



Thermo Scientific Dionex UltiMate 3000 Systems

Total solution for Isohumulones in beer

- Automated bitterness analysis
- Specific pattern recognition

Thermo
SCIENTIFIC

About isohumulones

Isohumulones (iso- α -acids) form approximately eighty percent of the typical bitterness of beer. Their antimicrobial effect leads to a sterile beverage, their tensioactive character stabilizes the foam, and they have a major influence on the general flavor, smell, and smoothness of beer.¹ The three main iso- α -acid variants which are present in beer differ only in their acyl side chain and are indicated by the prefixes co-, n-, or ad-, as shown in Figure 1. Due to the stereochemistry of iso- α -acids, each of them occurs as cis- and trans-isomers.

Six major iso- α -acid variants can be found in beer: trans-isocohumulone, cis-isocohumulone, trans-iso-n-humulone, cis-iso-n-humulone, trans-isoadhumulone, and cis-isoadhumulone.

Each iso- α -acid variant provides different contributions to beer taste and foam stability. Recent investigations¹ have shown that these differences are even true between both cis- and trans-isomers of the same iso- α -acid. Furthermore, the lifetimes of cis- and trans-isomers significantly differ from each other. Degradation products of iso- α -acid markedly influence the important beer attributes mentioned above. Consequently, the avoidance of less stable iso- α -acid variants is beneficial.²

A Total Solutions Approach

In general, the content of isohumulones in beer is expressed as a value of bitterness units (BU). This value, a numerical sum parameter which is derived from an unspecific, empirical, and spectrophotometric method, provides no information about the individual contents of each iso- α -acid variant. Furthermore, non-bitter components are also detected and adulterate that BU value.² Hence, only the measurement of the pure concentration of iso- α -acids offers precise and comparable information about the genuine beer bitterness.

High performance liquid chromatography (HPLC) embodies the only analytical method that enables specific quantitation of iso- α -acids in beer. Thermo Scientific™ Total Solutions for Isohumulones in Beer provide specific determination and quantitation of all major cis- and trans-isomer variants of the iso- α -acids that are present in beer.

The Total Solution for Isohumulones in Beer consists of a Thermo Scientific™ Dionex™ UltiMate™ 3000 system package and its related Isohumulones starter kit. Both are ordered separately (see last page). System packages contain Thermo Scientific™ Dionex™ Chromeleon™ 7.2 Chromatography Data System (CDS) software, as well as UltiMate 3000 hardware parts needed to set up the entire UHPLC*-focused system. Add the appropriate Thermo Scientific™ Isohumulones Starter Kit, that provides all of the consumables, and the analysis of isohumulones in beer can be started immediately.

Dedicated Chromeleon 7 CDS eWorkflow templates are provided as part of each starter kit. An eWorkflow creates a sequence, starts the run, and ensures that data are processed and reported correctly.

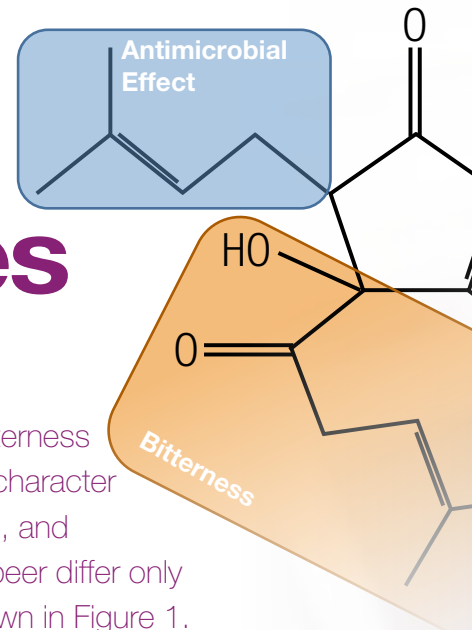
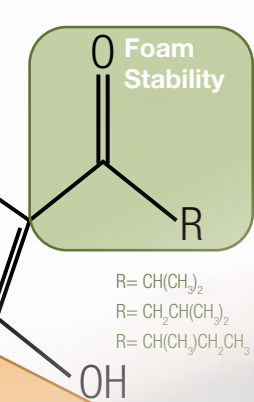


Figure 1. General structure of isohumulones





Examples of each package

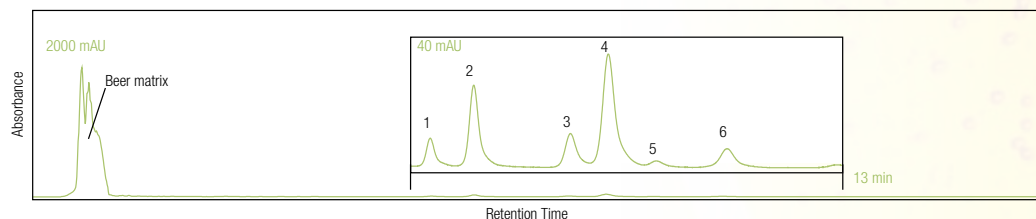


Figure 2. Isohumulones chromatogram of a German beer using the Standard Direct Injection system

The Total Solution for Occasional Beer Analyses

The total solution with standard direct injection system is the basic model and is suitable for occasional beer analyses as the HPLC column lifetime is affected by each injection of a raw beer sample. Furthermore, it has been shown that retention times change and the separation efficiency significantly adulterate from run to run if raw beer samples are directly injected onto the HPLC column.

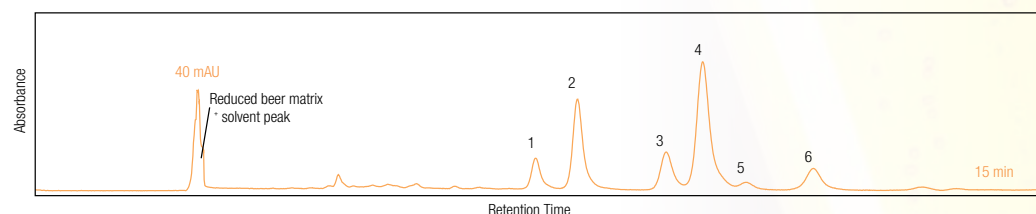


Figure 3. Isohumulones chromatogram of a German beer with a Standard On-Line SPE system

The Total Solution for Direct Injection of Untreated Beer Samples

The total solution with standard on-line SPE system enables the injection of untreated beer samples by providing automatic sample cleanup for extended analytical column life and consistently reproducible results. On-line SPE significantly saves analysis time, labor and material costs when compared to manual (off-line) SPE.

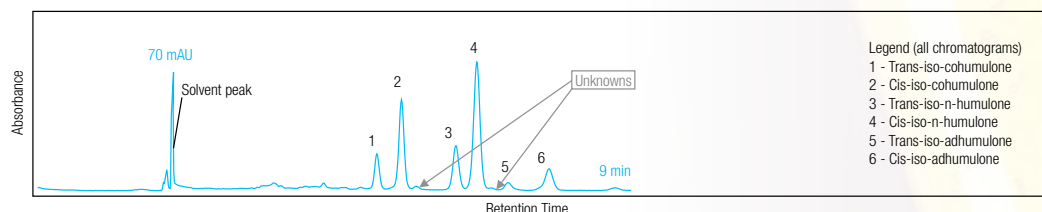


Figure 4. Isohumulones chromatogram of a German beer analyzed with a Rapid Separation On-Line SPE system

The Total Solution for High Throughput

The total solution with rapid separation on-line SPE system extends the benefits of automated on-line SPE by utilizing the advanced capabilities of UHPLC. This provides highest sample throughput, outstanding resolution, instant results, and lowest mobile phase consumption.



Ordering Information

Total Solution with Direct Injection System	Part Number
Thermo Scientific Dionex UltiMate 3000 SD System Package for Direct Injection Including: SR-3000 Solvent Rack, LPG-3400SD Analytical Pump, WPS-3000SL Well Plate Autosampler, TCC-3000SD Thermostatted Column Compartment, VWD-3100 Variable Wavelength detector with semi-micro flow cell 2.5 µL, Chromeleon CDS software, version 7.2.	5200.0510
Thermo Scientific Isohumulones Starter Kit for Direct Injection Including: Thermo Scientific™ Hypersil™ GOLD™ 3 µm column, 3.0 × 150 mm, mobile phases and chemicals, sample vials, disposable pipettes, isohumulones standard, and CD with eWorkflow and operating instructions.	TS-MKIT0014

Total Solution with Standard On-Line SPE System	Part Number
Thermo Scientific Dionex UltiMate 3000 SD System Package with On-Line SPE Including: SRD-3600 Degasser, DGP-3600SD, Analytical Pump, WPS-3000SL Well Plate Autosampler, TCC-3000SD Thermostatted Column Compartment, VWD-3100 Variable Wavelength detector with semi-micro flow cell 2.5 µL, valve actuation HT right side, pod 2 position 6-port HT valve, Thermo Scientific™ Dionex™ Viper™ On-Line SPE Kit SD System, Chromeleon CDS software, version 7.2.	5200.0505
Thermo Scientific Isohumulones Starter Kit for On-Line SPE RS System Including: Hypersil GOLD 3 µm column, 3.0 × 150 mm Hypersil GOLD C8 5 µm column, 2.1 × 20 mm, mobile phases and chemicals, sample vials, disposable pipettes, isohumulones standard, and CD with eWorkflow and operating instructions.	TS-MKIT0013

Total Solution with Rapid Separation On-Line SPE System	Part Number
Thermo Scientific Dionex UltiMate 3000 RS System Package with On-Line SPE Including: SRD-3600 Degasser, DGP-3600RS, Analytical Pump, WPS-3000RS Well Plate Autosampler, TCC-3000RS Thermostatted Column Compartment, valve actuation HT right side, pod 2 position 6-port HT valve, VWD-3100 Variable Wavelength detector with semi-micro flow cell 2.5 µL, Viper On-Line SPE Kit RS System, Chromeleon CDS software, version 7.2.	5200.0500
Thermo Scientific Isohumulones Starter Kit for On-Line SPE RS System Including: Hypersil GOLD 1.9 µm column, 2.1 × 100 mm, Hypersil GOLD 5 µm column, 2.1 × 20 mm, mobile phases and chemicals, sample vials, disposable pipettes, isohumulones standard, and CD with eWorkflow and operating instructions.	TS-MKIT0012

Individual items of the UltiMate 3000 system packages and Isohumulones starter kits can be ordered separately.

Find more information at www.thermoscientific.com/applicationkits.

¹ Caballero, I.; Blanco, C. A.; Porras, M. Iso- α -Acids, Bitterness and Loss of Beer Quality During Storage. *Trends Food Sci. Technol.* [online] **2012**, 26(1), 21-30. <http://dx.doi.org/10.1016/j.tifs.2012.01.001> (accessed July 1, 2013).

² Heidorn, M. Fast Determination of Iso- α -Acids in Untreated Beer Samples with Specific Separation into cis- and trans-Isomers. *J. Am. Soc. Brew. Chem.* [online] **2013**, 71(3), 109-113 <http://dx.doi.org/10.1094/ASBCJ-2013-0506-01> (accessed July 1, 2013).

www.thermoscientific.com/applicationkits

©2013 Thermo Fisher Scientific Inc. All rights reserved. ISO is a trademark of the International Standards Organization. All other trademarks are the property of Thermo Fisher Scientific Inc. and its subsidiaries. This information is presented as an example of the capabilities of Thermo Fisher Scientific Inc. products. It is not intended to encourage use of these products in any manners that might infringe the intellectual property rights of others. Specifications, terms and pricing are subject to change. Not all products are available in all countries. Please consult your local sales representative for details.

Thermo
SCIENTIFIC

Part of Thermo Fisher Scientific