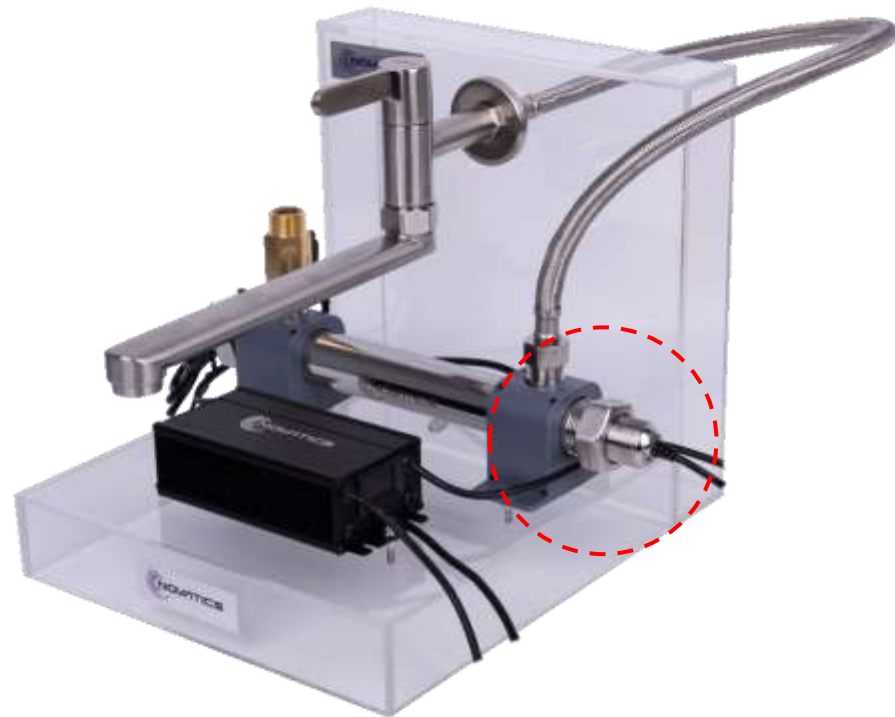


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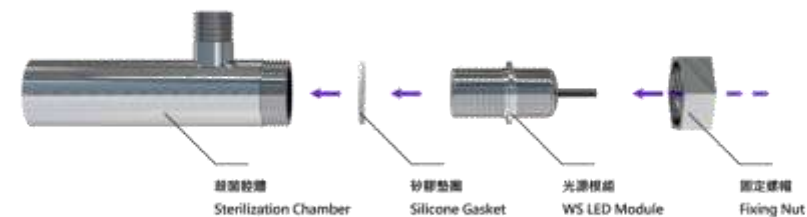
# NOVATICS Assembly Example



NOVATICS WS G4 for central kitchen



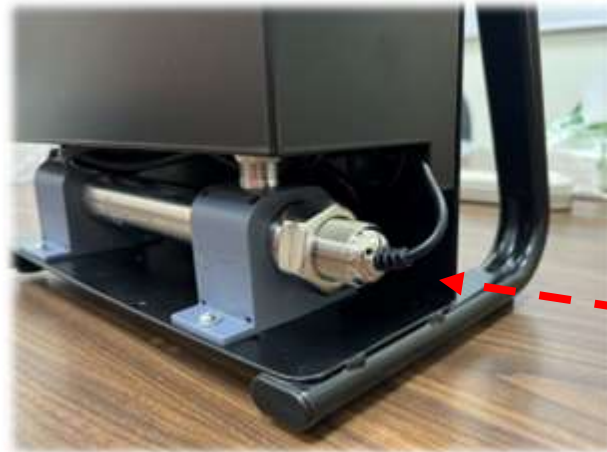
NOVATICS WS CORE  
UV-C LED Optical Module



# Emergency Water Package



# Household Drinking Water





# Household Drinking Water



# Central Kitchen Faucet





# Aquarium



CRISTAL





# Hi End Aquatank



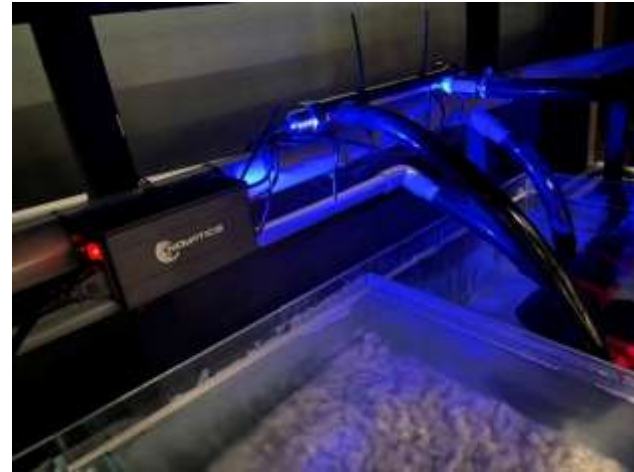
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# Seafood Tank Sterilizer



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# Natural Fish Pond





# Pig Farm Drinking Water





# Chicken Farm Drinking Water

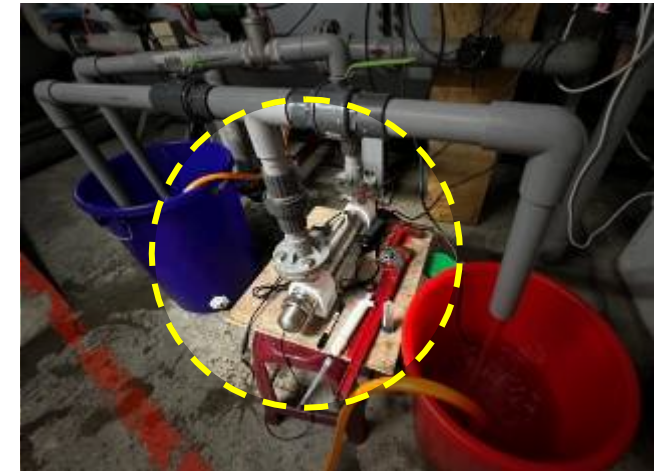




# Hospital Waste Water



## Waste Water treatment in Far Eastern Hospital





# Hospital Waste Water



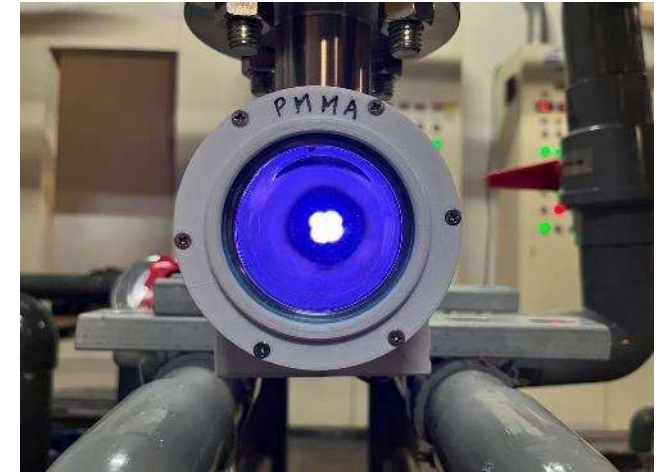


# Hospital Waste Water





# SPA Pool (WS T10)





# Tilapia Farm (WS T10)





# Sturgeon Farm (WS T10)

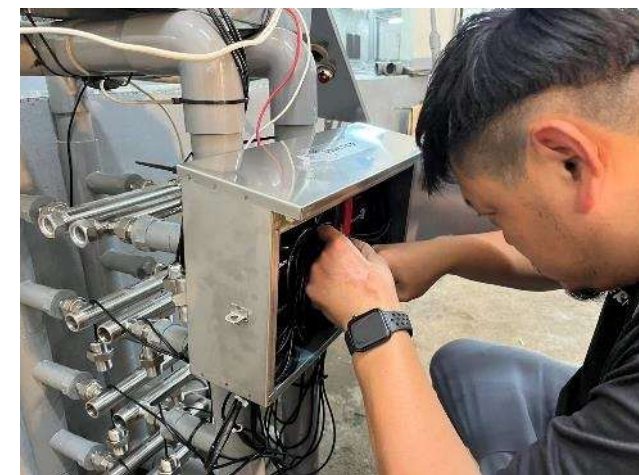
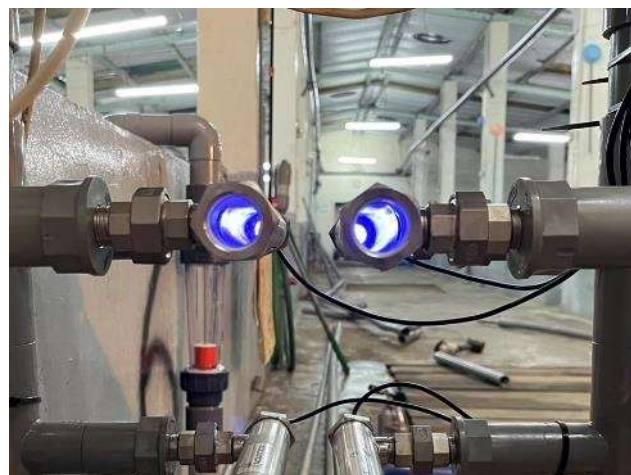


# Sturgeon Farm (4WS T5)






# Shrimp Farm (WS T5)



# Company Profile





Company	Cristal Materials Corporation
Establish	2006
Process	Nano Sol-Gel process
Material	Fused Silica
Certificate	ISO 9001 / ISO 14001
Brands	<b>NOVAXIL™ silica optics</b>
	NOVATICS UV-C LED solutions
Service	Optics manufacturing Optical design & Optical simulation UVC LED module integration





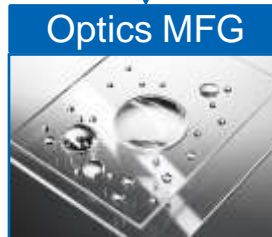


Since 2006

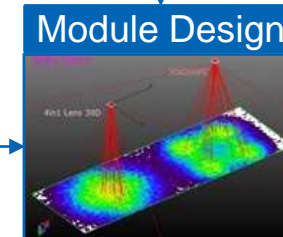


- Core Sol-Gel technology
- Vision Better life with NOVAXIL™
- Mission Customer orientated service

Since 2008



MFG technical support



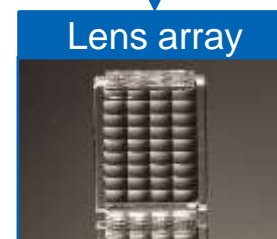
Since 2015



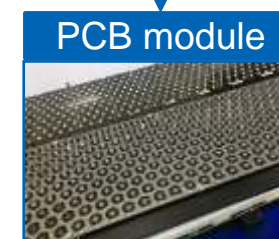
2008



2010



2016



2015



2020





## Continuous improvement

- 1) Complex geometry
- 2) Freeform design
- 3) Microstructures



# CRISTAL

## Applications

- 1) UV LED packages
- 2) PCB / 3DP / Printing
- 3) Laser projector



## Advanced study

- 1) Head up display (HUD)
- 2) Laser optics
- 3) Bio-Med analysis
- 4) UVC sterilization



## Mass production

- 1) Aspheric lens
- 2) TIR optics
- 3) Flyeye lens
- 4) Microlens array

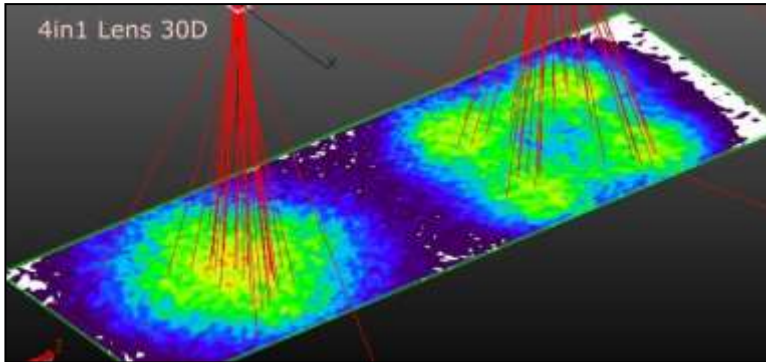


# NOVAXIL™ silica optics





# NOVATICS LED solutions



Optics  
Manufacturing

Optical Design

Electronic Design



Material Science

Fluid Dynamics

Module  
Integration



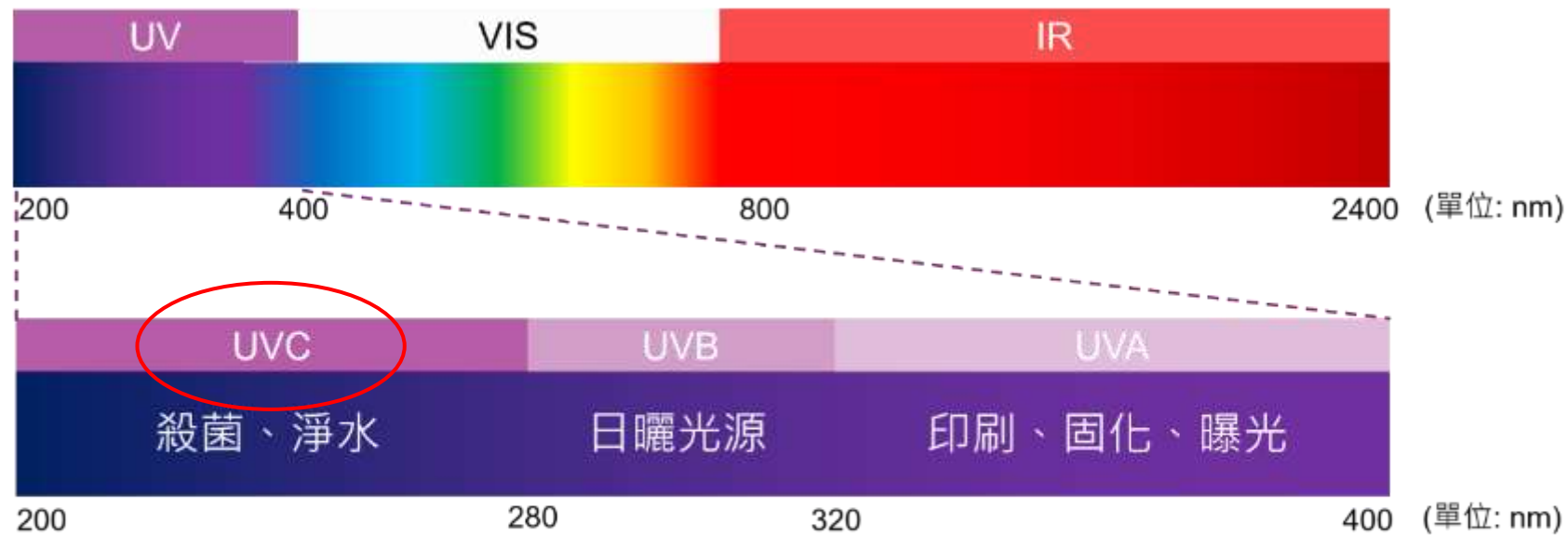
# Backup Slides

UVC spectrum & LED Sterilization

# UV spectrum



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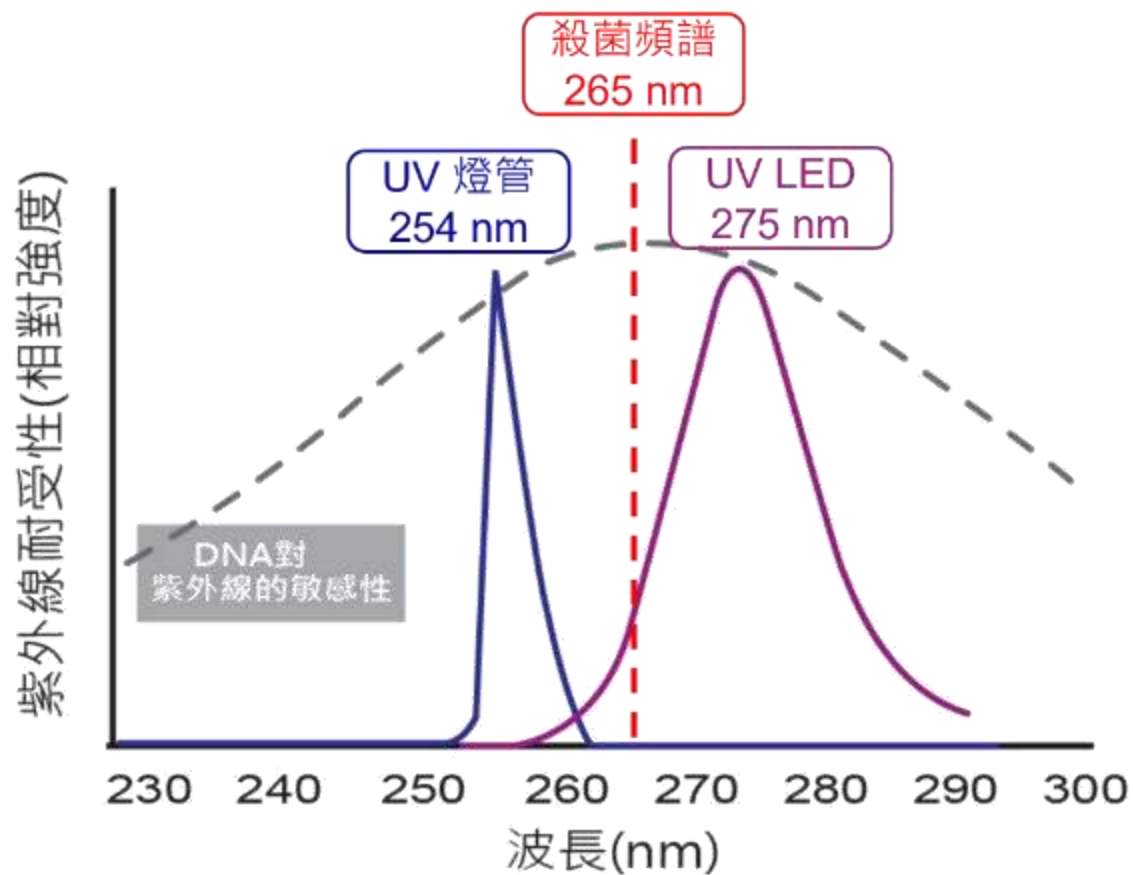


光學全波長頻譜示意圖





# UVC sterilization



UVC殺菌頻譜範圍





**CRISTAL**

[cristalmat.com](http://cristalmat.com)