Microbiological safety cabinets – Protective functions and their limits

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Based on EN 12469 it is of vital importance to protect the person and their environment while handling dangerous biological substances by using microbiological safety cabinets (MSC). The protection of the product and/or experiment is of equal importance.

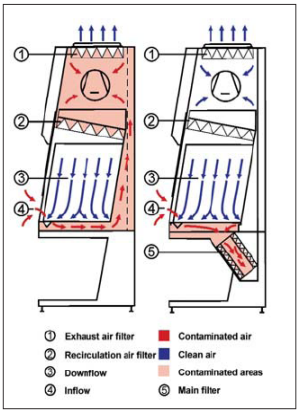

Figure 1: Side view of the design, function 2- and 3-Filter-System

The most fundamental properties of a MSC are the protective functions such as personal, product and cross contamination protection.

The correct combination of laminar down flow air in the workspace and the air inflow in the working aperture (s. fig. 1), together with the filtration of particles, essentially safeguards the protective functions.

From a flow mechanics point of view, a well-designed air flow is of special significance, i.e. laminar down flow with no reflux and an optimal balance between inflow and down flow air.

The main aim is the fast and safe removal of contamination, without endangering people, environment or product. For years, 0,4 m/s was regarded to be the optimal air flow velocity to guarantee best possible protective functions. Since several years now, the airflow velocities are no longer been standardised. The manufacturer of a MSC has to determine the optimal airflow conditions, within the lines of the design. Under these requirements the protective functions are to be demonstrated during type testing using the microbiological method (s. fig. 2).

Figure 2: Microbiological testing of the personal protection

Every MSC has an optimal „operating point“. Intensive testing of the protective functions especially within the thresholds is of special significance. The determined target airflow velocities are to be officially recorded in the documentation. These are to be verified regularly, during production by the manufacturer as well as in the laboratory by the user.

An example will serve to illustrate the importance of this interrelationship:

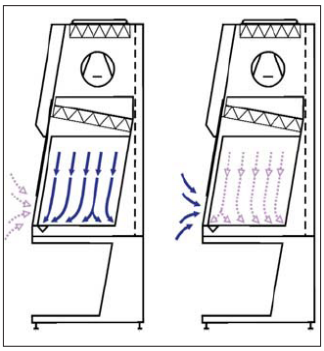

Figure 3: Correlation In- and Downflow

If the kinetic energy of the laminar flow is significantly larger than the air inflow, then personal protection can no longer be guaranteed (s. fig. 3, left). If, however, the inflow air is dominant, then product protection is questionable. (s. fig. 3, right).

This interaction is a well-known fact and should receive adequate attention during development. In the USA, this variation in airflow has been standardised since many years as "Performance Envelope Testing" based on NSF 49.

The presentation will show the latest research results reg. performance envelope testing at safety cabinets.

Literature

[1] Standards committee foodstuffs and agricultural products in DIN German standards institute, standards committee laboratory appliances and laboratory equipment in DIN; standards committee medical products; DIN EN 12469: Biotechnology - Performance criteria for microbiological safety cabinets; German version; Beuth Verlag GmbH; Berlin; 2000
[2] Standards committee Laboratory appliances and laboratory equipment in DIN German institute body; DIN 12980: Laboratory furniture – Safety cabinets for handling cytotoxic substances; Beuth Verlag GmbH; Berlin; 2005
[3] Standards committee laboratory appliances and laboratory equipment in DIN German institute body; DIN 12950 part 10 replaced by DIN EN 12469 [11]: Laboratory equipment– Safety cabinets for microbiological and biotechnological work; Beuth Verlag GmbH; Berlin; 1991
[4] Jones, R., Stuart, D., et al.; The effects of changing intake and supply air flow on biological safety cabinet performance; Appl. Occup. Environ. Hyg. 5(6); 1990
[5] NSF 49 National Sanitation Foundation (NSF) Joint Committee on Biohazard Cabinetry and NSF Council of Public Health Consultants; NSF/ANSI 49 - 2007, Class II (Laminar Flow) biosafety cabinetry; Ann Arbor, Michigan; 2007

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