Application Note

Introduction

Numerous compounds contribute to changes in beer flavor as it becomes stale. One of these compounds, (E)-2-nonenal, has been investigated as a major source of the papery/cardboard flavor that develops in aged beer[1].

This application note demonstrates the Teledyne Tekmar Atomx using the soil method to adequately detect this compound in beer. A GC/MS system using Selected Ion Monitoring (SIM) mode detects and quantifies (E)-2-nonenal levels in 5 beer samples.

The conditions listed, are one set of numerous possible conditions that accomplishes the separation and detection of these compounds. This does not preclude a scientific laboratory from operating this analysis with alternate conditions utilizing the Atomx soil method.

Method Conditions

Trap 1A (Tenax)

Table I Atomx Modified Soil Method Parameters.			
Purge Variable	**Value**	**Purge Variable**	**Value**
Valve Oven Temp	200 °C	Condensate Purge Temp	70 °C
Transfer Line Temp	210 °C	Dry Purge Time	0.50 min
Sample Vail Temp	50 °C	Dry Purge Flow	50 mL/min
Soil Valve Temp	120 °C	Dry Purge Temp	70 °C
Standby Flow	25 mL/min	**Desorb Variable**	**Value**
Purge Ready Temp	70 °C	Sweep Needle Time	0.50 min
Condensate Ready Temp	70 °C	Desorb Preheat Temp	220 °C
Purge Mix Speed	Fast	Desorb Temp	225 °C
Purge Time	10.00 min	**Bake Variable**	**Value**
Purge Flow	25 mL/min	Bake Time	8.00 min
Purge Temp	70 °C	Bake Flow	200 mL/min
		Bake Temp	230 °C

Highlights

The Teledyne Tekmar Atomx automated VOC sample prep system provides modern laboratories with a versatile VOC system to test multiple matrices.

It adequately detects (E)-2-nonenal in beer samples at mid ppt levels using the soil mode.

Salt added to the sample improves the detection limits for this compound.

Table II GC/MS System Settings	
GC Settings	
Column	Rtx®-VMS, 20 m x 0.18 mm ID x 1 m, 0.9 mL/min Constant Flow, Helium
Inlet/Transfer Line	230 °C, Split Ratio 60:1, Transfer Line 230 °C
Oven Program	95 °C, 3.5 °C/min to 145 °C, 15 °C/min to 240 °C, 3 min final hold, 21.7 min Run
MS Settings	
Scan	35.0 m/z to 200 m/z, Gain Factor 1, ATune, 1.4 min Solvent Delay
SIM	55 *m/z*, 70 *m/z*, 83 *m/z*, 96 *m/z*, 111 *m/z*, Dwell Time 100
Temperatures	Source 230 °C, Quad 150 °C

Standards and Samples

Standard: (E)-2-Nonenal, Aldrich, 255653, 0.27 to 5.4 ppb in 5% (v/v) ethanol solution

Samples: 5 Lots of a Pale Lager Beer, 10 mL degassed sample with 6 g NaCl

Results

Figure 1 Comparison of the SIM Total Ion Chromatogram of a Beer Sample (in Triplicate, Lower) to its Spiked Sample (Upper)
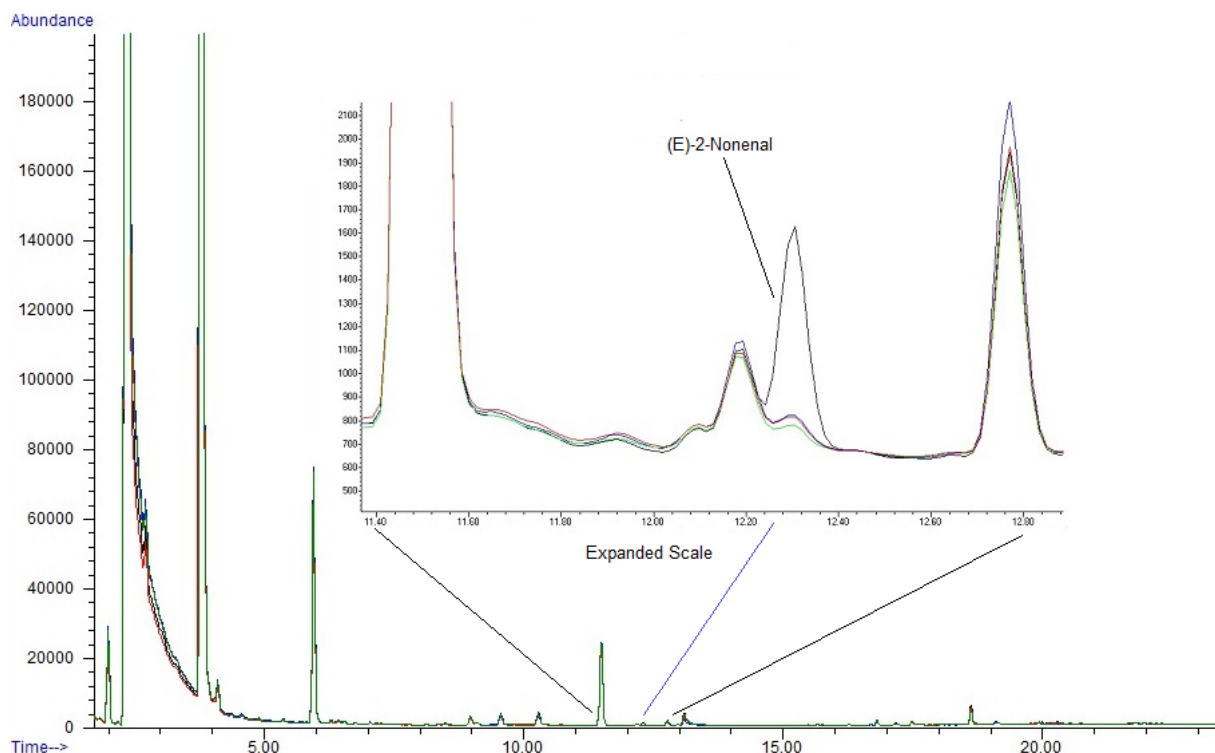

Table III Concentration of (E)-2-Nonenal in Five Lots of a Commercial Pale Lager	
Sample Lot	**ppb**
A	0.180
B	0.463
C	0.261
D	0.184
E	0.082

References

1 – Scherer, R.; Wagner, R.: Kowalski, C.H.: Godoy, H. T. (E)-2-Nonenal Determination in Brazilian Beers using Headspace Solid-Phase Microextraction and Gas Chromatographic Coupled Mass spectrometry (HS-SPME-GC-MS) Cinc. Tecnol Aliment., Campinas, 30(Supl.1): 161-165, Maio 2010 [Online] http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0101-20612010000500024