TCR TECORA POLLUTION CHECK

LABORATORY

In Compliance with:
ISO 15714 : 2019

Bioaerosol Sampling System

UV-C BioKit

Product passed by SURFACE DISINFECTION PROCESS

Virus • Bacteria • Fungi • Spores • Protozoa Pollen • Algae

Bioaersol Sampling System

Bioaerosol is a component of Particulate Matter (PM) in the atmosphere, and consists of airborne particles that have a biological origin.

Bioaerosol is a mix of:

- Microorganisms (viruses, bacteria, fungi and their spores, algae and protozoa);
- Pollen;
- Fragments of animals, insects, plants;
- Derived substances (toxins and allergenes) produced by any living species.

Airborne microorganisms including some pathogens in indoor air may cause different types of diseases or adverse health effects on humans. Among different air disinfection techniques, ultraviolet germicidal irradiation (UVGI) has been used for several decades to effetcively inactivate the airborne microorganisms in indoor air and hereby prevent the transmission of a variety of airborne infections.

The International Standard **ISO 15714** describes the test methods to evaluate the UV dose to airbone microorganisms transiting in-duct ultraviolet germicidal irradiation devices. In duct **UVGI** devices are a primary form of air disinfection method by UV lamps mounted in heating, ventilation and air-conditioning (HVAC) systems to irradiate the microorganisms in air with high intensities.

APPLICATIONS

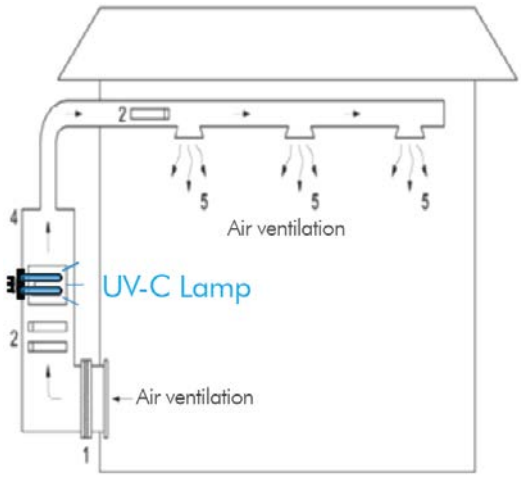

Diagram of an in-duct UVGI device in an HVAC system

Bioaerosol

The study of the microbial content of air has become increasingly significant in recent years when the need for "contamination-free" environments has become more evident.

Bioaerosol includes several types of primary bioaerosol particles (PBAP primary biological aerosol particles), with diameter ranging from a few nanometers (viruses), some micrometers (e.g. bacteria, pollen), >10-100 micrometers (e.g. fungi and spores), which are found in atmospheric particulates.

Knowing the dimensional distribution of bioaerosol allows to evaluate its aerodynamic behavior in the atmosphere (time of residence in the air, transport phenomena and deposition) and the potential health effects (deposition in different sections of the respiratory system).

Bioaerosol is sampled according to size by multi-stage impactors.
Bioaerosol is collected on an impact surface, consisting of a membrane, a fattened saucer or culture soil, and is studied using specific analysis techniques (microscope analysis; laboratory analysis for immunological, biological and chemical tests; culture-type techniques for culturable life cells).

INNOVATION MADE IN ITALY

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BioKit: ISO 15714

Method of evaluating the UV dose to airborne microorganisms transiting in-duct ultraviolet germicidal irradiation devices

(UV-C Biokit)
Complete test rig and components

- Microprocessor data management;
- High accuracy and precision in the measurement of air flow and volume;
- HEPA filters to remove the airborne microorganisms from the air stream;

Viable Multistage Cascade Impactor
Principle of operation

The human respiratory system tract is an aerodynamic classifying system for airborne particles.

The Viable Multistage Impactor (Andersen type), based on the particle inertial impaction principle, simulates the human respiratory tract (extrathoracic, tracheobronchial, alveolar). The micro holes in each of the 6 impactor planes act as nozzles that, in function of the diameter and impaction distance, let the collection of particles within a certain aerodynamic size range, with a characteristic efficiency impaction curve.

The specific design of the viable multistage impactor ensures the deposition of particles onto the impaction surface and lets bioaerosol viability by using a suitable collection media.

NIOSH Manual of Analytical Methods - 5 th Edition - Sampling and characterization of Bioaerosol - 2017

Particle nebulyzer
Cod : AC99-120-0000SP

- Generating Aerosol from all kinds of liquids, suspensions and solutions;
- Integrated pump (no compressed air required);
- Adjustable Nebulyzing and dilution air (dry) flow;

6 Stage impactor
Cod : AC99-120-0002SP

- Functioning principle: Inertial impaction;
- Required Flow: 28,3 l/min (1 CFM);
- Direct sampling on 90 mm petri plates;
- Made of corrosion resistant material.

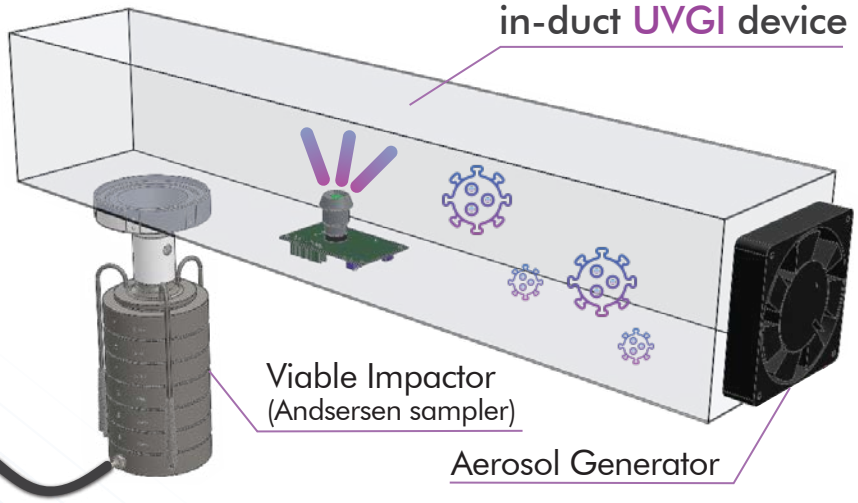
Irradiation aerosol Chamber
Cod : AC99-120-0009SP
(in-duct UVGI)

- Galvanized steel or aluminium
- Sampling port (Andersen impactor inlet)
- Microorganism injection port (aerosol generator inlet)
- Ventilation fan grid

Electronic Flow Control Sampler
Cod : AA99-000-0030SP [Bravo Basic H]
Cod : AA99-000-0740SP [Bravo X BIO]
(differential pressure)

- Automatic flow regulation;
- Flow range: 0.5 to 70 l/min
- Available models: Basic H or X-BIO
- HEPA filter (pump exhaust) included

Electronic flow Sampler



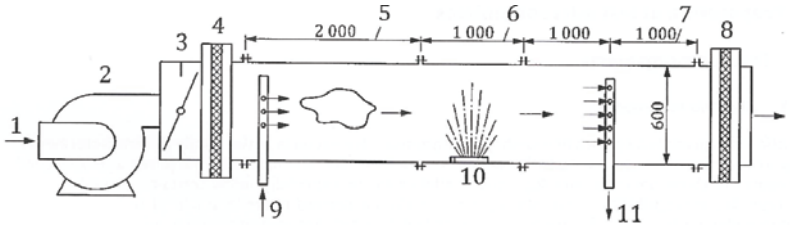
UV-C BioKit

The UV dose is the product of UV-C irradiance and specific exposure time on a given microoganism or surface.

The longer the time a microbe is expoed to UV light, the higher the UV dose it will receive. In a UVGI air disinfection device, the UV dose to every single microbe is different.

Therefore the average UV dose can be determined by the INACTIVATION RATE and a known microbial susceptibility.

Inactivation rate is expressed as N0/N (%) or log (N0/N) , where N is the active microorganism concentration, and N0 the original active microorganism concentration.

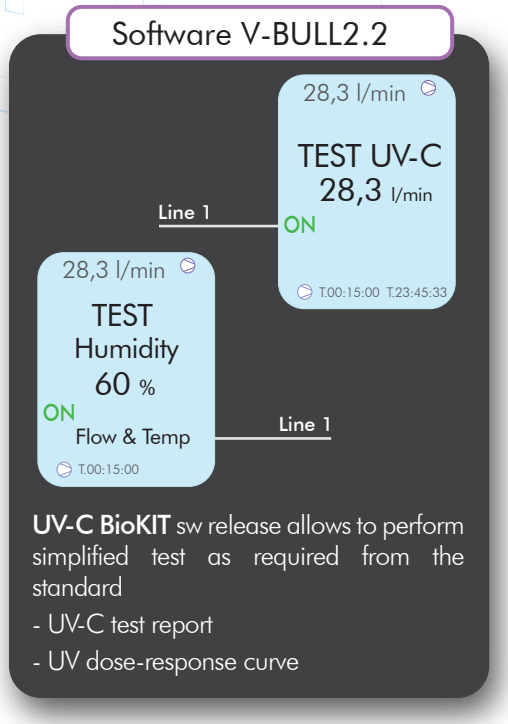


Irradiation chamber includes a blower, a damper, a HEPA filter before the duct, and upstream duct with test microorganism injection port , a UVGI device mounting duct, a downstream duct with sampling port an off-glass pipe with HEPA filter.

In order to perform a complete test, **UV-C BioKit** allows the measurements and control of air flow rates, air temperature, humidity and dilution concentration.

Test microorganisms have to be used for the test, like Serratia marcescens,Bacillus subtilis, Cladosporium Sphaerospermum Safety consideration about **UV-C** light and biological safety:

- ISO 15858:2016 specifies minimum human safety requirements for the use of **UV-C** lamp devices.
- All test microorganisms are in BSL-1 defined by the CDC "Biosafety in Microbiological and Biomedial Laboratories" (BMBL)



UV-C BioKIT sw release allows to perform simplified test as required from the standard

- UV-C test report
- UV dose-response curve

Results Reporting

- Start test date and time;
- Operator's name;
- Description of the UVGI Device;
- Description of the Test rig;
- Temperature and humidity;
- Airflow rate (m^3/h);
- Inactivation results with UV-C on and off;
- Calculation procedure;
- Summary - UVGI device performance;

REPORT ISO 15714

Date & time: 20-03-19 - 14:18
Operator: Name
UVGI device: Description
Test rig: Description
Humidity: 55%
Temperature: 25°C
Test Microorganism: Bacillus Subtilis
Lamp Power: watt ____
Air Flow Rate: 1000 m^3/h

UV-C Test

Q= 28,36 l/min | **ET**= 00:10:00
CFU/m3= $5*10^3$ | **V**= 280,36 l

References:

** Welch et al. Far-UVC light: A new tool to control the spread of airbornemediated microbial diseases. Sci. Report 8, Article number: 2752 (2018)

** Buonanno et al. Germicidal Efficacy and Mammalian Skin Safety of 222-nm UV Light. Radiat Res. 2017 Apr;187(4):483-491

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