BioSampler®

Operating Instructions

SKC Inc.
863 Valley View Road
Eighty Four, PA 15330 USA

Form 37084 Rev 1404

Description

The patented* SKC BioSampler is a highly efficient bioaerosol and biologically inert airborne particle collection device that traps airborne microorganisms into swirling liquid for subsequent analysis. The BioSampler is made of glass and consists of three parts: inlet, nozzle section (with three tangential sonic nozzles), and collection vessel (Figure 1). The collection vessel can be filled with a liquid collection medium or coated with a sticky medium. The BioSampler can be used with water or non-evaporating liquids up to 1,000 times more viscous than water for sampling up to eight hours. The BioSampler requires a high-volume vacuum pump such as the SKC VAC-U-GO Sampler.

Performance Profile

Flow Rate:	Approximately 12.5 L/min
Medium:	Water or more viscous liquids such as ViaTrap® mineral oil†
Collection Efficiency:	Nearly 100% over a wide range of particle sizes; decreases to approximately 90% at 0.5 μm
Pump:	High-volume vacuum pump capable of achieving sonic flow

† May not be suitable for PCR analysis

Figure 1. BioSampler with 20-ml vessel (5-ml vessel available)

** U.S. Patent Nos. 5,902,385 and 5,904,752*

Operation

Calibration

The BioSampler's tangential nozzles act as sonic orifices. Therefore, if the pump maintains a pressure drop of 0.5 atm (15 in Hg) or more across the sampler at normal atmospheric conditions, the flow rate will always be the same (about 12.5 L/min) unless one or more of the nozzles become clogged. Figure 2 shows the recommended calibration set up. Calibration is particularly important when sampling in areas with non-standard temperature and pressure.

1. Connect a flowmeter (bubble or dry-gas) to the inlet of the BioSampler.
2. Connect the outlet of the BioSampler (filled with collection liquid or coated) to the inlet of a liquid trap (Cat. No. 225-22) and the outlet of the trap to a vacuum pump with a vacuum pressure gauge or manometer in line.
3. Adjust the pump until sonic flow is achieved (vacuum gauge or manometer reads between 15 and 30).
4. Read and record flow rate, Q_s L/min.

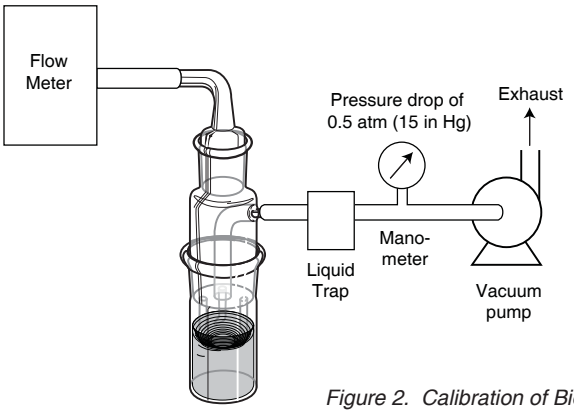


Figure 2. Calibration of BioSampler

Sampling with Collection Liquid

The BioSampler can be used for both short-term and long-term sampling depending on the collection liquid chosen.

Operating Cautions:
- **Visually inspect BioSampler operation frequently, particularly when using a viscous collection liquid.**
- **Use only 15 ml of viscous liquid in a 20-ml vessel and 4 ml inside a 5-ml vessel.**
- **Use a liquid trap in line to ensure that collection liquid (particularly viscous liquid) in a BioSampler vessel does not enter the pump.**

Short-term sampling (less than 30 minutes)
Use sterile distilled water or a liquid of similar viscosity such as physiological saline, phosphate buffered saline, nutrient broth, or peptone water.

Caution: Water or water-based liquids are not recommended for sampling periods over 30 minutes or when collecting hydrophobic particles such as fungal spores.

Long-term Sampling (greater than 30 minutes)
Use a non-evaporating liquid such as ViaTrap (a special mineral oil for collecting bioaerosols) or glycerol. These liquids can be used for both long-term and short-term bioaerosol sampling. Collection efficiency has been shown to remain essentially constant during an eight-hour sampling period.

Caution:
- Glycerol is not recommended as a liquid for viable microorganism collection because the microorganisms may die from osmotic pressure.
- ViaTrap mineral oil may not be suitable for PCR analysis.

1. Measure and record flow rate, Q_s L/min, through the BioSampler as described on page 2.

2. Sterilize all parts of the BioSampler (*see Cleaning, page 6*).

Note: To sterilize ViaTrap mineral oil, carefully filter it using a 0.4-μm pore size sterile polycarbonate membrane. **Do not autoclave ViaTrap;** heating the oil will make it cloudy.

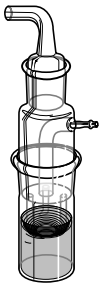
3. Aseptically pipet the appropriate amount of sterilized collection liquid into the collection vessel. Assemble a clean, sterilized inlet, nozzle, and collection vessel in an aseptic area (*see Cleaning, page 6*). Temporarily seal inlet and outlet of the sampler with aluminum foil or Parafilm.

4. Warm up the vacuum pump for at least one minute before connecting it to the sampling train (*see pump operating instructions*).

Caution: When operating correctly, the collection liquid in the BioSampler should be swirling gently up the inner wall of the sampler, wetting it where the nozzles output onto the inner wall. **It is important to visually monitor the following:**

a. That there is enough collection liquid in the vessel to wet the inner wall at the location where the nozzles output onto the inner wall. If this is not occurring, add more collection liquid.

b. That there is **not** excessive bubbling which indicates that there is too much collection liquid in the vessel. If excessive bubbling occurs, decrease the amount of collection liquid in the vessel.



Properly Filled

Under Filled

Overfilled

5. When ready to sample, remove foil or Parafilm from the BioSampler and connect the outlet to the vacuum pump.
6. Sample for the desired sampling period.
7. After sampling is complete, record the sampling time. Volume of air passed through the BioSampler can be calculated using the formula V [Liter] = Q_s [L/min] x t [min].
8. Disassemble the BioSampler.

9. Accurately measure the final volume of collection liquid in an aseptic area and aseptically transfer it to a sterilized container for analyses.

Note: If using a water-based liquid, do not sample at temperatures below 41 F (5 C) to avoid crystallization of the collection liquid.

Note: If sampling biologically inert particles, aseptic procedures are not necessary.

Sampling with a Coated Collection Vessel

The BioSampler can collect samples into a collection vessel coated with a sticky non-evaporating medium. Sampling times longer than 30 minutes are not recommended for this method.

1. Measure and record flow rate, Q_s L/min, through the BioSampler as described on page 2.
2. Sterilize all parts of the BioSampler *(see Cleaning, page 6)*.
3. Prepare the collection vessel by using a petroleum jelly/hexane solution (approximately 0.1 gram petroleum jelly per milliliter of hexane). Place a few drops of the solution into the collection vessel and rotate it so that its entire inner surface is wetted. Ensure that the coating covers the region where the air jets impact the inner surface of the collection vessel. The hexane will evaporate within five minutes leaving a uniform sticky layer on the inner surface of the collection vessel.

Note: Alternative coating methods may be used.

4. Assemble clean, sterilized inlet and nozzle sections with the prepared collection vessel in an aseptic area.
5. Warm up the vacuum pump for at least one minute before connecting it to the sampling train (*see pump operating instructions)*.
6. Connect outlet of newly prepared BioSampler to the inlet of a liquid trap and the trap outlet to the vacuum pump.
7. Sample for the desired sampling period not exceeding 30 minutes.
8. After sampling is complete, record the sampling time. Volume of air passed through the BioSampler can be calculated using the formula $V\ [Liter] = Q_s\ [L/min] \times t\ [min]$.
9. Disassemble the BioSampler.
10. After sampling is complete, wipe the inner surface of the collection vessel with a small piece of cloth or paper.
11. Transfer the cloth or paper sample to a laboratory for microbiological or chemical analysis.

Transporting Samples

1. All individual sample containers should be sealed to prevent contamination during transport and properly labeled with the sample identification.
2. Because many tests have very short hold times, samples should be delivered to the laboratory as soon as possible after collection, preferably within 24 hours.
3. Provide with the samples, sample identification, all pertinent sample information (e.g., sampling rate, time, and location), and analysis request. *Contact the laboratory for more specific requirements.*

Cleaning

Sterilize all parts of the BioSampler in an autoclave or an oven heated to 320 to 356 F (160 to 180 C) for 180 to 240 minutes before each use. This will kill bacteria, fungi, and DNA.

Note:
- Disassemble the sampler before sterilization to prevent the fritted joints in each section from sticking together after high temperature exposure.
- Each of the three BioSampler components feature an etched number that is unique to the sampler. Use this number to match components during reassembly for optimum fit and performance.

Storage

- Store BioSampler components **unassembled** (in three pieces) to prevent future difficulty in separating pieces.
- Store BioSampler in a clean, cool, dry area away from temperature extremes.

Analysis

Samples collected with the BioSampler can be analyzed using:

- **Growth Culture Analysis**
  Growth culture analysis is used to quantify and characterize airborne cultural bacteria and fungi. A portion of the liquid sample is transferred to a culture medium on which the microorganisms are grown into colonies for counting. A broad spectrum of media is generally used.
- **Microscopic Analysis**
  Microscopic analysis is used for the enumeration and limited identification of total airborne bacteria and fungi. Biological particles are differentiated from non-biological ones by staining techniques.
- **Biochemical Assay**
  Biochemical assay is used to measure biological compounds such as endotoxins. A chemical or biological substance is added to a portion of the sample. The ensuing reaction forms the basis for quantification.

- **Immunoassay**
  Immunoassay is used for the quantification of airborne allergens (e.g., dust mites and animal dander). It relies on the binding of antibodies to a specific target antigen. Other methods include fluorescence, enzyme, and radioimmunoassay.

- **Polymerase Chain Reaction**
  Polymerase Chain Reaction (PCR) is used to screen samples for a specific genus or species. The PCR process is based on in-vitro replication of selected nucleic acid sequences.

Note: ViaTrap mineral oil may not be suitable for PCR analysis.

References

Macher, J.M., Chatigny, M.A., and Burge, H.A., "Sampling Airborne Microorganisms and Aeroallergens," *Air Sampling Instruments for Evaluation of Atmospheric Contaminants*, 8th ed., ACGIH, Cincinnati, Ohio, 1995, pp. 589-617

Macher, J.M., "Evaluation of Bioaerosol Sampler Performance," *Applied Occupational Environmental Hygiene*, v. 12, 1997, pp. 730-736

Buttner, M.P., Willeke, K., Grinshpun, S.A., "Sampling and Analysis of Airborne Microorganisms," *Manual of Environmental Microbiology*, ASM Press, Washington, DC, 1997, pp. 629-640

Lin, X., Willeke, K., Ulevicius, V., Grinshpun, S.A., "Effect of Sampling Time on the Collection Efficiency of All-Glass Impingers," *Am. Ind. Hyg. Assoc. Journal*, v. 58, 1997, pp. 480-488

Willeke, K., Lin, X., and Grinshpun, S.A., "Improved Aerosol Collection by Combined Impaction and Centrifugal Motion," *Aerosol Science and Technology*, 29 (5), 1998, pp. 439-456

Lin, X., Reponen, T., Willeke, K., Grinshpun, S.A., Foarde, K.K., and Ensor, D.S., "Long Term Sampling of Airborne Bacteria and Fungi into a Non-Evaporating Liquid," *Atmospheric Environment*, 1999, pp. 4291-4298

Lin, X., Reponen, T., Willeke, K., Wang, Z., Grinshpun, S.A., and Trunov, M., "Survival of Airborne Microorganisms during Swirling Aerosol Collection," *Aerosol Science and Technology*, 32 (3), 2000, pp. 184-196

Willeke, K., and Macher, J. M., "Air Sampling", *Bioaerosols: Assessment and Control*, ACGIH, Macher, J. M., (editor) (1999), pp. 11-1 to 11-25

Reponen, T., Willeke, K., Grinshpun, S., and Nevalainen, A., *Biological Particle Sampling. Aerosol Measurement, Principles, Techniques, and Applications,* Baron, P. Willeke, K. (eds), John Wiley & Johns, Inc, (2001), pp. 751-777

Rule, A. M., Kesavan, J., Schwab, K.J., and Buckley, T.J., "Application of Flow Cytometry for the Assessment of Preservation and Recovery Efficiency of Bioaerosol Samplers Spiked with *Pantoea agglomerans*," *Environmental Science and Technology*, 41 (7), 2007, pp. 2467-2472

Nevalainen, A., Willeke K., Liebhaber F., Pastuszka J., Burge H., and Henningson E., *Bioaerosol Sampling: Aerosol Measurement Principles, Techniques, and Applications*, Van Nostrand Reinhold, New York, 1993, pp. 471-492

SKC Limited Warranty and Return Policy

SKC products are subject to the SKC Limited Warranty and Return Policy, which provides SKC's sole liability and the buyer's exclusive remedy. To view the complete SKC Limited Warranty and Return Policy, go to http://www.skcinc.com/warranty.asp.

BioSampler Kits and Accessories

Description			Cat. No.
BioSampler, 3-piece glass including inlet section, outlet section, and collection vessel *(does not include ground joint cap); inlet and outlet sections are a matched set*	**20 ml** **20 ml** **5 ml**	 pk/4 	**225-9595** **225-9595K4** **225-9593**
BioSampler Collection Vessel (bottom) and ground joint cap, for transporting samples	**20 ml** **5 ml**	 	**225-9596** **225-9596A**
ViaTrap Collection Media,† special mineral oil for bioaerosol sampling	**120 ml** **500 ml** **950 ml**	 	**225-9598A** **225-9598** **225-9599**
BioSampler Mini Kit includes 1 BioSampler, two 20-ml collection vessels (bottoms) with caps, 1 BioSampler case with mounting rod, and 1 ViaTrap (120 ml) collection media			**225-9597**
BioSampler Case with Mounting Rod, case serves as a base and rod secures BioSampler during sampling			**225-9606**
Complete BioSampler System includes 1 BioSampler, two 20-ml collection vessels (bottoms) with caps, 1 BioSampler case with mounting rod, 1 ViaTrap (120 ml), 1 Vac-U-Go Sampler (sonic flow), and 1 rotameter	**115 V**		**225-9594**
Sonic Flow Pumps, for BioSampler, includes protective housing with vacuum gauge and valve, supplied without orfices or rotameter, AC operation only	**115 V** **230 V**	 	**228-9605** **228-9610**
Glass Trap, for area sampling, prevents collection liquid from entering the pump, can be used with or without sorbent			**225-22**
Trap Sorbent, 200 grams, silica gel/activated charcoal sorbent mix to remove vapors			**225-22-02**

† *ViaTrap mineral oil may not be suitable for PCR analysis.*