

Advanced in vitro exposure systems

VITROCELL® 6 Exposure Systems



VITROCELL® Exposure Systems for Inhalation Toxicology

In vitro characterization of the effects of airborne substances

When you require a specific solution for your *in vitro* studies in the field of inhalation toxicology, talk to us with confidence. We have over a decade of experience in designing, producing and installing customized exposure systems specifically for your research needs.

VITROCELL® equipment offers you flexible solutions using biological systems for the accurate analysis of these airborne substances:

- Gases
- Complex mixtures
- Nanoparticles
- Fibers

Application Areas

- Combustion exhaust
- Cosmetics
- Household chemicals
- Indoor / outdoor air analysis
- Viruses
- Industrial chemicals
- Pesticides
- Pharmaceuticals
- Tobacco smoke (whole smoke and gas phase)
- E-cigarette aerosols

Direct Exposure Technology at Air/Liquid Interface

Primary cultures and cell lines, e.g. from the respiratory tract, can be observed in modules specifically designed for direct contact between cells and components of the test atmosphere at the air/liquid interface.

Features

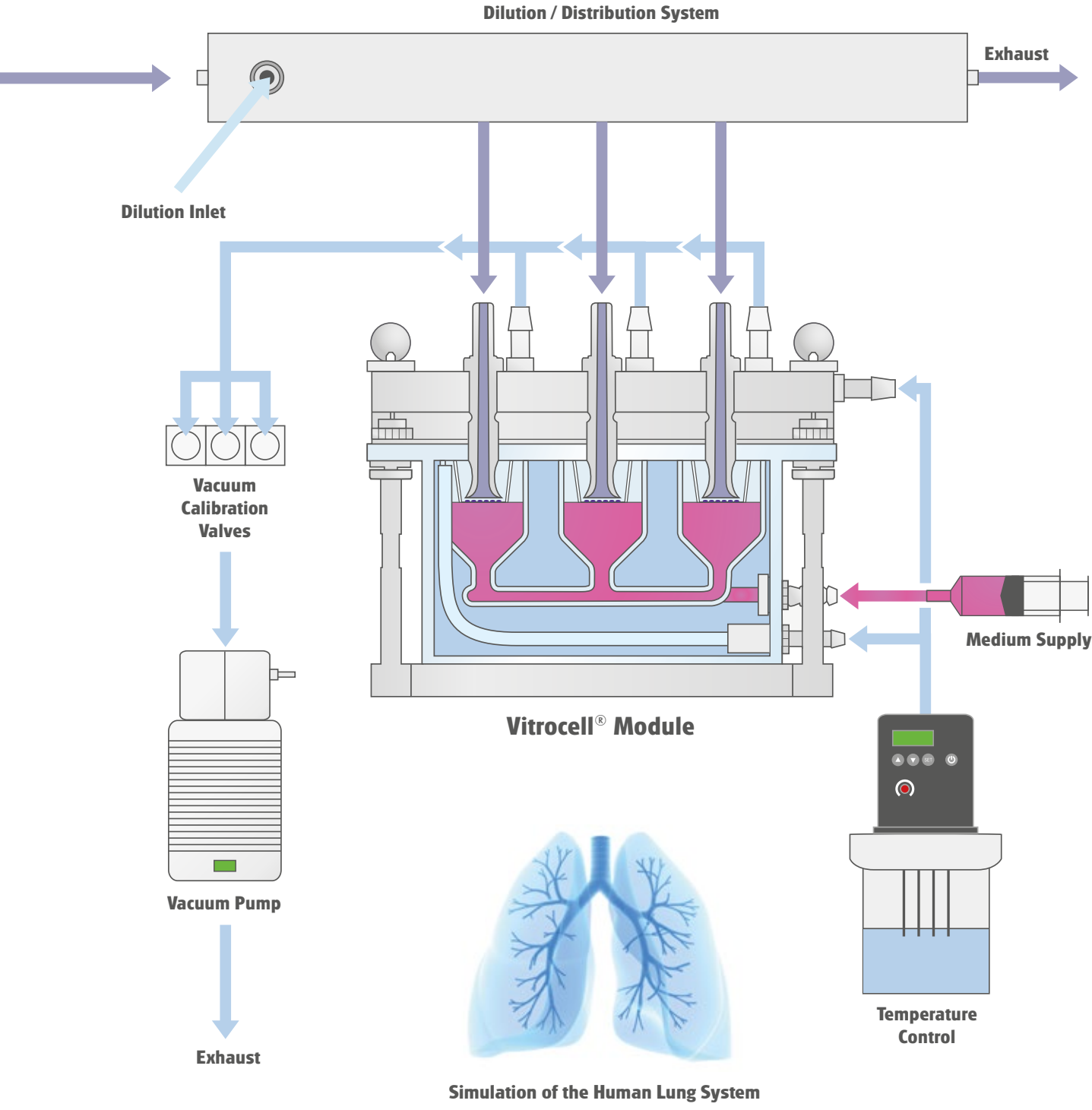
- Direct exposure to monolayer cell cultures, tissue constructs, suspension cells or bacteria
- Dose-dependent results
- Highest levels of design and manufacturing quality
- Tailor-made solutions
- Installation and application support





In vitro Inhalation Toxicology

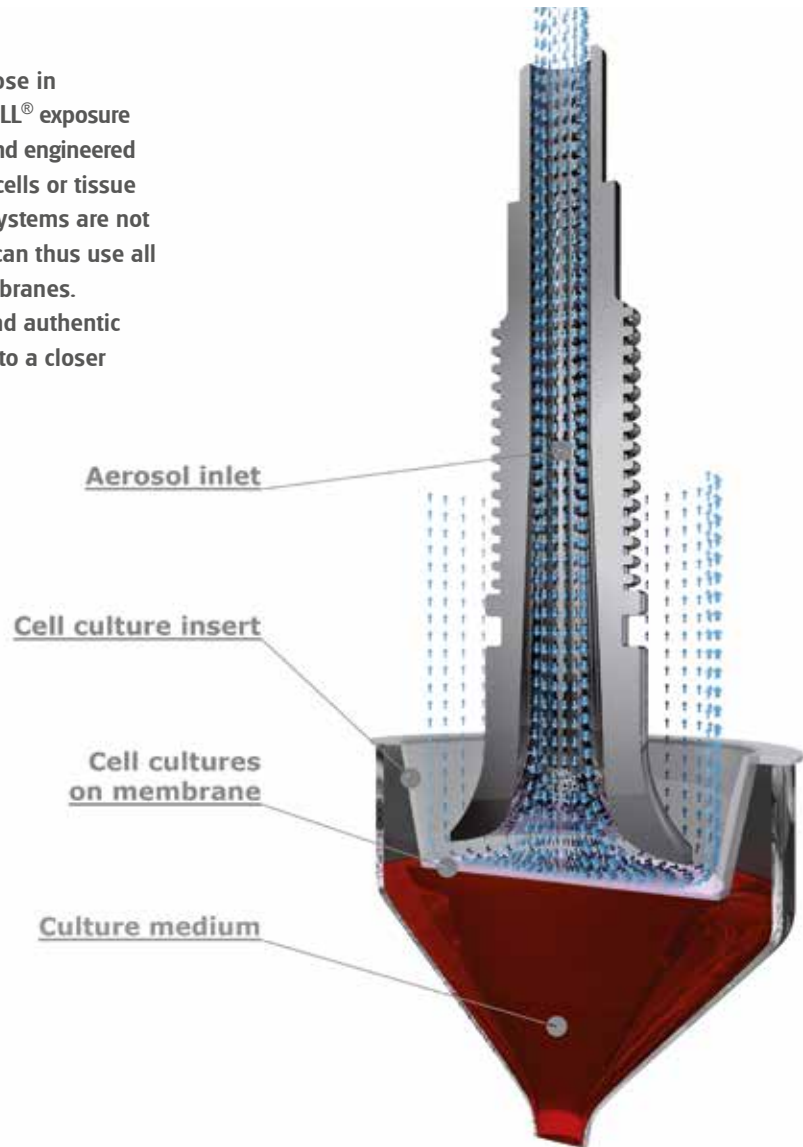
A typical system flow chart



VITROCELL[®] Exposure Systems for Inhalation Toxicology

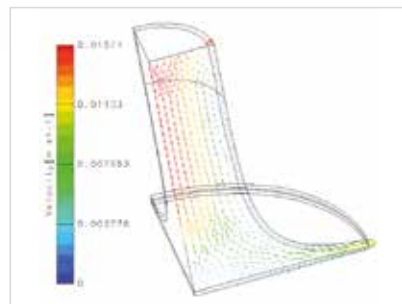
Direct Exposure Technology at Air/Liquid Interface

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 media. 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 media
- High sensitivity



Optimized
flow dynamics



VITROCELL® EXPOSURE AT THE AIR/LIQUID INTERFACE

Submerged Cultivation and Exposure in Incubator

- A** Media above cells
- B** Cells on membrane
- C** Media below cells

Interaction of test components with culture media

Low sensitivity

Suspension Cultivation and Exposure in Incubator

- A** Cells in media

Interaction of test components with culture media

Low sensitivity

Air / Liquid Cultivation and Exposure in Exposure Module

- A** Direct and controlled exposure of test atmosphere to cells
- B** Cells on membrane
- C** Media below cells

No losses
No reaction of principle components with culture media

High sensitivity of system

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 media. This procedure results in an undesired interaction of the formerly airborne substances with the media, causing limitations for authentic analysis. Therefore VITROCELL® recommends the air/liquid interface exposure technology.



System Options for 6-well insert sizes

VITROCELL® 6 system setup with a number of different module options



A

VITROCELL® 6/4 CF and 6/3 CF

In one module 4 compartments are used for exposure to the substances and in another module 3 compartments for clean air control.

1–4 compartments of the exposure module may be equipped with Quartz Crystal Microbalance sensors for validation or monitoring purposes.

B



VITROCELL® 6/3 CF

In this configuration 2 VITROCELL® 6/3 CF modules are used: One module houses 3 compartments for exposure, a second VITROCELL® 6/3 module takes care with its 3 compartments for clean air control.

C



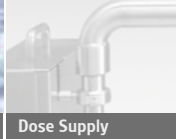
VITROCELL® 6/6

In this configuration there is the option to assess 3 different doses @ 3 replicates plus one row of compartments @ 3 replicates for clean air control. One compartment for

each row for exposure may be equipped with a Quartz Crystal Microbalance sensors for validation or monitoring purposes.



Exposure Systems



Dose Supply



Dilution



Racks & Carts



Dose Monitoring



Skin Exposure



Auxiliary Equipment

Delivery Content

1



Vacuum Pump

The vacuum diaphragm pumps supplied by VITROCELL® have been developed and manufactured to be chemically resistant. Thus, they are suitable for aggressive or corrosive gases and vapors alike.

The dry-running devices are specifically developed for laboratory applications and are maintenance-free. The pump exhaust line must be guided to a laboratory hood for proper extraction.

2



Vacuum Calibration Valve

VITROCELL® flow calibration valves regulate the flow of the aerosol through the modules in the ml range. The valves are located between the vacuum pump and the aerosol exposure top. Mass flow meters enable accurate valve read-outs. The consistent and adjustable flow rate ranges from 0...20 ml/min.

Alternative flow rate ranges are available upon request. The valves enable fast control of the flow rates prior to the experiment. They are manufactured from Teflon/stainless steel and can be easily cleaned. If the aerosol contains particles, we recommend installing disposable microfiber filters in front of the valves.

3



Flow Meter

Mass flow meters are required to adjust the vacuum flow by means of vacuum calibration valves and to

accurately set dilution and aerosol generator air flows. They are available in various ranges.

4



Flow Controller

Mass flow controllers have been specifically designed to regulate dilution and aerosol generator airflow precisely.

They are available various l/min. ranges.

5



Water Bath

VITROCELL® uses water baths to efficiently heat and pump water through the circuit of the exposure modules, ensuring accuracy in temperature control with a modern state-of-the-art design. These units provide best-in-class economical performance while

remaining user-friendly by reducing unnecessary functions and focusing on reliability. Engineered from highest-quality components and materials, such as stainless steel for the baths, durable heating thermostats with a long operation life are guaranteed.

6

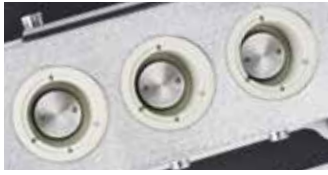


Option: Quartz Crystal Microbalance Sensor System

VITROCELL® Microbalance Sensor – optimal for dose-response measurement. With the advanced VITROCELL®

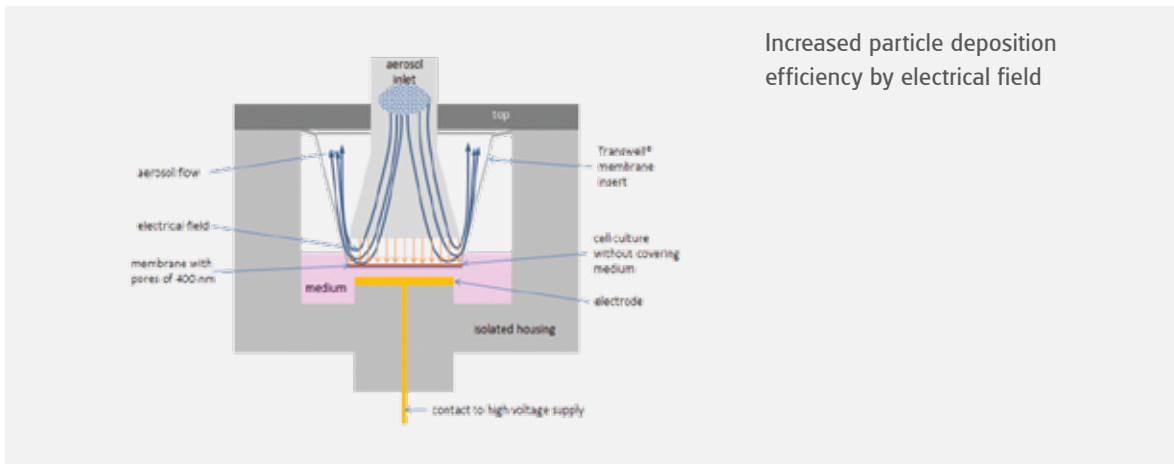
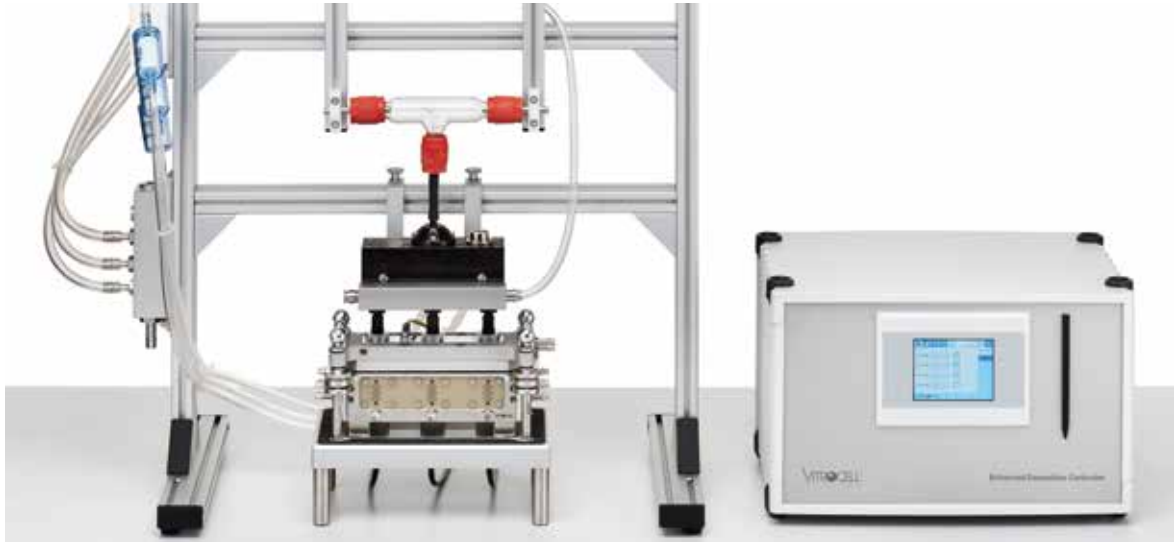
software, deposition data in ng/cm² is attainable online.

7



Option: High voltage charging for enhanced particle deposition

The VITROCELL® 6/3, 6/4 and 6/6 CF modules can be equipped with electrodes for high voltage charging to increase particle deposition efficiency significantly.



Features

- Suitable for **COSTAR®**, **FALCON®** and **ThinCert®** 6-well sized cell culture inserts
- Adaptors for 12 and 24-well sized inserts
- Individual media inlets and outlets for each cell culture insert compartment
- Special inlet geometry of the aerosol exposure top for optimal particle deposition
- Inlets made of stainless steel with a unique **VITROGLIDE** surface treatment
- Base module made of electropolished stainless steel
- Base module and aerosol exposure top with integrated water heating circuit
- Control window for monitoring culture media levels
- Autoclavability of all components
- Suitable for **VITROCELL®** Quartz Crystal Microbalance

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.

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