Specifications

Nominal air flow	11 lpm
Particle size range	0.045-8.5 µm
Number of stages	12
Inlet	NW16 flange
Outlet	R 3/8 (NW16 flange)
Operation temperature	-15°C– 120°C, non-condensing cond.*
Weight	3.6 kg
Dimensions of the impactor	Ø 96 x 395 mm
Pump specifications	minimum 6 m^3/h at 135 mbar abs.
	recommended 7 m^3/h at 135 mbar abs.
Material	stainless steel

*) for other temperatures contact the manufacturer

Stage data (nominal, calibrated)

Stage	D50% [µm]
12	8.5
11	4.1
10	2.7
9	1.7
8	1.1
7	0.80
6	0.60
5	0.34
4	0.23
3	0.15
2	0.090
1	0.045

SDI measurements of the 1995 field season at Summit in Greenland.

Photo: Timo Mäkelä, FMI.

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SDI-10 - Small Deposit Area Impactor

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DEKATI
REAL-TIME PARTICLE MEASUREMENTS

Enhanced sensitivity for impactor collection using the SDI.

The Small Deposit Area Impactor (SDI) is a cascade impactor in the product group of Aerosol Instruments by Dekati Ltd.

Originally SDI was developed in the Finnish Meteorogical Institute (FMI) to collect size-fractionated aerosol samples in remote locations for subsequent chemical analysis by PIXE (Proton Induced X-ray Emission, see details in Maenhaut et al., 1996). SDI sampling times remain short even in background areas with low aerosol mass concentrations because of the relatively high flow rate of 11 lpm.

SDI design enables increased sensitivity of the impactor method. This has been achieved by optimizing the number of nozzles and the volume flow rate, while keeping the sample deposit diameter small and the size range sufficient for typical aerosol mass size distributions.

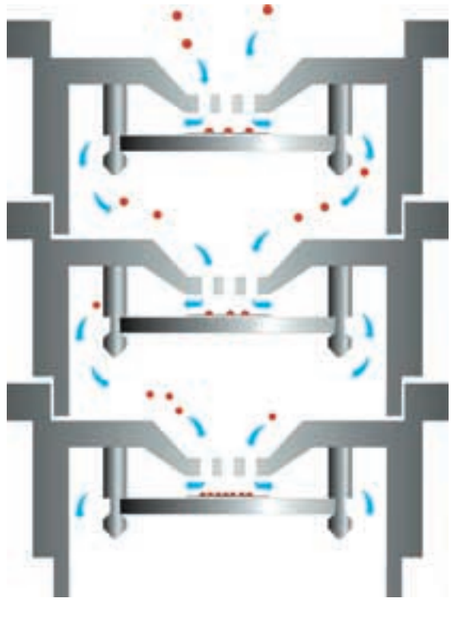
SDI is a low pressure impactor which separates particles into 12 size fractions from 45 nanometers up to 8.5 micrometers. The area in which particles are deposited is less than 8 mm in diameter. The small sample size is advantagenous if analytical methods which are sensitive to the deposit area will be used (PIXE, XRF).

The substrate holder is specially designed to fit the PIXE to make the analysis easier. The substrate holder favours contamination free and sensitive chemical analysis also using other methods. Analysis of inorganic ions or organic acids can be performed by ion chromatography with minimum risk of contamination.

Operating principle

SDI is a cascade-impactor which collects particles size-selectively. The operation principle is based on inertial classification and subsequent chemical or gravimetric analysis of the collected aerosol particles. SDI has several consecutive stages to separate different size fractions according to the aerodynamic diameter of the particle.

The impactor has co-linear plates of which one has small nozzles. The aerosol passes through this nozzle at high speed and makes a sharp turn with the flow between the plates. Particles with sufficient inertia cannot follow the flow and impact on the second plate, but particles with small enough inertia remain in the flow. The cut diameter for an impactor is defined as the size of particles collected with 50% efficiency. The plate with nozzles is called jet plate and the second one collection plate. Cascade impactors consist of several successive impactor stages with decreasing cut diameters. Particle size distribution is defined by measuring the amount of particles impacted on each stage.



Applications

- Elemental analysis by PIXE
- Ion analysis by ion chromatography
- Analysis of the elemental and organic carbon mass size distribution by thermal method (Viidanoja et al., 2002)
- Gravimetric mass size distributions
- Particle source apportionment studies
- Particle background concentration measurements
- Ambient or indoor air measurements

User Benefits

- 12 stages from 45 nanometers to 8.5 microns
- Flowrate of 11 l/min: higher aerosol mass collection in shorter time
- Small deposit area – the whole deposit on the SDI substrate can be covered by PIXE beam.
- Sensitivity
- Chemical analyses are easy to do on small substrates. Volume of solvent for sample can be as low as 1 ml
- Good loading characteristics with quarz filter

SDI measurements in the Spitsbergen in spring 2001. Ny Alesund, Svalbard.

Photo: Kimmo Teinilä, FMI.

References

Maenhaut, W., Hillamo, R., Mäkelä, T. (1996) A new cascade impactor for aerosol sampling with subsequent PIXE analysis, Nuclear Instruments and Methods in Physics Research B 109/110, 482-487.

Viidanoja, J., Kerminen, V.-M., and Hillamo, R. (2002) Measuring the Size Distribution of Atmopheric Organic and Black Carbon Using Impactor Sampling Coupled with Thermal Carbon Analysis: Method Development and Uncertainties, Aerosol Science and Technology 36, 607-616.

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