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**CORONA VIRUS AND ITS IMPACT ON
WATER, WASTE WATER – ONLINE
MONITORING AND UV DISINFECTION**

**MR. REEPAL JOSHI
DIRECTOR MARKETING**



Contributing to



ORGANIZATION INFORMATION

LAB SYSTEMS AND BIOTECH INDIA PVT. LTD. is more than 24 years rich in experience Organization in the field of Measurement Analytics. With couple of Business Units as Business Verticals, the Organization has always delivered Quality and Sustainable Solutions to their Customer Partners.

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Our Products and Solutions for Process Control and Compliance:

1. Instrumentation for measurement of parameters like Level, Flow, Temperature, Pressure etc.
2. Reagent less Laboratory COD, BOD, TOC, TSS, NO₃, NO₂ Analyzers for Drinking and Potable Water, River Water, ETP and STP Water (Full Spectrum High Resolution UV-VIS Spectrometer).
3. Reagent less Online COD, BOD, TOC, TSS, Nitrate, NO₃, NO₂ Analyzers for Drinking and Potable Water, River Water, ETP and STP Water (Full Spectrum High Resolution UV-VIS Spectrometer)
4. Digital Sensors for Online Measurement of Parameters like pH, TDS /Conductivity, DO, Turbidity, TSS, NH₃, Chlorine, etc.
5. Online Analyzer Solutions for Measurement of Colorimetric analytes like Chromate, Silica, Hardness, Chlorides, Color, Cyanide, Phosphate etc.
6. Online Analyzer Solutions for Measurement of Specialized Parameters in Water like Algae Species, Toxicity and Total Bacterial Count.
7. Treatment Solutions like Fine Bubble Disc Diffusers, Tube Diffusers, Plate Diffusers and Ultra Filtration based MBR Membranes, Vertical Cloth Disc Filter, Electro Coagulation Units and Complete ZLD Solutions.
8. USEPA Validated Medium Pressure UV Disinfection System that offer 6 Log deactivation of Microbes and 4 Log reduction of Adeno Virus as Tertiary Treatment for Process Water.
9. Solutions for Online Measurement of Parameters for Ambient Air and STACKS etc.

Directors and Team of Helm

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MISSION

Through continuous update and innovation and introduction of new technologies and solutions for a more cleaner future,. We aim to meet the highest standards of accuracy, precision and sensitivity, from frontier market research. Our high end quality solutions and services cover the complete spectrum with long Term value for money that Complies all stringent regulatory compliance and also ready to comply the future changes.

We are committed to provide the highest level of customer satisfaction and continually contribute in improving the quality of our products and services. We therefore welcome any customer suggestions, which we would evaluate and subsequently implement for the benefits to assist you in our drive forward to enhance our future performance.

In all our interactions, we help you to identify such initiatives that would make your company a cutting edge and competitive organization implementing more professional and ethical business practices.

Lab Systems & Biotech India Pvt. Ltd has been following simple philosophies since more than 2 decades. To continuously keep Introducing innovation and new state of art technologies and solutions that will help in building more cleaner and vibrant tomorrow

To make Environmental Analytics and Solution, the product of choice for all its users and customers in the field of Environment. To provide the highest quality product deliverable and to narrow down on solution specifications, for the analytical users.

To utilize the most advanced technologies for promotion of our high end solutions. To be focused on meeting the needs of our customers on regular basis. Integrity in dealings, Innovativeness in approach, Excellence in results



VISION

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Let us all together take Lead to protect our today and to make a better and cleaner Environment for tomorrow.



BRIEF COVID 19 CORONA VIRUS, SARS nCOV 2

WATER AND WASTE WATER SOLUTIONS, TECHNOLOGY PARTNERS

microLAN
On-line Biomonitoring Systems


Atlantium
Illuminating Water Technologies



BRIEF COVID 19 CORONA VIRUS, SARS nCOV 2

**CORONA VIRUS 2019 SARS nCOV 2 Global
Pandemic and its impact on Water, Waste
Water – Online Monitoring and UV
Disinfection**

BRIEF COVID 19 CORONA VIRUS, SARS nCOV 2

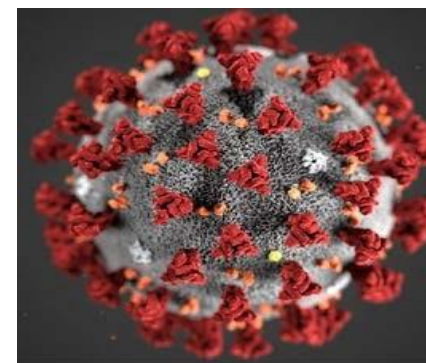
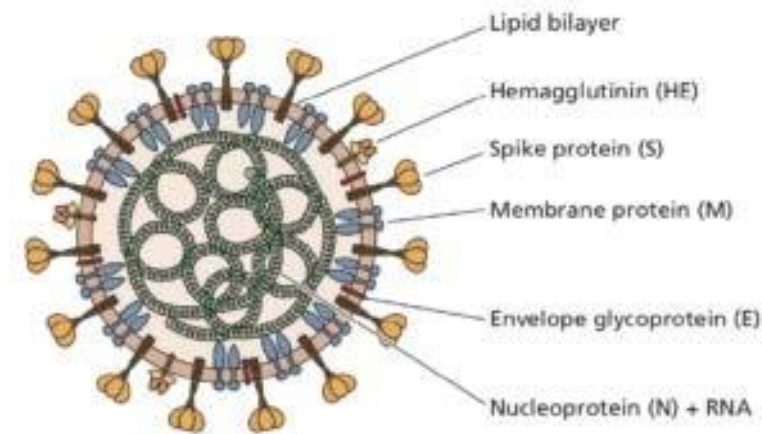
AGENDA

- Brief about **COVID 19 Corona Virus**
- Impact Assessment on Water and Waste Water
- Online Instrumentation for real time monitoring of Bacteria and Viral Load
- Conclusion
- Medium Pressure UV Treatment Technology – A Green initiative for deactivation of Covid 19 Viral Load
- Conclusion

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

BRIEF COVID 19 CORONA VIRUS, SARS nCOV 2

- A large virus with a lipid outer envelope
- Similar to SARS and MERS coronaviruses
- Zoonotic (goes from animal hosts to people)
 - Bats are main reservoir hosts; arose by mutation
 - Other wild animals caught for food and medicines are hosts that often transmit coronaviruses to people
- Pangolins (scaly anteaters) ?
- First discovered in December 2019 in a Wuhan city, Hubei Province, China “wet” (live animal) market
- Has now spread within China and to many other countries (~39) by infected people



Size: approx 0.1 micron

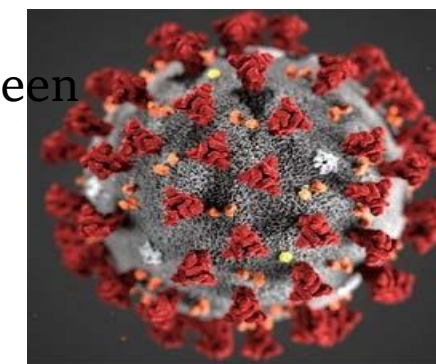
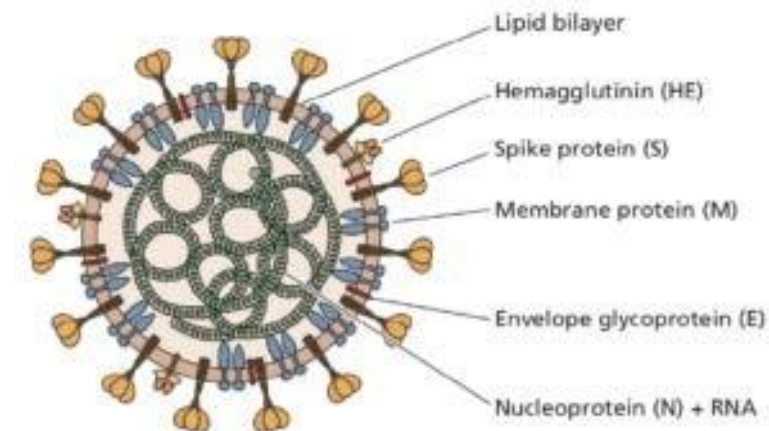
2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

SOURCE:



BRIEF COVID 19 CORONA VIRUS, SARS nCOV 2

- 2019-nCoV is a biosafety level 3 pathogen; a high risk agent
- Requires high level containment in specialized labs with trained staff
- Detection is usually by nucleic acid amplification & detection – reverse transcription-polymerase chain reaction (RT-PCR)
 - Detects viral nucleic acid and NOT infectious virus
- Can detect inactivated viruses & bits of virus nucleic acid
- Does not prove infectious viruses are present; maybe?
- Detection of infectious 2019-nCoV in a fecal sample by cell culture has been reported
- Virus concentration in the sample was not reported.
- Therefore, concentrations of infectious 2019-nCoV in clinical and environmental samples remains unknown at this time.
- More efforts needed to determine infectious virus concentrations

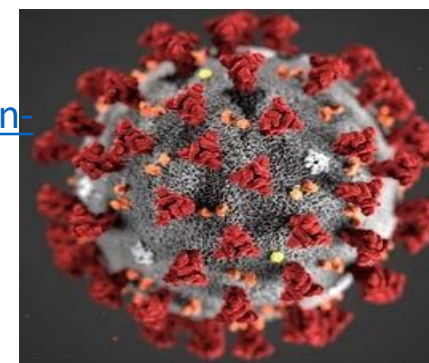
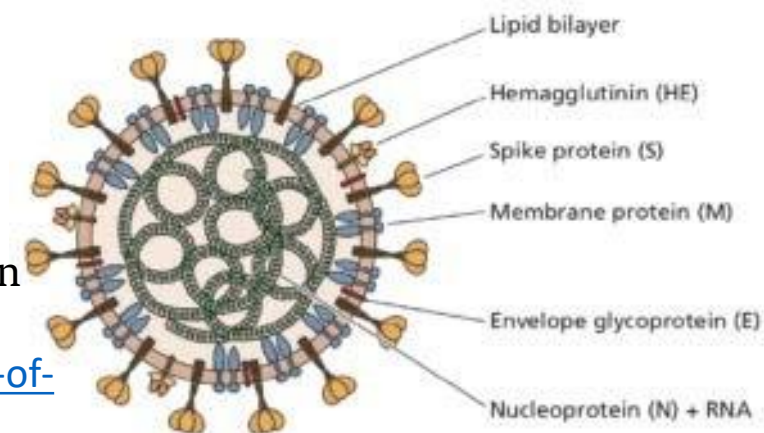


2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

SOURCE:

BRIEF COVID 19 CORONA VIRUS, SARS nCOV 2

- Detection of infectious 2019-nCoV in a fecal sample by cell culture has been reported in China. See:
 - <http://weekly.chinacdc.cn/en/article/id/ffa97a96-db2a-4715-9dfb-ef662660e89d>
- Detection of infectious 2019-nCoV in a Municipal Sewer sample has been reported in Netherland. See:
 - <https://www.dutchwatersector.com/news/sewage-water-as-indicator-for-spreading-of-covid-19>
- Detection of infectious 2019-nCoV in a canal water sample has been reported in Paris. See:
 - <https://www.thelocal.fr/20200421/has-coronavirus-really-been-found-in-the-water-in-paris>
- Virus concentration in the sample was not reported.
- Therefore, concentrations of infectious 219-nCoV in clinical and environmental samples remains unknown at this time.
 - More efforts needed to determine infectious virus concentrations



Size: approx 0.1 micron

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

SOURCE:



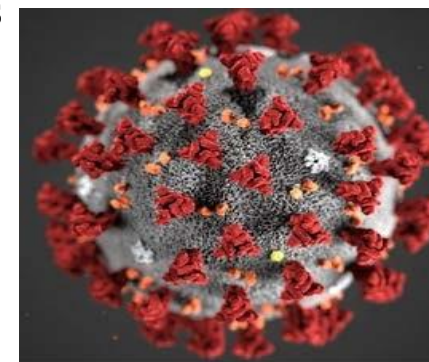
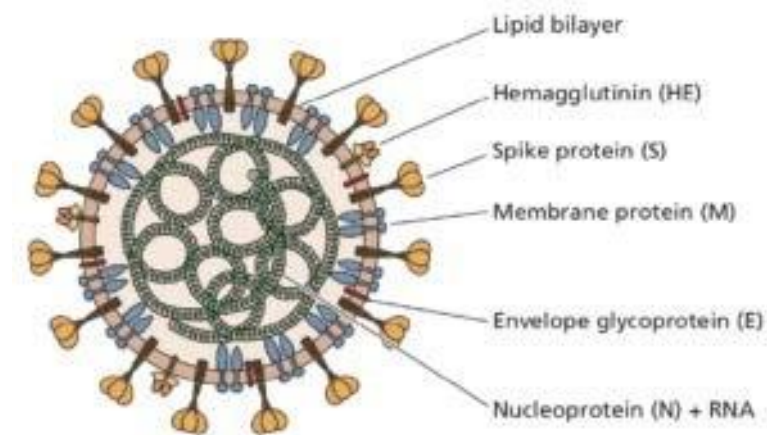
BRIEF COVID 19 CORONA VIRUS, SARS nCOV 2

Presence:

- 2019-nCoV concentrations in feces, sewage or water are unknown
- Concentrations of other CoVs, such as SARS and “common cold” CoVs in some samples are known
 - Whether predictive of 2019-nCoV concentrations is unknown

Survival:

- 2019-nCoV survival in feces, sewage, water and other media is unknown
- Survival of other CoVs, such as SARS, “common cold” and animal CoVs is known for some media (sewage, water, surfaces and some foods.
 - Assumption: Survival of other CoVs may be predictive of 2019-nCoV survival. Animal CoVs and common cold CoVs
 - For now, such CoV survival data is considered informative



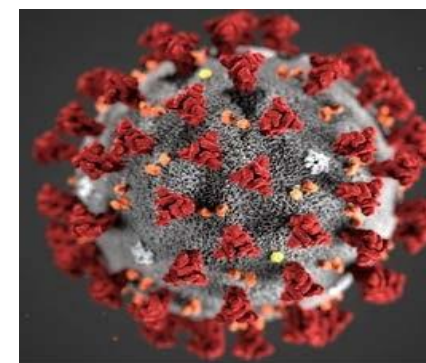
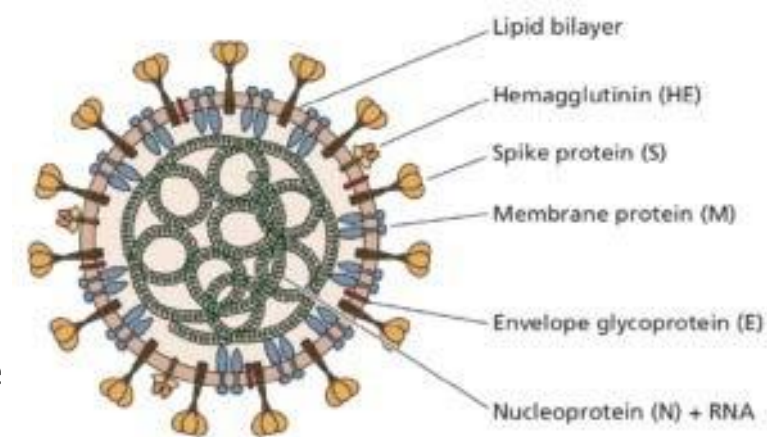
Size: approx 0.1 micron

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

SOURCE:

BRIEF COVID 19 CORONA VIRUS, SARS nCOV 2

- 2019-nCoV may be expected to survive for extended periods of time in environmental media
- Inactivation is not immediate or very rapid
- Extensive declines of virus infectivity are expected over several days or weeks in aqueous media (sewage & water), depending on temperature, matrix/medium and other environmental conditions
 - On environmental surfaces, extensive declines of virus infectivity are expected in hours, days or weeks, depending on the matrix/medium, surface and environmental conditions
 - Data on disinfection of 2019-nCoV is not available yet
 - Disinfection data on other CoVs indicates susceptibility to a range of chemical disinfectants and UV radiation (UVC)



Size: approx 0.1 micron

2019-nCOV 2 Online Measurement and UV Disinfection for Waste Water and Water

Total Coliform is already a parameter of measurement for treated Sewage Water Post Treatment as per Latest Guidelines of CPCB and NGT for Municipal Water Disposal

The New Circular by Central Pollution Control Board (CPCB)

Virus can spread through sewage systems: CPCB

Pollution body advises sewage treatment plant operators to use PPEs

RICHA SHARMA @New Delhi

CAN COVID-19 spread through sewerage systems? The guidelines issued by the country's top pollution watchdog say transmission to operators may be possible during treatment of Sewage Treatment Plants (STPs) and has called for use of Personal Protective Equipment (PPE).

Issued by the Central Pollution Control Board (CPCB), the Guidelines for Handling, Treatment and Disposal of Waste Generated during Treatment/Diagnosis/Quarantine of COVID-19 Patients also says that there is no evidence as of now that coronavirus spread through sewerage systems has occurred.

In Paris, French authorities

had found "minuscule traces" of coronavirus in non-potable water like water supply used for cleaning streets.

"As per the information available at CDC (Centres for Disease Control and Prevention), the risk of transmission of virus that causes COVID-19 through sewerage systems is thought to be low. Transmission to operators may be possible during treatment of STPs," said the guidelines.

"Operators of Effluent Treatment Plants/Sewage Treatment Plants attached with discharge from Healthcare Facilities and isolation wards should adopt standard operational practices, practice basic hygiene precau-



tions, and should wear (PPE) — goggles, face mask, liquid repellent coveralls, waterproof gloves and rubber boots," the CPCB said adding, that during the period of COVID-19 pandemic, utilisation of treated wastewater in utilities within healthcare facilities may be avoided.

The guidelines talks about management of general waste from quarantine homes and masks/gloves from other households. It says used masks and gloves generated from home quarantine or other households should be kept in paper bags for a minimum of 72 hours prior to disposal as general waste. Users are advised to cut the masks prior to disposal to prevent reuse.

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ BACT CONTROL – ONLINE INSTRUMENTATION FOR REAL TIME

MONITORING OF BACTERIA AND VIRAL LOADS

**BACT CONTROL – AN INITIATIVE FOR
ONLINE MONITORING OF BACTERIA
AND VIRAL LOAD IN SEWAGE WATER
(BOTH INFLUENT AND EFFLUENT) AND
DRINKING WATER
(BOTH INLET AND OUTLET).**

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ BACT CONTROL – ONLINE INSTRUMENTATION FOR REAL TIME MONITORING OF BACTERIA AND VIRAL LOADS- FEATURES



US patent No.8,518,246 -US 2010/0193313
 Based on Patented Fluorescent measurement
 Automatic sampling
 Methods configurable for four different types of Bacterial measurement

β -Glucuronidase-> indicates	<i>E.coli</i> activity
β -Galactosidase-> indicates	Coliform activity
Alkaline Phosphatase -> indicates	Total Activity
β -Glucosidase -> indicates	Enterococci

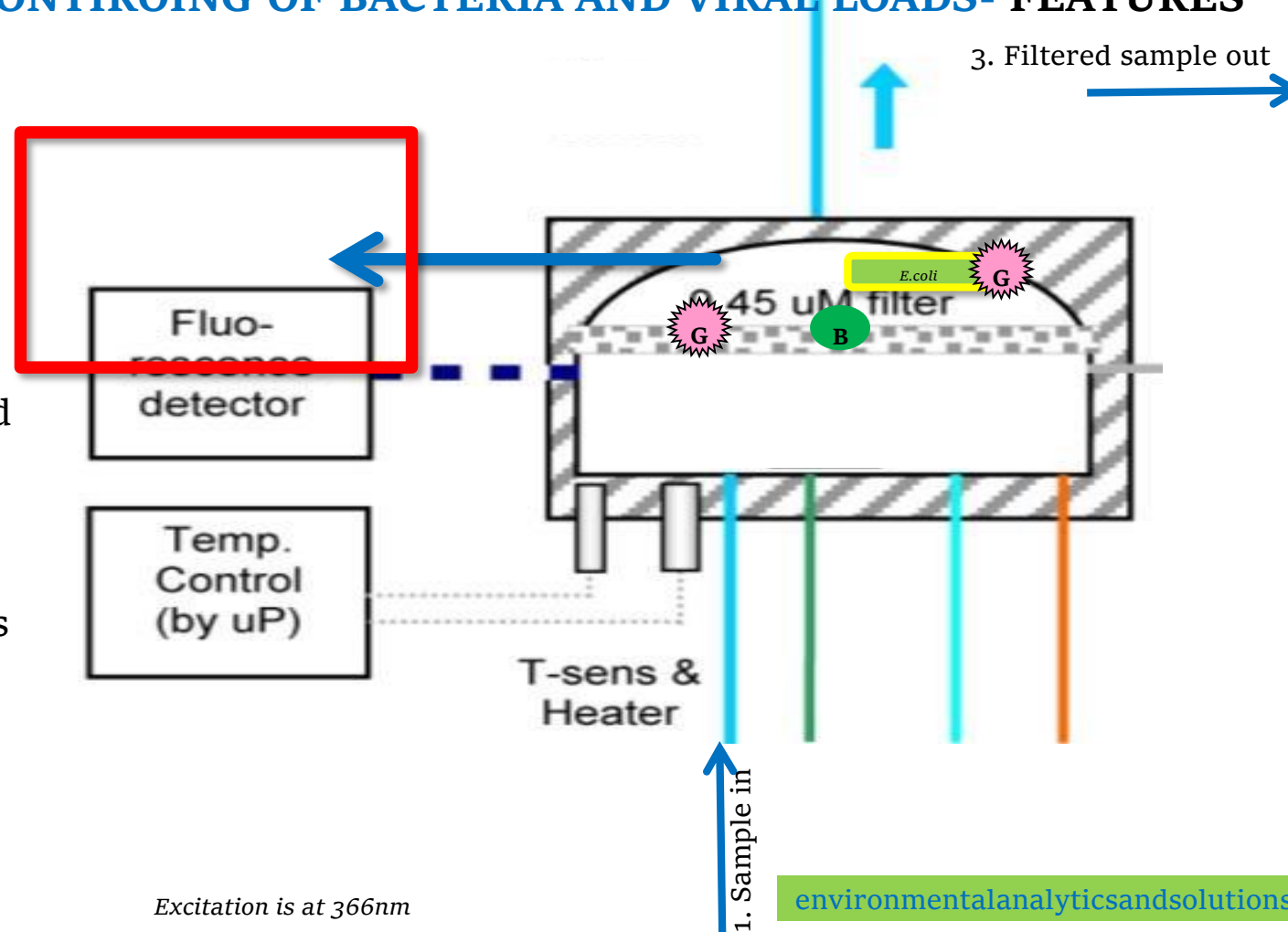
1 to 2 different sample Streams

Online Real Time measurement every 90 mins compared to 3 days to 5 days by conventional methods

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ BACT CONTROL – ONLINE INSTRUMENTATION FOR REAL TIME MONITORING OF BACTERIA AND VIRAL LOADS- FEATURES

- Sample going into the reaction chamber
- Sample is filtered and E.coli stays in the reaction chamber
- Filtered sample goes to waste
- Buffer is added
- EC solution (β -Glucuronidase) is added and reacts with the enzyme in the bacteria
- A fluorescent compound (methylumbelliferone) is released which is measured by the FluMini (detector)



2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ BACT CONTROL – ONLINE INSTRUMENTATION FOR REAL TIME MONITORING OF BACTERIA AND VIRAL LOADS- FEATURES

- The BACTcontrol is an “early warning system”, complementing the officially accepted methods for the detection of microbiological and Viral activity. The measurements are realized in a short period of time, 1-2 hours, depending on the sampling volume and cleaning procedures. This is in contrast to classical microbiological methods, which are labor-intensive and in which cultivation of the organisms is required, taking several days before obtaining reliable results (24-48 hours).
- The BACTcontrol is an online automated instrument for the detection of microbiological activity in water. **It measures the specific enzymatic activities of β -galactosidase (coliforms), A viral load increase, increases the spike in the measurement of total coliform and Covid 19 viral load increase will also give increased results in Total Coliform Activity. (Refer related application note)**
- β -glucuronidase (E.coli) and alkaline phosphatase (total activity, biomass), as an indicator of the presence of bacterial contamination. The enzyme activity is detected by adding reagents (consumables) which contain a fluorescent indicator. The reagents are substrate-specific for the enzyme to be detected, meaning that there is an increase in fluorescence when the enzyme is present in the sample.

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ BACT CONTROL – ONLINE INSTRUMENTAL MONITORING OF BACTERIA AND

Real-time monitoring technologies for indicator bacteria, pathogens and viruses for Water and Waste Water

The integrity of well managed sewer and water distribution systems in water companies and critical buildings is one of the most important barriers that protect drinking-water from contamination and spreading of diseases. However, management of distribution systems often receives too little attention. There is extensive evidence that inadequate management of Sewer and drinking-water distribution systems has led to outbreaks of illness. The causes of these outbreaks and the range of chemical and microbial hazards involved are diverse. The most common causes of illness were enteric pathogens, including bacteria (*Salmonella*, *Escherichia coli* O157), protozoa (*Cryptosporidium*, *Giardia*) and viruses (Norovirus) (Fig. 1)

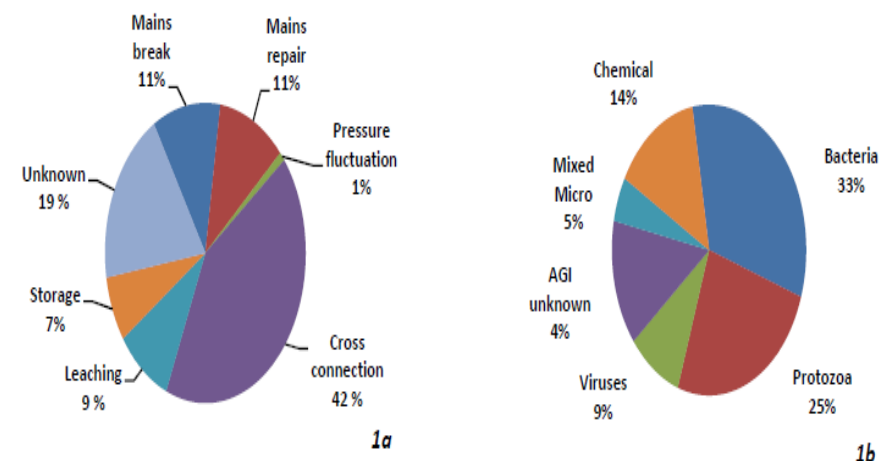


Fig.1 Waterborne outbreaks associated with distribution systems in the USA, 1981–2010, by (a) system fault and (b) causative agent. Water Safety Distribution Systems 2014- WHO.

2019-nCOV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ BACT CONTROL – ONLINE INSTRUMENTATION FOR REAL TIME MONITORING OF BACTERIA AND VIRAL LOADS- FEATURES

Using the BACTcontrol to monitor and maintain the microbiological quality

Online bacterial enzymatic monitoring can be used as a meaningful process variable that may improve and speed-up the detectability of incidents which impair microbiological water quality and safety. The BACTcontrol can rapidly detect *E.coli*, *total coliforms*, *enterococci* or *the total microbial activity in a continuous or laboratory setup to increase protection as early warning of contaminations.*

Examples where the BACTcontrol was used to protect people for diseases like viruses:

- A capital city in Eastern Europe suffered from a norovirus contamination. The BACTcontrol was used to quickly detect the source of the contamination in the distribution network
- A big utility in Southern Europe uses the BACTcontrol to monitor the effect of the final disinfection to protect users of their supply water
- It was used by the UN army to protect the water for soldiers against microbiological contaminations during a peace keeping mission in Africa.

2019-nCOV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ BACT CONTROL – ONLINE INSTRUMENTATION FOR REAL TIME MONITORING OF BACTERIA AND VIRAL LOADS- FEATURES

- Integrated PC with Windows
- Graphical user interface with touchscreen
- Full network capability via direct LAN
- 2 x USB 2.0 type A
- 2 x LAN 10/100/1000MB/s; RJ-45
- 2x digital input
- 2x relays output
- Protocols: Modbus TCP and Modbus serial, others on request
- 1 x 4 - 20mA outputs
- English operating system: German, French and Spanish, and others on request
- Modem slot for UMTS, ISDN or analog (modem optional)
- Second sample inlet / extra rinsing
- Air-conditioning unit (if higher than 30°C / 86F)

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ BACT CONTROL – ONLINE INSTRUMENTATION FOR REAL TIME MONITORING OF BACTERIA AND VIRAL LOADS- FEATURES

● **Automatic cleaning**

- User selectable cleaning cycles
- Cleaning solution (sodium hypochlorite solution < 0,05% active) prevents fouling and enables unattended deployment for several weeks.
- Protection classification: IP 54
- Power consumption (average): <100W
- 1 programmable pump (sample).

2019-nCOV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ BACT CONTROL – ONLINE INSTRUMENTATION FOR REAL TIME

MONITORING OF BACTERIA AND VIRAL LOADS- CONCLUSION

Some conclusions for using the BACT control, it offers:

- Flexibility: the system can be used for both important faecal indicators (e.g. E. coli, coliform and enterococci) as well as process parameters (total bacteria contamination)
- Added value: this method can be used to create a fingerprint to show the log-removal of different disinfection steps and also after a contamination happened.
- Automation: fully automated online monitoring offers unique perspectives with respect to increased security and protection of the public.
- Water Safety: it can detect episodes of operational stops and switching procedures between water and treatment types
- Microbial Monitoring & Protection: it measures the enzyme activity only of living and active cells.

Overall it can be said that the BACTcontrol can be used as an early warning monitor for screening of COVID 19 SARS nCOV 2 Viral loads along with other Bacterial contaminations when upstream disinfection steps show failures and in this way, can contribute to the microbiological quality of the treated water and the safety and protection of human kind.

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ HOD – MEDIUM PRESSURE UV TECHNOLOGY

**HOD MEDIUM PRESSURE UV
DISINFECTION– A GREEN INITIATIVE
FOR DISINFECTION OF COVID 19 SARS
nCOV 2 VIRAL LOAD IN SEWAGE WATER
(EFFLUENT) AND DRINKING WATER
(BOTH INLET AND OUTLET).**

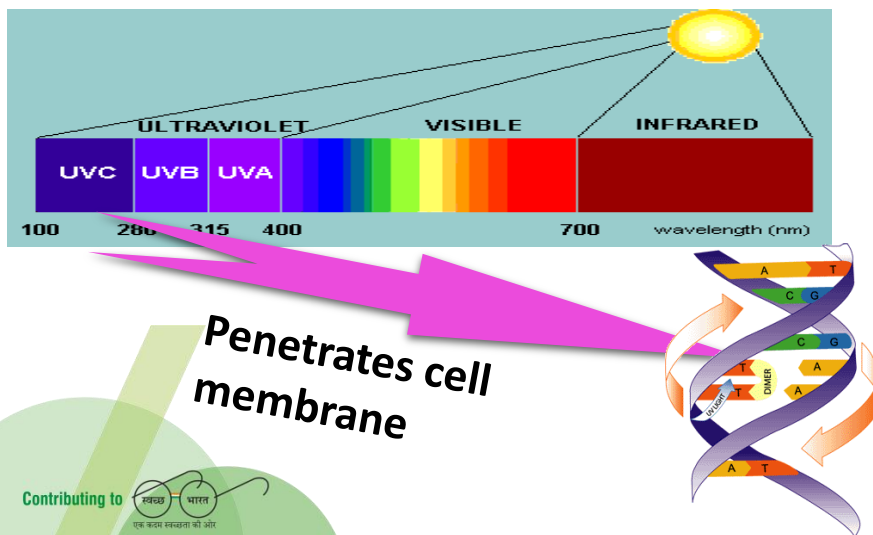
2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ HOD – MEDIUM PRESSURE UV TECHNOLOGY



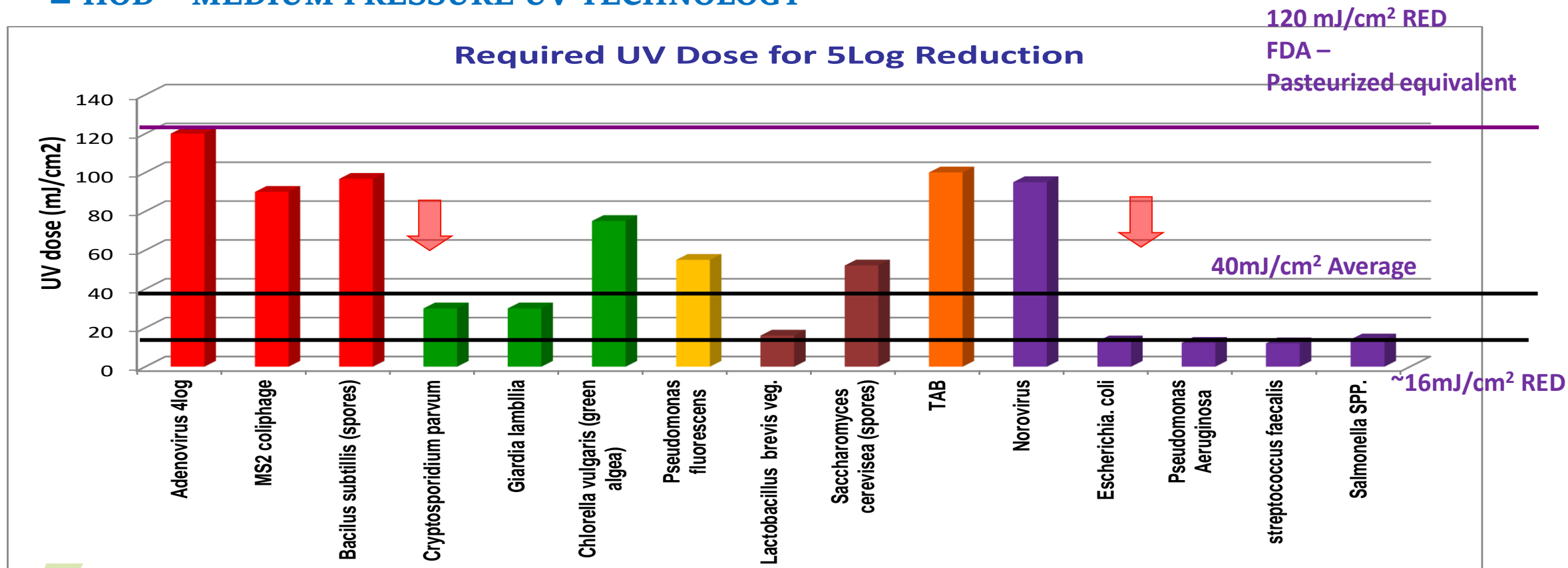
HYDROPTIC DISINFECTION SYSTEM (HOD)

- 62 Patents
- **USFDA VALIDATED** for **PATEURIZATION** equivalent water quality
- **USEPA VALIDATED** for **4 log reduction of ADENO VIRUS**
- Hydro Optic UV Disinfection System with Medium Pressure technology that offers no cell repair mechanism
- Integrated PLC that display UVT, FLOW, DOSAGE and LAMP LIFE
- UV light inactivates cells by damaging their DNA
- Medium Pressure (MP) UV lamps use entire germicidal spectrum (200 - 320nm) for much better efficiency
- Creates Thymine Dimers to inhibit DNA replication
- Medium Pressure totally inactivates cell repair mechanisms
- **Unlike Low pressure (LP) UV lamps that uses light at a single monochromatic wavelength of 253.7nm only**
- Low on opex



2019-nCOV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ HOD - MEDIUM PRESSURE UV TECHNOLOGY



- UV level indicator - EPA challenge microorganisms
- Chlorine resistive & Surface water originated
- Dairy Industry

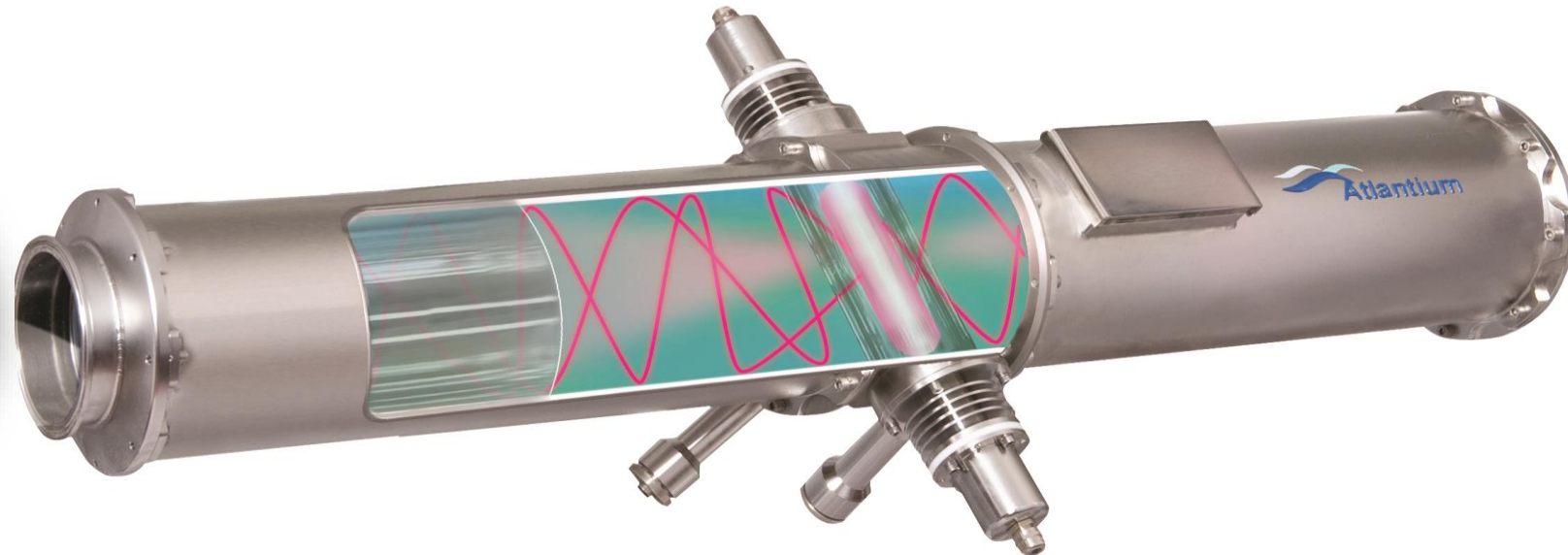
- Beer Industry
- Juice Industry
- General F&B Industry

Designing for the right DOSE

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ HOD – MEDIUM PRESSURE UV TECHNOLOGY

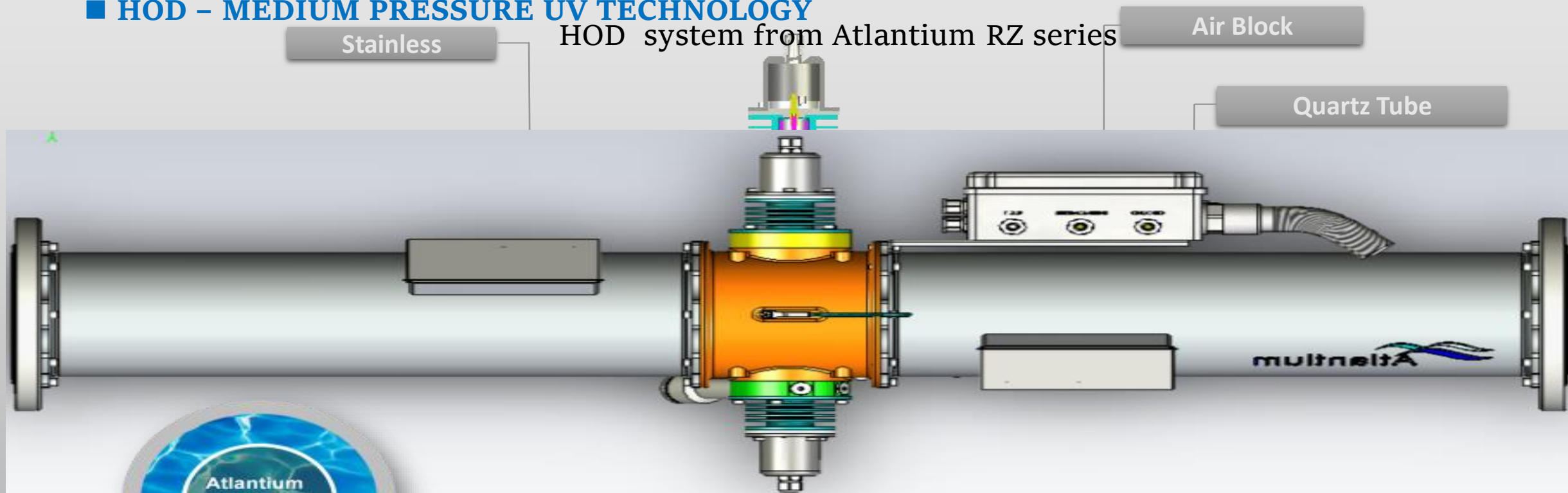
Atlantium's HOD uses "Total Internal Reflection", similar to the principle used in fiber optics, to deploy its UV light to ensure total destruction of bio-organisms



Hydro-Optic Disinfection (HOD) Technology

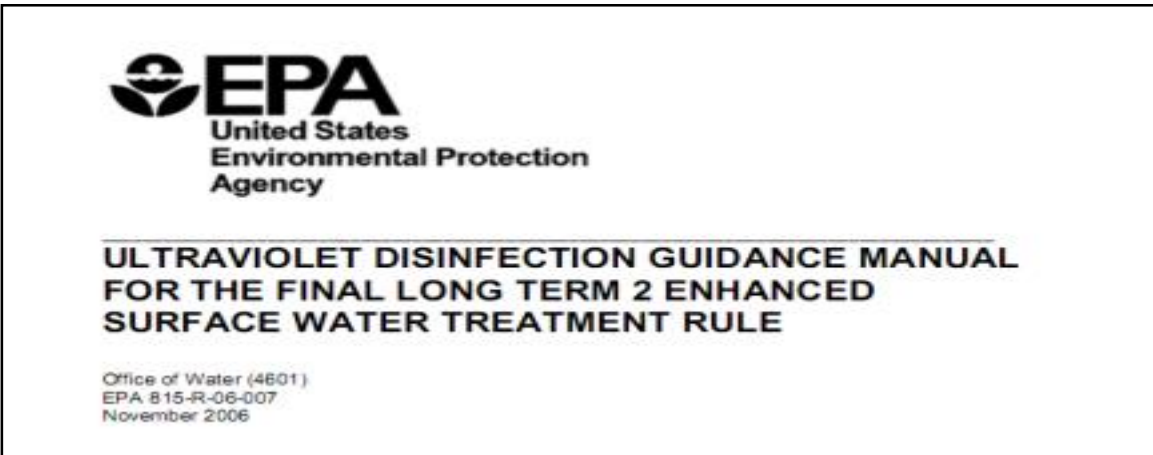
2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ HOD – MEDIUM PRESSURE UV TECHNOLOGY



Conventional

USFDA and USEPA Validation Certification Compliance Examples



Validated by third parties to meet the rigorous U.S. Environmental Protection Agency (EPA) protocols for full virus protection




PMO standards for pasteurized water equivalent

Grade "A"
Pasteurized
Milk
Ordinance

Replaces previous Grade "A" Condensed and Dry Milk Products and Condensed Dry Whey-Supplement to the Grade "A" PMO

2009 Revision



U.S. Department of Health and Human Services
Public Health Service
Food and Drug Administration



Servicio Nacional de Pesca y Acuicultura

Gobierno de Chile



Veterinærinstituttet
Norwegian Veterinary Institute

Norway - in process

National regulations







UL 508, UL 1563
E113027




guardians of drinking water quality

Compliance with different standards authorities

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ HOD – MEDIUM PRESSURE UV TECHNOLOGY - BRIEF

ABSTRACT: Ultraviolet (UV) technology is a physical process for disinfection by exposing bacteria, viruses and protozoa to UV light, rendering them incapable of reproducing or further affecting water supplies. Pathogenic viruses such as adenovirus, norovirus, rotavirus, and hepatitis A commonly occur in both surface and groundwater sources. This brief discusses evidence for SARS-CoV-2 (the virus that causes COVID-19) in water and the possibility of using UV systems for its disinfection, providing information regarding the ability of a UV system validated to a 4-log virus inactivation per the U.S. EPA guidelines with adenovirus to effectively mitigate SARS-CoV-2 in water.

This information is Reviewed by Prof. Hadas Mamane, Head of Environmental Engineering Program, School of Mechanical Engineering, Tel-Aviv University, Israel, and Yoram Gerchman Ph.D., Professor Biology and Environment at Oranim College and University of Haifa, Israel.

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ HOD – MEDIUM PRESSURE UV TECHNOLOGY - BRIEF

VIRAL INACTIVATION WITH UV

Viruses are composed of a nucleic acid (DNA or RNA; double-stranded or single-stranded) encased in a protein capsid, which in some viruses is encased in a lipid envelope. In all cases, the virus surface contains a proteinaceous receptor, which is necessary for binding to and entering the host cell. The sensitivity of a virus to UV irradiation can be roughly predicted according to its basic features. Lipid enveloped viruses are generally more sensitive to environmental stress, including UV than their non-enveloped counterparts.

The type of nucleic acid may also play a role in UV sensitivity. For example, single-stranded RNA (ssRNA) viruses tend to be more sensitive than double-stranded DNA (dsDNA) viruses.

This is due to the stability of the double-stranded structure, and the lack of a repair mechanism in most RNA viruses.

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ HOD – MEDIUM PRESSURE UV TECHNOLOGY - BRIEF VIRAL INACTIVATION WITH UV

The most familiar mechanism for virus inactivation by UV is the direct damage to the nucleic acid, due to the generation of pyrimidine dimers by the UV irradiation. In some cases, however, viruses may recover from DNA damage by applying a repair mechanism [7]. A wavelength of approximately 260 nanometers (nm), such as emitted from monochromatic low pressure (LP) UV lamps, is effective at generating pyrimidine dimers, thus the repair mechanism can increase the virus resistance to such UV inactivation. However, polychromatic UV systems (e.g., MP, 200-415 nm) inactivate microorganisms by damaging both DNA and proteins [8] and generating oxygen radicals [9]. This results in a virus that is unable to enter the host; a feat unachievable by monochromatic LP lamps. Atlantium's medium pressure (MP) Hydro-Optic™ (HOD) UV technology was validated for 4-log virus inactivation, per the U.S. EPA guidelines, using real adenovirus. This virus was chosen as a base for the U.S. EPA strict regulatory criteria of 4-log (99.99%) virus inactivation because adenoviruses, currently thought to be the most UV-resistant class of viruses, are used as the gold standard for viral inactivation requirements and the determination of biosecurity. The validated HOD UV solution has been proven in municipal, bottled water and other commercial applications since 2010.

2019-nCOV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ HOD – MEDIUM PRESSURE UV TECHNOLOGY - BRIEF

ADENOVIRUS AND SARS CoV-2

Adenovirus and coronavirus (SARS-CoV-2) are very different from each other in terms of virion properties that are important for UV sensitivity (Table 1). SARS CoV-2 is enveloped and has a single-stranded RNA genome, while adenovirus has a more stable dsDNA genome and is non-enveloped. The two viruses are similar to each other in terms of large genome and virion size. Large genomes are not rare for DNA viruses (the adenovirus) but they are not often common in RNA viruses. A large RNA genome is likely to require a repair mechanism for nucleic acid replication.

Table 1: Comparison of Basic Virion Properties of		
	Adenovirus	Coronavirus
Genome size (kb)	35-36	27-32
Envelope	Non-enveloped	Enveloped
Virion size (nm)	90	120
Nucleic acid	dsDNA	ssRNA (+)

2019-nCoV 2 Online Measurement and UV Disinfection for Waste Water and Water

■ HOD – MEDIUM PRESSURE UV TECHNOLOGY - BRIEF SARS-CoV-2 MECHANISM OF TRANSMISSION

The main route of SARS-CoV-2 transmission is person-to person by aerosols. It is also known that fomites (aerosol contaminated surfaces) have some contribution to transmission. However, recent information suggests that SARS-CoV-2 may be transmitted through the fecal-oral route as well.

Although it is not yet clear how SARS-CoV-2 infection transmits from feces and urine, a previous study on SARS-CoV-2 demonstrated survival and infectivity of the viruses in feces and urine up to 96 and 72h respectively, and in water up to 72h. This further emphasizes the need to re-examine the risk analysis to water safety from SARS-CoV-2.

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■ HOD – MEDIUM PRESSURE UV TECHNOLOGY - BRIEF

INACTIVATION OF SARS-CoV-2 BY UV

Testing a pathogen of an ongoing pandemic such as the SARS-CoV-2 may be difficult due to the required biosafety level (BSL) precautions. As a result, it is common practice to use related viral species as a reference to high BSL species. A surrogate species should have a similar response to UV treatment¹. In addition, since SARS-CoV-2 is still not well studied and its mechanism of transmission not fully known, reliance on a surrogate species becomes important when determining the efficacy of UV to treat the virus.

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■ HOD – MEDIUM PRESSURE UV TECHNOLOGY - BRIEF INACTIVATION OF SARS-CoV-2 BY UV

The corona virus family is composed of several genera, with all human pathogens belonging to the same genus (beta coronavirus). Several studies have been published detailing SARS inactivation by monochromatic UV (mainly 254 SOURCES 1 For example, EPA funded studies for adenovirus inactivation by UV used three different species; all three had similar UV sensitivity. nm). While the standard dose typically applied for inactivation of pathogens is approximately 40 [13] to 60 mJ/cm², further studies indicate that the required UV dose is closer to 100 mJ/cm² or even as high as 200 mJ/cm² to achieve 4-log inactivation [12], [14], [15], making it safe to estimate that SARS-CoV-2 will have the same UV sensitivity, i.e., a UV dose of 100 to 200 mJ/cm² will be needed to achieve 4-log inactivation of SARS-CoV-2. This point was emphasized in a March 12, 2020, “Corona virus Research Update” webcast hosted by the Water Research foundation (WRF), where Dr. Mark Sobsey³ of the Gillings Schools of Global Public Health, University of North Carolina Chapel Hill commented on what is known about SARS-CoV-2 UV inactivation. Dr. Sobsey stated, “We actually have a little bit of data on UV inactivation of some other corona viruses, and again, they can be inactivated with UV.

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■ HOD – MEDIUM PRESSURE UV TECHNOLOGY - BRIEF

INACTIVATION OF SARS-CoV-2 BY UV

Data that is available suggests that they are relatively persistent to UV, probably somewhere in between adenoviruses and others that are less resistant than adenoviruses, but certainly not more than adenoviruses. Depending on the design criteria and dosing criteria for UV systems, current UV systems that can inactivate adenoviruses should be fine for a virus like this, based on the other coronaviruses. UV should be effective.”

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HOD – MEDIUM PRESSURE UV TECHNOLOGY - CONCLUSION

When faced with a pandemic such as SARS-CoV-2, timely risk assessment and action are required to prevent the spread of the virus. Additionally, these circumstances highlight the importance of water and wastewater treatment facilities to consider enhancing their online measurement and treatment processes to provide continuous and permanent virus control.

A validated viable Validated UV treatment technology, such as the Atlantium's HOD UV with 4-log virus inactivation non-chemical treatment option for utilities and commercial facilities looking to protect their water sources from SARS-CoV-2. UV provides inactivation of SARS-CoV-2 without the reliance on chemical disinfectants and their associated risks (e.g., safety, storage, chain of supply, handling, and formation of carcinogenic disinfection by products).



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