



Apparatus for Sampling Surface Contamination

Liquid suspensions of samples can be dispensed systematically into analytical instruments.

Marshall Space Flight Center, Alabama

An apparatus denoted a swab device has been developed as a convenient means of acquiring samples of contaminants from surfaces and suspending the samples in liquids. (Hereafter, the liquids can be dispensed, in controlled volumes, into scientific instruments for analysis of the contaminants.) The swab device is designed so as not to introduce additional contamination and to facilitate, simplify, and systematize the dispensing of controlled volumes of liquid into analytical instruments.

The use of currently commercially available contamination-sampling devices involves significant mechanical manipulation of samples and liquids, and there is no provision for systematic dispensing of controlled volumes of liquid into analytical instruments: A typical use involves wiping a surface of interest with a standard implement resembling a cotton swab. The implement is then placed into a volume containing the liquid in which the sample is to be suspended. Ultimately, the liquid must be extracted from this volume and dispensed into an analytical instrument by use of a pipette. The swab device is a single apparatus into which are combined

all the equipment and materials needed for sampling surface contamination. The swab device contains disposable components stacked together on a non-disposable dispensing head. One of the disposable components is a supply cartridge holding a sufficient volume of liquid for one complete set of samples. (The liquid could be clean water or another suitable solvent, depending on the application.) This supply of liquid is sealed by Luer valves.

At the beginning of a sampling process, the user tears open a sealed bag containing the supply cartridge. A tip on the nondisposable dispensing head is engaged with a Luer valve on one end of the supply cartridge and rotated, locking the supply cartridge on the dispensing head and opening the valve. A bag containing a disposable swab tip is opened, and the end of the supply cartridge opposite the aforementioned end is engaged with the swab tip and rotated, opening a valve.

The swab tip includes a fabric swab that is wiped across the surface of interest to acquire a sample. A sealed bag containing a disposable dispensing tip (not to be confused with the non-dispos-

able dispensing head) is then opened, and the swab tip is pushed into the dispensing tip until seated. The dispensing head contains a piston that passes through a spring-loaded lip seal. The air volume displaced by this piston forces the liquid out of the supply cartridge, over the swab, and into the dispensing tip. The piston is manually cycled to enforce oscillation of the air volume and thereby to cause water to flow to wash contaminants from the swab and cause the resulting liquid suspension of contaminants to flow into the dispensing tip. After cycling several times to ensure adequate mixing, liquid containing the suspended contaminant sample is dispensed through the dispensing tip in 25- μ L increments into an analytical instrument. The disposable components are then removed from the dispensing head. Thereafter, the dispensing head can be reused with a fresh set of disposable components.

This work was done by Mark Wells of UAH for Marshall Space Flight Center. For further information, contact Sammy Nabors, MSFC Commercialization Assistance Lead, at sammy.a.nabors@nasa.gov. Refer to MFS-32560-1.

Novel Species of Non-Spore-Forming Bacteria

One new bacterial species was discovered in a regenerative enclosed life-support module air system.

NASA's Jet Propulsion Laboratory, Pasadena, California

While cataloging cultivatable microbes from the airborne biological diversity of the atmosphere of the Regenerative Enclosed life-support Module Simulator (REMS) system at Marshall Space Flight Center, two strains that belong to one novel bacterial species were isolated. Based on 16S rRNA gene sequencing and the unique morphology and the taxonomic characteristics of these strains, it is shown that they belong to the family *Intrasporangiaceae*, related to the genus *Tetrasphaera*, with phylogenetic distances from any validly described species of the

genus *Tetrasphaera* ranging from 96.71 to 97.76 percent.

The fatty acid profile supported the affiliation of these novel strains to the genus *Tetrasphaera* except for the presence of higher concentrations of octadecenoic acid ($C_{18:0}$) and *cis*-9-octadecenoic acid ($C_{18:1}$), which discriminates these strains from other valid species. In addition, DNA-DNA hybridization studies indicate that these strains belong to a novel species that could be readily distinguished from its nearest neighbor, *Tetrasphaera japonica* AMC

5116^T, with less than 20 percent DNA relatedness. Physiological and biochemical tests show few phenotypic dissimilarities, but genotypic analysis allowed the differentiation of these gelatin-liquefying strains from previously reported strains. The name *Tetrasphaera remsis* sp. Nov. is proposed with the type strain 3-M5-R-4^T (=ATCC BAA-1496^T=CIP 109413^T). The GenBank/EMBL/DBJ accession numbers for the 16S rRNA gene sequence are DQ447774 and EF028236 for the strains 3-M5-R-4^T and 3-M5-R-7, respectively.

The cells are Gram-positive, non-motile, cocci, in tetrad arrangement and clusters. Spore formation is not observed. The colonies are beige in color and convex with a glossy surface. The organisms are aerobic chemoheterotrophic in nature. They do not reduce nitrate to nitrite. They show no anaerobic growth and do not ferment glucose. They are gelatin-liquefying and esculin hydrolyzed. Catalase and β -galactosidase are produced. The cells use D-glucose, D-mannose, D-mannitol, D-maltose, N-acetyl-glucosamine, and malate. Tests show that the

cells do not assimilate the following compounds: L-arabinose, gluconate, capric acid, adipic acid, phenyl acetic acid, or citrate. Growth occurs at 15 to 45 °C and at pH 6–9. The optimal growth temperature and pH are 25 °C and 7, respectively.

No species of *Tetrashpaera* has ever been isolated from airborne samples. Previous discoveries have come from soil and activated sludge samples. As other species of this genus have demonstrated enhanced biological phosphorus removal activity, further tests are required to determine if this newly

discovered species would have bioremediation applications.

This work was done by Shariff Osman, Christine Moissl, Naofumi Hosoya, and Kasthuri Venkateswaran of the Biotechnology and Planetary Protection Group at Jet Propulsion Laboratory; Ariane Briegel of Caltech; Masataka Satomi of the National Research Institute of Fisheries Science, Fisheries Research Agency-Japan; and Shanmugam Mayilraj of MTCC Institute of Microbial Technology-India for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-45092

Chamber for Aerosol Deposition of Bioparticles

Standard coupons can be covered with reproducible areal concentrations of bioparticles.

NASA's Jet Propulsion Laboratory, Pasadena, California

The laboratory apparatus shown in the figure is a chamber for aerosol deposition of bioparticles on surfaces of test coupons. It is designed for primary use in inoculating both flat and three-dimensional objects with approximately reproducible, uniform dispersions of bacterial spores of the genus *Bacillus* so that the objects could be used as standards for removal of the spores by quantitative surface sampling and/or cleaning processes. The apparatus is also designed for deposition of particles other than bacterial spores, including fungal spores, viruses, bacteriophages, and standard micron-sized beads. The novelty of the apparatus lies in the combination of a controllable nebulization system with a settling chamber large enough to contain a significant number of test coupons. Several companies market other nebulizer systems, but none are known to include chambers for deposition of bioparticles to mimic the natural fallout of bioparticles.

The nebulization system is an expanded and improved version of commercially available aerosol generators that include nebulizers and drying columns. In comparison with a typical commercial aerosol generator, this system includes additional, higher-resolution flowmeters and an additional pres-



This **Bioparticle-Deposition Chamber** is sized to fit on a laboratory bench and to fit within a standard class-II biological safety cabinet.

sure regulator. Also, unlike a typical commercial aerosol generator, it includes stopcocks for separately controlling flows of gases to the nebulizer and drying column.

To maximize the degree of uniformity of dispersion of bioaerosol, the chamber is shaped as an axisymmetrical cylinder and the aerosol generator is positioned centrally within the chamber and aimed upward like a fountain. In order to mini-

mize electric charge associated with the aerosol particles, the drying column is made of aluminum, the drying column is in direct contact with an aluminum base plate, and three equally spaced ^{210}Po anti-static strips are located at the exit end of the drying column. The sides and top of the chamber are made of an acrylic polymer; to prevent accumulation of electric charge on them, they are spray-coated with an anti-static material. During use, the base plate and the sides and top of the chamber are grounded as a further measure to minimize the buildup of electric charge.

This work was done by Roger Kern and Larry Kirschner of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

*Innovative Technology Assets Management
JPL*

*Mail Stop 202-233
4800 Oak Grove Drive
Pasadena, CA 91109-8099
(818) 354-2240*

E-mail: iaoffice@jpl.nasa.gov

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