

VITROCELL® Shisha Testing System for Cell Cultures

For *in vitro* testing of water pipe tobacco at the air / liquid interface

Background

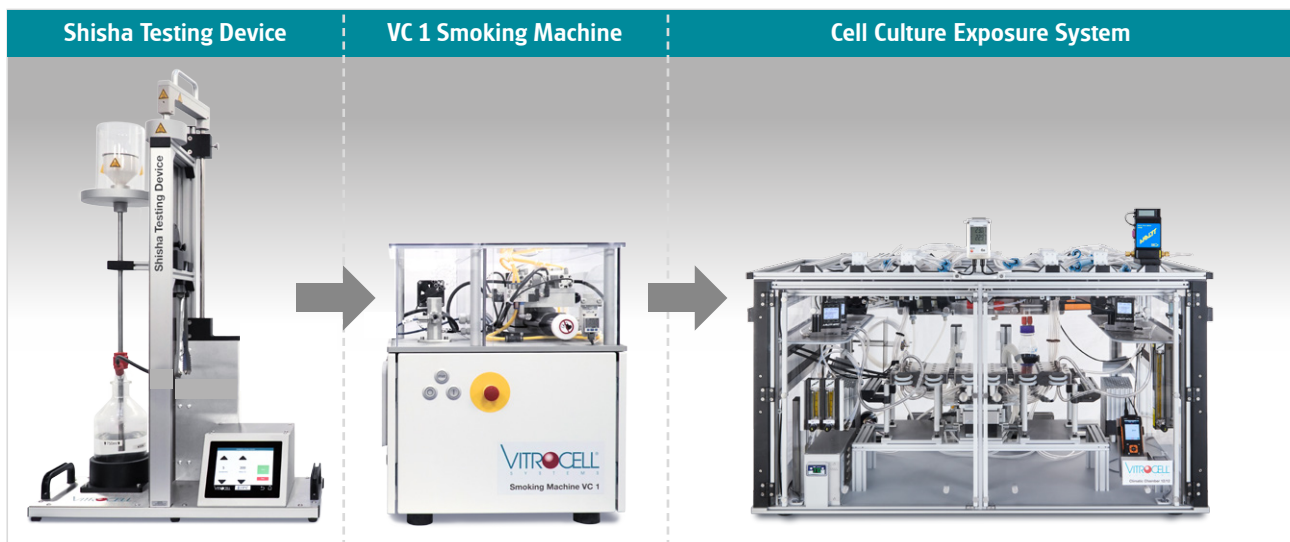
Emissions of water pipe tobacco can now be tested by *in vitro* exposure in a reliable and user-friendly setup. The novel Shisha Testing Device can be combined with any VITROCELL® Exposure System.

The same setup can also be expanded for chemical analysis of Shisha emissions.

Solution

The Shisha Testing System consists of the following components:

1. Shisha Testing Device
2. VC 1 Smoking Machine
3. Cell Culture Exposure System



Shisha Testing System with e. g. a VC 12/12 Climatic Chamber Exposure System

Key Features:

- Puff duration: $2.6\text{ s} \pm 0.1\text{ s}$
- Puff volume: $530\text{ ml} \pm 10\text{ ml}$
- Puff frequency: $20\text{ s} \pm 0.5\text{ s}$
- Square puff profile
- Electrical heating: $280\text{ }^\circ\text{C} \pm 10\text{ }^\circ\text{C}$
- Versatile Smoking Machine
- User-friendly temperature control unit
- Suitable for chemical and biological testing

1. Shisha Testing Device

The device follows the specifications of ISO 22486. The system can be operated with charcoal or via electrical heating. The water pipe tobacco holder is made of ceramics and holds approx. 25 ml of tobacco.

The electrical heating is precision-controlled in the range of 280 ± 10 °C. Alternatively a charcoal operation is possible.

The Shisha testing device comes with a set of useful tools for user-friendly operation.



Integrated electrical heating device



Heating via charcoal



Controller for heating with touchscreen display



Tools for user-friendly operation.

2. VC 1 Smoking Machine

All parameters for smoking such as puff volume, frequency, puff duration and puff profiles are set according to

ISO 22486 in the controls of the manual smoking machine VC 1. This device is specifically designed to fulfill the requirements of in vitro experiments and analytical testing.

The machine is also suitable for conventional and electronic cigarettes. For this purpose it can be equipped with different cylinder sizes (200, 300 and 600 ml) without compromising the accuracy of the puff profile. The conversion procedure to the higher/smaller cylinder size is possible within less than 10 minutes.

This makes the investment very versatile as testing of all combustion



cigarettes, cigars, ENDS (Electronic Nicotine Delivery Systems) as well as HTP's (Heated Tobacco Products) is possible with only one machine.



3. Cell Culture Exposure System for the Air/Liquid Interface

In response to the scientific need to expose in physiologically relevant conditions, VITROCELL® Exposure devices have been specifically designed to enable direct exposure of mammalian cells or tissue at the Air/Liquid Interface.

Here the cell cultures are not covered with media as opposed to submerged

conditions - which cause an undesired interaction of the formerly airborne substances with the culture media.

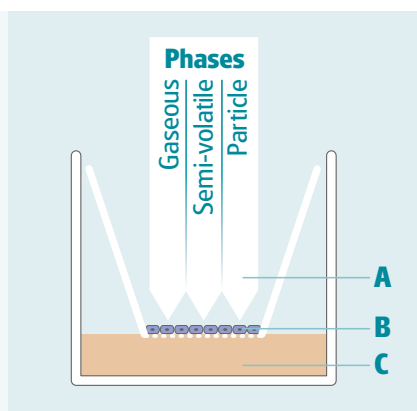
Cell systems cultivated on membrane inserts are exposed at the Air/Liquid Interface (ALI) so that the test substances are received directly. This approach allows for more credible and authentic

results than by submerged exposure due to a closer replication of the human physiology.

The VITROCELL® product range covers a wide range of solutions for exposure from 6 to 56 cell culture inserts in different dilution steps.

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



Direct Exposure Technology at Air/Liquid Interface

1. Aerosol inlet
2. Cell culture insert
3. Cell cultures on membrane
4. Culture medium

