Microbiological Testing of Foods, Beverages, Drinking Water and Pharmaceuticals
Introduction

The consumer's steadily growing requirements for the quality and the longer shelf life of foods and beverages must be met by the manufacturer. Quality assurance can't be limited to inspection of the final product alone, such as a bottled beverage or a prepared food product. Instead, continuous inspection of incoming raw materials and in-process quality control tests must be performed throughout production. Microbiological and aseptic testing play a significant role in such quality assurance.

In the soft drink industry the microbiological and hygienic quality including the biological stability of the products are important criteria for their assessment. The reason: just a few microbes are often all it takes to spoil large quantities of a beverage.

Although the explosive technological development has reduced the risk of contamination by spoiling microbes, the issue of shelf life has taken on new dimensions as a result of the enormous production output possibilities of today. Quality control of bottling and filling, in terms of chemical and, above all, biological stability, must be adapted to this development by state-of-the-art test methods.

The requirements for a practical microbiological test method are that it permits quantitative and reproducible detection of trace contamination and that it can be performed efficiently and economically under routine conditions. These requirements are fulfilled optimally by the membrane filter method.

The principle of this method is based on the concentration of microorganisms from relatively large samples on the surface of the membrane filter, and on culturing these microbes on a nutrient pad or an agar culture medium.
The Membrane Filter Method

**Description**
The Membrane Filter Method
A membrane filter of the appropriate pore size is placed in a filter holder, and the sample is filtered. In this process microorganisms in the test sample are retained on the filter surface by the screening action of the membrane filter.

Growth inhibitors can be removed by flushing the membrane with sterile NaCl solution after filtration. Afterwards, the membrane filter is placed on a culture medium and incubated.

For the Monitor MF-Methode the monitor is ready to use due to a pre-assembled membrane and pad inside.

The nutrient media is added from the top and sucked into the pad by a short vacuum (<1 sec.) After removal of the funnel the lid and the base fit to a petri dish.

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Nutrients and metabolites are exchanged through the pore system of the membrane filter. Colonies, which have developed on the membrane filter surface during incubation, are counted and related to the sample volume.

**The Advantages:**
- Proofen accuracy
  Compared with the direct method, considerably larger sample volumes can be tested. This concentration effect increases the accuracy of microbial detection.
- Quantitative results
  The visible colonies can be related directly to the sample volume.
- Documentation
  The membrane filter with colony growth can be filed as a permanent record of the test.

**No Inhibitors**
Inhibitors, such as essential oils or disinfectants, can be flushed from the membrane filter after filtration.

**GMP Quality**
Sartorius Stedim Biotech Membrane Filters are manufactured under GMP conditions, ensuring consistently quality and high reproducibility from batch to batch and within each batch.

**The Culture Media**
Microorganisms can be detected by different methods.

Methods involving culturing techniques and the microscope are used to detect microbes, whereas biochemical and serological techniques are commonly applied to differentiate among such organisms.

For detecting microorganisms in cultures, liquid and solid culture media are employed. Microorganisms are concentrated by growth in or on these culture media.

Quantitative detection is only possible with solid culture media because the individually developing colonies can be evaluated and counted on the surface.

The following culture media can be used for microbiological testing:

- Nutrient Pad Sets
  Nutrient Pad Sets definitely optimize the membrane filter method.
  They standardize microbiological test procedures, making them much more efficient.
  The simplify laboratory work.
  They help to save time and money.

  - Absorbent pads to be wetted with culture media.
  - Culture media with agar or gelatin as the solidifying agent.

The nutrient Pad Sets are described on the following pages and certainly offer the most convenient way to use the membrane filter method.
Direct Method
The test sample is pipetted into a petri dish...

Membrane Filter Method
The test sample is filtered through a membrane filter

Standard MF method
The membrane filter is rinsed and then placed on a culture medium – a, b, or c – and incubated.

Monitor MF method
The nutrient media is given from the top after filtration. After a short vacuum (<1 sec.), the monitor is closed with the plug at the bottom. Remove the funnel, fit lid and base to a petri dish.

... then mixed with the culture medium and incubated

For further information on Sartorius Stedim Biotech Biosart 100 Monitors, please refer to the publications SM-1013-e
User Benefits

**Economical**

Eliminates time-consuming and labor-intensive preparation of culture media (sterilization and cleaning, among others).

| After wetting with 3.5 ml distilled water NPS are ready to use: NPS and go |

**Simple to Use**

Nutrient Pad Sets can also be used in laboratories which do not have extensive microbiological equipment. Sterile water for moistening the pads can be added easily with a Sartorius Stedim Biotech Dosing Syringe and an attached Syringe Filter Holder (0.2 µm) or with an ampoule with sterile water.

| Everyone can use NPS |

**Consistently Quality**

During manufacture, each type of Nutrient Pad Set is compared with the corresponding agar medium with respect to their growth-promoting properties. This QA procedure ensures consistent quality and reproducible results.

| NPS are validated. In comparison to agar which is done within different deviations of amount and height NPS always give constant results |

**Trouble-free Storage**

Nutrient Pad Sets have a shelf life of up to 24 months at room temperature.

| No waste or overproduction of prepared agar media |

**Highly Versatile**

Nutrient Pad Sets can be modified by additives in the solution used to wet them; for example, Wort or Orange Serum Nutrient Pads when wetted with 5–8% ethanol promote the growth of acetic-acid bacteria

| Advanced system |
How to Use Nutrient Pad Sets

It’s so easy to use Nutrient Pad Sets: NPS and go

1. Before starting with the tests remove everything that is not essentially needed for this work.
2. Carefully clean and disinfect your working area.
3. For simple microbiological tests a laminar flow box is not needed. When used unprofessionally, a laminar flow box increases the risk of secondary contamination instead of protecting from it. A good protection against airborne contamination, however, is to work close to the flame of a Bunsen burner. Instruments like forceps should be placed into a glass with alcohol.

Label the needed amount of Nutrient Pads.

Wet the Nutrient Pad with 3.5 ml of sterile, deionized or distilled water.
Use a dosing syringe with a Minisart® or a sterile pipette.
Open the lid of the Petri dish only slightly to avoid airborne contamination.

Open the vacuum valve. [6 o’clock⁴]
Carefully flame the filter support for ~10 sec.
Close the vacuum valve again. [9 o’clock⁵]
Take the funnel at both sides of the clamp and flame it from its lower side for ~10 sec.
Then place it on the filter support.

Take the forceps and flame it.
Let it cool off for a few seconds before use.
Let the Microsart® c.emotion Dispenser release the membrane filter automatically by approaching tweezers or by press button.
Alternatively you peel back the transparent plastic layer of the membrane filter packaging manually.
Use tweezers to remove the content out of the packaging.

The membrane filter is placed by the tweezers onto the filter support of the filter holder.
The protective paper or grid should face upwards. If there is a protective disc make sure to discard it before assembling the funnel or the top part of the filter holder.

Place the funnel on the filter support and close it with the clamp.
For long time filtration cover the funnel with the lid.

Open the valve and filter the sample. [6 o’clock⁴]
Rinse with a few ml of sterile water to remove all product residues or inhibitors that might be contained in the sample.
Close the valve again. [9 o’clock⁵].
Remove the funnel and take the filter with the sterile forceps.

To cool it off faster, rinse with a few ml of sterile water.

Place the filter on the Nutrient Pad, avoid to entrap air bubbles under the filter.
Open the lid of the Petri dish only slightly to avoid airborne contamination.

Place the Petri dish into the incubator, lid above.
Incubate strictly according to the recommendations.
Evaluate immediately after the end of the incubation time.

How to Use Nutrient Pad Sets

10 o’clock – After the Filtration Run
The residual vacuum between the pump and valve is released via the venting filter.

12 o’clock – For Autoclaving
For reliable sterilization, the steam flows freely through all openings.

6 o’clock – For Filtration
The tap is open. The full vacuum is effective at the filter support/membrane filter. The venting filter is “off-line”.

9 o’clock – After Filtration
The tap is closed. The vacuum between the valve and membrane filter is released under sterile conditions. Secondary contamination of the bottom of the filter is ruled out entirely.
General Directions

General Procedure
To obtain reliable results for microbiological tests, it is necessary to work under conditions that rule out contamination by microorganisms which distort such results.

That is why it is recommended to work near the flame of a Bunsen burner in a room protected from drafts. Before beginning with the actual procedure, spraying or washing down the working area with a disinfectant is mandatory (e.g., 70% alcohol).

Before use, filter holders, tweezers and scissors should be sterilized by one of the standard methods, such as flaming for routine tests.

How to Handle Microorganisms
Microorganism cultures must always be handled as carefully as if they contained pathogens.

Working with microorganisms is not dangerous if the following safety rules are observed:

- Wash your hands thoroughly before and after working in a laboratory.
- Do not eat or drink in a laboratory.

Do not touch bacterial matter with your hands.

Before and after use, inoculating loops and wires must be sterilized by flaming until they glow red-hot.

All laboratory equipment which has come in contact with bacteria must be sterilized.

To protect people and animals from contagious diseases or poisoning, living cultures have to be destroyed before cleansing or disposing of the containers. One method is to coat them thoroughly with disinfectants or to autoclave them in suitable containers.

Sartorius Stedim Biotech Nutrient Pads are participating regularly at official inter-laboratory tests for the microbiological investigation of drinking water according to the New European Drinking Water Guideline. This certificate of the “Niedersächsischen Landesgesundheitsamt” in Aurich (public health agency, Lower Saxony) quote a reference for the passed tests with good success.
Description and Typical Growth Evaluation Results

1. Total Colony Count

**Casio NPS**
Type 14063

Soybean–Casein Digest medium for isolating microorganisms and for determining the total CFU count. Dehydrated culture medium for cultivating microorganisms in pharmaceuticals, cosmetics, raw materials, water (general quality), waste water, foods and other products.

**References:**
APHA (dairy), APHA (food), APHA (water), AOAC, DAB, EG 98/83, EP, FDA, IDF, ISO 7704, ISO 8199, ISO 9308-1 [1990], ISO 9308-1 [2001], USDA, USP

**Incubation Conditions:**
Bacteria: ≤ 3 days at 30–35°C
Yeasts and molds: ≤ 5 days at 30–35°C

**Evaluation and Typical Results:**
Predominantly bacteria grow on this medium. Predominantly bacteria grow on this medium. Their colonies are of different size and color, most of them are white or colorless. Remarks: Depending on the microbes to be detected, this medium can be converted into a selective one. When 10% serum is added to the wetting liquid a number of fastidious pathogenic bacteria like the genera Pneumococcus, Neisseria, Streptococcus, Corynebacterium, Erysipelothrix and Brucella are able to grow on the medium.

**R2A NPS**
Type 14084

Low nutrient medium for the enumeration of heterophilic organisms in treated potable water and highly purified water. Growth medium for microorganisms which have adapted to the particular living conditions of water low in nutrients. Dehydrated culture medium for cultivating microorganisms in water for pharmaceutical purpose, water (general quality), waste water and other products.

**References:**
APHA (water), EP, ISO 7704

**Incubation Conditions:**
Bacteria: ≥ 5 days at 30–35°C
Yeasts and molds: ≥ 5 days at 30–35°C

**Evaluation and Typical Results:**
Predominantly bacteria grow on this medium. Their colonies are of different size and color, most of them are white or colorless. Remarks: Stressed and chlorine-tolerant bacteria are stimulated by this medium in combination with lower incubation temperatures and longer incubation time.

**Standard TTC (I mod.) NPS**
Type 14055

Meat extract-peptone medium for determining the total CFU count based on the “APHA (water)” and modified by the addition of TTC. Dehydrated culture medium for cultivating microorganisms in raw materials, water (general quality), waste water, beverages, beer, foods and other products.

**References:**
APHA (water), ISO 7704, VLB

**Incubation Conditions:**
≤ 5 days at 30–35°C

**Evaluation and Typical Results:**
Predominantly bacteria grow on this medium. The majority of their colonies are stained red by TTC reduction.
1. Total Colony Count

**Standard NPS**
Type 14064

Meat extract-peptone medium for determining the total CFU count; based on the “APHA (water)”. Dehydrated culture medium for cultivating microorganisms in raw materials, water (general quality), waste water, beverages, beer, foods and other products.

**References:**
APHA (water), ISO 7704, VLB

**Incubation Conditions:**
≤ 5 days at 30–35°C

**Evaluation and Typical Results:**
Predominantly bacteria grow on this medium. The morphology and color of their colonies vary.

**TGE NPS**
Type 14076

Tryptone Glucose Extract medium for isolating microorganisms and for determining the total CFU count. Dehydrated culture medium for cultivating microorganisms in raw materials, water (general quality), waste water, beverages, soft drinks, concentrates, foods and other products.

**References:**
APHA (dairy), APHA (food), APHA (water), API, ISO 7704

**Incubation Conditions:**
≤ 5 days at 30–35°C

**Evaluation and Typical Results:**
On this medium predominantly colonies of bacteria grow that can have different size and colors.

**Yeast Extract NPS**
Type 14090

For the detection of the total count of aerobic heterotrophic bacteria. Dehydrated culture medium for cultivating microorganisms in water (general quality) and other products.

**References:**
EG 98/83, HMSO, ISO 6222, ISO 7704, ISO 8199

**Incubation Conditions:**
44 ±4 hours at 36 ±2°C; 68 ±4 hours at 22 ±2°C

**Evaluation and Typical Results:**
Predominantly bacteria grow on this medium. The majority of all colonies are colorless.
2. E. Coli and Coliforms, Enterobacteria

**CHROMOCULT**® NPS
Type 14087

For the detection of total coliforms and Escherichia coli. Dehydrated culture medium for cultivating microorganisms in raw materials, water (general quality), waste water, beverages, foods and other products.

References:
ISO 7704, Journal Food Protection, ZenHyg (journal of hygiene)

**Incubation Conditions:**
20–28 hours at 36 ±2°C

**Evaluation and Typical Results:**
E. coli develops dark-blue to violet colonies, other coliforms red to pink colonies. Other gram-negative colonies are colorless, a few with ß-Glucuronidase activity are light blue to turquoise. Remarks: To confirm E. coli give one drop of Kovacs indole reagent on each dark blue colony. Cherry red color after a few seconds is a positive reaction.

* Trade mark owner and manufacturer is Merck KGaA

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**ECD NPS**
Type 14082

Selective culture medium for detecting and identifying Escherichia coli. Bile salt inhibits the accompanying flora of microbes not living in the intestine. Dehydrated culture medium for cultivating microorganisms in raw materials, water (general quality), waste water, beverages, foods and other products.

References:
APHA (water), DIN 10110, EG 98/83, ISO 7704, ISO 8199, ISO 9308-1 [2001], LMBG, USDA

**Incubation Conditions:**
16–18 hours at 44 ±2°C

**Evaluation and Typical Results:**
Colonies that show light blue fluorescence under UV light indicate E. coli; confirmation with a drop of KOVÁCS indole reagent is required, a positive reaction is shown by a cherry color after a few seconds. Remarks: This medium can be used for the rapid detection of Escherichia coli based on the ISO 9308-1.

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**Endo NPS**
Type 14053

Selective medium for detecting and enumerating E. coli and coliform bacteria. Dehydrated culture medium for cultivating microorganisms in raw materials, water (general quality), natural water, waste water, beverages, soft drinks, concentrates, fruit juice, sugar, sugar products, foods and other products.

References:
APHA (dairy), APHA (food), APHA (water), DGHM, ISO 7704, ISO 9308-1 [1990], MNO, USDA

**Incubation Conditions:**
18–24 hours at 36 ±2°C

**Evaluation and Typical Results:**
E. coli form red colonies with a metallic sheen and a red dot at the underside of the membrane. Other coliforms grow as dark to light red colonies without metallic sheen. Colorless colonies of lactose-negative bacteria are not counted.

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* Abbreviations: APHA (American Public Health Association), ISO (International Organization for Standardization), USDA (United States Department of Agriculture), DGHM (Deutsche Gesellschaft für Hygiene und Mikrobiologie), EG (European Guidelines), LMBG (Ländergesetzgebung der Bundesländer in Deutschland, Landesgesetzgebung der Bundesländer in Deutschland), MNO (Mittleres Naturschutzordnungsverfahren).
2. E. Coli and Coliforms, Enterobacteria

**MacConkey NPS**
Type 14097

For the isolation and differentiation of coliform bacteria and other enterobacteriaceae. Dehydrated culture medium for cultivating microorganisms in pharmaceuticals, cosmetics, raw materials, water (general quality), natural water, waste water, beverages, soft drinks, concentrates, fruit juice, foods and other products.

**References:**
APHA (dairy), APHA (food), APHA (water), AOAC, DAB, DIN 38411, DGHM, EP, ISO 7704, LMBG, MNO, USDA, USP

**Incubation Conditions:**
18–72 hours at 30–35°C

**Evaluation and Typical Results:**
Escherichia coli forms large red or reddish colonies, coliform microbes form large pink, sometimes slimy colonies, lactose-negative enterobacteria form colorless colonies. Gram-positive microbes are inhibited.

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**m FC NPS**
Type 14068

For the detection of E. coli and faecal coliform bacteria according to Geldreich et al. Dehydrated culture medium for cultivating microorganisms in raw materials, water (general quality), waste water, beverages, foods and other products.

**References:**
APHA (food), APHA (water), AOAC, EPA, FDA, ISO 7704, ISO 9308-1 [1990], USDA

**Incubation Conditions:**
18–24 hours at 36 ±2°C

**Evaluation and Typical Results:**
E. coli and coliform bacteria form blue colonies with a blue surrounding. This color is dark blue at faecal coliforms with strong lactose fermentation and lighter blue for non-faecal coliforms with weaker lactose fermentation. Lactose-negative bacteria grow with different colors and are not evaluated. Remarks: Higher incubation temperatures largely suppress the non-faecal coliforms.

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**Teepol NPS**
Type 14067

Lauryl Sulphate medium for the detection of E. coli and faecal coliform bacteria according to Burman, N.P. (1967). Dehydrated culture medium for cultivating microorganisms in water (general quality), waste water, beverages, foods and other products.

**References:**
AFNOR, APHA (water), BS, FDA, ISO 7704, ISO 9308-1 [1990], USDA

**Incubation Conditions:**
18–24 hours at 36 ±2°C

**Evaluation and Typical Results:**
E. coli and coliform bacteria form 1–2 mm diameter yellow colonies surrounded by a yellow zone. Non-lactose fermenting bacteria develop red or colorless colonies without yellow zone.
3. Other Faecal Bacteria

**Tergitol TTC NPS**  
Type 14056

Selective and differential medium for the detection and enumeration of coliform bacteria and E. coli according to Pollard; modified acc. to Chapman. Dehydrated culture medium for cultivating microorganisms in raw materials, water (general quality), waste water, beverages, foods and other products.

**References:**  

**Incubation Conditions:**  
18–24 hours at 36±2°C

**Evaluation and Typical Results:**  
Lactose-positive microorganisms form yellow-orange colonies with a yellow surrounding and have a yellow dot under the membrane filter. According to ISO 9308-1 all colonies that show yellow color under the membrane filter are counted as positive. Remarks: Tergitol 7 inhibits Gram positive colonies and minimizes the swarming of Proteus. Further differentiations of E.coli and coliforms with Oxidase- and Indol-Tests are required.

**Azide NPS**  
Type 14051

For the detection and enumeration of intestinal enterococci according to Slanetz and Bartley. Dehydrated culture medium for cultivating microorganisms in raw materials, water (general quality), natural water, waste water, beverages, foods and other products.

**References:**  
APHA (food), APHA (water), EG 98/83, HMSO, ISO 7704, ISO 7899-2, ISO 8199, LMBG, MNO

**Incubation Conditions:**  
40–48 hours at 36±2°C

**Evaluation and Typical Results:**  
Enterococci form red, pink or reddish brown colonies with a diameter of 0.5–2 mm. Remarks: Enterococci are considered to be indicator organisms of faecal contamination. They are less sensitive to chemical effects than are E. coli organisms and are therefore longer detectable, for instance in waste water and in chlorinated water.

**Bismuth Sulfite NPS**  
Type 14057

Selective culture medium according to Wilson and Blair for isolating Salmonella typhi and other salmonellae. Dehydrated culture medium for cultivating microorganisms in pharmaceuticals, cosmetics, raw materials, water (general quality), waste water, foods and other products.

**References:**  
AFNOR, APHA (dairy), APHA (food), AOAC, DGHM, FDA, HMSO, ISO 6579 [1981], ISO 7704, USDA, USP

**Incubation Conditions:**  
40–48 hours at 36±2°C

**Evaluation and Typical Results:**  
Most salmonellae form light colored colonies with brown to black centers surrounded by a black zone with a metallic sheen (“fish eye”). Some Salmonella species develop uniformly dark brown to black colonies which may lack the typical zone. Remarks: If a very slight contamination with salmonellae is suspected, prepare a selective enrichment culture and subsequently streak the sample with an inoculation loop on a membrane filter that has been placed on the pre-wetted NPS.
4. Non-faecal, Pathogenic Bacteria

Cetrimide NPS
Type 14075
For the detection and enumeration of Pseudomonas aeruginosa according to Lowbury. Dehydrated culture medium for cultivating microorganisms in cosmetics, raw materials, water, waste water, foods and other products.

References:
APHA (water), AOAC, ASM, DIN 38411, EG 98/83, FDA, ISO 7704, ISO 8199, EN 12780, EN ISO 16266

Incubation Conditions:
40–48 hours at 36±2°C

Evaluation and Typical Results:
Pseudomonas aeruginosa forms blue, blue-green or yellow-green colonies with 1–2 mm diameter and blue zones. The colonies produce pyocyanin and fluorescein and show fluorescence in UV-light. Other Pseudomonads develop colonies with different colors. Remarks: Further tests are necessary for definitive identification of Ps. aeruginosa.

Chapman NPS
Type 14074
Mannitol salt medium according to Chapman, modified for detecting and isolating pathogenic Staphylococci. Dehydrated culture medium for cultivating microorganisms in pharmaceuticals, cosmetics, raw materials, water, waste water, foods and other products.

References:
APHA (food), AOAC, DGHM, FDA, HMSO, ISO 7704, USP

Incubation Conditions:
18–72 hours at 30–35°C

Evaluation and Typical Results:
Staphylococcus aureus forms yellow colonies with a yellow surrounding (mannitol-positive). Other Staphylococci grow without zones of color change. Most other bacteria are inhibited.

Torulopsis spec.
"Wild yeasts" from lager beer

5. Yeasts and Molds

Lysine NPS
Type 14061
Selective medium for isolating and enumerating "wild yeasts" in breweries acc. to Morris and Eddy. Dehydrated culture medium for cultivating microorganisms in beer and other products.

References:
Journal Institute of Brewing, VLB

Incubation Conditions:
3–5 days at 30–35°C

Evaluation and Typical Results:
Only "wild yeasts" (not belonging to the genus Saccharomyces) which utilize lysine as sole source of nitrogen grow on this medium, they form white or cream colored colonies; brewery culture yeasts grow not at all or very poorly.
5. Yeasts and Molds

**Malt Extract NPS**  
Type 14086  

For the isolation and enumeration of yeasts and molds. Dehydrated culture medium for cultivating microorganisms in beverages, wine, soft drinks, concentrates, fruit juice, foods and other products.  

**References:**  
APHA (food), AOAC, IFU  

**Incubation Conditions:**  
3–5 days at 20–25°C or at 30–35°C depending on the target of the investigation  

**Evaluation and Typical Results:**  
Yeasts normally develop smooth white, rarely colored colonies. Molds generally form velvety or fluffy, cotton-like colonies that are white during the early growth phase and later, after conidiospore formation, of various colors. Remarks: The low pH of this medium suppresses the growth of most bacteria. This medium is available with two different types of membrane filters.

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**Sabouraud NPS**  
Type 14069  

For the cultivation and enumeration of yeasts and molds. Dehydrated culture medium for cultivating microorganisms in pharmaceuticals, cosmetics, raw materials, water (general quality), waste water and other products.  

**References:**  
APHA (food), AOAC, EP, USP  

**Incubation Conditions:**  
≤ 5 days at 20–25°C  

**Evaluation and Typical Results:**  
Yeasts usually develop smooth white or colored colonies. Molds form velvety or fluffy, cotton-like colonies that are white in the early growth phase and may take various colors after conidiospore production. Remarks: According to the EP | USP antibiotics could be added immediately before use.

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**Schaufus Pottinger**  
(in Green yeast and mold) NPS  
Type 14070; 14072; 14080; 14083; 14091.  

M Green Yeast and Mold medium for the detection of yeasts and molds according to Schaufus and Pottinger. Dehydrated culture medium for cultivating microorganisms in wine, soft drinks, concentrates, sugar, sugar products and other products.  

**Incubation Conditions:**  
2–5 days at 20–25°C or at 30–35°C depending on the target of the investigation  

**Evaluation and Typical Results:**  
Molds develop velvety or fluffy whitish or greenish colonies which can get various colors after conidiospore production. Yeasts have a smooth surface. Acid forming sugar fermenters are whitish to yellow, non-acid formers are, by contrast, greenish to blue-green. Remarks: The low pH suppresses the growth of most bacteria. This medium is available with various types of membrane filters: 3 different pore sizes and 2 different colors.
6. Product-spoiling Microorganisms

Wallerstein (WL Nutrient) NPS
Type 14089

For the detection and enumeration of the microbiological flora of brewing and fermentation processes acc. to Green and Gray (1950). Dehydrated culture medium for cultivating microorganisms in beverages, beer, wine, soft drinks, concentrates, fruit juice and other products.

References:
ISO 7704

Incubation Conditions:
2–5 days at 30–35°C aerobic or anaerobic depending on the target of the investigation

Evaluation and Typical Results:
Yeast-spoiling microorganisms such as Saccharomyces cerevisiae and the mixed culture from canned vegetables grow as yeast colonies. The colonies are usually smooth and white or colored. Yeast colonies are typically round with a diameter of 2–5 mm, and may take various colors after conidiospore production. Bacteria grow slowly and their colonies are of different size and color.

Saccharomyces cerevisiae
Saccharomyces cerevisiae
Bacillus coagulans, the "flat sour" colony
Lactobacillus plantarum
Yeast and molds from spoiled beer
Mixed culture from canned vegetables

Wort NPS
Type 14058, 14092

For the detection and determination of yeasts and molds. Dehydrated culture medium for cultivating microorganisms in raw materials, beverages, beer, wine, soft drinks, concentrates, foods and other products.

References:
VLB

Incubation Conditions:
3–5 days at 20–25°C or at 30–35°C depending on the target of the investigation

Evaluation and Typical Results:
Yeasts usually grow as round yellowish green colonies. Molds generally form velvety or fluffy cotton-like colonies that look white in the early growth phase and may take various colors after conidiospore production. Bacteria grow slowly and their colonies are of different size and color.

Saccharomyces cerevisiae

Glucose Tryptone NPS
Type 14066

For the enumeration of mesophilic and thermophilic bacteria, especially “flat-sour” microorganisms in canned foods.

References:
APHA (dairy), APHA (food), AOAC, ICUMSA, IFU, ISO 7704, NCA

Incubation Conditions:
18–72 hours at 30–35°C for mesophilic bacteria; 48–72 hours at 55 ±2°C for thermophilic sporulating microorganisms

Evaluation and Typical Results:
Microorganisms that ferment glucose and produce acid grow as yellowish green colonies. “Flat-sour” colonies have a diameter of 2–5 mm, a yellowish-green color and are surrounded by a yellow zone. Remarks: For the incubation at 55 ±2°C the petri dishes must be placed into a moist chamber.
## Jus de Tomate (Tomato Juice) NPS
**Type 14079**

For the detection of product spoiling lactic acid bacteria especially *Oenococcus oeni* acc. to Dubois, Bindan and Lafon-Lafourcade. Tight-fitting, special petri dishes for microaerophilic incubation. Dehydrated culture medium for cultivating microorganisms in wine, fruit juice and other products.

**References:**
ISO 7704, Lanaridris & Lafon-Lafourcade

**Incubation Conditions:**
5–7 days at 30–35°C anaerobic (microaerophil); control for slowly growing micro-organisms after 10 days is recommended

**Evaluation and Typical Results:**
Lactobacilli form compact, whitish to slightly yellowish colonies with 1–3 mm diameter. *Pediococcus* develop somewhat smaller colonies with approx. 1 mm diameter that later get a whitish to slightly brownish color. *Oenococcus oeni* grows as colorless to whitish colonies with a diameter smaller than 1 mm. Remarks: This medium must be incubated under anaerobic to microaerophilic conditions.

## Orange Serum NPS
**Type 14062; 14096**

For the isolation and enumeration of acid-tolerant microorganisms. Dehydrated culture medium for cultivating microorganisms in raw materials, water (general quality), waste water, wine, soft drinks, concentrates, fruit juice, foods and other products.

**References:**
APHA (water), IFU, ISO 7704, MPP (packaging staff)

**Incubation Conditions:**
3–5 days at 30–35°C aerobic or anaerobic depending on the target of the investigation

**Evaluation and Typical Results:**
Only acid-tolerant microorganisms can grow on this medium such as lactic acid bacteria (*Lactobacillus, Pediococcus* etc.), acetic acid bacteria, yeasts and molds.

Remarks: This medium is available with pH 5.5 and with pH 3.2.

## VLB-S7–S NPS
**Type 14059**

For the detection of *pediococci* and lactobacilli according to Emeis; modified acc. to Rinck and Wackerbauer. Dehydrated culture medium for cultivating microorganisms in beer and other products.

**References:**
EBC, ISO 7704, MEBAC, VLB

**Incubation Conditions:**
3–5 days at 30–35°C anaerobic (microaerophil)

**Evaluation and Typical Results:**
*Pediococci* (“Sarcina”) develop round pale green colonies with smooth peripheries and approx. 1 mm in diameter. *Lactobacilli* grow as slightly rounded, irregularly lobed colonies with approx. 2 mm in diameter which are initially light green and later dark green. Remarks: This medium must be incubated under anaerobic to microaerophilic conditions.
6. Product-spoiling Microorganisms

**Weman NPS**
Type 14065

For the detection and determination of slime-forming mesophilic bacteria according to Weman, modified acc. to Lorenz. Dehydrated culture medium for cultivating microorganisms in soft drinks, concentrates, sugar, sugar products and other products.

**References:**
ICUMSA, ISO 7704

**Incubation Conditions:**
3–5 days at 30–35°C

**Evaluation and Typical Results:**
The colonies of slime-forming mesophilic bacteria are smooth, round, usually colorless and transparent or translucent. Some have a diameter greater than 5 mm.

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**MRS NPS**
Type 14077

For the detection of different Lactobacillus species and other lactic acid bacteria according to DE MAN, ROGOSA and SHARPE. Dehydrated culture medium for the isolation and cultivation of Lactobacillus from dairy and food products.

**References:**
APHA (food, dairy products)

**Incubation Conditions:**
3–5 days at 30°C anaerobic conditions

**Evaluation and Typical Results:**
The MRS NPS are used for the detection of a variety of Lactobacilli. The Lactobacilli species grow as slightly rounded whitish colonies with approximately 1–2 mm in diameter. Other microorganisms, which have not this typical growth, can be defined by confirmation tests. Lactobacilli species are gram positive, Katalase negative and negative in the production of Indole and Hydrogen sulfide.

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**Leuconostoc mesenteroides**

**Mixed culture from sugar syrup**

**Lactobacillus brevis**
Troubleshooting Guide

If the directions for use are not being followed this may lead to unsatisfactory results listed below:

1. Inhibited Growth, Tiny Colonies
   - pad too dry: not enough water used

2. Colonies Run
   - pad too wet, water film on the membrane filter: too much water used.
   - Colonies of motile microbes (such as Bacillus or Proteus) tend to run even though the water dosage is correct. To prevent this, add NaCl or an emulsifier.

3. Contamination from Underneath
   Inhibited colony growth, excess ring of liquid cloudy, often including discoloration of the pad:
   - membrane placed with grid facedown on the pad instead of faceup
   - contamination during rehydration (by airborne microbes, by contact or by contaminated water)

4. Growth on One Side Only
   - petri dish slanted in the incubator

5. Too Profuse or too Sparse Growth
   (optimum microbial number between 20 and 200 per filter)
   - wrong dilution selected or sample inadequately mixed with the diluent.

6. Non-uniform Growth
   - sample volume less than 5 ml filtered without adding sterile NaCl-buffer-solution as a diluent or sample volume inadequately mixed with the diluent.

Membrane Filters for Use on Agar Plates or on Adsorbent Pads

If agar plates or absorbent pads to be wetted with liquid culture medium are used instead of Nutrient Pad Sets, we recommend Sartorius Stedim Biotech cellulose nitrate (cellulose ester) membrane filters. These membranes are offered in a choice of three different colors to suit your specific test application, and provide a high-contrast background. For simple evaluation of the results, a grid divides the filtration area into 130 squares, each measuring 3.1 x 3.1 mm.

The membrane filters are available individually packaged and sterilized or packaged in a special designed individual package on a band for the use with the Microsart® c.motion membrane filter dispenser. The certificate included in every package documents the quality assurance tests as well as the compliance of the 0.45 µm membrane filters with ISO 7704.
# Membrane Filters for Use on Agar Plates or on Absorbent Pads

## For Detection of Bacteria in Dyed Media.

**White Membrane with Black Grid**

<table>
<thead>
<tr>
<th>Pore Size</th>
<th>Pckg. Size</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 µm</td>
<td>47 100</td>
<td>11407-47-ACN*</td>
</tr>
<tr>
<td></td>
<td>47 1,000</td>
<td>11407-47-ACR</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>11407-50-ACN*</td>
</tr>
<tr>
<td></td>
<td>50 1,000</td>
<td>11407-50-ACR</td>
</tr>
<tr>
<td>0.45 µm</td>
<td>47 100</td>
<td>11406-47-ACN*</td>
</tr>
<tr>
<td></td>
<td>47 1,000</td>
<td>11406-47-ACR*</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>11406-50-ACN*</td>
</tr>
<tr>
<td></td>
<td>50 1,000</td>
<td>11406-50-ACR*</td>
</tr>
<tr>
<td>HighFlow</td>
<td>0.45 µm</td>
<td>114H6-47-ACN</td>
</tr>
<tr>
<td></td>
<td>47 100</td>
<td>114H6-47-ACR</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>114H6-50-ACN</td>
</tr>
<tr>
<td></td>
<td>50 1,000</td>
<td>114H6-50-ACR</td>
</tr>
<tr>
<td>0.65 µm</td>
<td>47 100</td>
<td>11405-47-ACN*</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>11405-50-ACN</td>
</tr>
<tr>
<td>0.8 µm</td>
<td>47 100</td>
<td>11404-47-ACN*</td>
</tr>
<tr>
<td></td>
<td>47 1,000</td>
<td>11404-47-ACR</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>11404-50-ACN*</td>
</tr>
<tr>
<td>1.2 µm</td>
<td>47 100</td>
<td>11403-47ACN*</td>
</tr>
<tr>
<td></td>
<td>47 1,000</td>
<td>11403-47ACR</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>11403-50ACN*</td>
</tr>
<tr>
<td></td>
<td>50 1,000</td>
<td>11403-50ACR</td>
</tr>
</tbody>
</table>

**Green Membrane with Dark Green Grid**

<table>
<thead>
<tr>
<th>Pore Size</th>
<th>Pckg. Size</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.45 µm</td>
<td>47 100</td>
<td>13806-47-ACN*</td>
</tr>
<tr>
<td></td>
<td>47 1,000</td>
<td>13806-47-ACR*</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>13806-50-ACN*</td>
</tr>
<tr>
<td></td>
<td>50 1,000</td>
<td>13806-50-ACR*</td>
</tr>
<tr>
<td>HighFlow</td>
<td>0.45 µm</td>
<td>139H6-47-ACN</td>
</tr>
<tr>
<td></td>
<td>47 100</td>
<td>139H6-47-ACR</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>139H6-50-ACN</td>
</tr>
<tr>
<td>0.65 µm</td>
<td>47 100</td>
<td>13905-47-ACN</td>
</tr>
<tr>
<td>1.2 µm</td>
<td>47 100</td>
<td>13903-47-ACN</td>
</tr>
</tbody>
</table>

**Grey Membrane with White Grid**

<table>
<thead>
<tr>
<th>Pore Size</th>
<th>Pckg. Size</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.45 µm</td>
<td>47 100</td>
<td>13006-47-ACN*</td>
</tr>
<tr>
<td></td>
<td>47 1,000</td>
<td>13006-47-ACR*</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>13006-50-ACN*</td>
</tr>
<tr>
<td></td>
<td>50 1,000</td>
<td>13006-50-ACR*</td>
</tr>
<tr>
<td>0.65 µm</td>
<td>47 100</td>
<td>13005-47-ACN*</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>13005-50-ACN*</td>
</tr>
<tr>
<td>0.8 µm</td>
<td>47 100</td>
<td>13004-47-ACN*</td>
</tr>
<tr>
<td></td>
<td>47 1,000</td>
<td>13004-47-ACR</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>13004-50-ACN*</td>
</tr>
<tr>
<td>8 µm</td>
<td>47 100</td>
<td>13001-47-N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(non-sterile)</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>13001-50-N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(non-sterile)</td>
</tr>
</tbody>
</table>

**Prefilters, White Without Grid**

11301, a white membrane filter with a pore size of 8 µm is used as a prefilter in a special prefilter attachment (16807) for bacteriological analyses. It retains coarse suspended particles, whereas it allows microorganisms to pass through. These microbes are trapped on the surface of the underlying bacteria-retentive membrane filter. Order no.: 11301--47----ACN and 11301--50----ACN.

## For Detection of Yeasts and Molds.

**White Membrane with Green Grid**

<table>
<thead>
<tr>
<th>Pore Size</th>
<th>Pckg. Size</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.45 µm</td>
<td>47 100</td>
<td>13906-47-ACN*</td>
</tr>
<tr>
<td></td>
<td>47 1,000</td>
<td>13906-47-ACR*</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>13906-50-ACN*</td>
</tr>
<tr>
<td></td>
<td>50 1,000</td>
<td>13906-50-ACR*</td>
</tr>
<tr>
<td>HighFlow</td>
<td>0.45 µm</td>
<td>139H6-47-ACN</td>
</tr>
<tr>
<td></td>
<td>47 100</td>
<td>139H6-47-ACR</td>
</tr>
<tr>
<td></td>
<td>50 100</td>
<td>139H6-50-ACN</td>
</tr>
<tr>
<td>0.65 µm</td>
<td>47 100</td>
<td>13905-47-ACN</td>
</tr>
<tr>
<td>1.2 µm</td>
<td>47 100</td>
<td>13903-47-ACN</td>
</tr>
</tbody>
</table>

## Providing Optimal Contrast to Light-colored or Transparent Bacteria Colonies.

**HighFlow**

The special pore structure of the 0.45 µm HighFlow membrane filters allow shorter filtration times due to higher flow rates and throughputs. Especially E. coli shows best growth promotion on HighFlow membranes.

As every Sartorius Stedim Biotech 0.45 µm membrane filter lot these membranes are also tested and released according to ISO 7704.

* Also available as a non-sterile version.

To order boxes with 100 pcs. replace ACN with N and for boxes of 1,000 pcs. replace ACR with R.
Membrane Filters for Use with Microart® e.motion Dispenser

For Detection of Bacteria in Dyed Media.

White Membrane with Black Grid

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 µm</td>
<td>47</td>
<td>11407Z-47-SCM</td>
</tr>
<tr>
<td>0.45 µm</td>
<td>47</td>
<td>11406Z-47-SCM</td>
</tr>
<tr>
<td>0.8 µm</td>
<td>47</td>
<td>11403Z-47-SCM</td>
</tr>
<tr>
<td>1.2 µm</td>
<td>47</td>
<td>11402Z-47-SCM</td>
</tr>
</tbody>
</table>

For Detection of Yeasts and Molds.

Grey Filter with White Grid

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 µm</td>
<td>47</td>
<td>11407Z-50-SCM</td>
</tr>
<tr>
<td>0.45 µm</td>
<td>47</td>
<td>11406Z-50-SCM</td>
</tr>
<tr>
<td>0.8 µm</td>
<td>47</td>
<td>11403Z-50-SCM</td>
</tr>
</tbody>
</table>

Green Filter with Dark Green Grid

Providing Optimal Contrast to Light-colored or Transparent Bacteria Colonies.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 µm</td>
<td>47</td>
<td>15407Z-47-SCM</td>
</tr>
<tr>
<td>0.45 µm</td>
<td>47</td>
<td>13806Z-47-SCM</td>
</tr>
<tr>
<td>0.8 µm</td>
<td>47</td>
<td>13004Z-47-SCM</td>
</tr>
</tbody>
</table>

White Membrane with Green Grid

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.45 µm</td>
<td>47</td>
<td>13906Z-47-SCM</td>
</tr>
<tr>
<td>0.65 µm</td>
<td>47</td>
<td>13005Z-47-SCM</td>
</tr>
</tbody>
</table>

HighFlow

The special pore structure of the 0.45 µm HighFlow membrane filters allow shorter filtration times due to higher flow rates and throughputs. Especially E. coli shows best growth promotion on HighFlow membranes.

As every Sartorius Stedim Biotech 0.45 µm membrane filter lot these membranes are also tested and released according to ISO 7704.
### Typical Application Examples

<table>
<thead>
<tr>
<th>Product</th>
<th>Detection and Enumeration of...</th>
<th>Nutrient Pad Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beer</strong></td>
<td>Lactobacilli and Pediococci and other beer spoiling organisms</td>
<td>VLB-S7-S, MRS</td>
</tr>
<tr>
<td>Total colony count</td>
<td>Standard, Standard TTC</td>
<td></td>
</tr>
<tr>
<td>Wild yeasts</td>
<td>Lysine</td>
<td></td>
</tr>
<tr>
<td>Yeasts and molds</td>
<td>Malt Extract*, Wallerstein Nutrient, Wort</td>
<td></td>
</tr>
<tr>
<td><strong>Dairy</strong></td>
<td>Lactic Acid Bacteria</td>
<td>MRS</td>
</tr>
<tr>
<td></td>
<td>Lactobacillaceae</td>
<td></td>
</tr>
<tr>
<td><strong>Foods</strong></td>
<td>Acid-tolerant microorganisms</td>
<td>Orange Serum</td>
</tr>
<tr>
<td>Enterobacteria, E. coli and coliforms</td>
<td>CHROMOCULT™, ECD, Endo, [MacConkey], m FC, Teepol</td>
<td>Lauryl Sulphate, Tergitol TTC</td>
</tr>
<tr>
<td>Enterococci, Enterococcus faecalis</td>
<td>Azide</td>
<td>KF Strep</td>
</tr>
<tr>
<td>Lactobacilli</td>
<td>MRS</td>
<td></td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>Cetrimide</td>
<td></td>
</tr>
<tr>
<td>Salmonellae</td>
<td>Bismuth Sulfite</td>
<td></td>
</tr>
<tr>
<td>Staphylococci, Staphylococcus aureus</td>
<td>Chapman</td>
<td></td>
</tr>
<tr>
<td>Thermophilic spore formers and mesophilic bacteria</td>
<td>Glucose Tryptone</td>
<td></td>
</tr>
<tr>
<td>Total colony count</td>
<td>Caso, Standard, Standard TTC, TGE</td>
<td>Tryptone Glucose Extract</td>
</tr>
<tr>
<td>Yeasts and molds</td>
<td>Malt Extract, Wort</td>
<td></td>
</tr>
<tr>
<td><strong>Food &amp; beverage</strong></td>
<td>Lactobacilli</td>
<td>MRS</td>
</tr>
<tr>
<td><strong>Fruit juice</strong></td>
<td>Enterobacteria, E. coli and coliforms</td>
<td>Endo, [MacConkey], Tergitol TTC*</td>
</tr>
<tr>
<td>Lactobacilli</td>
<td>MRS</td>
<td></td>
</tr>
<tr>
<td>Oenococcus and other product spoiling organisms</td>
<td>Jus de Tomate</td>
<td>Tomato Juice, Orange Serum</td>
</tr>
<tr>
<td>Yeasts and molds</td>
<td>Malt Extract, Schaufus Pottinger</td>
<td>m Green yeast and mold, Wallerstein Nutrient, Wort</td>
</tr>
<tr>
<td><strong>Milk</strong></td>
<td>E. coli and coliforms</td>
<td>Endo</td>
</tr>
<tr>
<td>Enterococci, Enterococcus faecalis</td>
<td>Azide</td>
<td>KF Strep</td>
</tr>
<tr>
<td>Salmonellae</td>
<td>Bismuth Sulfite</td>
<td></td>
</tr>
<tr>
<td><strong>Pharmaceuticals, WFI, raw materials and cosmetics</strong></td>
<td>Enterobacteria, E. coli</td>
<td>MacConkey</td>
</tr>
<tr>
<td>Enterococci, Enterococcus faecalis</td>
<td>Azide</td>
<td>KF Strep</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>Cetrimide (cosmetics only)</td>
<td></td>
</tr>
<tr>
<td>Staphylococci, Staphylococcus aureus</td>
<td>Chapman</td>
<td></td>
</tr>
<tr>
<td>Total colony count</td>
<td>Caso, R2A</td>
<td></td>
</tr>
<tr>
<td>Yeasts and molds, Candida albicans</td>
<td>Sabouraud</td>
<td></td>
</tr>
<tr>
<td><strong>Soft drinks, concentrates</strong></td>
<td>Acid-tolerant microorganisms, Lactic-acid bacteria</td>
<td>Orange Serum, VLB-S7-S</td>
</tr>
<tr>
<td>Enterobacteria, E. coli and coliforms</td>
<td>Endo, MacConkey</td>
<td></td>
</tr>
<tr>
<td>Lactobacilli</td>
<td>MRS</td>
<td></td>
</tr>
<tr>
<td>Mesophilic slime-forming bacteria, Leuconostoc</td>
<td>Weman</td>
<td></td>
</tr>
<tr>
<td>Total colony count</td>
<td>Standard*, Standard TTC*, TGE</td>
<td>Tryptone Glucose Extract</td>
</tr>
<tr>
<td>Yeasts and molds</td>
<td>Malt Extract, Schaufus Pottinger</td>
<td>m Green yeast and mold, Wallerstein Nutrient, Wort</td>
</tr>
<tr>
<td><strong>Sugar, sugar products</strong></td>
<td>E. coli and coliforms</td>
<td>Endo</td>
</tr>
<tr>
<td>Mesophilic slime-forming bacteria, Leuconostoc</td>
<td>Weman</td>
<td></td>
</tr>
<tr>
<td>Thermophilic spore formers and mesophilic bacteria</td>
<td>Glucose Tryptone</td>
<td></td>
</tr>
<tr>
<td>Yeasts and molds</td>
<td>Malt Extract*, Schaufus Pottinger</td>
<td>m Green yeast and mold, Wort*</td>
</tr>
<tr>
<td><strong>Water (general quality), mineral water, natural water, waste water</strong></td>
<td>Acid-tolerant microorganisms, Lactic-acid bacteria</td>
<td>Orange Serum</td>
</tr>
<tr>
<td>Enterobacteria, E. coli and coliforms</td>
<td>CHROMOCULT™, ECD, Endo, [MacConkey], m FC, Teepol</td>
<td>Lauryl Sulphate, Tergitol TTC</td>
</tr>
<tr>
<td>Enterococci, Enterococcus faecalis</td>
<td>Azide</td>
<td>KF Strep</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>Cetrimide</td>
<td></td>
</tr>
<tr>
<td>Salmonellae</td>
<td>Bismuth Sulfite</td>
<td></td>
</tr>
<tr>
<td>Staphylococci, Staphylococcus aureus</td>
<td>Chapman</td>
<td></td>
</tr>
<tr>
<td>Total colony count</td>
<td>Caso, R2A, Standard, Standard TTC, TGE</td>
<td>Tryptone Glucose Extract, Yeast Extract</td>
</tr>
<tr>
<td>Yeasts and molds, Candida albicans</td>
<td>Sabouraud</td>
<td></td>
</tr>
<tr>
<td><strong>Wine</strong></td>
<td>Acetobacter</td>
<td>Orange Serum, Wort (both wetted with 5-8% ethanol)</td>
</tr>
<tr>
<td>Acid-tolerant microorganisms, Lactic-acid bacteria</td>
<td>Orange Serum</td>
<td></td>
</tr>
<tr>
<td>Lactobacilli</td>
<td>MRS</td>
<td></td>
</tr>
<tr>
<td>Oenococcus and other wine spoiling organ.</td>
<td>Jus de Tomate</td>
<td>Tomato Juice</td>
</tr>
<tr>
<td>Yeasts and molds</td>
<td>Malt Extract, Schaufus Pottinger</td>
<td>m Green yeast and mold, Wallerstein Nutrient, Wort</td>
</tr>
</tbody>
</table>

* These NPS types are suitable for the determination of the mentioned microorganisms, although the media are not explicit declared in the references described in this publication.

** Trade mark owner and manufacturer is Merck KGaA.
Growth Comparison

The principle of the membrane filter method is based on the concentration of microorganisms from relatively large samples on the surface of a membrane filter. Nutrients and metabolites are exchanged through the pore system of the membrane filter. The pore size alone is not a meaningful criterion. Due to the variance in allocation of the pores, not all membranes guarantee sufficient nutrient supply. A comparison of Sartorius Stedim Biotech cellulose nitrate (cellulose mixed ester) membranes with other mixed ester membranes reveals significant differences in growth promotion results.

Growth of E. Coli on Endo NPS

E. coli forms red colonies with a metallic sheen. Other coliforms would grow as dark to light red colonies without metallic sheen.

Growth of Pseudomonas Aeruginosa on Cetrimide NPS

Pseudomonas aeruginosa forms blue, blue-green or yellow-green colonies with 1–2 mm diameter and blue zones. The colonies produce pyocyanin and fluorescein and show fluorescence in UV-light. Other Pseudomonads would develop colonies with different colors.

E. coli shows no metallic sheen on this mixed esters membrane. Therefore it is very difficult to differentiate between E. coli and coliforms without any further test. A quantitative statement is difficult due to the fact of running colonies on the mixed esters membrane surface.

On this mixed esters membrane grow less colonies and without the blue zone. Due to the variance in the allocation of the pores, here the mixed esters membrane did not guarantee a sufficient nutrient supply. This may cause in false negative results.
Accessories

**Combi.jet Manifold plus Microsart® Funnel 100 and Microsart® e.jet Transfer Pump**
Microsart Funnel 100 | 250 are sterile 100 ml & 250 ml funnels. The optimal sealing is guaranteed by a click-fit closure. The large inner diameter ensures a high flow rate and the optimized shape allows a thorough rinsing of the system subsequent to the filtration. No liquid is retained in the funnel.

16A07--10------N  Microsart Funnel 100, sterile in 5 sealed bags
16A07--25------N  Microsart funnel 250, sterile in 6 sealed bags
166MP-4  Microsart e.jet Transfer pump
16848-CJ  Microsart Combi.jet 2-fold manifold

**Combisart® 3-Branch Manifold Plus Biosart® 250 Funnels**
The Biosart 250 Funnel has been designed for microbiological quality assurance in industry. The sterile 250 ml (50 ml graduations) plastic funnel guarantees fast filtration and high sample throughputs during routine testing. Its large inner diameter allows high flow rates, and the tapered inner wall permit thorough flushing of the funnel, after filtration.

16407-25-ALK  Biosart 250 Funnels, 50 units, sterile-packaged
16407-25-ACK  Biosart 250 Funnels, 50 units, individually sterile-packaged

For further information about our Combisart manifolds and accessories, please consider our Combisart brochure.

**Biosart® 100 Monitors**
Biosart 100 Monitors are sterile disposables with an incorporated membrane filter and cellulose pad. They are ready-to-use and after filtration, the funnel will be removed, so the lid and the base fit to a petri dish. Each box contains 48 units with 47 mm, gridded membrane filters.

16401-47-07-ACK  Biosart 100 Monitor, individually sterile-packaged, 0.2 µm white | black grid
16401-47-06-ACK  Biosart 100 Monitor, individually sterile-packaged, 0.45 µm white | black grid
16402-47-06-ACK  Biosart 100 Monitor, individually sterile-packaged, 0.45 µm green | dark green grid
16403-47-06-ACK  Biosart 100 Monitor, individually sterile-packaged, 0.45 µm grey | white grid
16414  Biosart 100 Adapter (altern. 16424)
Combisart® Individual Systems and Filter Holders
For low number of samples to test, the individual system is ideal to use. In this equipment set-up, you simply use a silicone stopper and a single base to fit your choice of funnel type on a suction flask.

16841 Stainless steel single base
6981065 Stainless steel funnel, 100 ml
6981002 Stainless steel funnel, 500 ml
17575-ACK Minisart® SRP 25, 50 sterile venting filters
17173 Silicone stopper
16672 Suction flask

Alternatively to position 1–3 you can use 16219-CS as 100 ml filter holder or 16201-CS as 500 ml filter holder.

Vacuum Pumps, Water Traps and Vacuum Hose
The vacuum pumps are neoprene membrane pumps with low noise level, oil- and maintenance-free, reliable sources of vacuum. The water traps are preventing an overflow of filtrate into the vacuum pump.

16694-2-50-22 Microsart® maxi.vac for multiple filtration runs, 230 V, 50 Hz
16694-1-60-22 Microsart® maxi.vac, 115 V, 60 Hz
16694-2-50-06 Microsart® mini.vac for single filtration run, 230 V, 50 Hz
16694-1-60-06 Microsart® mini.vac, 115 V, 60 Hz
17804-M Vacusart®, 3 individually sterile-packaged PTFE filter
166MP-4 Microsart® e.jet Transfer Pump
16610 Wouff's bottle, 500 ml, with stop cock
16623 Rubber vacuum hose, 1 m

Stainless Steel Prefilter Attachment
For removal of coarse particulate substances from samples in a single step along with bacteria-retentive filtration for subsequent microbiological testing. Clips between a filter support (16840 or 16841) and a stainless steel funnel (as shown at the photo) or Biosart 250 Funnel. Autoclavable and can be flamed.

16807 Prefilter attachment
Dosing Syringe | Colony Counter
The most convenient way to moist the NPS with water is to use a dosing syringe with an adapted Minisart syringe filter. Simultaneous sterilization and dosing of demineralized water in 3.5 ml steps is easy done by dropping the sinker at the end of the suction tubing into the water, and the dosing syringe filled and dosed by operating the trigger automatically.

Compact battery operated colony counter is as simple to use as a ball-point pen, and has a 4-digit LCD-display.

16685-2 Dosing syringe
17597k Minisart®, 0.2 µm, individually sterile-packaged
17649 Colony Counter

Microsart® e.motion Dispenser – Membrane Filters on Demand
The completely new membrane filter dispenser meets all requirements placed on advanced laboratory equipment. The membrane filters are released from their sterile packaging fully automatically at the touch of a button or hands-free – a dispensing operation is triggered when the optical sensor detects approaching tweezers.

16712 Microsart® e.motion Dispenser

Microsart® e.motion Membrane Filters
The cellulose nitrate (cellulose mixed ester) membranes suitable for the use in dispensers are sterile-sealed, without protective paper on top of each filter, in a specially designed individual package on a band. The special pleating of the band of membrane filter units ensures that they are perfectly flat when dispensed. The shape of the sealed band guarantees uniform dispensing of the individual membrane filters.

11407Z-47----SCM white | black, 0.2 µm
114H6Z-47----SCM white | black, 0.45 µm High Flow
11406Z-47----SCM white | green, 0.45 µm High Flow
13906Z-47----SCM white | green, 0.45 µm High Flow
13806Z-47----SCM green | dark green, 0.45 µm
13006Z-47----SCM gray | white, 0.45 µm
130H6Z-47----SCM gray | white, 0.45 µm High Flow
13005Z-47----SCM gray | white, 0.65 µm
15407Z-47----SCM green | dark green, 0.2 µm
### Absorbent Pads
The 1.4 mm thick absorbent pads are wetted with the appropriate liquid culture medium before a membrane filter is placed on. Each box contains 1,000 absorbent pads in 10 tubes, each with 100 pads, and with manual dispensing device, all presterilized.

- **15410-47-ALR** Absorbent pads, 47 mm, each approx. 3 ml absorbent capacity
- **15410-50-ALR** Absorbent pads, 50 mm, each approx. 3.5 ml absorbent capacity
- **13906-47-APR** Absorbent pads, 47 mm, including membrane filters 0.45 µm, white | green grid, individually sterile-packaged

### AirPort MD8
AirPort MD8 uses the gelatin membrane filter method guaranteeing reliable and exact measurement results. It is battery-powered and portable for universal use.

- **16757** AirPort MD8, 100–240 V, 47–63 Hz, complete with holder and battery charger
- **17528-80-ACD** Gelatin membranes, individually sterile-packaged, each in 1 bag
- **17528-80-BZD** Gelatin membranes, individually sterile-packaged, each in 3 bags

### arium® Laboratory Water Systems
A choice of more than 70 arium® versions is available to meet all your requirements on water quality and to cover any application. Whether for standard applications, routine analysis or critical applications where reagent-grade water is required, the arium® series consistently supplies highest water quality for your application.

- **proDI** Standard applications, e.g. buffer preparation
- **proUV** Low TOC applications e.g. HPLC
- **proUF** Low endotoxin applications
- **proVF** Low TOC and low endotoxin applications

Further laboratory water systems on request.
## Technical Data and Application Guide Nutrient Pad Sets

### Counting of Total Colony Forming Units

<table>
<thead>
<tr>
<th>Detection Target and Reference</th>
<th>Test Sample Materials</th>
<th>Media Type (pH)</th>
<th>Order No. (Filter Type)</th>
<th>Recom. Incubation Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total count</strong></td>
<td>Pharmaceuticals, cosmetics, raw materials, water (general quality), waste water, foods, other products.</td>
<td>Caso (pH 7.3)</td>
<td>14063----47------N (1)</td>
<td>Bacteria: ≤ 3 d at 30–35°C; Yeasts and molds: ≤ 5 d at 30–35°C</td>
</tr>
<tr>
<td>APHA (dairy), APHA (food), APHA (water), AOAC, DAB, EG 98/83, EP, FDA, IDF, ISO 7704, ISO 8199, ISO 9308-1 [1990], ISO 9308-1 [2001], USDA, USP.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total count</strong></td>
<td>Water for pharma purpose, water (general quality), waste water, other products.</td>
<td>R2A (pH 7.2)</td>
<td>14084----47------N (1)</td>
<td>≥ 5 d at 30–35°C</td>
</tr>
<tr>
<td>APHA (water), EP, ISO 7704.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total count</strong></td>
<td>Raw materials, water (general quality), waste water, beverages, beer, foods, other products.</td>
<td>Standard (pH 7.2)</td>
<td>14064----47------N (1)</td>
<td>≤ 5 d at 30–35°C</td>
</tr>
<tr>
<td>APHA (water), ISO 7704, VLB.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total count</strong></td>
<td>Raw materials, water (general quality), natural water, waste water, beverages, beer, foods, other products.</td>
<td>Standard TTC (pH 7.2)</td>
<td>14055----47------N (1)</td>
<td>≤ 5 d at 30–35°C</td>
</tr>
<tr>
<td>APHA (water), ISO 7704, VLB.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total count</strong></td>
<td>Raw materials, water (general quality), natural water, waste water, beverages, beer, foods, other products.</td>
<td>Standard TTC I mod. (pH 7.2)</td>
<td>14085----47------N (1)</td>
<td>≤ 5 d at 30–35°C</td>
</tr>
<tr>
<td>APHA (water), ISO 7704, VLB.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total count</strong></td>
<td>Raw materials, water (general quality), natural water, waste water, beverages, soft drinks, concentrates, foods, other products.</td>
<td>TGE Tryptone Glucose Extract (pH 7.0)</td>
<td>14076----47------N (1)</td>
<td>≤ 5 d at 30–35°C</td>
</tr>
<tr>
<td>APHA (dairy), APHA (food), APHA (water), API, ISO 7704.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total count</strong></td>
<td>Water (general quality), natural water, other products.</td>
<td>Yeast Extract (pH 7.2)</td>
<td>14090----47------N (1)</td>
<td>44 ± 4 h at 36 ± 2°C; 68 ± 4 h at 22 ± 2°C</td>
</tr>
</tbody>
</table>

### E. Coli and Coliforms, Enterobacteria

#### E. coli and coliforms

- **ISO 7704, Journal Food Protection, ZenHyg (journal of hygiene).**
- Raw materials, water (general quality), waste water, beverages, foods, other products.
- CHROMOCULT®* (pH 7.0) | 20–28 h at 36 ± 2°C
- 14087----47------N (7) |
- 14087----47-----RDN |

#### E. coli

- **APHA (water), DIN 10110, EG 98/83, ISO 7704, ISO 8199, ISO 9308-1 [2001], LMBG, USDA.**
- Raw materials, water (general quality), waste water, beverages, foods, other products.
- ECD (pH 7.0) | 16–18 h at 44 ± 2°C
- 14082----47------N (2) |

#### E. coli and coliforms

- **APHA (dairy), APHA (food), APHA (water), DGHM, ISO 7704, ISO 9308-1 [1990], MNO, USDA.**
- Raw materials, water (general quality), natural water, waste water, beverages, soft drinks, concentrates, fruit juice, sugar, sugar products, foods, other products.
- Endo (pH 7.4) | 18–24 h at 36 ± 2°C
- 14053----47------N (9) |
- 14053----47-----RDN |

#### E. coli and coliforms

- **APHA (food), APHA (water), AOAC, EPA, FDA, ISO 7704, ISO 9308-1 [1990], USDA.**
- Raw materials, water (general quality), waste water, beverages, foods, other products.
- m FC (pH 7.4) | 18–24 h at 36 ± 2°C
- 14068----47------N (2) |
- 14068----50-----PDN (closed petri dishes) (2) |

### Enterobacteria, E. coli

- **APHA (dairy), APHA (food), APHA (water), AOAC, DAB, DIN 38411, DGHM, EP, ISO 7704, LMBG, MNO, USDA, USP.**
- Pharmaceuticals, cosmetics, raw materials, water (general quality), natural water, waste water, beverages, soft drinks, concentrates, fruit juice, foods, other products.
- MacConkey (pH 7.1) | 18–72 h at 30–35°C
- 14097----47------N (2) |
<table>
<thead>
<tr>
<th>Shelf Life</th>
<th>Test Strains&lt;sup&gt;5&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>01, 03, 05, 09, 18, 22, 25, 26</td>
</tr>
<tr>
<td>24</td>
<td>01, 03, 05, 09, 18, 22, 26</td>
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<td>03, 07, 09, 18, 26</td>
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<td>06, 07, 09, 21, 25, 28</td>
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<td>24</td>
<td>06, 07, 09, 11, 21</td>
</tr>
<tr>
<td>24</td>
<td>02, 06, 09, 21, 25, 26</td>
</tr>
</tbody>
</table>

1) Reference Guide on page 34.

2) A Set contains 100 Nutrient Pads and 100 membrane filters, both individually, sterile packaged. The membrane filters are selected for optimum growth together with the corresponding nutrient media. The supplied membrane filter type is listed within brackets:

1) = green with dark green grid, 0.45 µm pore size
2) = white with green grid, 0.45 µm pore size
3) = gray (after wetting black) with white grid, 0.65 µm pore size
4) = white with green grid, 0.65 µm pore size
5) = white with green grid, 1.2 µm pore size
6) = gray (after wetting black) with white grid, 0.8 µm pore size
7) = white with black grid, 0.45 µm pore size
8) = gray (after wetting black) with white grid, 0.45 µm pore size
9) = white with green grid, 0.45 µm pore size, High Flow (ideal for E. coli)
10) = gray (after wetting black) with white grid, 0.45 µm pore size, High Flow

3) Diameter of the membrane filter, 47 mm. Order number for Nutrient Pad Sets with 50 mm membrane filter as above, but ---47------N replaced by ---50------N.

Most of the NPS types are also available with Microsart<sup>®</sup> e.motion Membrane Filters:
Order number as above, but ---N replaced by -RDN.

Other NPS types and NPS with Microsart<sup>®</sup> e.motion Membrane Filters on request.

4) The incubation conditions are recommended by Sartorius Stedim Biotech. They may be varied according to the type of samples in compliance with the reference standard or customer’s requirements.

5) Test strains on page 32.

* Trade mark owner and manufacturer is Merck KGaA
## Detection Target and Reference

<table>
<thead>
<tr>
<th>Yeasts and Molds</th>
<th>Test Sample Materials</th>
<th>Media Type (pH)</th>
<th>Recom. Incubation Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E. coli and coliforms</strong></td>
<td>AFNOR, APHA (water), BS, FDA, ISO 7704, ISO 9308-1 [1990], USDA.</td>
<td>Water (general quality), waste water, beverages, foods, other products.</td>
<td><strong>Teepol</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Lauryl Sulphate</strong></td>
</tr>
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</tr>
<tr>
<td><strong>E. coli and coliforms</strong></td>
<td>APNOR, APHA (food), EG 98/83, ISO 7704, ISO 8199, ISO 9308-1 [1990], ISO 9308-1 [2001].</td>
<td>Raw materials, water (general quality), waste water, beverages, foods, other products.</td>
<td><strong>Tergitol TTC</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>(pH 8.0)</strong></td>
</tr>
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<td></td>
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</tr>
</tbody>
</table>

## Other Faecal Bacteria

| Enterococci | APNOR, APHA (food), AOAC, IFU. | Pharmaceuticals, cosmetics, raw materials, water (general quality), waste water, foods, other products. | **Azide** | 40–48 h at 36 ±2°C |
| | | | **KF Strep** | 14051--47-----N (1) |
| | | | | 14051--47-----RDN |

## Non-faecal, Pathogenic Bacteria

| Pseudomonas aeruginosa | E. coli and coliforms | APNOR, APHA (food), AOAC, ASM, DIN 38411, EG 98/83, FDA, ISO 7704, ISO 8199, ISO 16266. | **Cetrimide** | 40–48 h at 36 ±2°C |
| | | | **(pH 7.1)** | 14075--47-----N (2) |
| | | | | 14075--47-----RDN |

## Yeasts and Molds

| Wild yeasts | Journal Institute of Brewing, VLB. | Beer, other products. | **Lysine** | 3–5 d at 30–35°C |
| | | | **(pH 5.0)** | 14061--47-----N (3) |

| Yeasts and molds | APNOR, APHA (food), AOAC, IFU. | Beverages, wine, soft drinks, concentrates, fruit juice, foods, other products. | **Malt Extract** | 3–5 d at 20–25°C or at 30–35°C depending on the target of the investigation |
| | | | **(pH 4.5)** | 14086--47-----N (6) |
| | | | | 14086--47-----CCN (8) |

| Yeasts and molds | APNOR, APHA (food), AOAC, EP, USP. | Pharmaceuticals, cosmetics, raw materials, water (general quality), waste water, other products. | **Sabouraud** | ≤ 5 d at 20–25°C |
| | | | **(pH 5.6)** | 14069--47-----N (10) |

| Yeasts and molds | **Schaufus Pottinger** | **m Green yeast and mold** | **(pH 4.3)** | 2–5 d at 20–25°C or at 30–35°C depending on the target of the investigation |
| | | | | 14070--47-----N (4) |
| | | | | 14072--47-----N (5) |
| | | | | 14080--47-----N (6) |
| | | | | 14080--47-----RDN |
| | | | | 14083--47-----N (3) |
| | | | | 14091--47-----N (8) |
| | | | | 14091--47-----RDN |

| Yeasts and molds and bacteria | ISO 7704. | Beverages, beer, wine, soft drinks, concentrates, fruit juice, other products. | **Wallerstein** | 2–5 d at 30–35°C aerobic or anaerobic depending on the target of the investigation |
| | | | **WL Nutrient** | 14089--47-----N (2) |
| | | | | 14092--47-----RDN (8) |

<p>| Yeasts and molds | VLB. | Raw materials, beverages, beer, wine, soft drinks, concentrates, foods, other products. | <strong>Wort</strong> | 3–5 d at 20–25°C or at 30–35°C depending on the target of the investigation |
| | | | <strong>(pH 4.4)</strong> | 14058--47-----N (3) |
| | | | | 14092--47-----RDN (8) |</p>
<table>
<thead>
<tr>
<th>Shelf Life</th>
<th>Test Strains$^5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>06, 07, 09, 11, 21</td>
</tr>
<tr>
<td>24</td>
<td>06, 07, 09, 11, 21</td>
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<td>07, 08, 09, 22, 26</td>
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<td>05, 12, 19, 20, 23</td>
</tr>
<tr>
<td>24</td>
<td>05, 20, 23, 24</td>
</tr>
</tbody>
</table>

1) Reference Guide on page 34.

2) A Set contains 100 Nutrient Pads and 100 membrane filters, both individually, sterile packaged. The membrane filters are selected for optimum growth together with the corresponding nutrient media. The supplied membrane filter type is listed within brackets:

(1) = green with dark green grid, 0.45 µm pore size
(2) = white with green grid, 0.45 µm pore size
(3) = gray (after wetting black) with white grid, 0.65 µm pore size
(4) = white with green grid, 0.65 µm pore size
(5) = white with green grid, 1.2 µm pore size
(6) = gray (after wetting black) with white grid, 0.8 µm pore size
(7) = white with black grid, 0.45 µm pore size
(8) = gray (after wetting black) with white grid, 0.45 µm pore size
(9) = white with green grid, 0.45 µm pore size, High Flow (ideal for E. coli)
(10) = gray (after wetting black) with white grid, 0.45 µm pore size, High Flow

3) Diameter of the membrane filter, 47 mm. Order number for Nutrient Pad Sets with 50 mm membrane filter as above, but --47------N replaced by --50------N.

Most of the NPS types are also available with Microsart® e.motion Membrane Filters: Order number as above, but ---N replaced by -RDN.

Other NPS types and NPS with Microsart® e.motion Membrane Filters on request.

4) The incubation conditions are recommended by Sartorius Stedim Biotech. They may be varied according to the type of samples in compliance with the reference standard or customer’s requirements.

5) Test strains on page 32.
## Detection Target and Reference

<table>
<thead>
<tr>
<th>Product-spoiling Microorganisms</th>
<th>Test Sample Materials</th>
<th>Media Type (pH)</th>
<th>Recom. Incubation Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermophilic spore formers and mesophilic bacteria</td>
<td>Fruit juice, sugar, sugar products, foods, other products.</td>
<td>Glucose Tryptone (pH 6.8) 14062-47------N (2)</td>
<td>18–72 h at 30–35°C for mesophilic bacteria; 48–72 h at 55±2°C for thermophilic sporulating microorganisms</td>
</tr>
<tr>
<td>Leuconostoc oenos and other wine spoiling organ.</td>
<td>Wine, fruit juice, other products.</td>
<td>Jus de Tomate</td>
<td>5–7 d at 30–35°C anaerobic (microaerophil); control for slowly growing microorganisms after 10 d is recommended</td>
</tr>
<tr>
<td>Acid-tolerant microorganisms</td>
<td>Raw materials, water (general quality), waste water, wine, soft drinks, concentrates, fruit juice, foods, other products.</td>
<td>Orange Serum (pH 5.5) 14062-47------N (1)</td>
<td>3–5 d at 30–35°C aerobic or anaerobic depending on the target of the investigation</td>
</tr>
<tr>
<td>Acid-tolerant microorganisms</td>
<td>Raw materials, water (general quality), waste water, wine, soft drinks, concentrates, fruit juice, foods, other products.</td>
<td>Orange Serum (pH 3.2) 14096-47------N (6)</td>
<td>3–5 d at 30–35°C aerobic or anaerobic depending on the target of the investigation</td>
</tr>
<tr>
<td>Lactobacilli and Pediococci and other beer spoiling organisms</td>
<td>Beer, other products.</td>
<td>VLB-S7-S (pH 5.5) 14059-47------N (2)</td>
<td>3–5 d at 30–35°C anaerobic (microaerophil)</td>
</tr>
<tr>
<td>Lactobacilli</td>
<td>Fruit juice, beer, diary, foods, soft drinks, other materials.</td>
<td>MRS (pH 6.1) 14077-47------N (1)</td>
<td>3–5 d at 30°C under anaerobic conditions (microaerophil)</td>
</tr>
<tr>
<td>Mesophilic slime-forming bacteria esp. Leu. Mesenteroides</td>
<td>Soft drinks, concentrates, sugar, sugar products, other products.</td>
<td>Weman (pH 5.5) 14065-47------N (1)</td>
<td>3–5 d at 30–35°C</td>
</tr>
</tbody>
</table>

### Test Strains [ATCC No.], [DSM No.]

<table>
<thead>
<tr>
<th>01. Aspergillus brasiliensis 16404, 1988</th>
<th>02. Bacillus cereus 11778, 345</th>
</tr>
</thead>
<tbody>
<tr>
<td>03. Bacillus subtilis subsp. spizizenii 6633, 347</td>
<td>04. Brevundimonas diminuta 19146, 1635</td>
</tr>
<tr>
<td>05. Candida albicans 10231, 1386</td>
<td>06. Enterobacter aerogenes 13048, 30053</td>
</tr>
<tr>
<td>07. Enterococcus faecalis 29212, 2570</td>
<td>08. Enterococcus faecium DSM 19434, 20477</td>
</tr>
<tr>
<td>09. Escherichia coli 8739, 1576</td>
<td>10. Geobacillus stearothermophilus 7953, 5934</td>
</tr>
<tr>
<td>11. Klebsiella pneumoniae 13883, 30104</td>
<td>12. Lactobacillus acidophilus DSM 20690</td>
</tr>
<tr>
<td>13. Lactobacillus plantarum subsp. plantarum 14917, 20174</td>
<td>14. Lactobacillus brevis DSM 70403</td>
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<td>15. Leuconostoc mesenteroides subsp. mesenteroides 8922, 20343</td>
<td>16. Lactobacillus acidophilus 5796, 6538</td>
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<td>17. Lactobacillus casei subsp. casei 8263, 5934</td>
<td>18. Lactobacillus delbrueckii subsp. bulgaricus 8263, 5934</td>
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<td>19. Lactobacillus delbrueckii subsp. lactis 8263, 5934</td>
<td>20. Lactobacillus delbrueckii subsp. delbrueckii 8263, 5934</td>
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<td>21. Lactobacillus helveticus 8263, 5934</td>
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<td>31. Lactobacillus helveticus 8263, 5934</td>
<td>32. Lactobacillus helveticus 8263, 5934</td>
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<tr>
<td>Shelf Life</td>
<td>Test Strains$^5$</td>
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<td>12, 14, 15, 24</td>
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<td>02, 05, 13, 14, 20, 23, 24</td>
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<td>06, 12, 13, 19, 24, 29</td>
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<td>13, 19, 22, 29, 31</td>
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<tr>
<td>24</td>
<td>14</td>
</tr>
</tbody>
</table>

$^1$ Reference Guide on page 34.

$^2$ A Set contains 100 Nutrient Pads and 100 membrane filters, both individually, sterile packaged. The membrane filters are selected for optimum growth together with the corresponding nutrient media. The supplied membrane filter type is listed within brackets:

- (1) = green with dark green grid, 0.45 µm pore size
- (2) = white with green grid, 0.45 µm pore size
- (3) = gray (after wetting black) with white grid, 0.65 µm pore size
- (4) = white with green grid, 0.65 µm pore size
- (5) = white with green grid, 1.2 µm pore size
- (6) = gray (after wetting black) with white grid, 0.8 µm pore size
- (7) = white with black grid, 0.45 µm pore size
- (8) = gray (after wetting black) with white grid, 0.45 µm pore size
- (9) = white with green grid, 0.45 µm pore size, High Flow (ideal for E. coli)
- (10) = gray (after wetting black) with white grid, 0.45 µm pore size, High Flow

$^3$ Diameter of the membrane filter, 47 mm.

Order number for Nutrient Pad Sets with 50 mm membrane filter as above, but --47------N replaced by --50------N.

Most of the NPS types are also available with Microsart® e.motion Membrane Filters:

Order number as above, but ---N replaced by -RDN.

Other NPS types and NPS with Microsart® e.motion Membrane Filters on request.

$^4$ The incubation conditions are recommended by Sartorius Stedim Biotech. They may be varied according to the type of samples in compliance with the reference standard or customer’s requirements.

$^5$ Test strains on page 32.

Remarks

The incubation conditions are recommended by Sartorius Stedim Biotech. They may be varied according to the type of samples in compliance with the reference standard or customer’s requirements.

The description of the typical results or any pictures show typical appearance of the mentioned microorganisms. In particular cases, color and shape of the colonies could vary from the expected habitus. Further tests may be necessary to validate the result.

Sartorius Stedim Biotech shall not be liable for consequential and/or incidental damage sustained by any customer from the use of its products.

Nutrient Pad Sets (NPS) are subject to continuous product improvement as part of our product development program to align our products with changing application requirements. For current specifications and lot release criteria please visit our homepage under: www.sartorius-stedim.com/NPSSearch.
Reference Guide

The compositions of the pads are based on the recommendations of numerous different standards and regulations.

<table>
<thead>
<tr>
<th>Abbreviation</th>
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</thead>
<tbody>
<tr>
<td>AFNOR</td>
<td>Association Franchaise de Normalisation</td>
</tr>
<tr>
<td>APHA (dairy)</td>
<td>American Public Health Association: Standard Methods for the examination of dairy products</td>
</tr>
<tr>
<td>APHA (food)</td>
<td>American Public Health Association: Compendium of methods for the microbiological examination of foods</td>
</tr>
<tr>
<td>APHA (water)</td>
<td>American Public Health Association, American Water Works Association (AWWA) and Water Environment Federation (WEF): Standard Methods for the Examination of Water and Waste Water</td>
</tr>
<tr>
<td>AOAC</td>
<td>Association of Official Analytical Chemists</td>
</tr>
<tr>
<td>API</td>
<td>American Petroleum Institute: Recommended practice for biological Analysis of Subsurface Injection waters</td>
</tr>
<tr>
<td>ASM</td>
<td>American Society for Microbiology</td>
</tr>
<tr>
<td>BS</td>
<td>British Standards</td>
</tr>
<tr>
<td>DAB</td>
<td>Deutsches Arzneimittelbuch (German Pharmacopoeia, replaced by EP)</td>
</tr>
<tr>
<td>DIN 10110</td>
<td>Deutsches Institut für Normung: Mikrobiologische Fleischuntersuchung. Bestimmung der E. coli. (Microbial detection of E. coli on meat)</td>
</tr>
<tr>
<td>DIN 38411</td>
<td>Deutsches Institut für Normung: Deutsche Einheitsverfahren zur Wasser-, Abwasser- und Schlammuntersuchung (German standard for water, waste water and sludge analysis)</td>
</tr>
<tr>
<td>DGHM</td>
<td>Deutsche Gesellschaft für Hygiene und Mikrobiologie (German Association of Hygiene and Microbiology)</td>
</tr>
<tr>
<td>EBC</td>
<td>European Brewery Convention</td>
</tr>
<tr>
<td>EG 98/83</td>
<td>European Guideline 98/83: Water Quality for human purpose</td>
</tr>
<tr>
<td>EP</td>
<td>European Pharmacopoeia</td>
</tr>
<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency: Laboratory standards for equipment and materials</td>
</tr>
<tr>
<td>FDA</td>
<td>U.S. Federal Drug Administration</td>
</tr>
<tr>
<td>ICUMSA</td>
<td>International Commission for Uniform Methods of Sugar Analysis</td>
</tr>
<tr>
<td>IDF</td>
<td>International Dairy Federation</td>
</tr>
<tr>
<td>IFU</td>
<td>International Federation of Fruit Juice Producers</td>
</tr>
<tr>
<td>ISO 6222</td>
<td>International Organization for Standardization: Water Quality - Enumeration of culturable micro-organisms</td>
</tr>
<tr>
<td>ISO 7704</td>
<td>International Organization for Standardization: Water Quality, Evaluation of membrane filters used for microbiological analysis</td>
</tr>
<tr>
<td>ISO 9308-1</td>
<td>International Organization for Standardization: Water Quality – Detection and enumeration of E. coli and coliform bacteria</td>
</tr>
<tr>
<td>EN ISO 16266</td>
<td>European</td>
</tr>
<tr>
<td>JFoodP</td>
<td>Journal of Food Protection</td>
</tr>
<tr>
<td>JIBrew</td>
<td>The Journal of the Institute of Brewing</td>
</tr>
<tr>
<td>LLL</td>
<td>Method described by Lanaridris &amp; Lafon-Lafourcade</td>
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<tr>
<td>LMBG</td>
<td>Amtliche Sammlung von Untersuchungsverfahren nach dem §35 des Lebensmittel- und Bedarfsgegenständegezesetzes des BGA (testing procedures for food stuffs and articles of daily use)</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Title</td>
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<tr>
<td>--------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>MEBAK</td>
<td>Methodensammlung der Mitteleuropäischen Brauereitechnischen Analysenkommision (methods of the Central European brewery commission)</td>
</tr>
<tr>
<td>MNO</td>
<td>Verordnung über natürlichen Mineralwasser, Quellwasser und Tafelwasser (Mineral/Table Water Guideline)</td>
</tr>
<tr>
<td>MPP</td>
<td>Merkblätter für die Prüfung von Packmitteln (Testing procedures for packaging stuff)</td>
</tr>
<tr>
<td>NCA</td>
<td>National Canners Association: A Laboratory manual of the canning industry</td>
</tr>
<tr>
<td>USDA</td>
<td>U.S. Department of Agriculture</td>
</tr>
<tr>
<td>USP</td>
<td>United States Pharmacopoeia</td>
</tr>
<tr>
<td>VLB</td>
<td>Versuchs- und Lehranstalt für Brauerei in Berlin (institute of brewery)</td>
</tr>
<tr>
<td>ZenHyg</td>
<td>Zentralblatt für Hygiene (Journal of Hygiene)</td>
</tr>
</tbody>
</table>

DIN standards and the „Amtliche Sammlung von Untersuchungsverfahren nach dem §35 des Lebensmittel- und Bedarfsgegenständegesetzes des BGA“ are available through the German publisher Beuth-Verlag, Burggrafenstr. 6, 10787 Berlin
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