The LC/MS Data Browsing Solution from Agilent

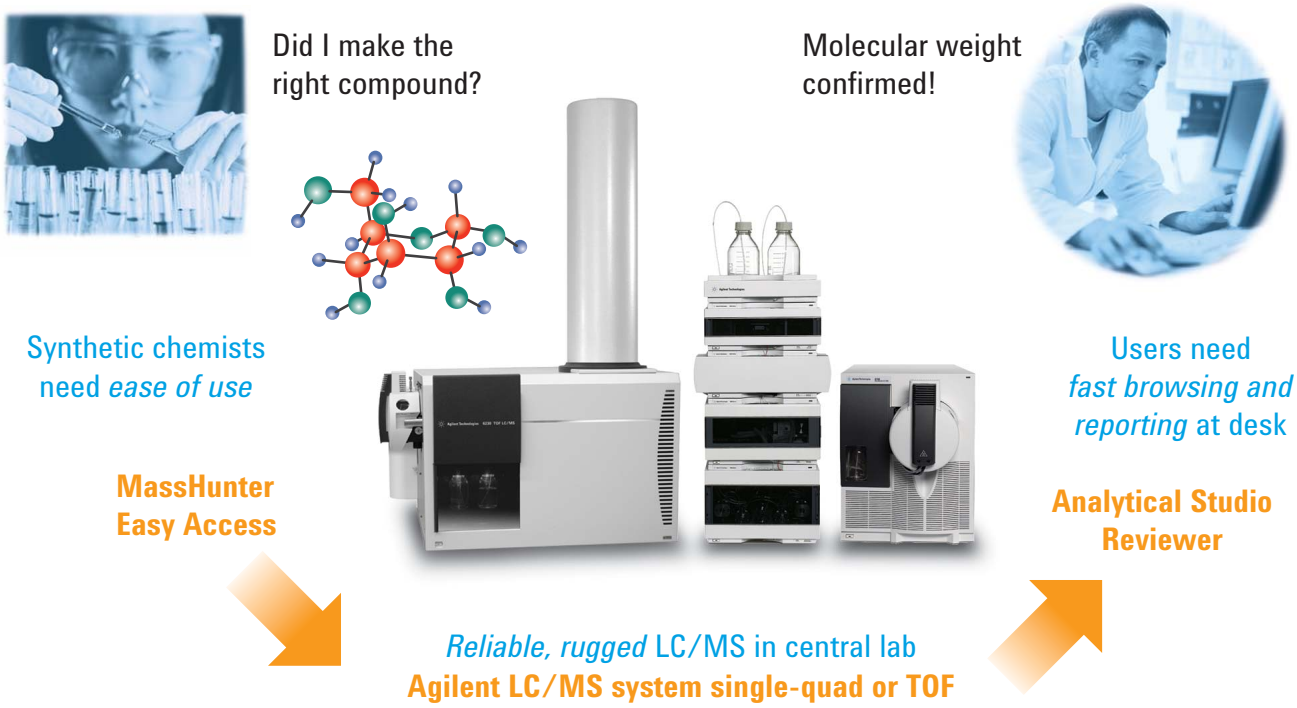
MassHunter Analytical Studio Reviewer software—*making drug development decisions faster with higher confidence*

Application Note

Rapid and accurate analysis of synthesis products is a crucial activity in early drug discovery. Synthetic and medicinal chemists need easy-to-use walk-up liquid chromatography/mass spectrometry (LC/MS) systems and immediate access to results in a concise, easy-to-read format. For scientists who work in a walk-up analysis environment, Agilent MassHunter Easy Access software provides a simplified user interface for the LC/MS single-quadrupole and time-of-flight (TOF) analyses required for either compound confirmation or purification of small molecules or proteins. The Agilent Analytical Studio Reviewer (ASR) provides fast, flexible, and accurate review and reporting of LC/MS data for small compound characterization, to expedite the development process.

This application note describes Analytical Studio Reviewer, while another note (Agilent publication 5990-6095EN) discusses MassHunter Easy Access. The combination of these two software packages—along with Agilent's rugged LC and MS systems—provides a flexible and powerful solution to the ever present need for rapidly obtaining high quality data.

Agilent Technologies



Synthetic and medicinal chemists in modern discovery labs need an analytical workflow that is easy to use and delivers rapid results.

High-throughput data review at desktop PC

Once labs have carried out rapid and accurate LC/MS analyses of large numbers of synthetic compounds, the data review process can be a critical step in launching a significant new drug. Analytical Studio Reviewer eliminates a potential bottleneck in data review. It provides the throughput, flexibility, and accuracy required to overcome the existing challenges of data analysis, giving scientists the ability to:

- Browse very large amounts of LC/MS data (single-quadrupole or TOF) very quickly
- Make an assessment of the quality of data taken from a variety of detectors
- Edit data and override data processing decisions made by automated systems
- Report the data in a format that fits the particular needs of their work environment

Analytical Studio Reviewer lets users view, print, and export single-quad or TOF data without having to purchase and run full analytical software on every desktop. To use Analytical Studio Reviewer, the ChemStation or TOF results file is converted to ASR format. With MassHunter Easy Access, ASR files can be e-mailed to users, who can review the results on client computers where Analytical Studio Reviewer software is installed.

Versatile review of large sample sets

Analytical Studio Reviewer provides access to LC/MS data through an intuitive user interface. Multiple options for chromatogram view allow the user to stack or overlay a large number of chromatograms for simultaneous review, or zoom in for analysis of any individual chromatogram. The example in **Figure 1** shows simultaneous display of data from positive and negative mode MS, as well as an evaporative light scattering detector (ELSD). By using dockable panels in the user interface, users can easily review large amounts of data on multiple monitors.

Flexible data viewing enables users to review data in a manner that best fits the needs of their workflow, allowing them to focus on key results. A unique tree view control allows the chemist to easily examine the contents of the original summary results file without having to open the file in a separate application and search for the text of interest.

The Analytical Studio Reviewer can accommodate a wide variety of sample container types (for example, plates of varying capacity), and can easily correct user errors in sample placement within the containers. For easy navigation, users can display the samples as either a plate image (shown in Figure 1) or a list. Results are color-coded for rapid visualization of the quality of syntheses.

Flexible viewing and output

Analytical Studio Reviewer can accept summary results from a wide variety of platforms, including the Agilent ChemStation and any system using the RPT file format, as well as Agilent MassHunter Qualitative Analysis software. Batch summary reports of purity, identity, and other parameters provide a fast overview of the syntheses. In addition, customized batch reporting allows the user to choose which samples to add to the report—a function that cannot be performed with other data review software. Images of chromatograms and spectra can be captured and shared with colleagues in presentations or e-mails, as well as exported to an external Web search engine for literature comparison. The user also has the unique ability to print reports in customizable Microsoft® Word and Adobe® PDF formats.

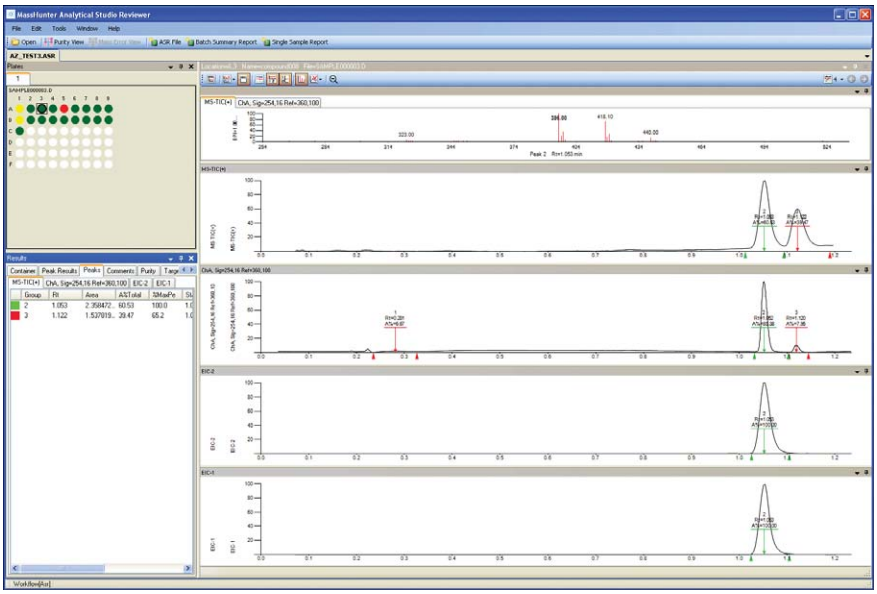


Figure 1. Representative full-screen display in Analytical Studio Reviewer highlights the chromatographic and peak results for the sample in well A3. Green peaks indicate target compound found.

Simple, clear reports

Analytical Studio Reviewer generates easy-to-read reports from data acquired with either Agilent ChemStation or Agilent MassHunter Qualitative Analysis. **Figure 2**, for example, shows a one-page report of ChemStation data. If desired, users can request these ASR reports in addition to those from the native data system. The ASR software includes full options to customize reports for a given workflow. Reports can include, for example, UV and MS peak purity, and/or sample purity for target masses. Furthermore, MassHunter Easy Access enables automated e-mailing of PDF reports produced by ASR.

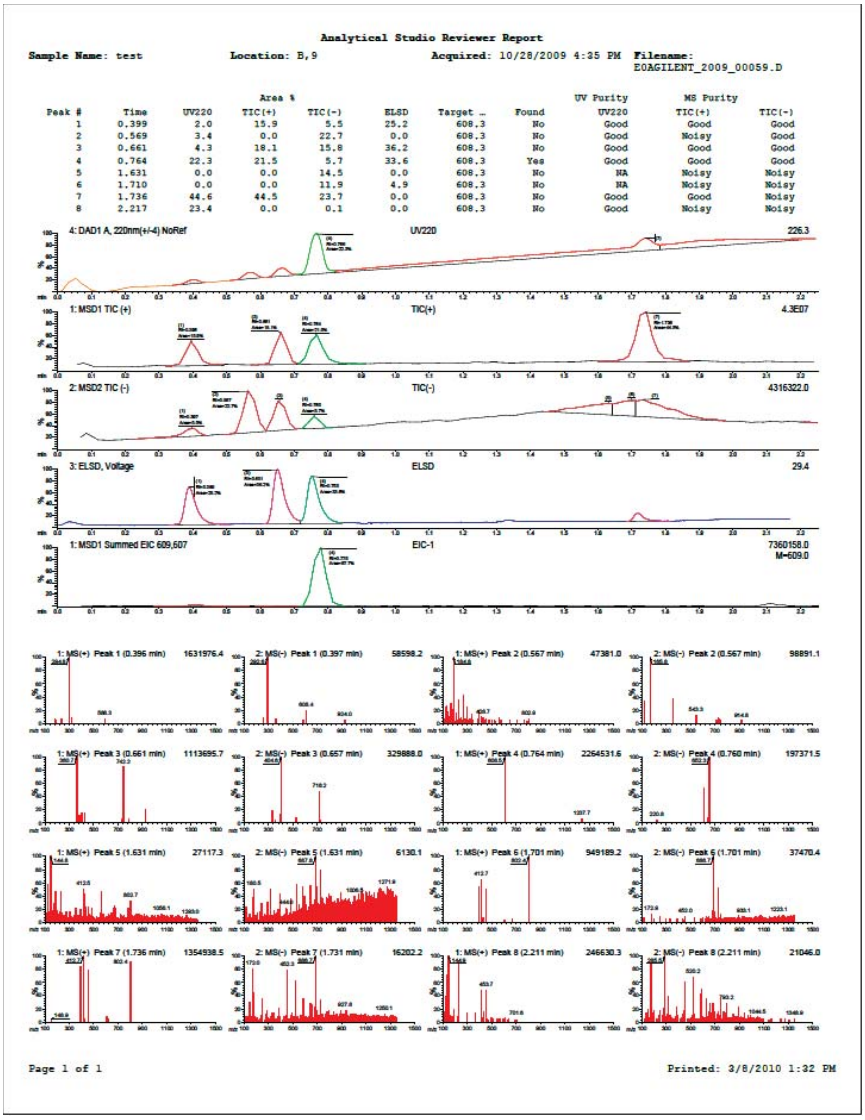


Figure 2. Analytical Studio Reviewer can generate a convenient single-page report from an Agilent single-quad LC/MS controlled by Agilent ChemStation software.

Composite DAD signals help to ensure compound detection

When evaluating purity, it is important that calculations use all the compounds present in the sample. To avoid missing compounds, if ChemStation has saved spectral data from a diode array detector (DAD), users can generate two types of composite signals (**Figure 3**):

- Maximum Absorbance Chromatogram – plots the maximum absorbance from each specific spectrum versus time.
- Total Wavelength Chromatogram – plots the summed absorbances from each specific spectrum versus time.

These chromatograms are available in ChemStation after MassHunter ASR File Generator for ChemStation (a component of Analytical Studio Reviewer) is installed. They provide more universal detection, and for purity calculations are far superior to a single-wavelength chromatogram, such as the "UV monitored at 254 nm" signal.

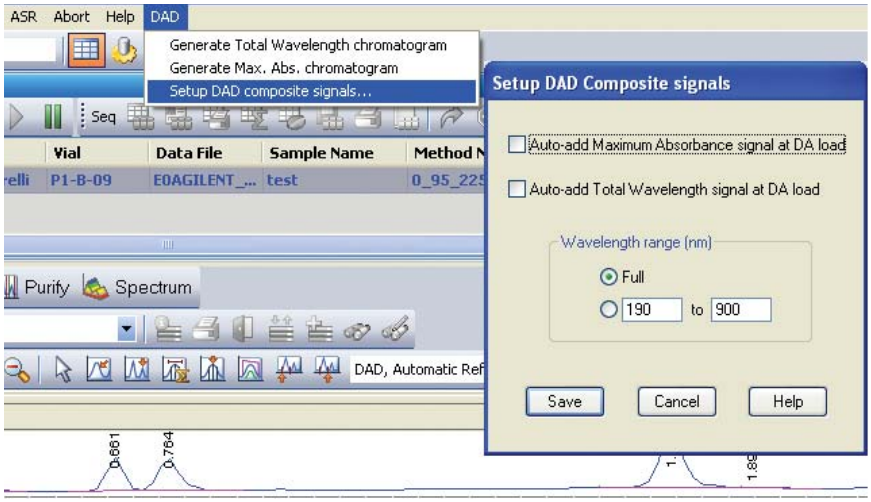


Figure 3. ChemStation dialog box to generate maximum absorbance and total wavelength chromatograms.

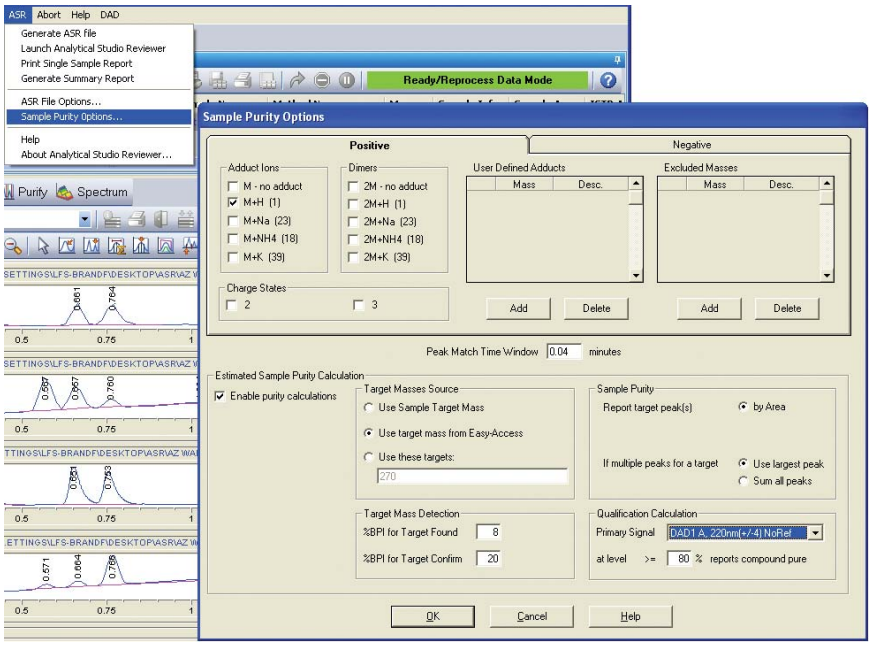


Figure 4. The ChemStation dialog box for sample purity options gives the user complete control over the signal used for purity calculations and the threshold to designate the sample as pure.

Extensive options for sample purity calculation

When users wish to calculate sample purity from Agilent ChemStation data and they have installed the MassHunter ASR File Generator for ChemStation, they benefit from a dialog box for enhanced purity calculations (**Figure 4**). This dialog box enables the ChemStation software to calculate purity based on positive ion MS, negative ion MS, or any of the LC detectors. In positive MS mode, the adduct ion automatically defaults to $[M+H]^+$, while in negative mode, it defaults to $[M-H]^-$. The options under *Qualification Calculation* allow the user to choose which signal the software will use to calculate peak purity, and to set a lower limit to declare that the sample is pure.

The options under *Target Mass Detection* allow the user to change the thresholds for the software to declare that the target compound was found. To make the determination for target found, the software calculates the %BPI—the ratio of the abundance of the target ion to the abundance of the base peak ion.

Single dialog box to set up ASR file export

Users who need to configure the export of ASR files from ChemStation can do that from a single dialog box (**Figure 5**). If they want to automatically print a report for each analysis through Analytical Studio Reviewer, they can set the *Print Report Options* accordingly. The ASR reports print in addition to any ChemStation reports they may have set up. Under *Signal Integration Options*, users have the ability to override method integration and auto-integrate in a time window, which optimizes the integration for multicomponent, complex samples.

The section under *Reported Peak Selection* allows the flexibility to select which signals the software will report. Chromatograms can be smoothed using a Savitsky-Golay filter, which is an excellent option because the software retains the chromatogram's minimum and maximum values after filtering, and uses them for purity calculations.

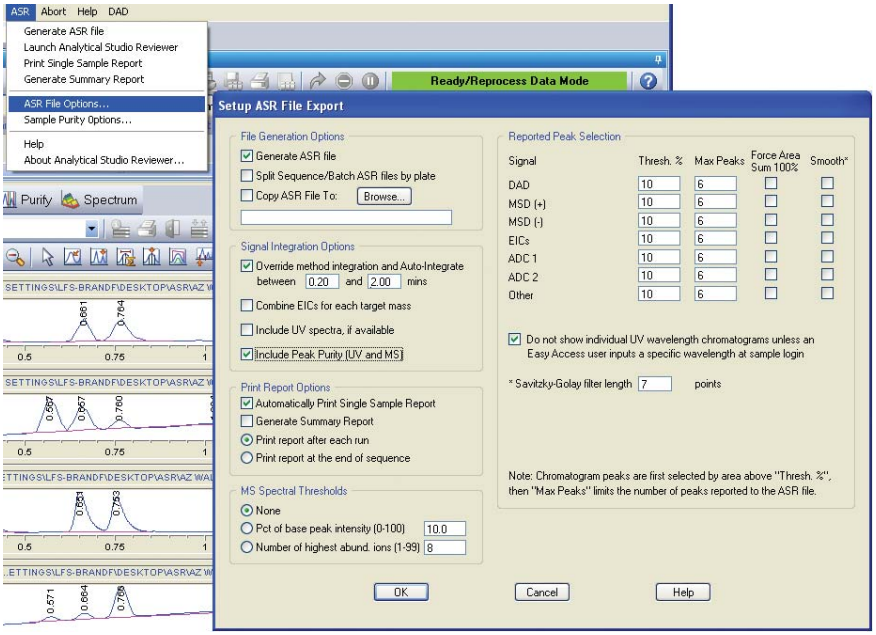


Figure 5. ChemStation dialog box enables users to configure which data will be viewed in ASR and which reports will be automatically generated.

Flexible batch summary report

Analytical Studio Reviewer makes it easy to customize a Batch Summary Report, which is in comma- or tab-delimited format for easy import into spreadsheets. As shown on the right side of **Figure 6**, chemists can select which fields to include and their order in the report. The Batch Summary Report includes results from a user-chosen sample group, such as an entire well plate or a set of vials. This allows the scientist to rapidly summarize related syntheses in a single customized file. The report can be imported into a spreadsheet for further sorting and analysis (**Figure 7**).

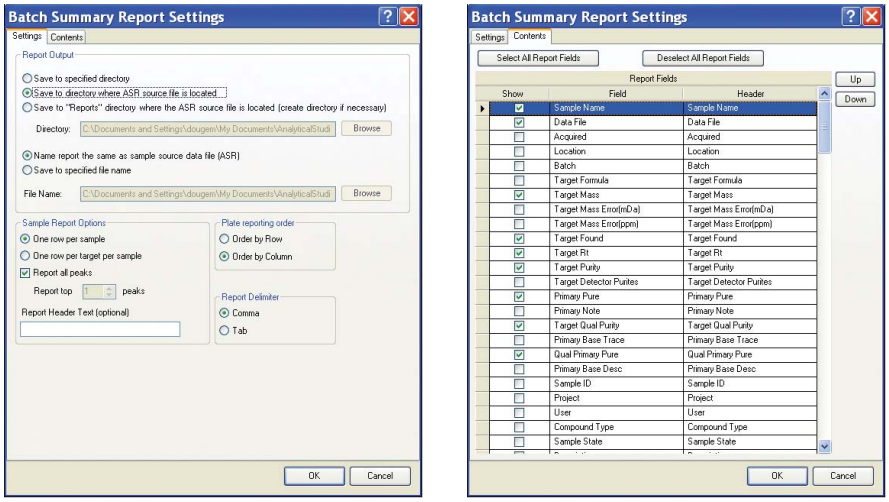
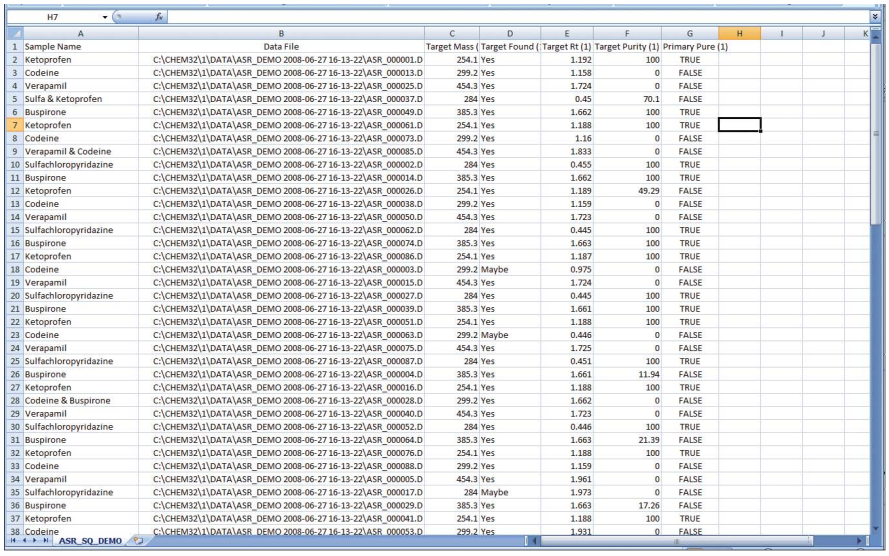


Figure 6. User can customize the Batch Summary Report to show critical information in a specific order, which facilitates rapid decision-making.



	A	B	C	D	E	F	G
1	Sample Name	Data File	Target Mass (	Target Found (	Target Rt (1)	Target Purity (1)	Primary Pure (1)
2	Ketoprofen	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000001.D	254.1	Yes	1.192	100	TRUE
3	Codeine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000013.D	299.2	Yes	1.158	0	FALSE
4	Verapamil	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000025.D	454.3	Yes	1.724	0	FALSE
5	Sulfa & Ketoprofen	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000037.D	284	Yes	0.45	70.1	FALSE
6	Buspirone	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000049.D	385.3	Yes	1.662	100	TRUE
7	Ketoprofen	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000061.D	254.1	Yes	1.188	100	TRUE
8	Codeine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000073.D	299.2	Yes	1.16	0	FALSE
9	Verapamil & Codeine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000085.D	454.3	Yes	1.833	0	FALSE
10	Sulfachloropyridazine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000002.D	284	Yes	0.455	100	TRUE
11	Buspirone	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000014.D	385.3	Yes	1.662	100	TRUE
12	Ketoprofen	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000026.D	254.1	Yes	1.189	49.29	FALSE
13	Codeine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000038.D	299.2	Yes	1.159	0	FALSE
14	Verapamil	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000050.D	454.3	Yes	1.723	0	FALSE
15	Sulfachloropyridazine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000062.D	284	Yes	0.445	100	TRUE
16	Buspirone	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000074.D	385.3	Yes	1.663	100	TRUE
17	Ketoprofen	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000086.D	254.1	Yes	1.187	100	TRUE
18	Codeine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000003.D	299.2	Maybe	0.975	0	FALSE
19	Verapamil	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000015.D	454.3	Yes	1.724	0	FALSE
20	Sulfachloropyridazine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000027.D	284	Yes	0.445	100	TRUE
21	Buspirone	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000039.D	385.3	Yes	1.661	100	TRUE
22	Ketoprofen	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000051.D	254.1	Yes	1.188	100	TRUE
23	Codeine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000063.D	299.2	Maybe	0.446	0	FALSE
24	Verapamil	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000075.D	454.3	Yes	1.725	0	FALSE
25	Sulfachloropyridazine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000087.D	284	Yes	0.451	100	TRUE
26	Buspirone	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000004.D	385.3	Yes	1.661	11.94	FALSE
27	Ketoprofen	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000016.D	254.1	Yes	1.188	100	TRUE
28	Codeine & Buspirone	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000028.D	299.2	Yes	1.662	0	FALSE
29	Verapamil	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000040.D	454.3	Yes	1.723	0	FALSE
30	Sulfachloropyridazine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000052.D	284	Yes	0.446	100	TRUE
31	Buspirone	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000064.D	385.3	Yes	1.663	21.39	FALSE
32	Ketoprofen	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000076.D	254.1	Yes	1.188	100	TRUE
33	Codeine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000088.D	299.2	Yes	1.159	0	FALSE
34	Verapamil	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000005.D	454.3	Yes	1.961	0	FALSE
35	Sulfachloropyridazine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000017.D	284	Maybe	1.973	0	FALSE
36	Buspirone	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000029.D	385.3	Yes	1.663	17.26	FALSE
37	Ketoprofen	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000041.D	254.1	Yes	1.188	100	TRUE
38	Codeine	C:\CHEM32\1\DATA\ASR_DEMO 2008-06-27 16-13-22\ASR_000053.D	299.2	Yes	1.931	0	FALSE

Figure 7. Chemists can import the Batch Summary Report into Microsoft Excel for further processing.

Summary

The fast, flexible, and accurate data review of Agilent MassHunter Analytical Studio Reviewer is a perfect complement to the Agilent 6100 Series Single Quadrupole LC/MS Systems and 6200 Series Accurate-Mass TOF LC/MS Systems. The powerful compound identification and purity assessment capabilities of these solutions enable the user to make the right decisions faster, leading to enhanced drug development efficiency.

Related information

For an overview of Agilent's MassHunter Easy Access software for walk-up sample submission, please see Agilent publication 5990-6095EN.

www.agilent.com/chem/masshunter

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