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APPLICATION NOTE

SAS SUPER 100 AIR SAMPLER
MICROBIOLOGICAL COLLECTION EFFICIENCY TEST

AIR-HANDS-SURFACES
N. 99/70
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❑ **Principle of "SAS Super 100" microbial air sampler**

Air containing microbe-carrying particles is aspirated and accelerate through a hole and direct towards a nutrient agar surface of a plate. As the air turns away from the agar surface, the microbe-carrying particles that cannot follow the flow are impacted. The plate containing nutrient agar is then incubate at a suitable time and temperature, and the resulting Colony Forming Units (CFU) are counted to evaluate the number of microbe-containing particles collected from a specific volume of air.

❑ **How the microbe-carrying particles impact on agar surface**

The aspirated air passes through an intake orifice of the sampler head at a velocity of "U" and, as it approaches the agar surface, it turns. The arc of the turning circle has a radius of "r" which is assumed to be the same as the radius of the intake nozzle. The velocity round the curve is assumed to be "U".
The microbe-carrying particle travels along the streamline and experiences a centrifugal force that causes it to move toward the agar surface of the plate.

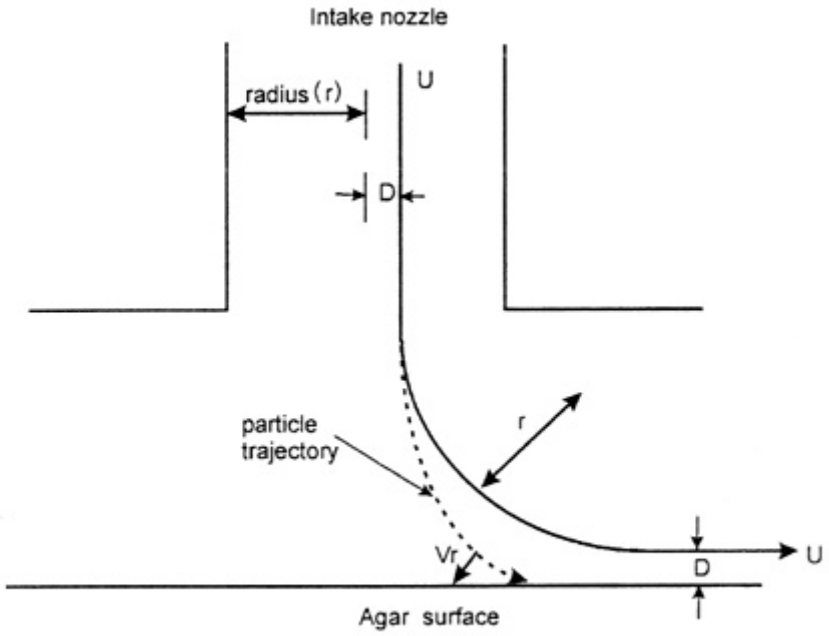


Fig. 1. Impaction of a particle on a surface after exiting a nozzle.

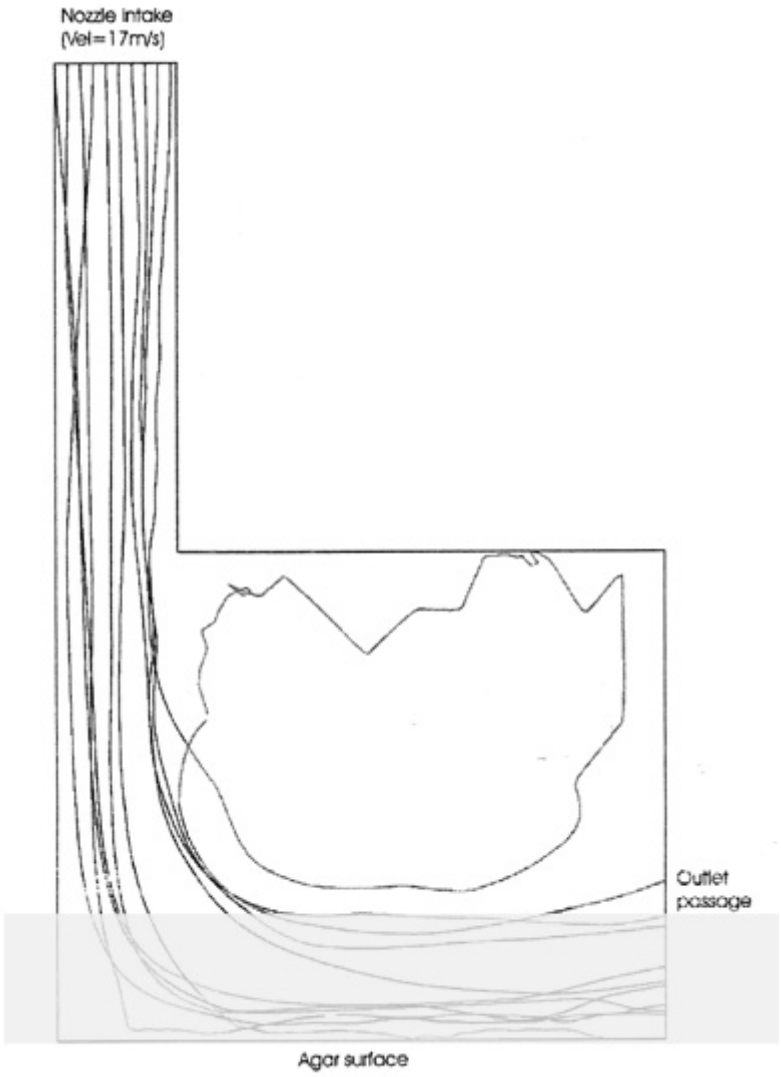


Fig. 2. Trajectories of 1 μm particles in the SAS sampler.

❑ The collection efficiency calculation

The collection efficiency "E" is calculated by the formula:

$$E = \frac{\pi.U}{2.r}\left(\frac{p.d^2.C}{18\,\eta}\right)$$

Where:
"U" is the velocity of the air through the nozzle
"r" is the radius of the curvature of the streamline
"p" is the density of microbe-carrying particles (1100 Kg/cubic metre)
"d" is the equivalent particle diameter
"C" is the Cunningham slip factor
"n" is the viscosity of room air at 20°C (1.81×10^{-5} Pa x s).
The collection efficiency of an air sampler can be calculated by the above formula and then the d_{50} "cut-off" size. The d_{50} size is often used to describe the impact efficiency of a sampler, it being the particle size at which 50% of the particles are collected and 50% pass through the sampler because they are too small to impact.

❑ The sizes of environmental micro-organisms

The normal size range of environmental airborne micro-organisms is 4-20 microns. Never less, some research works for biological aerosol, where single cell aerosol are used, require the ability to collect micro-organisms up to 1 micron.

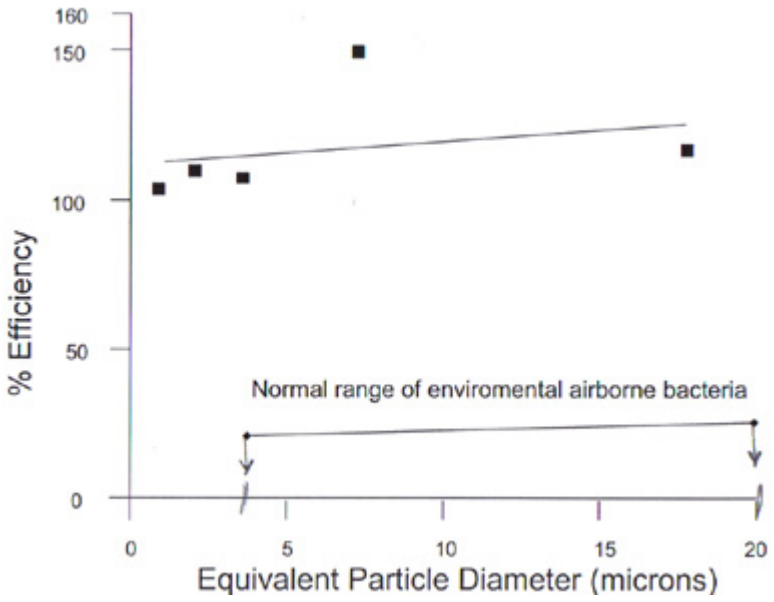
❑ Material and method

- "SAS ISO Super 100" microbial air sampler with HE aspirating head
- "Piramid" controller
- *Bacillus subtilis* var. niger suspension
- Contact plate with TSBA
- Collection Efficiency Chamber

Different diameters of particles can be generated under controlled conditions using different suspensions of a known organisms in 0-7% solutions of KI.

❑ The results

Effective sample rate vs equivalent particle diameter for SAS sampler with HE aspirating head.



❑ **References**

Benbough, J.E. Bennet, A.M. and Parks, S.R. (1993), “Determination of the collection efficiency of a microbial air sampler”. Journal of Applied Bacteriology 74, 170-173 (1993).
L. Steward, A. Grinshèun, K, Willeke, S: Terzieva, V. Ulevicius, J. Donnelly. “Effect of impact stress on microbial recovery on an agar surface”. Applied and Environmental Microbiology, 61, 1232, (1995).
S. Mehta et al, “Evaluation of portable Air Samplers for Monitoring Airborne Culturable Bacteria”. AIHAJ 61(6), 850-854 (2000).
G: Temprano, D. Garrido, M. D0Aquino, “Comparative Study of Airborne Viable Particle Assessment Methods in Microbiological Environmental Monitoring”, J. Pharm. Sci.Tech.58 (4), 215-221 (2004).
Chapter <1225>, Validation of Compendial Methods, U.S. Pharmacopeia, USP 27, United States Pharmacopoeial Convention, Inc. Rockville, MD (2005).
B. Andon, “Active Air vs. Passive Air Monitoring in Routine Environmental Monitoring Programs”. PDA Journal of Pharm. Science Tech. 60 (6) 350-354 (2006).
W. White, G. Green, A. Albisu, “Collection Efficiency and Design of Microbial Air Samplers”, Journal of Aerosol Science, 38 101-114 (2007).