New Products: Lab Equipment

# Spectrophotometers and Titrators Get Better, Cheaper and Faster

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**MOST WINERIES DON'T TYPICALLY** conduct enough routine analyses. With it being infinitely easier to prevent wine spoilage than it is to correct it, one should really run pH, TA, VA, free and total $SO_2$ on every tank of wine in the winery once a week, and then again on every barrel of wine every time it is topped. However, even if one were to pare this down to the absolute minimum number of analyses and just check pH and free $SO_2$, this can still mean that a moderately sized winery, around 5,000 cases annual production, should be conducting more than several hundred titrations a week during élevage while a large winery with a large barrel program could push this number into the tens of thousands. The problem is that most wineries are unprepared to deal with the sheer number of samples this would require.

A very basic winery lab needs nothing more than a burette, pH meter, flasks, beakers, and some additional fancy glassware, like a Cash-still for VA and an aeration setup for $SO_2$ determinations. With this equipment, a lab tech can run anywhere from 50 to 200 titrations a day, depending upon the individual and whether they actually bother to standardize their solutions at regular intervals. The problem then remains as to finding the best manner for dealing with having to conduct a large number of analyses.

In a similar vein, one can conduct most of the analyses requiring a spectrophotometer with a traditional unit. Using an automated unit, like the Astoria2 discussed below, becomes a necessity when the number of analyses that need to be run starts to be more than a tech can do in a batch-style spectrophotometer.

It has been my experience that running routine analyses is not the best way to use all of a lab tech/enologist's time. I would much rather invest in a couple pieces of equipment and enable the winery to better make use of the enologist's skills. The good news is that lab equipment continues to get "better, faster, and, overall, cheaper," reducing the investment required to significantly increase the productivity of a winery's lab.

## New Spectrophotometer- and Titrator-focused Lab Equipment

This year, the industry continues to see new applications of infrared spectroscopy to wine analysis with the introduction of a **VFA-IR** spectrometer from **Wilks Enterprise, Inc.** This small, compact and rugged spectrophotometer is designed as a much less expensive alternative to a **Fourier-Transform IR** (FTIR) spectrophotometer. Another spectrophotometer, the relatively new **Astoria 2** from **Astoria-Pacific**, has received another upgrade to its data-capture software. The **FASPac II** software allows a great deal of end-user customization, real time results, calibration of results and data file import/export to standard spreadsheet formats like **Microsoft Windows Excel**.

New automated titrators continue to be introduced that are adaptable to, or specifically designed for, winery laboratories. **Sirius Analytical** entered the winery-laboratory equipment market with a dedicated pH/TA titrator called **Vinotrate**. At the same time, both **Hanna Instruments** and **Mettler-Toledo** expanded their automated titrator lines. Some of the titrators, like the Sirius Vinotrate and Hanna Instruments **HI 84102**, are single-purpose pieces of equipment while others, like the **HI 901** and **902**, are designed to be able to do a broad range of titrations. The new Mettler-Toledo titrators attempt to achieve a bit of both with a very modular design that can allow for an a la carte approach. Winery labs can get the features they need without having to buy those they don't.

## Spectrophotometers

Infrared (IR) analysis has become more prominent in winery labs over the past few years. Although the particulars vary, depending upon the exact analyzer, all spectroscopy involves measuring how much light is absorbed by a compound at a particular frequency. The frequencies used for IR spectroscopy are just those that are too long to be seen, 2,500 to 16,000 nm. Organic chemicals, that is pretty much anything consisting of carbon, all absorb IR radiation but do so at a unique collection of frequencies. For example, C-H bonds absorb IR in specific ranges depending upon the other bonds on the carbon atom. Alkyl C-H absorbs IR in the range of 3,390 to 3,509 nm, alkenyl C-H absorbs 3,226 to 3,322 nm, alkynyl C-H absorbs at 3,030 nm, and aromatic C-H 3,300 nm due to C-H bond stretching and 11,628 to 14,706 nm due to C-H bond bending. Similarly, the O-H bond in alcohols and phenols absorbs in the range of 2,817 to 3,125 nm. Since ethanol ($CH3CH_2OH$) has five alkyl C-H bonds and an O-H bond, one would expect IR absorbance peaks at 3,390 to 3,509 nm and 2,817 to 3,125 nm.

## INFRASPEC VFA-IR ALCOHOL ANALYZER BY WILKS ENTERPRISE, INC.

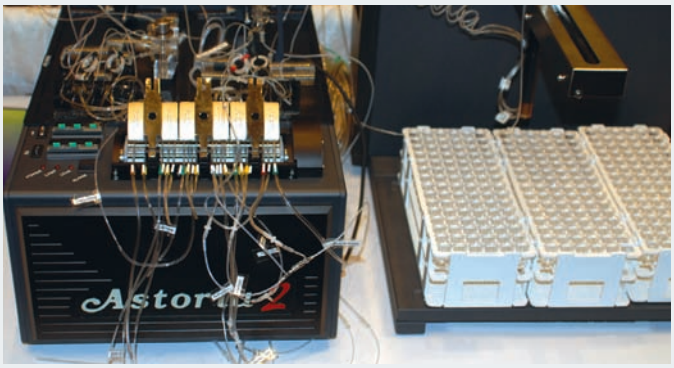
Although reasonably well established, the infrared analyzers produced by Wilks Enterprises have recently entered the landscape for U.S. wineries thanks to **Alpine Scientific**. The Wilks IR analyzers are compact, mid-infrared (mid-IR) spectrometers that are designed to supplement the capabilities of FT-IR spectrometers in areas where it is not practical or cost-effective to utilize such sophisticated and expensive instrumentation as an FT-IR.

Since wine is a fluid, most spectrophotometers used in wineries are used to measure the transmission/absorbance at a given wavelength. The **InfraSpec** is a little different in that it is a type of attenuated total reflectance (ATR) spectrophotometer. This means that little or no sample preparation is required. A sample is just placed on the exposed crystal sample surface, made of zinc selenide for ethanol analysis, where it is quickly analyzed.

Wine, while a complex solution, is mostly water and ethanol, so the O-H absorbance peak can be used to determine the ethanol concentration. This seems to be the main target in the wine industry for InfraSpec. Wilks has released an application note for ethanol analysis, noting that mid-IR analysis of ethanol yields results comparable to ebulliometry with a range of 2-95 percent v/v ethanol and an accuracy of plus or minus 0.15 percent (recent improvements are likely to increase the accuracy to better than 0.06 percent by the time this article is printed). The sample can be turbid, so active fermentations can be measured, and only about a 1ml sample is needed. Finally, the result is available in about one minute, a considerably shorter time than it takes to measure ethanol using an ebulliometer.

**Notable Feature:** The InfraSpec can measure ethanol accurately in about one minute.

**For more information, contact Wilks Enterprise at 203-855-9136 or visit *www.wilksir.com*.**




## ASTORIA 2 AND FASPAC II BY ASTORIA-PACIFIC

The Astoria 2 joined Astoria-Pacific's line of auto analyzers in 1995. The Astoria 2 is an extremely versatile piece of equipment that can sample up to 120 samples per hour. Most winery laboratories would use the Astoria 2 as a spectrophotometer for automated phenol determination, and, to that end, Astoria-Pacific has released a total phenol procedure based on Folin-Ciocalteau.

The Astoria 2 is not a single-purpose analyzer, however. A lot of its flexibility comes from a modular design. The heart of the system is the "Analyzer Module." This is the middle section of an installed Astoria 2. It contains two detectors, a peristaltic pump, two heat bath controllers and space for two analytical cartridges.

The Astoria 2 can also be linked with an external detector, like an ultraviolet/visible (UV/V) spectrophotometer, a fluorometer or a flame photometer, for example, as an alternative to one of the internal detectors or as an additional third channel detector.

The Astoria 2 analyzer modules can even be set up in linked pairs and operate in a "2+2 mode" that allows four simultaneous analyses to be conducted on each individual sample. The Astoria 2 sells for around $35,000, but the exact combination of modules and options can significantly add to this baseline price.

Astoria-Pacific has also released an update to the detector-to-computer software. The Flow Analyzer Software Package (FASPac II) controls, collects and processes data from up to six digital channels and one analog channel simultaneously. Running within the Windows environment, FASPac II offers a graphical presentation of information and data, easily customized for the individual winery laboratory's needs.

**Notable Feature:** Automated and extremely versatile, Astoria 2 can perform multiple spectrophotometric measurements on the same sample.

**For more information contact Astoria-Pacific at 800-536-3111 or visit *www.astoria-pacific.com*.**

# Titrators

There are several new automated titrators that have been introduced into the market recently. These include multi-purpose units that can be used for a number of analyses and others that are designed for a particular type of titration. Note that single tiration units often can be used for more than one individual analysis. For example, an automated acid-base titrator would be used for the determination of pH and titratable acidity (TA).

### VINOTRATE BY SIRIUS ANALYTICAL

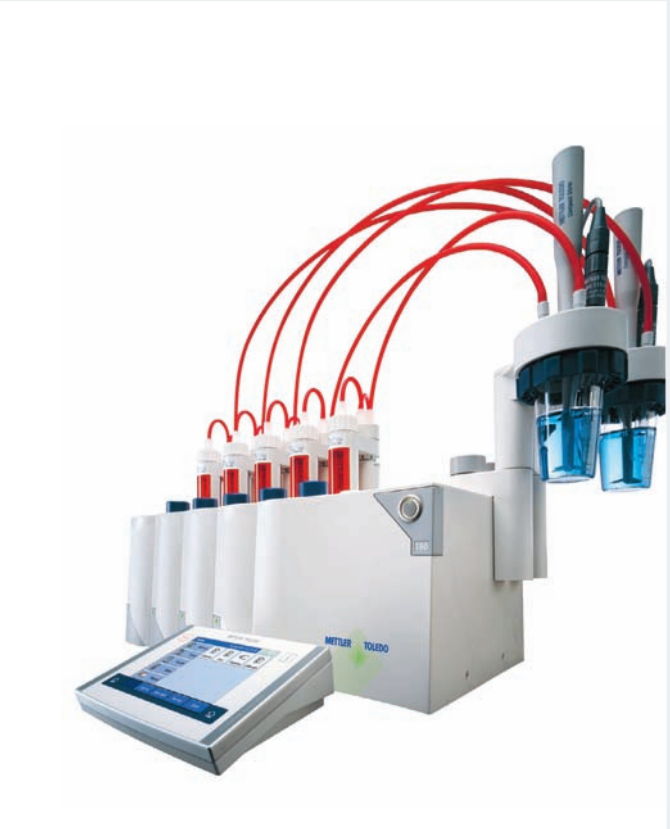
Sirius Analytical has introduced the Vinotrate, a wine auto-titrator for measuring pH and Titratable Acidity (TA) in juice, must and wine.

Features include $CO_2$ removal and flowing water wash. The Vinotrate can hold 50 samples. All the probes, including the pH electrode, stirrer, capillaries for delivering the titrant (0.5N NaOH), temperature sensor and inert gas delivery (for $CO_2$ removal), move on the same actuator. The instrument automatically moves the probe-package between the buffer solutions, wash solutions and samples. The Vinotrate can be set to self-calibrate at regular intervals.

The Vinotrate has an open electrode cavity that is refreshed with KCl solution between each sample. The probe is rinsed by fresh deionized water at each step and soaked in a pepsin solution between uses. The Vinotrate sells for around $25,000.

**Notable Feature:** Specifically designed for measuring pH and TA in juice and wine.

**For more information, visit *www.vinotrate.com* or contact Alpine Scientific at 530-756-6082 or visit *www.alpinescientific.com*.**




### METTLER-TOLEDO

Mettler-Toledo has a new line of automated titrators known as "Titration Excellence." The individual titrator model numbers, in order of increasing complexity, are T50, T70 and T90. All offer modular design, automatic burette recognition, personalized home screens and a specialized macro programming interface called "One-Click Titration" that allows the individual steps of an analysis to be pre-programmed and assigned to a single touch-screen button on the technician's personalized home screen.

All models in the "Titration Excellence" line feature USB connectivity to printers, barcode readers and USB-flash memory. They can also connect to a LabX network via a standard RJ45 Ethernet connector.

**Notable Feature:** Modular design. Titrators automatically recongnize which burette has been attached.

**For more information, contact Mettler-Toledo at 800-38-8537, ext. 7066 or visit *www.mt.com*.**

### HI 901 AND HI 902 TITRATORS BY HANNA INSTRUMENTS

Hanna Instruments has brought a couple new titrators onto the market. The HI 901 and HI 902 are designed to perform acid-base, potentiometric and amperometric titrations. They come pre-programmed with a hundred analytical procedures. This includes several procedures appropriate for winery labs, including pH, Free $SO_2$, Total $SO_2$, Total Acidity (AKA Titratable Acidity or TA), Volatile Acidity (VA), Reducing Sugars (RS), Nitrogen and more. The onboard software also allows the end-users to develop their own analytical methods. The HI 901/902 can drive two dosing pumps. The HI 902 can drive both at the same time and perform back titrations.

While smaller wineries would be most interested in the HI 901/902 titrators, due to their ability to be used for a large number of analyses, larger winery labs often find that they have to run so many samples for each individual analysis that it makes sense to have dedicated auto-titrators. For these wineries' labs Hanna Instruments has introduced another dedicated titration system, the HI 84102 for TA, to complement the HI 84100 discussed last year (see WBM: "Lab Equipment: Affordable Products Allow Small Wineries to Automate Labs," July 2006).

**Notable Feature:** The HI 901/902 titrators are pre-programmed for almost any titration a winery needs to conduct.

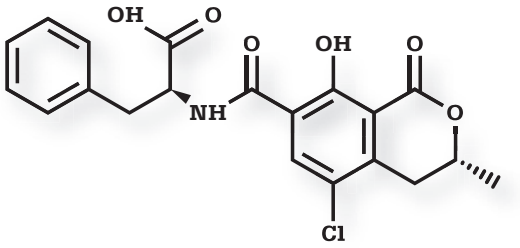
The dedicated pH/TA titrator from Hanna is a close relative of the HI 84100. The HI 84102 is specifically designed to determine Total Titratable Acidity for wine analysis. As one would expect, the HI 84102 uses a simple acid-base titration with an end-point of pH 7.0 (neutral pH) or 8.2 (same endpoint as a titration using phenolphthalein indicator). The HI 84102 TA program includes an algorithm to analyze the shape of the pH electrode response and thereby determines the reaction completion.

**Notable Feature:** Dedicated pH/TA titrator. Can titrate to both pH 7 and pH 8.2 endpoints.

**For more information, contact Hanna Instruments at 401-765-7500 or visit *www.hannainst.com*.**

## Ochratoxin Analysis

In 2005, the European Union declared that, "The Standing Committee on the Food Chain and Animal Health voted in favour of a European Commission proposal to amend Regulation 466/2001 to establish a maximum level of ochratoxin A in coffee, wine and grape juice." When the bureaucratic Brussels-ese is translated to something resembling a human language, we find that the European Union (E.U.) has set a limit of 2 parts per trillion (2.0 µg/kg or 2.0 µg/L) for Ochratoxin-A in wine.




Although Ochratoxin-A is considered a carcinogen, it's really much more common in grain and coffee than it is in wine. The E.U.-imposed limit shouldn't pose a problem for most U.S. wine producers; ochratoxin is produced by certain molds, including several *Penicillium* and *Aspergillus* species that are considered undesirable spoilage fungi and are therefore avoided anyway. Unfortunately, anyone exporting or considering exporting to the European Union should expect to produce proof that the wine has been tested for and does not contain Ochratoxin-A.

### OCHRATEST WB BY VICAM

It is to this end that **VICAM** has introduced their **OchraTest WB**. In all fairness, the OchraTest WB has been available for a while, but with the relatively recent traction gained by various "mycotoxin awareness" groups in Europe, E.U. Regulation 466/2201 is being cited as justification for universal Ochratoxin-A testing for all wines imported into the E.U.

The OchraTest WB uses an HPLC monoclonal antibody affinity chromatography to separate out the ochratoxin. The concentration of ochratoxin is determined by fluorimetry. The OchraTest WB is relatively quick, taking less than 10 minutes after the sample has been prepared and doesn't require any special skills on the part of the technician. The OchraTest does require a high-pressure liquid chromatograph (HPLC), an investment that will put the test out of the reach of most small and mid-sized wineries. Wineries lacking an HPLC can have their wine analyzed for Ochratoxin-A by a third party laboratory like **ETS Laboratories** (*www. etslabs.com*) in St. Helena, CA or by **Vinquiry** (*www.vinquiry.com*) in Windsor, Napa and Santa Maria, California.

**Notable Feature:** Well proven technology widely used in the food products industry.

**For more information, contact VICAM at 617-926-7045 or visit *www.vicam.com*.**

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