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Wine and beer applications compendium

Gallery Discrete Analyzer

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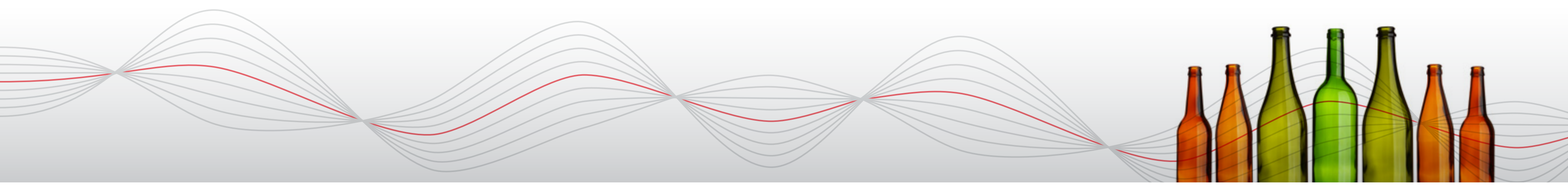

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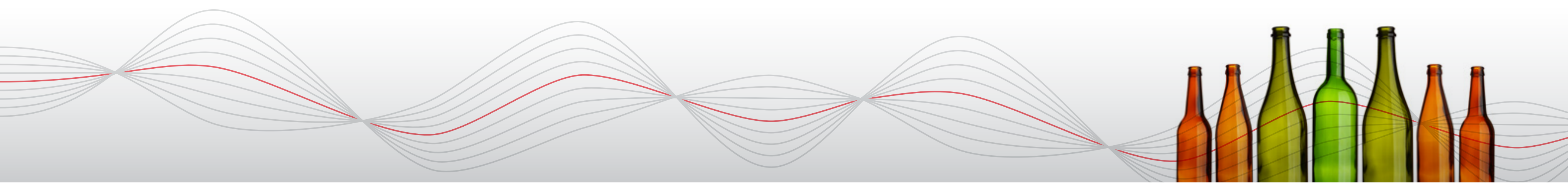
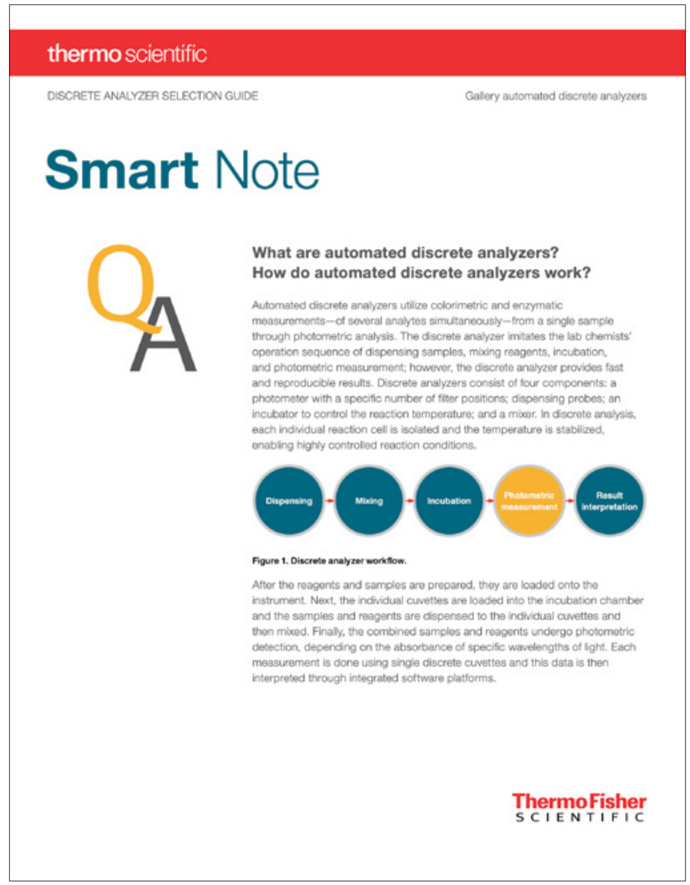


What are automated discrete analyzers?
How do automated discrete analyzers work?

Overview

Automated discrete analyzers utilize colorimetric and enzymatic measurements from a single sample through photometric analysis. The Thermo Scientific™ Gallery™ Discrete Analyzer imitates the lab chemists' operation sequence of dispensing samples, mixing reagents, incubation, and photometric measurement. The discrete analyzer provides fast and reproducible results. In discrete analysis, each individual reaction cell is isolated and the temperature is stabilized, enabling highly controlled reaction conditions.

This smart note introduces you to automated discrete analyzer technology and how they function.



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DISCRETE ANALYZER SELECTION GUIDE

Gallery automated discrete analyzers

Smart Note

Q A

What are automated discrete analyzers?
How do automated discrete analyzers work?

Automated discrete analyzers utilize colorimetric and enzymatic measurements—of several analytes simultaneously—from a single sample through photometric analysis. The discrete analyzer imitates the lab chemists' operation sequence of dispensing samples, mixing reagents, incubation, and photometric measurement; however, the discrete analyzer provides fast and reproducible results. Discrete analyzers consist of four components: a photometer with a specific number of filter positions; dispensing probes; an incubator to control the reaction temperature; and a mixer. In discrete analysis, each individual reaction cell is isolated and the temperature is stabilized, enabling highly controlled reaction conditions.

Dispensing → Mixing → Incubation → Photometric measurement → Result interpretation

Figure 1. Discrete analyzer workflow.

After the reagents and samples are prepared, they are loaded onto the instrument. Next, the individual cuvettes are loaded into the incubation chamber and the samples and reagents are dispensed to the individual cuvettes and then mixed. Finally, the combined samples and reagents undergo photometric detection, depending on the absorbance of specific wavelengths of light. Each measurement is done using single discrete cuvettes and this data is then interpreted through integrated software platforms.

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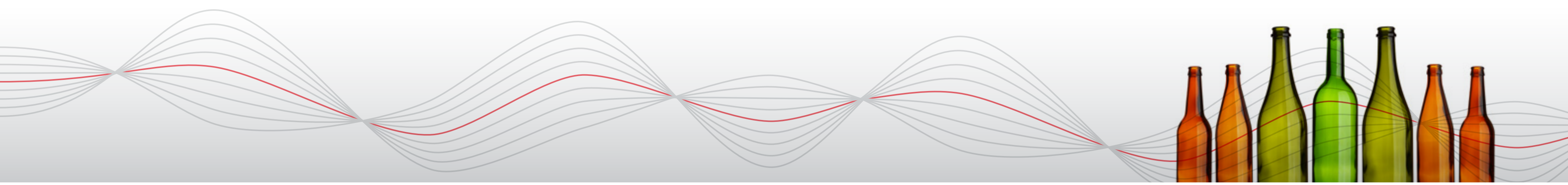

What is better for automating wet chemical analysis? Integrated discrete analyzer or flow analyzers?

Overview

In general, Flow Injection Analyzers (FIA), Segmented Flow Analyzers (SFA) or Continuous Flow Analyzers (CFA) are batch analyzers, meaning they are particularly suitable for analyzing a few parameters for a large number of samples. Flow systems use specific detector modules, reagents delivery and mixing, which limits the number of parameters that they can test per sample. Typically, flow systems test 2 to 6 maximum different parameters per sample. If a laboratory is looking for an easy-to-use, high throughput, expandable, multiparameter, wet chemistry analyzer for large numbers of samples, then integrated discrete analyzers are better suited than FIA, SFA, or CFA.

This smart note details comparisons between the different technologies and walks you through the advantages of each technology.

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SMART NOTE

Gallery discrete analyzers

What is better for automating wet chemical analysis? Integrated discrete analyzer or flow analyzers?

Technology selection considerations should be based on various factors:

- Current and future sample analysis load
- Additional costs incurred by adding additional tests
- Number of parameters per sample
- Complexity of wet chemistry parameters testing for each sample
- Detection limits
- Reagent consumption
- Waste generation
- Cost per analysis
- User's skill level
- Regulatory requirements
- Maintenance and bench space requirement of equipment
- Total cost of ownership and Return on Investment (ROI)

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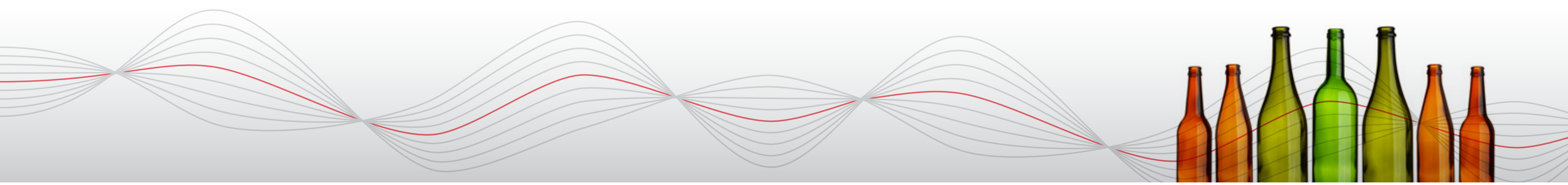

How discrete wet chemical analysis is bringing flexible, cost-effective multiparameter testing to the beverage industry

Overview

Multiparameter beverage analysis with discrete analyzer technology ensures high product quality and throughput, while reducing cost, waste and hands-on sample time. This approach is used with great success in Montana State University's Barley, Malt & Brewing Quality Lab, USA, which performs integrated malt testing with the Gallery discrete analyzer.

This executive summary explains how and why the laboratory uses the Gallery discrete analyzer for testing, and reveals how it has enabled consistency, compliance and quality, and expanded the lab's analytical capabilities.

View related on-demand webinar
Quality attributes of beverage testing by integrated wet chemical analyzer

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EXECUTIVE SUMMARY 73267

How discrete wet chemical analysis is bringing flexible, cost-effective multiparameter testing to the beverage industry

Deck: Multiparameter beverage analysis with discrete analyzer technology ensures high product quality and throughput, while reducing cost, waste and hands-on sample time. This approach is used with great success in Montana State University's Barley, Malt & Brewing Quality Lab, USA, which performs integrated malt testing with the Thermo Scientific™ Gallery™ discrete analyzer.

Introduction

When producing any type of product, quality and consistency are key—and nowhere is this more true than in the beverage industry. From testing water at the point of entry to assessing batches of end product, screening for potential performance issues to ensure a consistent, high-quality outcome is essential across all stages of production.

Traditional methods of wet chemical analysis test for various parameters using continuous flow technology. Parameters range from those affecting taste and color to those impacting product development and stability, and each plays a crucial role in quality assurance (QA). But such techniques can be labor intensive and time-consuming. Testing for more than one parameter with traditional wet chemical analysis requires multiple techniques, instruments and highly skilled operators, adding time, cost and complexity to the beverage production process.

However, innovative discrete analyzers offer a different approach: one that is automated, streamlined and more cost-effective. The benefits of such technology were discussed in a SelectScience webinar exploring the application of the Thermo Scientific Gallery discrete analyzer at Montana State University's Barley, Malt & Brewing Quality Lab, USA. This summary provides an overview of how and why the laboratory uses the Gallery discrete analyzer for testing, and reveals how it has enabled consistency, compliance and quality, and expanded their analytical capabilities.

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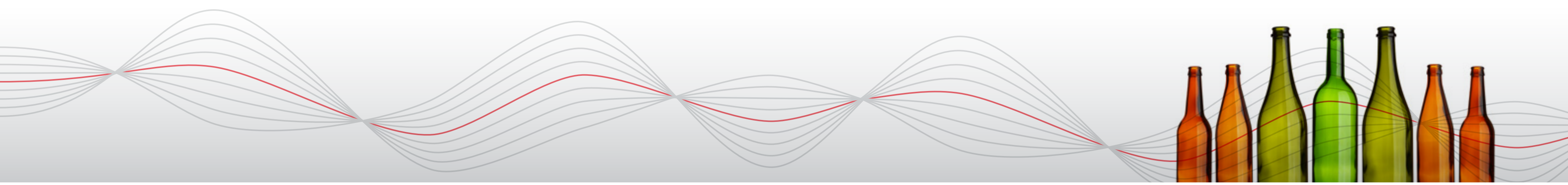
View the full executive summary



Combine selectivity and sensitivity for rapid multi-parameter sugar analysis with automated discrete analyzers

Overview

Sugar analysis is a critical quality assurance and control (QA/QC) parameter in many manufacturing industries, from the production of wine and beer to the creation of vaccines and biofuels. Whenever sugar is an ingredient or product, analysis is key to assessing process progression and product quality. However, since sugars are often part of a complex matrix and are closely connected to other quality parameters, analysis is often challenging.

This executive summary provides an overview of a Thermo Fisher Scientific webinar presented by Dr. Hari Narayanan on Rapid Sugar Analysis by Automated Discrete Analyzer. During the session, Dr. Narayanan demonstrates how this automated method can achieve rapid sugar analysis through enzymatic methods with photometric detection. While delivering selectivity and sensitivity, the technique delivers results in a fraction of the time, compared to more traditional methods. With automated workflows, higher throughputs and a reduced skill requirement, laboratories can now produce up to 350 sugar assays per hour, a four-fold increase on the number offered by traditional methods.

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EXECUTIVE SUMMARY 73996

Combine selectivity and sensitivity for rapid multi-parameter sugar analysis with automated discrete analyzers

Sugar analysis is a critical quality assurance and control (QA/QC) parameter in many manufacturing industries, from the production of wine and beer to the creation of vaccines and biofuels. Whenever sugar is an ingredient or product, analysis is key is to assessing process progression and product quality. However, since sugars are often part of a complex matrix and are closely connected to other quality parameters, analysis is often challenging.

For many years, QA/QC laboratories have been relying on multiple techniques to elucidate results, determining sugar in a variety of matrices with complex technology, such as titration, high-performance liquid chromatography (HPLC) and ion chromatography (IC). These techniques rely on highly skilled operators running complicated, error-prone and time-consuming workflows and, in fast-paced manufacturing environments and contract testing laboratories, sugar analysis places huge pressures on over-worked QA/QC teams. Since delayed results mean delayed decision-making, time-consuming techniques can be damaging to industries that rely on continuous monitoring to deliver safe products that meet brand standards.

This executive summary provides an overview of a recent Thermo Fisher Scientific webinar presented by Dr. Hari Narayanan on Rapid Sugar Analysis by Automated Discrete Analyzer. During the session, Dr. Narayanan demonstrated how this automated method can achieve rapid sugar analysis through enzymatic methods with photometric detection. While delivering selectivity and sensitivity, the technique delivers results in a fraction of the time, versus the more traditional methods. With automated workflows, higher throughputs and a reduced skill requirement, laboratories can now produce up to 350 sugar assays per hour, a four-fold increase on the number offered by traditional methods.

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View the full executive summary

How discrete wet chemical analysis is bringing flexible, cost-effective multiparameter testing to the beverage industry

Overview

For all beverages, the compositional quality and safety must be monitored to help track contamination, adulteration, and product consistency, and to ensure regulatory compliance from raw ingredients (water, additives, and fruits) to the final product.

Analytes of interest include process critical parameters in alcoholic beverages such as NOPA, beta-glucan, alpha-amylase, polyphenol, ions, sugars, organic acids, alcohol, color, metals, protein, and titration parameters such as free and total SO_2 and enzymes.

This analytical guide summarizes the use of the Gallery discrete analyzers to detect the various analytes of interest, their respective methods, chemistries, reagents required, calibration curves, precision summaries, and method performance linearities.

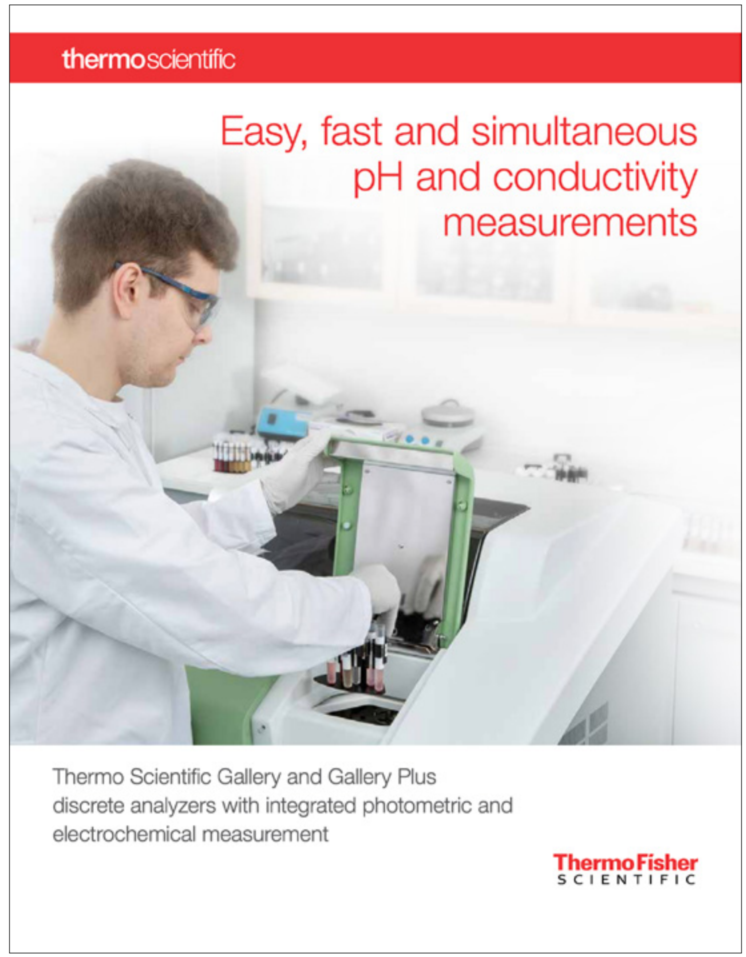
View the analytical guide

Easy, fast and simultaneous pH and conductivity measurements

Overview

pH and conductivity measurements provide crucial insight for a range of industries, including the food and beverage, industrial process, enzyme kinetics and water analysis sectors. Fast, accurate and cost-effective pH and conductivity measurement workflows create the stream of regular, meaningful data that drives important decisions. By regularly testing all parameters of a manufacturing line, process problems are detected early, enabling intervention and improvements that protect equipment, product consistency and quality standards. In turn, the collection of accurate and timely data provides evidence for regulatory approval and audit submissions.

This brochure discusses how the integrated electrochemical measurement (ECM) module in the Gallery discrete analyzers provides parallel, automated electrochemical measurement of pH and conductivity along with complete photometric testing.



View the full brochure

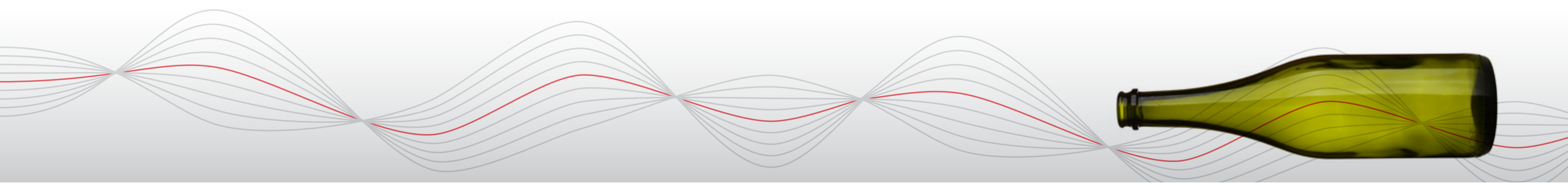
Simplified wine analysis for walkaway efficiency

Overview

Effective quality monitoring during different production stages improves productivity and ensures consistent product. For this reason and for effective vinification process control, a tight quality control through an in-house laboratory is recommended. The ability to measure and manage the levels of wine spoilers in juice or wine ensures a good final product. Whether you make white wine, red wine, rosé wine, sparkling wine, or grape juice, routine multiparameter measurement gives accurate information on the spot, just when you need it. A new wealth of analytical data allows oenologists to track wine production more closely at every stage, from grape juice all the way to bottling and shipping, and to make any necessary process optimization at the right moment.

This brochure explains how Gallery discrete analyzers, together with the ready-to-use enzymatic reagents, can perform multi-parameter analysis that enables lab personnel with limited technical or chemistry knowledge to carry out routine wine analysis with walkaway productivity from juice to wine bottling testing.

View the full brochure

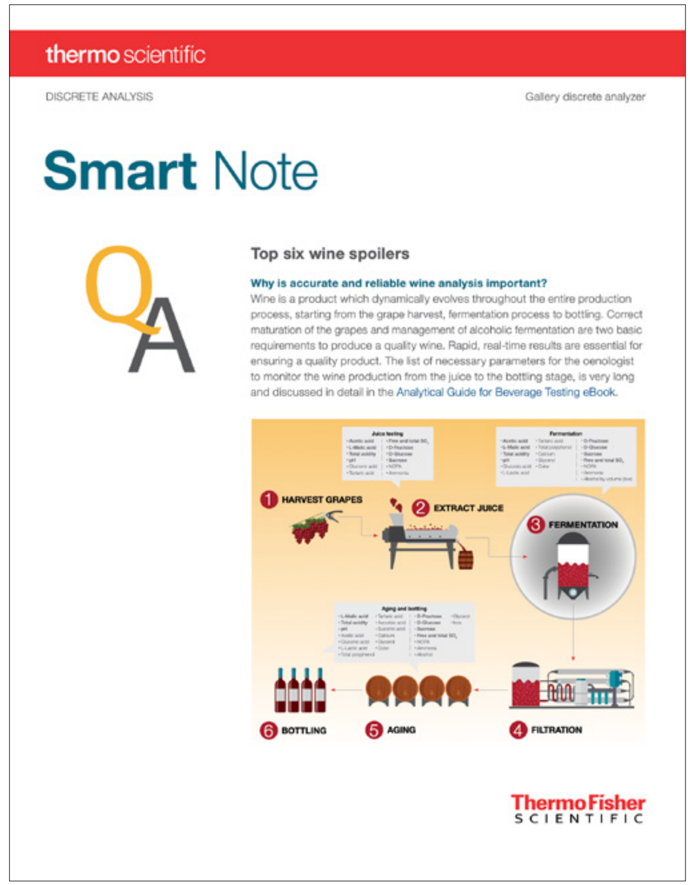


Top six wine spoilers
Why is accurate and reliable wine analysis important?

Overview

Wine is a product which dynamically evolves throughout the entire production process, starting from the grape harvest to the fermentation process to bottling. Correct maturation of the grapes and management of alcoholic fermentation are two basic requirements to produce a quality wine. Rapid, real-time results are essential for ensuring a quality product.

This smart note lists the top six chemical parameters that ruin wine if they are not monitored and corrected.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DISCRETE ANALYSIS | Gallery discrete analyzer

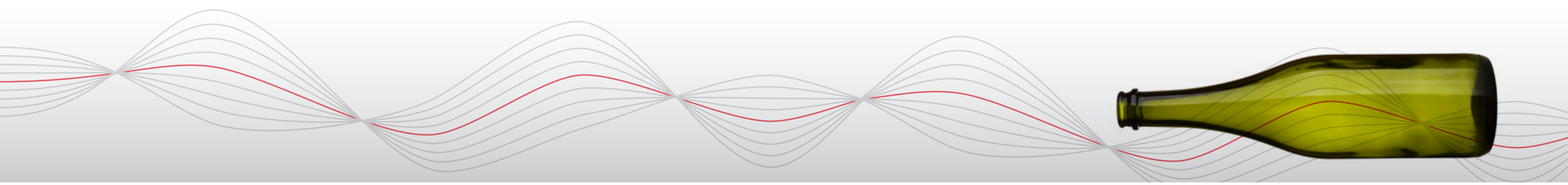
Smart Note

Top six wine spoilers

Why is accurate and reliable wine analysis important?

Wine is a product which dynamically evolves throughout the entire production process, starting from the grape harvest, fermentation process to bottling. Correct maturation of the grapes and management of alcoholic fermentation are two basic requirements to produce a quality wine. Rapid, real-time results are essential for ensuring a quality product. The list of necessary parameters for the oenologist to monitor the wine production from the juice to the bottling stage, is very long and discussed in detail in the Analytical Guide for Beverage Testing eBook.

View the full smart note



Fast and accurate automated method for free sulfite analysis in wine

Overview

Sulfur dioxide (SO_2) is added to control the process of wine making. The presence of total SO_2, both free and bound, is regulated and, as a result, a warning statement is required on wine labels because sulfite is considered an allergen. The European Union established a maximum permitted level of total SO_2 in wine varying from 150 to 500 mg/L which is dependent upon the sugar level of the product.

In the USA, the maximum level of total SO_2 permitted is 350 mg/L. The measurement of both total and free SO_2 can be automated using Thermo Scientific™ system reagents and Gallery discrete analyzers.

In this study, an automated method to measure free SO_2 in wine samples is presented. The method is based on the reaction between sulfur dioxide, p-rosaniline hydrochloride, and formaldehyde. This method is designed to use optimal reagent concentrations and volumes to provide accurate results. The concentration of free SO_2 in the sample is calculated automatically from a calibration curve. This method enables a laboratory to fully automate SO_2 determinations and replace traditional time-consuming reference and distillation methods.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APPLICATION NOTE 71451

Fast and accurate automated method for free sulfite analysis in wine

Authors
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Keywords
Discrete Analyzer, Photometric Analyzer, Gallery Analyzer, Arena

Goal
To develop a method for free sulfite analysis in wine using automated discrete photometry

Introduction
Sulfur dioxide (SO_2) is added to control the process of wine making. It serves many useful functions, for example, it acts as an enzyme inhibitor in musts preventing juice from browning. As a microbiological control agent, SO_2 is added to the winemaking process to prevent oxidation in the finished product.

Sulfur dioxide can be found in wine in its free forms, SO_2 (gas) and bisulfate ion (HSO_3^-), or bound to compounds that incorporate a carbonyl group, such as acetaldehyde. Free forms of SO_2 are pH and temperature dependent and because of the acidic nature of wines, SO_2 is usually present and measured as bisulfate ion (HSO_3^-). Results are reported as SO_2.

The presence of total SO_2, both free and bound, is regulated and, as a result, a warning statement is required on wine labels because sulfite is considered an allergen. The European Union established a maximum permitted level of total SO_2 in wine varying from 150 to 500 mg/L which is dependent upon the sugar level of the product.

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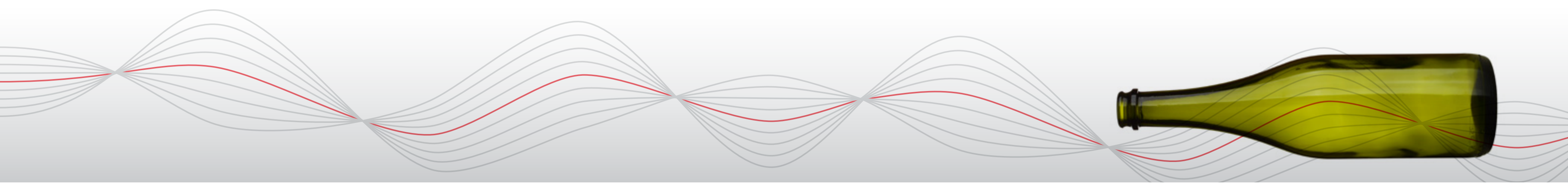

Evaluation of a fully automated method for the measurement of glycerol in wine

Overview

Glycerol is the third most common chemical compound in wines and an important by-product of alcoholic fermentation. Usually the glycerol concentration in wines is around 5 g/L, but concentrations can be as high as 15–20 g/L and depend upon fermentation conditions, especially the level of sulfur dioxide. The influence of glycerol in finished wine is usually at or below the level of sensory perception. Wines with elevated levels of alcohol tend to have more body and viscosity and a sweet taste, which has often been attributed to the presence of glycerol.

The purpose of this study is to evaluate the performance of the Thermo Scientific system reagent kit for determination of glycerol in wine using a Thermo Scientific discrete analyzer to complete the photometric measurements. Results are compared to those analyzed with the WineScan™ FT120 analyzer (FOSS). Five proficiency test samples, analyzed by the accredited enzymatic reference method of ALKO, Inc., are also analyzed with the discrete analyzer.


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APPLICATION NOTE 71838

Evaluation of a fully automated method for the measurement of glycerol in wine

Authors
Mari Kivluoma,[1] Leena Kaski,[1] Annu Suoniemi-Kähärä,[1] Pekka Lehtonen[2]
[1]Thermo Fisher Scientific, Vantaa, Finland
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Keywords
DA, Discrete Analysis, Gallery, Arena, Gallery Plus, 20XT, WineScan, Glycerol, Fermentation, FOSS

Goal
To demonstrate that the automated discrete analyzer method for analysis of glycerol in wine provides comparable results to the WineScan™ FT120 FOSS and accredited enzymatic methods, while also allowing multiple automated tests to be performed on the same sample.

Introduction
During fermentation, glycerol is synthesized from the glucose within yeast cells. Glucose is converted to glyceraldehyde-3-phosphate and dehydroxyacetone phosphate. Most of the dehydroxyacetone phosphate produced converts to glyceraldehyde-3-phosphate eventually producing ethanol. The remainder produces glycerol.

Glycerol is the third most common chemical compound in wines and an important by-product of alcoholic fermentation. Usually the glycerol concentration in wines is around 5 g/L, but concentrations can be as high as 15-20 g/L and depend upon fermentation conditions, especially the level of sulfur dioxide. The influence of glycerol in finished wine is usually at or below the level of sensory perception. Wines with elevated levels of alcohol tend to have more body and viscosity and a sweet taste which has often been attributed to the presence of glycerol.

The purpose of this study is to evaluate the performance of the Thermo Scientific™ system reagent kit for determination of glycerol in wine using a Thermo Scientific™ Arena™ discrete analyzer to complete the photometric measurements. Results are compared to those analyzed with the WineScan™ FT120 analyzer (FOSS). Five proficiency test samples, analyzed by the accredited enzymatic reference method of ALKO, Inc., are also analyzed with the Arena discrete analyzer.

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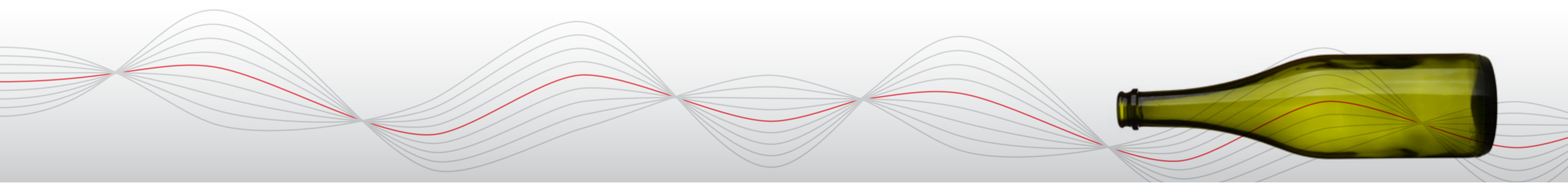

Refining the craft of winemaking through automated analysis

Overview

Celebrating a period of huge growth, King Estate Winery in Oregon, US, invested in the Thermo Scientific Gallery discrete analyzer to automate quality control processes and support the much-increased production capacity.

Time-consuming, error-prone and manual analysis processes were eliminated, resulting in many benefits detailed in this case study.


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CASE STUDY 74102

Refining the craft of winemaking through automated analysis

King Estate Winery: A success story of sustainable growth rooted in quality control

Celebrating a period of huge growth, King Estate Winery in Oregon, US, invested in the Thermo Scientific™ Gallery™ Discrete Analyzer to automate quality control processes and support the much-increased production capacity. Time-consuming, error-prone and manual analysis processes were eliminated, resulting in many benefits, including:

- Increased efficiencies and reduced spoilage rates delivered through complete monitoring of the entire end-to-end winemaking process
- Analysis tasks reduced from days to hours, greatly expanding the laboratory's capacity for sample processing
- Even subtle shifts in maturation are now identified, quantified and remedied through interrogation of the winemaking process

King Estate Winery is a sight to behold. Set in over 1,000 acres amid the mountains and hills of the beautiful Willamette Valley, near Eugene, Oregon, King Estate Winery is the largest Biodynamic® certified vineyard in North America. With 470 organic acres under vine, it is famous for its Pinot Gris and Pinot Noir varieties, mostly grown on-site, and for its wide range of distinctive and expertly crafted white, red and rosé wines. Established in 1991 by the King family, King Estate Winery is a thriving family business, rooted in sustainable practices and producing over 300,000 cases each year.

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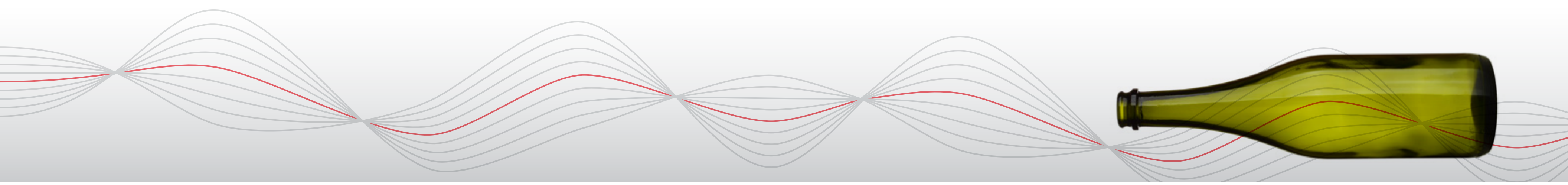
View the full case study



Robust and reliable, an automated analyzer increases efficiency at a Napa Valley winery

Overview

Merryvale Family of Wines includes the brand names Starmont, Brown Ranch, and Profile. Starmont Winery and Vineyards, a member of Merryvale Family of Wines became an integral part of the Merryvale family about fifteen years ago for the purpose of delivering high quality wines at approachable prices.

The laboratory at Starmont updated their ailing equipment to include a Thermo Scientific™ Gallery™ Plus discrete analyzer to replace an old model plate reader which had many mechanical and software related issues leading to excessive time consumption and inefficiencies.

Read more about the benefits from test automation and the test parameters the Starmont winery runs in this case study.

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CASE STUDY

Robust and reliable, an automated analyzer increases efficiency at a Napa Valley winery

Merryvale Family of Wines

Merryvale Family of Wines includes the brand names Starmont, Brown Ranch, and Profile. One of the buildings they currently occupy on Main St. in St. Helena, California was the first winery constructed in 1933 shortly after the Repeal of Prohibition in the United States and is considered a favorite among tourists visiting Napa Valley.

Starmont Winery and Vineyards, a member of Merryvale Family of Wines, is situated at the crossroads of Carneros and Napa Valley, two major wine growing regions in Northern California. Occupying a portion of historic Stanly Ranch, this region has been growing grapes for over 150 years and is renowned for its Chardonnay and Pinot Noir varietals. The Starmont name became an integral part of the Merryvale family about fifteen years ago for the purpose of delivering high quality wines at approachable prices. At that time, fifty acres of Stanly Ranch property were acquired and they constructed a state-of-the-art "green" facility on the site capable of recycling 100% of the winery's process water, diverting 98% of production waste away from local landfills, and generating electricity to power 250 homes each day. Their current wine portfolio includes Pinot Noir and Chardonnay, as well as Cabernet Sauvignon, Merlot, Sauvignon Blanc, and Rose.

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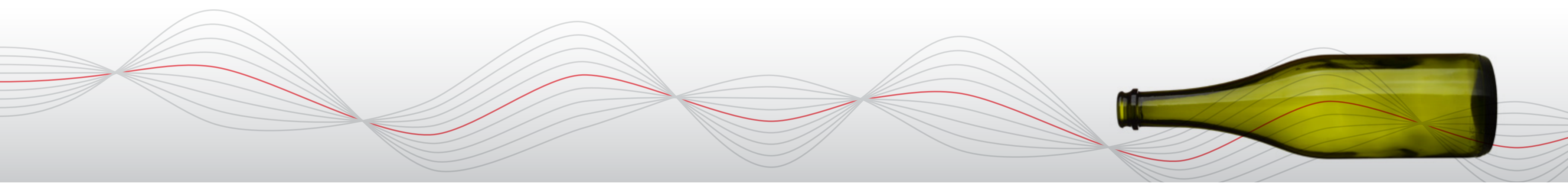
View the full case study



Testing time decreases ten-fold for a commercial wine lab in Germany

Overview

Weinlabor Braun, a commercial wine analysis laboratory located in the heart of the Pfalz, Germany wine region, tests up to 120 samples per day during their busiest testing period from October to April, during and immediately after harvest. In the laboratory, they have been able to replace older HPLC methods with a Gallery discrete analyzer to test organic acids and other key parameters.

Read more in this case study about the improved productivity the laboratory realizes from switching to a Gallery discrete analyzer.

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CASE STUDY

Testing time decreases ten-fold for a commercial wine lab in Germany

The Pfalz wine region is a narrow nine-mile stretch of land sheltered to the west by the Pfazerwald and bordered to the east by the Rhine River. It is the second largest German wine grape growing region and extends as far south as the Alsace region in France. The ratio of grapevines to people in this idyllic landscape is said to be 600:1. One of Germany's warmest growing regions boasting an average 1800 hours of sunshine per year, the Pfalz region's grapes benefit from dry summers and mild winters. Reisling is the most common white wine varietal grown followed closely by a red wine varietal called Dornfelder.

Weinlabor Braun, a commercial wine analysis laboratory located in the heart of the Pfalz wine region, tests the following local varietals: Riesling, Silvaner, Pinot Blanc, Pinot Grigio, Chardonnay, Dornfelder, Pinot Noir, and Portugieser. Gunter Braun, his wife Ewa, and two part time associates process about 10,000 samples per year for alcohol, sugar, total acid, density, and sulfite aiming to meet certain strict parameters so that the finished wine can be labeled from this region. The laboratory is officially certified by the Chamber of Agriculture Reinland-Pfalz to examine and provide quality control for wine and sparkling wine from the region.

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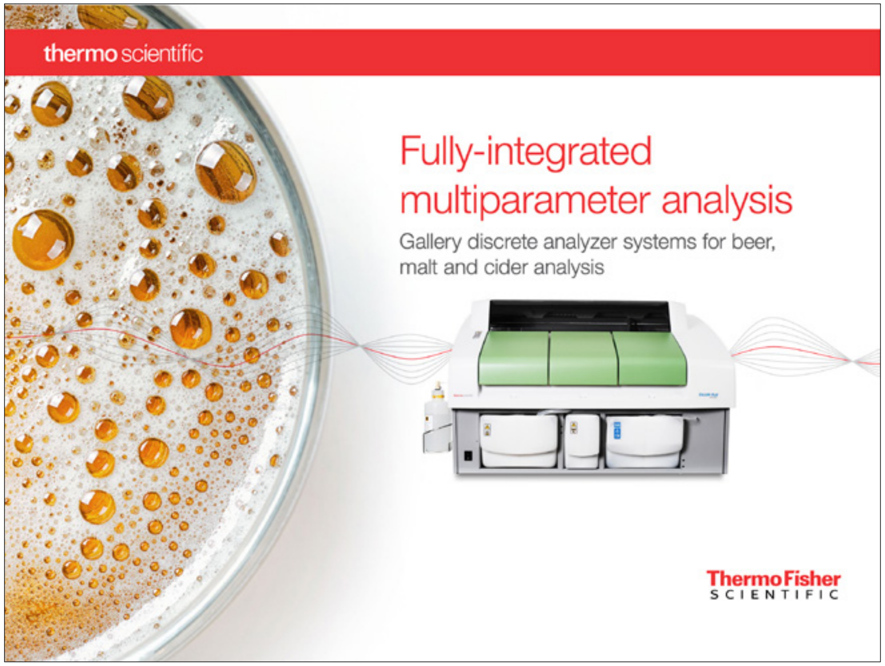
View the full case study

Fully-integrated multiparameter analysis Gallery discrete analyzer systems for beer, malt and cider analysis

Overview

For growing laboratories that perform routine brewing and malting analysis while experiencing increased demand for routine analytical services, Gallery discrete analyzers automate labor-intensive and time-consuming beer, cider, malt and wort testing. The discrete analyzer simultaneously automates the determination of analytes, like beta-glucan, NOPA and SO_2 from a single sample—offering fast sample turnaround and expanding your laboratory's analytical capabilities. Automated discrete analysis is also more flexible—able to perform many different reactions within a single instrument, thus simultaneously analyzing multiple analytes—all managed by one technician.

This brochure details the benefits of automated workflow and fast analysis that Gallery discrete analyzers can help you achieve in beer, malt, and cider analysis.



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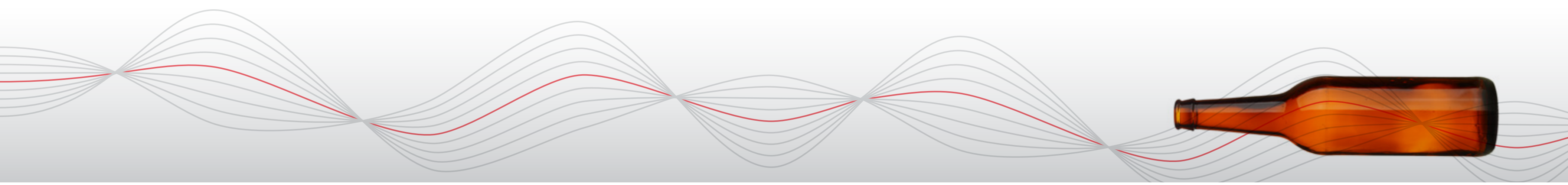


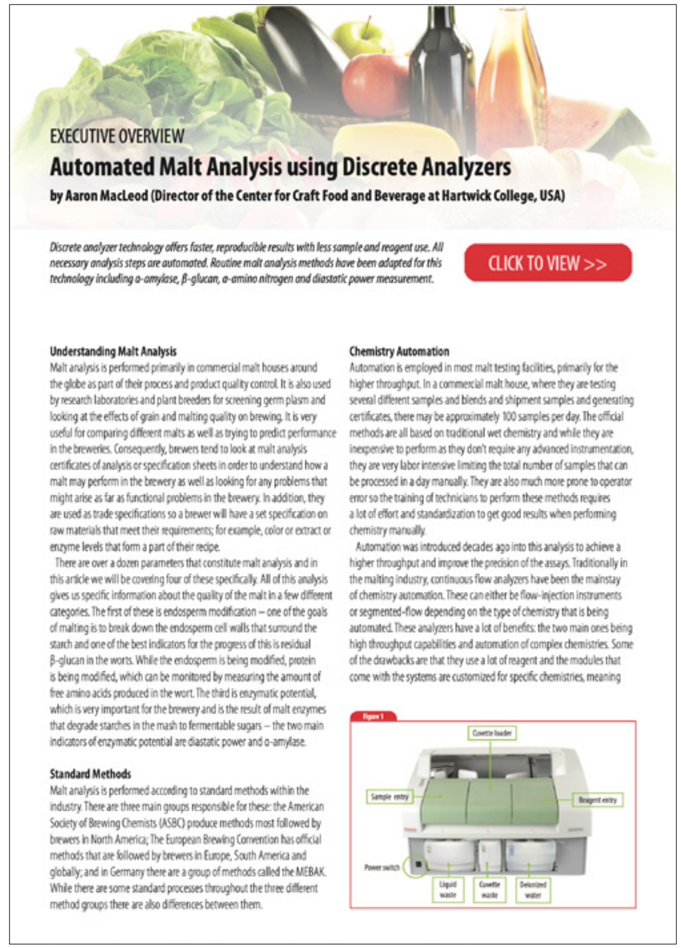
Automated malt analysis using discrete analyzers

Overview

Discrete analyzer technology offers faster, reproducible results with less sample and reagent use. All necessary analysis steps are automated. Routine malt analysis methods have been adapted for this technology including alpha-amylase, beta-glucan, alpha-amino nitrogen and diastatic power measurement.

The American Society of Brewing Chemists (ASBC) has adopted the four methods for malt analysis using discrete analyzers. ASBC reports conclude that the repeatability and reproducibility coefficients of variation for free amino nitrogen, beta-glucan, alpha-amylase, and diastatic power in malt by automated discrete analysis were acceptable and similar to the results from using the segmented flow analysis.

In this executive overview and webinar presented by Mr. Aaron McLeod, discover new approaches for automation of malt chemistries and potential benefits and cost-efficiencies of discrete analysis methods in this executive overview.



EXECUTIVE OVERVIEW

Automated Malt Analysis using Discrete Analyzers

by Aaron MacLeod (Director of the Center for Craft Food and Beverage at Hartwick College, USA)

Discrete analyzer technology offers faster, reproducible results with less sample and reagent use. All necessary analysis steps are automated. Routine malt analysis methods have been adapted for this technology including α-amylase, β-glucan, α-amino nitrogen and diastatic power measurement.

CLICK TO VIEW >>

Understanding Malt Analysis

Malt analysis is performed primarily in commercial malt houses around the globe as part of their process and product quality control. It is also used by research laboratories and plant breeders for screening germ plasm and looking at the effects of grain and malting quality on brewing. It is very useful for comparing different malts as well as trying to predict performance in the breweries. Consequently, brewers tend to look at malt analysis certificates of analysis or specification sheets in order to understand how a malt may perform in the brewery as well as looking for any problems that might arise as far as functional problems in the brewery. In addition, they are used as trade specifications so a brewer will have a set specification on raw materials that meet their requirements; for example, color or extract or enzyme levels that form a part of their recipe.

There are over a dozen parameters that constitute malt analysis and in this article we will be covering four of these specifically. All of this analysis gives us specific information about the quality of the malt in a few different categories. The first of these is endosperm modification – one of the goals of malting is to break down the endosperm cell walls that surround the starch and one of the best indicators for the progress of this is residual β-glucan in the worts. While the endosperm is being modified, protein is being modified, which can be monitored by measuring the amount of free amino acids produced in the wort. The third is enzymatic potential, which is very important for the brewery and is the result of malt enzymes that degrade starches in the mash to fermentable sugars – the two main indicators of enzymatic potential are diastatic power and α-amylase.

Standard Methods

Malt analysis is performed according to standard methods within the industry. There are three main groups responsible for these: the American Society of Brewing Chemists (ASBC) produce methods most followed by brewers in North America; The European Brewing Convention has official methods that are followed by brewers in Europe, South America and globally; and in Germany there are a group of methods called the MEBAK. While there are some standard processes throughout the three different method groups there are also differences between them.

Chemistry Automation

Automation is employed in most malt testing facilities, primarily for the higher throughput. In a commercial malt house, where they are testing several different samples and blends and shipment samples and generating certificates, there may be approximately 100 samples per day. The official methods are all based on traditional wet chemistry and while they are inexpensive to perform as they don't require any advanced instrumentation, they are very labor intensive limiting the total number of samples that can be processed in a day manually. They are also much more prone to operator error so the training of technicians to perform these methods requires a lot of effort and standardization to get good results when performing chemistry manually.

Automation was introduced decades ago into this analysis to achieve a higher throughput and improve the precision of the assays. Traditionally in the malting industry, continuous flow analyzers have been the mainstay of chemistry automation. These can either be flow-injection instruments or segmented-flow depending on the type of chemistry that is being automated. These analyzers have a lot of benefits: the two main ones being high throughput capabilities and automation of complex chemistries. Some of the drawbacks are that they use a lot of reagent and the modules that come with the systems are customized for specific chemistries, meaning

Figure 1

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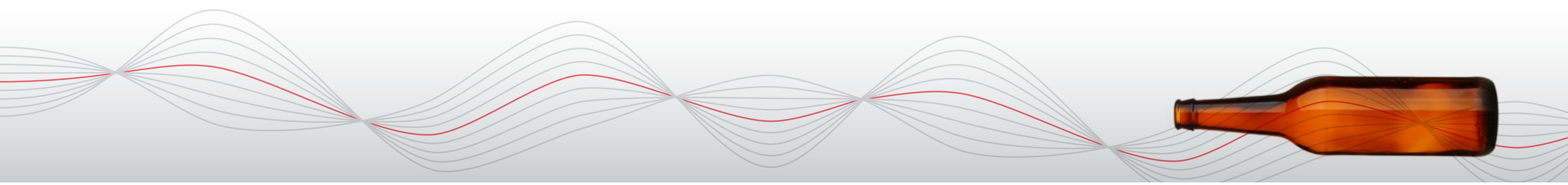


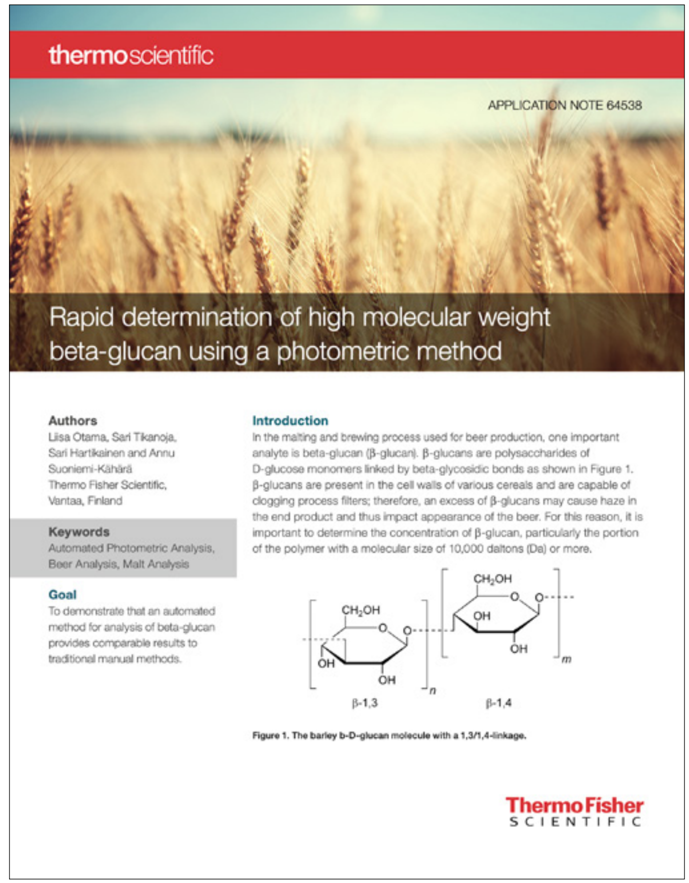
Rapid determination of high molecular weight beta-glucan using a photometric method

Overview

In the malting and brewing process used for beer production, one important analyte is beta-glucan (β-glucan). β-glucans are present in the cell walls of various cereals and are capable of clogging process filters; therefore, an excess of β-glucans may cause haze in the end product and thus impact the appearance of beer. For this reason, it is important to determine the concentration of β-glucan, particularly the portion of the polymer with a molecular size of 10,000 daltons (Da) or more.

In this application note, a novel method for analyzing β-glucans from wort and beer samples is presented. This rapid two-reagent method was developed for a multipurpose discrete analyzer as well as for manual spectrophotometer use. The method was designed with the use of a blank buffer to eliminate possible sample color interference.

Method automation, repeatability, reproducibility, linearity, molecular weight studies and a correlation to the Calcofluor method are presented in this study. A fully automated benchtop photometric analyzer which enables simultaneous analysis of multiple parameters, like β-glucan, color, SO_2, pH, and free amino nitrogen (FAN) from the same sample is also described.



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APPLICATION NOTE 64538

Rapid determination of high molecular weight beta-glucan using a photometric method

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Keywords
Automated Photometric Analysis, Beer Analysis, Malt Analysis

Goal
To demonstrate that an automated method for analysis of beta-glucan provides comparable results to traditional manual methods.

Introduction
In the malting and brewing process used for beer production, one important analyte is beta-glucan (β-glucan). β-glucans are polysaccharides of D-glucose monomers linked by beta-glycosidic bonds as shown in Figure 1. β-glucans are present in the cell walls of various cereals and are capable of clogging process filters; therefore, an excess of β-glucans may cause haze in the end product and thus impact appearance of the beer. For this reason, it is important to determine the concentration of β-glucan, particularly the portion of the polymer with a molecular size of 10,000 daltons (Da) or more.

Figure 1. The barley b-D-glucan molecule with a 1,3/1,4-linkage.

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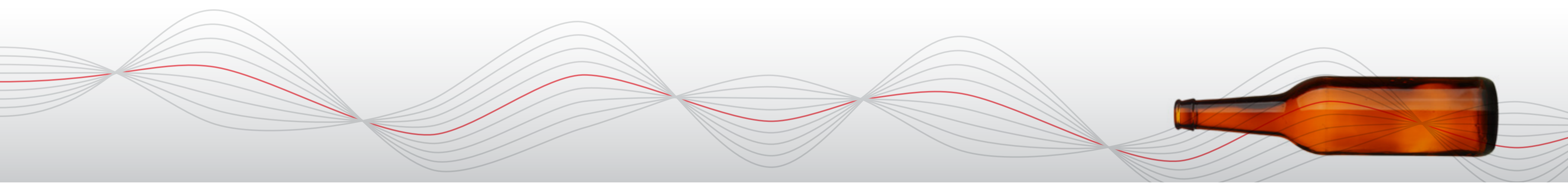

Correlation of an automated discrete analysis sulfur dioxide method to standardized para-rosaniline methods in the analysis of beer

Overview

In beer, sulfur dioxide (SO_2) originates from yeast metabolism and reacts with carbonyl compounds to form hydroxysulfonates. Hydroxysulfonates react with the carbonyl compounds in beer and produce a stale, unwanted flavor. Sulfur dioxide also plays an important role as an antioxidant and is known to exert antimicrobial properties at high concentrations. Its concentration is controlled at the end of beer production to ensure beer quality. Sulfur dioxide is typically measured by the European Brewery Commission (EBC) Method 9.25.3 or by the similar American Society of Brewing Chemists (ASBC) Beer-21 para-rosaniline (p-rosaniline) method.

This application note shows correlation between the p-rosaniline method and the total SO_2 method that is based on 5, 5´-dinitrobenzoic acid (DTNB) measurement at 405 nm.


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APPLICATION NOTE 71456

Correlation of an automated discrete analysis sulfur dioxide method to standardized para-rosaniline methods in the analysis of beer

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Keywords
Discrete Analyzer, Photometric Analyzer, Gallery Analyzer

Goal
To compare the total sulfur dioxide test to standardized *p*-rosaniline methods for beer analysis

Introduction
In beer, sulfur dioxide (SO_2) originates from yeast metabolism and reacts with carbonyl compounds to form hydroxysulfonates. Hydroxysulfonates react with the carbonyl compounds in beer and produce a stale, unwanted flavor. Sulfur dioxide also plays an important role as an antioxidant and is known to exert antimicrobial properties at high concentrations. Its concentration is controlled at the end of beer production to ensure beer quality.

Sulfur dioxide is typically measured by the European Brewery Commission (EBC) Method 9.25.3 or by the similar American Society of Brewing Chemists (ASBC) Beer-21 para-rosaniline (*p*-rosaniline) method. This study shows correlation between the *p*-rosaniline method and the total SO_2 method that is based on 5, 5′-dinitrobenzoic acid (DTNB) measurement at 405 nm. Sulfur dioxide can be found in beer in its free forms, SO_2 (gas) and bisulfate ion (HSO_3^-), or bound to compounds that incorporate a carbonyl group, such as acetaldehyde. Free forms of SO_2 are pH and temperature dependent and because of the acidic nature of beer, SO_2 is usually present and measured as a bisulfate ion (HSO_3^-) with results reported as SO_2.

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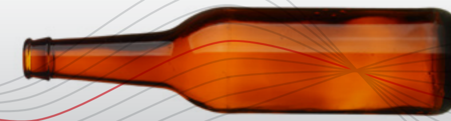

Gallery method performance of beer (and wort) color measurement using the EBC protocol

Overview

The purpose of this application note was to test beer (and wort) color measurement with the automated Thermo Scientific Gallery discrete analyzer by using 430 nm filter. Results of the Gallery discrete analyzer were compared to the results measured with manual spectrophotometer.

As a method comparison result, the Gallery discrete analyzer and the reference method (manual spectrophotometer) give very good correlation. This analysis showed the automated Gallery discrete analyzer's ability to perform several other beer analyses from a single sample in a short amount of time.

Gallery Method Performance of Beer (and Wort) Color Measurement using the EBC protocol

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Abstract

The purpose of the study was to test beer (and wort) color measurement with automated Thermo Scientific Gallery analyzer by using 430 nm filter. Results of the Gallery analyzer were compared to the results measured with manual spectrophotometer.

From the 7 beer samples (n= 10) precision of the color measurement was very good. CV% of all measured samples was also very good, < 0.15 %. Measuring range for the beer color test was determined as 5 – 50 EBC units without dilution and up to 200 EBC with a automated predilution of 1+3. Correlation between two Gallery analyzers or two 430 nm filters was excellent (r= 0.991). Bias between color results of two filter was detected as 0 – 1 %. As a Method comparison result, Gallery and reference method (manual spectrophotometer) gives very good correlation. With this Gallery automated analyzer we were additionally able to perform several other beer analysis from the same sample in very short time.

Introduction

In general, most common beer color is a pale amber (EBC unit ≤ 12). Beer color originates mainly from the malt, but also other factors can affect Beer Color. Naturally dark beers are usually brewed from a pale malt or lager malt base with a small proportion of darker malt added to achieve the desired shade. Very dark beers, such as stout, use dark or patent malts that have been roasted longer.

Other factors that can affect the beer color are mainly increased pH, Maillard reaction or oxidation. When wort is boiled, color increases. Also fermentation can deposit proteins in beer that can create a change in color. Color can change also with the yeast strain selected, filtration can reduce color or oxidation can deepen beer color. Sometimes colorants, such as caramel, is used to darken beer.

The system used to characterize beer color has its origins in the late 1800's. The original lovibond system used colored slides that were compared to the beer color to determine approximate value. By the mid-20'th century, light spectrophotometer technology was developed. In 1950 visual system called the European Brewing Convention (EBC) was created. This method uses nowadays a spectrophotometer with wavelength of 430 nm. There is also another spectrophotometric color system, the Standard Reference Method (SRM), adopted by the ASBC (American Society of Brewing Chemists). Conversion factor SRM = 0.377 x EBC + 0.45 can be used to convert EBC unit to SRM units.

The instrumental EBC method is the official reference method for wort and beer color measurement in Europe (1).

Materials and Methods

Thermo Scientific Gallery (manufactured by Thermo Fisher Scientific), is a new discrete photometric analyzer, a fully automated bench-top system. The beer color method of the Gallery analyzer was compared with manual spectrophotometer Shimadzu MultiSpec – 1501 (Element resolution < 1.5 nm, Wavelength accuracy ± 1.0 nm).

Several beers from different countries were tested. Some sample pretreatments, like filtration through a membrane filter and addition of "kieselguhr" before the membrane filtration, were also tested.

SAMPLE PRETREATMENT: Tested pretreatments were syringe filtration with 0.45 µm membranefilter alone and "kieselguhr" addition before filtration.

PRECISION: Precision was done by measuring each seven beer samples ten (10) times.

LINEARITY: For linearity / measuring range test, the dark beer samples were diluted with pale beer or with deionized water. Lowest and highest samples were measured with manual spectrophotometer. Color of the diluted samples between those two measured samples were calculated according to the dilution ratio. All samples were measured three times with the Gallery analyzer.

METHOD COMPARISON: Seven beer samples were measured with two Gallery analyzers and manual spectrophotometer.

Results

SAMPLE PRETREATMENT: Most beer samples gave same result without pretreatment and with syringe filtration with 0.45 µm membranefilter when measured with Gallery. Instead bubbles on the wall of the cuvette interfered manual spectrophotometric measurement of untreated beer samples. The use of kieselguhr didn't have remarkable effect on results. The advance of adding kieselguhr was easier filtration of dark beers.

PRECISION: Precision of the color measurement was very good. CV% of all measured samples was < 0.15 %.

LINEARITY: Measuring range is 5 – 50 EBC without dilution and up to 200 EBC with automated dilution 1+3.

METHOD COMPARISON: Method comparison between Gallery and the reference method (manual spectrophotometer) gave good results. Average bias between measured samples was – 5 %.

Correlation between two Gallery analyzers or two 430 nm filters is excellent. Bias between color results of two filter is 0 – 1 %.

Table 1. Precision

Mean (EBC), N = 10	SD	CV%
5,6	0,006	0,10
8,9	0,007	0,08
12,0	0,011	0,09
15,7	0,014	0,09
35,5	0,044	0,12
41,1	0,044	0,11
104,1	0,092	0,09

Figure 1. Linearity

Figure 2. Method comparison

Conclusion

Thermo Scientific Gallery analyzer is suitable for beer color measurement by official EBC reference method (1). The advance of using automated analyzer is the usability to measure many analytes in addition of color measurement from the same sample. The results of all measured analytes can be printed to the same report.

Reference

1. Analytica-EBC Method 8.5 Colour of Wort: Spectrophotometric Method (IM) and Method 9.6 Colour of Beer: Spectrophotometric Method (IM)

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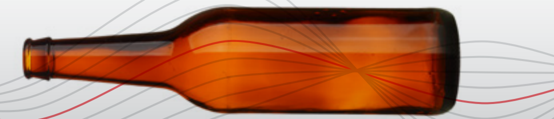
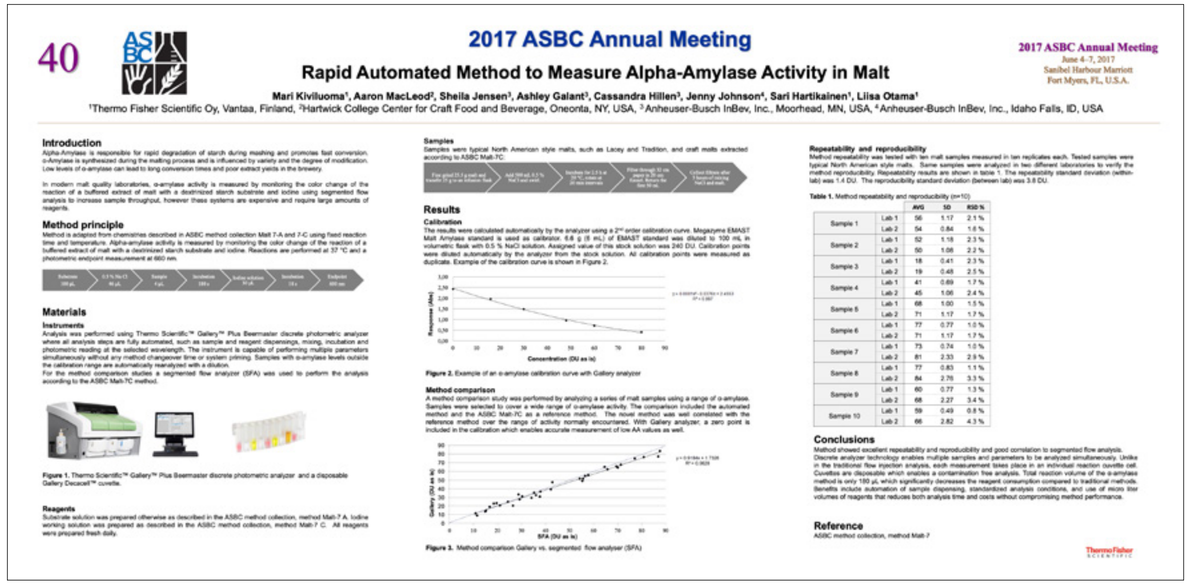


Rapid automated method to measure alpha-amylase activity in malt

Overview

Alpha-amylase is responsible for rapid degradation of starch during mashing and promotes fast conversion. α-amylase is synthesized during the malting process and is influenced by variety and the degree of modification. Low levels of α-amylase can lead to long conversion times and poor extract yields in the brewery. In modern malt quality laboratories, α-amylase activity is measured by monitoring the color change of the reaction of a buffered extract of malt with a dextrinized starch substrate and iodine using segmented flow analysis to increase sample throughput. However these systems are expensive and require large amounts of reagents.

This poster demonstrates that the results of the repeatability and reproducibility coefficients of variation for alpha-amylase in malt by automated discrete analysis were similar to the results from using the segmented flow analysis.



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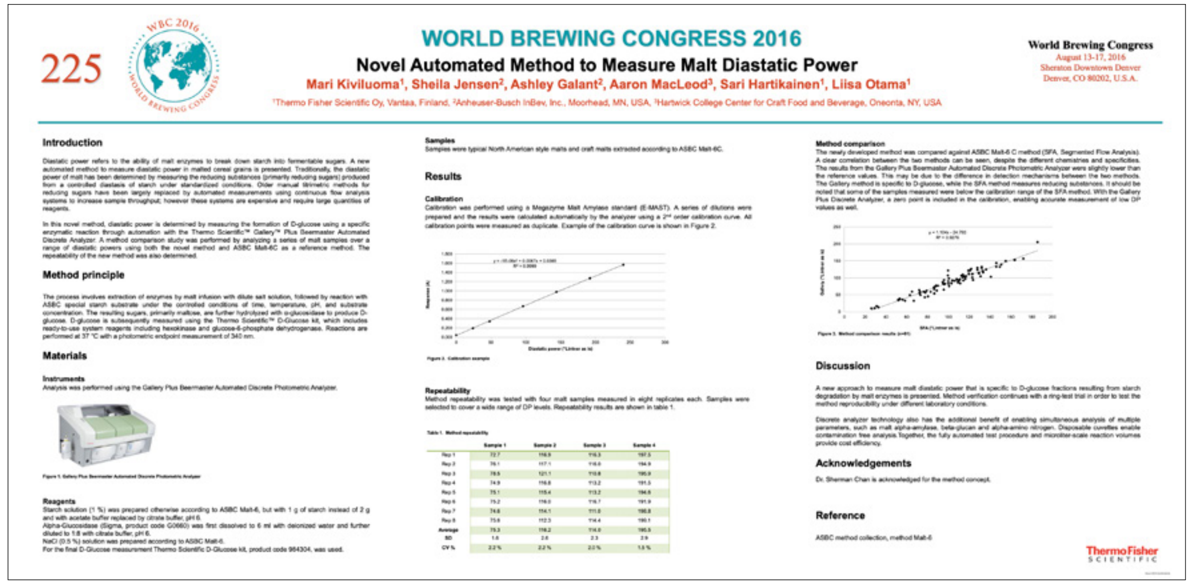
Novel automated method to measure malt diastatic power

Overview

Diastatic power refers to the ability of malt enzymes to break down starch into fermentable sugars. A new automated method to measure diastatic power in malted cereal grains is presented. Traditionally, the diastatic power of malt has been determined by measuring the reducing substances (primarily reducing sugars) produced from a controlled diastasis of starch under standardized conditions. Older manual titrimetric methods for reducing sugars have been largely replaced by automated measurements using continuous flow analysis systems to increase sample throughput; however these systems are expensive and require large quantities of reagents.

In this novel method, diastatic power is determined by measuring the formation of D-glucose using a specific enzymatic reaction through automation with the Thermo Scientific™ Gallery™ Plus Beermaster Automated Discrete Analyzer. A method comparison study was performed by analyzing a series of malt samples over a range of diastatic powers using both the novel method and ASBC Malt-6C as a reference method. The repeatability of the new method was also determined.



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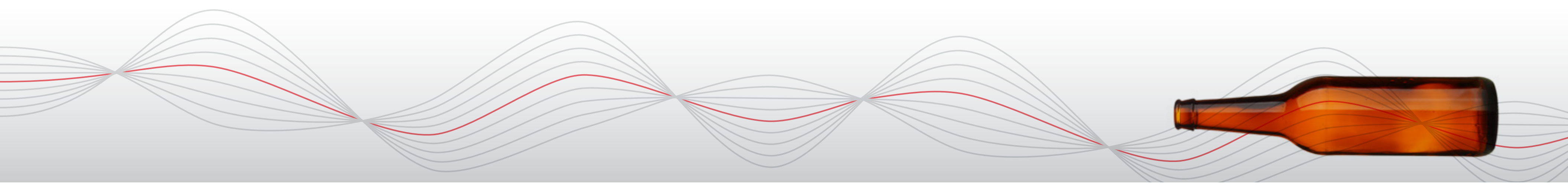
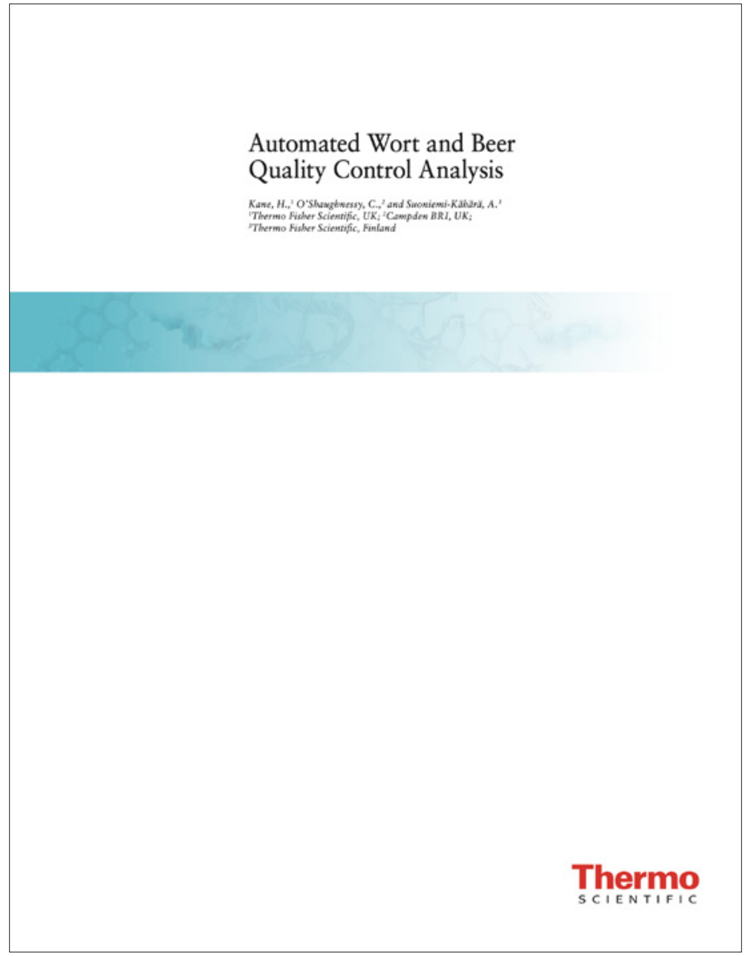


Automated wort and beer–quality control analysis

Overview

This application note presents a system capable of producing fast and reliable results from several analytes by combining automated colorimetric detection and solid phase extraction techniques. The Gallery Plus Beermaster discrete analyzer can determine bitterness and simultaneously perform other colorimetric determinations (e.g. SO_2, FAN, pH, color, polyphenol and beta-glucan) from beer or wort samples. In addition, many water quality parameters can be measured using the same analyzer.

This application note also presents a comparison of bitterness measurement from beer and wort samples between a new automated method and the iso-octane extraction method, as well as method comparison studies from beer and wort samples for pH, color, FAN and SO_2.


Automated Wort and Beer Quality Control Analysis

Kane, H.,[1] O'Shaughnessy, C.,[2] and Suoniemi-Kähärä, A.[3]
[1]Thermo Fisher Scientific, UK; [2]Campden BRI, UK; [3]Thermo Fisher Scientific, Finland

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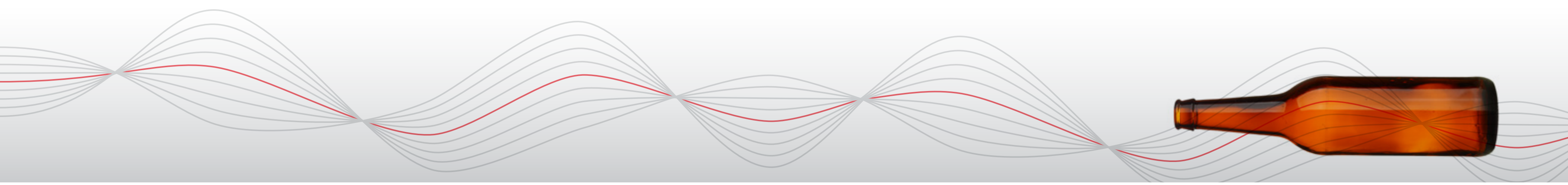


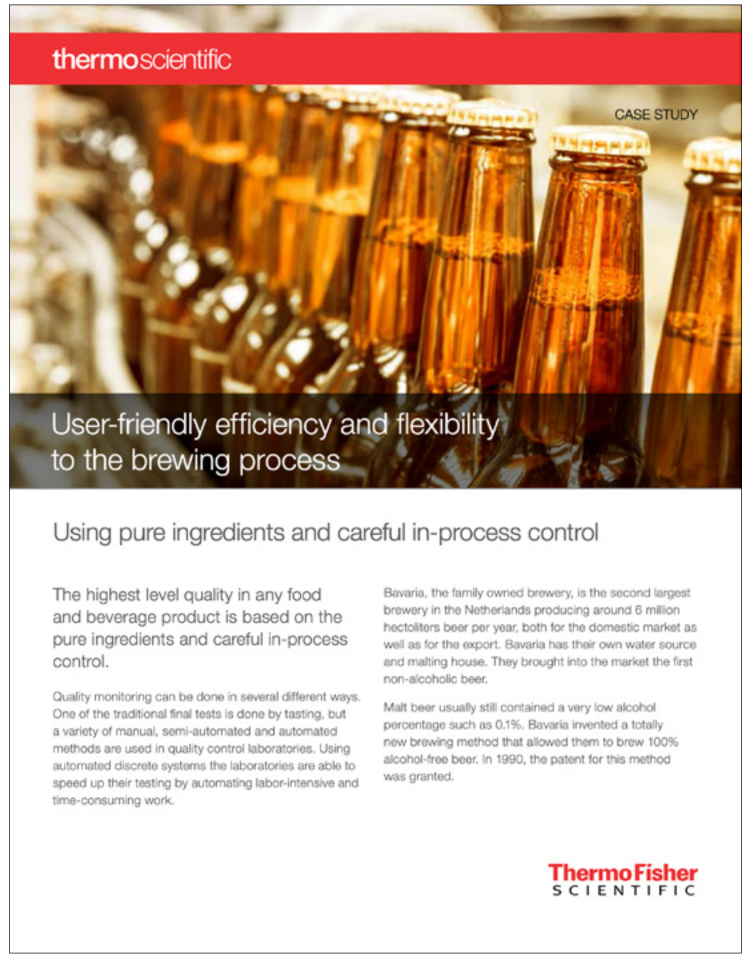
User-friendly efficiency and flexibility to the brewing process

Overview

Bavaria, the family owned brewery, is the second largest brewery in the Netherlands producing around 6 million hectoliters beer per year, both for the domestic market as well as for export. Bavaria has their own water source and malting house. They brought into the market the first non-alcoholic beer.

The Gallery Plus Beermaster is used in Bavaria both in the core laboratory and in the brewery process laboratory. On a daily basis, bitterness and alcohol in low alcohol beers, as well as water hardness, iron, malt beta-glucans and amino acids, are tested with the Gallery Plus Beermaster discrete analyzer.

Learn more about Bavaria's experience of beer analysis in this case study.



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CASE STUDY

User-friendly efficiency and flexibility to the brewing process

Using pure ingredients and careful in-process control

The highest level quality in any food and beverage product is based on the pure ingredients and careful in-process control.

Quality monitoring can be done in several different ways. One of the traditional final tests is done by tasting, but a variety of manual, semi-automated and automated methods are used in quality control laboratories. Using automated discrete systems the laboratories are able to speed up their testing by automating labor-intensive and time-consuming work.

Bavaria, the family owned brewery, is the second largest brewery in the Netherlands producing around 6 million hectoliters beer per year, both for the domestic market as well as for the export. Bavaria has their own water source and malting house. They brought into the market the first non-alcoholic beer.

Malt beer usually still contained a very low alcohol percentage such as 0.1%. Bavaria invented a totally new brewing method that allowed them to brew 100% alcohol-free beer. In 1990, the patent for this method was granted.

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Streamlining the test process in a German beer production facility

Overview

The laboratory for Radeberger Group, which analyzes both alcoholic and non-alcoholic beer as well as soft drink samples, is located in Frankfurt, Germany. The lab replaced the old Skalar™ instruments with Gallery Plus Beermaster discrete analyzers. The Gallery analyzers enable the lab to run all their required tests simultaneously.

Know more about Radeberger Group's experience of beer analysis in this case study.


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CASE STUDY

Streamlining the test process in a German beer production facility

Radeberger Group uses only the highest quality ingredients, such as hops and malt, allowing them to maintain their standards and produce the best beers. They brew their products in accordance with the strict specifications of the German Purity Law of 1516 supplemented with current testing and quality control procedures. In fact, they have received numerous awards that provide evidence of the excellence and consistency of their brands.

The laboratory for Radeberger Group, which analyzes both alcoholic and non-alcoholic beer as well as soft drink samples, is located in Frankfurt, Germany. Radeberger is represented in almost every region in Germany by its 14 brewing sites and two soft drink production facilities. Even though they adhere to traditional brewing culture, they actively develop their end product to reflect its regional heritage. Binding and Henninger are two of the premier brands recognized in Frankfurt and have been a favorite among German dignitaries since the 1880's. Raesen, a true fermented alcohol-free beer is also produced in Frankfurt. Guinness, Kilkenny, and Corona are among the globally known brands exported to 50 countries around the world.

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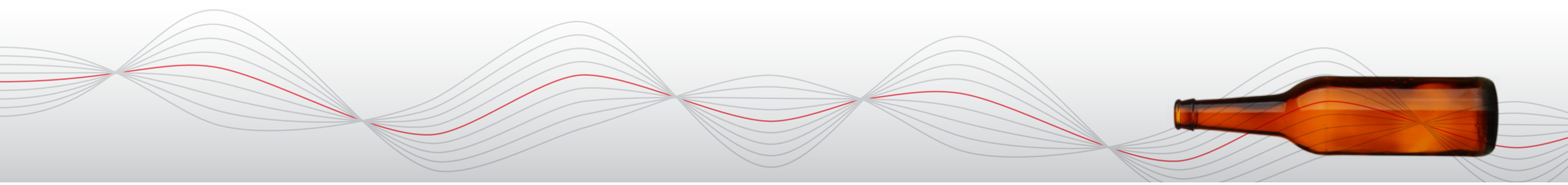

Quality, consistency, efficiency—helping microbreweries streamline their process

Overview

With the investment in a Gallery Plus Beermaster discrete analyzer, "It would take an entire day in the past to complete seven tests on eight samples using traditional wet chemistry methods. Now 50 tests are completed in one hour."
—Paul Taylor, Laboratory Manager, Murphy and Son Limited

Learn more about Paul and his lab's experience of beer analysis in this case study.

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CASE STUDY

Quality, consistency, efficiency – helping microbreweries streamline their process

In 1887 Murphy and Son Limited, originally located in Leeds, was established by Albert John Murphy as a supplier of brewing components. In 1919, the company relocated to Nottingham at the Hutchinson's, Prince of Wales Brewery site, a historic landmark which subsequently became a listed building. While developing his products, Murphy realized the importance of formulating water treatment techniques that could be used to complement the specific characteristics of a beer.

Today the company continues to make brewing supplies and also serves as a quality and consistency consultant to microbreweries in the United Kingdom.

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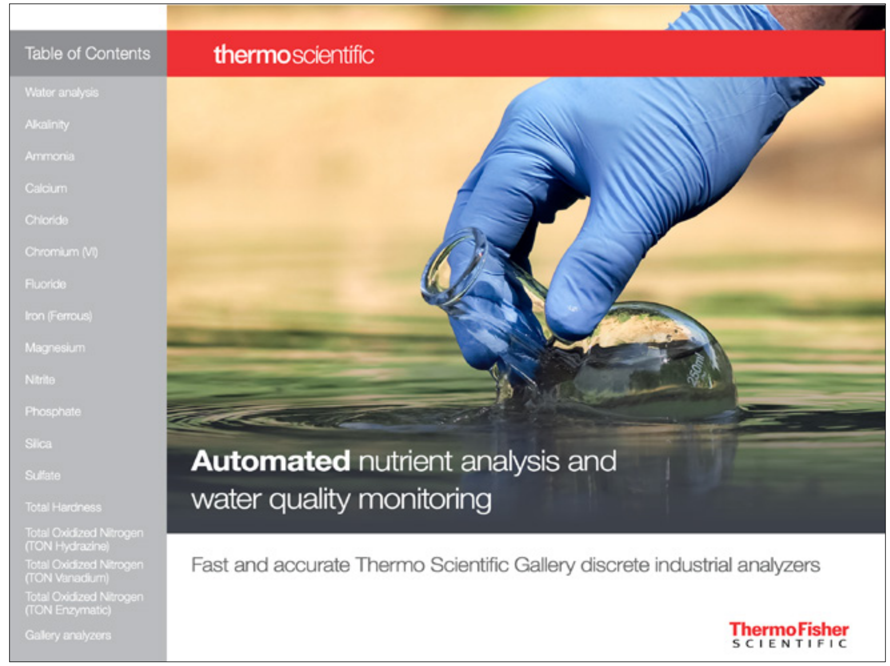
Automated nutrient analysis and water quality monitoring

Overview

To achieve the great taste of wine and beer, the water quality must be tested in the various stages of the wine making and brewing process with reliable and accurate instruments. From feed water analysis to process water, to process critical parameters in beverages, to wastewater analysis, Gallery discrete analyzers provide a consolidated testing solution to help you achieve consistent product quality.

Analytes of interest in water analysis includes pH, conductivity, alkalinity, ammonia, total hardness, divalent ions, iron, chloride, silica, sulphate, phosphate, nitrate, nitrite, TON, and more.

This analytical guide summarizes the use of Gallery discrete analyzers to detect the various analytes of interest, their respective testing chemistries, applicable regulatory method references, reagents required, sample matrixes, calibration curves, method detection limits, precision summaries, and method performance linearities.



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Discrete analyzer products

Thermo Scientific Gallery discrete analyzers with ready-to-use system reagents are optimized for speed, flexibility, and precision for wine, beer, malt, beverages, enzymes, soil, process water, ground water, waste water and drinking water, analysis, that enables improved quality control through consolidated testing.

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Find out more at **thermofisher.com/discreteanalysis**

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