

TSE OptoPan



for aerosol assessment during inhalation studies

OptoPan

A new photometric Particle Analyzer for inhalation toxicology monitoring physio-logical size fractions

The measuring principle of the OptoPan (optical particle analyzer) is a combination of inertial classification and concentration enrichment using a virtual impactor, filter sampling and aerosol photometry. It is a compact and easy to use instrument. Using only one sampling head, OptoPan collects and monitors three size ranges important for the analysis of aerosol deposition in the lung of the animals.

OptoPan monitors therefore simultaneously five health related size fractions of the aerosol. Three of these are measured directly.

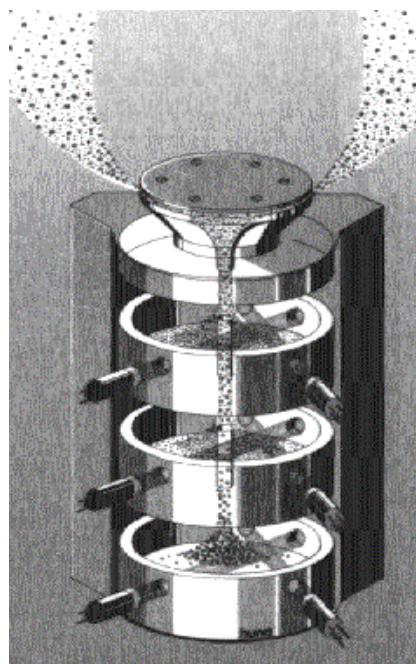
The three size fractions are:

- **inhalable:** representing the aerosol fraction that enters the nose and/or mouth during breathing (50% cut-point at $100\mu\text{m}$).
- **thoracic:** representing the subfraction of inhalable aerosol that penetrates into the respiration tract below the (50% cut-point at $10\mu\text{m}$).
- **respirable:** representing the subfraction of inhalable aerosol that penetrates to the alveolar region of the lung. (50% cut-point at $4\mu\text{m}$.)

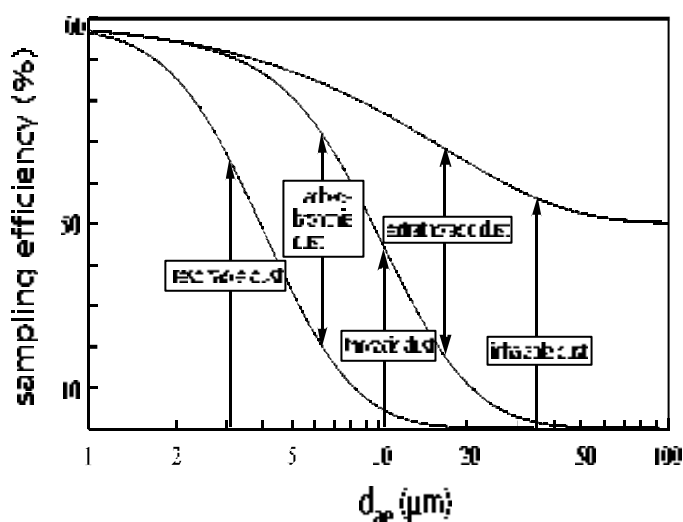
Two additional fractions are derived from the above.

- extrathoracic fraction
- tracheobronchial fraction

OptoPan has been specially designed for use in inhalation toxicology in order to analyze aerosols generated online for a better toxicological evaluation of any possible hazard or substance. The evaluation design is in conformity with requirements of international standards.



Working principle of the OptoPan particle analyzer



Sampling conventions according to EN 481

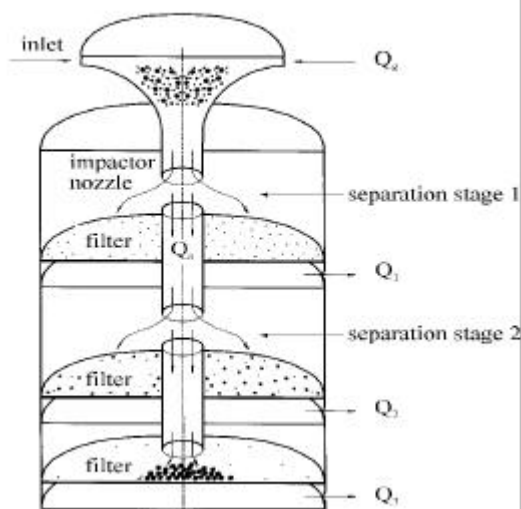
Principles of Measurement

The OptoPan consists of a two stage, virtual impactor which, together with filters, are in a symmetrical-rotation, concentric configuration. The airborne particles are drawn in through a ring gap and into the OptoPan via a 3 stage flow divider. Coarse particles pass straight through to the lower collector while other particles are aerodynamically separated. Particles of smaller diameter follow flow paths and are distributed into channels according to their flow characteristics. The first virtual impactor stage separates out the respirable fraction with a separation diameter of 4 μm . The second stage addresses the thoracic fraction with a separation diameter of 10 μm . Both these fractions are separated out through the re-directed air streams and the concentrically arranged filters. The coarse particles with an aerodynamic particle diameter larger than 10 μm are to be found on the last filter.

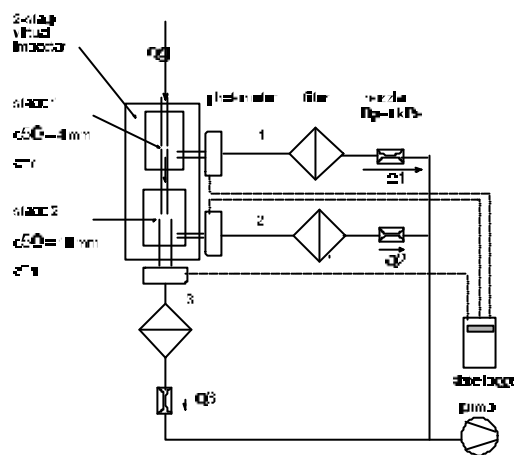
The aerosol fractions passing the 3 stages are measured by scattered light photometers continuously and simultaneously. Photometer 1 measures the respirable fraction. Photometer 2 and 3 measures the coarse dust fractions enriched by the factors 7 and 28. This enrichment increases the sensitivity of the photometers concerning coarse dust.

Special benefits

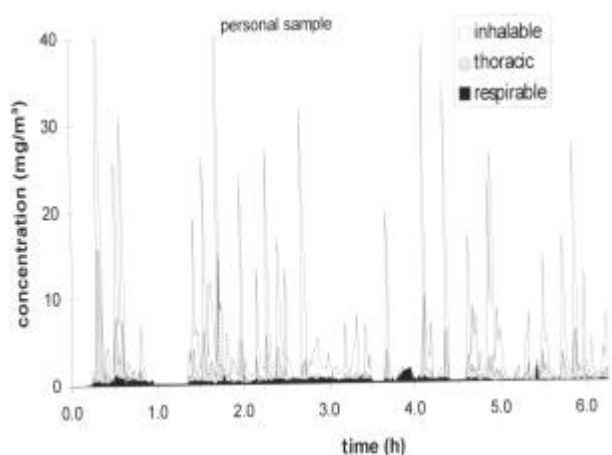
- flexible use in inhalation studies
- meets international standards like EN 481, COSHH and others
- Permits dust components analysis
- measurements of average concentrations and monitoring of temporal variations of mass concentration
- compact instrument for easy use
- provides conversion factors to transform the photometer signals into mass concentration for each fraction.
- low consumption costs.



OptoPan: Longitudinal Section



Scheme of OptoPan



Measurements in a bakery

Application

- dust sampling
- toxicological evaluation of aerosols
- adaptable to all inhalation systems and their designs
- control measurements
- area sampling and monitoring

Components of OptoPan

- 2-stage virtual cascade impactor (base unit)
- Data logger
- Software
- Filter cassettes
- Consumables, filters, accessoires

Portable Datalogger

- 8 measuring channels:, three to be used by OptoPan; 5 or up to 8 channels free for other sensors
- measuring ranges: +/- 1V , +/- 5V, +/- 10 V , each channel
- Option. 0-20mA
- Resolution: 0,01% each channel
- Display: LED-display
- Internal memory: 512 KB for data storage
- Extensive software package: for data transfer, storing and pre-processing onto the datalogger, data processing via notebook or personal computer
- On-line monitoring via datalogger to PC or notebook
- Interface: RS 232
- Powersupply: On the mains 230 V/ 50/60 Hz
- Rechargeable accu-bloc, operation time via accu approx. 12 hours.
- Accessoires: Set cables, software

Sensor and Sampling Module

- Mantle
- Three filtersupports to insert three filter with glasfibre or membranfilter 37mm size
- Sampling head
- Three photometric dustsensors
- Signal output voltage: 0-4 V each sensor
- Measuring range: 0-250mg/m³ using mineral dust (SAE fine fraction)
- Lower detection limit 0,1 mg/m³
- Laser diode 780nm, 5mW;
- Receiver: Siliciumphotodiode
- Data processing, averaging, storing of the three output signals via portable Datalogger

Sampling pump requirements:

- operation time: min 8 hours battery power
- flow rate: 3,5 l/min, adjustable,
- pressure drop: 4,5 kpa

consumables, accessoires

Technical changes reserved

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