APPLICATION NOTE

The analysis of BTEX in water with EST Purge and Trap

AN183; SCION Instruments, V1.

Introduction

BTEX compounds: Benzene, Toluene, Ethylbenzene and Xylene are volatile organic compounds (VOCs) that naturally occur in crude oil and are widely used in industrial processes. The compounds can be found in petroleum based products such as gasoline and solvents, making them prevalent in areas associated with fuel production, storage and distribution.

Due to their high solubility and volatility BTEX compounds can rapidly evaporate into the atmosphere and easily leach into groundwater. Their persistence in water is problematic for aquatic ecosystems. Benzene is a carcinogenic and so even trace amounts in drinking water can have a negative effect.

Groundwater pollution from BTEX is a major concern, especially when these compounds infiltrating drinking water sources. This contamination can lead to long-term exposure risks for communities relying on groundwater.

This application note demonstrates the effective analysis of BTEX in water using either the SCION Instruments 8300 GC or 8500 GC with two FIDs and the EST evolution and centurion Purge and Trap autosampler (Figure 1).

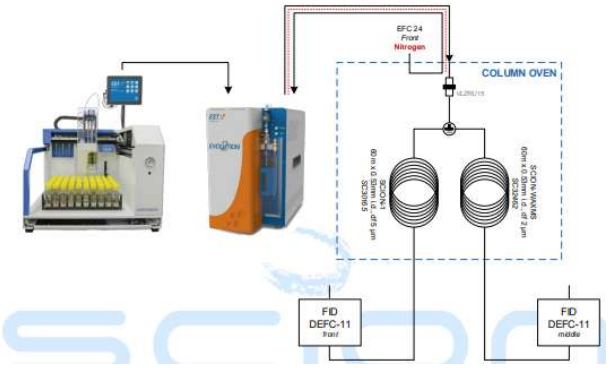

Figure 1 Flow diagram of instrument set up

Helium has long been the standard carrier gas for GC applications however due to recent global shortages many companies are keen to find alternatives.[1] Nitrogen was used as carrier gas in this application note.

Experimental

Benzene, Toluene, Ethylbenzene and Xylene were purchased in order to run individual standards and confirm the elution order of components. 15 individual standards were used for the determination of the linearity.

For analyte confirmation two different phase columns were used. Go to the SCION knowledge centre to find our technical note on analyte confirmation.

Table 1 Analytical method parameters

Part	Settings
Column	SCION-1 60m x 0.53mm x 5 µm SCION-WAXMS 60m x 0.53mm x 2 µm
Carrier Gas	Nitrogen 3.5 mL/min
Oven Program	35°C (hold 8.0 min), 5°C/min to 150°C (hold 0.00 min), 30°C/min to 260°C (hold 10.33 min)
Run Time	45 min
Detectors	Front/middle FID, 300°C Make-up N_2: 25 mL/min
Software	CompassCDS
EST Evolution	**Settings**
Sample Type	Water
Transfer Line	140 °C
Valve Oven	140 °C
Trap ready	35 °C
MoRT ready	39 °C
Purge flow	40 ml/min
Purge time	11 min
Desorb Preheat	250 °C
Desorb	250 °C
Bake	110 °C
EST Centurion	**Settings**
Sample type	Water
Sample Loop Fill Time	35 sec
Sample Transfer Time	50 sec
Water heater temperature	85 °C

Sample preparation

For this application BTEX standards were initially prepared separately from Benzene, Toluene, Ethylbenzene and Xylene standards to determine the elution order. A BTEX mixture was then made and diluted in MeOH to a concentration of 0.15 ng/mL.

Five sets of calibration standards were prepared at 0.05, 2 and 5 ng/mL to determine the linearity of BTEX. The internal standard, Fluorobenzene, was added to all samples at a concentration of 1.575 ng/mL.

Blank injections of HPLC grade water were made in between samples, in order to check for carryover and check method performance.

Results

The linearity results were collected and calculated using the ratio of the peak area of the target analyte to that of the internal standard, using CompassCDS, for the front (SCION-1) and for the middle (WAXMS) channels (Table 2). See our technical note on the Importance of using an Internal Standard.

$$\textbf{Peak area ratio} = \frac{\textbf{Peak area of analyte}}{\textbf{Peak area of IS}}$$

Table 2 Linearity results

Compound	Front (SCION-1) R^2	Middle (WAXMS) R^2
Benzene	0.9996	0.9996
Toluene	0.9997	0.9998
Ethylbenzene	0.9975	0.9973
p-m-Xylene	0.9987	-
p-Xylene	-	0.9992
m-Xylene	-	0.9980
Styrene	0.9996	0.9995
o-Xylene	0.9993	0.9995

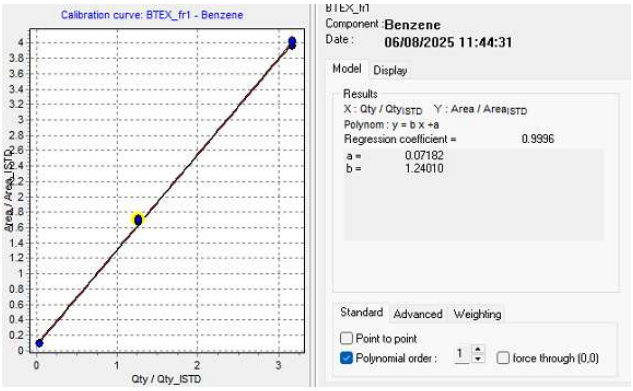

Figure 2 Benzene linearity results shown in CompassCDS

The chromatograms shown in Figures 3 and 4 show good separation on both columns, with exception of p-Xylene and m-Xylene which cannot be separated on the SCION-1 column. These analytes were calculated as a SUM. The Xylenes were successfully separated on the WAXMS column.

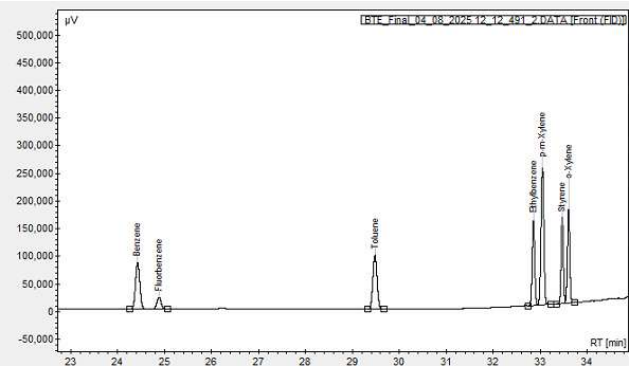

Figure 3 Example chromatogram (SCION-1) 5.00 ng/mL

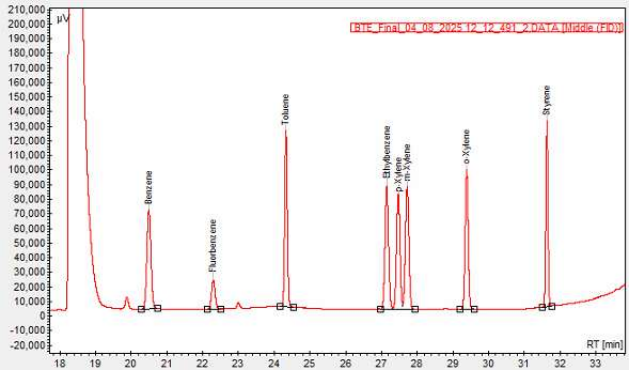

Figure 4 Example chromatogram (WAXMS) 5.00 ng/mL

Conclusion

The EST purge and trap evolution and centurion coupled with a SCION Instruments 8500 GC with two FIDs is a perfect solution to determine BTEX components in water.

Excellent linearity results were achieved for this application, calculated using the CompassCDS software.

Two columns (SCION-1 and SCION-WAXMS) were used for analyte confirmation and showed good resolution and separation of the BTEX compounds.

References

1. Innovation News Network, Helium Shortage 4.0, https://www.innovationnewsnetwork.com/helium-shortage-4-0-what-caused-it-and-when-will-it-end/29255 (Accessed August 2025)

Ordering Information

Ordering Information for the GC

Part	Part Number
8500-GC Gas chromatograph, 230V	850000022
8500-GC Gas chromatograph, 120V	850000011
8300-GC Gas chromatograph, 230V	850000022
8300-GC Gas chromatograph, 120V	850000011
A05-PT-PACK-W	Value package for P&T for water only
CompassCDS Data Acquisition Software	BR502002

Suggested Consumables

Part	Part Number
15% Graphite/85% Vespel Ferrule 1/16" with 0.8 mm hole pk/10	41312150
SCION-1 60m x 0.53 mm x 5.00 µm	SC30165
SCION-WAXMS 60m x 0.53 x 2.00 µm	SC32462

For ordering info on the SCION 8300 and 8500 GC, which offers greater functionality with the option of up to 4 detectors (including MS), please contact your local SCION sales representative.

For more information, please contact:

E: sales-eu@scioninstruments.com

W: www.scioninstruments.com