

ITRI

Industrial Technology
Research Institute

Introduction and application of UVC water sterilization

Electronics and Opto-Electronics Research Laboratories

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Outline

1. Introduction and development status of ITRI
2. Introduction of UVC water sterilization
3. Case studies in remote areas
4. Conclusion

Current Status



總人力：6,181人

博士：1,393 (23%)
碩士：3,702 (60%)
學士等：1,086 (17%)
院友：25,777

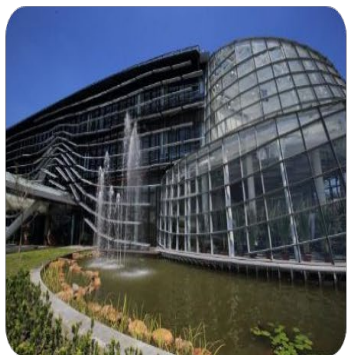


專利獲證數

29,369件

新創事業家數(~2020/Q2)

149家

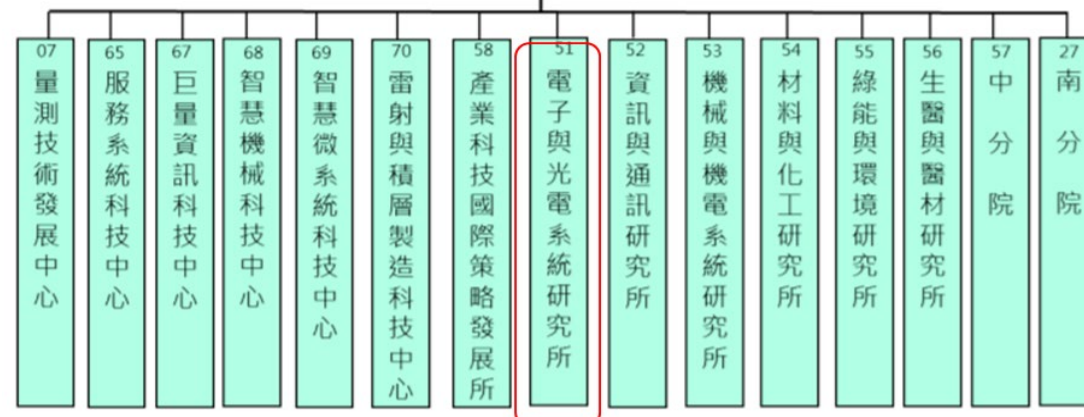


產業服務 (2019)

服務家次：18,657家次
技術授權：643家次

育成進駐(~2019)

169家



R & D Focus : Optoelectronic Semiconductor

Focus On Advanced LED Technology

Objective : To Promote industrial upgrading, Create industrial value.

Vertical integration from chip to system application



Past Achievement- LED Lighting Applications

- ◆ Surgical LED Lighting
- ◆ LED Endoscope
- ◆ LED Dental Lighting
- ◆ LED Phototherapy
- ◆ LED Photodynamic Therapy



LED無影手術燈



LED美容燈



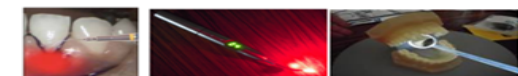
LED牙科燈



LED NBI



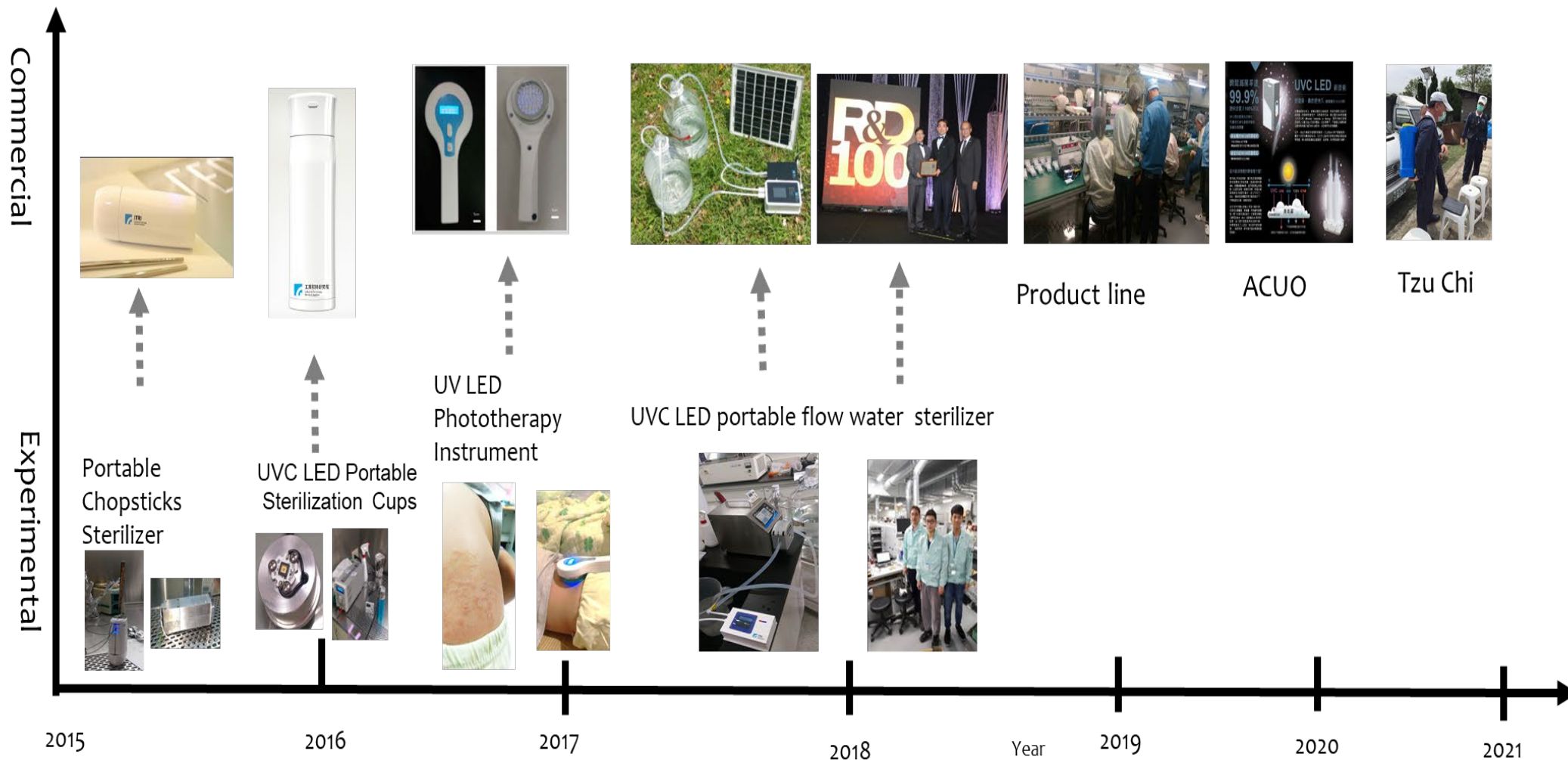
LED 內視鏡光源機



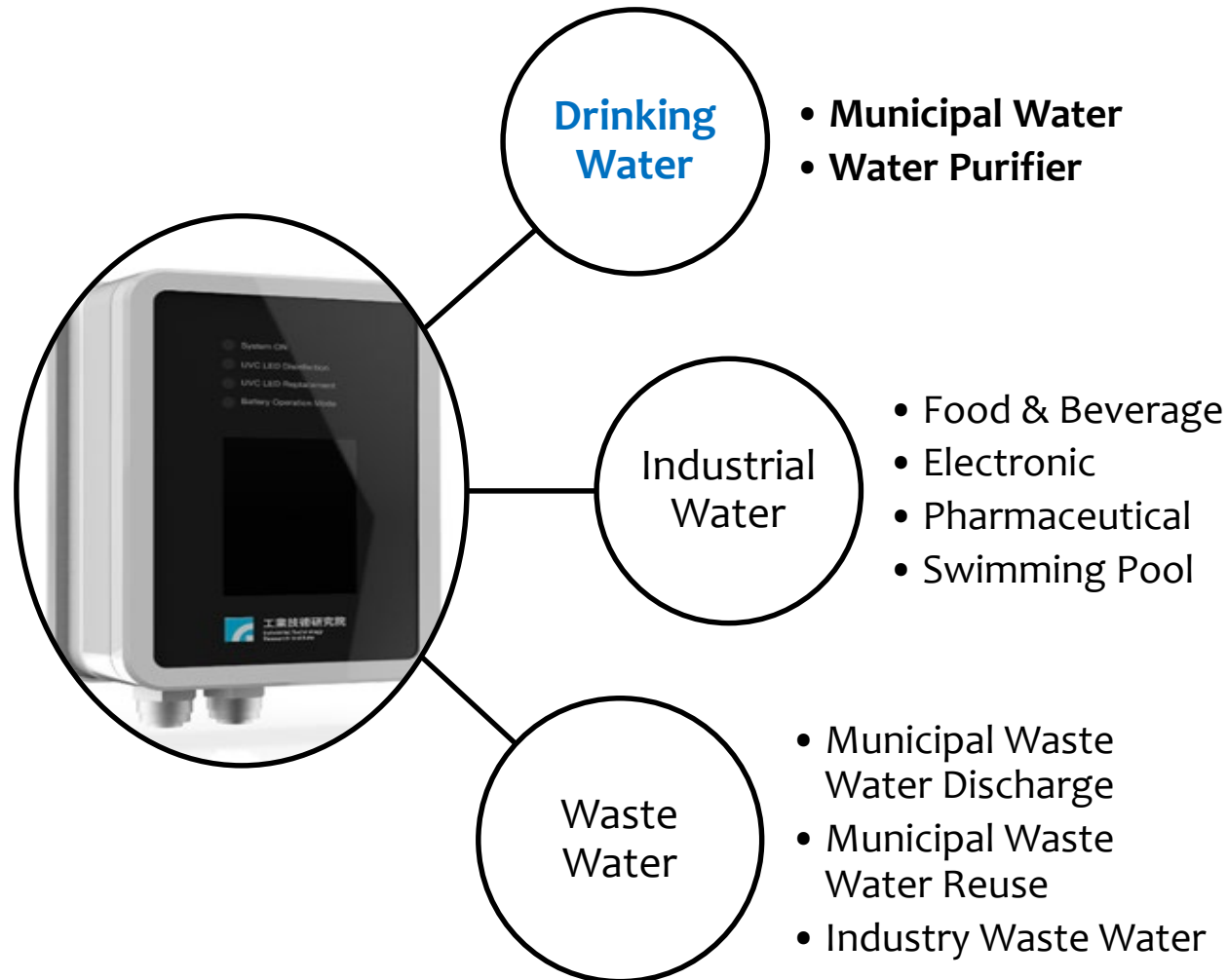
口腔光動力照明

LED口腔照明

Focus On Advanced UV LED Technology



UV Sterilization Of Water In Practice



Precautions For Drinking Water

Physical pollutants



Chemical pollutants



Microbial contamination



1st

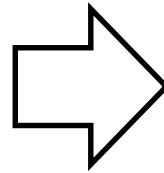
Drinking Water System

Good For UV Lamp(so Far)

Municipal UV Systems



Water Treatment Plant



Good For UVC LED

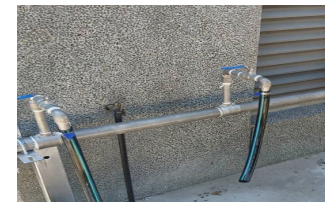
Community Water Supplier



Point Of Entry (POE)



Point Of Use (POU)



What Is Good For UV LED System?

Size Is Small



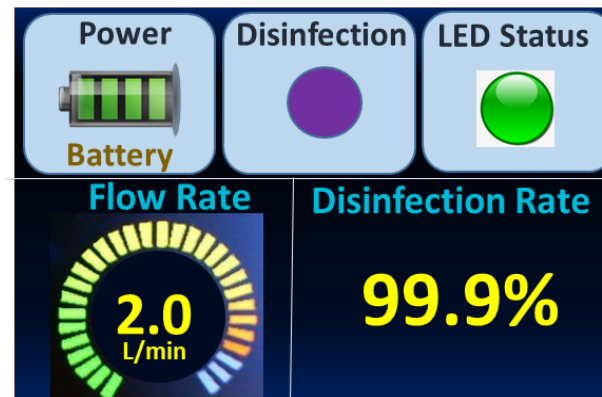
Portable



Solar Power



System integration



What Is The Future Of UV LED Systems?

Future demand for functions:

1. System integration → Functional requirement , Customer needs. (Is 10000hrs enough?)
2. Follow-up service (troubleshooting?)

@ Berlin



@Shanghai



@California



@Taipei



Portable UVC LED Water Sterilizer System



<https://www.youtube.com/watch?v=7VScxsJeurs>

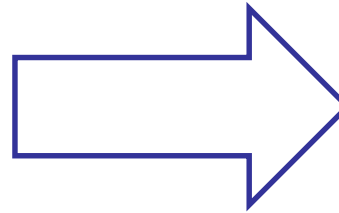
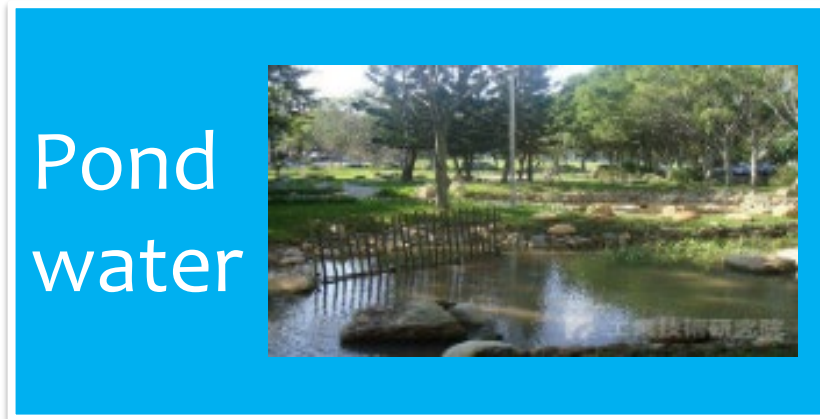
Case studies in remote areas

Portable UVC LED Water Sterilizer, with small size, low energy consumption and can use the solar charging. It is more suitable for areas lacking electricity, such as helping to provide clean drinking water and basic sanitation facilities for developing countries and disaster areas.



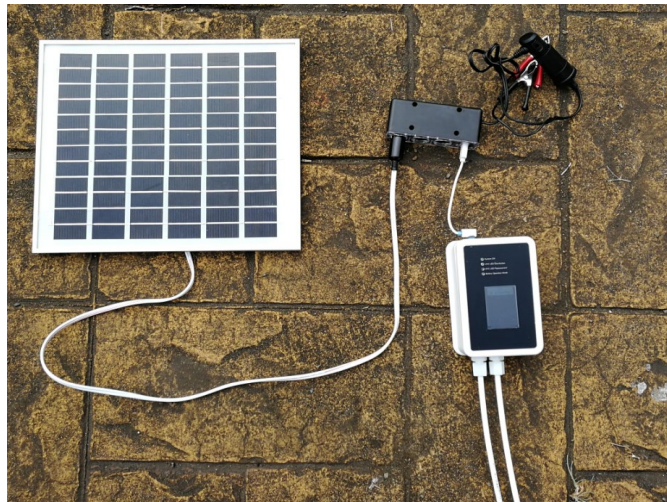
Research Topic

We use UVC LED module to study the germicidal efficacy of reverse osmosis source water (turbidity of bacterial suspensions : <0.5 ntu) and turbidity lake water (<30 ntu).



Experimental Setup

We design the smart UVC LED water purification module, with a UVC high-performance reaction chamber, solar charging, and easy to carry.

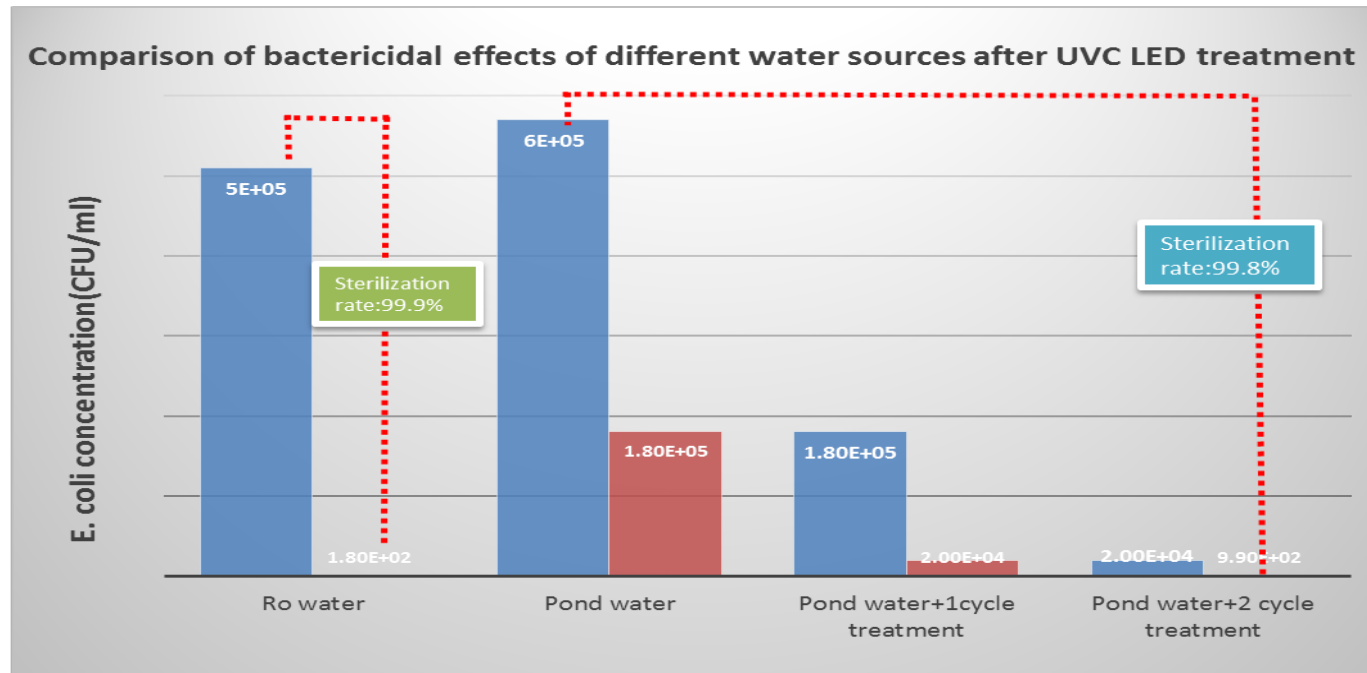


Parameter	Units	Value
Rated power consumption	W	<5
Rated flow rate	L/min	2
Peak Wavelength	nm	275
Weight	kg	<0.5 KG

Experimental Result

Germicidal Efficacy Analysis

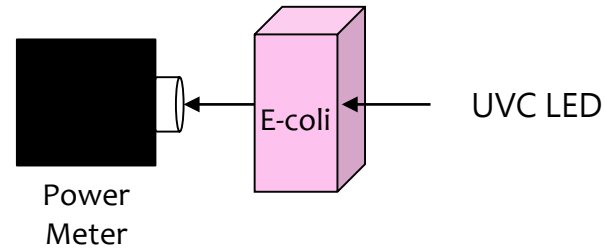
Using reverse osmosis water as the test source, the flow rate is 2 liters / minute, and the germicidal efficacy is > 99.99%. Using pond water as test source, the flow rate is 2 liters /minute, and after sterilization two times, it reaches 99.8%.



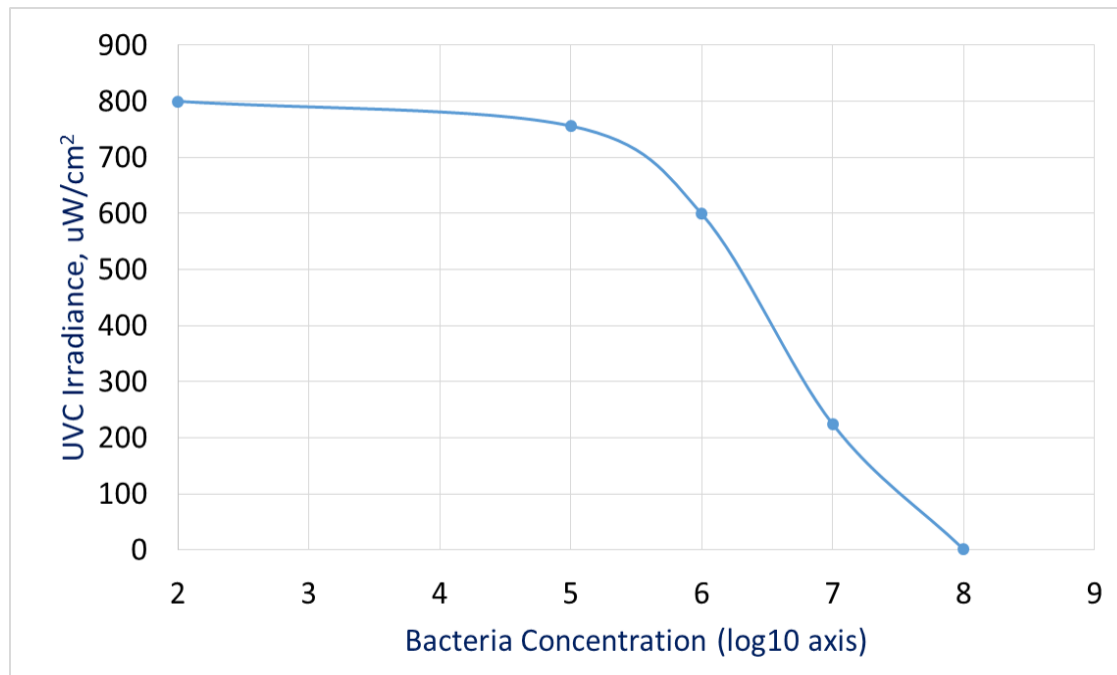
Experimental Discussion

E-coli concentration V.S. UVC transmission in UV reactor

❑ Experiment Setup



E-coli concentration Vs UVC transmission



1. The efficiency of UV reactors for water disinfection is mainly depends on the UV transmission of the contaminated water.

2. Therefore, the UV transmission in our UVC LED based reactor for different bacteria concentrations was measured.

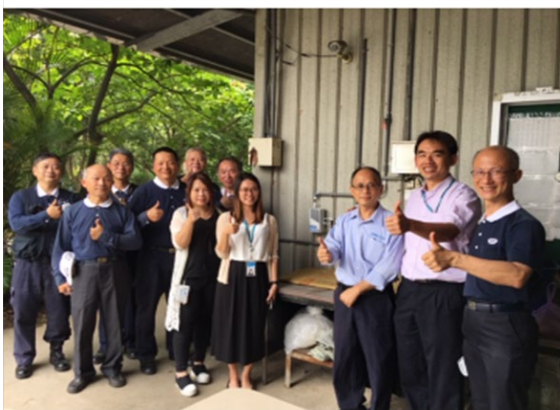
3. Figure shows the experiment setup for UVC transmission measurement. Quartz reactor's side wall is illuminated with UV meanwhile at another sidewall the power meter is measuring the irradiance.

4. Figure depicts the UVC transmission through different bacteria concentration in our reactor.

5. The UVC transmission through the bacteria water is decaying significantly for the bacteria concentration above 10^5 .

Conclusion

1. UVC light-emitting diodes are based on the characteristics of small size and power saving, and now more and more applications are in use.
2. Using a test site is the best way to check system requirements.
3. The ITRI test field has performed well in the past two years, and POU is a good application.
4. The community point of entry (POE) will be the subject of further research.





Thanks For Your Attention !!