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Volume 1 • 2017

Beer & Wine

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Quality Control in Alcoholic Beverages

Welcome to the first edition of the 2017 **F&B**FOCUS Magazine. In this issue you will find solutions for your alcoholic beverage quality control needs, from sample collection to analysis. Use this magazine along with our *All You Need for Food Analysis* Catalog to get started! We would like the opportunity to serve you with your laboratory and production needs; please contact us at **1.800.932.5000** for any assistance. We hope you will find this magazine a good resource and we welcome your feedback for future editions.

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Liquid Sample Instrumentation Platform for Peroxide and Alkenal	**75870-844**	**13,125.00**
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Alkenal. 0.0–1200 µmol/kg Alkenals	**75870-822**	**498.75**
Percent Fat, 0.06–0.33% of Sample	**75870-836**	**498.75**
Total Glycerin, 0.008–0.06% of Sample	**75870-886**	**498.75**

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Specifications

Tip Size	17.4 mm (0.687")
Tip Diameter	5.15 mm (0.203")
Handle Length	82.55 mm (3.25")
Overall Tube Length	103.12 mm (4.06")
Fill Solution	10 mL (also available in 4mL and customized fills)

ESK Sampling Kits	Cat. No.	Case of 50
Butterfield's Solution	**89221-698**	**66.34**
Letheen Broth	**89221-706**	**70.52**
Neutralizing Buffer	**89221-714**	**63.66**
Buffered Peptone Water	**89221-722**	**64.42**

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- Rigid paddle inside foam is ideal for reaching into crevices

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Tip Size	56.38 mm (2.22")
Tip Diameter	15.545 mm (0.612")
Handle Length	Pointed: 147.32 mm (5.8"); Round: 145.03 mm (5.71")
Overall Tube Length	152.91 mm (6.02")

EnviroMax Plus Swabs	Cat. No.	Pack of 25
Pointed	**89221-742**	Pk. 25/ **65.18**
Pointed	**89221-744**	Cs. 250/ **61.09**
Rounded	**89221-746**	Pk. 25/ **65.18**
Rounded	**89221-748**	Cs. 250/ **62.32**

Featured Kits are Sterile.

METTLER TOLEDO DM45 for Alcohol Measurement; According to OIML R-22

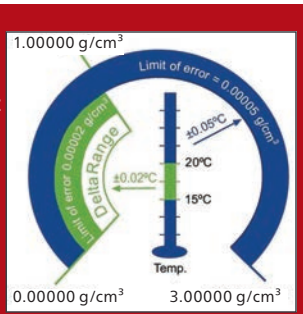
by Angela DeMartin, METTLER TOLEDO Application Specialist

Summary
Producer of alcohol products (e.g. distillery) have to pay tax based on the alcohol content of the product. (The tax is rate is based on the product's alcohol content). One of the possible ways to determine the alcohol (Ethanol) content is by measuring the density of the product. In earlier days hydrometers were used to determine the alcohol content. With this technique the alcohol was read off fast and directly, but the accuracy was relatively low. Today, digital density meters offer a much more reliable way to measure alcohol content with a high accuracy. They measure the density which is converted directly into alcohol in Vol% with the built-in table of OIML R-22 (International Organization of Legal Metrology, Recommendation 22: alcohol tables). This measurement of distillates is straight forward and only needs an accurate measuring system and a careful sample preparation.

Sample
Ethanol pure > 99.8%

Equipment
METTLER TOLEDO DM45 DeltaRange™ Density Meter with SC1/SC30 Sample and Cleaning Delivery Unit; **Cat. No. 97049-872**

Measurement accuracy is often the most important criterion when purchasing a density meter, as the instrument must provide results with the accuracy specified by the standards and norms associated with the particular application or process.



Five decimal place measuring accuracy is not usually needed over the entire measuring range, as most organic solvents and alcohol solutions have a density lower than 1 g/cm³. With the DM45 DeltaRange measuring cells, METTLER TOLEDO offers a tailor-made solution for such applications—at best value prices.

Additional Equipment
Ultrasonic Bath

Different Alcohol Samples: Alcohol content in beverages (Beer, Wine, Liquors)

1. Liquors (Vodka, Gin, Brandy, etc.) which contain no extracts are almost a pure mixture of alcohol and water. These alcoholic beverages are treated as pure alcohol/water mixtures and are measured directly with a density meter. The obtained density is automatically converted to the desired alcohol content using the built-in tables of the meter.
2. Beer and wine are multi-component mixtures. Measurement of alcohol can't be done with a density measurement only, because the sample is a complex mixture of alcohol, water, sugar, and other ingredients. Traditionally the alcohol content in such a mixture was measured after distillation. This technique is still the official reference technique to be used. The initial alcohol concentration in the beverage can be calculated either by the volumetric or by the gravimetric approach. This sample preparation is very time consuming and therefore in some industries, for example, in the beer and wine, formulas have been developed to determine the alcohol content directly in the samples. If formulas exist, it is sometimes possible to omit the distillation process and express the alcohol content directly from the measured density and refractive index. Otherwise a distillation has to be done and the alcohol content measured with a density meter on the distillate.

The MEBAK (Mitteleuropäische Brautechnische Analysenkommision) literature explains how to obtain The alcohol concentration of beer.

The formulas by REBELEIN can be used to determine the alcohol content in Wine. With both analyses it is necessary to combine measurements of density and refractive index to obtain the correct alcohol content. The description below is only for samples which can be treated as alcohol/water mixtures (liquors).

Alcohol content in pharmaceutical industry
The same approach as for the beverages is applied here. It is necessary to distill the sample and determine the density of the distillate. As well, it is possible to store customized tables in the density meters to get the alcohol % of a specific sample in either %v/v or %w/w.

Sample preparation
Alcohol sample contain air (i.e. normal samples coming from the delivery) and have to be degassed prior to measurement because the bubbles in the measuring cell will influence the result. The samples can be degassed directly in the sample vial in an ultrasonic bath. After the ultrasonic treatment, close the vials tightly. If they are not filled to the top, gently tilt them (do not shake them) to dissolve the alcohol in the head space back into the sample. Now, put them on the sample changer table. Note that it is possible to use other treatments to degas the samples.

METTLER TOLEDO

Measurement

To perform accurate and repeatable alcohol measurements a careful sample preparation is crucial. The higher the alcohol concentration, the more difficult the measurement because of the air bubbles in the sample. To show the good measurement performance pure ethanol has been measured.

A SC30 sample changer has been used to deliver the sample into the DM45 (for single samples a SC1 Sample Delivery Unit can be used instead). With this setup the sample vials are always covered and to detect the bubbles automatically the multiple measurements can be turn on.

The DM45 has different tables stored to calculate the alcohol % of a binary alcohol/water mixture. The user only needs to choose the desired tables to convert the measured density to the needed alcohol unit. By performing at least a two-fold multiple measurement for each determination allows secure recognition of bubbles in case of insufficient degassing, as the standard deviation of such measurements will exceed the instrument resolution by far.

Results

The obtained results measured with a DM45 (n=13) shows high reproducibility with accuracies of:
Alcohol in %v/v according to OIML better: ± 0.01
Density in g/cm^3 better: ± 0.00002

Conclusion

The DM45 together with a sample and cleaning unit will give results of highest precision and show an excellent repeatability if the sample preparation is done carefully and the product is free of air bubbles. Furthermore the automatic calculation of the alcohol result and the automatic bubble detection with the multiple measurement features make the measurements fast and reliable.

Description	Accuracy	Measurement Range	Cat. No.	Each
Model DM45 Benchtop Density/ Specific Gravity Meter with 4.5 Decimal Place Accuracy	±0.00002 (0.7 to 1 g/cm^3), ±0.00005 (0 to 3 g/cm^3)	0.00000 to 3.00000 g/cm^3	**97049-872**	**16,123.25**

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- Calibrated in an ISO 17025 certified laboratory using certified Standards
- Traceable to NIST Standard Reference Materials

pH Value	Color	pH Accuracy	Traceable to N.I.S.T. (SRM) No.	Cat. No.	Each
1	Colorless	±0.01	185, 186	**BDH5004-20L**	**234.28**
2	Colorless	±0.01	185, 186	**BDH5012-20L**	**233.82**
3	Colorless	±0.01	185, 186	**BDH5000-20L**	**284.65**
4	Red	±0.01	185,186	**BDH0198-20L**	**204.87**
4	Colorless	±0.01	185, 186	**BDH5028-20L**	**184.23**
5	Colorless	±0.01	185, 186	**BDH5036-20L**	**194.74**
6.86	Colorless	±0.01	185, 186	**BDH5042-20L**	**210.34**
7	Yellow	±0.01	186,191	**BDH0194-20L**	**236.90**
7	Colorless	±0.01	186, 191, 192	**BDH5056-20L**	**263.94**
9.18	Colorless	±0.01	186, 191, 192	**BDH5068-20L**	**210.10**
10	Blue	±0.01	186,191	**BDH0190-20L**	**199.86**
10	Colorless	±0.01	186, 191, 192	**BDH5082-20L**	**263.94**
12	Colorless	±0.02	186, 191, 192	**BDH5090-20L**	**235.83**
12.45	Colorless	±0.02	186, 191, 192	**BDH5096-20L**	**390.47**

Packaging: 20 L (5.3 gal.) Cubitainer. Visit **vwr.com** to find additional packaging and size options.

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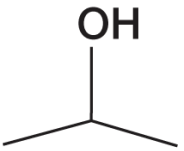
BDH® Isopropyl Alcohol, 70% Laboratory Reagent



- Clear, colorless liquid
- Meets ACS specifications for general use

Specifications

Formula	$(CH_3)_2CHOH$
Density	0.8 to 0.92 g/cm^3 (20 °C)
Flash Pt	12
MDL Number	MFCD00011674
CAS Number	67-63-0
ADR	3,II

Size	Packaging	Cat. No.	Each	Case of
1 L	Poly Bottle	**BDH1131-1LP**	**25.26**	6/ **134.29**
4 L	Poly Bottle	**BDH1131-4LP**	**67.54**	4/ **226.14**
5 gal.	Cubitainer	**BDH1131-5GL**	**203.64**	—
204 L	Steel Drum	**BDH1131-204L**	**1512.07**	—

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Determination of Catechins and Phenolic Acids in Red Wine by Solid Phase Extraction and HPLC

By Monica Dolci, Thermo Scientific, Runcorn, Cheshire, UK

Abstract

This application note demonstrates a simple and rapid HPLC method for the analysis of nine catechins and phenolic acids in red wine. of these polar analytes was achieved on Thermo Scientific™ HyperSep™ Extraction Retain PEP material. The polyphenols in the extracts were quantified by a matrix-standard calibration, with extracts from a wine sample spiked with increasing amounts of analytes. Determination of the polyphenols was performed by HPLC, using a Thermo Scientific Accucore™ PFP HPLC column under gradient mobile phase conditions.

Introduction

Dietary polyphenols comprise a wide range of aromatic compounds that are responsible for numerous organoleptic characteristics of plant-derived food and beverages. In addition to color and taste properties, polyphenols are reported to have antioxidant characteristics, making them responsible for the healthy features of fruit, vegetables, and plant-derived beverages.

The polyphenols that are present in foods can be divided into two main groups: non-flavonoids and flavonoids. Non-flavonoids are mostly monocyclic acids and can be further divided into two main sub-classes: phenolic acids and stilbenes (e.g. resveratrol). Phenolic acids are subdivided into benzoic acids and hydroxycinnamic acids.

Flavonoids share a common nucleus consisting of two phenolic rings and an oxygenated heterocycle. They form a diverse range of compounds and can be categorized into many classes, such as anthocyanins, flavonols (e.g. quercetin), flavanols (e.g. catechins), flavones, and chalcones.[1]

The catechin group of flavanols are major components in wine and are reported to have antioxidant, antimicrobial, antimutagenic, and anticarcinogenic activities. Some of the main catechins present in red wine are shown in **Figure 1**.

The presence of polyphenols in plant matter is highly variable. Some compounds are ubiquitous; whereas others are restricted to specific species. Large variations may also occur because of environmental conditions, ripening stages, genetic variations, and part of the fruit considered (e.g. peel or pulp). Polyphenols are also highly unstable species. For these reasons, assaying polyphenols can be very difficult. However, since polyphenols contribute to the taste, appearance, and formation of unappetizing flavors in foods and drinks, compositional studies have gathered momentum in recent years.[2]

Most phenolic substances are water-soluble and aromatic; therefore, reversed-phase HPLC with UV detection is the technique of choice. However, since polyphenols are structurally similar, their analysis requires high chromatographic selectivity and resolution.

The method described in this application note uses the Accucore PFP (pentafluorophenyl) HPLC column for the fast and efficient chromatographic determination of several catechins and other polyphenols in red wine under gradient HPLC conditions.

Accucore columns use Core Enhanced Technology™ to facilitate fast and highly efficient separations. The 2.6µm diameter particles are not totally porous, but have a solid core and a porous outer layer. The optimized phase bonding creates a series of high coverage, robust phases. The tightly controlled 2.6µm diameter of the Accucore particles results in much lower backpressures than typically seen with sub-2 µm materials. Introduction of fluorine groups into the Accucore PFP stationary phase leads to significant changes in the analyte-stationary phase interactions. This chemistry is well suited to the analysis of polar compounds containing hydroxyl, carboxyl, nitro, or other polar groups. Furthermore, its selectivity is more evident when the functional groups are located on an aromatic ring, making the Accucore PFP HPLC column the ideal candidate for the analysis of polyphenols and catechins.

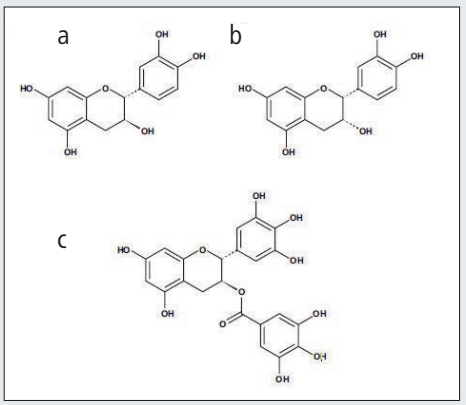

Figure 1: Catechins: a. catechin, b. epicatechin, c. gallocatechin gallate

The sample preparation for wine requires a solid phase extraction. In this application note we demonstrate the efficacy of the versatile HyperSep Retain PEP (polar enhanced polymer) material. HyperSep Retain PEP products consist of high-purity, highly porous polystyrene divinylbenzene material, modified with urea groups. This material provides exceptional recoveries for polar and non-polar analytes. Additionally, pH stability across the 0–14 range, fast sample preparation, fast method development, and consistent recoveries are key attributes exhibited by HyperSep Retain PEP products and demonstrated here.

thermo scientific

Consumables	Cat. No.
Formic Acid, High Purity Grade	**97064-708**
Methanol, HiPerSolv CHROMANORM® gradient for HPLC	**BDH20864.400**
Acetonitrile, HiPerSolv CHROMANORM Super gradient for HPLC	**BDH83639.400**
Water, HiPerSolv CHROMANORM® for HPLC	**BDH23595.400**
Sample Handling Equipment	
Thermo Scientific Finnpipette™ F2 Pipettor Kit 10 µL–100 µL, 100 µL–1000 µL, 1 mL–10 mL	**89096-136**
Thermo Scientific HyperSep Retain PEP (200 mg/3 mL)	**10047-170**
Thermo Scientific SPE 16-Port Vacuum Manifold	**10047-014**
Thermo Scientific Borosilicate Glass Vials (2 mL, 12 mm x 32 mm) with 8 mm Black Screw Cap Fitted with a Silicone/PTFE Seal	**66030-450**
Separation Columns	
Thermo Scientific Accucore PFP 2.6 µm, 100 mm x 2.1 mm	**10038-778**

Sample Preparation

Analytical Standards:

Primary analytical standards of catechin, epicatechin, gallocatechin gallate, syringic acid, hydroxybenzaldehyde, p-vanillin, myricetin, resveratrol, and quercetin were prepared separately. Catechin, epicatechin, gallocatechin gallate, syringic acid, hydroxybenzaldehyde, and p-vanillin standards were prepared in water. Myricetin, resveratrol, and quercetin were prepared in water/methanol (50:50 v/v). A mixed working standard was prepared by combining 1000µL of each primary standard.

Solid Phase Extraction Method Development:

The extraction procedure was optimized by performing an elution profile to determine the best wash and elution conditions for the SPE. This was achieved by aliquoting 2mL of working standard mixture (prepared in water) onto the HyperSep Retain PEP cartridges (following conditioning and equilibration with 2mL of methanol and water, respectively). Washes with increasing elutropic strengths of solvent were applied, starting with 0:100:0.1 (v/v/v) methanol/water 0.1% formic acid and increasing stepwise by 10% to 100:0:0.1 (v/v/v) methanol/water/0.1% formic acid.

Four wash steps (using 1mL of 100% methanol for each step) were then performed. Each wash stage was collected and analyzed by HPLC. The data obtained are presented in **Figure 2**, which shows an optimal wash condition of 20% methanol before compounds start to elute from the cartridge. **Figure 2** shows that 90% elution solvent is strong enough to elute all of the components. However, a 100% methanolic solution was used to reduce the time taken on the solvent evaporation stage.

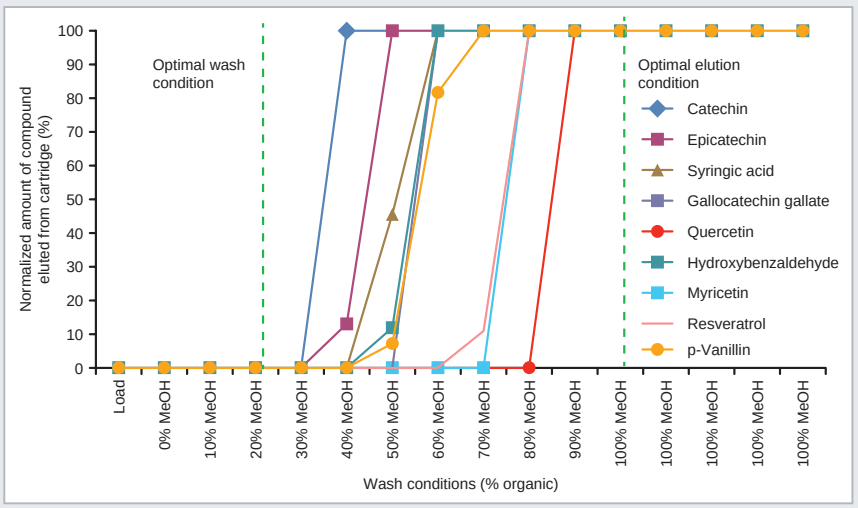

Figure 2: HyperSep Retain PEP column elution profile for catechins and phenolic compounds

Solid Phase Extraction Analysis:

The optimized extraction procedure was performed by using mixtures of the phenolic compounds and catechins dissolved in a wine matrix (**Table 1**). The standard mixtures were prepared at six concentration points (Std 1–11, **Table 2**), by carrying out serial dilutions from the working standard solution. The wine chosen for this study was a red Bonarda Shiraz from Argentina (year 2010). The same extraction procedure used for the standard mixtures was then applied to the wine sample. The wine sample was diluted in water by a factor of three prior to SPE and prior to the standard mixtures spiking to ensure retention of the analytes.

Condition	2 mL methanol (MeOH)
Equilibration	2 mL water
Load	2 mL sample
Wash	2 mL water + 0.1% formic acid (FA)
Wash	2 mL 20% MeOH + 0.1% FA
Elute	4 x 1 mL MeOH + 0.1% FA

Table 1: SPE procedure

Results

Under the conditions adopted for this analysis, good retention and baseline separation of nine polar molecules can be accomplished in approximately five minutes. The chromatography is presented in **Figure 3**. The total run time is ten minutes due to the column equilibration necessary at the end of the gradient.

A matrix-matched calibration line was obtained from the standard mixtures prepared in wine. The standard mixtures were prepared at six concentration points (Std 1–11), by carrying out serial dilutions from the working standard solution.

Continued on next page

Table 2 summarizes the concentrations of catechins and polyphenols in the standard mixtures spiked into a sample of red Bonarda Shiraz.

Linearity in detector response was observed over the concentration ranges investigated (as reported in **Table 2**), with correlation coefficients greater than 0.995 for all nine analytes. An example of linearity in detector response for catechin (over the concentrations reported in **Table 2**) is presented in **Figure 4**. Catechin was chosen as a representative for the linear responses of the phenolic compounds investigated in this application note.

Recoveries were calculated by comparing the detector response of the extracted top standard mixture against an unextracted standard at the same concentration (**Table 2**). Accuracy values (calculated by comparing the backcalculated values with the actual values) are shown in **Table 2**.

Chromatographic Conditions		
Instrumentation:	Thermo Scientific Accela™ UHPLC system	
Column:	Thermo Scientific Accucore PFP 2.6 µm, 100 mm x 2.1 mm	
Mobile phase:	A: Water + 0.1% formic acid; B: acetonitrile + 0.1% formic acid	
Gradient:	**Time (min) %**	**B**
	0	2
	0.1	2
	7.1	65
	7.2	95
	7.9	95
	8.0	2
	10.0	2
Flow rate:	0.4 mL/min	
Column temperature:	30°C	
Autosampler temperature:	Ambient	
Detection:	UV at 280 nm	
Injection volume:	1 µL	
Run time:	10 minutes	
Syringe flush:	Mobile phase	

Conclusion

In this application note an HPLC method for the analysis and quantitation of nine catechins and phenolic acids from red wine was developed. Extraction of these polar analytes was achieved on HyperSep Retain PEP material, and shows excellent recovery. The polyphenols in the extracts were quantified by a matrix-standard calibration, with extracts from a wine sample spiked with increasing amounts of the analytes. The unique selectivity offered by the Accucore PFP HPLC column provides exceptional separation performance to resolve these very structurally similar compounds.

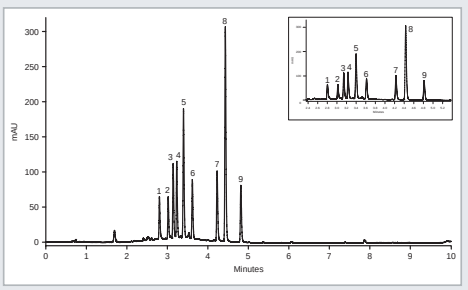

Figure 3: Chromatogram for standard mixture 1, containing nine polyphenol standards prepared in a red wine matrix and extracted by SPE. Order of elution:
1. catechin; 2. epicatechin; 3. syringic acid;
4. gallocatechin gallate; 5. hydroxybenzaldehyde;
6. p-vanillin; 7. myricetin; 8. resveratrol; 9. quercetin.

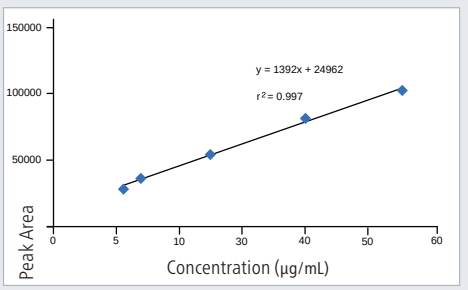

Figure 4: Calibration graph for catechin

	Accuracy, %											
	Std 1 (55 µg/mL)	**Std 2 (40 µg/mL)**	**Std 3 (25 µg/mL)**	**Std 4 (20 µg/mL)**	**Std 5 (15 µg/mL)**	**Std 6 (10 µg/mL)**	**Std 7 (8 µg/mL)**	**Std 8 (6 µg/mL)**	**Std 9 (5 µg/mL)**	**Std 10 (4 µg/mL)**	**Std 11 (3 µg/mL)**	**Std 1 Recovery, %**
Catechin	100.0	101.0	84.0	94.6	111.5	93.7	N/A	N/A	N/A	N/A	N/A	93.7
Epicatechin	97.5	104.3	100.4	98.2	101.4	98.2	N/A	N/A	N/A	N/A	N/A	95.4
Gallocatechin Gallate	100.3	99.5	99.2	99.5	102.9	98.2	N/A	N/A	N/A	N/A	N/A	93.3
Myricetin	100.7	98.5	99.6	100.4	102.9	98.2	N/A	N/A	N/A	N/A	N/A	89.3
Resveratrol	99.8	100.2	99.6	98.6	102.9	98.2	N/A	N/A	N/A	N/A	N/A	95.7
Quercetin	100.0	100.2	98.2	99.5	104.3	97.3	N/A	N/A	N/A	N/A	N/A	94.8
Syringic Acid	N/A	N/A	N/A	100.4	103.8	92.7	100.0	N/A	105.2	100.0	N/A	95.1
Hydroxybenzaldehyde	N/A	N/A	N/A	98.9	N/A	105.0	96.3	98.6	N/A	102.3	100.0	97.5
Catechin	N/A	N/A	N/A	N/A	97.1	105.4	101.7	N/A	96.4	97.1	100.0	95.9

Table 2: Concentration levels for the mixtures of catechins and phenolic compounds spiked into the wine sample, with accuracies and recoveries. N/A indicates that this concentration level was not used for this compound.

References

[1] *H.S. Lee, B.W. Widmer. Phenolic compounds. In: L.M.L. Nollet, ed. Handbook of food analysis. New York, Marcel Dekker, 1996, 821-894.*

[2] *M. del Alamo, L. Casado, V. Hernandez, J. J. Jimenez, J. Chromatogr. A, 2004, 1049, 97-105.*

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- Filter cap vials provide in-line filtration, reducing sample treatment and overall cost

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VWR IC Vials for Metrohm-Peak Autosamplers

VWR Ion Chromatography Vials designed for use with Metrohm-Peak autosamplers are made from high-grade polypropylene. With a 16mm diameter and a capacity of up to 12mL, these conical tubes have a pierceable polyethylene cap that keeps airborne contaminants out, yet is easily penetrated by sampling needle.

Capacity, mL	For Use With	Cap Type	Cat. No.	Pack of
IC Vials for Dionex Autosamplers				
7	Dionex AS-50/AS-AP	Pierceable Polyetheylene	**10571-308**	250/ **156.06**
5	Dionex AS-40/AS-DV	40–60 µm Porous Filter	**10571-344**	250/ **133.25**
0.5	Dionex AS-40/AS-DV	40–60 µm Porous Filter	**10571-348**	250/ **133.25**
5	Dionex AS-40/AS-DV	40–60 µm Porous Filter, Sample Pack	**10799-706**	10/ **7.69**
5	Dionex AS-40/AS-DV	Cap - No Filter	**10571-346**	250/ **88.25**
IC Conical Tube Vial for Metrohm-Peak Autosamplers				
12	Metrohm-Peak IC	Piercable Polyethylene	**10571-312**	1,000/ **244.31**

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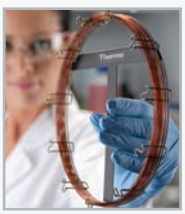

ANY Trace Gold GC Columns

ANY Accucore Columns

Thermo Scientific understands the demands of food and beverage safety related testing. Our separation and detection technologies, combined with experienced applications competence, and our best suited Chemistries provide solutions for the analysis of inorganic ions, small drug molecules, and pesticides to large components, such as polysaccharides. Your laboratory can now conduct reliable, accurate, and fast testing of food and beverages.

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2. To redeem offer and obtain FREE items, go to **vwr.com**/promotions and search for **Promo Code 4940**. Complete the online form before 1.30.2018.
3. Include your VWR invoice or packing slip as proof-of-purchase.
4. Allow up to 8 weeks for delivery of FREE items.

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TERMS: Promotion applies to any Thermo Scientific Chromatography-branded product available on vwr.com. To qualify, purchase a minimum of $1,000 in Thermo Scientific Chromatography products. To redeem, complete the redemption form for this promotion at **vwr.com/promotions**, where you can identify your $250 in FREE Thermo Scientific products. All FREE product will be calculated at VWR list price.

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MilliporeSigma

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Us, too.

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Your Benefits:

- Saves time and reduce errors with pre-calibrated methods
- Easy handling—clear "cook book" method descriptions
- Accurate measurements with user-defined calibration

Learn more at **vwr.com/emdmillipore**

Description	Bandwidth	Light Type	Wavelength	Display	Cat. No.	Each
Prove 300 UV/VIS Spectrophotometer	4 nm	Xenon Flash	190 to 1100 nm	Resistive Touch Screen	**EM1.73017.0001**	**7386.15**

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Syringe Filter Housing	Diam., mm	Membrane Material	Pore, µm	Cat. No.	Case of 100
Acrylic	25	Cellulose Acetate	0.2*	**28145-475**	**270.51**
Acrylic	25	Cellulose Acetate	0.45	**28145-479**	**270.51**
Acrylic	25	Polyether sulfone	0.2*	**28145-499**	**351.07**
Acrylic	25	Polyether sulfone	0.45	**28145-503**	**351.07**
Polypropylene	13	PTFE	0.45	**28145-493**	**239.77**
Polypropylene	25	Nylon	0.2	**28145-487**	**252.12**
Polypropylene	25	Nylon	0.45	**28145-489**	**252.12**
Polypropylene	25	Poly-propylene	0.2	**28145-483**	**256.68**
Polypropylene	25	Poly-propylene	0.45	**28145-485**	**256.68**
Polypropylene	25	PTFE	0.2	**28145-495**	**268.34**
Polypropylene	25	PTFE	0.45	**28145-497**	**268.34**

*Retains 107 Brevundimonus diminuta per cm^2 according to modified ASTM F838-83

Featured filters are nonsterile; visit **vwr.com** for additional options.

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- Medium flow rate

Ideal for drugs, pharmaceuticals, liquors, tinctures, chromatography, and protein-free filtrations in the clinical laboratory.

Diameter, cm	Cat. No.	Pack of 100
12.5	**28333-021**	**78.65**
15	**28333-043**	**84.80**
18.5	**28333-065**	**92.52**
24	**28333-087**	**97.94**
32	**28333-101**	**105.60**
38.5	**28333-123**	**115.13**

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The proven technology you have come to expect from Hach® just got better with the DR3900 Benchtop VIS Spectrophotometer. The DR3900 provides the simplest way to perform testing for water analysis. Used together with TNTplus chemistries, testing steps are reduced and the potential for human error is minimized.

How TNTplus® Works

1. **Barcode Recognition:** Simply drop in the vial and get results immediately with automatic method detection.
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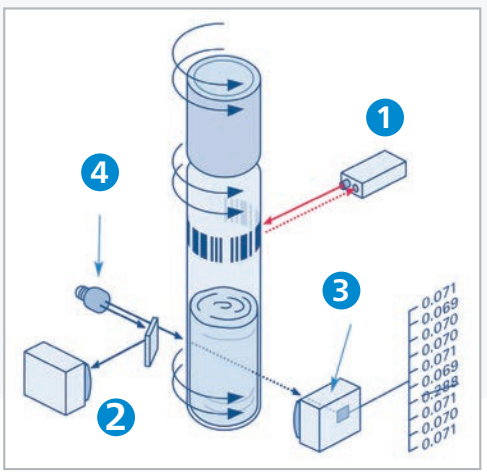

Description	Measurement Range, mg/L	EPA Method	Cat. No.	Price
DR3900 Benchtop VIS Spectrophotometer	—	—	**75921-230**	Ea./ **4301.00**
Vial Tests				
Ammonia TNTplus, HR	2-47 NH3-N	Yes	**75919-206**	Pk. 25/ **52.45**
Ammonia TNTplus, LR	1-12 NH3-N	Yes	**75919-204**	Pk. 25/ **52.45**
Chemical Oxygen Demand (COD) TNTplus, HR	20-1,500 COD	Yes	**75919-300**	Pk. 25/ **53.59**
Chemical Oxygen Demand (COD) TNTplus, LR	3-150 COD	EPA, Digestion Required for Total	**75919-246**	Pk. 25/ **53.59**
Phosphorus (Reactive and Total) TNTplus, HR	1.5-15.0 PO4	EPA, Digestion Required for Total	**75919-250**	Pk. 25/ **52.79**
Phosphorus (Reactive and Total) TNTplus, LR	0.15-4.5 PO4	EPA, Digestion Required for Total	**75919-328**	Pk. 25/ **52.75**

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Beer: Where History and Science Collide

By Daniel Ballew, Marketing Associate, Hardy Diagnostics

When most Americans think about beer, a few distinct images come to mind: cold, glistening glasses, backyard barbecues, and "dad bellies." That being said, the story of beer cannot and should not be distilled down to a few blurry mental images that come from television, movies, and general social commentary. Beer has a history and a complexity that is so rich, you might need a cold mug just to get it all down. To truly understand the importance of beer, we must start at the beginning.

Beer is the most widely consumed alcoholic beverage, and more than likely the oldest. Behind water and tea, it is the most consumed beverage on earth. Historically, beer is thought to date back to 9500 BC. The Sumerians regarded beer so highly, that brewing a bad batch would mean death, ironically by drowning in your own bad brew. In ancient Egypt, workers on the Giza pyramid received four liters of beer a day. In the middle ages, beer was drunk more than water, because the alcohol made it safer for consumption. Even the first President of the United States, George Washington, had his own personal brew house on the grounds of his home, Mount Vernon. But history aside, what is in this beloved beverage?

The Reinheitsgebot or the German Beer Purity Law outlines what, according to the Germans, are the acceptable/necessary ingredients for brewing beer. When it was first drafted in 1516 in Bavaria, the only ingredients it permitted to be used in production were barley, hops, and water. The law was later changed to incorporate yeast with the discovery of its role in fermentation by Louis Pasteur in the mid 1800's. While a fair amount of beer follows this basic outline of ingredients, beer can include fruit, flowers, cinnamon, root vegetables, honey, chocolate, coffee, and even hot sauce. For this reason, beer is one of the most diverse drinks in the world. There is an old saying: "if you don't like beer, you haven't tried enough of it." Beer is so wonderfully diverse that it is impossible to judge the beverage as a whole based on one or two of its variants. So, what are some of the more popular types of beer?

Well in brewing terms, there are only two types of beer and, no, I do not mean good beer and bad beer. What I mean is that beer is either an Ale or a Lager. These two types have a plethora of variations beneath them though they all share some similar characteristics. Ales are by far the oldest types of beers. They yield intense flavor profiles and can range from golden in color with flowery or citrus flavors to almost black and opaque in color with notes of oak, coffee, and chocolate. Some Ale styles you may have heard are Saisons, Hefe-weizen, India Pale Ales (IPA's), Stouts, Porters and Barley Wines. Lagers have only been around for a few hundred years, which in historical terms make them the infant brother of Ales. Lagers were only viable to produce after the process was more fully understood with the introduction of the microscope. Like white wines, they are fermented and served at much colder temperatures. Lager styles you may be aware of include Pilsners, Marzens, and Bocks, though you would probably know them not by style name but by their manufacturer names: Budweiser, Coors, Miller, and Sam Adams.

What most people do not realize is the difficulties involved in the microbiology of the beer itself. Beer made on a mass scale must undergo extensive testing not only so that it is consistent in taste and appearance but that its fermentation is consistent. Fermentation is the metabolic process by which yeast converts a carbohydrate such as sugar into an alcohol. Without proper fermentation monitoring, alcohol content would vary wildly from batch to batch. Furthermore, proper environmental monitoring of facilities must be done and high standards met if a brewery hopes to keep its good reputation. This is where Hardy Diagnostics comes to help.

Contact your VWR Sales Representative to learn more about the Hardy Diagnostics portfolio of specialized products for the beer and wine industries. Whether it is environmental monitoring plates for air monitoring and surface testing to our Beer Agar with Cyclohexamide for the detection of Lactobacillus acidophilus, we have everything you need to make sure your brewery or winery is up to snuff. Custom formulations of media are also available upon request.

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DuPont Tyvek 800 J Coveralls

Size	Cat. No.	Case of 25
Small	10809-151	280.62
Medium	10809-131	280.62
Large	10809-133	280.62
X-Large	10809-135	280.62
2X-Large	10809-137	297.46
3X-Large	10809-155	321.44
4X-Large	75854-084	346.95
5X-Large	75854-086	374.51
6X-Large	75854-088	404.61
7X-Large	75854-090	436.75

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Volume, mL	Increments, mL	A/CV	Cat. No.	Each
10	0.05	0.3%/0.1%	**MP75993-418**	**1036.00**
20	0.05	0.2%/0.1%	**MP83007-660**	**1036.00**
50	0.1	0.2%/0.1%	**MP83007-662**	**1036.00**

No redemption required, simply use these special Cat. Numbers when purchasing. German beer stein will ship with your order. Promotional part numbers are available for a limited time, must be used at the time of purchase, and may be ordered via the "ORDER ENTRY" link on **vwr.com**. (Promotional part numbers cannot be found via Search on **vwr.com**.) For assistance with ordering, please contact VWR Customer Service at 1.800.932.5000. Offer expires 12.31.2017.

Save 10% on solarus and get a free German Beer Stein!

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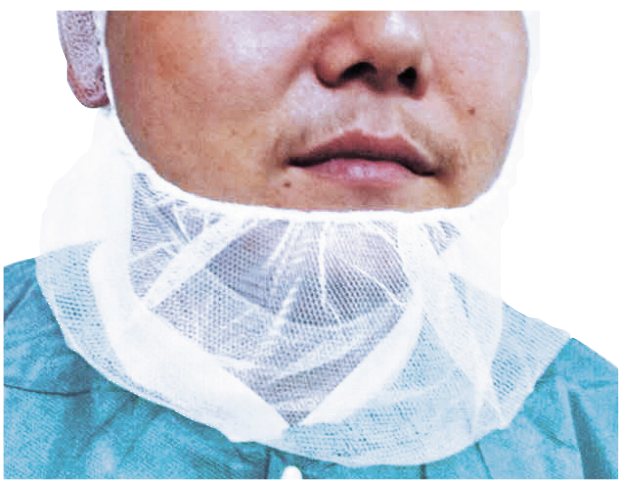
VWR® Basic Protection Industrial Hairnet

Comfortable and sturdy VWR Basic Protection Industrial Nylon Hairnet is made from nylon and allows users to keep hair secure and out of the way.

Size	Color	Cat. No.	Case of 1,000
53.3 cm (21")	White	**75829-204**	**66.99**

VWR® Basic Protection Industrial Beard Cover



VWR Basic Protection Industrial Beard Cover provides comfortable fit and nylon construction. Ideal for all types of beards.

Size	Color	Cat. No.	Case of 1,000
45.7 cm (18")	White	**75829-206**	**69.01**

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The new Repeaters E3 and E3x are your tool of choice for overcoming these challenges. They combine the advantages of a direct displacement dispenser with those of an electronic pipette. In this manner, they facilitate long pipetting series and working with challenging liquids.

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Pipette Description	Cat. No.	Each
Repeater E3 with Power Cable, Combitips® Pack	**75796-404**	**1040.68**
Repeater E3 Bundle, Including Charger Stand	**75796-408**	**1145.27**
Repeater E3x with Power Cable, Combitips Pack	**75796-406**	**1248.83**
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VWR® symphony™ CO_2 Incubators

Over $300 Value

Purchase any VWR symphony CO_2 Incubator and get a FREE case of 100 VWR® Standard (10062-862) or Vented (10062-860) Cell Culture Flasks.

Designed for optimal cell Growth and protection, these CO_2 incubators deliver the performance and solution flexibility your cultures demand.

Description	Sensor	Capacity, cu. ft.	Cat. No.	Each
Air-Jacketed CO_2 Incubators				
Single Unit	TC	1.4	**10810-742**	**5714.34**
Basic Single Unit	TC	5.3	**10810-888**	**6291.24**
Single Unit	IR	6.5	**10810-944**	**8256.22**
Single Unit	TC	6.5	**10810-902**	**7519.82**
Dual-Stacked	IR	2 x 6.5	**10811-004**	**16,474.14**
Dual-Stacked	TC	2 x 6.5	**10811-002**	**14,996.05**
Water-Jacketed CO_2 Incubators				
Single Unit	IR	6.5	**10810-878**	**8256.22**
Single Unit	TC	6.5	**10810-744**	**7519.82**
Dual-Stacked	IR	2 x 6.5	**10810-886**	**16,474.14**
Dual-Stacked	TC	2 x 6.5	**10810-884**	**14,996.05**

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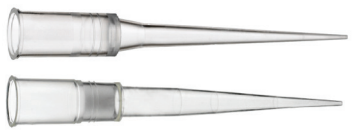
VWR® RAININ® LTS Pipet Tips



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Free Case of Centrifuge Tubes

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Value up to $250

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- HyperSep Dispersive (QuEChERS)
- Trace Gold GC Columns
- Accucore Columns

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VWR® Advanced Hotplate Stirrers

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- Excellent temperature uniformity
- Microprocessor controlled
- Cool touch, chemical resistant housing
- Best in class 5 year warranty

Over $150 Value

Electrical	Top Plate Dim., cm	Max Capacity, mL	Top Plate Material	Cat. No.	Each
120V, 400W, 3.3A	10.2 x 10.2	600	Aluminum	**97042-606**	**639.27**
120V, 400W, 3.3A	10.2 x 10.2	600	Ceramic	**97042-602**	**530.47**
120V, 1000W, 8.3A	17.8 x 17.8	2500	Aluminum	**97042-646**	**654.39**
120V, 1000W, 8.3A	17.8 x 17.8	2500	Ceramic	**97042-642**	**579.67**
120V, 1550W, 12.9A	25.4 x 25.4	6000	Aluminum	**97042-686**	**865.67**
120V, 1550W, 12.9A	25.4 x 25.4	6000	Ceramic	**97042-682**	**714.79**

Visit **vwr.com/promotions** and search **Promo Code 4292** to redeem.

Offer expires 12.31.2017

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VWR® Vortex Mixers

Free Mixer

Buy 3 VWR® Vortex Mixers, Get One FREE!

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- Trace Gold GC Columns

Free Vortex Mixer must be of equal or lower price than the lowest value Vortex Mixer purchased.

Description	Cat. No.	Each
Fixed Speed Vortex Mixer	**10153-834**	**364.39**
Analog Vortex Mixer	**10153-838**	**421.98**
Digital Vortex Mixer	**10153-842**	**501.26**
Pulsing Vortex Mixer	**10153-812**	**648.53**

Visit **vwr.com/promotions** and search **Promo Code 4309** to redeem.

Offer expires 12.31.2017

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VWR® CO_2 Incubators

Buy one VWR Microbiology Incubator and get a Case of Semi-stackable, Sterile VWR® Petri Dishes (25384-088) and 500g VWR Amresco Life Science Bacteriological Agar (97064-336) FREE!

Designed for optimal cell growth and protection, these CO_2 incubators deliver the performance and flexibility your cultures demand.

Over $420 Value

Volume, L (cu. ft.)	Exterior Dimensions, H x W x D, in.	Heat-Up Time	Cat. No.	Each
Gravity Convection Incubators				
75 (2.6)	28 x 21 x 22	25 min. to 37°C	**89511-418**	**1973.17**
117 (4)	32 x 25 x 22	35 min. to 37°C	**89511-420**	**2550.41**
194 (6.85)	36 x 25 x 29	35 min. to 37°C	**89511-422**	**2888.39**
Forced Air Incubators				
66 (2.3)	28 x 21 x 22	15 min. to 37°C	**89511-424**	**2534.37**
104 (3.6)	32 x 25 x 22	30 min. to 37°C	**89511-426**	**3339.81**
178 (6.3)	36 x 25 x 29	30 min. to 37°C	**89511-428**	**3752.52**
371 (13.4)	61 x 29 x 31	35 min. to 37°C	**89511-430**	**6881.19**

Visit **vwr.com/promotions** and search **Promo Code 4394** to redeem.

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VWR® Recirculating Chillers, -10° to +40°C

- Economical chillers reduce water consumption
- Compact, portable design saves floor space
- Reliable cooling at ambient temperatures as high as 35°C
- large, dual displays, which present temperature and pressure or flow rate simultaneously
- Exclusive WhisperCool® Environmental Control System reduces noise levels below conversational speech at a distance to two meters

Compressor Size	Cooling Capacity	Maximum Pressure	Flow Rate	Cat. No.	Each
Magnetic Drive Centrifugal Pumps					
1/4 HP	300W at 0°C, 700W at 10°C, 950W at 20°C	10 psi (0.69 bar)	4.1 gpm (15.5 l/min.)	**13271-184**	**4659.96**
1/3 HP	700W at 0°C, 1000W at 10°C, 1430W at 20°C	10 psi (0.69 bar)	4.1 gpm (15.5 l/min.)	**13271-192**	**5071.59**
1/2 HP	850W at 0°C, 1250W at 10°C, 1800W at 20°C	10 psi (0.69 bar)	4.1 gpm (15.5 l/min.)	**13271-200**	**5408.96**
Positive Displacement Pumps					
1/4 HP	400W at 0°C, 600W at 10°C, 850W at 20°C	100 psi (6.9 bar)	1.0 gpm (3.8 l/min.)	**13271-188**	**4814.89**
1/3 HP	530W at 0°C, 990W at 10°C, 1400W at 20°C	100 psi (6.9 bar)	1.0 gpm (3.8 l/min.)	**13271-196**	**5071.59**
1/2 HP	750W at 0°C, 1150W at 10°C, 1700W at 20°C	100 psi (6.9 bar)	1.0 gpm (3.8 l/min.)	**13271-204**	**5408.96**
Turbine Pumps					
1/4 HP	400W at 0°C, 600W at 10°C, 850W at 20°C	100 psi (6.9 bar)	3.5 gpm (13.2 l/min.)	**97044-090**	**4798.63**
1/3 HP	530W at 0°C, 990W at 10°C, 1400W at 20°C	100 psi (6.9 bar)	3.5 gpm (13.2 l/min.)	**97044-094**	**5204.72**
1/2 HP	750W at 0°C, 1150W at 10°C, 1700W at 20°C	100 psi (6.9 bar)	3.5 gpm (13.2 l/min.)	**97044-098**	**5509.86**

Electrical: 120VAC/60Hz. Also available 208-230VAC/60Hz; visit **vwr.com**.

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- Value and performance for everyday cell culture applications by providing a reliable growth environment
- Choice of long lasting TC or independent IR CO_2 sensor
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- Available in-chamber HEPA filtration airflow protects samples from airborne contaminants during routine access
- Dual stack configurations include mobile support stand and stacking kit to maximize lab space

10810-902

10810-888

Description	Volume, cu. ft.	Sensor	Cat. No.	Each
Basic Air Jacketed CO_2 Incubator	5.3	TC	**10810-888**	**6291.24**
HEPA Filtration, High Temperature Decon.	6.5	TC	**10810-902**	**7519.82**
HEPA Filtration, High Temperature Decon.	6.5	IR	**10810-944**	**8256.22**
Dual Stacked, HEPA Filtration, High Temperature Decon., Roller Dolly	6.5	TC	**10811-002**	**14,996.05**
Dual Stacked, HEPA Filtration, High Temperature Decon., Roller Dolly	6.5	IR	**10811-004**	**16,474.14**

VWR® Refrigerated Circulating Baths

- Precise temperature control at temperature ranges from -40° to 200°C (depending on the controller)
- Digital Temperature Controller offers a touch-pad
- Programmable Temperature Controller includes a full touch-screen display, and programmability (ten 100-step programs)
- All include Swivel 180™ technology allowing controller to rotate independently from bath

Specifications

Maximum Pressure	4.3 psi (0.3 bar)
Maximum Pressure Flow Rate	5.3 gpm (20.1 l/min)
Temperature Stability	±0.01°C

Refrigerated Circulating Baths	Temperature Range	Cooling Capacity, at 20°C	Cat. No.	Each
Advanced Digital Controller				
7L, Low Profile	-20° to 200°C	200W	**89202-962**	**4773.65**
7L, Space-Saving	-20° to 200°C	200W	**89202-970**	**4668.89**
7L, Space-Saving	-40° to 200°C	505W	**89202-978**	**5400.54**
15L, Space-Saving	-30° to 200°C	915W	**89202-986**	**5529.98**
15L, Space-Saving	-40° to 200°C	1000W	**89202-994**	**6218.54**
20L, Space-Saving	-30° to 200°C	915W	**89203-002**	**5955.80**
28L, Space-Saving	-30° to 200°C	915W	**89203-010**	**6547.47**
45L, Space-Saving	-25° to 135°C	1400W	**89203-018**	**9021.03**
Advanced Programmable Controller				
7L, Space-Saving	-20° to 200°C	200W	**89202-974**	**5738.89**
7L, Space-Saving	-40° to 200°C	505W	**89202-982**	**6343.37**
15L	-30° to 200°C	915W	**89202-990**	**6469.88**
15L	-40° to 200°C	1000W	**89202-998**	**7251.59**
20L	-30° to 200°C	915W	**89203-006**	**6783.21**
28L	-30° to 200°C	915W	**89203-014**	**7340.78**
45L	-25° to 135°C	1400W	**89203-022**	**9955.99**

Many additional options are available; visit **vwr.com**.

Thermo Scientific™ Orion™ Meters

Now's the time to enjoy the measure of confidence. Thermo Scientific Orion meters are designed to offer an easier way to test. Simple interfaces with onscreen prompts allow for easy training and consistent testing.

For Versatility in the Lab
Thermo Scientific™ Orion™ Versa Star Pro™ meter has a four channel design, allowing you to mix-and-match measurement modules as needed.

For Everyday Testing
Thermo Scientific™ Orion Star™ A210 series meters offer dedicated single and dual parameter measurement capabilities.

For a Budget-Friendly Solution
Thermo Scientific Orion Star A110 series meters offer an economical solution for single parameter measurement needs.

For an All-in-One Solution
Thermo Scientific Orion meters are available in kit versions, providing you with the electrodes, buffers, and solutions you need at a great value.

Description	Cat. No.	Each
Versa Star Pro pH/ISE Benchtop Meter Kit	**MP89206-392**	**1775.16**
Versa Star Pro 2 x pH/ISE Benchtop Meter Kit	**MP89206-396**	**2057.67**
Versa Star Pro pH & Conductivity Meter Kit	**MP89206-400**	**1857.49**
Star A211 pH Benchtop Meter Durable Kit	**MP89260-360**	**883.80**
Star A214 pH/ISE Meter pH & Ammonia Kit	**MP89206-334**	**1885.45**
Star A214 pH/ISE Meter pH & Fluoride Kit	**MP89206-336**	**2022.92**
Star A214 pH/ISE Meter pH & Sodium Kit	**MP89206-338**	**1741.17**
Star A215 pH/Conductivity Benchtop Meter Kit	**MP89206-342**	**1524.37**

Trade-in and save up to 20%!

For a limited time, trade in your old benchtop meter and get special pricing on a new Thermo Scientific Orion benchtop meter! We'll also make sure your old meter is disposed using Responsible Recycling (R2) methods. For more information, and a complete listing of many additional available options, visit **vwr.com/promotions** and search **Promo Code 4797**. Offer expires 12.31.2017.

No redemption necessary, simply use these special promotional VWR catalog numbers when placing order. (available for a limited time, must be used at the time of purchase, and may be ordered via the "ORDER ENTRY" link on vwr.com. Promotional part numbers cannot be found via Search on wr.com.) For assistance with ordering, please contact VWR Customer Service at 1.800.932.5000.

Purely SMART!

One System, Two Types of Water, From Tap

Save with easy-to-order packages that include water system and start-up consumables!

Thermo Scientific™ Barnstead™ Smart2Pure™ water purification systems with start-up consumables that deliver ultrapure up to 18.2 megohm water from tap water with consistent quality, outstanding flexibility and great savings.

- Integrated 6L tank on 3LPH and 6LPH models to free up bench space
- Independent cartridges so you only replace those that need replacing
- Quick connect cartridges for easy change-outs

Complete package in one part number! All packages include: Barnstead Smart2Pure water system, hardness stabilizer 5 micron filter with activated carbon pretreatment, pressure regulator valve, RO/pretreatment cartridge, ultrapure polishing cartridge, UV lamp, 0.2 micron final filter, and hand dispenser for Type 2 water. Optional ultrafilter available on applicable units only.

Thermo Scientific Barnstead Smart2Pure Water System	RO Production	Cat. No.	Each
Smart2Pure UV Water System Applications: Analytical methods such as inorganic and organic trace analysis, HPLC, ICP-MS, IC, and TOC Analysis.	3 LPH	**MP50129872PR**	**4460.52**
	6 LPH	**MP50129885PR**	**6327.71**
	12 LPH*	**MP50129890PR**	**7572.51**
Smart2Pure UV/UF Water System Applications: Life science methods that utilize DNA or RNA, such as PCR, or cell culture media prep requiring nuclease removal.	3 LPH	**MP50129688PR**	**4875.45**
	6 LPH	**MP50129887PR**	**6742.65**
	12 LPH*	**MP50129845PR**	**7883.71**

*Requires purchase of accessory storage vessel.

For more information and to redeem visit **vwr.com/promotions** and search **Promo Code 3570**. Offer expires 12.31.2017. Promotional part numbers must be used at the time of purchase, and may be ordered via the "ORDER ENTRY" link on vwr.com. (Promotional part numbers cannot be found via Search on vwr.com.) For assistance with ordering, please contact VWR Customer Service at **1.800.932.5000**. Offer valid in the US only.

Savings you can see!

Package includes everything needed to make Type 1 or Type 2 water the day you receive your system.

VWR COLLECTION designed for precision

VWR® Spectrophotometers, Basic Vis or UV-VIS

V-1200 and UV-1600PC are basic visible and UV/Vis spectrophotometers for the routine daily quality control requirements, in process control and teaching laboratories.

- Large LCD display (128×64 pixels)
- Can save up to total 200 results and 200 standard curves
- Download data to PC via USB interface
- Application software, allows PC control of the spectrophotometers (delivered with UV-1600PC), includes the following methods: basic mode, quantitative, wavelength scan, kinetics, multi-wavelength, DNA/protein
- Variety of optional accessories including an automatic 8-cell changer

Ordering Information: Accessories supplied with the V-1200 include four optical glass cells and 4-position cell holder. Accessories supplied with the UV-1600PC include four optical glass cells, two quartz cells, 4-position cell holder, dust cover and application software for PC control.

Specifications

Display	Graphic LCD (128×64 pixels)
Electrical	120V
Interfaces	USB port to PC/parallel port to printer
Optical design	Single beam, grating 1200 lines/mm silicon photodiode detector
Photometric accuracy	±0,5% T
Photometric range	–0,3 to 3 A; 0–200% T
Photometric stability	±0,002 A/h @ 500 nm
Spectral bandwidth (nm)	4
W×D×H (mm)	490 × 360 × 210

Spectrophotometer	Light Type	Wavelength, nm	Cat. No.	Each
V-1200	Tungsten Halogen, ≤0,3% T	325 - 1000	**10037-434**	**1848.00**
UV-1600PC, Scanning	Deuterium/Tungsten Halogen, ±0,05% T @ 220, 360 nm	190 - 1100	**10037-436**	**2784.86**

VWR COLLECTION designed for reliability

VWR® Clinical 200 Large Capacity Centrifuges

Designed for ease of use, this large-capacity centrifuge is ideal for clinical lab and research environments.

- Microprocessor control
- Safety lock lid
- Dynamic braking with non-disruptive soft stop
- VWR Two-Year Limited Parts and Labor Warranty
- Accepts all common blood draw tubes; Hematocrit tube rotor also available

Clinical 200 Centrifuge	Electrical	Rotor, mL	Cat. No.	Each
Without Rotor	120V, 60Hz	—	**82013-812**	**2570.09**
Without Rotor	230V, 50Hz	—	**82013-814**	**2175.10**
With Rotor and Adapters	120V, 60Hz	12 x 15	**82017-654**	**3084.09**
With Rotor and Adapters	230V, 50Hz	12 x 15	**82017-656**	**2712.22**

VWR COLLECTION designed for precision

VWR® sympHony™ Benchtop Meter Kits

Step-by-step on screen prompts enable both new and seasoned users to operate the meter easily and effectively, resulting in consistently accurate measurements.

- Consistently accurate and reliable measurements
- Configurable to each user's unique needs
- Simple to operate and maintain

Meter Kit	Probe	Includes	Cat. No.	Each
B10P pH Meter	pH	B10P Meter (**89231-662**) and Refillable Glass pH Electrode (**89231-580**)	**89231-664**	**964.39**
B20PI pH/ISE Meter	pH	B20PI Meter (**89231-692**) and pH Probe (**89231-580**)	**89231-694**	**1559.29**
B30PCI pH/ Conductivity/ISE Multimeter	pH, Conductivity	B30PCI Meter (**89231-696**), pH Probe (**89231-580**), and Conductivity Probe (**89231-614**)	**89231-698**	**1902.61**
B10C Conductivity Meter	Conductivity	B10C Meter (**89231-676**) and Conductivity Probe (**89231-614**)	**89231-678**	**1349.62**
B40PCID Multimeter	pH, DO	B40PCID Meter (**89231-684**), pH Probe (**89231-580**), and DO Probe (**89231-624**)	**89231-704**	**2411.73**
B40PCID Multimeter	DO	B40PCID Meter (**89231-684**) and Dissolved Oxygen Probe (**89231-624**)	**89231-670**	**2175.15**
B40PCID Multimeter	pH, DO, Conductivity	B40PCID Meter (**89231-684**), pH (**89231-586**), Conductivity (**89231-618**), and DO (**89231-624**) Probe	**89231-686**	**2984.90**

thermo scientific

Thermo Scientific™ Heratherm™ Microbiological Incubators, Low Temperature Incubators, and Ovens

Designed for Your Food and Beverage Quality Testing Applications

All Thermo Scientific Heratherm temperature controlled models include:

- Outstanding temperature stability and uniformity
- Access port
- Easy to use, bright florescent display controllers
- Stainless steel interior and shelves
- Easy to clean rounded edges
- Flexible shelving system, no tools required
- Internal glass door (incubator models)

Thermo Scientific Heratherm advanced protocol microbiological incubators

- Dual convection with adjustable fan that can be reduced to 0%
- Ambient plus 5°C to 105°C temperature range
- Internal outlet

Thermo Scientific Heratherm low temperature incubators

- Energy efficient Peltier heating and cooling technology, no refrigerants required
- Wide temperature range: 5°C to 70°C
- Programmable

Thermo Scientific Heratherm advanced protocol heating and drying ovens

- Gravity or mechanical convection (with adjustable fan)
- 50°C to 330°C temperature range
- Programmable and advanced timer

Capacity, L	Shelves, Supplied (Max)	Cat. No.	Each
Advanced Protocol Microbiological Incubators			
60	2 (13)	**10124-574**	**2966.84**
100	2 (16)	**10124-592**	**3827.28**
180	2 (19)	**10124-604**	**4444.34**
Advanced Protocol Low Temperature Incubators			
178, Bench Top	2 (9)	**75840-782**	**6400.00**
178, Bench Top with Internal Outlet	2 (9)	**75840-778**	**6700.00**
381, Floor Standing	2 (17)	**75840-784**	**9200.00**
381, Floor Standing with Internal Outlet	2 (17)	**75840-780**	**9500.00**
Advanced Protocol Compact Microbiological Incubator			
18	2 (3)	**10200-150**	**693.84**
Advanced Protocol Heating & Drying Oven			
62	2 (13)	**10124-590**	**3811.13**

VWR Supports You Before, During, and after Installation

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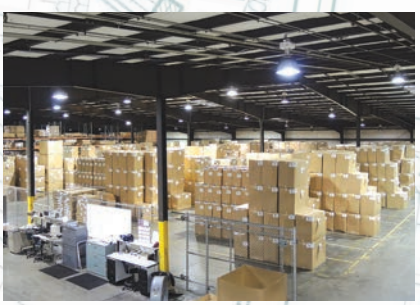
delivered



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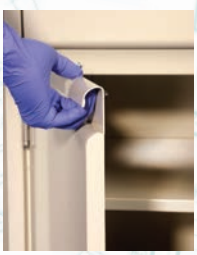

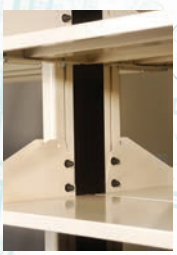

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The New VWR 3D Configurator allows you to easily design a lab workstation complete with accessories. Follow four easy steps—the configurator walks you through the simple process of selecting a VWR bench and adding accessories to build a lab workstation that best meets your needs.

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- Safety Cabinets
- Sinks & Fixtures
- Tables/Workstations
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