

Safe Beverages

Culture media and tests
for the microbiological quality
control of beverages



High Quality and Safe Beverages

Spoilage organism testing is a crucial step within the beverage industry to enable the safe release of drinks to the market. Requirements can vary from industry to industry, depending on different spoilage parameters—we can offer a full range of culture media and tests for microbiological quality control with our new combined Merck and Sigma-Aldrich portfolio.

Our beverage safety testing solutions cover the most important spoilage organisms, so you can ensure the quality of your beverages. Whether you need to test wine, beer, soft drinks, juices, or water, we have the safety testing solution to fit your needs.



Wine

Wine is an alcoholic beverage made from fermented grapes or other fruits. The natural chemical balance of grapes lets them ferment without the addition of sugars, acids, enzymes, water, or other nutrients. Yeast consumes the sugars in the grapes and converts them into ethanol and carbon dioxide. Different varieties of grapes and strains of yeasts produce different styles of wine.

Typical spoilage organisms for wine are wild yeasts (for example, *Brettanomyces*), lactic acid bacteria such as *Lactobacillus*, *Leuconostoc*, *Oenococcus* and *Pediococcus*, or acetic acid bacteria from the genus *Acetobacter* and *Gluconobacter*.

Process Outline

Harvest – The grapes are picked based on sugar levels, and acidity (pH).

Crush – Step to remove the stems and skin from the grape to extract the juice (called must).

Fermentation – Yeast turns the sugar in the juice into carbon dioxide and alcohol.

Maceration – Dwell time of the must for developing flavor, color and tannins.

Pumping over – Mix skin and other solids that have floated to the top with the rest of the must to increase tannin and color extraction.

Press – This separates the wine from the grape skins.

Aging – Can be carried out in oak barrels or stainless steel tanks.

Filtration/stabilization – Clarification, filtration and addition of preservatives.

Finishing – This includes blending, fining and filtration to get the right taste and to avoid spoilage by microbes.

Microbiological Control of Wine:

Wine quality depends on the ability to avoid any undesired fermentation by spoilage microorganisms in the different steps of the process (fermentation, aging, finishing, bottling).

Fermentation is the least risky phase, particularly if selected yeasts strains are added to drive it.

During aging, microorganisms can produce metabolites (e.g. guaiacol by *Brettanomyces*) affecting the bouquet and flavors, so periodic chemical controls are recommended, followed by microbiological control.

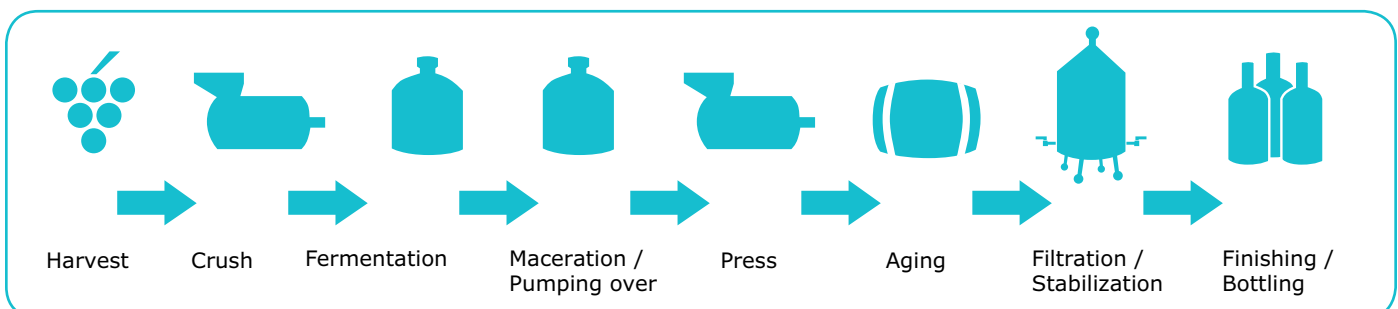
Microbiological control of wine is carried out before bottling (samples taken after the filters from final storage tanks), to test washing water after cleaning of pipes, and bottled wine by taking some random samples. Cork stoppers should be also checked for any microbiological contamination.

Culture media and tests are used to check the presence or absence of undesired microorganisms in wine and washing solutions. Typical examples of spoiling yeasts are *Dekkera/Brettanomyces*, *Kloeckera*, *Saccharomyces*, *Zygosaccharomyces* and *Candida*. All of them grow in media supplemented with cycloheximide while the pitching yeast are inhibited. Other types of media like Schwarz Differential Agar can differentiate wild yeast from brewing yeast. Typical spoiling bacteria can be detected using diverse media such as MRS, NBB, WL Differential Agar etc. (see the culture media list).

Air samplers are used to check the microbiological contamination of the bottling environment.

The aim of all tests performed before bottling is to prevent any contamination that can modify the taste of bottled wine (particularly for high quality wines that are not submitted to any chemical treatment for microbiological stabilization).

Process of wine manufacturing



Beer

Beer is an alcoholic beverage brewed from cereal grains—most commonly from malted barley, but also wheat, maize (corn), and rice. During the brewing process, fermentation of the starch sugars in the wort produces ethanol and carbonation in the resulting beer. Most modern beer is brewed with hops, which add bitterness and other flavors and act as a natural preservative and stabilizing agent. Other flavoring agents such as fruit, herbs, or fruits may be included or used instead of hops.

The microorganisms responsible for beer spoilage are often wild yeasts or bacteria from the genera *Lactobacillus*, *Pediococcus*, *Pectinatus* and *Megasphaera*.

Process Outline

At the Maltings

Malting is the process to release starch/malt out of the barley.

Steeping – the grain is set under water by aeration to swelling.

Germination – allows the development of enzymes, to modify the structure of the barley by breaking down the cell walls and the protein matrix. The enzymes are also needed to breakdown starch into shorter molecule lengths.

Kilning – drying process at ambient or high temperatures and stopping of the germination

At the Brewery

Milling – is the cracking of the grain

Lautering/Mashing – Converts the starches, which were released during the malting stage, to sugars that can be fermented. The so-called mash is separated into the clear liquid wort and the residual grain.

Boiling/Brewing – In the brew kettle, the wort is brought to boil. The boiling stage of brewing involves many technical and chemical reactions. Certain types of hops are added at different times during the boil for either bitterness or aroma.

Cooling – the wort is transferred from the brew kettle through a device to filter out the hops, and then onto a heat exchanger to be cooled (to a point where yeast can safely be added).

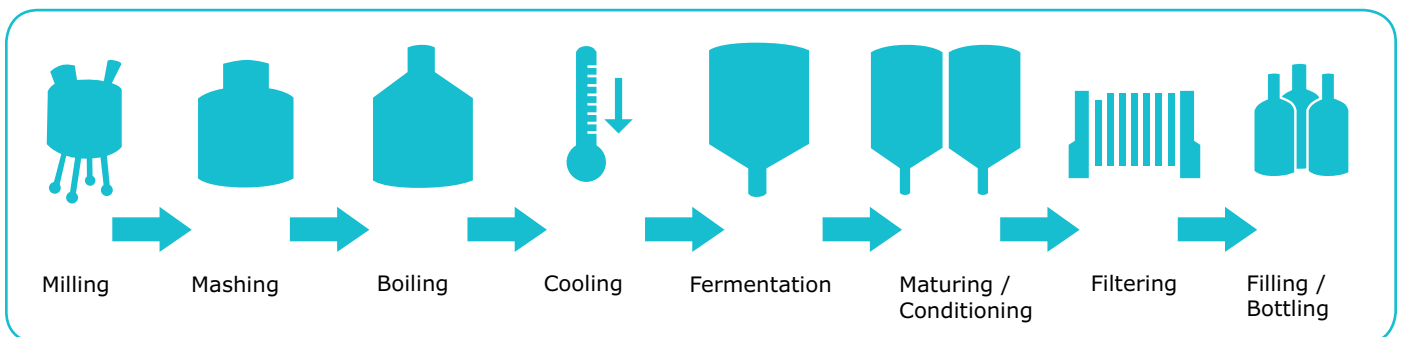
Fermentation – yeast is added and the wort sugars are fermented into alcohol.

Conditioning/Maturing – the beer is usually transferred into a fresh container, so that it is no longer exposed to the dead yeast. Beer is conditioned, matured or aged.

Filtration, Carbonation and Filling – finally, the beer can be filtered and then carbonated. Then the beer is moved to a holding tank where it stays until it is bottled or kegged.



Process of beer manufacturing



Microbiological Control of Beer:

Brewing beer involves microbial activity at every stage, from raw material (grain, hops, water, syrups, sugars), to wort and fermentation, up to the final packed beer. Most of these activities are desirable, as beer is the result of a traditional fermentation, but others represent threats to the quality of final product.

Water is an important raw material used for steeping and mashing; it is checked for chemical (e.g. hardness, alkalinity etc.) and microbiological properties (potable water parameters, EU Directive 98/83/EC *Quality of Water Intended for Human Consumption*).

In pursuit of a constant beer quality, brewers seek to achieve consistent fermentations, which demands control of the key variables of yeast type and quantity, oxygen input, wort nutritional status, temperature, yeast-wort contact (mixing) and the absence of spoiling organisms.

Through the fermentation of maltose and other sugars to ethanol and carbon dioxide, the resulting conditions are hostile to the growth of most microorganisms. Nevertheless, some spoilage yeasts (e.g. *Brettanomyces* or its teleomorph *Dekkera*) and bacteria can survive and grow slowly and may start to spoil the beer weeks after leaving the brewery.

The packaging and distribution of beer represent the two greatest challenges to the microbial stability of beer. Biofilms can form on the surfaces of filler kegs, tubes or any vessel, increasing the risk of microbial contamination. The industry long ago addressed this issue through product stabilization via filtration, pasteurization, or some combination thereof. However, with today's increasing demand for unpasteurized beers, this has led to an increase in incidents of microbial contamination and spoilage of beer.

Rinsing water is also checked for microbial contamination of the process (after filtration, usually using Schwarz Differential Agar as a non-selective medium, and Raka-Ray for the enumeration of *Lactobacillus* that create turbidity and undesired flavors). In some cases, dip-slides are also used to test the water as an indicator of potential microbial contamination.



Soft drinks and juices

Soft drinks are water based drinks with natural or artificial flavoring, often sweetened by sugars, syrups, fruit juices, fruit juices concentrates or sweeteners. They are often carbonated and supplemented by minerals, vitamins, stabilizers, antioxidants and caffeine. They are often stored in bottles, either cooled or at room temperature. Typical examples are teas and lemonades.

Juice is a liquid that is naturally contained in fruit and vegetables. Today there is also a trend for smoothies, which are blends of raw fruits and vegetables often with other additives like water, ice, sweeteners or dairy products.

Fermented soft drinks and probiotic beverages are also a big market today, examples include Yakult (Japan, China) and Kombucha (China, Korea, Japan, Russia).

Often microorganisms cause spoilage and build a malodor, turbidity or slime in soft drinks and juices. Typical causes are yeasts but many bacteria can also lead to spoilage, as listed below:

Acetic Acid Bacteria

- *Acetobacter*
- *Gluconobacter*

Lactic Acid Bacteria

- *Lactobacillus*
- *Lactococcus*
- *Leuconostoc*
- *Oenococcus*
- *Pediococcus*
- *Microbacterium*

Acidophilic Heat Resistant Bacteria

- *Alicyclobacillus*
- *Bacillus spp.*
- *Clostridium pasteurianum*
- *Clostridium butyricum*

Ethanol Producing Bacteria

- *Zymomonas*
- *Saccharobacter*
- *Zymobacter*



Microbiological Control of Soft Drinks and Water:

The main risk for microbial contamination of soft drinks comes from raw material (water, syrups, sugars, juices, additives) and from final filling. Today's trend for natural and healthy drinks increases the risk for contamination and final spoilage, due to the minimization of heat and filter steps. In addition, several heat resistant spore forming organisms are known to be frequent spoiling organisms in soft drinks.

Water is an important raw material as it is practically used for all soft drinks except the pure juices. It is checked for chemical (e.g. hardness, alkalinity) and microbiological properties (potable water parameters, EU Directive 98/83/EC *Quality of Water Intended for Human Consumption*).

Microbial control for bottled water also follows national and international regulations and can include testing of the following microbes or total count:

- *Escherichia coli* (*E. coli*)
- Coliforms
- *Enterococcus*
- *Pseudomonas aeruginosa*
- *Clostridium perfringens*
- Total Viable Count

Tests for the Detection of Spoiling Organisms

HybriScan® kits

An innovative simple molecular screening method for beer spoilage organisms based on the detection of rRNA

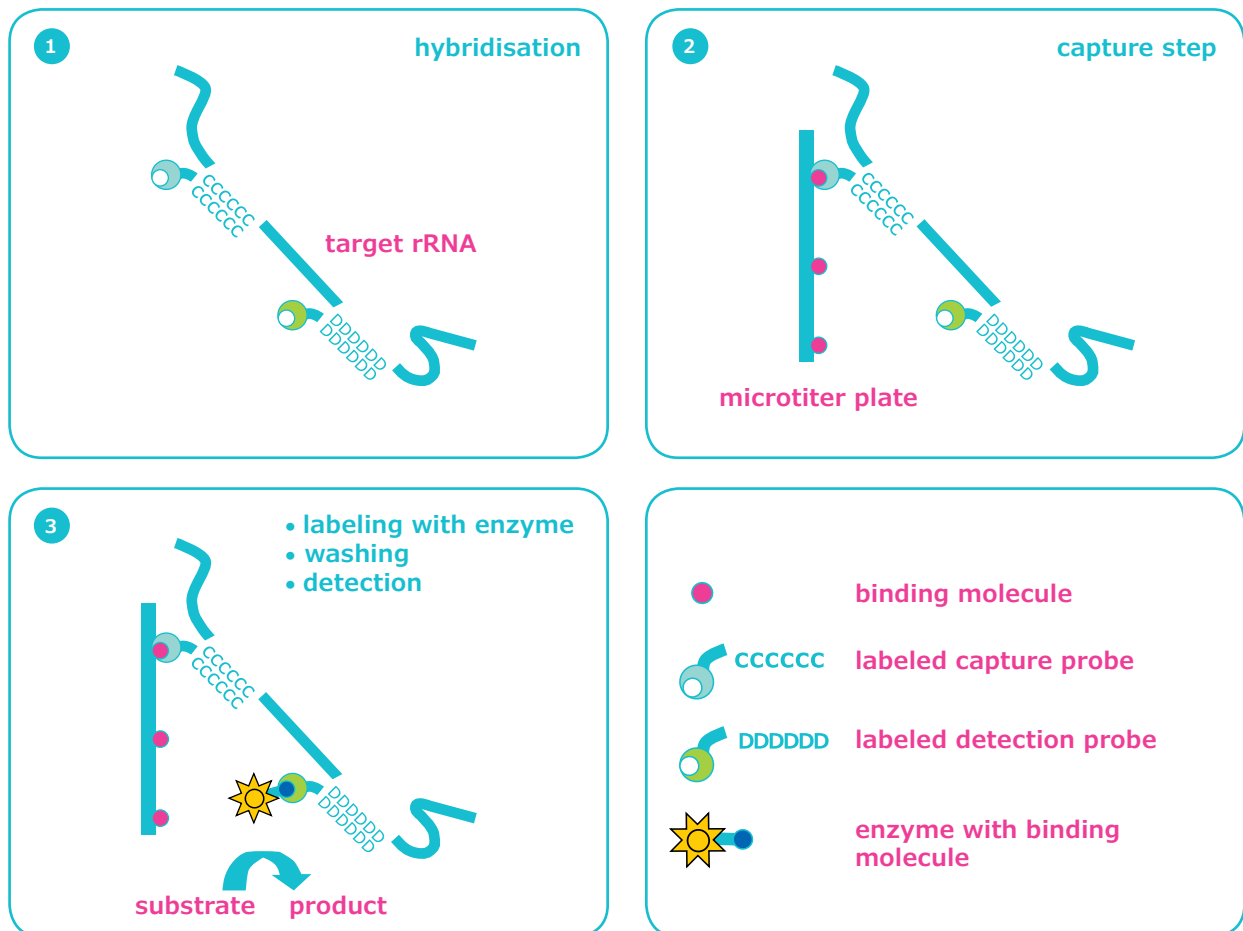
Most laboratories still use conventional standard based cultivation methods, which are very time consuming and take from 3 to 12 days for beer, juices, wine and other beverages to be released to the market. Our HybriScan® rapid test system could lead to a faster and easier product release of beverages when used as an alternative for the detection of beverage spoilage contaminants. Results are available after only 2 hours of testing with a pre-enrichment of 24 hours.

Using two different probes for detection of microbial RNA, false-positive results are almost impossible.

Principle:

The HybriScan® method is based on the detection of rRNA via hybridization events and specific capture and detection probes. Sandwich hybridization is very sensitive, detecting attomoles of the respective target rRNA molecules. The ideal hybridization target for bacteria and yeast is rRNA. These cells contain a large number of rRNA-containing ribosomes; a single cell therefore contains several thousand copies of rRNA but only one DNA. Sandwich hybridization also provides sensitivity in crude biological samples because it is not susceptible to matrix interference.

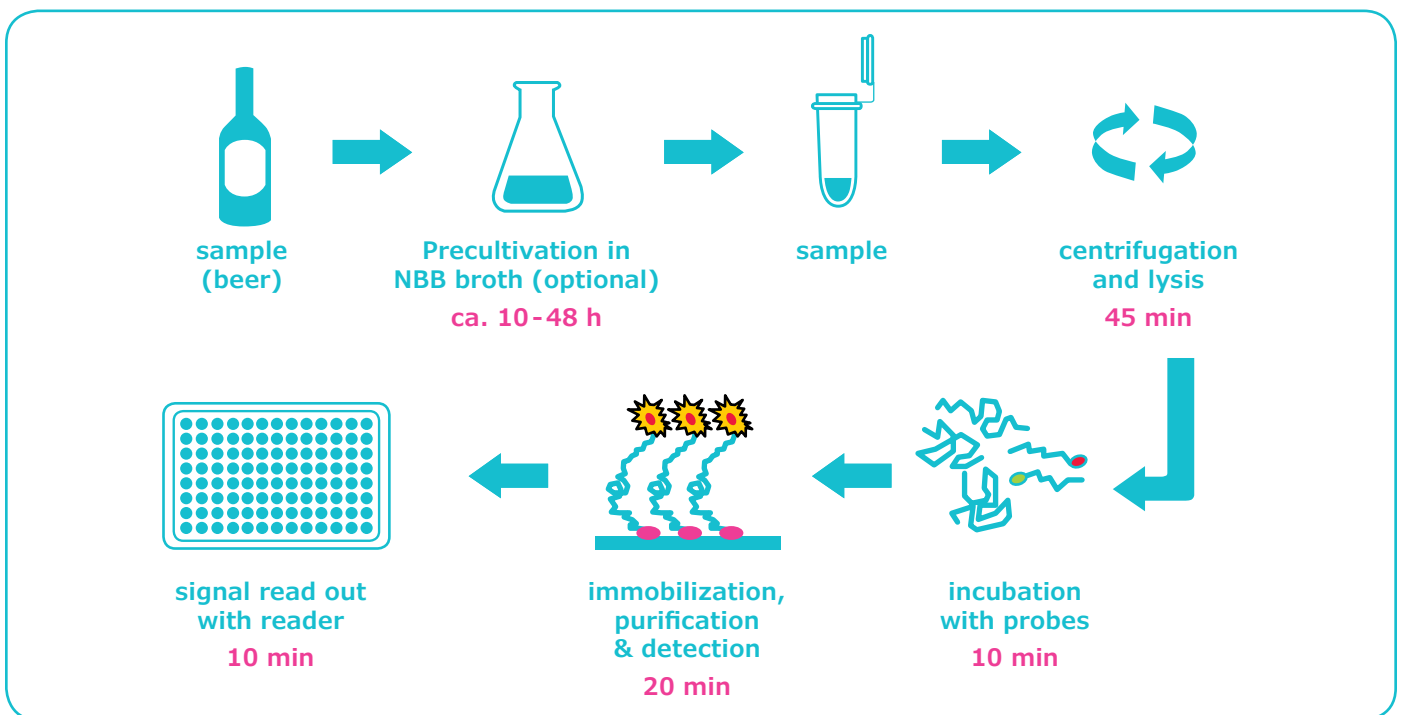
Specificity is achieved by targeting conserved or unique rRNA sequences. A biotin-labeled capture probe is used to immobilize the target sequence on a solid support plate (streptavidin-coated microtiter plate). A digoxigenin-labeled detection probe provides an enzyme-linked optical signal read-out. Detection results from application of anti-DIG-horseradish peroxidase Fab fragments. The bound complex is visualized by horseradish peroxidase substrate TMB (3,3',5,5'-tetramethylbenzidine). Photometric data are measured at 450 nm and compared with standard solutions.



Detection kit (quantitative)	Cat. No.	Beverage	Brewery	Wine
HybriScan®D Beer	62533		x	
HybriScan®D Drinks	68301	x		x
HybriScan®D Lactobac	59744	x	x	x
HybriScan®D Total Bacterial Count	02349	x	x	x
HybriScan®D Yeast	61397	x	x	x
Identification Kit				
HybriScan®I Brettanomyces	79742	x	x	x
HybriScan®I Lactobacillus brevis	75724	x	x	x
HybriScan®I Lactobacillus buchneri	80065	x	x	x
HybriScan®I Lactobacillus lindneri	86827	x	x	x
HybriScan®I Leuconostoc	77007	x	x	x
HybriScan®I Megasphaera	42875		x	
HybriScan®I Pectinatus cerevisiiphilus	89384	x	x	
HybriScan®I Pectinatus frisingensis	73582	x	x	
HybriScan®I Pediococcus damnosus	67289	x	x	x

* **Table:** HybriScan®D kits for beer control. D is for detection kits and means it is a quantitative test and includes 96 tests. HybriScan®I kits for beer control. I is for Identification kits and means it is a qualitative test and includes 48 tests (a half microtiter plate).

Workflow



The detection limit is about 1000 cfu per mL for bacteria or about 100 cfu per mL for yeasts. That means often an enrichment step is used for testing small numbers of beverage spoilers.

To learn more, visit SigmaAldrich.com/hybriscan

Equipment	Cat. No.
Thermomixer Comfort, Eppendorf	Z605271
Exchange unit for 24x2ml reaction tubes; Eppendorf	Z605670
Exchange unit for microtiter plate; Eppendorf	T3942
Centrifuge for 2 mL reaction tubes	Z605220 Z606235
Microplate reader (e.g. Multiskan FC , Order number: 51119000 Thermo)	na

* Table: Equipment needed for HybriScan® kits

EZ-Fluo® System

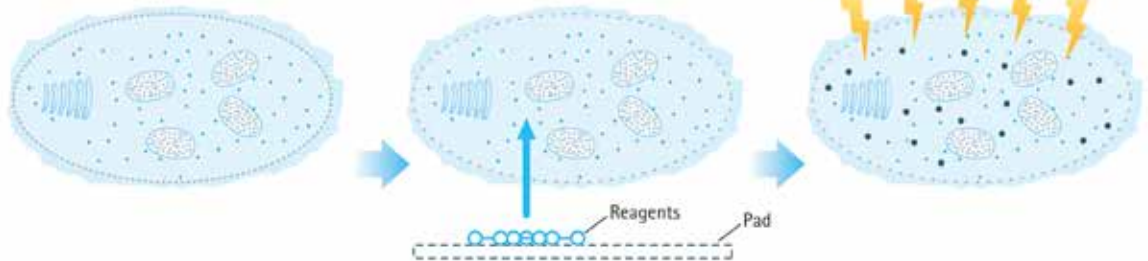
For rapid detection of spoilage organisms in beverages

Many beverage manufacturing processes are susceptible to spoilage organisms like yeast or bacteria contamination. Contamination can alter the odor, flavor or turbidity of a beverage, resulting in customer dissatisfaction and, in some cases, in product recall. For these microorganisms, traditional monitoring methods require up to 10 days to obtain microbiological results allowing the release of the product. A rapid microbiology system that can detect potential contamination 3 times faster than traditional monitoring methods would result in a significant cost saving and preserved company reputation. The EZ-Fluo® System uses fluorescence-based technology, and is a convenient and a sensitive platform for the quantitative detection of contaminants in filterable samples. This rapid microbiological method is based on a universal enzymatic fluorescent staining of viable and culturable microorganisms. The fluorescent staining procedure is non-destructive, allowing microorganism identification following a positive result.

Microorganisms:

Lactic Acid Bacteria, *Oenococcus oeni* strain, *Brettanomyces spp.* strain, Acetic acid bacteria (AAB), Yeast Counts / *Saccharomyces cerevisiae* strain

Note: Fluorescence detection is a non-destructive method that enables the microorganisms to continue to grow after they have been stained in order to identify them using standard ID technology.



Protocol for rapid detection

The standard protocol to detect spoilage microorganisms in samples of interest with the fluorescence detection is as follows:

- A filtration unit is installed onto the filtration system
- The appropriate volume of sample is poured into the filtration unit
- After filtration, the membrane is disconnected from the device and aseptically transferred onto a media plate
- The incubation is performed according to the specifications
- After incubation, the membrane is stained with the fluorogenic reagent for 30 min at 32.5°C (± 2.5)
- The fluorescent micro-colonies are counted using the fluorescence reader
- After detection, the stained membrane can be re-incubated on fresh media for traditional plate count and identification if required



The EZ-Fluo® system offers a fast and reliable alternative for the rapid detection of spoilage microorganisms in wines. An evaluation study, performed by the accredited lab Centro de Investigación y Asistencia Técnica a la industria (CIATI AC) in Argentina, shows that the system enables a faster response and corrective action when used during the wine manufacturing process. It improves process control, product yield and the faster release of final product to market.

Principle of detection

The principle of the fluorescence detection is based on an enzymatic reaction. The fluorogenic substrate used is a non-fluorescent viability marker which is cleaved by non-specific ubiquitous intracellular enzymes resulting in a fluorescent product. Natural amplification of fluorescence by accumulation inside cells is an indicator of microbial metabolism. The dye is diluted in a staining buffer allowing cell membrane permeability and thus dye introduction into cells.

Definition of a rapid incubation time

An appropriate incubation time is defined as the minimal time which allows a percentage of recovery above 70% compared to the traditional method. The calculation is based on both formulas:

- The fluorescence recovery is the fluorescent dot count compared to the traditional method count.
Fluorescence recovery (%) = (average of fluorescence counts / average of traditional method count) x 100

- The viability recovery is the colony count on stained membranes after re-incubation compared to the traditional method count. Viability recovery (%) = (average of Colony-Forming Units counts after re-incubation / average of traditional method counts) x 100

An optimal incubation time should allow a sufficient fluorescent signal intensity and fluorescence and viability recoveries above 70%.

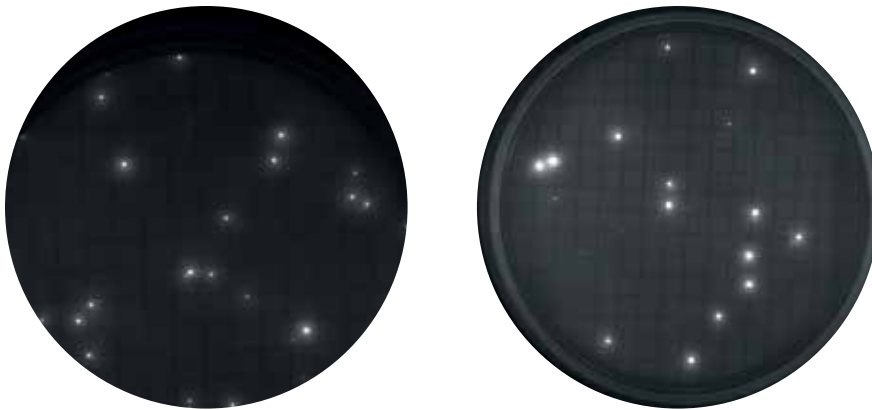


Figure: The picture on the right illustrates a sufficient fluorescent signal intensity translating to an appropriate incubation time. The picture on the left shows that an accurate count is not possible if the intensity of fluorescence is too low due to an insufficient incubation time.

Materials:

- EZ-Fluo® system Reader (EZFKIT001WW)
- Membrane Filtration systems (EZFTIMIC01)

Equipment:

- EZ-Fluo® system Reagent Kits (EZFREAG57)

Media:

- MRS agar + tomato juice
- Brettanomyces agar
- Carr agar
- YEPD agar

[SigmaAldrich.com/EZ-Fluo](https://www.sigmaaldrich.com/EZ-Fluo)

Culture Media for Water Testing

Media for Water Testing

Medium	Medium format	Ordering from	Cat. No.	Packaging
<i>Clostridium perfringens</i>				
CP ChromoSelect Agar*	Powder	Sigma-Aldrich	12398	500 g
m-CP Agar Base	Powder	Sigma-Aldrich	75605	500 g
TSC Agar*	Powder	Sigma-Aldrich	93745	500 g
TSC Agar	Granules	Merck	1119720500	500 g
<i>E. coli</i> / Coliforms				
CHROM CCA ISO 9308, ReadyPlate™	90mm plate	Merck	1466890020	20 EA
Chromocult® Coliform agar acc ISO 9308-1	Granules	Merck	1104260500	500 g
CCA ISO 9308, ReadyPlate™ 55	55mm plate	Merck	1467570020 1467570200	20 EA 200 EA
CCA ISO 9308, ReadyPlate™ 55 KIT	KIT	Merck	1467580150	KIT
Coliforms 100, Readycult®	Granules	Merck	1012980001	1 x 20 test
Coliforms 50, Readycult®	Granules	Merck	1012950001	1 x 20 test
ECD Agar*	Powder	Sigma-Aldrich	44655	500 g
ECD ChromoSelect Agar with MUG	Powder	Sigma-Aldrich	09142	500 g
ENDO Agar	Granules	Merck	1040440500	500 g
Endo Agar	Powder	Merck	E5399	500 g
ENDO Agar (Base)	Powder	Sigma-Aldrich	70137	500 g
Lactose TTC Agar mit Tergitol® 7	Granules	Merck	1076800500	500 g
Lactose TTC Agar with Tergitol®-7	Powder	Sigma-Aldrich	54232	500 g
Lactose TTC Agar with Tergitol®-7	90mm plate	Merck	1461850020	20 EA
Lactose TTC, ReadyPlate™ 55	55mm plate	Merck	1467590020	20 EA
Lactose TTC, ReadyPlate™ 55 KIT	KIT	Merck	1467600150	KIT
Membrane Lactose Glucuronide Agar (MLGA)	Powder	Sigma-Aldrich	39734	500 g
m-FC Agar	Powder	Sigma-Aldrich	96961	500 g
m-FC Agar	Granules	Merck	1112780500	500 g
Tergitol®-7 Agar	Powder	Sigma-Aldrich	86455	500 g
Enterobacteriaceae				
Mac Conkey Agar No 1	Powder	Sigma-Aldrich	70143	500 g
<i>Enterococcus</i> (intestinal)				
Bile Esculin Azide Agar	Granules	Merck	1000720500	500 g
Bile Esculin Azide Agar	Powder	Sigma-Aldrich	06105	500 g
Bile Esculin Azide Agar	90mm plate	Merck	1463210020	20 EA
Bile Esculin Azide Agar ISO 7899-2:2000	Powder	Sigma-Aldrich	72678	500 g
Enterococci 100, Readycult®	Granules	Merck	1012990001	1 x 20 test
KF-Streptococcus Agar	Powder	Merck	1107070500	500 g
KF-Streptococcus Agar	Powder	Sigma-Aldrich	60641	500 g
Membrane filter Enterococcus Selective Agar	Powder	Sigma-Aldrich	63647	500 g
Slanetz and Bartley Agar	90mm plate	Merck	1467120020	20 EA
Slanetz-Bartley Agar (Base)	90mm plate	Merck	1467090020 1467090100	20 EA 100 EA
Slanetz-Bartley Agar (Base), acc. to ISO 7899, GranuCult®	Granules	Merck	1052890500	500 g
SLANETZ-BARTLEY agar incl. TTC acc. ISO 7899, GranuCult®	Granules	Merck	1052620500	500 g
General spoilage organisms				
Yeast Extract Agar	Powder	Sigma-Aldrich	01497	500 g
Yeast Extract Agar acc. ISO 6222	18 mL tubes	Merck	1461210020	20 EA
Yeast Extract Agar acc. ISO 6222, GranuCult®	Granules	Merck	1131160500	500 g

Media for Water Testing

Medium	Medium format	Ordering from	Cat. No.	Packaging
<i>Pseudomonas aeruginosa</i>				
Cetrimide Agar	Powder	Sigma-Aldrich	22470	500 g
Pseudomonas CFC/CN Agar (Base), GranuCult®	Granules	Merck	1076200500	500 g
Bismuth sulfite Agar	Powder	Merck	1054180500	500 g
Bismuth sulfite Agar*	Powder	Sigma-Aldrich	95388	500 g
Total Count/Spoiling organisms				
Tryptone Glucose Extract Agar (TGE Agar)	Granules	Merck	1101280500	500 g
Tryptone Glucose Extract Agar (TGE Agar)	Powder	Sigma-Aldrich	70159	500 g
TGE Agar, ReadyPlate™ 55	55mm plate	Merck	1467610020	20 EA
TGE Agar, ReadyPlate™ 55 KIT	KIT	Merck	1467620150	KIT
Yeast & Molds				
Sabouraud 2% Glucose Agar	Granules	Merck	1073150500	500 g
Sabouraud 2% Glucose Agar*	Powder	Sigma-Aldrich	84086	500 g
Sabouraud 4% Glucose Agar	Granules	Merck	1054380500	500 g
Sabouraud 4% Glucose Agar	Powder	Sigma-Aldrich	84088	500 g
Yeast & Molds, Bacillus				
m-Green Agar, ReadyPlate™ 55	55mm plate	Merck	1467690020	20 EA
m-Green Agar, ReadyPlate™ 55 KIT	KIT	Merck	1467700150	KIT
m-Green Yeast and Mold Broth	2 mL ampoules	Merck	MHA000P2M	50 EA

* no growth performance testing on the certificate of analysis

Supplements for Water Testing Media

Supplement	function	corresponding Media	Ordering from	Cat. No.	Packaging
Clostridium perfringens selective supplement	inhibits yeasts & moulds, chromogenic substrate	TSC agar (Cat. No. 1119720500)	Merck	1008880010	10 Vials
M-CP selective Supplement I	inhibit gram positive and most gram negative bacteria	CP ChromoSelect Agar (Cat. No. 12398), m-CP Agar Base (Cat. No. 75605)	Sigma-Aldrich	51962	5 Vials
m-CP selective Supplement II	indicator	m-CP Agar Base (Cat. No. 75605)	Sigma-Aldrich	82265	5 Vials
Perfringens T.S.C. Supplement	inhibit gram positive bacteria	CP ChromoSelect Agar (Cat. No. 12398)	Sigma-Aldrich	P9352	1 Vials
Pseudomonas CN Selective Supplement	inhibit the Gram-positive and Gram-negative bacteria	Pseudomonas CFC/CN Agar, Base (Cat. No. 1076200500)	Merck	1076240010	10 Vials
Rosolic acid	indicator	m-FC Agar (Cat. No. 96961 & 1112780500)	Sigma-Aldrich	861324	25 g 100 g
TTC Solution	chromogenic Indicator	Lactose TTC Agar with Tergitol®-7 (Cat. No. 54232), Tergitol®-7 Agar (Cat. No. 86455), Tryptone Glucose Extract Agar/TGE Agar (Cat. No. 70159)	Sigma-Aldrich	17779	10x10 mL

Culture Media for Beverage Product Testing

Media for Quality Control of Beverage Products

Medium	Soft Drinks	Brewery	Wine	Samples and remarks	Medium format	Ordering from	Cat. No.	Packaging
Acetic Acid resistant organisms								
Cetrimide Agar	x	x	x	bottling	2 mL ampoules	Merck	MHA00PRY2	50 EA
<i>Alicyclobacillus spp.</i>								
BAT agar	x			citrus juice	Granules	Merck	1079940500	500 g
BAT broth	x			citrus juice	Granules	Merck	1079930500	500 g
<i>Aspergillus flavus, A. parasiticus</i>								
Dichloran Rose Bengal Agar (Base)		x		grain	Powder	Sigma-Aldrich	17147	500 g
<i>Aspergillus flavus, A. parasiticus, spoiling Yeasts & Molds</i>								
Dichloran Rose Bengal Agar, GranuCult®		x		grain	Granules	Merck	1004660500	500 g
<i>Bacillus species</i>								
Bacillus ChromoSelect Agar	x	x		syruaps, sugars	Powder	Sigma-Aldrich	92325	500 g
Cereus Selective Agar*	x	x		syruaps, sugars	Powder	Sigma-Aldrich	22310	500 g
<i>Bacillus thermoacidurans (Spores)</i>								
Thermoacidurans Agar	x			bottling	Powder	Sigma-Aldrich	17274	500 g
<i>Brettanomyces</i>								
Brettanomyces Selective Broth		x	x	wort, fermentation, bottling	2 mL ampoules	Merck	MHA00BSM2	50 EA
Fungi								
Aspergillus Differentiation Agar (Base)	x	x		grain, juice	Powder	Sigma-Aldrich	17121	500 g
Potato Dextrose Agar		x		grain	Granules	Merck	1101300500	500 g
Potato Dextrose Agar		x		grain	Powder	Sigma-Aldrich	70139	500 g
Potato Dextrose Agar		x		grain	Powder	Sigma-Aldrich	P2182	500 g
Potato Dextrose Broth		x		grain	Powder	Sigma-Aldrich	P6685	500 g
Potato Glucose Rose bengal Agar		x		grain	Powder	Sigma-Aldrich	17204	500 g
Czapek Dox Agar*		x		grain	Powder	Sigma-Aldrich	70185	500 g
DG 18 (Dichloran glycerol chloramphenicol) agar (base), GranuCult®	x	x		grain	Granules	Merck	1004650500	500 g
DG 18 ISO 21527, ReadyPlate™	x	x		grain	90mm plate	Merck	1461610020	20 EA
Dichloran Glycerol Agar (DG 18 Agar)	x	x		grain	Powder	Sigma-Aldrich	40587	500 g
BPW ISO, ReadyTube® 1000	x			in raw materials and brewery environments	Bottle 100 mL	Merck	1464030006	6 EA
BPW ISO, ReadyTube® 9	x			in raw materials and brewery environments	Tubes 9 mL	Merck	1461420020	20 EA
Buffered Peptone Water acc. ISO 6579, ISO 21528, ISO 22964, FDA-BAM and EP, GranuCult®	x			in raw materials and brewery environments	Granules	Merck	1072280500	500 g
Cooked Meat Broth	x			in raw materials and brewery environments	Powder	Sigma	60865	500 g

Media for Quality Control of Beverage Products

Medium	Soft Drinks	Brewery	Wine	Samples & remarks	Medium format	Ordering from	Cat. No.	Packaging
General spoilage organisms								
Nutrient agar acc. ISO 6579, ISO 10273 and ISO 21528, GranuCult®		x		raw materials and brewery environments	Granules	Merck	1054500500	500 g
Nutrient Agar No 2*		x		in raw materials and brewery environments	Powder	Sigma-Aldrich	70116	500 g
Nutrient broth		x		in raw materials and brewery environments	Granules	Merck	1054430500	500 g
Nutrient Broth No. 4		x		in raw materials and brewery environments	Powder	Sigma-Aldrich	03856	500 g
Orange Serum Agar		x		in raw materials and brewery environments	Granules	Merck	1106730500	500 g
Orange Serum Agar*	x			in raw materials and brewery environments	Powder	Sigma-Aldrich	75405	500 g
Orange Serum Agar	x			in raw materials and brewery environments	Bottle 200 mL	Merck	1464250006	6 g
Peptone Water, phosphate-buffered	x			in raw materials and brewery environments	Powder	Sigma-Aldrich	77187	500 g
Peptone Water, phosphate-buffered, Vegitone	x			in raw materials and brewery environments	Powder	Sigma-Aldrich	40893	500 g
RLS Broth* (Rapid Lemonade Spoilage Organism Broth)	x		x	in raw materials and brewery environments	Powder	Sigma-Aldrich	38587	500 g
Universal Beer Agar		x		in raw materials and brewery environments	Granules	Merck	1004450500	500 g
Universal Beer Agar		x		in raw materials and brewery environments	Powder	Sigma-Aldrich	17226	500 g
Wallerstein Differential Broth		x	x	in raw materials and brewery environments, bacteria present in a small number in a mixed flora (cycloheximide inhibits the growth of most of the yeasts and molds)	2 mL ampoules	Merck	MHA000P2D	50 EA
Wallerstein Nutrient Broth		x	x	in raw materials and brewery environments	2 mL ampoules	Merck	MHA000P2N	50 EA
WL Differential Agar		x	x	in raw materials and brewery environments	Powder	Sigma-Aldrich	17215	500 g
WL Nutrient Agar		x	x	in raw materials and brewery environments	Powder	Sigma-Aldrich	17222	500 g
WL Nutrient Agar		x	x	in raw materials and brewery environments	Granules	Merck	1108660500	500 g
WL Nutrient Broth		x	x	in raw materials and brewery environments	Powder	Sigma-Aldrich	W2261	500 g
Yeast Malt Agar	x			in raw materials and brewery environments	Powder	Sigma	Y3127	500 g
WL Nutrient Agar, modified		x		in raw materials and brewery environments	Powder	Merck	1006100500	500 g
Lactic acid bacteria, <i>Pectinatus</i>, <i>Megasphaera</i>								
NBB Agar		x		yeast, fermentation, bottling	Powder	Sigma-Aldrich	64198	500 g
NBB Broth		x		yeast, fermentation, bottling	Powder	Sigma-Aldrich	50725	500 g
Raka Ray Agar, Base		x		wort, fermentation, bottling	Powder	Sigma-Aldrich	02538	500 g
<i>Lactobacillus</i>, <i>Leuconostocs</i> and lactic acid streptococci								
APT agar	x	x		wort, fermentation, bottling	Granules	Merck	1104530500	500 g

* no growth performance testing on the certificate of analysis

Media for Quality Control of Beverage Products

Medium	Soft Drinks	Brewery	Wine	Samples and remarks	Medium format	Ordering from	Cat. No.	Packaging
Lactobacillus								
MRS Agar*	x	x		wort, fermentation, bottling	Powder	Sigma-Aldrich	69964	500 g
MRS agar (de MAN, ROGOSA and SHARPE) acc. ISO 15214, GranuCult®	x	x	x	wort, fermentation, bottling	Granules	Merck	1106600500	500 g
MRS Agar ISO ReadyTube® 200	x	x	x	wort, fermentation, bottling	Bottle 200 mL	Merck	1463640006	6 EA
MRS Agar ISO, ReadyPlate™	x	x	x	wort, fermentation, bottling	90mm plate	Merck	1467170020	20 EA
MRS Agar, original acc. DeMan-Rogosa-Sharpe*	x	x	x	wort, fermentation, bottling	Powder	Sigma-Aldrich	30912	500 g
MRS Agar, Vegitone	x	x	x	wort, fermentation, bottling	Powder	Sigma-Aldrich	41782	500 g
MRS Broth	x	x	x	wort, fermentation, bottling	Granules	Merck	1106610500	500 g
MRS Broth	x	x	x	wort, fermentation, bottling	Powder	Merck	69966	500 g
MRS Broth modified, Vegitone	x	x	x	wort, fermentation, bottling	Powder	Sigma-Aldrich	38944	500 g
MRS Liquid medium	x	x	x	wort, fermentation, bottling	2 mL ampoules	Merck	MHA00MRS2	50 EA
Rogosa Agar (Lactobacillus Selective Agar)	x	x		wort, fermentation, bottling	Granules	Merck	1054130500	500 g
Rogosa SL Agar	x	x		wort, fermentation, bottling	Powder	Sigma-Aldrich	R1148	500 g
Tomato Juice Agar	x	x		wort, fermentation, bottling	Powder	Sigma-Aldrich	17216	500 g
Total Count/Spoiling organisms								
MC-Media Pad Rapid Aerobic Count	x			for "non-filterable materials"	Plating film system	Merck	1323020001	100 EA
Plate Count Agar	x			bottling	Powder	Sigma-Aldrich	70152	500 g
Plate Count Agar	x			bottling	Bottle 200 mL	Merck	1463650006	6 EA
Plate Count Agar acc ISO 4833, ISO 17410 and FDA-BAM, GranuCult®	x			bottling	Granules	Merck	1054630500	500 g
Plate Count Agar according to Buchbinder et al.	x			bottling	Powder	Sigma-Aldrich	88588	500 g
Plate Count Agar according to Buchbinder et al. (Sachets)	x			bottling	Sachets for 500mL	Sigma-Aldrich	03628	5 EA
Plate count Agar, ReadyPlate™ 55	x			bottling	55mm plate	Merck	1467630020	20 EA
Plate count Agar, ReadyPlate™ 55 KIT	x			bottling	KIT	Merck	1467640150	KIT
Plate Count Agar, Vegitone	x			bottling	Powder	Sigma-Aldrich	19718	500 g
Plate Count MUG Agar	x			bottling	Powder	Sigma-Aldrich	51413	500 g
Tryptone Glucose Extract Broth (TGE)	x	x	x	bottling	2 mL ampoules	Merck	MHA000P2T	50 EA
Tryptone Glucose Extract Broth (TGE) with TTC	x	x	x	bottling	2 mL ampoules	Merck	MHA000P2TT	50 EA
Yeast								
Brettanomyces Selective Broth		x	x	bottling, end product	2 mL ampoules	Merck	MHA00BSM2	50 EA
CaCO ₃ Agar*		x		wort, fermentation, bottling	Powder	Sigma-Aldrich	40545	500 g
Lysine Medium		x	x	wort, fermentation, bottling	Powder	Merck	L5910	500 g

Media for Quality Control of Beverage Products

Medium	Soft Drinks	Brewery	Wine	Samples and remarks	Medium format	Ordering from	Cat. No.	Packaging
Yeast & Molds								
Corn Meal Agar		x		grains, hops	Powder	Sigma-Aldrich	42347	500 g
MC-Media Pad Yeasts & Molds	x	x	x	for "non-filterable materials"	Plating film system	Merck	1323030001	100 EA
OGY Agar*	x			grains, hops	Powder	Sigma-Aldrich	75310	500 g
OGYE Agar (Base)	x			grains, hops	Granules	Merck	1059780500	500 g
OGYE ChromoSelect Agar Base	x			grains, hops	Powder	Sigma-Aldrich	66481	500 g
Rose Bengal Chloramphenicol Agar		x		grains, hops	Granules	Merck	1004670500	500 g
Rose Bengal Chloramphenicol Agar		x		grains, hops	Powder	Sigma-Aldrich	17211	500 g
Schwarz Differential Agar		x		wort, fermentation, bottling	Powder	Sigma-Aldrich	40608	500 g
Wort Agar*		x	x	wort, fermentation, bottling	Powder	Sigma-Aldrich	70196	500 g
Wort Agar		x	x	wort, fermentation, bottling	Granules	Merck	1054480500	500 g
Wort broth		x	x	wort, fermentation, bottling	Granules	Merck	1054490500	500 g
Yeast and Mold Selective Broth		x	x	grain, malt, mash, wort, fermentation, bottling, chloramphenicol inhibits background bacteria growth	2 mL ampoules	Merck	MHA00P2SM	50 EA
Yeast Nitrogen Base		x	x	wort, fermentation, bottling	Powder	Sigma-Aldrich	51483	500 g
Yeast Nitrogen Base without Amino Acid*		x	x	wort, fermentation, bottling	Powder	Sigma	Y0626	500 g
Yeast Nitrogen Base without Amino Acid and Ammonium Sulfate*		x	x	wort, fermentation, bottling	Powder	Sigma	Y1251	500 g
Yeast & Molds at low pH (Media Fill - aseptic filling)								
Linden Grain medium	x			sterility in aseptic filling lines	Granules	Merck	1005535000 1005539025	5 kg 25 kg
Linden Grain medium HALAL	x			sterility in aseptic filling lines	Powder	Merck	1027475000 1027479025	5 kg 25 kg
Yeast & Molds, <i>Bacillus</i>								
Malt Agar	x	x		syrops, sugars, hops	Powder	Sigma-Aldrich	M9802	500 g
Malt Extract Agar	x	x	x	syrops, sugars, hops	Powder	Sigma-Aldrich	70145	500 g
Malt Extract Agar	x	x	x	syrops, sugars, hops	Granules	Merck	1053980500	500 g
Malt Extract Agar	x	x	x	syrops, sugars, hops	90mm plate	Merck	1461510020	20 EA
Malt Extract Agar modified, Vegitone	x	x	x	syrops, sugars, hops	Powder	Sigma-Aldrich	38954	500 g
Malt Extract Agar with chloramphenicol	x	x		syrops, sugars, hops	90mm plate	Merck	1467290020	20 EA
Malt Extract Agar, modified	x	x		syrops, sugars, hops	Powder	Sigma-Aldrich	97218	500 g
Malt Extract Broth	x	x		syrops, sugars, hops	Granules	Merck	1053970500	500 g
Malt Extract Broth	x	x		syrops, sugars, hops	Powder	Sigma-Aldrich	70146	500 g
m-Green Yeast and Mold Broth	x			water analysis	Powder	Merck	MB000000Y	100 g
m-Green Agar, ReadyPlate™ 55	x			water analysis	55mm plate	Merck	1467690020	20 EA
m-Green Agar, ReadyPlate™ 55 KIT	x			water analysis	KIT	Merck	1467700150	KIT
m-Green Yeast and Mold Broth	x			water analysis	2 mL ampoules	Merck	MHA000P2M	50 EA

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Supplements for Quality Control of Beverage Products

Supplement	Inhibiting organisms	corresponding Media	Ordering from	Cat. No.	Packaging
Chloramphenicol Selective Supplement	inhibits bacteria	Rose Bengal Chloramphenicol Agar Base (Cat. No. 17211)	Sigma-Aldrich	29231	5 Vials
Cycloheximide Solution	inhibits yeasts & moulds	Raka-Ray Agar, Base (Cat. No. 02538)	Sigma-Aldrich	18079	10x10 mL
Glycerol for analysis EMSURE®	inhibits bacteria	Supplement for DG18 agar	Merck	1040921000	1 L
Lactic Acid Supplement, modified	inhibits non lactic acid bacteria	Rakay-Ray Agar, Base (Cat. No. 02538)	Sigma-Aldrich	14121	5 Vials
OGYE Selective supplement	inhibits bacteria	OGYE Agar, Base (Cat No. 1059780500)	Merck	109877.0010	10 vials
Oxytetra Selective Supplement	inhibits bacteria	OGYE Chromogen Agar Base (cat. No. 66481), OGY Agar (Cat. No. 75310)	Sigma-Aldrich	51239	5 Vials

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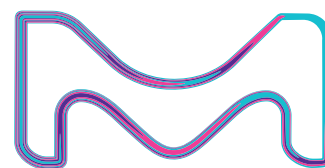
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