avantor™

Informative articles, technical advice and the latest product updates, as well as techniques and equipment for testing or analysis.

FOCUS: FOOD & BEVERAGE

2024-2025

Welcome to FOCUS: Food & Beverage magazine

Welcome to our FOCUS Food & Beverage, your premier magazine tailored for professionals in the food and beverage industry.

Within these pages, you'll discover a wealth of informative articles, technical insights, and the newest product releases.

Whether you're involved in food production or operate within a laboratory setting, our content covers techniques, equipment and analysis methods pertinent to your field.

We invite you to delve into this edition and trust it will serve as a valuable resource for your endeavors.

Your feedback is invaluable as we strive to enhance future editions to better meet your needs.

SERVICING THE FOOD & BEVERAGE MARKET

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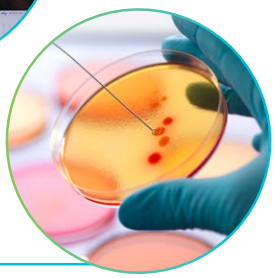

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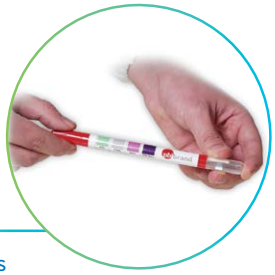

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- Hygiene monitoring systems
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DILUTION

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SEQUENCING-BASED MICROBIAL IDENFICATION

- Portable MinION™ sequencing devices
- Whole-genome and metagenome sequencing kits
- 16S rRNA sequencing kits
- RNA sequencing kits

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- Microbiological safety cabinets
- Ductless fume hoods

Navigating disinfection control in food and beverage manufacturing

Saskia Neubacher, Product Manager, Point of Use MilliporeSigma

AN OVERVIEW OF DISINFECTION CONTROL

Disinfection is the process of cleaning using compounds that either eliminate bacteria and other disease-causing organisms or reduce them to levels not harmful to health. Disinfection control is a key process in food manufacturing and comprises several steps: ensuring the correct concentrations of disinfecting reagents are used, checking that disinfection has been completed sufficiently, and testing that it has been accomplished without leaving any contaminating residues. Disinfection control makes use of the chemical reactions caused by disinfectants to determine their absence or presence, or more precisely their concentration.

It is important to note that, in contrast, hygiene monitoring is a related and sometimes overlapping process that is generally preventative. Hygiene monitoring also involves ensuring that cleaning procedures have been implemented adequately and that no contaminating residues remain, but additionally can involve allergen monitoring and prevention of microbial growth.

Both of these processes are critical in the food and beverage industry where preventing food-borne illnesses is a key objective in maintaining safe manufacturing. Here, we focus on disinfection control and how to navigate the numerous options in its methods and instrumentation.

CONSIDERATIONS IN CHOOSING DISINFECTANT

One of the primary concerns in selecting a disinfectant is to maintain the quality of the final manufactured product. As such, a disinfectant in the food and beverage industry must not be toxic or leave toxic residues. It should also be fast-acting in order to minimise disruption to the manufacturing process. Additionally, it should not leave any odour or taste residue that could affect the end product. In order to facilitate the removal of any residues, it is for instance helpful if a disinfectant has good solubility so that it may be rinsed away after disinfection is complete.

The compatibility of the disinfectant with the equipment and methods used in manufacturing is also important. For example, it should work well on the type/material of the surface being disinfected without damaging the equipment. It should also be compatible in terms of other physical factors such as temperature and pH, remaining effective under the conditions it is used in.

Finally, the method of disinfection control required for a given disinfectant can also affect which disinfectant is chosen.

DISINFECTION CONTROL WITH PHOTOMETRY

A number of photometric methods can be used to assess commonly used disinfectants such as peroxide, peracetic acid, chlorine, quaternary ammonium compounds, ozone and more. There are two options for instrumentation in these types of measurements: high-tech benchtop instruments like the Spectroquant® Prove spectrophotometer, or convenient mobile instruments like the Spectroquant® Move family of colorimeters.

Benchtop Spectrophotometers

For disinfection control conducted in a laboratory setting, benchtop spectrophotometers like the Spectroquant® Prove can be used. One key advantage of these instruments is that they have a broad measuring range. The Spectroquant® Prove 600, for example, can detect ultra low concentrations if that is required by a disinfection control method. They also use Live ID codes which automatically detect the test method, lot number, expiry date and calibration updates to streamline analysis and documentation.

Spectroquant® Move Colorimeter for disinfection control

Portable colorimeters for On-the-Spot Analysis

Often the convenience of portable instruments is important, especially when it would be most appropriate to conduct disinfection control in the field. Spectroquant® Move colorimeters are portable instruments that allow analysis directly at the sampling site.

These instruments are robust. They are waterproof according to IP68 standard and are therefore suitable for use in wet or dusty environments. They also give fast results and are easy to use. The Spectroquant® Move 100 is designed for use with over 100 pre-programmed parameters for versatility. The Spectroquant® Move DC, on the other hand, is designed specifically for disinfection control and can measure five essential parameters: chlorine, ozone, chlorine dioxide, cyanuric acid and pH.

TEST STRIP METHODS FOR DISINFECTION CONTROL

An alternative to wet chemistry is using disinfectant test strips. Both of the methods discussed here can be conducted on-site, and share this advantage with Spectroquant® Move Colorimeters. Additionally, test strip analysis circumvents the need for handling liquid chemicals or using glass vials in the field to enhance safety, which can be an important factor in choosing a disinfection control procedure.

RQflex® 20 reflectometer for disinfection control

Reflectometry with Test Strips

Disinfection control using Reflectoquant® test strips and the RQflex® 20 reflectometer for read-out can be an attractive option because it can be done in the field, is easy to conduct, produces little waste and yields quantitative results. An additional benefit is that tests are barcoded with batch-specific calibration information for accuracy and precision, and results are traceable. Test strips are available for 23 different parameters, and the portfolio includes compounds commonly investigated in the food and beverage industry.

MQuant® test strips also available for disinfection control

Test Strips as a Standalone Method

Visual tests using a colour chart for comparison with test strips are also an option for semi-quantitative disinfection control. The MQuant® line of test strips can be used for this type of analysis and has the benefit of being the most economical of the methods discussed here. Test strips offer the additional advantage of not requiring any instrumentation, and consequently no electricity, to carry out analyses. MQuant® test strips are robust, easy to use and safe.

A smartphone app, MQuant® StripScan, is available to perform colour comparison if desired in order to improve precision, as well as provide documentation of results and traceability.

A CLOSER LOOK AT COMMON DISINFECTANTS

Peracetic Acid

Peracetic acid is often used to disinfect drinking water bottles and surfaces in production. Its determination by titration is complex, with many steps requiring the use of glassware. It is also time-consuming, taking about 15 minutes for each measurement.

MQuant® test strips, in contrast, can give a semi-quantitative result within a minute, thereby cutting down the analysis time significantly. For a quantitative and documented result, Reflectoquant® test strips can be used to get a result in just a few simple steps and comparably a short period of time.

Hydrogen Peroxide

Another disinfectant frequently used in food and beverage manufacturing is peroxide. Tests for its levels are available in the Spectroquant® line as well as in test strips both for use with the RQflex® 20 reflectometer and for the standalone MQuant® method. Several different concentration ranges are available for all of the methods.

Ozone

Ozone is a powerful antioxidant and is also used as a disinfectant. Spectroquant® test kits can be used for a quantitative determination of ozone. Alternatively, MQuant® rapid liquid test kits with colour cards or colour disk comparators can also be used to determine ozone concentrations.

Chlorine

Chlorine is used in the food and beverage industry for its ability to quickly eliminate bacteria and other microbes in water. It is used in potable water disinfection and washing vegetables, among other things. Spectroquant® kits can be used for quantitative chlorine testing, whereas MQuant® test strips and rapid liquid tests are for semi-quantitative and fast results.

RELATED PRODUCTS

Instruments

Description	Cat. No.
Prove 100 Spectroquant®	1.73016.0001
Prove 300 suitable for UV/Vis spectroscopy, Spectroquant®	1.73017.0001
Prove 600 suitable for UV/Vis spectroscopy, Spectroquant®	1.73018.0001
Colorimeter Move 100	1.73632.0001
Move DC	1.73635.0001
Reflectometer RQflex® 20 , Reflectoquant®	1.17246.0001

Spectroquant® tests, photometric kits to use with instruments

Description	Cat. No.
Chlorine test (Free), 0.010-6.00 mg/L (Cl_2)	1.00598.0001
Chlorine test (Total), 0.010-6.00 mg/L (Cl_2)	1.00602.0001
Hydrogen Peroxide test, 0.015-6.00 mg/L (H_2O_2)	1.18789.0001
Hydrogen Peroxide Cell Test, 2.0-20.0 mg/L (H_2O_2)	1.14731.0001
Ozone test, 0,010 - 4,00 mg/L O_3	1.00607.0001

Reflectoquant® test strips, to be used with RQflex®20

Description	Cat. No.
Peracetic acid test, 1.0-22.5 mg/L (peracetic acid)	1.16975.0001
Peracetic acid test, 20.0-100 mg/L (peracetic acid)	1.17956.0001
Peracetic acid test, 75-400 mg/L (peracetic acid)	1.16976.0001
Chlorine test, 0.5-10.0 mg/L (Cl_2)	1.16896.0001
Peroxide test, 0.2-20.0 mg/L (H_2O_2)	1.16974.0001
Peroxide Test, 20.0-100 mg/L (H_2O_2)	1.17968.0001

Mquant® test strips for visual control

Description	Cat. No.
Chlorine test, 0-20 mg/L (Cl_2)	1.17925.0001
Peracetic acid test, 5-50 mg/L (peracetic acid)*	1.10084.0001
Peracetic acid test, 20-160 mg/L (peracetic acid)	1.17976.0001
Peracetic acid test, 100-500 mg/L (peracetic acid)	1.10001.0001
Peracetic acid test, 500-2000 mg/L (peracetic acid)	1.17922.0001
Peroxide test, 0.5-25 mg/L (H_2O_2)*	1.10011.0001
Peroxide test, 0.5-100 mg/L (H_2O_2)	1.10081.0001
Peroxide test, 100-1000 mg/L (H_2O_2)	1.10337.0001

*can be used with MQuant® StripScan App

Environmentally preferable production supplies from Avantor®

Make every day Earth Day

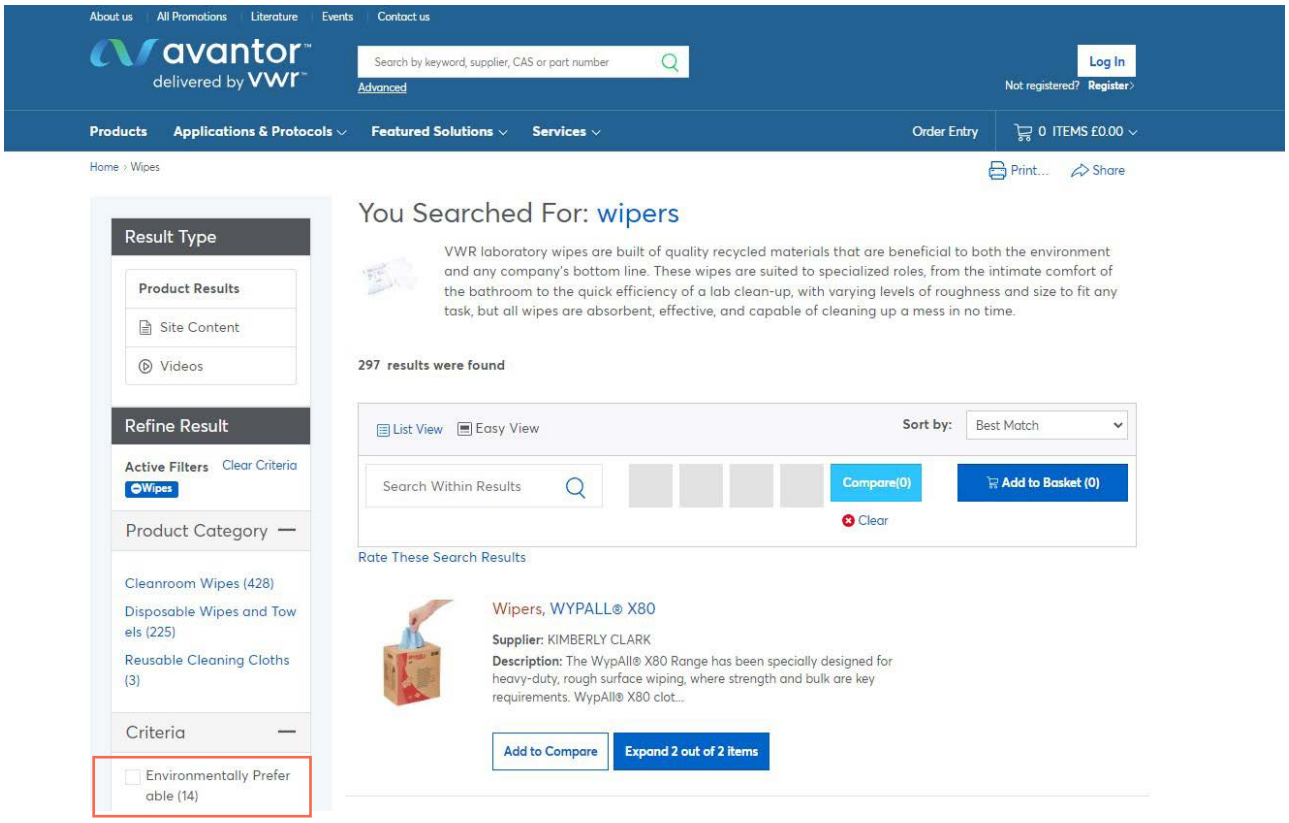
Protecting the health, safety and welfare of your people and the integrity of your processes is always the priority, but looking after the future of our planet is also essential. At Avantor® we would like to help you make more sustainable product choices, so we have curated a selection of more environmentally friendly safety and cleanroom supplies and services. We are actively working with our manufacturing locations and key suppliers to add more products and services to this list.

Together we can go green!
VISIT OUR WEBSITE

OUR ENVIRONMENTALLY PREFERABLE PRODUCT (EPP) METHODOLOGY

When we identify more environmentally preferable solutions, they are given an (EPP) green leaf designation on our website, so they can be easily identified.

When searching for an article, you can filter to show those that are EPP.



Products must incorporate one or more of the attributes below to qualify for the EPP green leaf.

- Energy efficient
- Water efficient
- Waste reducing (uses less material, recyclable, reusable, compostable or refillable)
- Sustainable materials (>30% post-consumer, renewable or bio-based material)
- Low manufacturing impact (made with >50% renewable energy or 20% less water than standard)
- Safer human and environmental health (refrigerants, chemicals, solvents, low VOC, etc.)
- Sustainable packaging (100% recyclable, or made from >30% recycled or renewable content, no single-use plastics, no packaging)
- Product transparency and disclosure (has verified life cycle assessment (LCA), environmental product declaration (EPD), health product declaration (HPD), ACT label or other third party verified environmental impact assessment)

Verification by a government agency or recognised third party certification is also accepted. For example:

ACT Label
Biodegradable Products Institute (BPI)
BioPreferred
Blue Angel
California Air Resource Board (CARB)
CDPH Standard Method v1.1 2010
Cradle to Cradle Certified
Declare
EcoLogo
ENERGY STAR
EPEAT
EU Ecolabel
Forest Stewardship Council (FSC)
German AgBB
Global Recycled Standard
GreenCircle Certified
GREENGUARD
GreenScreen For Safer Chemicals
Green Seal
LEVEL by BIFMA
Nordic Ecolabel
NSF International Programme For The Endorsement Of Forest Certification
RoHS Compliant
Safer Choice
SCS Global Services
South Coast Air Quality Management District (SCAQMD)
Sustainable Forestry Initiative (SFI)
TCO Certified
WaterSense

Visit our 'Sustainable Solutions' web page to see the environmentally preferable solutions available now.
www.vwr.com/sustainable-production-supplies






Ensuring purity from production to plate: Bürkle's innovative disposable samplers

From liquids to solids, dry to highly viscous substances) (particularly in the food industry), the spectrum of raw materials couldn't be more diverse. Whether assessing the consistency of dairy products, the texture of grains, or the viscosity of sauces, the distinct properties of foods demand specific tools and techniques to obtain a representative and accurate sample for analysis and quality control.

Moreover, the purity of the product is an extremely critical issue in industries as sensitive as the food industry. Any form of contamination throughout the production process – from the quality control of the raw material to the final packaging – must be excluded completely to ensure a high-quality product and comply with strict and constantly increasing requirements such as EU food and FDA guidelines.

To meet these criteria, the use of reusable stainless-steel tools, including samplers, has become prevalent. However, cleaning these samplers poses a significant disadvantage and risk factor. Even with non-viscous raw materials that do not strongly adhere, making cleaning challenging or even impossible, a simple wipe after use unfortunately does not suffice to prevent cross-contamination. Validating the critical cleaning processes of reusable tools is a challenging task that often leads to issues.

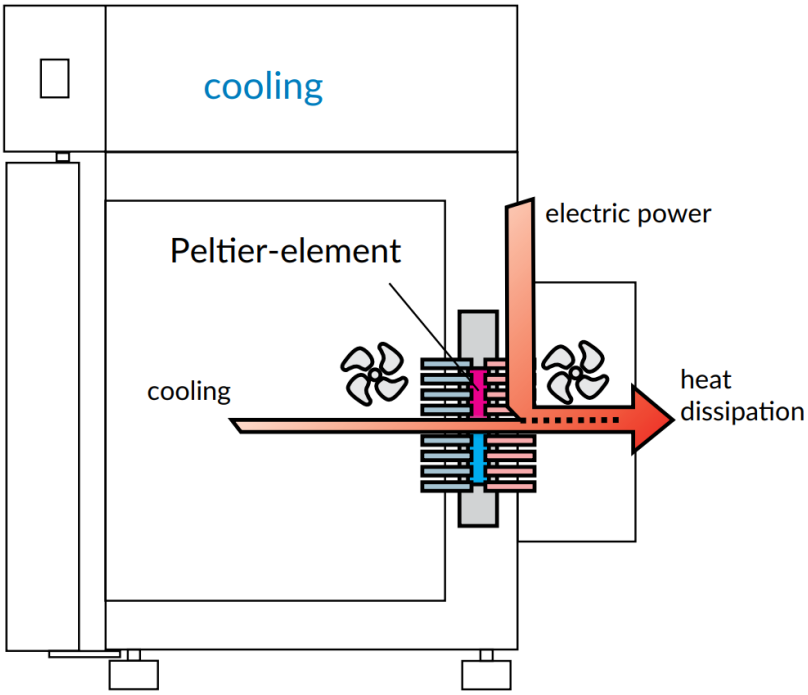
Single-use Samplers:
+ highest standards regarding purity & sterility
+ complying with EU food requirements & FDA regulations

To avoid these problems, the use of single-use items is an optimal solution. Bürkle's disposable samplers and tools are produced in class 7 cleanrooms, individually packaged, op-tionally sterilised (SAL 10^{-6}), and compliant with EU food and FDA guidelines. The use of these single-use products ensures complete exclusion of cross-contamination.

With the "DispoSamplers", Bürkle offers a wide range of disposable samplers covering various raw materials from liquids to powders, providing an ultra-pure alternative to conventional reusable stainless-steel samplers, addressing the different needs of the food and beverage industry.

Take Samples – but do it right! Make your daily work comfortable, reliable, and avoid contaminations with Bürkle disposable items.

Peltier technology explained



Peltier technology, also known as thermoelectric technology, is commonly used in laboratory heating and cooling applications. The technology is based on the Peltier effect, which was discovered by Jean Charles Athanase Peltier in 1834. The Peltier effect describes the phenomenon where a temperature difference is created at the junction of two different conductive materials when an electric current is passed through them.

In Peltier devices, typically called thermoelectric modules or coolers, there are two types of semiconductor materials connected in series. These materials are usually made of bismuth telluride or other similar materials with good thermoelectric properties. When a direct current (DC) electric current is applied to the module, one side of the module absorbs heat, while the other side releases heat. This results in one side becoming cooler and the other side becoming hotter.

In laboratory applications, Peltier devices are commonly used for both heating and cooling purposes:

COOLING

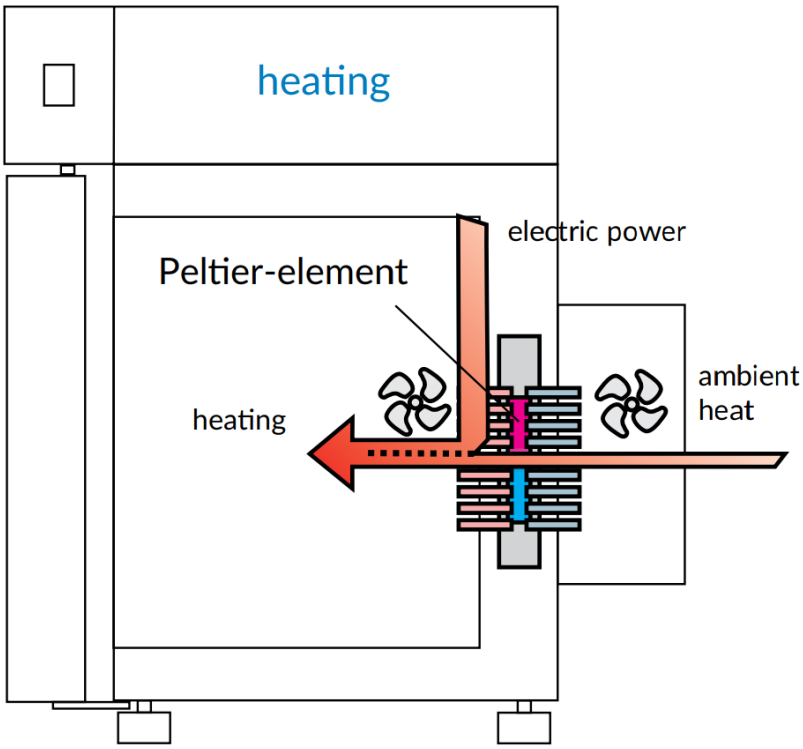
The side of the Peltier module facing the sample or the area to be cooled is known as the cold side. This side absorbs heat from the surroundings, providing a cooling effect.

Peltier coolers are often used in applications where precise temperature control is required, such as maintaining a stable temperature for biological samples, chemical reactions, or electronic components.

HEATING

The opposite side of the module, facing away from the sample or the area to be heated, is known as the hot side. This side releases the absorbed heat.

By reversing the direction of the electric current, the Peltier module can be used for heating applications. This is useful for maintaining a specific elevated temperature, such as in the case of incubators or temperature-controlled reactions.



ADVANTAGES OF PELTIER TECHNOLOGY IN LABORATORY HEATING AND COOLING INCLUDE:

Precision: Peltier devices offer precise temperature control, making them suitable for applications that require tight temperature regulation.

Compact size: Peltier devices are often compact and lightweight, allowing for integration into small laboratory equipment.

Low maintenance, long lifespans: Peltier devices are solid-state and have no moving parts, which means they have lower maintenance requirements and longer lifespans compared to systems with mechanical components.

No refrigerants: Unlike traditional cooling systems that use refrigerants, Peltier devices are solid-state and do not involve any fluids. This eliminates the need for refrigerant maintenance and reduces the risk of leaks.

Lower energy consumption: Peltier devices with heating and cooling function have a much lower energy consumption than comparable compressor cooled systems as also no separate heating elements are required.

Lower noise level: Peltier devices have a much lower noise level than comparable compressor cooled systems and operate almost vibration free.

The choice between Peltier devices and compressor cooled systems depends on the specific requirements, constraints and operating conditions of the intended application.

VWR® Cooled incubators with Peltier technology, INCU-Line® ILPR PREMIUM

PELTIER ADVANTAGES:

- Excellent temperature stability and uniformity
- Energy efficient and environmentally friendly
- Low noise level
- Almost vibration-free as no compressor is installed
- No dehumidification of samples due to the closed chamber

ADVANTAGES OF THE INCU-LINE ILPR PREMIUM SERIES

- Equipped with a multi-functional microprocessor controller with 7"full colour touchscreen, which gives overview of set and current parameters while running
- Access control via password login and administrator function to manage 5 user accounts
- 40 user-program memory, quick and easy change of parameters during a running program
- Adjustable over- and under-temperature safety thermostat Class 3.3 (DIN 12880) protects samples and the incubator
- Supplied with Premium Control Software (can be downloaded from internal memory onto USB stick) and manufacturer test certificate at 37 °C

Intuitive menu and user-friendly software. The units can be connected to Ethernet network for remote control from any computer, being one of the greatest advantages.

Available in 3 different chamber volumes: 56, 112 or 245 L
Temperature range: 0 °C … +70 °C (max. 20 °C below ambient temperature)

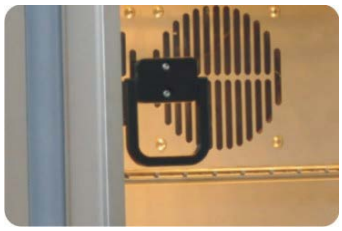
USB port for data download to USB stick and for uploading programs.

Quick change mode for set temperature during a running program.

Quick change mode for time during a running program.

Access port Φ 30 mm with a silicon cap

Internal LED light



Internal glass door

Handle with door lock

Please find all detailed information on our product page.

CLICK HERE

VWR® CPR Premium series climate chambers

Excellent performance - boosted with Peltier elements cooling system

CPR Premium series climatic chambers feature a stainless steel (DIN 1.4301) inner chamber, stainless steel housing, solid outer door and internal glass door. They are designed for long-term stability testing of drugs and medicinal products (in terms of temperature and humidity conditions), in accordance with ICH (Q1A) standard guidelines. These chambers can also be used for testing the stability of cosmetics, food, as well as for various types of durability tests.

Available in 2 different chamber volumes: 245 or 749 L

Working Temperature range (with humidity): +5 °C to +70 °C (max. 20 °C below ambient temperature)

Humidity range: 10 to 90%

Advantages of CPR Premium series with Peltier technology

AS SMART AS YOUR SMARTPHONE

Highly advanced Premium controller manages the unit. It also has a large 7" touchscreen plus easy and intuitive operation.

PERFECT PERFORMANCE

The cooling system, based on the Peltier element, features excellent temperature variation and fluctuation. It also improves the temperature recovery time (eg., after door opening). The humidity inside the chamber is extremely stable.

ENVIRONMENTALLY FRIENDLY

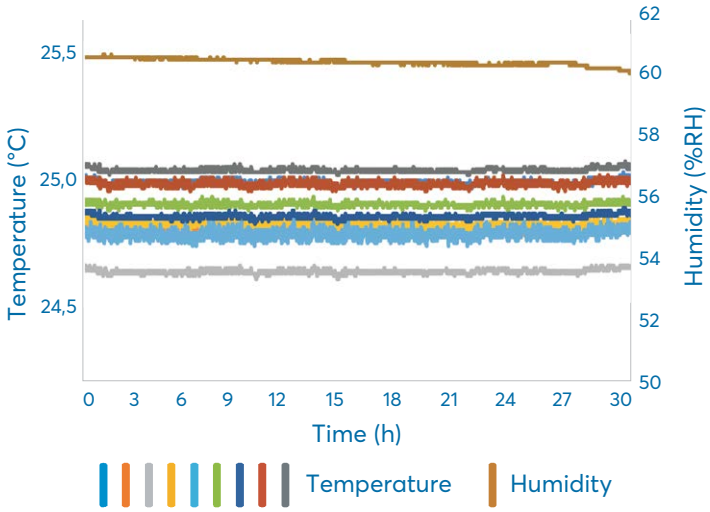
Elimination of compressor and refrigerants ensure environmental protection.

Compressor-cooled chamber

Peltier-cooled chamber

LOW WATER CONSUMPTION

The external 6 L water tank is mounted on the side wall for easy access.
Water consumption for CPR 240 is so low that you only need to refill the water tank only every second month. Thanks to the installation of a heater in the wastewater pan, the chamber is maintenance-free and can be used in any location.



NO VIBRATION & MORE QUIET OPERATION

Compared to compressor-cooled climate chambers, the CPR Premium does not vibrate, and the noise level is significantly lower.

LIGHTER & SMALLER

The cooling system based on Peltier modules allows reduction in the dimensions of the unit and its weight (compared to compressor-cooled chambers).

ENERGY SAVING

When operating the unit at temperatures close to ambient, energy costs are reduced on average by 40% compared to compressor-cooled chambers.

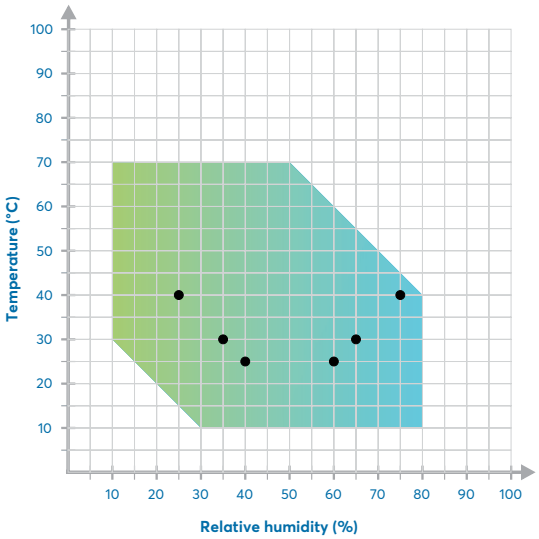
State-of-the-art
7" full colour touchscreen controller

The CPR Premium constant climate chamber is equipped with an innovative controller and a large (7") colour touchscreen. It displays all important information about the program settings, current parameters, alarms, and program status in a very clear, easy to understand way. The controller uses icons for easy navigation. All information is legible, and programming the unit is extremely intuitive.

Diagram of temperature-humidity range
Climate testing points according to ICH Q1 A (R2) guidelines

VWR® CPR Premium constant climate chambers are designed for long-term stability testing of drugs and medicinal products (in terms of temperature and humidity conditions), in accordance with ICH (Q1A) standard guidelines. These chambers can also be used for testing the stability of cosmetics, food, as well as for various types of durability tests.

Stability study	Storage conditions	Minimum time period	Testing frequency
Long-term (choice of storage conditions)	25 ±2 °C / 60 ±5% RH or 30 ±2 °C / 65 ±5% RH	12 months	Each 3rd month 1st year, each 6th month 2nd year, annually thereafter
Intermediate (if long-term conditions are 25 ±2 °C / 60 ±5% RH)	30 ±2 °C / 65 ± ±5% RH	6 months	Minimum 3 time points
Accelerated	40 ±2 °C / 75 ±5% RH	6 months	Minimum 3 time points
Long-term (only semi-permeable containers)	25 ±2 °C / 40 ±5% RH or 30 ±2 °C / 35 ±5% RH	12 months	Each 3rd month 1st year, each 6th month 2nd year, annually thereafter
Accelerated (only semi-permeable containers)	40 ± 2°C / not more than ±25% RH	12 months	Minimum 3 time points



Remotely controlled constant climate chamber with Premium Control sofware

VWR® CPR Premium constant climate chambers can be connected to the Ethernet network and controlled remotely using the Premium Control software supplied. This software has been designed to meet customers' needs to facilitate the operation and control of the VWR® Premium models. Premium Control software can be downloaded from the unit's internal memory to a USB stick.

For more detailed information download the brochure

Introducing SICS technology: Enhancing precision and efficiency in your laboratory

INTRODUCTION

Recognising the crucial significance of precision and efficiency in laboratory environments, we are excited to announce that our touchscreen precision balances now feature the cutting-edge SICS (Standard Instrument Command Set) technology.

SICS, a standardised command set, has been crafted to optimise communication and control functions within precision balances. Offering a universal language, it facilitates smooth integration with laboratory systems, software (such as LIMS - Laboratory Information Management Systems), and instrument networks spanning multiple laboratories.

Through precision balances equipped with SICS, you achieve unmatched authority and adaptability in your weighing protocols. From basic taring tasks to calibration procedures, SICS commands empower you to enhance your workflow effortlessly and accurately.

BENEFITS OF SICS-ENABLED PRECISION BALANCES

Enhanced productivity
Enhance the efficiency of your operations and reduce downtime through the effective control and automation features provided by SICS commands.

Accuracy
Achieve unparalleled accuracy and consistency in your measurements, thanks to precise calibration and data acquisition facilitated by SICS technology.

Seamless integration
Effortlessly incorporate your precision balance into laboratory systems and software, including LIMS and networks of instruments spanning multiple laboratories. Improve interoperability and simplify data management across your entire organisation.

Simplified operation
Simplify intricate weighing tasks and procedures using intuitive SICS commands, allowing for centralised control and remote monitoring.

In brief, the SICS command set empowers you with remote control over your precision balance, transforming how you oversee and enhance your laboratory workflow and industrial process automations.

Grinding of boneless chicken leg

PRODUCT
MultiDrive control (Cat. No. 412-0325)
MI 400 grinding chamber (Cat. No. 431-0304)
MI 400.2 cutting blade (Cat. No. 431-0318)

INDUSTRY
Food

OVERVIEW
The requirement was to grind boneless chicken legs into a paste for food formulation.

Pate is a cooked meat paste commonly consumed in Europe as a savoury appetizer. It is normally eaten together with bread and it can be made from poultry, liver or other types of ingredients. Other condiments and vegetables can be added to the recipes for more flavour.

SAMPLE MATERIAL
Boneless chicken leg

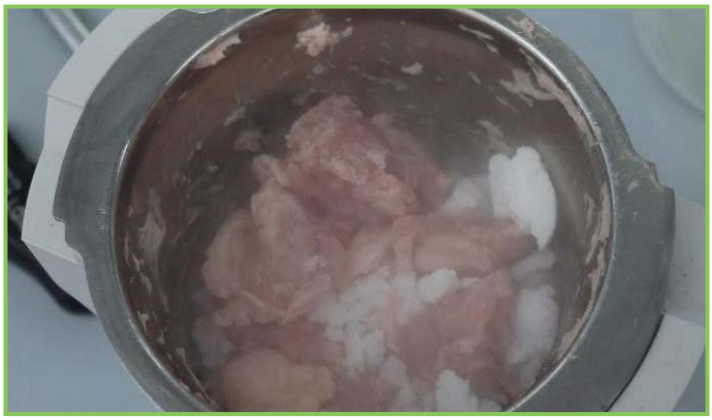
EXPERIMENTAL SETUP / SETTINGS

Stability study	Storage conditions
Mill	MultiDrive control
Grinding chamber	MI 400
Cutting blade	MI 400.2
Speed	From 3,000 to 20,000 rpm
Grinding time	1 minute
Sample quantity	350 g

RESULTS

1. Pre-cutting of the boneless chicken leg into 3x3 cm pieces is recommended before grinding to reduce the required grinding time.

Before grinding



During grinding

2. The sample is recommended to be mixed and ground with dry ice (1:1) in the grinding chamber to prevent any temperature increase during the high speed grinding process and to achieve a fine, smooth and homogenous paste.

During grinding

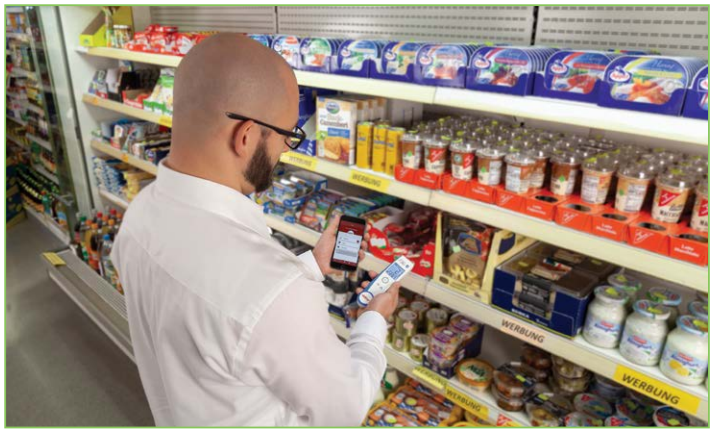
After grinding

Regardless of whether samples are hard, soft or fibrous – the IKA MultiDrive crusher can perform a wide range of crushing tasks involving coarse and fine crushing, thanks to the variety of vessels available. MultiDrive control mixes, grinds and is also fitted with a dispersion vessel and a disposable tube. There is a USB interface available for easy actuation and documentation respectively. Excellent crushing performance is guaranteed by a combination of variable rotational speeds, ranging from 3000 rpm to 20 000 rpm, and a 1000 Watt output. It also offers temperature measurement and includes a weighing function as well as integrated cooling in the milling cup.

Paperless temperature control with Bluetooth

Thermometers with wireless interface

Roland Trübswetter, Product Manager for Measurement Technology Food, ebro Electronic, Xylem Analytics Germany Sales GmbH & Co. KG



Everyone who produces, transports or stores food faces a challenge: Everything must be done to ensure that the food is still edible when it ends up on the plate. At the same time, work must be done efficiently and cost-effectively because the price competition is so fierce. Measuring technology, such as thermometers, also finds itself in precisely this field of tension. These are essential to control compliance with the cold chain. With the current state of the art, you had the choice between simple hand-held thermometers, temperature recording devices (so-called data loggers) and automatic temperature monitoring systems.

CONVENTIONAL TEMPERATURE MEASUREMENT

The hand-held thermometers are the most cost-effective variants, but require a lot of effort on the part of the measuring staff: The measurement data must be recorded manually because the devices do not save anything and do not have an interface to the PC. This means that the examiner would actually need three hands: for a clipboard, pen and thermometer. This measurement takes a relatively long time and the data is difficult to evaluate afterwards. Temperature monitoring systems have the advantage that everything from recording and saving measurement data, to evaluation, to alerting and reporting can be automated.

This is particularly true if they contain wireless data loggers. But they are significantly more expensive. Conventional data loggers in combination with PC software are somewhere in between, both in terms of price and level of automation and effort. Each technology has its advantages and disadvantages, although for cost reasons hand-held thermometers are usually used, at least when monitoring storage rooms, cold rooms, refrigerated cabinets, etc.

NEW TECHNOLOGIES

This situation has not changed for a long time. However, there is currently a change in thinking: More and more companies are realising that they can use current wireless technologies such as Bluetooth and special software not only to reduce the effort, but also to achieve a much higher degree of control over temperature events. Thermometers with a Bluetooth interface are able to send the data to an app on a mobile device. From there they can be forwarded via WiFi, for example a cloud software.

The app can also be designed to guide the measuring staff step by step through the measuring process. Alternatively, the thermometer can send the measurement data to a PC software via a Bluetooth receiving device. Either way, the data is permanently stored in a database and this enables any evaluation at any time – which was almost impossible with hand-held thermometers. At the same time, handling during measurements is significantly improved because you no longer need a clipboard and a pen. This also saves paper – the environment and your wallet will thank you. If a rechargeable battery is used instead of normal batteries, the sustainability of the measuring system is significantly increased.

DIVERSE PROPERTIES

The measurement is even easier if the thermometer can also temporarily store the measured values, as it is the case with the new thermometer TLC 750 BT from the ebro® brand. A tour of several measuring points can then be completed quickly, and the measured values are then transferred to the software at once.

In the past, dual thermometers have proven to be the best, as they are suitable for both incoming goods inspections and warehouse monitoring, and are now very sophisticated in terms of handling and equipment. The TLC 750 BT is the further development of such a thermometer and is therefore one of the top products on the market.

Interface IF 50

SIMPLE SOFTWARE EDC

For customers who focus on the efficient collection and storage of measurement data, ebro® has developed a new software: EDC, short for Easy Data Collector. This software makes it possible to easily read out the measured values from the TLC 750 BT, saving them in the database in the same step. The data can then optionally be evaluated and put into report form. The operation is self-explanatory, as the user interface is clearly structured and does not require a lot of additional bells and whistles. It may seem contradictory, but the goal during development was very clear: to allow the user to spend as little time as possible with the system, so that they can concentrate fully on their actual tasks.

PRACTICAL INTERFACE IF 50

The EDC software is sold as a set together with the IF 50 interface. This interface is a combination device with various functions that are intended to further simplify the operation of the system. It serves as a battery charging station for the TLC 750 BT, practical storage location, but also as an interface for accessing the TLC 750 BT remotely. In many cases the thermometer will be used in places where there is no PC nearby. Without an interface, the thermometer would then have to be carried across several rooms or buildings to the PC on which the software was installed. Since the IF 50 interface has an Ethernet interface, it can communicate with the PC via the LAN while receiving the thermometer data via the Bluetooth interface. This means that you can place the interface where you are measuring, and the software can be on a computer that is in a different location and still communicate with the thermometer or thermometers. Although it sounds complicated, it is not in practice. Once set up, you no longer work with the interface directly, but only with the measuring device and later the software.

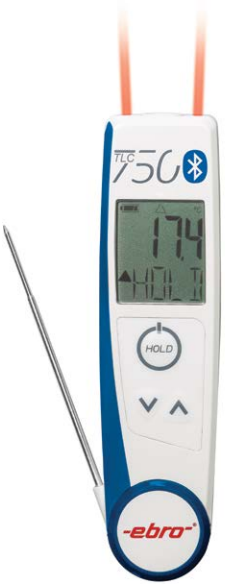
TLC 750 BT DUAL INFRARED / FOLD-BACK-THERMOMETER WITH BLUETOOTH

Contamination free surface measurement and core temperature measurement in one device

- Compact pocket size for everyday use
- Temperature measurement range from -50 °C to +250 °C
- HACCP and DIN EN 13485 compliant including calibration certificate
- Display with backlight for reading in dark environments
- Waterproof case (IP 65)
- °C / °F switchable
- Exchangeable battery

APPLICATIONS:

- Incoming goods inspection, transport and storage
- Cold chain monitoring
- Ideal for retail, catering and the food industry
- Contactless and contamination-free surface measurement with infrared
- Core temperature measurement with fold-out penetration probe



Detection of gluten in industrial bakery

Study carried out by a French industrial bakery

CONTEXT

The number of gluten-free consumers has increased greatly in recent years and more and more food industries are trying to develop a range of gluten-free products in order to fulfill the need.

This study is aimed at evaluating the level of gluten contamination in a 2000 m^3 production workshop in an industrial bakery. The objective was to create a specific area in the production workshop dedicated to the production of gluten-free products.

The Coriolis® Micro has been used to perform air sampling at various points in the bakery during production and also when the machines were stopped. The samples have been then analysed by ELISA.

MATERIALS & PROTOCOLS

Materials

- Air sampler: Coriolis® Micro, sterile cones
- Collection liquid: 15 ml of distilled water

Protocols

- First sampling area (A1)

This area has been emptied out of all products containing gluten before the sampling, but gluten residues still remain in the air. Sampling at 300 L/min for 10 and 20 min when the machines were stopped and during production time

- Second sampling area (A2)

Raw materials containing gluten are continuously used in this area. Sampling at 300 L/min for 10 and 20 min and at 200 L/min for 5 min during production time

Liquid air samples analysed by R5-Mendez ELISA (external laboratory)

RESULTS

Results of the air sampling performed in the first area

Sampling parameters	Gluten (mg of gluten/ kg of liquid collection)	Gluten (mg of gluten/ m^3 of air)	Results
Control (distilled water)	<5 ppm	-	OK
A1-300 L/min-20 min Machines stopped	<5 ppm	< 0,075 mg of gluten/6000 L of air < 12,5 µg of gluten/m^3 of air	
A1-300 L/min-10 min Machines stopped	<5 ppm	< 0,075 mg of gluten/3000 L of air < 25 µg of gluten/m^3 of air	Low gluten contamination
A1-300 L/min-20 min Production time	<5 ppm	< 0,075 mg of gluten/6000 L of air < 12,5 µg of gluten/m^3 of air	Low gluten contamination
A1-300 L/min-10 min Production time	8 ppm	0,12 mg of gluten/3000 L of air 40 µg of gluten/ m^3 of air	Increase of the level of gluten during the production

The level of gluten detected with Coriolis® Micro in this area is at the detection limit of the analysis method. An increase of the gluten concentration is observed when the sampling is performed during the production. This moderate increase has to be confirmed by further trials.

Results of the air sampling performed in the second area

Sampling parameters	Gluten (mg of gluten/ kg of liquid collection)	Gluten (mg of gluten/ m^3 of air)	Results
A2-300 L/min-20 min Production time	35 ppm	0,525 mg of gluten/6000 L of air 87,5 µg of gluten/m^3 of air	Detection of gluten at a high concentration -> the production of gluten-free products close to this area is not possible
A2-300 L/min-10 min Production time	54 ppm	0,81 mg of gluten/3000 L of air 270 µg of gluten/ m^3 of air	
	44 ppm	0,66 mg of gluten/ 3000 L of air 220 µg of gluten/m^3 of air	
A2-200 L/min-5 min Production time	18 ppm	270 µg of gluten/m^3 of air	

During the production, the level of gluten detected in the area is high. The installation of a gluten-free production line close to this area is not possible because of the high risk of cross-contamination.

Description	Model	Pk	Cat. No.
Air sampler	Coriolis® µ	1	**710-1973**
Cones and caps, single-use, autoclavable		10	**710-1999**

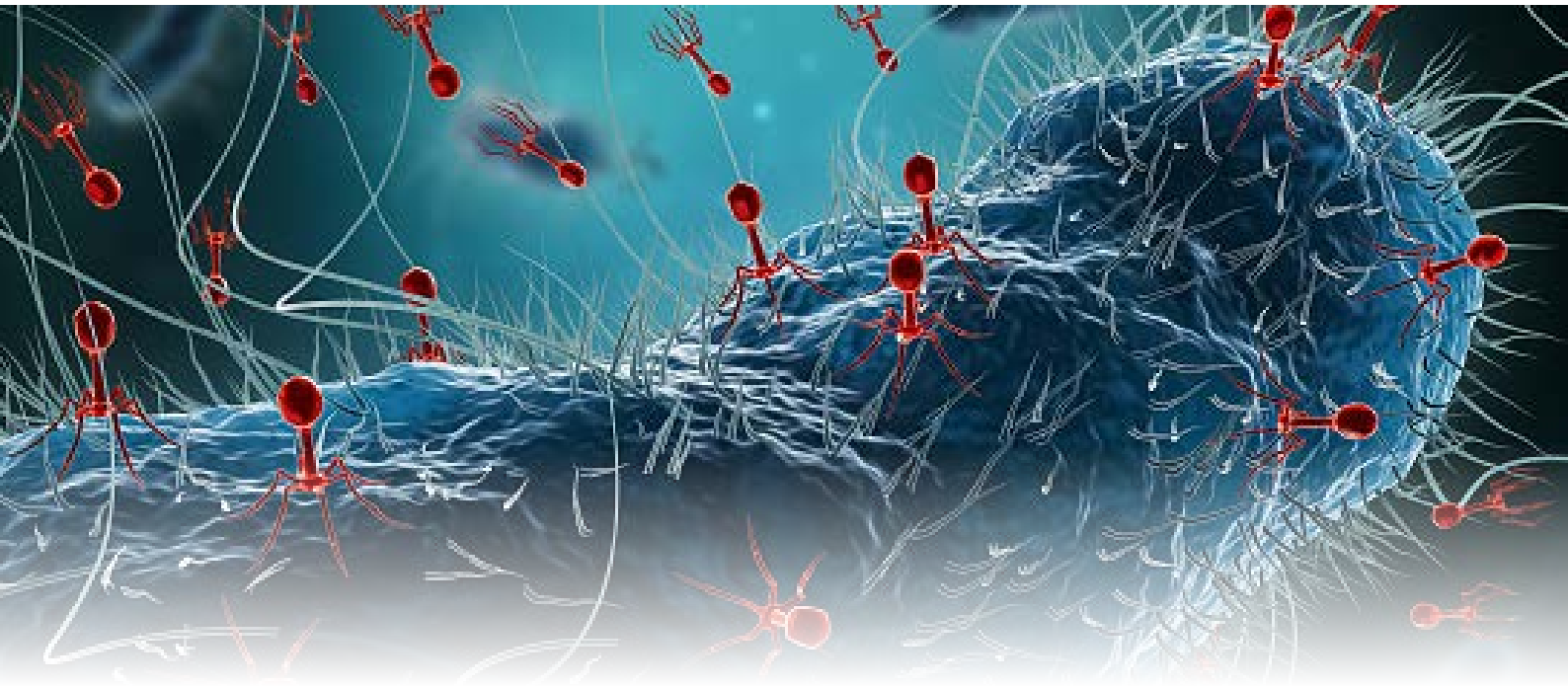
Not available through Avantor in UK

CONCLUSION

Thanks to its high flow rate, Coriolis® Micro is a valuable tool for the collection of gluten even in a low-contaminated environment. Coriolis® Micro can be used by food industries for quality control, in particular, to check the level of gluten in the atmosphere of gluten-free production areas.

VWR® Modified Scholten's media

ISO 10705-2: Counting and isolating coliphages in potable, environmental and wastewater samples.



Isolation and enumeration of somatic coliphages in water using the double-layer technique, by incubating the sample with a suitable bacterial strain.

- Concentrated, diluted or direct sample is mixed with a small volume of semisolid agar and a culture of the host bacterial strain. This mixture is poured into a nutrient agar plate
- After adequate incubation, all lysis plaques present in the gelled medium are counted
- Results are expressed as PFU plaque-forming units (particles) per unit volume (PFU/100 ml)
- Somatic coliphages and host bacterium are not pathogenic to humans or animals. Handle according to normal microbiology laboratory safety procedures

Follow specific incubation and culture conditions described on ISO 10705 to obtain accurate and reproducible results. Avoid cross-contamination and external contamination during the entire process of coliphage isolation and enumeration.

ORDERING TABLE

Description	Cat. No.
Modified Scholten's Broth (MSB)	376234ZA / 456230ZA / 92429.0500
Modified Scholten's Semisolid Agar (ssMSA)	306233ZA / 92430.0500
Modified Scholten's Agar (MSA)	106100ZAL / 406103ZA / 92428.0500

PROCEDURE:

1 CULTURE PREPARATION (*E.Coli*)

0,5 ml

***E.Coli* WG5**
Frozen 10^8 CFU/ml

50 ± 5 ml **MSB**
BEFORE INOCULATING
Warm to room temperature or
preheat **36 ± 2 °C** for 30 min - 1 h

Incubate **36 ± 2 °C** for 3 ± 1 h
in **SHAKER** (140 rpm)

1 ml

1 ml

2 MEDIA PREPARATION

Melt **ssMSA** with
Nalidixic acid (N1)
and $CaCl_2$ (N2)

Distribute 2,5 ml
in 10 ml tubes

Keep at **45 ± 1 °C**

Mix carefully avoiding
formation of air bubbles

2,5 ml of molten medium at **45 °C**
MINIMUM 2 DUPLICATES (N3)

Mix carefully avoiding
formation of air bubbles

3 SAMPLE PREPARATION

SAMPLE
Original, concentrated
or diluted

BEFORE DISPENSING
Preheat to room
temperature

Pour content on
MSA plates surface

MSA plate previously
tempered (15-30 °C)

4 COLIPHAGE TEST

Incubate
36 ± 2 h
18 ± 2 h

5 PLATE FORMING UNITS COUNT

Coliphage count with
oblique illumination

NOTES:

(N1): Nalidixic acid is recommended when there is a suspicion of high accompanying microbes.

(N2): $CaCl_2$ favors phage-bacteria interaction. Use in samples where low phage counts are expected.

(N3): Minimum 2 replicates. For samples suspected of low phage count, it is recommended to increase replicates or to concentrate it.

MSB: Modified Scholten's Broth.

ssMSA: Modified Scholten's Semisolid Agar.

MSA: Modified Scholten's Agar.

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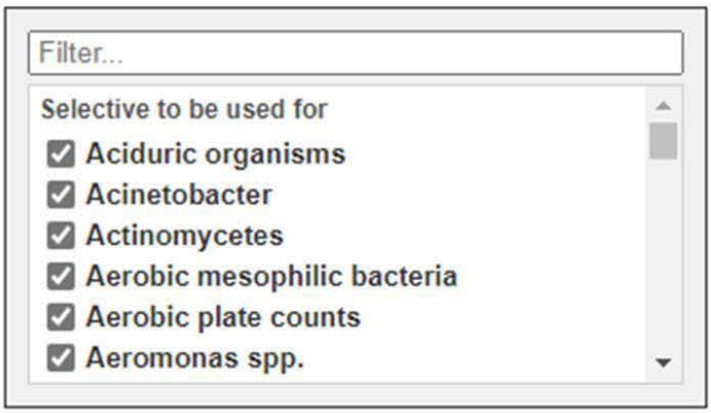
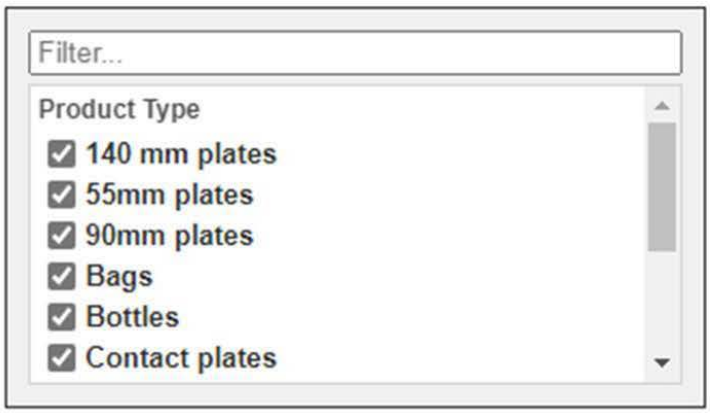
TEST OUR MICROBIOLOGY SELECTOR

- Not sure which growth or culture medium you need for your analysis? Try searching by microorganism and browse through our range
- Discover test protocols in the technical sheets to optimise your testing conditions
- Do you already know which medium you are looking for? Then don't hesitate to use our product search box instead





Please visit our leading page for more information:
www.vwr.com/microbiology

Regulatory news 2023

New EN ISO 15213 series for the enumeration and detection of *Clostridium spp.* in the food chain

The International Organisation for Standardisation (ISO) is publishing the three-part EN ISO 15213 series, which specifies the enumeration and detection of sulfite-reducing *Clostridium spp.*, including *C. perfringens*, in a broad range of foods, pet food and animal feed, in samples from the primary production stage and in environmental samples in food and feed production and handling.

NEW EN ISO 15213-1:2023 AT A GLANCE ...

- Describes the horizontal method for the enumeration of Clostridium spp. by colony-count technique
- Scope of the method has been changed from "sulphite-reducing bacteria" to "sulphite-reducing Clostridium spp." and includes samples from the primary production
- Typical colonies on Iron sulfite agar (ISA) are confirmed by anaerobic growth and no growth under aerobic conditions
- Concentration of sulfite in the Iron sulfite agar (ISA) has been reduced from 1.0 to 0.5 g/L
- Ten-minute heat treatment at 80 °C for selection of spores has been made optional
- Option to use tubes for inoculation and option to incubate the samples at 50 °C for enumeration of thermophilic sulphite-reducing bacteria have been removed
- A special protocol for the enumeration of sulphite-reducing *Clostridium spp.* in feed has been added in an informative
- Performance characteristics of the method, determined in an interlaboratory study, have been added
- The main technical changes are significant and have major impact on the performance characteristics of the method

Part 1: Enumeration of sulphite-reducing *Clostridium spp.* by colony-count technique. It has replaced ISO 15213:2003.
Part 2: Enumeration of *Clostridium perfringens* by colony-count technique.
It is set to replace EN ISO 7937:2004.
Part 3: Detection of *Clostridium perfringens*. This part will be newly published.

PART 1: ENUMERATION OF *CLOSTRIDIUM SPP.* ACC. TO NEW EN ISO 15213-1:2023

Procedure step	
Sample preparation	Preparation of test portion or initial suspension. OPTIONAL for selection of spores: Heat treatment at (80 ± 2) °C for (10 ± 1) min
Plating (pour plate)	Prepare decimal dilutions. Transfer 1 ml of 1:10 diluted sample or decimal dilution into empty 90 mm Petri dish. Add 12-15 ml Iron sulfite agar (ISA) at 44-47 °C. After solidification, overlay with 5 ml of liquid ISA. Incubate under anaerobic conditions at (37 ± 1) °C for (48 ±2) h.
Plating (pour plate)	Count typical colonies of presumptive sulphite-reducing *Clostridium spp.*: Black or grey to yellow brownish colonies. For confirmation, take 5 colonies and streak out each colony onto two non-selective agar plates (e.g. Columbia blood agar). From each pair of plates: Incubate 1 plate at 37 °C for 20 h ± 2 h aerobically. Incubate 1 plate at 37 °C for 20 h ± 2 h anaerobically. Only colonies that grow ANAEROBICALLY but not aerobically belong to the genus Clostridium. This and other colonies with the same morphology on ISA are counted as sulphite-reducing *Clostridium spp.*

PART 2: ENUMERATION OF *CLOSTRIDIUM PERFRINGENS* ACC. TO NEW EN ISO 15213-2:2023

NEW EN ISO 15213-2:2023 AT A GLANCE ...

- Describes the horizontal method for the enumeration of *Clostridium perfringens* by colony count technique
- Scope has been expanded to include samples from the primary production stage
- Typical colonies on Tryptose sulfite (TSC) agar are confirmed by SIM agar or acid phosphatase test
- Ten-minute heat treatment at 80 °C has been made optional
- The selective medium has been re-named from Sulfite-cycloserine agar (SC) to Tryptose sulfite cycloserine agar (TSC) without changes in the formulation
- Description of acid phosphatase test has has been aligned with ISO 14189
- Molecular differentiation between pathogenic and non-pathogenic
- *C. perfringens* has been added in an informative annex
- Performance characteristics of the method, determined in an interlaboratory study, have been added
- The main technical changes are significant and have a major impact on the performance characteristics of the method

Procedure step	
Sample preparation	– Preparation of test portion or initial suspension. – OPTIONAL for selection of spores: Heat treatment at (80 ± 2) °C for (10 ± 1) min
Plating	– Prepare decimal dilutions. – Transfer 1 ml of 1:10 diluted sample or decimal dilution into empty 90 mm Petri dish. – Add 12-15 ml Tryptose sulfite cycloserine (TSC) agar at 44-47 °C. – After solidification, overlay with 5 ml of liquid TSC agar. – Incubate under anaerobic conditions at (37 ± 1) °C for (20 ± 2) h.
Enumeration & confirmation	– Count typical colonies of presumptive *Clostridium perfringens:* black or grey to yellow-brownish colonies. – For confirmation, take 5 colonies and subculture these on a non-selective agar (e.g. Columbia blood agar). – Incubate under anaerobic conditions at (37 ± 1) °C for (20 ± 2) h. – Confirm colonies are *C. perfringens* by using either acid phosphatase or SIM agar test. – For acid phosphatase test: Spread colonies on filter paper and add 2-3 drops of acid phosphatase reagent. A purplish colour developing within 3-4 min is considered a positive reaction. – For SIM agar test: Stab colonies from non-selective agar plates into SIM tubes. Incubate under anaerobic conditions at (37 ± 1) °C for (22 ± 2) h with loose caps. Tubes showing blackening (sulphite production: positive), NO growth outside the inoculation stab (motility: negative) and NO red ring formation after adding Kovac's reagent (indole production: negative) are confirmed as positive for *C. perfringens*.

PART 3: DETECTION OF *CLOSTRIDIUM PERFRINGENS* ACC. TO NEW EN ISO/TS 15213-3:2023

NEW EN ISO/TS 15213-3:2023 AT A GLANCE ...

- Describes the horizontal method for the detection of *Clostridium perfringens*
- Scope includes the detection of *C. perfringens* in food, feed and environmental samples in food and feed production and handling, and for samples from the primary production stage
- Rapid Perfringens Medium (RPM) is described as a new culture medium for selective enrichment
- For isolation, Tryptose sulfite (TSC) agar and new Lactose egg-yolk neomycin agar (LENA) are used as described
- Typical colonies on TSC agar and/or LENA are confirmed by SIM agar or acid phosphatase test.
- Molecular differentiation between pathogenic and non-pathogenic *C. perfringens* has been added in an informative annex
- Performance characteristics of the method, determined in an interlaboratory study with some participating laboratories, have been added

Step	Procedure step	
1	Sample preparation	Liquid sample or initial suspension + Rapid perfringens medium (RPM): Tenfold dilution (of 1 ml or 10 ml sample / initial suspension) (with RPM).
2	Selective enrichment	– Incubate at (46 ± 1) °C for (18 ± 4) h.
3	Plating	– Streak 10 µl onto the surface of TSC agar and 10 µl onto the surface of LENA plates. – Incubate TSC agar plates for (24 ± 2) h at (37 ± 1) °C anaerobically. – Incubate LENA plates for (24 ± 2) h at (46 ± 1) °C anaerobically.
4	Confirmation	– Typical colonies of presumptive *C. perfringens* on TSC agar: black or grey to yellow-brownish colonies; on LENA: yellow colonies (acid fermentation of lactose) with precipitation (lecithinase reaction). – For confirmation, take 5 colonies and subculture these on a non-selective agar (e.g. Columbia blood agar). – Incubate under anaerobic conditions at (37 ± 1) °C for (20 ± 2) h. – Confirm colonies are *C. perfringens* by using either acid phosphatase or SIM agar test. – For acid phosphatase test: Spread colonies on filter paper and add 2-3 drops of acid phosphatase reagent. A purplish colour developing within 3-4 min is considered a positive reaction. – For SIM agar test: Stab colonies from non-selective agar plates into SIM tubes. Incubate under anaerobic conditions at (37 ± 1) °C for (22 ± 2) h with loose caps. Tubes showing blackening (sulphite production: positive), NO growth outside the inoculation stab (motility: negative) and NO red ring formation after adding Kovac's reagent (indole production: negative) are confirmed as positive for *C. perfringens*.

As a worldwide leading provider of a broad range of granulated and ready-to-use culture media for food, beverage and water microbiology, we closely track and support the development of relevant standards aimed at increasing consumer confidence and safety.

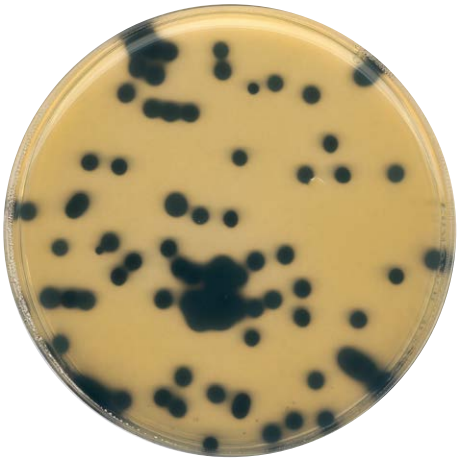
Our GranuCult® granulated media, Readybag® pre-weighed granulated media in ready-to-use bags, ReadyPlate™ and ReadyTube® ready-to-use media are all compliant with EN ISO 11133:2014+Amd1:2018+Amd2:2020. All information regarding compliance with additional reference standards are displayed on the product label and in the product's technical information available on our website.

COMPLIANCE WITH THE NEW EN ISO 15213 SERIES

We are implementing all the requirements as described in the new EN ISO 15213 series.

DEHYDRATED CULTURE MEDIA – FROM BASIC TO PRIME

To best suit your needs, we offer two media formats: superior granulated GranuCult® and powdered NutriSelect® culture media. The added designations basic, plus or prime indicate the quality control level, from basic quality control, to standard QC plus, to prime for full regulatory compliance.



Clostridium perfringens WDCM 00174 on 111972 TSC agar

Ordering Information

Description	Pack size	Cat. No.
GranuCult® prime Iron Sulfite Agar (ISA) acc. ISO 15213-1	500 g	**1108640500**
GranuCult® prime Columbia Agar (base) acc. ISO 10272 and EP/USP/JP	500 g	**1002140500**
GranuCult® prime TSC (Tryptose Sulfite Cycloserine) Agar (base) acc. ISO 15213, ISO 14189 and FDA-BAM	500 g	**1119720500**
TSC (Cycloserine) Selective supplement	1 x 10 vials	**1008880010**
GranuCult® prime Rapid Perfringens Medium (RPM) acc. ISO 15213-3	500 g	**1167510500**
GranuCult® prime SIM (Sulfite Indole Motility) Agar acc. ISO 15213	500 g	**1054700500**
Bactident® Indole (Kovac's indole reagent) acc. ISO and FDA-BAM	30 ml	**1113500001**
Kovac's Indole Reagent acc. ISO and FDA-BAM	100 ml	**1092930100**
Products for anaerobic cultivation		
Anaerotest® strips for microbiology (to indicate an anaerobic atmosphere)	50 strips	**1323710001**
Anaerocult® A mini (gas generator system for 1-4 Petri dishes)	25 x 1 set	**1323690001**
Anaerocult® P (reagent for generation of an anaerobic atmosphere for 1 Petri dish)	25 x 1 set	**1323820001**
Anaerocult® A (reagent for generation of an anaerobic atmosphere in an anaerobic jar)	10 x 1 piece	**1323690001**
Anaerobic Jar (2.5 liter volume) for microbiology	1 unit	**1136810001**
Anaeroclip® for use in providing a mechanical closure of Anaerocult® products	25 units	**1142260001**

Analysis of pesticide residues in pistachios

Using QuEChERS extraction and cleanup with Supel™ QuE Z-Sep+

Kathy Stenerson, Principle R&D Scientist, Megan Wesley, 2016 R&D Summer Intern

INTRODUCTION

Pistachios are popular and enjoyed for both taste and health benefits such as decreased cholesterol, weight management, protection against diabetes and hypertension, and improved digestion[1]. These nuts are grown in the United States (specifically, California), Italy and countries in Central Asia like Iran, Turkey, Afghanistan and Syria. Pesticide tolerances set by the US EPA for pistachios range from 0.01 - 0.7 µg/g before harvest to 3 - 200 µg/g after harvest, depending on the pesticide[2]. Testing for pesticide residues then requires a method which will allow for low level and accurate determination. The "quick, easy, cheap, effective, rugged and safe" (QuEChERS) approach has been used to analyse multiple pesticide residues found in pistachios[3]. Pistachios contain approximately 45% fat, which can result in a significant amount of co-extracted matrix in the acetonitrile extract generated using the QuEChERS procedure. The use of a cleanup sorbent which can reduce this fat is essential to prevent fouling of LC-MS/MS and GC-MS/MS systems, and minimise ion suppression, thus allowing low level detection. In this application, Supel™ QuE Z-Sep+ sorbent was used as part of the QuEChERS method in the analysis of pesticide residues in pistachios. Z-Sep+ is a zirconia and C18 functionalised silica sorbent which acts to retain fatty constituents through both Lewis acid/base and hydrophobic interactions. The selectivity of the zirconia present in Z-Sep+ offers retention of a wider range of fats than C18 alone. In this application, QuEChERS extraction and cleanup using Z-Sep+ sorbent were used before the LC-MS/MS and GC-MS/MS analysis of pesticide residues in pistachios. The targeted analyte list included pesticides relevant to pistachios[4,5].

EXPERIMENTAL

Pistachios were purchased from a local grocery store. They were frozen with liquid nitrogen (shells on), ground, and spiked at 10 ng/g with the pesticides listed in Table 2 and 4, and allowed to equilibrate for 1 hour. Samples were then subjected to QuEChERS extraction and cleanup with Z-Sep+ following the procedure in Figure 1. A 100 µl aliquot of the final extract was diluted to 1 ml with 5 mM ammonium formate/0.1% formic acid in water, and analysed by LC-MS/MS using the conditions shown in Table 1. The remaining acetonitrile extract was analysed directly by GC-MS/MS using the conditions shown in Table 3. Spiked samples were quantitated against 5-point matrix-matched calibration curves prepared in unspiked pistachio matrix blanks (after cleanup). No internal standard was used.

Figure 1. QuEChERS extraction and cleanup procedure used for pistachios.

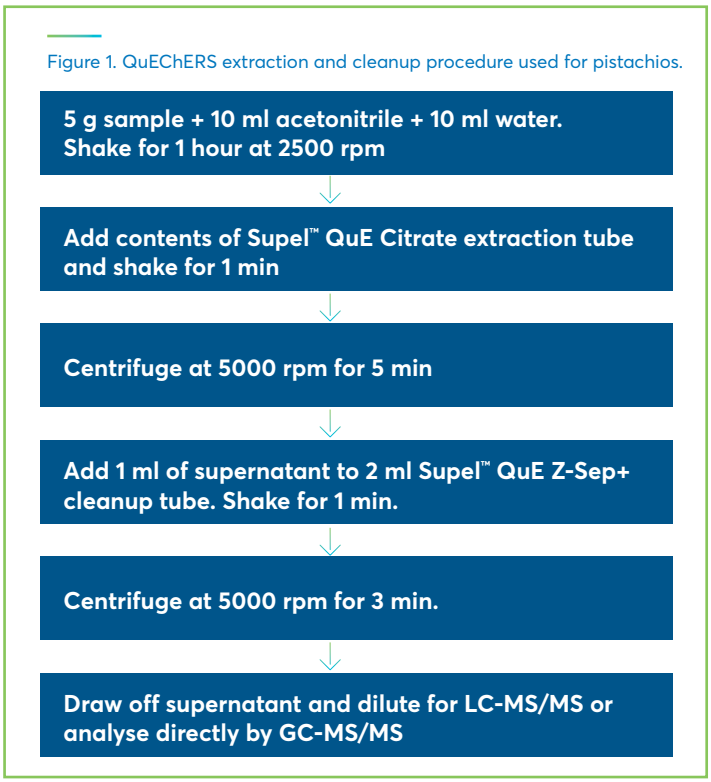


Table 1. LC-MS/MS analysis conditions

Column	Ascentis® Express RP-Amide, 10 cm × 2.1 mm I.D., 2 µm (Cat. No. 51576-U)
Mobile phase	[B] 5 mM ammonium formate, 0.1% formic acid in 95:5 acetonitrile:water
Gradient	5% B held for 1 min; 5 to 100% B in 12 min; held at 100% B for 1.5 min; 100 to 5% B in 0.5 min; held at 5% B for 1.5 min
Flow rate	0.4 ml/min
Column temp.	30 °C
Detector	MS, ESI (+), MRM (see Table 2)
Injection	5 µl

Table 2. MRMs used for quantitation, LC-MS/MS

Compound	CAS No.	MRM	Frag (V)	CE
Aclonifen	74070-46-5	265/182.1	115	28
Aldicarb	116-06-3	208.1/89.1	70	12
Aldicarb-sulfone	1646-88-4	223.1/86.1	80	8
Bifenazate	149877-41-8 301.1/170.1	95	16	
Butocarboximsulfoxide 34681-24-8	207.1/132	65	0	
Carbendazim	10605-21-7	192.1/160.1	105	16
Carbofuran	1563-66-2	222.1/165.1	80	20
Chlorantraniliprole	500008-45-7 483.9/452.9	105	16	
Etrimfos	38260-54-7	293.1/125	120	28
Flufenoxuron	101463-69-8 489.1/158	100	20	
Isoxathion	18854-01-8	314.1/105	135	12
Malathion	121-75-5	331/126.9	80	5
Methabenzthiazuron	18691-97-9	222.1/165.1	90	12
Methomyl	16752-77-5	163.1/106	50	4
Neburon	555-37-3	275.07/57.1	100	20
Omethoate	1113-02-6	214/109	80	24
Pyraflufen-ethyl	129630-19-9 413/339	120	25	
Quinalphos	13593-03-8	299/163	90	20
Rotenone	83-79-4	395/213.1	145	20
Spinetoram	187166-40-1 748.5/142.2	206	32	
Spiromesifen	283594-90-1 388/273	110	10	
Thiacloprid	111988-49-9 253/126	100	16	
Thiophanate-methyl	23564-05-8	343/151	90	20
Triazophos	24017-47-8	314.1/162.1	110	16
Trichlorfon	52-68-6	256.9/109	80	12

Table 3. GC-MS/MS analysis conditions

Column	SLB®-5ms, 20 m × 0.18 mm I.D., 0.18 µm
Oven	50 °C (2 min), 15 °C/min to 320 °C (5 min)
Inj. Temp.	250 °C
Carrier gas	helium, 1.2 ml/min constant flow
Detector	MSD, scan and MRM (see Table 4)
Msd interface	325 °C
Injection	1 µl, splitless (0.75 min)
Liner	4 mm I.D. FocusLiner™ with taper

Table 4. MRMs used for quantitation; GC-MS/MS

Compound	CAS #	MRM	CE
Chlorpyrifos-methyl	5598-13-0	286/93	20
Tolclofos-methyl	57018-04-9	265/250	15
Fenthion	55-38-9	278/169	15
MGK-264	18691-97-9	164/98	10
Endosulfan sulfate	1031-07-8	274/239	15
Etoxazole	153233-91-1	141/63	30

RESULTS AND DISCUSSION

Background

Initially, cleanup using Z-Sep+ sorbent was compared to PSA/C18, a common QuEChERS cleanup sorbent for fat-rich samples. A visual comparison of the QuEChERS extracts (in acetonitrile) is shown in Figure 2. Both cleanups removed some green colour, resulting in similar light yellow extracts. GC-MS-scan comparisons (Figure 3) show lower background after Z-Sep+ cleanup compared to PSA/C18. The predominant peaks present in the uncleaned extract are fatty acids and monoglycerides. While PSA/C18 only reduced the levels of these compounds, almost none were detected after Z-Sep+ cleanup.

Pesticide recovery

Table 5 shows the average %Recovery and %RSD for n=3 replicates of spiked pistachio samples. The majority of the pesticides were analysed by LC-MS/MS; and those without sufficient response were analysed by GC-MS/MS. Out of the 30 pesticides analysed, 22 had recoveries within the generally accepted range of 70-120%. Reproducibility was good, with RSD values < 20% for all 30 pesticides, and < 10% for many. Two pesticides, etoxazole and trichlorfon, had recoveries < 50%. Trichlorfon was most likely retained by the Z-Sep+ sorbent during the cleanup step. This could be due to the Lewis base character of the phosphate group present in its structure. Etoxazole, on the other hand, does not contain a phosphate group. It is a very lipophilic pesticide, indicated by its log P value of 5.6. Extraction efficiency of this compound from the fatty pistachio matrix was probably very poor using acetonitrile. Spinetoram, with a log P of 6.3, also showed lower recovery (56%) than a majority of the pesticides studied. This trend of decreased recovery for high log P pesticides has been observed by others for high fat matrices[6]. Recovery of both of these compounds may be increased by addition of a less polar solvent such as ethyl acetate for the extraction; however, an increase in the level of co-extracted background can be expected.

Figure 2. Comparison of pistachio extracts; before and after cleanup.

No cleanup PSA/C18 Z-Sep +

Figure 3. GC-MS-scan comparison of pistachio extracts with (a) No cleanup, (b) PSA/C18 cleanup, and (c) Z-Sep+ cleanup; all the same Y-scale

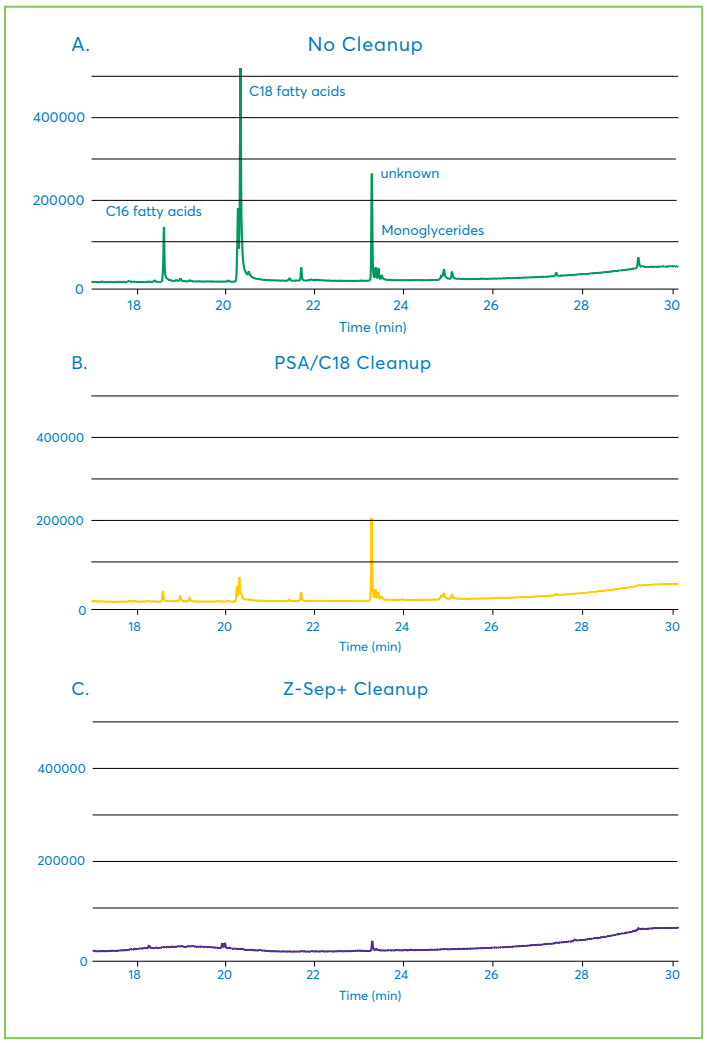


Table 5. Pesticide recoveries from pistachios using Z-Sep+ Cleanup, Spike level of 10 ng/g

Pesticide	Avg. % (n=3)	% RSD	Analysis
Aldicarb	102%	3%	LC-MS/MS
Aldicarb-sulfone	108%	1%	LC-MS/MS
Bifenazate	88%	4%	LC-MS/MS
Butocarboximsulfoxide	83%	5%	LC-MS/MS
Carbendazim	71%	4%	LC-MS/MS
Carbofuran	104%	4%	LC-MS/MS
Chlorantraniliprole	90%	5%	LC-MS/MS
Chlorpyrifos-methyl	66%	10%	GC-MS/MS
Endosulfan sulfate	58%	6%	GC-MS/MS
Etoxazole	45%	9%	GC-MS/MS
Etrimfos	90%	7%	LC-MS/MS
Fenthion	72%	9%	GC-MS/MS
Flufenoxuron	62%	15%	LC-MS/MS
Isoxathion	92%	3%	LC-MS/MS
Malathion	102%	4%	LC-MS/MS
Methabenzthiazuron	84%	3%	LC-MS/MS
Methomyl	106%	5%	LC-MS/MS
MGK-264 (avg. 2 isomers)	57%	17%	GC-MS/MS
Neburon	92%	7%	LC-MS/MS
Omethoate	66%	2%	LC-MS/MS
Pyraflufen-ethyl	97%	18%	LC-MS/MS
Quinalphos	104%	7%	LC-MS/MS
Rotenone	100%	3%	LC-MS/MS
Spinetoram	56%	10%	LC-MS/MS
Spiromesifen	83%	4%	LC-MS/MS
Thiacloprid	100%	2%	LC-MS/MS
Thiophanate-methyl	100%	3%	LC-MS/MS
Tolclofos-methyl	71%	10%	GC-MS/MS
Triazophos (avg. 2 isomers)	89%	3%	LC-MS/MS
Trichlorfon	14%	13%	LC-MS/MS

CONCLUSIONS

Pistachios, which contain 45% fat, present a challenging matrix when doing pesticide residue analysis. If using QuEChERS extraction, some fat will be co-extracted with the analytes of interest. Thus, the cleanup step must be able to reduce this background. In this application, the use of Supel™ QuE Z-Sep+ was demonstrated for the effective cleanup of these extracts prior to LC-MS/MS and GC-MS/MS analysis. Fatty acid and monoglyceride background were significantly reduced using Z-Sep+, and compared to PSA/C18 cleanup, the resulting extract had lower background; as evidenced by GC-MS-scan data. Pesticide recovery was within the acceptable range of 70-120% for 22 out of 30 targeted pesticides, with excellent reproducibility demonstrated for spiked replicates.

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2. Index to Pesticide Chemical Names, Part 180 Tolerance Information, and Food and Feed Commodities (by Commodity); US Environmental Protection Agency Office of Pesticide Programs, U.S. Government Publishing Office: Washington, DC, 2012.
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Featured products

Description	Cat. No.
Supel™ QuE QuEChERS products	
Empty centrifuge tube, 50 ml, pk of 50	**55248-U**
Supel™ QuE citrate extraction tube, 12 ml, pk of 50	**55227-U**
Supel™ QuE Z-Sep+, 2 ml, pk of 100	**55414-U**
Supel™ QuE Z-Sep+, 15 ml, pk of 50	**55486-U**
Capillary GC Column	
SLB®-5ms, 20 m × 0.18 mm I.D., 0.18 µm	**28564-U**
HPLC Column	
Ascentis® Express RP-Amide, 10 cm × 2.1 mm I.D., 2 µm	**53913-U**
Accessories	
QuEChERS shaker and rack starter kit, USA compatible plug	**55278-U**
QuEChERS shaker and rack starter kit, EU Schuko plug	**55438-U**

Related Products

Description	Cat. No.
Accessories	
Inlet liner, split/splitless type	
Single Taper FocusLiner™ design (wool packed)	**2879901-U**
Molded Thermogreen® LB-2 Septa, solid discs, pk of 50 28676-U	
Thermo-O-Ring™ Inlet Liner O-Ring, pk of 10	**21003-U**
Gold-plated inlet seal (straight design), pk of 2	**23318-U**
Capillary column nut for Agilent®MS, pk of 5	**28034-U**
Vials	
Certified vial kit, low adsorption (LA), 2 ml, amber, w/slit caps pk of 100	**29654-U**
Certified vial kit, low adsorption (LA), 2 ml, clear with marking spot, PTFE-silicone septa w/slit, pk of 100	**29652-U**

Managing hydroxymethylfurfural (HMF) in food processing

INTRODUCTION

Hydroxymethylfurfural (HMF) can be formed in many carbohydrate-containing foods during thermal treatment like cooking, frying or baking, but can also increase during storage and transportation.

While thermal treatment guarantees food safety and can improve sensory properties (e.g. flavor, colour and taste) of foodstuffs, HMF can be used as a quality marker and adulteration indicator in specific foods, such as juices, milk, sauces, honey or cereals. It can also be found in alcoholic beverages or vinegar. The level of HMF in baked goods (e.g. bread and cookies), roasted coffee, caramelised sugars and others can vary depending on factors such as cooking time, temperature, and ingredients. The substance is formed during the thermal decomposition of carbohydrates as a product of the Maillard reaction. While HMF can provide caramel-like flavor and a brown colour, which is desired in some foods, excessive levels of HMF can negatively impact taste, aroma and overall quality of others.

As a constituent of processed foods, HMF has both profoundly adverse and beneficial effects on human and bee health[1]. According to Codex Alimentarius, honey must meet the 40 mg/kg HMF limit after processing and blending, to ensure that the product has not undergone extensive heating during processing and is safe for consumption (except for honey that originated from tropical climates with a higher limit of 80 mg/kg).

While HPLC or spectrophotometric methods can be labour intensive, reliable fast alternatives are of high interest. See how our application note HMF in honey and the Reflectoquant® HMF test provide the first rapid test method for the accurate determination of HMF content in just a few minutes.

REFLECTOMETRIC DETERMINATION AFTER CONVERSION WITH A BARBITURIC ACID DERIVATIVE AND AN AMINOPHENAZONE DERIVATIVE

Reagents:

Description	Cat. No.
Reflectoquant® Hydroxymethylfurfural (HMF) test	1.17952.0001
Reflectometer RQflex® 20	1.17246.0001
Water for analysis	1.16754.4000 1.16754.5000 1.16754.9010
Reflectoquant® Blank strips	1.16730.0001
Test vessels	1.17989.0001

This application note pertains to RQflex® 20 and all discontinued instruments (RQflex® 10, RQflex® plus).

SAMPLE PREPARATION

Weigh 2,5 g of honey into a test vessel, dissolve with approx. 4 ml of water for analysis, transfer quantitatively to a 10 ml volumetric flask, and make up to the mark with water for analysis. Prepare larger sample volumes according to the instructions as necessary.

BLANK

Every type of honey gives rise to a more or less intense blank value depending on its intrinsic colour. This blank value is determined by immersing a blank strip into the prepared honey sample solution and measuring it in the reflectometer. Select the HMF method beforehand by means of the bar code.
It is advisable to take the blank value into consideration even when light-coloured types of honey are being investigated.

ANALYSIS

Press the START button of the reflectometer and at the same time immerse both reaction zones of the test strip in the prepared sample (15 - 30 °C) for 1 second. Allow excess liquid to run off via the long edge of the strip onto an absorbent paper towel.

Approx. 10 seconds before the end of the reaction time, insert the test strips all the way into the strip adapter with the reaction zones facing the display.

After the end of the reaction time, read off the result from the display in mg/l hydroxymethylfurfural.

The result [mg/l] is automatically stored. (Please refer to the RQflex® operating instructions and the package insert of the Reflectoquant® Hydroxymethylfurfural (HMF) Test.)

CALCULATION

HMF content [mg/kg] = (measurement result [mg/l] - blank [mg/l]) x 4 / 1.4

MEASUREMENT RESULTS

A series of tests with 50 different types of honey were measured with the Reflectoquant® HMF Test. The results were compared with those obtained using the official DIN methods DIN 10751-3 (HPLC). The factor of 1.4 used in the calculation formula is used to balance effects of the honey matrix on the test.

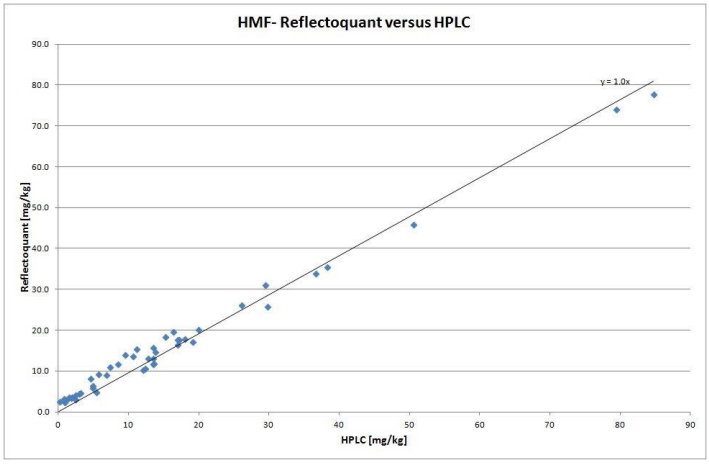

Figure. HMF Reflectoquant versus HPLC

References

1. 5-Hydroxymethylfurfural (HMF) levels in honey and other food products: effects on bees and human health, Shapla et al. Chemistry Central Journal (2018)

Quantification of ethylglyoxal in Manuka honey – A simple HPTLC based approach

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INTRODUCTION

Honey, a natural product, is one of the most frequently tested food products. In recent years, manuka honey has gained popularity because of its high antibacterial activity[1]. Methylglyoxal (MGO) has been identified as one of the major contributors to its antibacterial activity. MGO is present in high concentrations in manuka honey and is directly responsible for its potency. This makes the manuka honey exclusive and high-priced as compared to the other traditional kinds of honey. Manuka honey from New Zealand usually contains 40 to 800 mg/kg of MGO but can even contain up to 1900 mg/kg[2]. To avoid adulteration of manuka honey products, a strict quality regulation regarding its origin, purity and quality need to be fulfilled and is a prerequisite for the UMF™ (Unique Manuka Factor) grading[2]. It mostly reflects the MGO amount in the honey but also considers other authenticity markers.

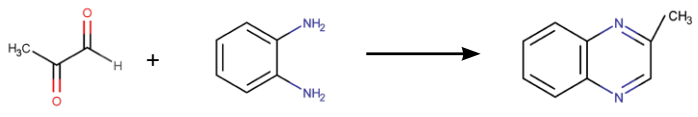
In the following application, we focus on the MGO quantification using High-Performance Thin-Layer chromatography (HPTLC) with subsequent substance confirmation by MS measurement. The high viscosity and high sugar content of honey makes it a very complex and matrix-rich sample for an analysis. Thin-layer chromatography (TLC) and high-performance thin-layer chromatography (HPTLC) are convenient, fast, and efficient separation techniques that enable the development of analytical methods without the need for complicated sample preparations or high investments. Low cost and short analysis time per sample are given by the parallel analysis of many samples on one plate. Furthermore, the high matrix tolerance of TLC offers additional opportunities to existing routine methods.

EXPERIMENTAL

Six different commercially available manuka honey samples were analysed. MGO shows a mesomeric effect and reacts immediately with water to form either methylglyoxal monohydrate or methylglyoxal dihydrate in aqueous environments[3]. Only a small amount of around 1% MGO remains unreacted. Direct detection of MGO in manuka honey is found to be difficult using conventional methods. In this application, MGO is converted to stable 2-methylquinoxaline by derivatising it with 1,2-phenylenediamine (Figure 1)[4].

The stable form is then used as the reference. For confirmation of the method and determination of the recovery rate regular honey samples have been spiked with MGO and 1,2-phenylenediamine. Other derivatization options were tested but the reaction with 1,2-phenylenediamine performed best. Water and honey matrix were tested to confirm, that the optimzed reaction conditions provide reproducible results for both matrices.

A calibration curve of 2-methylquinoxaline was calculated based on 3 different standard volumes (Table 1 and Figure 2).



Methylglyoxal (MGO) 1,2-phenylenediamine

Figure 1. Reaction scheme of MGO with 1,2-phenylenediamine

Table 1. Calibration Curve

Spots	Application volume µl	Amount (µg)	Mean Area
1, 10, 19	0.3	0.045	4080.52
2, 11, 20	1.5	0.225	11120.91
3, 12, 21	3.0	0.451	15677.39

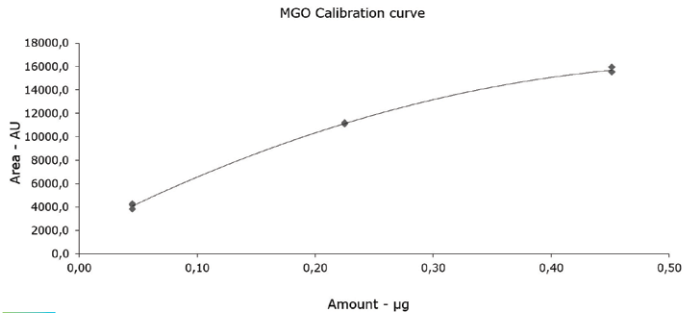


Figure 2. Calibration plot with corresponding calibration function.

A recovery study was performed using regular honey to simulate honey matrix. It was spiked with a known amount of MGO standard solution, followed by the addition of 1,2-phenylenediamine. The measured (and calculated) MGO amount allowed for the correlation of the actual amount of MGO in the Manuka honey samples. The experimental details of the recovery rate study can be found in Table 2, Table 3, Figure 3 and Figure 4.

Table 2. TLC data of recovery rate: In total, nine regular honey samples were applied and one MGO standard sample. Seven honey sample (4-10) were spiked with MGO and 1,2-phenylenediamine.

Spots	Application volume µl	Amount (µg)
1	1.0	Methylglyoxal standard 0.15 mg/ml (water) with 0.2% 1,2-diphenylenediamine
2	5.0	Regular honey, 100 mg/ml in water/ethanol 3:2
3	5.0	Regular honey, 100 mg/ml in water/ethanol 3:2 + 0.2% 1,2-phenylenediamine
4	5.0	Regular honey, 100 mg/ml in water/ethanol 3:2 + 0.2% 1,2-phenylenediamine spiked with methylglyoxal 0.024 mg/ml

Table 3. Quantification of methylglyoxal in the seven honey samples

Honey sample #	"Area AU"
1	6759.37
2	6665.00
3	6911.29
4	6756.10
5	7055.36
6	7059.58
7	7014.80
Mean area	6888.79
RSD %	2.35
Amount (µg)	0.108
Spiked amount (µg)	0.12
Recovery rate (%)	90.05

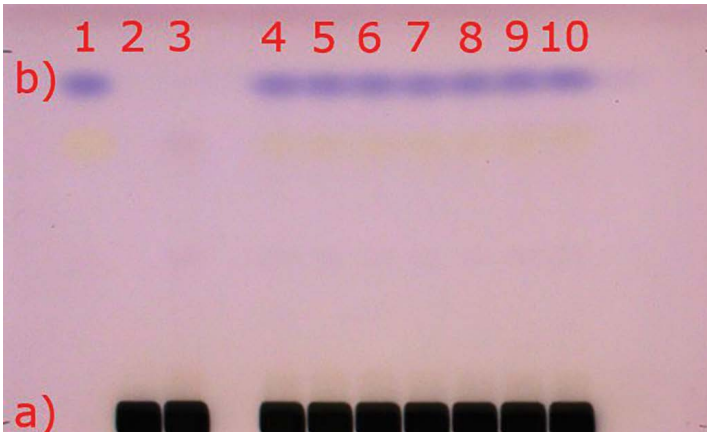


Figure 3. Visualization of the plate under visible light (white light); a) matrix compounds after staining with anisaldehyde sulfuric acid (black areas); b) 2-Methylquinoxaline (blue spot at hRf 80), (reaction product of Methylglyoxal with 1,2-phenylenediamine)

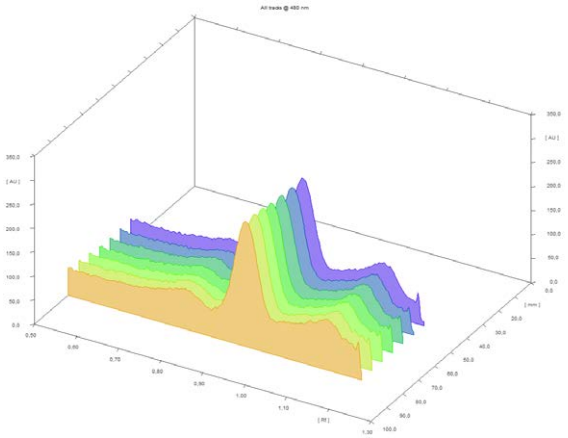


Figure 4. Scan of spiked honey tracks (sample 4 – 10) at 480 nm with CAMAG TLC Scanner 3.

All TLC analyses were performed using HPTLC Silica gel 60 F254. The plates were pre-washed with the mobile phase (up to 7 cm) and dried before use.

The standards were prepared by dissolving 100 µl of ~40% aq. MGO solution (exact content known) diluted in 20.0 ml water. 800 µl of this stock solution was further diluted with water to 10.00 ml volume and 0.2% (20 mg) of the reactant 1,2-phenylenediamine was added. All standard solutions were stored at 8 °C for two days before use to achieve reproducible reaction of MGO with 1,2-phenylenediamine. Longer storage times (>3 days) lead to partly degradation of 2-methylquinoxaline.

Honey sample solutions of 100 mg/ml in case of sample numbers 1, 3, 5, and 150 mg/ml in case of honey samples 2, 4 and 6 were applied with a higher volume due to the expected lower amount of MGO. To each sample 0.2% of 1,2-phenylenediamine was added, eg., sample 1, 4.0 g honey diluted in 40 ml solution of water / ethanol in 3:2. To the solution 0.2% (80 mg) of the reactant 1,2-phenylenediamine was added. Before using the samples, they needed to be stored at 8 °C for two days to complete the reaction.

The samples and standards were applied as spots in an area of 5 x 3 mm^2. This step is necessary because of the high matrix and high application volumes of the honey samples. The plate was developed, dried, and then derivatized by dipping in an anisaldehyde-sulphuric acid reagent. Blue spots of 2-methylquinoxaline (product of the reaction of MGO with 1,2-phenylenediamine) appeared at hRf 80. Daylight examination and scanning of the plate at 480 nm were carried out for quantification. Experimental results are shown in Figure 5 and Table 4.

Figure 5. Visualisation of the plate under visible light (white light); a) matrix compounds after staining with anisaldehyde sulphuric acid (black areas); b) 2-methylquinoxaline (blue spot at hRf 80), (reaction product of methylglyoxal with 1,2-phenylenediamine)

Table 4. TLC data: In total 27 samples were applied. Track numbers with applied samples and volumes and obtained hRf values are summarised here (details of tracks 1-3, 10-12 and 19-21 for calibration are given in Table 1):

Manuka samples	Application position	Conc. sample (mg/ml)	Application volume (µl)	Mean area (AU)	Mean amount (µg)	%RSD	MGO in honey (mg/kg)	Expected amount MGO in honey according to information on product label (mg/kg)
1	4, 13, 22	100.0	5.0	11225.00	0.228	2.68	507.4	600.0
2	5, 14, 23	150.0	9.0	4548.80	0.055	2.84	45.3	nd
3	6, 15, 24	100.0	5.0	8002.84	0.136	3.10	301.4	300.0
4	7, 16, 25	150.0	8.0	6031.58	0.088	2.48	81.4	80.0
5	8, 17, 26	100.0	5.0	9674.57	0.181	3.06	401.8	400.0
6	9, 18, 27	150.0	8.0	7578.22	0.125	3.14	115.6	nd

* The expected MGO concentrations in sample 2 and 6 were not specified by the supplier

A separate plate without staining was used for MS measurement. The coupling to MS was performed on an elution-based approach, that utilised a TLC-MS interface. This enabled the dissolution of the analyte from the silica plate at the zone of hRf 80 by a solvent and a transfer to the mass spectrometer in the liquid phase. This additionally confirmed the spot identification of the MGO derivative 1-methylquinoxaline[5].

EXPERIMENTAL CONDITIONS

Plate	HPTLC Silica Gel 60 F254 20 x 10 cm (Cat. No. 1.05642.0001)
Application volume	0.3 – 9.0 µl, area application 5 x 3 mm with CAMAG ATS 4
Detection	480 nm
Chamber	20 x 10 chamber without filter paper
Mobile phase	Ethyl acetate/Acetonitrile 85:15 (v/v)
Staining	Anisaldehyde-sulfuric acid reagent (0.5 ml p-anisaldehyde, 85 ml methanol, 10 ml glacial acetic acid, 5 ml sulfuric acid 98%)
Migration distance	5 cm
hRf	80
Drying	60 °C
Standard preparation	100 µl of ~40 % aq. methylglyoxal solution (exact content known) diluted in a 20.0 ml volumetric flask and filled up with water. 800 µl of this stock solution is diluted again in a 10.0 ml volumetric flask and made up to the mark with water. Addition of 0.2 % (20 mg) of the reactant 1,2-phenylenediamine. Before the standard is ready for use it is refrigerated at 8 °C for two days to complete the derivatization reaction.
Sample	Solutions of 100 mg/ml of sample nos. 1, 3, 5, and 150 mg/ml of sample nos. 2, 4, 6 were prepared. To every sample 0.2 % of 1,2-phenylenediamine was added. eg, sample 1: 4.0 g honey diluted in 40 ml solution of water/ethanol in 6:4. To the solution 0.2 % (80 mg) of the reactant 1,2-phenylenediamine was added. Before the samples are ready to use, they are refrigerated at 8 °C for two days to complete the derivatization reaction.
MS measurement	The samples are extracted with the Plate Express and measured with the single-quadrupole expression compact mass spectrometer (CMS) from Advion.
Extraction solvent	Acetonitrile/Water 95:5 (v/v) + 0.1% formic acid

RESULTS AND DISCUSSION

As demonstrated, MGO can be identified and quantified in different honey samples within the concentration range of 50 mg to 600 mg/kg. The conversion of MGO into the more stable compound 2-methylquinoxaline allows for an easy evaluation of the MGO content. The recovery study showed a detectable MGO amount of around 90%. The correlated MGO amount in manuka samples was calculated accordingly. One of the samples (sample 1) showed a lower MGO content than indicated by the supplier. This might be because of the degradation of the MGO during storage. Sample 2 and sample 6 only showed MGO concentrations of 50 and 100 mg/kg. These manuka honey samples are considered of lower quality. Although no indication of MGO concentration was provided by the supplier.

CONCLUSION

The analysis of MGO in a complex and challenging food matrix like honey was described. Target analyte could be easily separated and detected without time-consuming and labor-intensive sample preparation. The flexible set-up enabled a combination with MS measurements.

Screening and method development capabilities were shown by the application of 27 tracks on one plate (honey samples and standard solutions). The study clearly differentiated various honey qualities (referring to MGO content) on the market. Though the analysis of MGO is challenging, MGO content could be well quantified in the expected range.

To summarise, a fast, cheap, and simple quantification of methylglyoxal can be accomplished with HPTLC. This application demonstrates the main advantages of the method, such as quick sample preparation, high matrix tolerance, and high-throughput.

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FEATURED PRODUCTS

Description	Cat.No.
HPTLC Silica gel 60 F254 20 x 10 cm	1.05642.0001
Methylglyoxal solution ~40% in H_2O	M0252-25G
1,2-Phenylenediamine ≥99%	694975-1G
Ethyl acetate, for liquid chromatography LiChrosolv®	1.00868.2500
Acetonitrile, gradient grade for liquid chromatography LiChrosolv® Reag. Ph Eur	1.00030.2500
Ethanol, gradient LiChrosolv®	1.11727.2500
Methanol, gradient grade for liquid chromatography LiChrosolv® Reag. Ph Eur	1.06007.2500
Sulfuric acid, ACS reagent, 95.0-98.0%	258105-2.5L
Acetic acid, glacial, ACS reagent, ≥99.7%	695092-500ML
p-Anisaldehyde 98%	8.22314.0250
TLC-MS	
Acetonitrile, for UHPLC-MS LiChrosolv®	1.03725.2002
Water, for UHPLC-MS LiChrosolv®	1.03702.2500
Formic acid 98% - 100% for LC-MS LiChropur™	5.33002.0050
Millex LCR PTFE Syringe filter	SLCRBZ5NZ

Determination of total glucose and xylose in instant coffee by reverse phase HPLC-UV

Eddy Tan, Application Scientist, Lee May May, Senior Application Scientist, Singapore Applications Laboratory

This is a method for the determination of total glucose and xylose in coffee samples by reverse phase HPLC- UV. The limit of detection for glucose and xylose is 53.2 and 33.8 ppm respectively for freeze dried coffee.

INTRODUCTION

Coffee is an indispensable beverage for many people. The adulteration of coffee with coffee husks, cereal grains and soy beans to raise the profit margin is well known. Typical markers for such adulteration include glucose and xylose. Instant coffee is considered to be adulterated if it contains more than 2.46% total glucose and 0.45% total xylose[1,2].

As sugars lack UV chromophores, their determination is typically accomplished by HPLC-RID (Refractive Index Detector) [3] or by anion exchange chromatography with a pulsed amperometric detector (HPAEC-PAD)[1,4] The RID is less sensitive compared to the UV detector and often requires a longer time to stabilise. It is therefore not the detector of choice for many HPLC users. The HPAEC-PAD is a more expensive setup with a limited set of applications and separation columns. It is therefore not a common instrument.

Although there are established methods for sugar determination in coffee eg. AOAC Method 995.13 and ISO Method 11292:1995, they all require the HPAEC- PAD instrument.

Here, we demonstrate the determination of total glucose and xylose using a procedure to release the sugars from the coffee followed by an SPE cleanup. The released sugars are next derivatized with a UV tag, 1-phenyl-3-methyl-5-pyrazolone (PMP)[5,6,7]. A final clean up by liquid-liquid extraction with dichloromethane is done before HPLC injection. The standard addition technique was chosen as it corrects for varying levels of matrix interferences with different coffee samples.

INSTRUMENTS & SAMPLES

The analysis was performed on a Thermo Dionex UltiMate 3000 UHPLC. An ultrasonic bath was used to dissolve the coffee samples. For sample digestion and derivatisation, a water bath and vortex mixer were used. The Visiprep™ vacuum manifold with a vacuum pump was employed for the SPE cleanup. A bench and a mini centrifuge were used to spin down the samples.

Freeze dried coffee and milk coffee mixture samples were purchased from a local grocery store. Freeze dried coffee refers to pure and instant soluble coffee granules or powder whereas milk coffee mixture would have sugar, milk, emulsifier, flavouring agents etc. compounded with instant coffee powder.

METHOD

Glucose and xylose standard solutions

Prepare 1 L of 1 M hydrochloric acid. Weigh 100 mg of glucose and 100 mg of xylose into a 10 ml volumetric flask. Add 6 ml of hot 1 M hydrochloric acid (~80 °C) and swirl gently. Sonicate for 10 minutes to dissolve completely before topping up to the mark with 1 M hydrochloric acid. Mix well before use.

Coffee sample solutions and reagent blank

Weigh 1.5 g of the freeze dried coffee sample into a 10 ml volumetric flask. For milk coffee mixture sample, use 0.5 g. Add 6 ml of hot 1 M hydrochloric acid (~80 °C) to both. Swirl gently and sonicate for 10 minutes. Ensure all solids are dissolved (milk solids will remain insoluble) before topping up to mark with 1 M HCl.

Table 1. Glucose and xylose spiking for freeze dried coffee sample

Identity	Freeze dried coffee, µl	Glucose, µl	Xylose, µl	1M HCl, µl	Dilution factor	Glucose ppm	Xylose ppm
A	2000	0	0	3000	Nil	0	0
B	2000	200	200	2600	25.00	400	400
C	2000	400	400	2200	12.50	800	800
D	2000	800	800	1400	6.25	1600	1600

Spike in glucose and xylose at 400, 800 and 1600 ppm for freeze dried coffee samples as in Table 1. Do a reagent blank using water in place of sample. For milk coffee samples, use 500 µl of sample solution instead.

Acid digestion

Incubate all spiked solutions at 80 ±2 °C for 3 hours. Then cool to room temperature, spin down contents and filter through a Millex PTFE hydrophilic 0.45 µm filter into a new tube.

SPE cleanup

This SPE cleanup is necessary to remove oils, fats and other organics present in the coffee samples. Set up the SPE cartridges (LiChrolut® RP-18 200 mg/3 ml PP SPE tubes) on the Visiprep™ SPE vacuum manifold system. Connect this to the vacuum pump. Condition the SPE cartridges first with 2 x 3 ml methanol followed by 2 x 3 ml 1 M HCl. Next, place a 15 ml centrifuge tube as a receiver for each of the SPE cartridges. Transfer 1 ml of the filtrate from the acid digestion step into the SPE cartridge. Control flowrate for a dropwise elution.

Derivatization: Tagging the sugars with PMP (UV label)

Prepare 10 ml of 0.5 M PMP in methanol and 10 ml of 1.2 M sodium hydroxide. Pipette 200 µl from the SPE cleanup step into a 2 ml microcentrifuge tube. Add 200 µl of 1.2 M sodium hydroxide and vortex for 30 seconds. Pipette 100 µl into a 5 ml microcentrifuge tube. Add 100 µl of 0.5 M PMP and vortex for 1 minute. Spin down and incubate at 70 ±2 °C for 100 minutes in a water bath. Cool to room temperature for the next step.

Cleanup of sample for HPLC

Prepare 10 ml of 0.2 M hydrochloric acid. Add 100 µl of 0.2 M hydrochloric acid to the tagged sample. Vortex for 30 seconds and spin down contents. Add 1800 µl of water and 1500 µl of dichloromethane to it. Vortex for 1 minute and centrifuge for 2 minutes at 7000 RCF. Draw off the top aqueous layer into another 5 ml tube. Discard the dichloromethane. Repeat extraction of the aqueous layer with 1500 µl of dichloromethane twice more. Filter the aqueous layer through a 0.22 µm 13 mm Millex PTFE hydrophilic filter into a 2 ml HPLC vial. Seal vials and proceed to HPLC injection. Chromatographic conditions are in Table 2.

Table 2. Chromatographic conditions

column	Purospher® STAR RP-18e, 15 cm x 3 mm, 3 µm (Cat. No. 1.50750) with guard cartridge, 4-4 mm (Cat. No. 1.50270) and pre-column holder (Cat. No. 1.16217)
mobile phase	[A] 200 mM ammonium acetate (pH 6.8 ± 0.05); [B] acetonitrile; (78% A / 22% B; isocratic elution). All filtered through hydrophilic PTFE, 0.2 µm
flow rate	0.4 ml/min
column temp	35 °C
detector	UV, 245 nm
pressure	~200 bar
injection volume	20 µl

RESULTS & DISCUSSION

Both glucose and xylose peaks were symmetrical and eluted at ~9.8 and ~11.5 minutes respectively (Figure 1). The freeze dried coffee has a more complex HPLC profile compared to the coffee mixture sample. See Figure 2 for spiked freeze dried coffee sample.

The freeze dried coffee samples 1 and 2 had a total xylose content >0.42% w/w (Table 3). The coffee mixture samples 1 and 2 had a high glucose content.

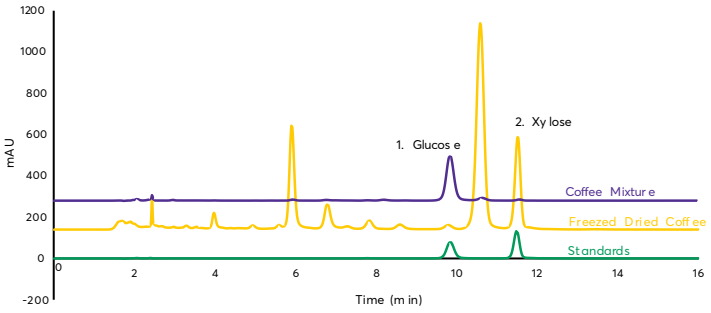


Figure 1. Coffee mixture and freeze dried coffee with glucose and xylose standards

Sample	Peak	Compound	Retention time (min)	Resolution	Peak symmetry
Freeze dried coffee	1	Glucose	9.79	5.75	0.97
	2	Xylose	11.52	-	0.93
Coffee mixture	1	Glucose	9.83	5.72	1.03
	2	Xylose	11.55	-	0.93

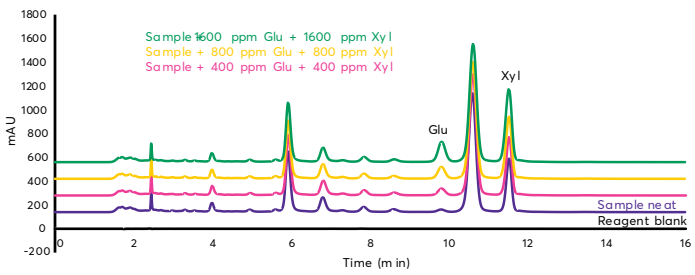
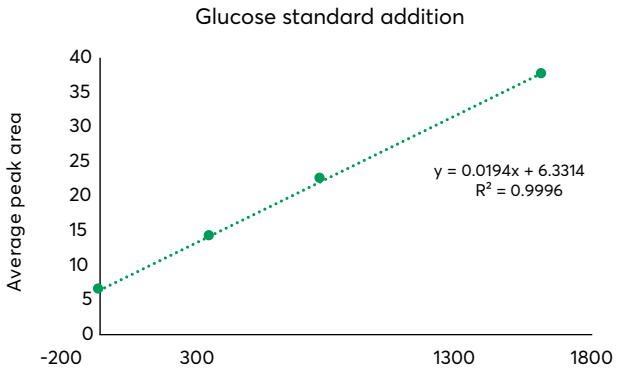
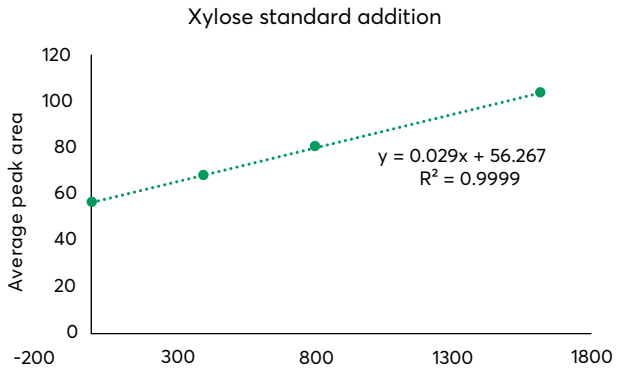


Figure 2. Freeze dried coffee sample spiked with glucose and xylose standards





Linearity - Glucose

Concentration (ppm)	Mean area
0	6.1962
404.08	14.1098
808.16	22.4116
1616.32	37.5630
Slope	0.0194
STEYX	0.3132
LOD	53.2 ppm
LOQ	161.2 ppm

Linearity - Xylose

Concentration (ppm)	Mean area
0	56.0414
403.64	68.0976
807.28	80.0099
1614.56	102.9951
Slope	0.0290
STEYX	0.2978
LOD	33.8 ppm
LOQ	102.5 ppm

Figure 3. Standard addition calibration plots and data for freeze dried coffee

>40% w/w as both have sugar and glucose syrup listed as ingredients.

Table 3. Results for coffee samples

Sample	Glucose (% w/w)	Xylose (% w/w)
Freeze dried coffee 1	0.35	4.10
Freeze dried coffee 2	0.55	3.23
Coffee mixture 1	43.31	0.68
Coffee mixture 2	46.59	0.13

CONCLUSION

We can determine total glucose and xylose in coffee by Reversed Phase HPLC-UV. This is a sensitive isocratic separation that can be completed by fifteen minutes with the Purospher® STAR RP-18e fully porous particle column. The method can be modified using Fused-Core® or Chromolith® columns for even faster separation while still applicable to conventional HPLC and to UHPLC instruments.

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FEATURED MATERIALS

Description	Cat. No.
HPLC columns	
Purospher® STAR RP-18e, 3 µm, 150-3 mm, Hibar® RT	1.50750
Purospher® STAR RP-18e 4-4 mm guard cartridge	1.50270
Pre-column holder for LiChroCART® cartridges 4-4 for capillary connection	1.16217
Sample prep, reagents and accessories	
LiChrolut® RP-18, 200 mg, 3 ml SPE PP tube, Pk.50	1.02014
Visiprep™ SPE vacuum manifold	57030-U
Millipore® Chemical duty pump, 220 V/50 Hz	WP6122050
Acetonitrile isocratic grade for liquid chromatography LiChrosolv®	1.14291
Ammonium acetate for analysis EMSURE® ACS, Reag. Ph Eur	1.01116
Dichloromethane for liquid chromatography LiChrosolv®	1.06044
Hydrochloric acid fuming 37%, for analysis EMSURE® ACS, ISO, Reag. Ph Eur	1.00317
Methanol for analysis EMSURE® ACS, ISO, Reag. Ph Eur	1.06009
Methanol for liquid chromatography LiChrosolv®	1.06018
3-Methyl-1-Phenyl-2-Pyrazoline-5-one (PMP), 99%	M70800
Sodium hydroxide pellets for analysis EMSURE®	1.06498
Omnipore® 0.2 µm 47mm membrane filters	JGWP04700
Millex® - LCR 0.22 µm 13 mm filter unit, hydrophilic PTFE	SLCR013NL
Millex® - LCR 0.45 µm 33 mm filter unit, hydrophilic PTFE	SLCR033NB
HPF Millex® - LCR 0.45 µm 33 mm filter unit	SLLGM25NS
Reference materials	
D-(+)-Glucose, Pharmaceutical Secondary Standard	PHR1000
D-(+)-Xylose, Pharmaceutical Secondary Standard	PHR2102

Analysis of plant-based proteins pH measurement using inlab sensors

The complex matrix, diverse physical properties, and varied chemical composition of ingredients in alternative protein products often interfere with pH measurement, posing significant challenges. This application note shares valuable tips and hints on how to obtain reliable and accurate results when measuring the pH of plant-based proteins.

As demand for plant-based proteins continues to grow, manufacturers face increasing pressure to ensure their products are of high quality and meet customer expectations. Accurate pH measurement is essential for ensuring the products' safety, quality, texture, and flavor. However, measuring the pH of such protein samples can be challenging, even more with conventional pH sensors. Many would face issues such as junction clogging, insufficient sample interaction or electrolyte contamination, which can lead to inaccurate pH readings. Using METTLER TOLEDO's InLab® sensors provides a reliable solution for pH measurement of viscous and solid plant-based protein samples.

These measurements require specialized sensors and systems to ensure precise pH readings. This application note provides in-depth guidance on overcoming these challenges and improving the pH measurement results for plant-based proteins using METTLER TOLEDO's InLab® sensors. It also emphasises the importance of following good electrochemistry practices and shares valuable tips on sensor maintenance and storage.

The right sensor choice: InLab® Power Pro-ISM and InLab® Solids Pro-ISM

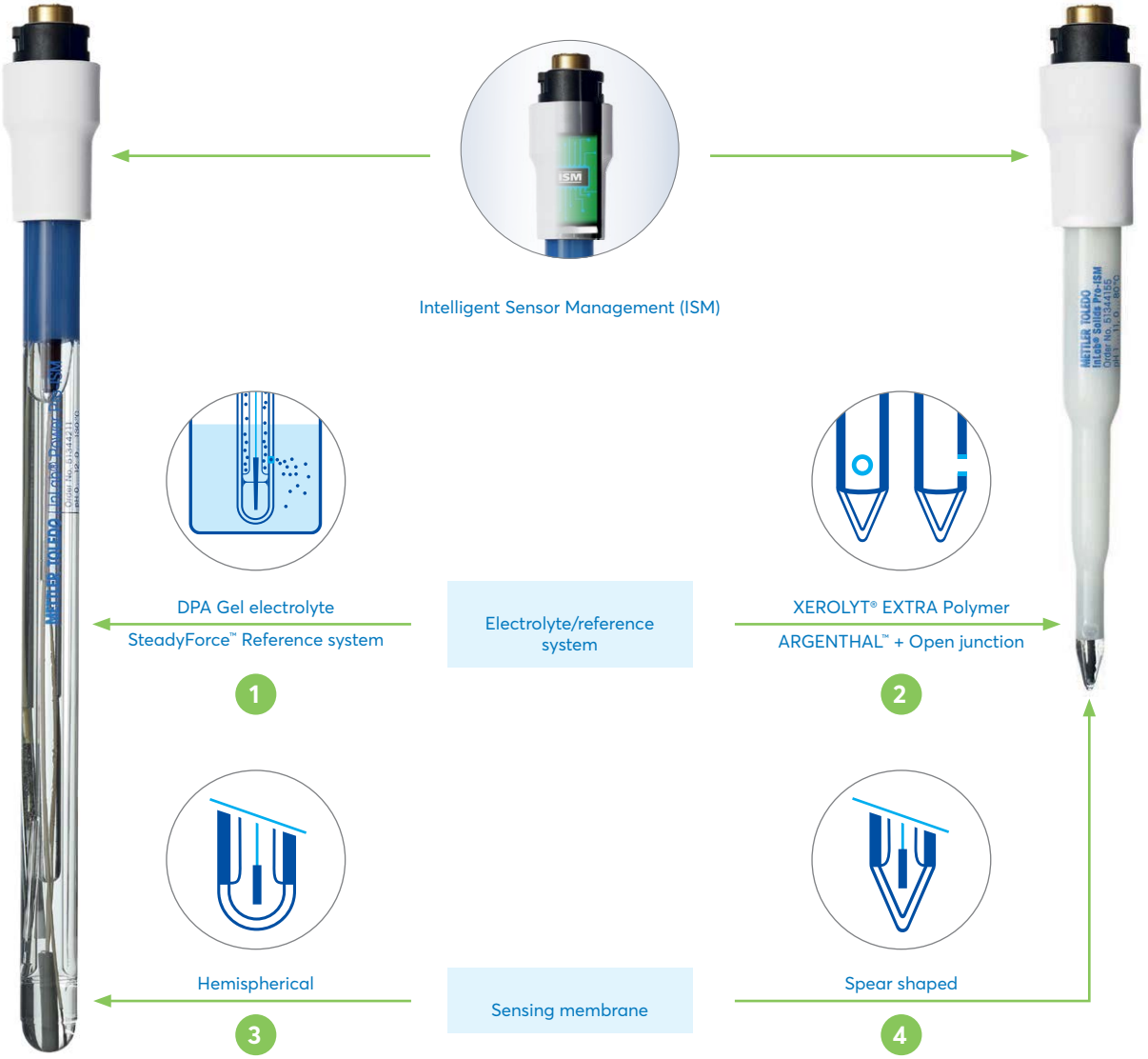

Figure 1. InLab Power Pro-ISM and InLab Solids Pro-ISM sensors.

No.	Sample type	Challenge	InLab Power Pro-ISM	InLab Solids Pro-ISM	Advantage
1	Viscous	Sensor clogging	Pressurised SteadyForce™ reference system	–	Ensures continuous electrolyte flow in viscous samples and prevents sample ingress.
2	Solid		–	Open junction	Makes the InLab Solids Pro-ISM sensor maintenance-free, and the open junction prevents clogging related issues.
3	Viscous	Insufficient sample contact	Hemispherical sensing membrane	–	Provides greater surface area and minimises gradient effects that may exist in the sample, thus providing stable readings.
4	Solid		–	Spear shaped sensing membrane	Allows easy sample insertion for solid and semi-solid samples.
5	Viscous and solid	Contamination	Easy-to-clean sensing membranes reduce risk of contamination		Improves accuracy of sensors.
6	Viscous and solid	Frequent monitoring and refilling of electrolytes	Maintenance free sensors		Improves productivity due to reduced downtime.
7	Viscous and solid	Inconsistencies in results caused by varying temperatures	Integrated temperature probe (and ATC functionality of METTLER TOLEDO pH meters)		Integrated temperature probe accurately notes sample temperature and yields a precise slope by compensating for temperature effects.
8	Viscous and solid	Secure and easy data handling	ISM® (Intelligent Sensor Management)		Provides maximum traceability and data security by keeping a track of important information such as the latest calibration data and maximum temperature exposure.

Table 1. Features and advantages of the InLab Power Pro-ISM and InLab Solids Pro-ISM sensors.

Applying good practices for consistent and high-quality results

A. Calibration and verification

- Calibrate the sensor regularly using METTLER TOLEDO pH buffer solutions before measuring the first sample of the day. If the number of samples exceeds 30 per day, the calibration must be repeated after completing half of the samples
- Use at least two pH buffers for calibration, bracketing the expected sample pH, e.g., use pH buffers 4 and 7 for calibration if the expected sample pH is 6.22
- A slope of 95–105% and an offset of 0 mV ± 20 mV confirm a good state of the electrode and hence ensure reliable measurements
- Verify the calibration by measuring a pH buffer of known pH value between the calibration range, like pH buffer 5, in case of point 2 above. For details on pH calibration, refer to our pH Essentials Guide
- In case of more than 10 samples, perform a verification measurement after every 10 samples. If the verification result is outside of the specified tolerance, perform a new calibration
- Always use fresh pH buffers of high quality and never re-use them

B. Sample preparation and measurement

To evaluate the pH of plant-based proteins such as soy milk, protein powder, plant-based liquid egg, or plant-based chicken nuggets, samples were used as representatives of such food types.

1) Soy milk, plant-based liquid egg, and protein powder

- Soy milk and plant-based liquid egg can be directly measured without any additional preparation.
- Disperse 10% (w/v) protein powder in deionised water or as required.
- Dip the InLab® Power Pro-ISM sensor in the sample, making sure that the junction is fully immersed. Samples with soy milk and protein powder require stirring.
- Record the pH along with the sample temperature. Perform triplicate measurements to obtain consistent results.
- Thoroughly clean the sensor with deionized water after each measurement.
- The InMotion Autosampler could also be used for measuring these thick samples. When using an InMotion Autosampler for the pH measurement of thick samples, additional rinse cycles with deionised water are required.

2) Plant-based chicken nuggets

- Select a small, representative portion of plant-based chicken nuggets for pH measurement.
- Gently insert the InLab Solids Pro-ISM sensor into the sample, ensuring proper contact between the pH sensor tip (including the junction) and the sample
- Record the pH along with the sample temperature
- Perform triplicate sample measurements to obtain consistent results
- Thoroughly clean the sensor with deionised water after every measurement

C. Maintenance and storage of pH sensor

- Repetitive pH measurements of protein-rich samples can result in protein accumulation and contamination of the sensor membrane, leading to delayed response. To avoid slow behaviour, proper electrode maintenance is essential
- Keep the InLab Power Pro-ISM sensor upright for a minimum of 15 minutes prior to measurement
- For thorough cleaning wash the electrode with ethanol and then rinse it with deionized water. Avoid rubbing the sensor surface; instead, gently blot excess water using tissue paper
- Soak the sensor in Pepsin/HCl solution for one hour after completion of measurements
- Periodically recondition the sensor in 0.1 M HCl for InLab Power Pro ISM sensor and 0.01 M HCl for InLab Solids Pro-ISM sensor. The frequency of reconditioning depends on the number of samples analysed per day and the results of the calibration
- The sensor must be re-calibrated after reconditioning
- Store the sensor in the wetting cap filled with InLab storage solution during periods of non-use
- Never store the sensor dry or in distilled water, as this may damage the pH-sensitive glass membrane and shortens the electrode lifetime

RESULTS AND DISCUSSION

The pH of samples like soy milk, plant-based liquid egg, and aqueous solution of plant-based protein powder were measured using the InLab Power Pro-ISM sensor, while the pH of plant-based chicken nuggets was measured using the InLab Solids Pro-ISM pH sensor, both at 25 °C. All the pH measurements were carried out using a SevenExcellence benchtop meter. Additionally, LabX software and an InMotion Autosampler were used to automate the measurement of liquid/emulsion samples. All the samples were measured in triplicates. The standard deviation and average response time were noted as enlisted in Tables 2 and 3.

The standard deviation of the results was less than 0.05 pH, which confirms the reliability of the pH measurement data. An average response time of

Figure 2. pH measurement of soy milk using InLab Power Pro-ISM sensor and SevenExcellence S400 meter.

Figure 3. pH measurement of plant-based chicken nuggets using InLab Solids Pro-ISM sensor and SevenExcellence S400 meter.

Sr. no.	Sample	Method	pH value	Standard deviation (n≥3)	Average response time (s)
1	Soy milk	Standalone	7.22	0.01	20.3
		InMotion	7.22	0.02	13.7
2	Liquid egg	Standalone	6.96	0.01	15.3
		InMotion	6.97	0.01	9
3	Protein powder	Standalone	6.96	0.03	20.7
		InMotion	6.99	0.02	11

Table 2. pH values of soy milk, protein powder in aqueous solution and plant-based liquid egg measured with InLab Power Pro-ISM sensor.

Sr. no.	Sample	Method	pH value	Standard deviation (n≥3)	Average response time (s)
1	Plant-based chicken nuggets	Standalone	5.85	0.02	**21**

Table 3. pH values of plant-based chicken nuggets measured with InLab Solid Pro-ISM sensor.

around 20 seconds was observed for measuring these samples. Using automation enabled time efficiency both in response time and susequent sensor cleaning after each measurement. In contrast to general aqueous samples, thick samples require sufficient rinse cycles with deionised water for effective cleaning.

CONCLUSION

For measuring the pH of liquid plant-based samples comprising proteinaceous emulsions or suspensions, the InLab Power Pro-ISM sensor is a reliable choice. Its pressurized SteadyForce™ reference system ensures that the sensor junction does not clog, even in thick or semi-solid samples. It is also possible to maximise the sample throughput by using automation in the case of liquid samples.

For the pH measurement of solid protein samples, the InLab Solids Pro-ISM is a suitable sensor with a clog-free open junction. Regular cleaning and reconditioning as advised in the note ensure a well-performing pH sensor. It is possible to maximise the sample throughput by using automation in the case of liquids. With the right sensor and meter setup, the use of good practices for calibration and measurement, and proper sensor maintenance, reliable pH results can be achieved.

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Supporting quality control in food processing

OHAUS scales and moisture analysers help ensure safety and compliance.

FOOD SCALES

Food processing is a highly scrutinised industry with rigorous government oversight and regulations to ensure consumer and worker safety. Manufacturers must rely on quality control measures for their products and processes to remain compliant with the strict standards set by regulatory agencies. More importantly, quality control guidelines allow food manufacturers to minimise contamination risk and provide safe, quality food to customers.

Manufacturers implement standard operating procedures and incorporate the highest quality measuring instruments to ensure reliable and recorded results and product consistency across batches. Since government agencies are paying such close attention, the product's quality status must be reviewed and documented carefully throughout all stages of the production process. The two most common sets of requirements for oversight are GMP (Good Manufacturing Practices) system and HACCP (Hazard Analysis and Critical Control Point). OHAUS keeps both standards in mind when developing precision weighing and measuring instruments for the food industry.

ENSURING QUALITY

Quality control is integral to every step of food processing, including procurement, development, production and distribution. After carefully selected raw materials are approved, the production team will formulate the finished product by following standard operating procedures for ingredients, recommended weights, batch size and process time. Not only does the SOP need to be carefully documented, but so does the ongoing manufacturing process to ensure consistency and compliance, and to identify the cause should an issue arise.

One of the final steps – labeling – is also heavily regulated as what is indicated on the outside of the package must be matched by the finished product that is on the inside from formulation and consistency to weight and other factors. Instruments supporting food quality control are needed both at the front of the building (bench scales, moisture analysers) and in the back processing area (floor scales, washdown scales).

To support food manufacturer needs, OHAUS offers a wide range of durable, reliable measuring instruments to suit many applications in processing, research and development, testing, packaging, warehousing, shipping and more. We have worked with the food processing industry for decades to help support safety, efficiency, throughput and profitability. We offer solutions for improving consumer safety, product consistency and quality control.

OHAUS commercial instruments are designed to help you meet demands for food safety, quality and regulatory compliance. Our scales and moisture analysers provide efficient solutions for nearly all aspects of food processing - material receiving, formulation, quality control, filling, batching, basic weighing and checkweighing. Our precision weighing and measuring instruments for food are dependable, easy to set up and use, and reliably precise to help you maximise yield and minimise waste.

SELECTING THE RIGHT INSTRUMENTS

OHAUS offers a range of precision and analytical balances designed specifically for the food industry. They are durably constructed and designed for ease-of-use and high precision results. We offer models that are certified by NSF to support HACCP systems and are also USDA-AMS accepted. These OHAUS scales are designed with smooth, unobstructed surfaces that are easy to clean and free of areas where material can build up and cause contamination. Here are just a few of the high-performance food scales and moisture analysers we stand behind.

Food scales for high capacity, heavy duty food weighing up to 150 kg OHAUS offers the Defender™ 6000 series of bench scales. Specifically designed for food processing, Defender

6000 manages the most demanding applications with a 316 stainless steel platform and frame and durable 316 stainless steel or food grade polycarbonate indicator. Defender 6000 bench scales are available in a range of platform sizes, weighing capacities, readability capacity and special features to suit your needs.

Defender 6000 bench scales are designed to handle high-pressure washdowns and harsh cleaning agents and meet metrological standards for legal-for-trade applications with a laser-sealed stainless steel IP68 and IP69K load cell.

Defender 6000 bench scales feature large bright displays and colour checkweighing indicators for easy readouts and efficient work. Software modes include counting, percent weighing and even filling. Communication is simple with a range of connectivity options and GLP/GMP data output with real-time clock for processing tracking and traceability.

Defender 6000 is loaded with special features for convenience and safety, including 150% overload capacity protection, menu and key lock, selectable environmental and auto-print settings, stability indicator, overload/underload indicators, auto shut-off, auto tare and adjustable rubber feet.

To further support quality control and industry compliance, OHAUS offers a range of compact moisture analysers with intuitive features to help you monitor quality and consistency through moisture content analysis. With halogen lamp heaters, durable construction, and easy-to-read displays, our MB Series of Moisture analysers offer a range of capacities, readability, and pan sizes to suit your application needs .

Measuring total, permanent and chill haze in beer

SUMMARY

The formation of haze in beer can be problematic, as it affects the quality of the end product. Beer consists of various ingredients such as proteins, carbohydrates, polyphenols, fatty acids, nucleic acids, amino acids, etc. These ingredients can precipitate, and a haze or turbidity is formed. Most beers are clear at room temperature. If there are haze-producing proteins and tannins (both primarily from malt) suspended in the beer, haze particles don't form because of the warm temperature. When beer is chilled, these proteins and tannins react to clump into larger particles that are big enough to reflect light.

In this procedure you will measure total and permanent chill in beer and the difference between the two values is the chill haze value.

THE APPLICATION

- Hach® Portable 2100Q or Benchtop TL2310 TL2360 ISO Turbidimeter
- Hach Sample Cells
- Ice
- Salt
- 95% Ethanol
- 2 pitchers/beakers or sonication device
- 1 x 500 ml Erlenmeyer flask
- 10 ml pipette

APPLICATION: DETERMINING HAZE IN BEER

Procedure

1. Obtain a beer sample.
2. Degas beer sample.
   a. Passing back and forth up to 70 times
   b. Ultrasonic
   c. Blowing gas through sample with air stone
3. Measure out 200 ml of degassed beer into 500 ml Erlenmeyer flask.
4. Bring to room temperature.
5. Add 14 ml of 95% ethanol to the 200 ml of degassed beer and mix thoroughly.
6. Let stand for 20 minutes.
7. Obtain Hach cuvettes and fill with the beer ethanol mixture past the white line.
8. Take initial turbidity reading using the Hach portable 2100Q or benchtop TL2310/TL2360 ISO Turbidimeter.
   a. The result of this reading is the permanent haze
9. Prepare an ice water bath with salt added and allow to stand until a minimum temperature of -5 °C has been reached.
10. Chill samples for 1 hour in ice bath in a refrigerated environment.
11. Taking chilled sample reading:
    a. Remove sample from the ice bath
    b. Invert once
    c. Quickly wipe down with paper towel
    d. Once dry, wipe with a Kimwipe to remove finger prints, lint from paper towel, condensation and smudges from the cuvette
    e. Condensation can be an interference so it is important to be in a dry/AC lab environment
    f. Properly oiled cells also help with condensation
12. Place sample in the turbidimeter and take turbidity reading
13. Take turbidity readings as quickly as possible
    a. This measurement is the total haze reading

CALCULATING CHILL HAZE

Chill haze = Total haze – Permanent haze

	1 EBC	1 NTU/FNU	1 ASBC
EBC	1	0.25	0.014
NTU/FNU	4	1	0.057
ASBC	70	17.5	1

BEER SAMPLES

Beer sample	Total haze	Permanent haze	Chill haze
Pilsner	13.5 NTU	5.48 NTU	8.02 NTU
Amber ale	59.3 NTU	2.55 NTU	56.8 NTU
Porter	84.1 NTU	8.04 NTU	76.1 NTU
Stout	31.9 NTU	14.1 NTU	17.8 NTU

Key

EBC: European Brewing Convention
ASBC: American Society of Brewing Chemists
NTU/FNU: Formazine Nephelometric Unit

DR6000 in the brewing industry: Important methods in accordance with MEBAK and ASBC

INTRODUCTION

Compliance and consistent high quality are two of the key goals within the beverage industry. Hach® provides support for these goals through comprehensive analyses of water and beer.

The DR6000™ UV-VIS Spectrophotometer supports many of the analytical measurements necessary for monitoring throughout the entire brewing process–from raw materials to final product. The DR6000 brewing-specific software has been expanded to include the most important parameters from both MEBAK [1] and the American Society of Brewing Chemists (ASBC)[2]. This means that the DR6000 can be used to measure beer quality around the globe.

THE KEY METHODS IN DETAIL

Beer Colour

MEBAK, Wort, Beer, Beer-Based Beverages, 1st Edition 2012, page 185 ff. ASBC Beer 10-A

The EBC and ASBC units are used throughout Europe and the United States to describe the colour (more specifically: The colour intensity) of beer and beer wort. The value stipulated by the European Brewery Convention (EBC) or ASBC indicates how much light is absorbed by beer of a certain content of original wort. The actual colour of each beer is nothing more than gradations of a brown tone, which decreases in concentration through red, copper, and amber colours, through to golden yellow and light yellow.

In addition to malt colour and original wort, the colour intensity of the finished beer still depends on many other factors, such as the wort preparation, the pH value and the fermentation process.

The measurement of the colour may seem trivial, but it is the first impression that the customer gets before the consumption of the beer. The compliance of the beer colour is therefore an important issue that can be monitored throughout the entire fermentation process.

The absorbance of the beer is measured at a wavelength of 430 nm. Historically, the beer colour in EBC units is 10x absorbance at 430 nm measured in a 1 inch (2.54 cm) cuvette. However, for MEBAK a 1 cm (10 mm) square cuvette is stipulated. Accordingly, the following calculation applies for the determination of the beer colour in accordance with MEBAK:

Absorbance of the beer at 430 nm × 25 = Colour in EBC units.

Historically, the beer colour in ASBC units is 10 x absorbance of the beer at a wavelength of 430 nm and with the use of a ½ inch (1.27 cm) cuvette. With the use of an intermediately stipulated 1 cm (10 mm) cuvette, the following applies in accordance with ASBC method Beer-10A:

Absorbance of the beer at 430 nm × 12.7 = Colour in EBC units

Additionally, the turbidity of the sample is checked in the ASBC method by means of an absorbance measurement at 700 nm. A sample is not classed as turbid if the 700 nm absorbance is ≤ 0.039 × 430 nm absorbance.

In the DR6000, the programmes for the measurement of the beer colour are available both for the measurement in accordance with MEBAK and also for the measurement in accordance with ASBC.

MEBAK Beer Colour	Programme 2006	0–60 units
ASBC Beer Colour*	Programme 2020	0–60 units

The following scale of beer colours is useful for orientation:

EBC	Example	Beer colour
4	Pale Lager, Witbier, Pilsener, Berliner Weisse	
6	Maibock, Blonde Ale	
8	Weißbier	
12	American Pale Ale, India Pale Ale	
16	Weißbier, Saison	
20	English Bitter, Extra Special Bitter	
26	Biere de Garde, Double IPA	
33	Dunkles Lager, Märzen, Amber Ale	
39	Brown Ale, Bock, Dunkelbier, Dunkelweizen	
47	Irish Dry Stout, Doppelbock, Porter	
57	Stout	
69	Foreign Stout, Baltic Porter	
79	Imperial Stout	

(Source: http://de.wikipedia.org/wiki/EBC_(Bier))

BITTERNESS UNITS

MEBAK, Wort, Beer, Beer-Based Beverages, 1st Edition 2012, page 234 ff. ASBC Beer-23, Wort-24

The concentration of the bitters is a key quality feature of the beer. Bitters emerge during boiling due to the isomerisation of α-acids from the hops. Bitters are extracted with isooctane from the acidified sample and the absorbance is measured spectrophotometrically at a wavelength of 275 nm.

The MEBAK and ASBC methods differ only minimally in their execution. While in the MEBAK, 6 N HCl is used to acidify the samples, the ASBC uses only 3 N HCl. After extraction, the absorbance is measured in a 10 mm quartz cuvette against a blank of isooctanol of the same quality.

In accordance with the definition of MEBAK and ASBC, the results are calculated as follows:

Beer: Absorbance 275 nm × 50 = Bitterness in Bitterness Units
Wort: Absorbance 275 nm × 100 = Bitterness in Bitterness Units

The various calculations result from the dilutions of beer and/or wort samples specified in the procedure.

The standard values in accordance with MEBAK are 10–40 BU (bitterness units) for beer and 20–60 BU for wort. In accordance with ASBC, the measurement range for beer is up to 100 units (wort 200) and is reported in IBU (International Bitterness Units).

In the DR6000, the programmes for the measurement of the bitter units are available both for the measurement in accordance with MEBAK and also for the measurement in accordance with ASBC.

Bitterness units, beer	Programme 2001	10–40 BU
Bitterness units, wort	Programme 2003	20–60 BU
ASBC bitterness units, beer*	Programme 2021	10–100 IBU
ASBC bitterness units wort*	Programme 2011	20–200 IBU

Note:
For the analysis of bitterness units, the Hach cuvette test LCK241 (only available in Europe) can also be used. Through the introduction of the chemicals in pre-manufactured cuvettes, both time and costs for chemicals (above all, high-quality isooctane) can be saved.

Beer type	Bitterness units	mg iso-alpha acids/L beer
Wheat	15 – 20	15 – 20
Vollbier	18 – 24	18 – 24
Märzen	20 – 25	20 – 25
Export	22 – 26	22 – 26
Bock	28 – 36	28 – 36
Pils	30 – 38	30 – 38
Alt	35 – 50	35 – 50

Table 1. Bitter units of the most popular beer types (from Brauerei-Forum, VLB)

ISO-A- AND B-ACIDS

MEBAK, Wort, Beer, Beer-Based Beverages, 1st Edition 2012, page 237 ff.

The humulones (or α-hop bitter-acids) from the hops give the beer the bitter taste. During beer production (wort boiling), the bitter iso-α-acids emerge from the hops. Therefore, the iso-α-acid content is a key factor in the taste of the beer. The β-acids also contribute to the bitter taste and are recorded with this measurement.

After the bitters (see above) have been extracted from the sample with isooctane, and after further sample washing, the iso-α- and β-acid content is determined by the measurement of the sample absorbance at 255 nm and 360 nm [1]. A 10 mm quartz cuvette is used, and both acid types are determined in a combined measurement at two wavelengths.

The standard values according to MEBAK are:

Beer: 10–40 mg/L iso-α-acids and less than 2 mg/L β-acids
Wort: 15–50 mg/L iso-α-acids and less than 1–15 mg/L β-acids

In the DR6000, the programme for the measurement of the iso-α- and β-acids is available for the measurement in accordance with MEBAK.

Iso-α- and β-acids	Programme 2013	0–60 mg/L iso-α-acids and 0–80 mg/L β-acids

FAN (FREE AMINO NITROGEN)

MEBAK, Wort, Beer, Beer-Based Beverages, 1st Edition 2012, page 84 ff. ASBC Beer-31, Wort-12

The sum of the bioavailable nitrogen components in the wort is represented by the free amino nitrogen (FAN). An excessive FAN content can lead to problems, both in the taste and in the microbiological stability of the beer. Brewer's yeast and wild yeast ferment excess amino acids into long-chain alcohols (propanol, isobutanol). FAN levels are also a good indicator of

when fermentation is complete. Monitoring the FAN level with the DR6000 will help to turn over tanks faster once the FAN level is low enough. The typical FAN content is 200–250 mg/L in the wort and 10–120 mg/L in the beer (MEBAK).

The methods for both MEBAK and ASBC are identical. The prepared beer or wort are mixed with a colour reagent (based on ninhydrin) and the absorbance is measured at a wavelength of 570 nm in a 10 mm cuvette.

This absorbance is compared with the colour produced by a 2 mg/L glycine standard as reference. For a more precise determination, the blank value, the glycine standard, and the sample are measured in triplicate and the average value is calculated. Due to the differing sample preparation of beer and wort, internal factors of 50 (for beer) or 100 (for wort) are required.

For dark beers and worts, the MEBAK method makes provision for the measurement of a sample blank value, in addition to the usual reagent blank value in order to take into account the intrinsic colouration of the sample. The measurement process and the concentration calculation for dark beers and worts are stored in the DR6000 as separate programmes. In the DR6000, the programmes for the measurement of free amino nitrogen are available both for the measurement in accordance with MEBAK and for the measurement in accordance with ASBC.

FAN, light beer	Programme 2008	0–400 mg/L FAN
FAN, light wort	Programme 2007	0–400 mg/L FAN
FAN, dark beer	Programme 2016	0–400 mg/L FAN
FAN, dark wort	Programme 2015	0–400 mg/L FAN
ASBC FAN, beer*	Programme 2024	0–400 mg/L FAN
ASBC FAN, wort*	Programme 2025	0–400 mg/L FAN

TOTAL POLYPHENOLS

MEBAK, Wort, Beer, Beer-Based Beverages, 1st Edition 2012, page 223 ff. ASBC Beer-35

Phenolic compounds from malt and hops come into the beer in differing quantities dependent on production techniques. Dependening on the structure and molecule sye, they have a strong influence on various beer characteristics such as colour, taste, taste stability, foam and chemical–physical stability[1]. Polyphenols also have an especially large impact on the final appearance of the beer. High polyphenols levels lead to a hazy beer.

The methods in accordance with MEBAK and ASBC are identical. The polyphenols in the samples react with iron(III) ions in alkaline solution forming coloured iron complexes. Their absorbance is measured spectrophotometrically in a 10 mm cuvette at a wavelength of 600 nm.

The calculation is performed as follows:
Absorbance at 600 nm × 820 = mg/L total polyphenols

The calculation is performed as follows:
Absorbance at 600 nm × 820 = mg/L total polyphenols

Standard values in beer are 150–200 mg/L total polyphenols. The measurement range of the saved programmes reaches up to 800 mg/L.

In the DR6000 the programmes for the measurement of total polyphenols are available both for the measurement in accordance with MEBAK and also for the measurement in accordance with ASBC.

Total polyphenols	Programme 2006	0–800 mg/L phenols
ASBC total polyphenols*	Programme 2020	0–800 mg/L polyphenols

VICINAL DIKETONES

MEBAK brew-technical analysis methods, 4th Edition, 2002, page 134 ff. ASBC Beer-25 B

The current MEBAK[1] describes the gas chromatographic measurement of diacetyl and 2,3-pentanedione.

In the older MEBAK[3] and in the ASBC two different photometric methods for the determination of the vicinal diketones are provided.

During yeast metabolism, 2-acetolactate and 2-acetohydroxybutyrate emerge in the course of fermentation. These are converted through oxidation into the vicinal diketones diacetyl and 2,3-pentanedione.

However, diacetyl can also occur as a characteristic metabolic product of certain micro-organisms[1]. With too high a vicinal diketone content the beer obtains an off-flavour. This often causes a butterscotch flavour, or oily mouth feel, which is unpleasant for the consumer.

Following the MEBAK method, the two diketones diacetyl and 2,3-pentanedione react with 1,2-phenylenediamine to form a coloured end product, whose absorbance is measured in a 2 cm quartz cuvette at 335 nm. This frequently used method for operational analytics is clearly faster than the gas chromatographic method, but allows no differentiation between diacetyl and 2,3-pentanedione.

Using the calibration performed by MEBAK, the content of vicinal diketones is calculated as follows:

Absorbance at 335 nm × 1.2 = mg/kg VDK (vicinal diketones)

The target value for light beer is less than 0.15 mg/kg.

The method in accordance with ASBC is described in the method Beer-25 B under the title "Diacetyl – Broad spectrum method for VDK". This method also does not record the diacetyl separately, but rather all present vicinal diketones.

Following ASBC Beer-25 B, diacetyl (and 2,3-pentanedione) reacts with a naphthol solution forming a colour complex, which is measured at a wavelength of 530 nm. The method

was calibrated by Hach with diacetyl standard solutions, and the corresponding factor stored in the programmeming. A user measurement of diacetyl standards for the recording of a calibration curve can then be omitted.

Using the calibration performed by Hach, the content of vicinal diketones is calculated as follows:

Absorbance at 530 nm × 3.7 = mg/L diacetyl (vicinal diketones).

In the DR6000, the programmes for the measurement of vicinal diketones are available both for the measurement in accordance with MEBAK and also for the measurement in accordance with ASBC.

Vicinal diketones	Programme 2014	0–1 mg/kg VDK
ASBC diacetyl*	Programme 2023	0–1 mg/L diacetyl

Note:
Just as for the determination of the bitters, there is also a pre-manufactured cuvette test from Hach under the number LCK242 (only available in Europe) or TNT819 (available in U.S.) for the determination of vicinal diketones.

Reducibility MEBAK, Wort, Beer, Beer-Based Beverages, 1st Edition 2012, page 204 ff.

The reducibility of the beer is a key issue for taste and the biological, chemical, and physical stability of beer. Reducing compounds arising from the malt and the hops prevent and/or minimise oxidative processes in the beer. All fast-reducing compounds present in the beer are summarised as reducibility. They are measured by their reducing effect on the Tillmann's reagent (DPI). The decolouration of this reagent in the presence of the beer sample is measured at a wavelength of 520 nm, and compared with the original colouration of the reagent. The reducibility is expressed in a dimensionless number. It indicates what percent of the reagent is reduced by the beer sample.

In the evaluation of the reducibility of beers, the following scale applies in accordance with MEBAK1:

60	Very good
50–60	Good
45–50	Satisfactory
< 45	Poor

In the DR6000, the programme for the measurement of the reducibility is available for the measurement in accordance with MEBAK.

Reducibility	Programme 2004	0–100

THIOBARBITURIC ACID NUMBER (TAN)

MEBAK, Wort, Beer, Beer-Based Beverages, 1st Edition 2012, page 55 ff.

The thiobarbituric acid number is a summary characteristic. It indicates the thermal load of malt and wort. Alongside 5-hydroxymethylfurfural (HMF), a large number of substances that arise from the Maillard reaction (heat promoted reaction of sugars and amino acids) react with thiobarbituric acid.

In the MEBAK test, the substances to be measured react with thiobarbituric acid and form a yellow colour complex that is photometrically analysed at a wavelength of 448 nm.

The standard values in the brewing process are (in relation to 12% original wort):

Light kettle full wort:	< 22
Light cast wort:	< 45
Light cold wort after wort cooling:	< 60

A new approach to this analysis uses a test called TBARS (thiobarbituric acid reactive substance), which essentially records malondialdehyde. Here too, the extent of the thermal load of the wort through the effect of heat is recorded by the measurement.

In the DR6000, the programme for the measurement of TAN is available for measurement in accordance with MEBAK.

TAN in beer/wort	Programme 2011	0–100 TAN (diluted 1/10)
TAN in congress wort	Programme 2012	0–100 TAN (diluted 1/5)

ANTHOCYANOGENS

MEBAK, Wort, Beer, Beer-Based Beverages, 1st Edition 2012, page 226 ff.

Anthocyanogens, or also leucoanthocyanidins, are a special form of anthocyanidins. Anthocyanidins are the colour-giving part of anthocyanins, a group of plant colourants with a phenolic basis. The anthocyanogens (leucoanthocyanidins from the hops) are converted by hot hydrochloric acid into the red-coloured anthocyanidins.

In the measurement the anthocyanogens are first adsorbed onto polyamide and then converted by hot hydrochloric acid into a red solution. The measurement is made at a wavelength of 550 nm in a 10 mm cuvette.

The standard values in accordance with MEBAK in the beer are 50–70 mg/L, dependent on production techniques. When the stabilised. with PVPP the standard values are correspondingly lower.

In the DR6000, the programme for the measurement of the anthocyanogens is available for the measurement in accordance with MEBAK.

Anthocyanogens	Programme 2005	0–100 mg/L ATC

PHOTOMETRIC IODINE SAMPLE

MEBAK, Wort, Beer, Beer-Based Beverages, 1st Edition 2012, page 52 ff.

After malt has been produced from grains, mostly barley, the malt is ground. The actual brewing process begins with

mashing. In this process, water is heated to approximately 60 °C, then the ground malt is added and the resulting mash is heated under constant stirring to approximately 75 °C, dependent on the process. With different roasting temperatures, enzymes convert the starch from the malt into malt sugar. Alternatively, parts of the mash are boiled, which leads to a physical gelatinisation of the starch. An iodine sample it is then measured to determine whether the dissolved starch is completely saccharified.

Dextrins and starch from worts or beer are precipitated, dissolved in phosphate buffer, and mixed with iodine solution. The red-to-blue colouration is measured in the spectrophotometer at a wavelength of 578 nm in a 4 cm cuvette. The standard values (in wort) per MEBAK are < 0.45.

In the DR6000, the programme for the measurement of the anthocyanogens is available for the measurement in accordance with MEBAK.

Iodine sample	Programme 2010	0–1 iodine value

IRON

MEBAK, Wort, Beer, Beer-Based Beverages, 1st Edition 2012, page 423 ff.

Iron can enter the beer through the raw materials as well as through filter agents and/or fining agents. It can also be picked up from apparatus, lines, or cans, or be contained in beer foam stabilising agent. Iron negatively effects the colloidal stability, taste, foam, and gushing tendency of the beer.

Alongside AAS, iron in beer can also be determined spectrophotometrically. Trivalent iron is first reduced to bivalent iron. The bivalent iron reacts with FerroZine to form a violet-coloured complex. The method stored in the DR6000 for iron determination already contains the absorbance coefficient for iron. The increase of the calibration curve is 0.037/µg/L Fe^{2+}. Thus, the user of this programme is not required to generate a proprietary iron standard series for the calibration. The reference values in beer are 0.200 mg/L.

In the DR6000, the programme for the measurement of iron in accordance with MEBAK is available.

Iron	Programme 2017	0–1 mg/L iron

References

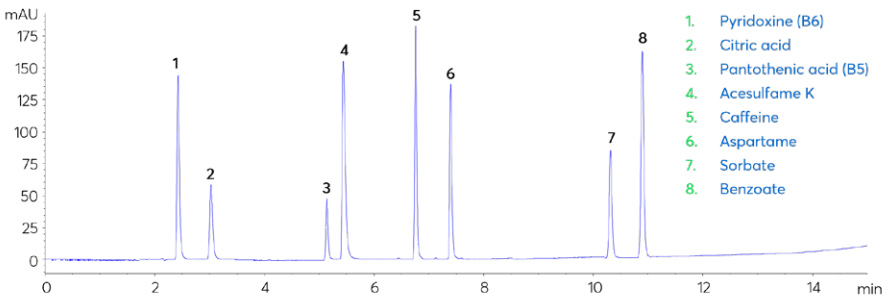
01. MEBAK Wort, Beer, Beer-Based Beverages, 1st Edition 2012
02. American Society of Brewing Chemists, Methods of Analysis, 14th Edition
03. MEBAK, brew-technical analysis methods, volume II, 4th Edition 2002

Analysis of additives in caffeinated energy drinks by HPLC

Caffeinated energy drinks contain a wide range of additives which may include vitamins, preservatives and sweeteners. Food and beverage manufacturers are required to clearly label products with any additives that are used in their product ranges. Therefore, there is a requirement for robust analytical methods for the determination of various ingredients for quality control and to substantiate label claims.

This article discusses the development of a method for the analysis of a range of commonly occurring ingredients in energy drinks that could be used for the routine analysis of the finished drinks product in a quality control environment. Due to the potential complexity of samples and the range in hydrophobicity of the sample components, a high-resolution method capable of retaining polar and more hydrophobic analytes is required.

Initially a standard test mix containing the analytes of interest was screened using a generic 5-95% B reversed-phase gradient on six Avantor® ACE® novel selectivity phases (**vwr.com/ace**) using a VWR® Hitachi Chromaster HPLC system. Several of the ACE® novel phases provided good retention and selectivity for this set of compounds, with the Avantor® ACE® C18-Amide providing the most promising result. The method was then optimised to provide the separation shown in Figure 1.



Column:	Avantor® ACE® Excel® 3 C18-Amide
Dimensions:	150 x 4,6 mm
Mobile Phases:	A: 0.1% H_3PO_4 in H_2O B: 0.1% H_3PO_4 in MeCN
Gradient:	

Time (mins)	%B
0.0	5
12.0	65
15.0	95
16.0	95
16.5	5
30.0	5

Flow Rate:	1.0 ml/min
Injection:	5 µl
Temperature:	30 °C
Detection:	UV, 214 nm
Instrument:	VWR Hitachi Chromaster

Figure 1: Separation of analyte standards commonly found in energy drinks using the Avantor® ACE® C18-Amide.

The method was then applied to the analysis of two commercially available energy drinks (Figure 2) and was proved to be suitable for detection of all eight analytes without interference from other sample peaks. Energy drink samples were decarbonated and filtered, prior to direct injection onto the HPLC system. Caffeine was found to be present in the largest quantity in both energy drinks. The standard amount of caffeine found in energy drinks is 80 – 150 mg per serving, with anything containing over 150 mg/L needing to be stated as having a "high caffeine content" and being unsuitable for consumption by children and pregnant women. The two drinks analysed in this study contain approximately 300 mg and 120 mg/L of caffeine respectively. The average daily caffeine consumption for adults is recommended not to exceed 400 mg on a regular basis.

Both energy drinks analysed also contained two of the most common artificial sweeteners; aspartame and acesulfame K. These sweeteners are approximately 200x sweeter than natural sugars and are added to soft drinks to induce a sweet taste, without the associated calories of natural sugars such as sucrose. Sweeteners also do not increase blood sugar levels after consumption and so are suitable for people with diabetes. The first energy drink analysed contained two B vitamins (B5 and B6) whereas the second soft drink contained only vitamin C (ascorbic acid). All vitamins are present in very small amounts. Citric acid, benzoate and sorbate were also detected and are added to energy drinks as preservatives to increase the product shelf-life.

CONCLUSION

This short article presents a reversed-phase method for the analysis of analytes commonly found in energy drinks. The developed method was applied to two commercially available energy drinks and successfully identified the analytes, where present, with no co-elution with other sample components observed. This method is suitable for the routine analysis of energy drinks for quality control purposes and could easily be scaled to UHPLC to provide a high-throughput solution for large sample numbers or if rapid turnaround is required.

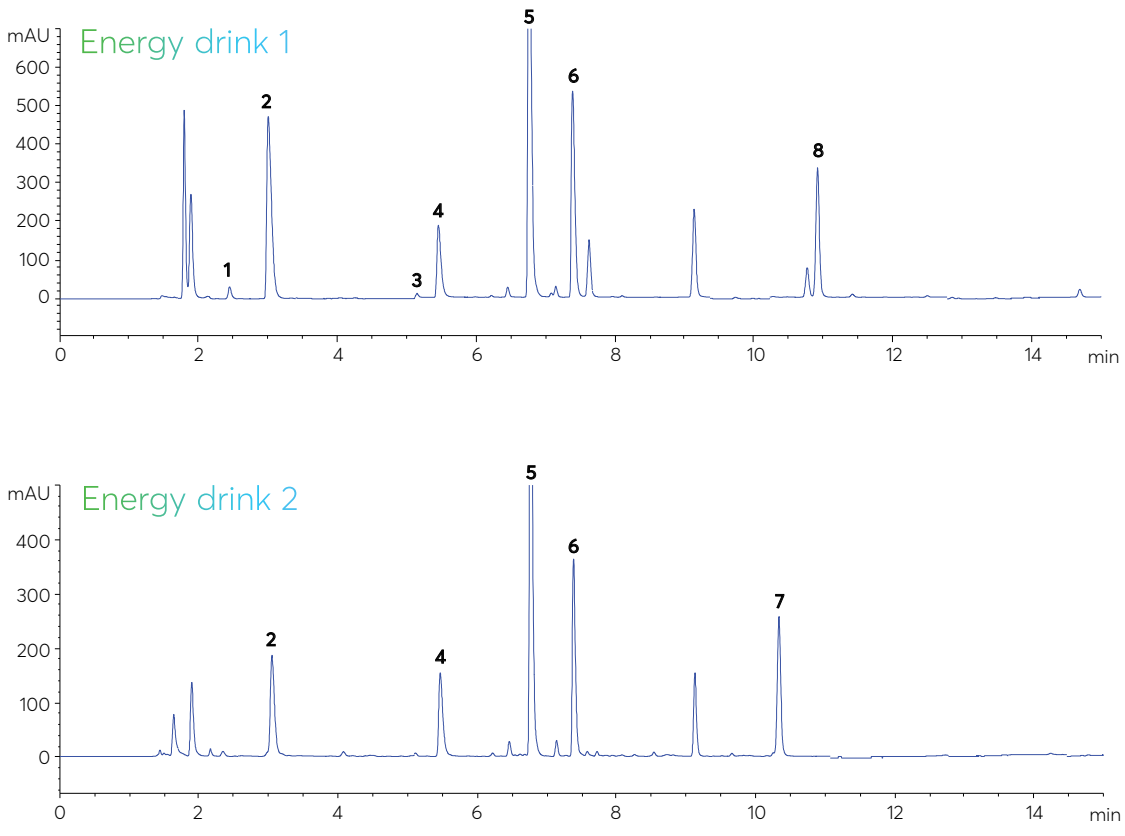


Figure 2: Analysis of two commercially available energy drinks using the method conditions as stated in Figure 1. Analytes: 1. Pyridoxine (B6), 2. Citric acid, 3. Pantothenic acid (B5), 4. Acesulfame K, 5. Caffeine, 6. Aspartame, 7. Sorbate, 8. Benzoate.

Analysis of sugars using the Avantor® ACE® NH_2 and VWR® Hitachi Chromaster

Carbohydrates are one of the most important components of foodstuffs and beverages that contribute to taste and nutritional value. The determination of carbohydrates in beverages is important for nutritional information, quality control and can be useful in the detection of adulteration. The carbohydrate component of drinks is typically comprised of simple sugars including mono- and di-saccharides, which are readily analysed in HILIC mode using an amino bonded stationary phase. The Avantor® ACE® NH_2 phase is an ultra-inert phase, bonded with a proprietary amino propyl ligand, which is ideal for the analysis of sugars. The high silica purity and proprietary bonding technology provides high robustness with excellent peak shape and column lifetime.

Figure 1 shows example separations of both monosaccharides (a) and disaccharides (b), the structures of the sugars analysed are presented in Figure 2. Full separation of both standard mixes was readily achieved on the Avantor® ACE® NH_2 with excellent resolution of the sugar components obtained. One of the challenges associated with sugar analysis is the lack of a UV chromophore, thereby eliminating the use of the ubiquitous UV detector. In this application, detection is readily achieved using a VWR® Hitachi Chromaster HPLC system equipped with a 5450 Refractive Index (RI) detector. The design of the detector provides a stable signal and minimal baseline drift which is often associated with this type of detector.

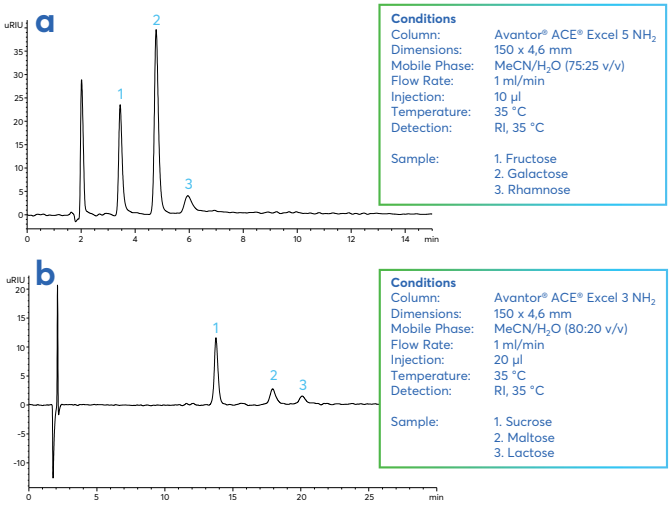


Figure 1: Separation of a) monosaccharides and b) disaccharides on the Avantor® ACE® NH2.

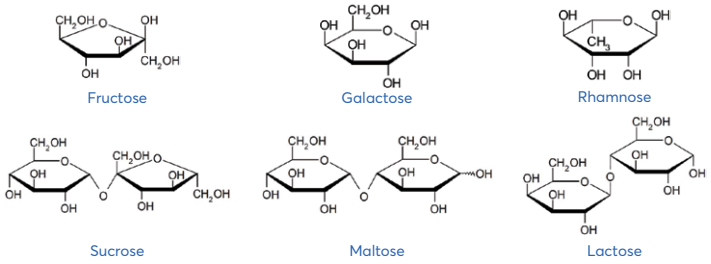


Figure 2: Structures of mono- and di-saccharides chromatographed in Figure 1.

Figure 3 shows the application of the ACE NH_2 and VWR® Hitachi Chromaster HPLC system for the analysis of sugars in three soft drinks; orange juice, cola and diet cola. Fructose, glucose and sucrose are found naturally in fruit juices and are also commonly added to sweetened soft drinks. The cola and orange juice samples were shown to contain sucrose as the main sugar component, along with its constituent monosaccharides glucose and fructose. These analytes were then demonstrated to be absent in the diet cola sample. This simple method is useful for routine screening of food and beverage samples for carbohydrate components and may also be used as a good starting point for the determination of other mono- and di-saccharides.

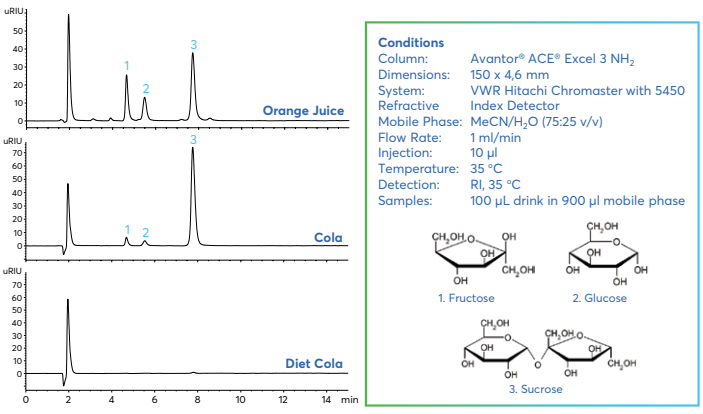


Figure 3: Separation of sugars in different soft drinks on the ACE 3 NH2.

WTW
a xylem brand

Get more secure and correct analysis of food and beverage samples

By analysing pH, conductivity, oxygen, and turbidity, manufacturers can monitor and optimise the production processes, ensure product consistency and maintain quality and safety standards.

Digital sensor systems can reduce or often even avoid failures during this analysis. The analysis is much better documented than with traditional systems. Failures like not or wrong calibrated equipment can practically not happen. Digital systems (IDS) are also far better supporting GLP demands. More details below.

pH measurement is crucial in food and beverage analysis as it affects the taste, texture, microbial safety and shelf life of products. pH levels can indicate the presence of spoilage microorganisms, fermentation processes, or chemicals.

1. Reactions that may affect product quality. For example, low pH levels in acidic pH also tells a lot about the quality and freshness of meat and cheese. The quality of meat, cheese or other semisolid food can be determined by using a spear type pH electrode like SenTix® Sp-T 900. The pH of juice and other beverages like milk can be perfectly measured by using a SenTix® 980 with the platinum diaphragm. There are more types of pH sensors eg., for surfaces or micro for small volumes.

2. Conductivity measurement provides information about the presence of dissolved ions in a sample. In food and beverage analysis, it helps to assess the content of salts, minerals, or contaminants that may impact product quality and safety. Conductivity is often employed to monitor the cleanliness of processing equipment and the degree of water hardness, which can affect the taste and texture of final products. The salt concentration in sauces, ketchup or mustard can be measured accurate with a TetraCon® 925/LV. The fork design makes cleaning easy; the four-electrode technology is insensitive against pollution.

3. Oxygen plays a critical role in food quality and shelf life. Oxygen can cause oxidative reactions, leading to the deterioration of flavours, colours, and nutritional integrity. Monitoring oxygen levels is particularly important in perishable foods prone to oxidation, such as oils, fats and beverages like beer and wine. The FDO® 925 extends below 1 mg/l the resolution up to three digits. This allows a trend display also in the very low range down to extreme low concentrations. Analysing oxygen content helps ensure product stability and extend shelf life by implementing proper packaging and storage conditions.

4. Turbidity refers to the cloudiness or clarity of a liquid caused by suspended particles. In food and beverages, turbidity analysis helps assess the quality and cleanliness of products. It can indicate the presence of unwanted particles like sediments, microbial contaminants, or other impurities. Turbidity measurement is crucial in industries such as brewing, where clarity is an essential quality attribute. In juice and other drinks, it is sometimes desirable to have an idea about pulp. With a turbidity sensor VisoTurb® 900-P it is easy to measure the turbidity and draw conclusions on the pulp content.

IDS, the digital system, is perfectly suited for supporting the quality in food and beverage analysis. IDS means:

Intelligent: IDS sensors are smart. They log on automatically, transfer description, serial number, calibration record and calibration history as well as their complete parameters.

Digital: IDS sensors process the sensitive signals into digital signals and transfer them fail-safe and error-free to the meter. There is no difference when using cable or wireless modules.

Sensor: IDS sensors are based on proven and continuously enhanced WTW® sensors. They cover almost any application in pH, conductivity, dissolved oxygen and turbidity measurement.

The IDS system is based on two components: digital sensors and corresponding field and benchtop meters. The outstanding innovation: The measurements are processed in the sensor, not in the meter: One meter for all parameters: pH – conductivity -dissolved oxygen – turbidity. All measured results are saved together with meter and sensor data for easy GLP supporting assignment and tracking, also a user administration is possible.

In conventional systems there are meters with certain sockets for defined parameters, like a pH meter with a socket for a pH sensor, another meter with a different socket to connect eg., a conductivity cell and so on. Digital (IDS) removes all these restrictions and at the same time strongly improves the documentation quality. The user can connect any type of IDS sensor to the digital meter, with cable or even wireless, using the same meter socket. They can change not only simply between different pH sensors without new calibration. They can also change to any available parameter. There is no manual setting of parameters or calibration required at all.

All this makes the digital system IDS clearly to the best choice, not only for Food & Beverage application.

For more information visit our page 'Digital Intelligent Measurement for more Accuracy and Flexibility'

Zero Waste Box™ from TerraCycle®

Zero Waste Box™ from TerraCycle®, available through Avantor®, is a complete and convenient brand neutral service. It includes the storage, shipping and recycling of many single-use safety and cleanroom items which aren't currently recyclable through conventional facilities, giving them a new life in a variety of forms.

The Zero Waste Box™ range has now been extended to include two new versions that recycle non hazardous waste and to collect any flexible packaging.

INDUSTRIAL SAFETY EQUIPMENT, ZERO WASTE BOX™

To recycle non hazardous waste including:

- Industrial safety helmets
- Hi-vis jackets
- Heavy-duty gloves
- Ear defenders
- Protective eyewear (goggles)
- Safety bump caps

LEARN MORE

PLASTIC PACKAGING, ZERO WASTE BOX™

To collect any flexible plastic packaging, carrier bags and shipping material including bubble wrap, airbags, shrink wrap, cushioning pallet liners and covers. Any hard / rigid plastic packaging and plastic containers.

LEARN MORE

TERRACYCLE ZERO WASTE BOX

HOW ARE THE DIFFERENT TYPES OF MATERIALS RECYCLED?

PLASTICS are separated by number, melted down and turned into pellets that can be moulded and extruded to produce new products.

METALS are separated by type and smelted into ingots for reuse.

GLASS is cleaned and sorted by colour for processing. It is then crushed and melted to be used in new glass products.

ORGANICS are composted or used in industrial and commercial fertilisers.

FIBRES will be hydro pulped to separate out wax or plastic. TerraCycle® will not landfill or incinerate any of the waste they receive.

With over a billion items of PPE distributed across the globe to maintain safe work environments, proactive steps need to be taken to reduce the resulting waste.

This recycling service also reduces the need to extract virgin materials and deplete resources for new production. This avoided impact is not small for the manufacture of an average product. Over 90% of the environmental impact comes from extracting and refining the raw materials from which it is made.

HOW IT WORKS

- **ORDER:** Place your order with Avantor®.
- **COLLECT:** Place your Zero Waste Box™ in a convenient location and dispose of the accepted waste in to the box.
- **RETURN:** Once full, seal your Zero Waste Box™ and return it to TerraCycle® using the pre-paid shipping label that is fixed at the back of the box.
- **RECYCLE:** The collected waste is sorted into relevant categories, then sent for processing and transformed into new products.

Your collected waste will find a second life as recycled materials, reducing the need to extract virgin materials and deplete resources.

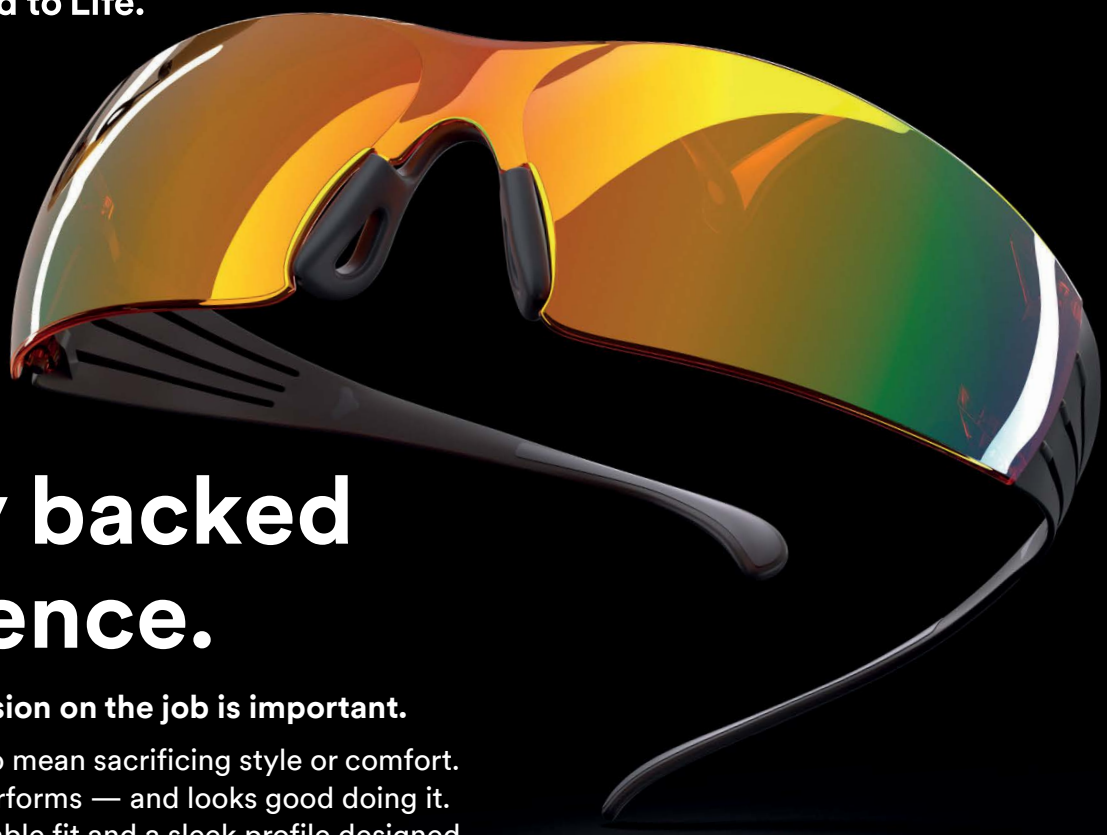
- Service currently available in Belgium, Germany, Spain, France, Ireland, Netherlands and United Kingdom
- Accepted waste type varies by region

Zero Waste Box™ is a complete and convenient brand neutral solution which includes the storage, shipping and recycling of a waste that isn't currently recycled through local councils or traditional recycling facilities.

For more information contact **Jenifer.jones@avantorsciences.com**

For more sustainable safety solutions go to **https://vwr.com/sustainable_production_supplies**

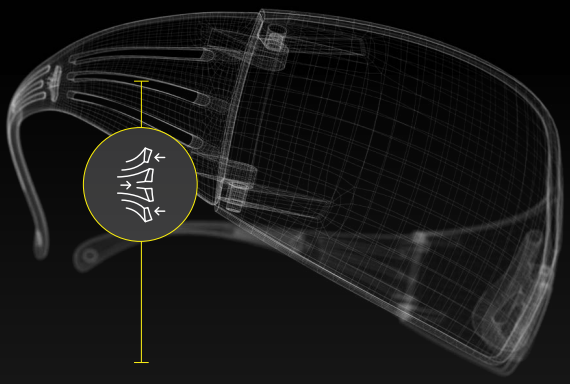
3M Science. Applied to Life.™



Safety backed by science.

Protecting your vision on the job is important.

But it doesn't have to mean sacrificing style or comfort. Get eyewear that performs — and looks good doing it. Featuring a comfortable fit and a sleek profile designed to work with other personal protective equipment, 3M™ SecureFit™ Safety Glasses helps keep you safe and comfortable on the job.



3M™ Pressure Diffusion Temple Technology.

3M's innovative temple design features slotted ribs that provide comfortable pressure equalisation, allowing the temples to flex and self-adjust to the size and shape of the wearer's head. Regardless of head size, from small heads to large heads, this technology is designed to provide a secure and comfortable fit for an extended period of wear time.

Meet the family!

The newest family members are the 100 Series, providing sleek, comfortable eye protection at an economical price and the 500 Series, featuring a contemporary lens design with adjustable ratcheting temples for a more personalised fit.

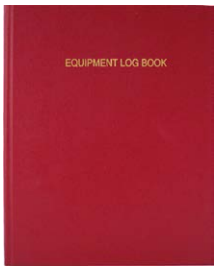
View the range

VWR® Laboratory notebooks

To store data, details and reminders

Covers and binding are made from durable materials that protect indispensable documents from water or chemicals. Numbered pages and fill-in spaces for specific data guarantee that owners will always remain organised. Many models include periodic and conversion tables in the back for convenient reference.

- Available with many options (type, Farbe, paper size, etc)
- All books are made in accordance with GLP, GMP and GCP guidelines
- Customisation service is available on request



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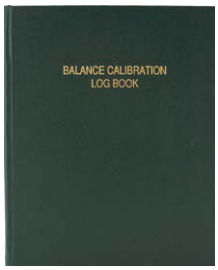

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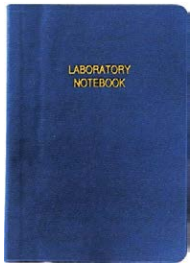

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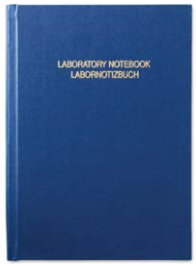

VWR® LABORATORY NOTEBOOKS
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- Full coloured laminate
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- 100s of custom options

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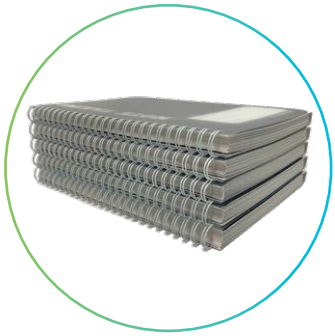

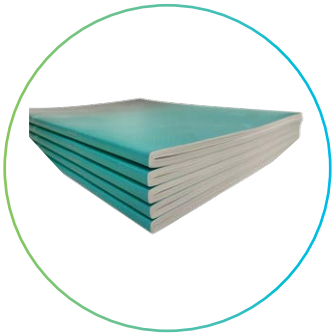

Languages available: English, English/French, English/German and English/Spanish
Minumum order quantity: 50 pcs

FOCUS:
FOOD & BEVERAGE
2024-2025

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Avantor® is a leading global provider of mission-critical products and services to customers in the life sciences and advanced technologies & applied materials industries. The company operates in more than 30 countries and delivers an extensive portfolio of products and services. As our channel brand, VWR® offers an integrated, seamless purchasing experience that is optimised for the way our customers do business. We set science in motion to create a better world. For information visit, **avantorsciences.com** and **vwr.com**.

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