

Advanced in vitro exposure systems



VITROCELL®
12/12 Plus

VITROCELL® 12/12 Plus Exposure Module

For up to 16 culture inserts (12-well size) and optional 24-well size



The VITROCELL® 12/12 Plus has been specifically designed and engineered for direct exposure studies of human-derived cell cultures at the air/liquid interface. It enables controlled exposure to airborne substances such as gases, complex mixtures, nanoparticles and fibers under physiologically relevant conditions.

The compact exposure module provides 16 compartments in a 4 x 4 layout, allowing simultaneous exposure to three dilutions of the test atmosphere and one clean-air control. Each exposure condition has four positions, accommodating up to four cell culture replicates.

Alternatively, the fourth position in each group can be used for integrated dosimetry, combining three cell culture replicates with one dosimetry position per exposure condition. Depending on

the application, this position can be equipped with a Quartz Crystal Microbalance (QCM), a TEM Grid Holder or a stainless-steel Dosimetry Insert for aerosol trapping in liquids. This flexible configuration allows cell exposure and dosimetric assessment to be performed simultaneously within the same module.

The robust base module is made of electropolished stainless steel and is fully autoclavable at 121 °C / 250 °F for 20 minutes. Electronic temperature control maintains a constant module temperature throughout the exposure process.

Dedicated adaptor sets accommodate 12-well and 24-well sized cell culture inserts. Combining flexible insert compatibility with a choice of additional replicates or integrated dosimetry, the VITROCELL® 12/12 Plus supports reproducible dose-response studies in a compact format.

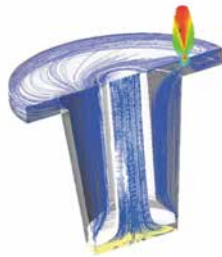
Aerosol exposure top

Special sealing technology and connection mechanisms ensure a hermetic seal between the base module and the aerosol exposure top.

The aerosol flow is guided towards the cell culture inserts through specially shaped inlets with hyperboloid geometry. The inlets are available in stainless steel or stainless steel with a Diamond Finish surface treatment to minimize aerosol adhesion. They are specifically designed for applications involving aerosols containing nanoparticles.

The aerosol inlets are connected to the dilution and distribution system. A vacuum pump draws a controlled sample flow through the exposure module, with VITROCELL® calibration valves used to adjust the flow rates.

The aerosol exposure top is made of high-quality anodized aluminum and features inlet and outlet connections for a temperature-controlled water circuit. This allows its temperature to be matched to that of the base module.



Direct exposure at the air/liquid interface

VITROCELL® exposure systems have been specifically designed and engineered for direct exposure of mammalian cells and tissues at the air/liquid interface. Cell cultures grown on microporous membranes are supplied with culture medium from below, while their apical surface is exposed directly to the test atmosphere. This approach reflects physiologically relevant inhalation exposure conditions more closely than submerged exposure.



Adaptor sets

The universal module accommodates cell culture inserts using optional adaptor sets for:

- 12-well sized inserts
- 24-well sized inserts

All commercial insert brands are supported in these formats.

Features

- 16 positions in a 4 x 4 layout for three test atmosphere dilutions and one clean-air control
- Up to four cell culture replicates per exposure condition, or three replicates plus one integrated dosimetry position
- Suitable for **COSTAR®**, **FALCON®**, **ThinCert®** and **cellIQART** 12-well or 24-well sized cell culture inserts
- Autoclavable main components
- Base module made of electropolished stainless steel for high durability
- Electronic temperature control
- Base module and aerosol exposure top with integrated heating circuits
- Hyperboloid inlet geometry for optimized particle deposition

Dosimetry Method 1 | Liquid Trapping

Stainless Steel Inserts

Liquid trapping of aerosol constituents, whether particles or gases, is one of the most established methods to determine the delivered dose. It is an easy and hands-on approach to dosimetry, and can be used in every VITROCELL® exposition system. So maybe this is all you really want?

The inserts come in every size there is, from 6-well up to 96-well. Typical trapping fluids are water, phosphate-buffered saline (PBS) or dimethyl sulfoxide (DMSO). After exposition,

different types of subsequent chemical or spectrometric analysis can be performed on the collected sample.

Additionally, VITROCELL® offers Kits for fluorescence spectrometry or Free Glycerol evaluation.



Dosimetry Method 2 | Deposited Mass

sQCM 12

Whenever you need to determine the exact delivered dose to your cell culture, VITROCELL® QCM-Technology should be your choice.

Our sensors are placed right where the aerosol deposits the cell surfaces, mimicking nearly every aspect of a regular insert. Thus, their readout can be directly used as delivered dose to your cells, linearly spanning five decades of dosis ($10 \text{ ng/cm}^2 \dots >100 \text{ } \mu\text{g/cm}^2$).

Our sQCM 12 fits into 12-well compartments. It has been re-designed for maximum ease of use, allowing easy assembly and cleaning.

Furthermore, the sQCM 12 can be used for 24-well setups as well.



VITROCELL® 12/12 Docking Station

Easy connection to distribution and dilution systems



VITROCELL® 12/12 incl. rack, docking station, quick-connect system, distribution/dilution systems and vacuum valves.



Vitrocell 12/12 Base Module



VITROCELL® 12/12 quick connect system replaces the mounting of tubing material.

Features

- Complete rack system for fixation of components
- Docking station with sliding base for fast and safe connections
- Quick-connect system for distribution system

VITROCELL® 12/12 Climatic Chamber

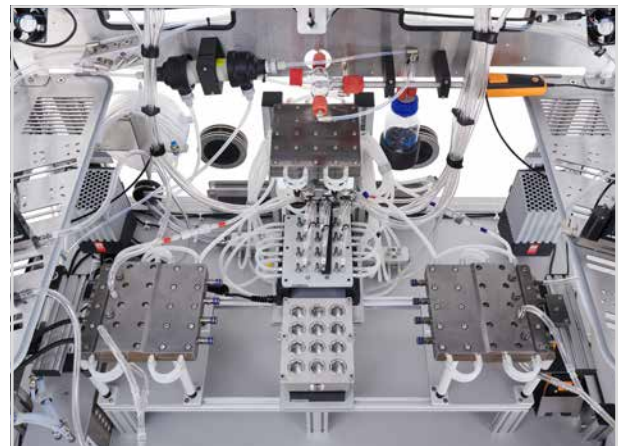
The professional solution to avoid condensation during the exposure to liquid aerosols



System includes rack, docking station, quick-connect system, dilution systems and optional flow controllers for dilution air.



Easy access to all components.



Components can be separated with ease.

Features

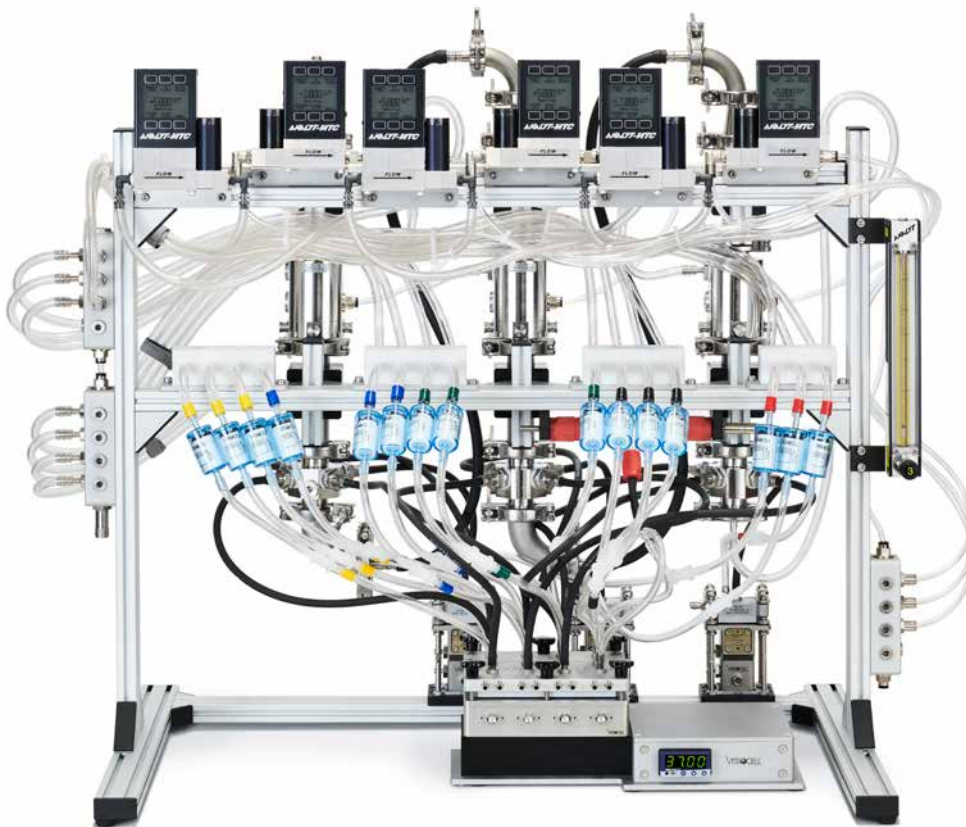
- Dimensions (L x W x H): 1 280 x 900 x 870 (open 1 350) mm
- Supplied with dynamic double-jet dilution system for 4 dilutions with 3 replicates
- Integrated aerosol distribution system made of stainless steel/VITROGLIDE surface
- Climatic Chamber with temperature monitoring
- Unique quick-connect system for easier handling

VITROCELL® 12/12 Isokinetic Sampling System

For uniform particle distribution – optional dilution systems

Compact Design

3 doses @ 3 replicates
1 control @ 3 replicates

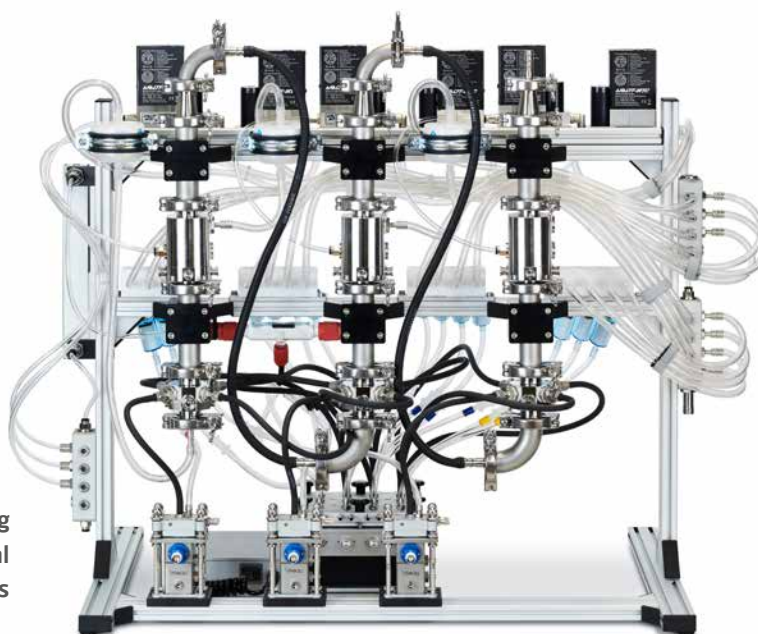


Rack with Isokinetic Sampling and Dilution System and optional Microbalance Modules

The aerosol is guided from the central duct to the modules via isokinetic sampling probes enabling high reproducibility and uniformity of results.

The inlets aspirate directly from the constant flow of test substance. The isokinetic distribution system is made of stainless steel.

The optional dilution systems are equipped with air jets for dynamic dilution to obtain different dose / response results per row @ 3 replicates.



Back view – Isokinetic Sampling and Dilution System and optional Microbalance Modules



Small flange connections for easy disassembly and cleaning.



Isokinetic Sampling probes made of stainless steel.



Dynamic dilution system with air jets featuring a constant flow rate over the entire system.



The optional microbalance sensor is capable of measuring the deposited mass in separate VITROCELL® 12/1 Modules at a resolution of 10 nanogram/cm² per second.



VITROCELL® Flow Monitor Software

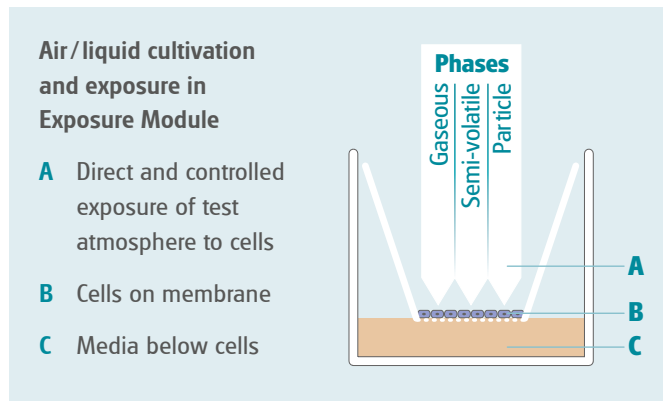
Integration of the controllers into the VITROCELL® Monitor Software for easy setting of target flows and reporting of actual flows.

Features

- Distribution from the source of the test substances to the module inlets
- High reproducibility
- Optional dynamic dilution system

VITROCELL® Exposure Systems for Inhalation Toxicology

Direct Exposure Technology at Air/Liquid Interface



In response to the scientific need to expose in physiologically relevant conditions, VITROCELL® exposure modules have been specifically designed and engineered to enable direct exposure of mammalian cells or tissue at the Air/Liquid Interface where the cell systems are not covered with culture medium.

Researchers can thus use all cell types cultivated on microporous membranes.

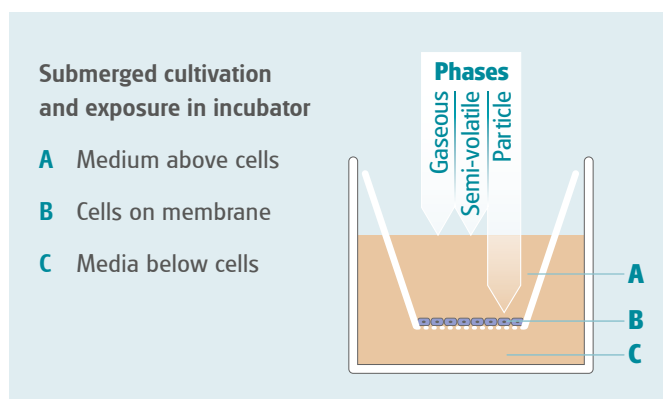
This approach allows for more credible and authentic results than by submerged exposure due to a closer replication of the human physiology.

The advantages

- No losses
- No dissolution
- No reaction of constituents with culture medium
- High sensitivity



Disadvantages of submerged exposure



The exposure of mammalian cells or tissues to airborne substances is frequently performed under submerged conditions. In doing so, the test substances are dosed into the culture medium. This procedure results in an undesired interaction of the formerly airborne substances with the medium, causing limitations for authentic analysis.

Therefore VITROCELL® recommends the air/liquid interface exposure technology.

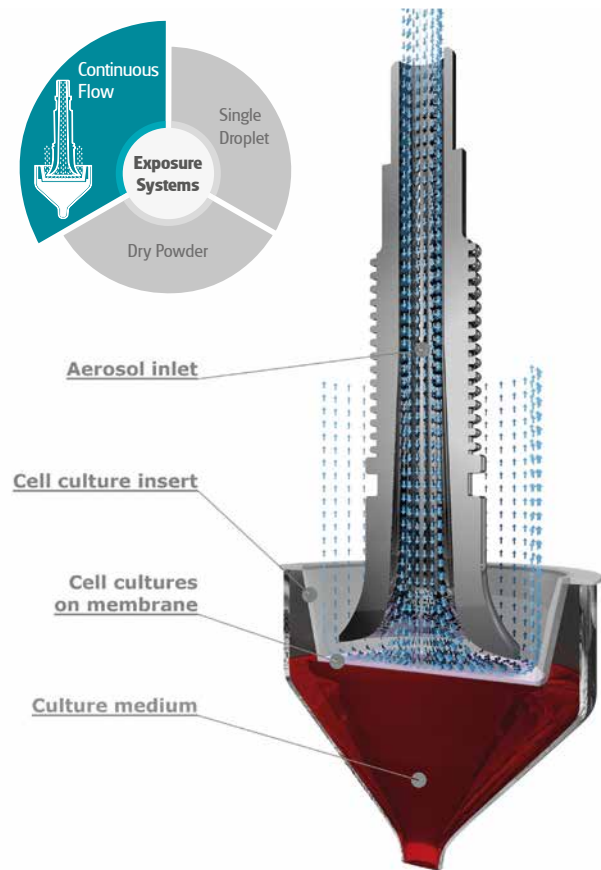
Exposure Principle

Continuous Flow Exposure

When using the Continuous Flow Exposure Systems, cell cultures are exposed to a continuous flow of gases, complex mixtures or particles. Only this exposure principle is suitable for aerosols containing a gas and particle phase.

The advantage of this method is a longer exposure duration. In the VITROCELL® standard systems exposure durations are normally up to 6 hours, whereas the VITROCELL® Automated Exposure Stations make exposures for 24 hours possible.

Continuous Flow Exposure is used for gases, chemicals or materials which are available in larger quantities (several g) under a constant delivery. When scarce and very expensive materials need to be tested, this method is less suitable. We recommend in these cases Single Droplet Sedimentation or Dry Powder Systems.



Main application areas



- Gases and complex mixtures
- Chemicals and nanoparticles
- Environmental atmospheres
- Combustion and e-cigarettes

Continuous Flow Exposure Systems



Flow 4



12/12 Plus



48 Plus



AirTox Monitor

About VITROCELL®

VITROCELL® exclusively concentrates on the developing, producing, installing, training and servicing of advanced *in vitro* exposure systems.

The VITROCELL® Systems' team is driven by their vision for new in-vitro standards through state-of-the-art technology, highly qualified workmanship and absolute client dedication. VITROCELL® has successfully collaborated with clients from leading research institutes, contract research organizations, regulatory authorities or industrial laboratories across the world. Working with our team experts, all modules have been tailored to create durable and complete turnkey-systems for *in vitro* inhalation toxicology. Gases, environmental atmospheres, nano particles and complex mixtures are analyzed on lung cells at the air/liquid interface using these systems. VITROCELL® technologies are also applicable to solutions for skin research.

Over a decade of devotion to research in this specific field has given our team of design & precision manufacturing specialists the opportunity to mentor highly diversified and complex projects from conception to completion. We strive to become a constructive member of each research team, providing support when it is needed, advice when it is required and modules of the highest quality, which are even polished by hand before leaving here to be integrated into your workspace. Every piece of our German engineered equipment is manufactured to the highest of standards – yours.

For more information please scan the QR-Code:



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