About this reference guide

For more than 30 years food safety professionals around the world have trusted 3M™ Petrifilm™ Plates for fast, accurate microbial quantitative testing. These revolutionary, ready-to-use plates have streamlined, standardized and simplified microbial testing and analysis.

This reference guide is a compilation of selected studies from researchers all over the world, who have used 3M Petrifilm Plates to test food products from fruit juices and dairy products to meat, seafood, poultry and processed foods. The studies help prove what most food safety professionals already know: 3M Petrifilm Plates provide consistently accurate results, improve technician productivity and help reduce costs.

For more information about 3M Petrifilm Plates or to request samples, visit 3M.com/foodsafety or call 1-800-328-6553.
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Quality of pasteurized milk influences the performance of ready-to-use systems for enumeration of aerobic microorganisms
Beloti, V., et. al.  
**Petrifilm Plate(s):** Aerobic Count  
**Region:** Latin America

**Efficacy of 3M™ Petrifilm™ Aerobic Count Plates for Enumerating *Bacillus sporothermodurans* and *Geobacillus stearothermophilus* in UHT Milk**
Casillas-Buenrostro, R.M., et. al.  
**Petrifilm Plate(s):** Aerobic Count  
**Region:** Latin America

**Enumeration of the contaminating bacterial microbiota in unfermented pasteurized milks enriched with probiotic bacteria**
Champagne, C.P., et. al.  
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**Evaluation of Petrifilm method for enumerating aerobic bacteria in Crottin goat cheese**
de Sousa, G.B., et. al.  
**Petrifilm Plate(s):** Aerobic Count  
**Region:** Latin America
### Comparison of 3M Petrifilm Staph Express Count System with the bacteriological analytical manual direct-plating method for enumeration of *Staphylococcus aureus* in artificially contaminated hard cheese

Fedio, W.M., et al.


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The 3M™ Petrifilm™ Staph Express Count System was evaluated in comparison to the USDA BAM direct-plate count method looking for *Staphylococcus aureus* in Asiago, Cheddar, Gruyère, Parmesan, Romano and Swiss hard cheeses. Results showed no significant difference between the methods and the 3M™ Petrifilm™ System was reviewed as more convenient to use, considerably faster and less expensive to perform.

### Enumeration of total bacteria and coliforms in milk by dry rehydratable film methods: collaborative study

Ginn, R.E., et al.


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<th>Petrifilm Plate(s):</th>
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### Enumeration of starter cultures during yogurt production using Petrifilm AC plates associated with acidified MRS and M17 broths


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### Shedding patterns of *S. aureus* in quarter foremilk samples of cows with known *S. aureus* infections [Ausscheidung und nachweis von *Staphylococcus aureus* über milch aus infizierten milchdrüsenvierteln]

Krömker, V., et al.


[http://www.animalhealth.bayer.com/456.0.html?&no_cache=1&tx_ttnews%5BpS%5D=1328691219&tx_tnews%5Bpointer%5D=2&tx_ttnews%5Btt_news%5D=1296&tx_ttnews%5BbackPid%5D=425&cHash=f25838d350923d68bebe83635beba4ff](http://www.animalhealth.bayer.com/456.0.html?&no_cache=1&tx_ttnews%5BpS%5D=1328691219&tx_tnews%5Bpointer%5D=2&tx_ttnews%5Btt_news%5D=1296&tx_ttnews%5BbackPid%5D=425&cHash=f25838d350923d68bebe83635beba4ff)

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### Pathogenic microflora found in white “telita” cheese made in four states of Venezuela [Microflora patógena del queso blanco “telita” elaborado en cuatro estados de Venezuela]

Márquez, J.G., et al.


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3M™ Petrifilm™ Plate Bibliography—Dairy

Evaluation of the University of Minnesota Tri-plate and 3M Petrifilm for the isolation of *Staphylococcus aureus* and *Streptococcus* species from clinically mastitic milk samples
McCarron, J.L., et. al.
Petrifilm Plate(s): Staph Express Count
Region: Canada

Laboratory evaluation of 3M Petrifilms and University of Minnesota Bi-plates as potential on-farm tests for clinical mastitis
McCarron, J.L., et. al.
Petrifilm Plate(s): Aerobic Count, Coliform Count
Region: Canada

Recovery of lactic acid bacteria on Petrifilm SM under various incubation atmospheres
McGregor, J.U., et. al.
http://www.ingentaconnect.com/content/iafp/jfp/1995/00000058/00000003/art00017
Petrifilm Plate(s): Aerobic Count
Region: United States

Enumeration of bifidobacteria using Petrifilm AC in pure cultures and in a fermented milk manufactured with a commercial culture of *Streptococcus thermophilus*
Miranda, R.O., et. al.
*Food Microbiology.* 2011; 28(8): 1509-1513.
Petrifilm Plate(s): Aerobic Count
Region: Latin America

**Comparison of Petrifilm aerobic count plates and de Man-Rogosa-Sharpe agar for enumeration of lactic acid bacteria**
Petrifilm Plate(s): Aerobic Count
Region: Latin America

The enumeration of lactic acid bacteria (LAB) in raw milk was compared with a side by side study of 3M™ Petrifilm™ Aerobic Count (AC) plates and de Man-Rogosa-Sharpe (MRS) agar. Results indicate there is no significance in counts between the two media and the advantages of using 3M™ Petrifilm™ Aerobic Count Plates for a rapid enumeration in aerobic microorganisms can be expanded for enumeration of LAB in foods. The authors also noted the convenience is particularly interesting for testing fermented milk products.
Evaluation of two alternative techniques for counting mesophilic aerobic bacteria in raw milk
Rosmini, M.R., et. al.
Petrifilm Plate(s): Aerobic Count Plate
Region: Latin America

Evaluation of the effect of probiotic cultures on two different yogurt brands over a known population of \textit{Staphylococcus aureus} and the production of thermonuclease [Evaluación del efecto de cultivos probióicos presentes en yogurt sobre \textit{Staphylococcus aureus} y la producción de termonucleasa]
Salvatierra M., et. al.
Petrifilm Plate(s): Staph Express Count
Region: Latin America

3M Petrifilm Staph Express Count plate method for the enumeration of \textit{Staphylococcus aureus} in selected dairy foods: collaborative study
Silbernagel, K.M., et. al.
Petrifilm Plate(s): Staph Express Count
Region: United States

Comparison of methods for enumeration of yeasts and molds in shredded low-moisture, part-skim mozzarella cheese
Spangenberg, D.S., et. al.
Petrifilm Plate(s): Yeast & Mold Count
Region: United States

Performance of two ready-to-use systems for enumeration of aerobic mesophilic microorganisms in frozen goat milk
Tavolaro, P., et. al.
Petrifilm Plate(s): Aerobic Count
Region: Latin America

Enumeration of coagulase and thermonuclease-positive \textit{Staphylococcus} \textit{spp.} in raw milk and fresh soft cheese: An evaluation of Baird-Parker agar, Rabbit Plasma Fibrinogen agar and the 3M Petrifilm Staph Express Count System
Vicosa, G.N., et. al.
Petrifilm Plate(s): Staph Express Count
Region: Latin America
Evaluation of the Petrifilm Rapid Coliform Count plate method for coliform enumeration from surimi-based imitation crab slurry
Chung, K.S., et. al.
Petrifilm Plate(s): Rapid Coliform Count
Region: Asia

A survey of microbial levels for incoming raw beef, environmental sources, and ground beef in a red meat processing plant
Eisel, W.G., et. al.
Petrifilm Plate(s): Aerobic Count, Coliform Count, E. coli/Coliform Count
Region: United States

Dry rehydratable film method for enumerating confirmed *Escherichia coli* in poultry, meats, and seafood: collaborative study
Gangar, V., et. al.
Petrifilm Plate(s): E. coli/Coliform Count
Region: United States

Dynabeads™ plus 3M Petrifilm HEC versus Vitek Immunodiagnostic Assay System for detection of *E. coli* O157 in minced meat
Grif, K., et. al.
Petrifilm Plate(s): E. coli/Coliform Count
Region: United States
3M™ Petrifilm™ Plate Bibliography—Meat, Poultry, Seafood

Comparison of conventional plating methods and Petrifilm for the recovery of microorganisms in a ground beef processing facility
Linton, R.H., et. al.
http://www.ingentaconnect.com/content/iafp/jfp/1997/00000060/00000009/art00014?crawler=true

Petrifilm Plate(s): Aerobic Count, Coliform Count, E. coli/Coliform Count
Region: United States

Evaluation of consumable household products for decontaminating retail skinless, boneless chicken breasts
McKee, L.H., et. al.

Petrifilm Plate(s): Aerobic Count, Coliform Count, E. coli/Coliform Count
Region: United States

Evaluation of the Petrifilm plate method for the enumeration of aerobic microorganisms and coliforms in retailed meat samples
Park, Y.H., et. al.

Petrifilm Plate(s): Aerobic Count, Coliform Count
Region: United States

The 3M™ Petrifilm™ Plate method was compared to AOAC aerobic count method and violet red bile agar method for pork, chicken and beef. The performance implies that the 3M Petrifilm Plate method could replace the conventional methods in the analysis of microorganism contamination measurement in meat products. The 3M Petrifilm Plate method was characterized as simpler and less time consuming in sample preparation and in procedures, and faster than conventional methods.

Repeatability of the Petrifilm™ HEC test and agreement with a hydrophobic grid membrane filtration method for the enumeration of Escherichia coli O157: H7 on beef carcasses
Power, C.A., et. al.

Petrifilm Plate(s): E. coli/Coliform Count
Region: Canada
Evaluation of *Escherichia coli* enumeration methods in poultry dishes [Penilaian Kaedah Pengiraan *Escherichia coli* dalam Masakan Ayam]


**Petrifilm Plate(s):** E. coli/Coliform Count  
**Region:** Asia

Eleven methods, including 3M™ Petrifilm™ Plates, for *Escherichia coli* enumeration in poultry dishes were evaluated based on ISO 16140 procedures. Each type of E. coli strains (ATCC 25922, IMR 1/3 107B and IMR E243) were inoculated into five types of poultry dishes to obtain 10^5 cfu/g bacterial concentration. All methods were comparable in term of accuracy, correlation and relative accuracy. Pour plating, drop plating and 3M Petrifilm Plate methods were more practical than the other eight methods evaluated.

Effect of incubation temperature on aerobic plate counts of beef and sheep carcasses

Simmons, J., et al.


**Petrifilm Plate(s):** Aerobic Count  
**Region:** Asia

Enumeration of coliforms and *Escherichia coli* in frozen black tiger shrimp *Penaeus monodon* by conventional and rapid methods

Suwansonthichai, S., et al.


**Petrifilm Plate(s):** E. coli/Coliform Count  
**Region:** Asia
A bibliography of research papers related to the 3M Petrifilm Staph Express Count Plate method for the enumeration of *Staphylococcus aureus* in prepared and processed foods:

**3M Petrifilm Staph Express Count Plate method for the enumeration of *Staphylococcus aureus* in selected types of meat, seafood, and poultry: collaborative study**

McMahon, W.A., et. al.


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**Comparison of the Baird-Parker agar and 3M Petrifilm rapid *S. aureus* count plate methods for detection and enumeration of *Staphylococcus aureus***

Schoeller, N.P., et. al.


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**3M Petrifilm Staph Express Count Plate method for the enumeration of *Staphylococcus aureus* in selected types of processed and prepared foods: collaborative study**

Silbernagel, K.M., et. al.


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**Evaluation of the 3M Petrifilm *Enterobacteriaceae* Count plate method for the enumeration of *Enterobacteriaceae* in foods**

Silbernagel, K.M., et. al.


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<th>Petrifilm Plate(s)</th>
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Comparison of Petrifilm method to conventional methods for enumerating aerobic bacteria, coliforms, *Escherichia coli* and yeasts and molds in foods

Jordano, R., et. al.


Petrifilm Plate(s): Aerobic Count, Coliform Count, E. coli/Coliform Count, Yeast & Mold Count

Region: Europe

Evaluation of Petrifilm series 2000 as a possible rapid method to count coliforms in foods

Priego, R., et. al.

*Journal of Food Protection*. 2000; 63(8): 1137-1140.


Petrifilm Plate(s): Aerobic Count, Coliform Count, E. coli/Coliform Count

Region: Europe

Efficacy of Petrifilm for the enumeration of the aerobic flora, coliforms and *E. coli* in typical Italian products

[Valutazione dei sistemi di analisi microbiologica petrifilm per la conta aerobica totale, coliformi ed *E. coli* in prodotti alimentari italiani]

Seminii, L., et. al.


Petrifilm Plate(s): Aerobic Count, Coliform Count, E. coli/Coliform Count

Region: Europe
Petrifilm Rapid S. aureus count plate method for rapid enumeration of *Staphylococcus aureus* in selected foods: collaborative study
Silbernagel, K.M., et. al.

*Petrifilm Plate(s):* Staph Express Count  
*Region:* United States

Coliforms at 45°C and comparison of most probable number method and Petrifilm EC for enumeration of total coliforms and *Escherichia coli* of foods [*Avaliação do padrão coliformes a 45°C e comparação da eficiência das técnicas dos tubos múltiplos e Petrifilm EC na detecção de coliformes totais e *Escherichia coli* em alimentos*]
Silva M.P., et. al.

*Petrifilm Plate(s):* E. coli/Coliform Count  
*Region:* Latin America
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<td>A comparison of ready-to-use systems for evaluating the microbiological quality of acidic fruit juices using non-pasteurized orange juice as an experimental model</td>
<td>Ramazotti-Ferrati, A., et. al.</td>
<td><em>International Microbiology</em></td>
<td>2005</td>
<td>8(1)</td>
<td><a href="http://www.ncbi.nlm.nih.gov/pubmed/15906261">http://www.ncbi.nlm.nih.gov/pubmed/15906261</a></td>
<td>Aerobic Count, Yeast &amp; Mold Count</td>
<td>Latin America</td>
<td>This study evaluated the performance of 3M™ Petrifilm™ Plates for the enumeration of total aerobes and fungi (yeasts and molds) in acidic fruit juices, using non-pasteurized orange juice as an experimental model. 3M Petrifilm Plates proved to be good alternative methods for testing the microbiological quality of acidic fruit juices.</td>
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<td>Comparison of methods for determining <em>coli form</em> and <em>Escherichia coli</em> levels in apple cider</td>
<td>Silk, T.M., et. al.</td>
<td><em>Journal of Food Protection</em></td>
<td>1997</td>
<td>60(11)</td>
<td><a href="http://www.ingentaconnect.com/content/iafp/jfp/1997/00000060/00000011/art100001?crawler=true">http://www.ingentaconnect.com/content/iafp/jfp/1997/00000060/00000011/art100001?crawler=true</a></td>
<td>High-Sensitivity Coliform Count, E. coli/Coliform Count</td>
<td>United States</td>
<td>This research determined that the easiest and most reliable media for enumerating coliform bacteria and <em>Escherichia coli</em> levels in apple cider are 3M™ Petrifilm™ High-Sensitivity Coliform Count Plates for coliform levels and 3M™ Petrifilm™ E. coli Count Plates for E. coli.</td>
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Evaluation of Petrifilm methods for enumeration of aerobic flora and coliforms in a wide range of foods
Blackburn, C.D.W., et. al.

Petrifilm Plate(s): Aerobic Count, Coliform Count
Region: Europe

Microbiological validation of a film system for monitoring total anaerobic bacterial pollution on surfaces and operator’s overalls in controlled areas [CONVALIDA MICROBIOLOGICA DI UN SISTEMA A FILM PER IL MONITORAGGIO DELLA FLORA BATTERICA AEROBICA TOTALE SU SUPERFICI ED INDUMENTI DI LAVORO IN AREE CONTROLLATE]
Dal maso, G., et. al.

Petrifilm Plate(s): Aerobic Count
Region: Europe

Evaluation of dryfilm method for isolation of microorganisms from foods
Ha, S.-D.
http://astp.jst.go.jp/modules/search/DocumentDetail/0257-2389%2B%2540%2B1598-642x%2B%2540%2B1598-642x%2B%2540%2B_24_2_N%252A%25EC%2588%259D%25ED%2592%2588%25EB%2582%25EB%2584%25EC%259D%2598%2B%25EB%25AF%2588%25EC%2583 %259D%25EB%25AC%25BC%2B%25EB%25B6%2584%25EC%259C%2595%25ED%2595%259C%2Bdryfilm%2B%25EB%2580%25A9%25EB%2582%2595%25EC%259D%2598%2B%25ED%258F%2589%25EA%2B%2580%25 EC%2597%2580%25EA%2585%25AC

Petrifilm Plate(s): Aerobic Count, Coliform Count, E. coli/Coliform Count
Region: Asia

Manual squeezing as an alternative to mechanical stomaching in preparing beef carcass sponge samples for microbiological analysis
Ingham, S.C., et. al.

Petrifilm Plate(s): Aerobic Count, Coliform Count, Enterobacteriaceae Count
Region: United States
Comparison of the Baird-Parker agar and 3M™ Petrifilm™ Staph Express Count Plate methods for enumeration of *Staphylococcus aureus* in naturally and artificially contaminated foods

Ingham, S.C., et. al.


Petrifilm Plate(s): Staph Express Count

Region: United States

Comparison of Petrifilm method to conventional methods for enumerating aerobic bacteria, *Escherichia coli* and yeasts and molds in foods

Jordano, R., et. al.


Petrifilm Plate(s): Aerobic Count, Coliform Count, E. coli/Coliform Count, Yeast & Mold Count

Region: Europe

Dry rehydratable film method for rapid enumeration of coliforms in foods (3M™ Petrifilm™ Rapid Coliform Count Plate): collaborative study

Kinneberg, K.M., et. al.


Petrifilm Plate(s): Rapid Coliform Count

Region: United States

Comparison of the Petrifilm dry rehydratable film and conventional culture methods for enumeration of yeasts and molds in foods: collaborative study

Knight, M.T., et. al.


Petrifilm Plate(s): Yeast and Mold Count

Region: United States

Evaluation of a dry, rehydratable film method for rapid enumeration of *Staphylococcus aureus*

Mach, P.A., et. al.


Petrifilm Plate(s): Staph Express Count

Region: United States
3M™ Petrifilm™ Plate Bibliography—Miscellaneous

Development of a PCR assay for detection of Enterobacteriaceae in foods
Nakano, S., et. al.
Petrifilm Plate(s): Enterobacteriaceae Count
Region: United States

Comparison of 3M Petrifilm Environmental Listeria plates against standard enrichment methods for the detection of Listeria monocytogenes of epidemiological significance from environmental surfaces
Nyachuba, D.G., et. al.
Petrifilm Plate(s): Environmental Listeria
Region: United States

Evaluation of Petrifilm series 2000 as a possible rapid method to count coliforms in foods
Priego, R., et. al.
Petrifilm Plate(s): Aerobic Count, Coliform Count, E. coli/Coliform Count
Region: Europe

Evaluation of Petrifilm EC method for enumeration of E. coli from soil
Samarajeewa, A.D., et. al.
Petrifilm Plate(s): E. coli/Coliform Count
Region: Canada

Evaluation of Petrifilm system for enumeration of aerobic flora, coliforms and E. coli. Results of a ring test [Valutazione dei sistemi di analisi microbiologica Petrifilm conta aerobica totale, coliformi ed E. Coli. Risultati di uno studio interlaboratorio]
Senini, L., et. al.
http://agris.fao.org/agris-search/search/display.do?f=2001%2FIT%2FIT01004.xml%38IT2001060826
Petrifilm Plate(s): Aerobic Count, Coliform Count, E. coli/Coliform Count
Region: Europe
3M™ Petrifilm™ Plate Bibliography—Miscellaneous

**Efficacy of Petrifilm for the enumeration of the aerobic flora-coliforms and *E. coli* in typical Italian products [Valutazione dei sistemi di analisi microbiologica petrifilm per la conta aerobica totale, coliformi ed *E. coli* in prodotti alimentari Italiani]**

Senini, L., et. al.

**Petrifilm Plate(s):** Aerobic Count, Coliform Count, E. coli/Coliform Count  
**Region:** Europe

**3M™ Petrifilm™ Enterobacteriaceae Count plate method for enumeration of Enterobacteriaceae in selected foods: collaborative study**

Silbernagel, K.M., et. al.

**Petrifilm Plate(s):** Enterobacteriaceae Count  
**Region:** United States

**Petrifilm Rapid S. aureus Count plate method for rapid enumeration of Staphylococcus aureus in selected foods: collaborative study**

Silbernagel, K.M., et. al.

**Petrifilm Plate(s):** Staph Express Count  
**Region:** United States

**Coliforms at 45°C and comparison of most probable number method and Petrifilm EC for enumeration of total coliforms and *Escherichia coli* of foods [Avaliação do padrão coliformes a 45°C e comparação da eficiência das técnicas dos tubos múltiplos e Petrifilm EC na detecção de coliformes totais e *Escherichia coli* em alimentos]**

Silva, M.P., et. al.
*Ciencia e Tecnologia de Alimentos.* 2006; 26(2): 352-359.

**Petrifilm Plate(s):** E. coli/Coliform Count  
**Region:** Latin America
Volunteer monitoring of *E. coli* in streams of the upper Midwestern United States: A comparison of methods

Stepenuck, K.F., et al.


**Petrifilm Plate(s):** E. coli/Coliform Count

**Region:** United States

This study evaluated two *E. coli* monitoring methods, Coliscan Easygel and 3M™ Petrifilm™ Plates to compare to the results of the EPA-approved laboratory analyses. 3M Petrifilm Plates results were more related to the laboratory analyses than Coliscan Easygel. Both test methods had comparable overall accuracy of predicting if a sample exceeded or fell below the 235 cfu/100 mL EPA body contact standard for recreational surface waters but two-thirds of volunteers favored 3M Petrifilm Plates.

Enumeration of *Staphylococcus aureus* using CHROMagar and Petrifilm plates [Quantitative Bestimmung von *Staphylococcus aureus mittels CHROMagar™ und Petrifilm*]

Wichmann-Schauer, H., et al.

*Fleischwirtschaft*. 2004; 84(6): 120-123.

http://cat.inist.fr/?aModele=afficheN&cpsidt=15862414

**Petrifilm Plate(s):** Staph Express Count

**Region:** Europe

Comparative evaluation of the association among enumeration methods and production of enterotoxins in food-derived *Staphylococcus aureus*

Zhang, C., et al.


**Petrifilm Plate(s):** Staph Express Count

**Region:** Asia

The morphological enumerations of food-derived *S. aureus* and production of SEs using different methodologies was evaluated and the 3M™ Petrifilm™ Staph Express Count Plate displayed better performance for the enumeration of SE-positive *S. aureus* when compared with BP, including higher frequencies of SE-positive isolates and better correlation indices between typical and SE-positive counts. Among all the evaluated culture media, no significant difference (P > 0.05) was shown on the frequencies of typical colonies that carried 11 individual SE genes. This study will be important for the selection of methods for inspection of food-derived *S. aureus*. 