Application Note #GC3001

BUCK Scientific

Rapid Measurement of Alcohol (Ethanol) in Beer and Wine Making by GC/FID

Improvements in manufacturing processes and equipment have allowed beer and wine producers to increase both the quantity and quality of the products. In the consumer products business, it is crucial to maintain good quality control practices. The higher throughput of manufacturing plants requires faster, more sophisticated analytical techniques to do this. Classical physical and sensory tests may have been suitable years ago, but today's health and government standards usually specify specific tests for the major desired components and the trace contaminants.

The desired product of most fermentation-based operations is alcohol (or ethanol). The grades and qualities of most beers and wines are based primarily on the alcohol content. The determination of alcohol content can be done by physical measurement (hydrometry), spectroscopy (infra-red), and chromatography (GC/FID). Utilizing a gas chromatograph with a fairly short packed column and a general use flame ionization detector (FID) allows for a fast, simple, and very reproducible measurement of alcohol content. In addition, measurement by GC does not require any special sample preparation or handling. Such a system also allows for the determination of other compounds that arise from the fermentation process, mainly sugars, tannins, acids, and aromatic components.

Some examples of alcohol monitoring in beer are shown below, with an actual chromatogram and analytical conditions listed on the back. These analyses were researched and developed on a Buck Model 910 GC/FID system. Wine samples would be handled in an identical fashion.

Sample: An imported double-malt Lager
[Results are the average of triplicate runs on a GC system by manual injection]

Sample ID	Ferment Time	Avg. % Alcohol	R.S.D.
Initial Malt/ Hop mix	0 hours	< 0.01%	7.3%
First Fermentation	8 hours	0.82%	4.1%
First Chilling	24 hours	1.68%	3.6%
Second Fermentation (after supplementation)	36 hours	3.24%	3.9%
Final Product	7 days	4.13%	3.2%

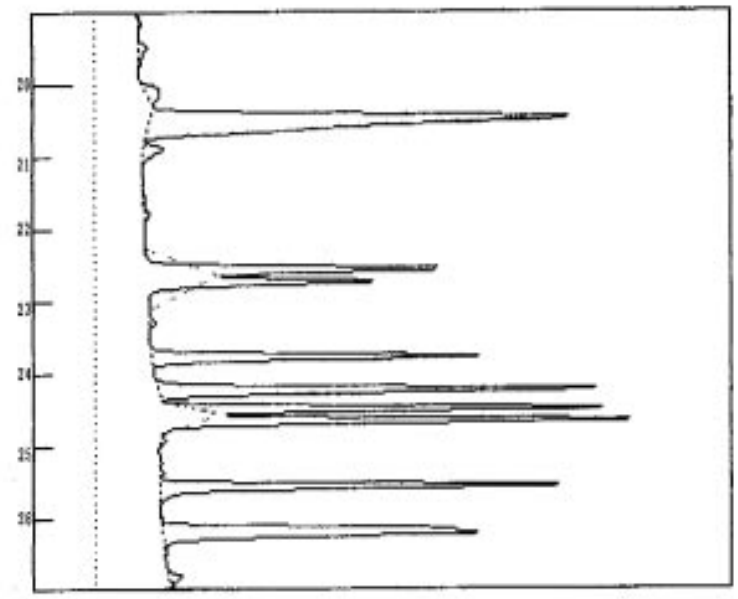
Complex mixtures, which beers and wines certainly are, can be easily "resolved" into their individual components for precise and accurate analysis. The ultimate flexibility of the Buck 910 GC design permits a wide range of testing capability to be done very economically and efficiently with just one system, saving space, money, and time.

Analyst: Gerald J. DeMenna

SIC: 2082, 2084

Rapid Measurement of Alcohol (Ethanol) in Beer and Wine Making

Retention	Area	Component
19.483	8.28	Methanol
20.150	12.76	Acetaldehyde
20.450	349.31	Ethanol
20.883	12.88	n-Propanol
22.716	37.65	i-Butanol
23.750	133.21	Acetone
24.200	182.53	Acetic Acid
24.466	141.49	Propanaldehyde
24.633	148.00	s-Butanol
25.533	150.91	Butyraldehyde
26.183	200.63	Butyric Acid
26.800	6.92	Inositol



Component	Number	Retention	Area	Area %	External	Units
Methanol	1	19.483	8.28	0.56	1942.60	ppm
Acetaldehyde	2	20.150	12.76	0.87	2.00	% vol
Ethanol	3	20.450	349.31	23.78	20.96	% vol
n-Propanol	4	20.883	12.88	0.88	2688.49	ppm
i-Propanol	5	22.533	84.29	5.74	6451.25	ppm
I-Butanol	6	22.716	37.65	2.56	2207.00	ppm
Acetone	7	23.750	133.21	9.07	4156.25	ppm
Acetic Acid	8	24.200	182.53	12.43	4.56	% vol
Propanaldehyde	9	24.466	141.49	9.63	232.05	ppm
s-Butanol	10	24.633	158.00	10.08	742.98	ppm
Butyraldehyde	11	25.533	150.91	10.27	1365.26	ppm
Butytic Acid	13	26.183	200.63	13.66	878.78	ppm
Inositol	14	26.800	6.92	0.47	39.80	ppm

Turnkey System: $7,310.00

Includes: Buck Model 910 FID Gas Chromatograph with Air Compressor, Carbowax Column, and PeakSimple II Software.

For detailed configuration, refer to Quote #GC4001.

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