TSE
Technical & Scientific
Equipment GmbH

TSE Impactors

for aerosol assessment during inhalation studies

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1. Introduction

As essential tools in inhalation studies cascade impactors serve to evaluate the particle size distribution of the aerosol generated in inhalation systems. In addition they are used in aerosol research or environmental monitoring.

Beside aerosol concentration the particle size distribution is the second important „aerosol parameter“ to be analyzed during inhalation exposure studies. Generally small particles are more effective than larger ones. Generating small particles for maximum deposition in the lung is therefore critical (Tillery et al., 1976). Our impactors are available in a wide range of specifications and designs. All features necessary to perform and evaluate your experiments according to the requirements of authorities (e.g. the OECD) regarding particle characterization are included.

The design of TSE impactors is based on fundamental physical principles. Basically the aerodynamic particle size is determined via inertial impaction. Sampled masses are weighed directly without influences generated by statistical or other processing steps before getting the data.

Compared to optical methods cascade impactors come as low cost instruments for single or multi point measurements during inhalation studies

TSE impactors are precision engineered. Highest demands are paid on each individual impactor via comprehensive checks during and after the production.

Note: OptoPan (virtual impactor) and **SpectroPan** (Laser particle analyzer) are optical instruments for the real-time assessment of the particle size distribution. Please ask for further information.

2. Working Principle

Inside the impactor the aerosol is drawn from stage to stage - each stage providing progressively smaller jets.

The figure below schematically illustrates the technical design of our standard impactors.

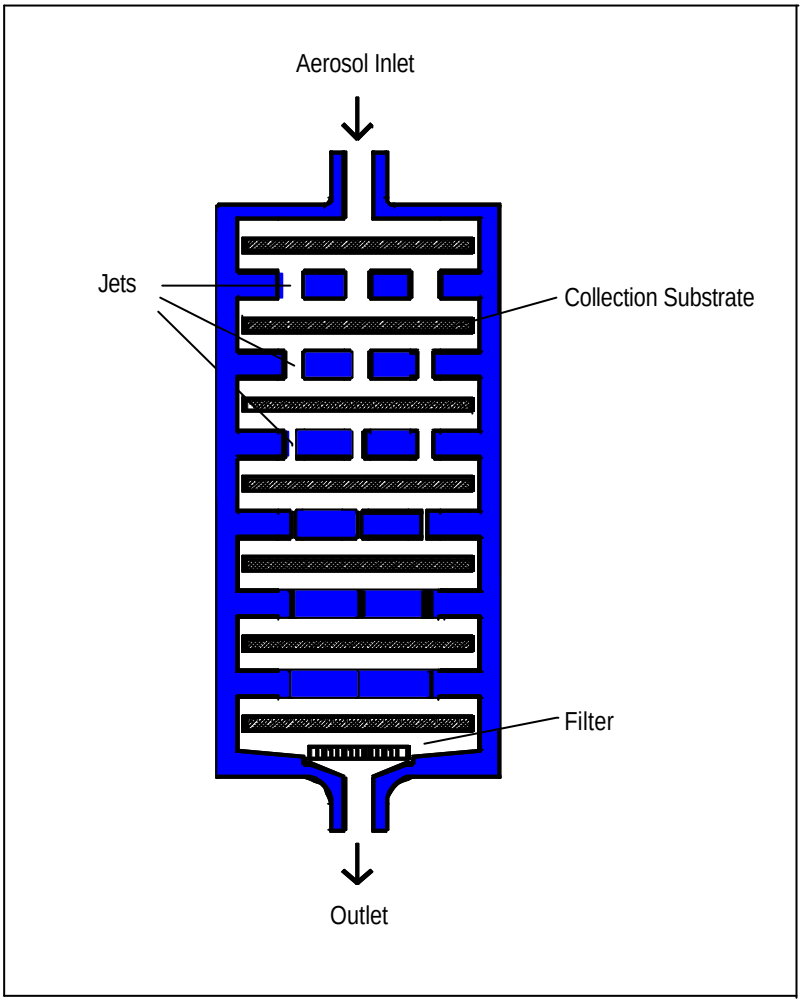

Figure 1: TSE Standard Impactor

Progressively smaller jets result in progressing jet speeds of the aerosol at each impactor stage. This leads to successively smaller particles to be collected. After the final stage a filter collects all particles left in the aerosol.

A collection surface, the impaction plate, is placed close to the jet exit. The particles must make a right angle change of direction to reach the next stage. Otherwise they are impacted.

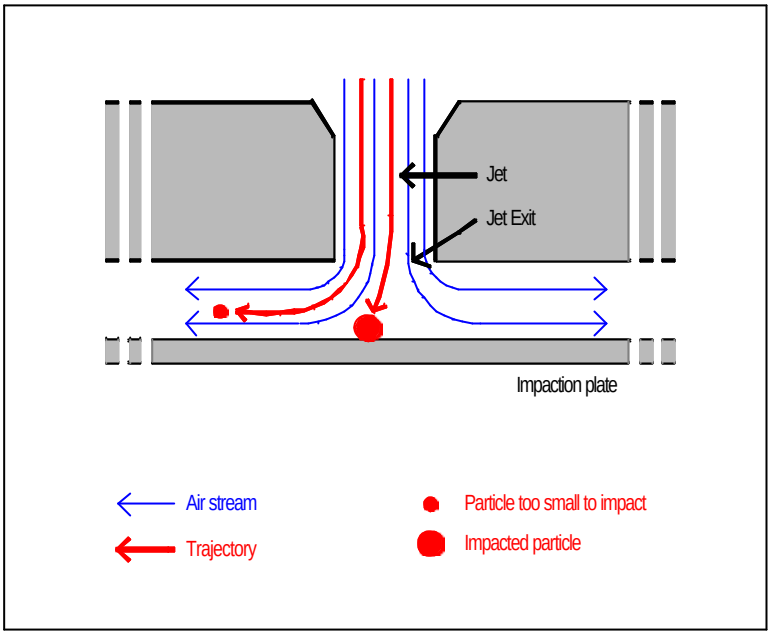

Figure 2: The principle of impaction

Aerodynamic diameter

Aerosol particles never meet the theoretical shape of a sphere. The aerodynamic diameter is an index of an irregular shaped particle compared to a reference particle of unit-density with the same impacting behavior. This includes that the aerodynamic diameter is defined by a particle´s size, shape and mass.

3. Impactor Designs

In Table 1 you find all standard impactors (7 stage impactors) provided. In addition following impactor designs are available.

Mercer Style

The Mercer Style Impactor is a single jet impactor that was primarily designed to sample highly radioactive aerosols. Tey are not designed to have optimum reynolds numbers. However, it has excellent predictable collection characteristics. The reduction in sample size was necessary to reduce the external radiation exposure to the technicians handling this type of instrument. This Mercer Style Impactors´ performance was used by Virgil Marple in the development of the model to establish the performance and criteria of the impactor design. Mercer Style Impactors are available with flow rates ranging form 100 cc/min through 5 l/min.

Multi-Jet Style

The Multi-Jet Cascade Impactor was designed follwing unsatisfactory results with commercially available impactors sampling approximately 25 l/min. This particular impactor was designed to have optimum flow reynolds numbers through each jet. This was accomplished by having different numbers of jets on each stage, all aimed towards having flow reynolds number of approximately 3,000. This particular impactor has very good collection characteristics and predictability. It fulfilled the requirements of the high flow rate impactor.

TSE Cascade Impactors		
Catalog No.	**Flow**	**E.C.D. ***
02-100	100 cc/min	3.0 to .3
02-102	250 cc/min	5.0 to .3
02-105	500 cc/min	5.0 to .25
02-130	1 l/min	4.5 to .3
02-133	1 l/min	3.5 to .3
02-135	1 l/min	2.0 to .4
02-140	2 l/min	5.0 to .25
02-150	2 l/min	6.0 to .6
02-160	2 l/min	12.0 to .6
02-170	5 l/min	8.0 to .15
02-180	5 l/min	5.0 to 0.3
02-182	5 l/min	8.0 to 0.5
02-183	5 l/min	10.0 to .3
02-185	5 l/min	10.0 to .5
02-200	10 l/min	8.0 to .5
02-210	10 l/min	10.0 to .5
02-220	15 l/min	8.0 to .5
02-230	15 l/min	10.0 to .5
02-240	20 l/min	8.0 to .5
02-250	20 l/min	10.0 to .5
02-260	20 l/min	11.2 to .66
02-270	25 l/min	8.0 to .5
02-280	25 l/min	10.0 to .5
02-280	28 l/min	9.2 to .5

Table 1: TSE Standard Cascade Impactors

* Effective Cutoff Diameter

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