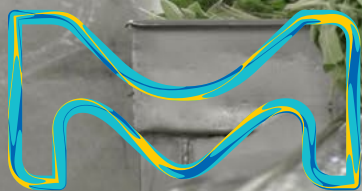


**MILLIPORE
SIGMA**

Hygiene Monitoring solutions for Food & Beverage Manufacturers



MilliporeSigma is the U.S.
and Canada Life Science
business of Merck KGaA,
Darmstadt, Germany.

Millipore®

Preparation, Separation,
Filtration & Monitoring Products

Raising the Standard of HYGIENE. TOGETHER.

Your work is essential to ensuring the highest standards of hygiene in food and beverage production, safeguarding consumer health and product quality. Our Life Science business combines world-class products and services, innovative capabilities, and exceptional talent to create a global leader in hygiene monitoring solutions.

As a trusted provider for Food& Beverage Manufacturing, we address the critical needs of industries where cleanliness and contamination control are paramount.

We offer:

- A comprehensive portfolio of high-quality hygiene monitoring solutions designed to streamline workflows and deliver rapid results
- Access to a dedicated team with experience in food safety to help you ensure compliance with regulatory standards.
- Our reliable and interconnected services that are specifically tailored to support the food and beverage industry in maintaining safe and hygienic production environments.



Learn more about food and beverage testing:

SigmaAldrich.com/HM



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LEADING EXPERTISE IN MICROBIOLOGY

A long history of innovations and milestones

1885

Merck KGaA, Darmstadt, Germany holds the 1st culture media patent

1970



1979

First portable microbial air sampler RCS™ Standard

2000

Launch of MAS-100 Eco®, a specially designed air sampler for the food industry



2010

- Acquisition of Millipore Corporation

2002

Launch of world's 1st Lateral Flow Tests (Singlepath® Campylobacter, Duopath® Verotoxins (STEC))

1955

1st filter membrane for use in microbiology

1990's

Pioneer of Chromogenic culture media

2004

1st rapid filtration-based detection system – Milliflex® Rapid

1950

Dust-reduced culture media granulation process

1980

Low-binding filtration membranes (Durapore®)

2003

- 1st room temperature stable prepared media
- 1st all-in-one swab

2015

- MAS air sampler family extension with 5 new instruments
- **2015 Acquisition of Sigma-Aldrich Corporation**
- EZ-Fit™ filtration units for Bioburden Testing of Liquid Samples

2020

Merck KGaA, Darmstadt, Germany approves Cultured Meat as an Innovation Center

2021

Val@M™ online validation platform

2022

- MAS-100® ATMOS system for compressed gas sampling for environmental monitoring
- DCM Halal-certified – compliant high-quality culture media for hygiene monitoring in halal- and/or kosher-certified production areas
- M-Trace® Software - your Digital QC companion for sterility testing and other regulated processes for trusted & efficient data recording!
- ReadyStream® system to prepare and dispense up to 100 L of pre-heated culture media on demand

2016

- DiluCult® gravimetric dilutor instrument designed for automatic dilution of food testing samples
- Dehydrated Culture Media (DCM) QC release under ISO 17025 accreditation

2014



2018

- PyroMAT® system for *in vitro* testing of pyrogens
- ReadyPlate™ 55 ready-to-use 55 mm agar plates
- Milliflex® OASIS for water and bioburden testing



2024

2024 Wild Type creates cultivated salmon with food-grade basal media from MilliporeSigma



Photo credit Wild Type

2011

Acquisition of heipha™ and Hycon®, the microbiology business from Biotest AG

2017

- **Acquisition of BioControl Systems, Inc. to strengthen position in food safety testing**
- 2017 MC-Media Pads® for enumeration and detection of microbial contamination



2023

- DCM Kosher-certified
- Milliflex® Rapid 2.0

F&B PRODUCTION WORKFLOW

1



RAW MATERIAL QC

2



PREPARATION & PROCESSING

2

3

Environmental Monitoring & Hygiene Control

Wide range of products to monitor: air, surface and water.



Air samplers (air and gas, MAS-compressed100®).



ATP Monitoring (MVP ICON®).



Swab cloths & sponges for collecting environmental monitoring samples (eMcollect).



Contact plates, dip slides, swabs for microbial testing of flat and curved surfaces.



Allergen-Indicator Protein Test (FLASH®).

1

2

4

Sample Preparation

Sample preparation, culture media for enrichment.



Enrichment Media wide offer: DCM, RTU, Readytube® and Readybag®.



On-Demand Enrichment Media (ReadyStream®).



Automatic gravimetric dilutors (DiluCult®).



Paddle homogenizer (ESH).



Detection of Somatic Coliphages (VIRALPREP® kit).

Services: Application, validation (Val@M™)

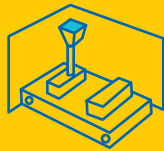


Food



Beverages

3



FILL & PACKAGING

4

FINISHED
PRODUCTS QC

1 2 3 4

Quality Indicators

Conventional culture media, alternative method and state of the art product range in filtration.



Rapid enumeration
(MC-Media Pad®).



Quantitative
counting
(SimPlate®).



Wide family of media:
Dehydrated or
Ready-to-use solids:
plates, tubes and
bottles (GranuCult®).



Manifold, membrane dispenser, funnels, rapid detection system
(EZ Family).

1 2 4

Pathogen Testing

Traditional and rapid testing solutions.



Wide family of
media: Dehydrated
or Ready-to-use
solids: plates,
tubes and bottles.
(GranuCult®).



Real-Time
PCR Analysis
(Assurance®
GDS) Automation
optional
(PipetMax®).



Certified reference
materials
(Vitroids™ &
LENTICULE®).



Lateral Flow Tests
(SinglePath®,
VIP Gold®).



ELISA test
(Transia® PLATE).
Fully automated
option (Gemini®).

, training (Learn@M), maintenance & repair.

Concept of Zoning & Application in Food Processing for *Listeria* and *Salmonella*

Manufacturing plants are compartmentalized based on the nature of the specific activities being carried out. The categorization can be based on the different type of activities or simply to segregate and manage different services. The segregation can be based on raw materials and stages of finished products, prevention of environmental cross contamination, human traffic flow and management and to manage health and safety concerns.¹ Due to the rising complexities in food manufacturing process, management of food safety has become a critical requirement. The concept of hygienic zones has been introduced to effectively manage food safety concerns.^{1, 2} This led to the introduction of pathogen environment monitoring program (PEMP) based on risk assessment which is required for the implementation of various food safety management system (HACCP, FSSC 22000, British Retail Consortium Global Standard).

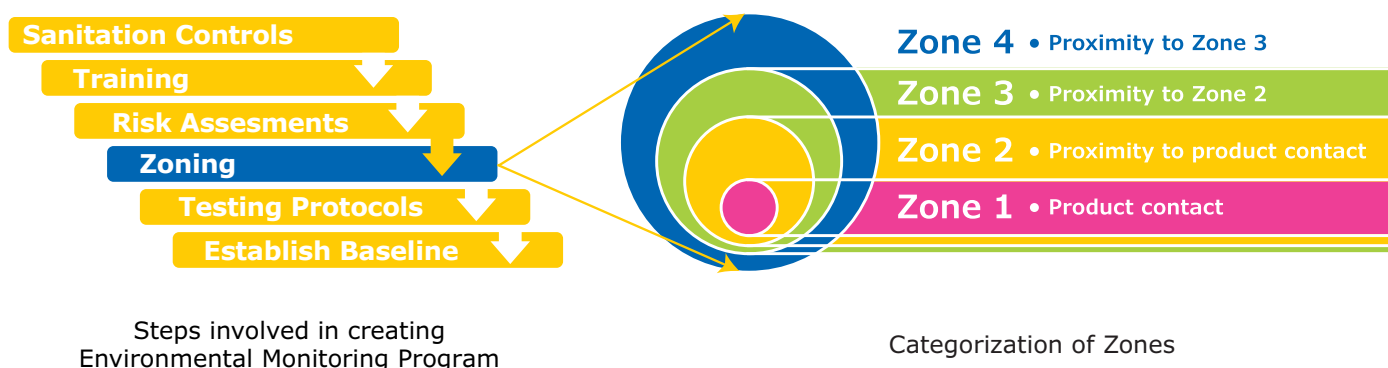
The goal of these food safety management system is to have a compliant finished product as per the microbiological criteria set by regulatory food safety authorities.²

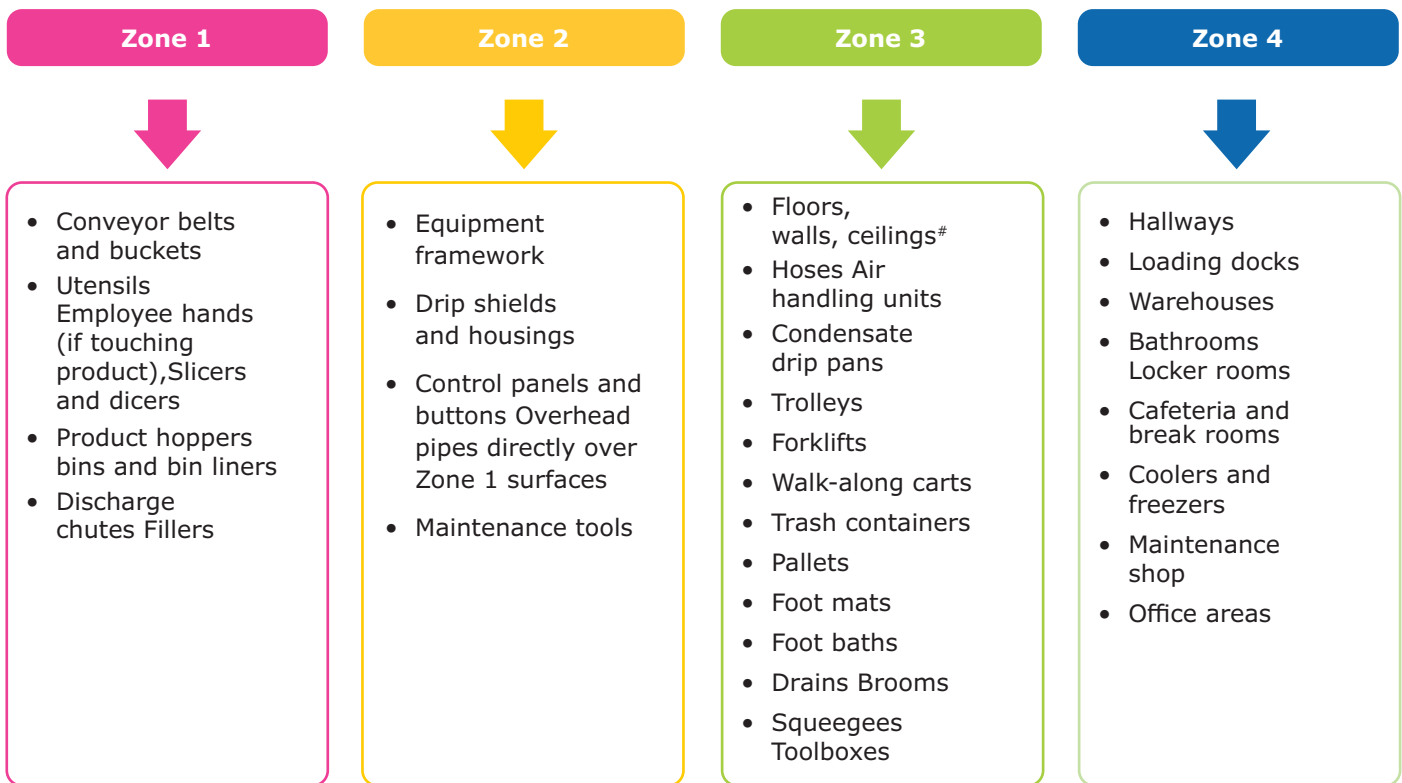
The hygienic zoning supports in limiting the entry of transient micro-organisms in sensitive area whereas PEMP is used to verify the maintenance of these hygienic zones, effectiveness of cleaning, sanitation procedures, to identify proliferation sites of pathogens and conduct corrective actions to eliminate the same.⁴ One of the effective tools to conduct PEMP is by swabbing designated zones and ISO 18593 can

be used as a standard for conducting the swabbing examination.² The most common approach used for categorization of manufacturing areas for environmental sampling is division in four zones. Zone 1 represents the food or product contact surfaces, zone 2 is the surface adjacent or close to the food or product contact surfaces and zone 3 has proximity to zone 2 and is represented by non-food contact surface which are within the production area. Zone 4 is represented by non-food production areas or facilities.^{3, 4} The frequency of swabbing can vary based on the sensitivity of the zones and higher frequency of monitoring is generally recommended for zone 1 and 2.⁵

References:

1. Holah J. 2005. Improving zoning within food processing plants, p. 148–167. In Handbook of Hygiene Control in the Food Industry. Elsevier.
2. Bourdichon F, Betts R, Dufour C, Fanning S, Farber J, McClure P, Stavropoulou DA, Wemmenhove E, Zwietering MH, Winkler A. 2021. Processing environment monitoring in low moisture food production facilities: Are we looking for the right microorganisms? Int J Food Microbiol 356:109351.
3. Pathogen environmental monitoring program (PEM) by Almond Board of California. https://www.almonds.com/sites/default/files/2020-05/pem_book.pdf. Retrieved 19 June 2024.
4. Gupta P, Adhikari A. 2022. Novel Approaches to Environmental Monitoring and Control of *Listeria monocytogenes* in Food Production Facilities. Foods 11:1760.
5. Zoellner C, Ceres K, Ghezzi- Kopel K, Wiedmann M, Ivanek R. 2018. Design elements of *Listeria* environmental monitoring programs in food processing facilities: A scoping review of research and guidance materials. Compr Rev Food Sci Food Saf 17:1156–1171.





Above are some of the examples of area, equipment, etc. categories for zoning but the same will be different and will depend on actual situation of one's manufacturing site. [#]If the product contact surface is open, then ceiling and walls will be considered as Zone 2 rather than zone 3.

Listeria



* *Listeria innocua* is considered as indicator organism for *L.monocytogenes* and hence is generally tested on Zone 1. In certain microbiological criteria *Listeria* is allowed in certain quantities, hence the limit depends on the product criteria and process criteria

Salmonella



*As there is no indicator organism for Salmonella, EB is generally tested on Zone 1. In usual scenario, Salmonella is not tested on Zone 1 since the presence of Salmonella on Zone 1 indicates presence in product and ultimately Sanitation Controls closure of manufacturing which is not a predictive scenario.

HYGIENE MONITORING SOLUTIONS

Dip Slides

Reliable, easy-to-use tools for surface and liquid microbial monitoring — no specialist equipment required.

Dip & Swab Test Kits

- Ready-to-use dehydrated testers for convenient microbial counting across a broad range of applications. Suitable for both liquid and swab samples.
- Available in four variants: HPC Total Count, Yeast & Mold, Coli-count for Coliform, and Swab with neutralizing agent.



Envirocheck® Dip Slides

- Semi-quantitative detection of microorganisms on surfaces and in liquids. Flexible, media-coated paddles allow sampling on all surface types, with two parameters determined in a single step.
- Key benefits include a flexible pliable paddle for hard-to-reach areas, safe enclosed plastic tube design, a cost-effective alternative to external lab testing, and easy result interpretation after incubation.



HY-RiSE® Test Strips

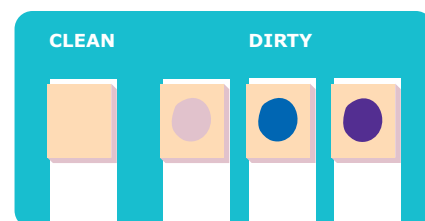
Color Hygiene Test Strips allow for rapid, qualitative determination of surface cleanliness and hand hygiene. It is also suitable for use in testing C.I.P. (Clean in Place) rinse water for contamination.

Measurements made with this test strip can provide early warning of possible contamination on specific surface areas allowing immediate corrective action.

- Test results are available in 4–5 minutes require no equipment
- Results are presented as a color change on the test strip



Learn More
SigmaAldrich.com/Hygiene-Monitoring



FLASH® Swab

FLASH® is a total protein visual test that rapidly detects protein residues left on food contact surfaces after cleaning, allowing verification of adequate removal of protein residues, including allergens on surfaces, reducing the risk of cross-contamination between products.

- Ready-to-use device: Colorimetric Assay, no equipment needed
- Detects total protein including “Big 9” food allergens
- Rapid pass / fail result within 10 minutes
- Detects down to 20 µg total protein



3 Step Process. Simple.



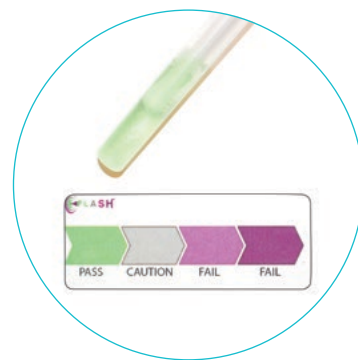
SWAB

Sample a 4 x 4 inch
(10 x 10 cm) surface



ACTIVATE

Activate swab and
shake for 5 seconds



READ

Use chart to interpret result
(Pass, Caution or Fail)

eMcollect® Cloth, Swabs & Sponges

Swab cloths and sponges for collecting environmental monitoring samples in accordance with ISO 17604 and ISO 18593 standards

Capable of sampling microorganisms even in the presence of traces of disinfectant on the sampling surface.

Cloth swabs collection:

- Cloths are blue with a compliant size of 34 x 16 cm (544 cm²), featuring a honeycombed structure for effective surface sample collection.
- **Different options available:** With neutralizing agent to monitor the cleaning effectiveness even in presence of residual disinfectants, or simply cloth with Buffered Peptone Water (BPW), water, or dry.
- Bags are easy to reseal and can be closed with a twist closure or with an adhesive label.
- All bags can be used directly in a homogenizer

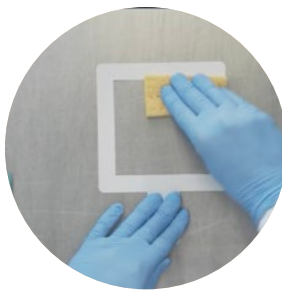


Sponges products collection:

- Sponges are made of premium quality cellulose. Sponge size measure 8x4 cm with thickness of 1.2 to 1.6 cm.
- **Different options available:** With neutralizing agent to monitor the cleaning effectiveness even in presence of residual disinfectants, or simply sponges with BPW.
- Sponges with sticks are also available to access hard-to-reach sampling areas. The design features piercings, making it easy to detach the sponge from the stick.
- Bags are easy to reseal with an adhesive label.
- All bags can be used directly in a homogenizer



Speak to a Specialist About
Our New Sampling Solutions.
[Click here.](#)





MVP ICON® ATP Luminometer

Surface Cleaning Validation System using Bioluminescence (ATP).
The MVP ICON® is a device capable of detecting ATP, a molecule found in all viable cells and in most biological materials.

Unlike traditional methods that only detect the presence of microorganisms, the MVP ICON® also reveals the presence of organic residues on surfaces or in water (CIP).

- Superior ATP swab design with best-in-class sample release
- Room-temperature stable swabs are ready for immediate use
- Flexible testing options that complement existing workflows
- Perform instrument calibrations and verifications onsite, anytime
- Easily track failure rates, retest compliance and monitor overall program effectiveness



Learn More
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With an intuitive dashboard software for data management, it allows for quick trend reports, HACCP analysis, and calibration graphs, speeding up corrective action if needed.

Audits are made easy by using the Dashboard's print-and-present HACCP reports such as instrument calibration and verification history, test point frequency, and other key measurements that help you demonstrate an in-control process.



PASS

Green = Clean

For measurements below
2.5 Zones

PASS

Orange = Caution

For measurements of 2.5 –
2.9 Zones

FAIL

Red = Dirty

For measurements of 3.0 Zones
and higher

The MVP ICON® sampling swab ensures accurate detection and sample collection. The swab tip is not involved in activation and the design ensures uniform sample release.

MAS-100 Eco® Air Sampler

The Economic Choice

The portable **MAS-100 Eco®** sampler is the basic version of the **MAS-100®** range. It is used for microbiological air monitoring in the hygienic production of food and cosmetics, as well as in the maintenance of ventilation and air-conditioning systems (HVAC). The **MAS-100 Eco®** sampler is the lightest of the models and particularly easy to handle.

As an open system the **MAS-100 Eco®** sampler works with a broad variety of agar media in 90 mm Petri dishes and other plate formats.

- Easy cleaning with industry standard disinfectants
- Compatible with different nutrient plates, e.g., ready-to-use 90 mm standard plates, and (with optional adapters) 55 mm contact or Growth Direct™ plates
- Active volume flow control
- Calibration with **MAS-100 Regulus®** digital anemometer
- Easy exchange of rechargeable batteries



Technical Specifications

Parameter	MAS-100 Eco® sampler
Size: Body / Perforated lid	Ø 109 x 110 mm (w. handle) / Ø 109 x 32 mm
Weight: Body / Perforated lid	1.4 kg incl. perforated lid / 0.19 kg
Material: Body / Perforated lid	Anodized aluminum / anodized aluminum
Flow rate	100 liters per minute (LPM) ±4%
Flow regulation	Electronically
Default perforated lid	400 holes with Ø 0.7 mm (D50 value of 1.6 µm; impaction speed 11 m/s @100 LPM)
Sample volumes	1 to 1000 liters (pre-set: 10, 20, 100, 250 and 500 L)
Sample modes	Standard single sample, start delay configurable from 1 to 60 min
Batteries	2 x rechargeable NiMH cells (1.2 V/4.5 Ah)
Battery capacity	Approx. 3 h (= 18.000 L)
Operating conditions	5 °C to 40 °C non-condensing up to 2000 m above sea level
Tripod mounting	Optional



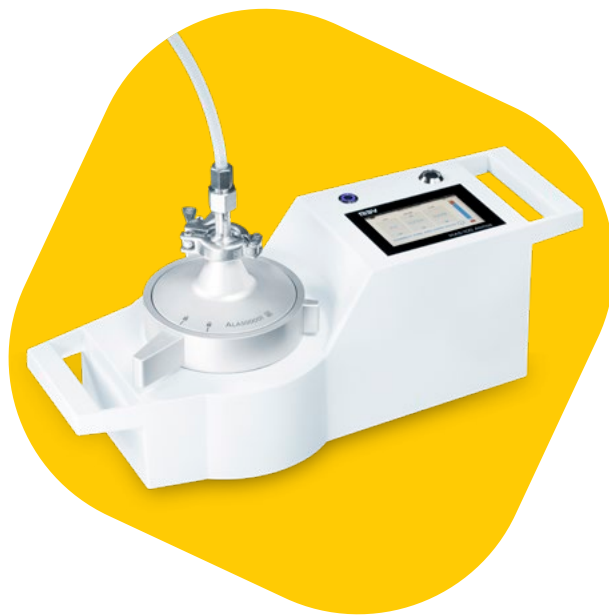
MAS-100 Atmos®

Microbial compressed gas sampler

The instrument is designed to collect microorganisms in compressed gases by gentle but direct impaction onto agar. The impaction is performed under pressure to prevent any harm to microorganisms caused by fast dynamic decompression. The impaction speed at a default flow rate of 100 LPM is identical to all other MAS-100® air samplers and provides a nominal d50 of 1.1 µm.

Automatic detection of pressure and a mass flow sensor ensure secure, accurate sampling of compressed gases. Four gas types (Ar, N₂, air and CO₂) are pre-programmed and easily accessible. The instrument is also designed to operate at lower pressure. This new level of automation minimizes risk and makes sampling compressed gas much easier.

- Easy to handle
- Automated flow rate regulation and decompression avoids human errors
- Validated accuracy of gas amounts for selectable gas types and pressure range
- 21 CFR Part 11 compliant software



Find out more about
our latest innovation:
[SigmaAldrich.com/
mas-atmos](https://SigmaAldrich.com/mas-atmos)

MC-Media Pad®

Our MC-Media Pad® convenient culture media tests for rapid counting of coliforms, *E. coli*, aerobic *bacteria*, fungi, and yeasts.

Validations: AOAC-PTM, AOAC-OMA, ISO 16140 and is quality controlled with strain selection according to ISO 11133

Our MC-Media Pad® are designed for indicator organism testing and hygiene monitoring in food and beverage production. The pads are saturated with growth media and chromogenic substrates for specific detection, allowing faster results and improved read-outs.

- Reduces waste and saves space
- Shelf-life up to 36 months
- Improve your inventory management
- Quick and reliable results
- Simplify workflow
- No spreading device required



Learn More
SigmaAldrich.com/quality-indicators

Figure 7: Selected microorganisms grown after glove print on various MC-Media Pad® tests:



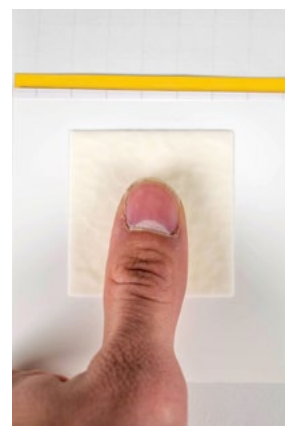
E. coli
ATCC 11775
on MC-Media Pad® EC



Candida albicans
ATCC 10231
on MC-Media Pad® YM

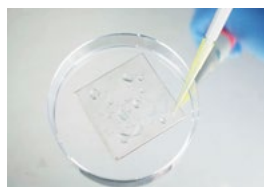


Staphylococcus epidermidis
ATCC 12228
on MC-Media Pad® RA

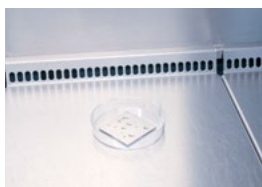


Direct fingerprint on a pre-moistened
MC-Media Pad® test

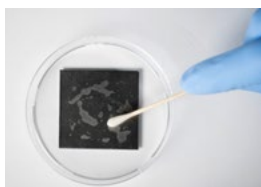
Test procedure for determination of the recovery rates using MC-Media Pad® as an alternative to pour plates (Swab Method A):



Inoculation of stainless steel
coupon with specified test strain



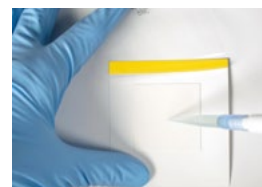
3 hours drying at room
temperature



Swab the complete surface
horizontally and vertically while
rotating the swab



Transfer swab into 2 mL dilution
broth (Lethen Broth) and vortex



Transfer 1 mL of dilution broth to
MC-Media Pad® RA

CONVENIENT MICROBIOLOGICAL TESTING SOLUTIONS

SimPlate® Device

Fast Quantitative Method for: Total Plate Count, Yeast & Mold, Coliforms/*E. coli*, Campylobacter, Enterobacteriaceae

SimPlate® device delivers accurate results with visual reading for positive and negative outcomes, eliminating subjective interpretation.

- **Reduce Costs:** Compared to standard culture media. No complicated media preparation required
- **Simplify Procedures:** Easy-to-Read Results, Less Interference, Single Plate Results
- **Validated:** Accredited by regulatory bodies
- **Convenience:** Requires less dilutions max count of 700 CFU



Beginning incubation



Incubation complete

After incubation, wells that are positive will exhibit color change from the background color. Simply count the number of positive wells, refer to the SimPlate® Conversion Table and arrive at the number of organisms in the sample.



Learn More
SigmaAldrich.com/quality-indicators

CERTIFIED REFERENCE MICROORGANISMS

The Simple Way to Ensure Accurate Results, Every Time

Vitroids™ and LENTICULE® Discs

Vitroids™ and LENTICULE® Discs Certified Reference Materials help make your growth promotion tests quick, convenient and consistent. Provided as a ready-to-use disc, in convenient CFU levels (15-80 CFU), there is virtually no prep needed: simply place the disc onto your media of choice, rehydrate for 10 minutes, and streak. It's as simple as that!

Produced in accordance to ISO 17025 and 17034, you can be assured of accuracy, traceability and homogeneity.

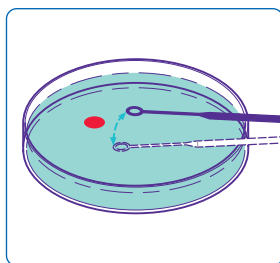
Validations: AOAC and Microval.

- Ready to use, defined CFU & standard deviation (ISO 14025)
- Flexibility
- Save time
- Cost saving
- Sustainable
- Ease-of use



Using Vitroids™ and Lenticule® discs:

- More accuracy
- Save time & costs
- Easy handling
- No stock culture maintenance
- Less documentation



Tap and tip onto culture plate or into buffer or liquid media. **Wait 10 minutes!** Streak out, pour it or filter it



Enumerate the colony forming units after 18-24 hours



Choosing Vitroids™ and LENTICULE® discs not only simplifies your media testing workflow but also supports a lower carbon footprint, making it a smart choice for more sustainable practices now and for the future.

Selected Strains*

Cat. No.	Description	CFU	Strain	Equivalent Strains
VT000322	<i>Staphylococcus aureus</i>	15-80	CECT® 239	WDCM 00032, ATCC™ 6538, NCTC 10788
VT000262	<i>Pseudomonas aeruginosa</i>	15-80	CECT® 111	WDCM 00026, ATCC™ 9027, NCTC 12924
VT000032	<i>Bacillus subtilis</i>	15-80	CECT® 193	WDCM 00003, ATCC™ 6633, NCTC 10400
VT000542	<i>Candida albicans</i>	15-80	CECT® 1394	WDCM 00054, ATCC™ 10231, NCPF 3179
VT000532	<i>Aspergillus brasiliensis</i>	15-80	CECT® 2574	WDCM 00053, ATCC™ 16404, NCPF 2275
VT000122	<i>Escherichia coli</i>	15-80	CECT® 516	WDCM 00012, ATCC™ 8739, NCTC 12923
VT000312	<i>Salmonella enterica</i> serovar Typhimurium	15-80	CECT® 5494	WDCM 00031, ATCC™ 14028, NCTC 12023
VT000292	<i>Salmonella enterica</i> serovar Abony	15-80	CECT® 545	WDCM 00029, NCTC 6017
VT000082	<i>Clostridium sporogenes</i>	15-80	CECT® 485	WDCM 00008, ATCC™ 19404, NCTC 532

*Table is not all-inclusive

The strains listed above are applicable to:

- USP <51> Antimicrobial Effectiveness Testing
- USP <61> Microbiological Examination of Nonsterile Products – Microbial Enumeration Tests
- USP <62> Microbiological Examination of Nonsterile Products – Tests for Specified Microorganisms
- USP <71> Sterility Tests

*ATCC is a trade mark of American Type Culture Collection

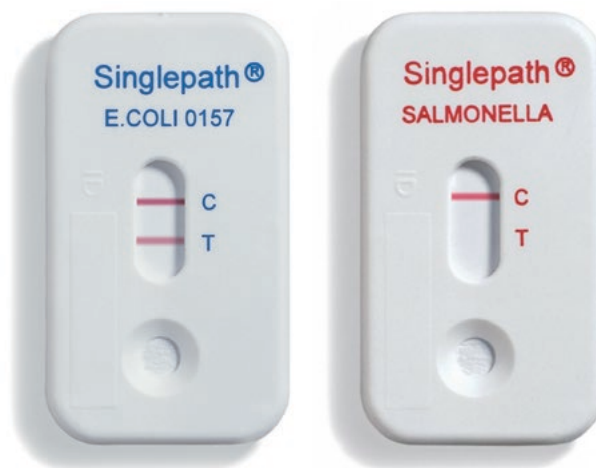


Learn More
SigmaAldrich.com/mibi-crm

Singlepath® Lateral Flow Test

Single-step visual lateral flow immunoassay test with maximum convenience approved by AOAC-PTM.

- Fast: Results within 20-30 minutes post incubation
- Clear positive and negative outcomes.
- Cost-effective: rapid tests reduce operational expenses
- Sensitive: detection limit equivalent to the reference method (validation studies)



Lateral flow method for *Salmonella*, *E.coli* O157, *Listeria monocytogenes*, *Campylobacter*

VIP® Gold Lateral Flow Test

Our VIP® Gold (Visual Immuno Precipitate) single-step visual lateral flow immunoassay tests are designed to be used with our enrichment media, like mEHEC for food and environmental pathogen detection.

Validated as AOAC OMA and PTM methods

- Convenience and ease with detachable kit format
- 2 x 10 test format facilitating sample transfer and result recording
- Simple, easy to read lines provide unambiguous results
- Simple protocols requiring minimal handling.
- No additional capital equipment such as readers, washers, etc

Lateral Flow Tests for *Listeria*, EHEC and *Salmonella*



Learn more at
SigmaAldrich.com/LFT

Update your Food Safety Knowledge

Free Food & Beverage
Webinar Library



Millipore®

Preparation, Separation,
Filtration & Monitoring Products

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400 Summit Drive
Burlington, MA 01803

SigmaAldrich.com



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Or order online at: SigmaAldrich.com/order

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We have built a unique collection of life science brands with
unrivalled experience in supporting your scientific advancements.

Millipore® Sigma-Aldrich® Supelco® Milli-Q® SAFC® BioReliance®

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