Application Note

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GC/MS/MS Analysis of Phthalates with the Novel Agilent J&W HP-5Q Column

Using an Agilent 8890 gas chromatography system and an Agilent 7000E triple quadrupole GC/MS

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Abstract

As phthalates can migrate from plastics into the environment, their widespread use in various polymeric consumer products raises regulatory concerns. This application note examines the capabilities of the Agilent 7000E triple quadrupole GC/MS operating in dynamic multiple reaction monitoring (dMRM) mode for quantifying 19 phthalates using helium carrier gas and the Agilent J&W HP-5Q ultra low-bleed column. The HP-5Q column delivers reduced bleed for improved baseline quality and enhanced sensitivity, while dMRM minimizes silicone-related interference. Excellent separation was achieved for 17 phthalates, including bis(4-methylpentyl) ester (BMPP). Diisononyl phthalate (DINP) and diisodecyl phthalate (DIDP) required a fixed retention-time window with spectral summation for consistent integration. Calibration spanned four to five orders of magnitude and the average instrument detection limit (IDL) for the 17 individual phthalates was 0.16 ng/mL. Among the nine consumer products tested, 15 phthalates were detected in at least one sample, demonstrating broad applicability of the method. The method also demonstrates that the HP-5Q column is a drop-in replacement for the Agilent J&W HP-5ms column, offering improved robustness and reduced contamination impact.

Introduction

Phthalates are a class of synthetic compounds derived from the esterification of phthalic acid and are primarily used as plasticizers to improve the flexibility, durability, and processability of polymeric materials. These additives are widely incorporated into polyvinyl chloride (PVC) and other plastics, making them essential in manufacturing products such as electrical wire insulation, flooring, packaging materials, medical devices, and children's toys. Unlike covalently bonded additives, phthalates are physically mixed into the polymer matrix, which allows them to migrate over time. This leaching process introduces phthalates into the environment, raising concerns about potential environmental exposure.

In response, numerous international regulations have been established to limit phthalate content in consumer products. Within the European Union, the Restriction of Hazardous Substances (RoHS) directive was amended in 2015 (Directive 2015/863/EU) to include four commonly used phthalates—diisobutyl phthalate (DIBP), dibutyl phthalate (DBP), benzyl butyl phthalate (BBP), and bis(2-ethylhexyl) phthalate (DEHP)—in electrical and electronic equipment.[1] Complementing RoHS, the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) regulation (EC No. 1907/2006) enforces stricter controls, regulating these four substances along with three additional phthalates: di-n-octyl phthalate (DNOP), diisononyl phthalate (DINP), and diisodecyl phthalate (DIDP), particularly in toys and childcare articles.[2] Similar restrictions exist in the US, under 16 C.F.R. part 1307 of the Consumer Product Safety Improvement Act (CPSIA), which has established limits on DEHP, DBP, BBP, DINP, DIBP, DNOP, dihexyl phthalate (DHXP), and dicyclohexyl phthalate (DCHP) content in children's products.[3] In China, GB6675.1-2025, set to replace GB 6675.1-2014 in November 2026, has set regulations for DEHP, DBP, BBP, DINP, DIDP, DNOP, DIBP, DHXP, DCHP, and dipentyl (diamyl) phthalate (DDP).[4] These regulatory developments underscore the need for robust analytical methods such as gas chromatography/mass spectrometry (GC/MS) to ensure compliance.

Several GC/MS techniques for quantifying phthalates have been published by Agilent, demonstrating the use of both helium and hydrogen as carrier gases. For example, seven phthalates in polymer materials were successfully analyzed with GC/MS using helium carrier gas and calibrated from 50 to 1,000 ng/mL.[5] The calibration performance for 17 phthalates over the range of 10 to 1,000 ng/mL and for two isomeric mixtures (DINP and DIDP) over the range of 125 to 10,000 ng/mL using helium carrier gas and the Agilent JetClean self-cleaning ion source has been described.[6] A calibration range of 200 to 5,000 ng/mL has been achieved using hydrogen carrier gas, the Agilent HydroInert source, and backflushing for analyzing 10 phthalates in electrical cable samples.[7] Additionally, the performance of 17 target phthalates, along with DINP and DIDP, was demonstrated over a range of 1 to 1,000 ng/mL in hydrogen carrier gas using the standard extractor source on the Agilent 5977C GC/MSD.[8] Also, a rapid screening method for the qualitative detection of phthalates was performed on the Agilent Intuvo 9000 GC with the Agilent 5977B GC/MSD.[9] These studies highlight the versatility of Agilent GC/MS systems for phthalate analysis and the growing interest in hydrogen as a cost-effective alternative to helium for routine testing. Since many laboratories are considering converting from helium to hydrogen carrier gas for GC/MS analyses, it is useful to evaluate the performance of phthalates with hydrogen carrier gas down to low levels (< 10 ng/mL).[8]

This application note examines the capabilities of the Agilent 7000E triple quadrupole GC/MS operating in dynamic multiple reaction monitoring (dMRM) mode for phthalate quantification using helium carrier gas. The dMRM approach on a triple quadrupole system delivers significantly higher sensitivity compared to traditional single quadrupole methods. One of the key challenges in phthalate analysis is mitigating interference from silicone-based contaminants.[8] By leveraging multiple reaction monitoring (MRM) transitions, this method effectively reduces the impact of such contamination, ensuring more accurate and reliable results.

Further, this application note explores the performance benefits of the Agilent J&W HP-5Q ultra low-bleed column, designed to deliver a naturally lower baseline for enhanced sensitivity. While column bleed is an inherent characteristic of GC columns, its impact on detector performance and analytical sensitivity can be minimized through advanced column technology. The Agilent J&W DB5Q and HP-5Q columns offer superior thermal stability, significantly reducing bleed at elevated temperatures. Lower bleed translates to improved mass spectrometer sensitivity by minimizing spectral interference caused by phase degradation.

These advancements make DB5Q and HP-5Q columns ideal for high-sensitivity applications, including GC/MS, triple quadrupole GC/MS, and GC/QTOF systems.[10]

Experimental

Chemicals and reagents

Table 1 shows all 19 compounds and the abbreviations used throughout this study. Phthalate calibration standards were prepared in two separate calibration sets. The first set contained 17 of the 19 phthalates and the second set contained DINP and DIDP phthalate isomers. A 15-component custom phthalates mix was purchased from Ultra (now Agilent). The concentration of each component was 1,000 µg/mL in isooctane. DAP, DINP, and DIDP were purchased in pure form from Agilent. DPHP was purchased from MilliporeSigma. Calibration standards were prepared for 17 phthalates at 14 concentration levels: 0.1, 0.25, 0.5, 1, 2.5, 5, 10, 25, 50, 100, 250, 500, 750, and 1,000 ng/mL in isooctane. Calibration standards for the DIDP and DINP isomers were dissolved in isooctane at 14 concentration levels: 10, 25, 50, 100, 250, 500, 750, 1,000, 2,500, 5,000, 7,500, 10,000, 20,000, and 30,000 ng/mL.

Table 1. Compound name, abbreviation, and CAS number for all target analytes.

Compound	Abbreviation	CAS Number
Dimethyl phthalate	DMP	131-11-3
Diethyl phthalate	DEP	84-66-2
Diallyl phthalate	DAP	131-17-9
1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	DIBP	84-69-5
Dibutyl phthalate	DBP	84-74-2
Bis(2-methoxyethyl) phthalate	DMEP	117-82-8
1,2-Benzenedicarboxylic acid, bis(4-methylpentyl) ester	BMPP	146-50-9
1,2-Benzenedicarboxylic acid, bis(2-ethoxyethyl) ester	DEEP	605-54-9
Diamyl phthalate	DPP	131-18-0
1,2-Benzenedicarboxylic acid, dihexyl ester	DHXP	84-75-3
Benzyl butyl phthalate	BBP	85-68-7
Bis(2-butoxyethyl) phthalate	DBEP	117-83-9
Dicyclohexyl phthalate	DCHP	84-61-7
Bis(2-ethylhexyl) phthalate	DEHP	117-81-7
Di-n-octyl phthalate	DNOP	117-84-0
Bis(2-propylheptyl) phthalate	DPHP	53306-54-0
1,2-Benzenedicarboxylic acid, dinonyl ester	DNP	84-76-4
Diisononyl phthalate	DINP	28553-12-0
Diisodecyl phthalate	DIDP	26761-40-0

Instrumentation

Table 2 outlines the operating conditions for the Agilent 8890 gas chromatography system and the 7000E triple quadrupole GC/MS. A key point to highlight is the use of pulsed splitless injections, which ensures maximum transfer of phthalates onto the column while reducing unwanted reactions in the heated inlet. For this setup, the Agilent universal Ultra Inert mid-frit inlet liner proves highly effective. Its design promotes heat transfer to the injected liquid, allowing complete vaporization before the sample enters the column. Although a multimode inlet (MMI) was employed, it was run isothermally at 280 °C. This means that a standard split/splitless inlet could also be used for similar performance.[8]

Table 2. GC and MS conditions for phthalates analysis.

Agilent 8890 Gas Chromatography System, Auto Injector, and Tray	
Injection Volume	1.0 µL
Inlet	MMI split/splitless
Mode	Pulsed splitless
Injection Pulse Pressure	25 psi until 0.9 min
Purge Flow to Split Vent	50 mL/min at 0.75 min
Septum Purge Flow Mode	Switched, 3 mL/min
Inlet Temperature	280 °C
Oven	Initial: 60 °C (1 min hold) Ramp 1: 20 °C/min to 220 °C Ramp 2: 5 °C/min to 320 (1.0 min hold)
Column	Agilent J&W HP-5Q, 30 m × 0.25 mm, 0.25 µm
Control Mode	Constant flow, 1.2 mL/min
Agilent 7000E Triple Quadrupole GC/MS	
Source	Agilent extractor source
Transferline Temperature	280 °C
Source Temperature	300 °C
Quadrupole Temperature	150 °C
Mode	Dynamic MRM
EM Voltage Gain	10
Solvent Delay	7.0 min
Collision Gas	Nitrogen, 1.5 mL/min
Quench Gas	Helium, 2.5 mL/min
Automatically Subtract Baseline	Yes
Advanced SIM/MRM Thresholding	Yes

The Agilent MassHunter Optimizer software was utilized to generate MRMs from standards. Table 3 shows the quantifier and qualifier transitions utilized for each phthalate, and Table 4 lists the consumables required to execute the method.

Table 3. MRM transitions used for quantifier and qualifier ions, and target analyte IDLs.

Target Analyte	RT (min)	Quantifier Transition	CE	Qualifier Transition	CE	IDL (ng/mL)
DMP	7.766	163.0 → 77.0	25	163.0 → 92.0	30	0.13
DEP	8.644	149.0 → 65.0	25	149.0 → 93.0	15	0.21
DAP	9.578	149.0 → 65.0	20	149.0 → 93.0	10	0.28
DIBP	10.379	149.0 → 65.0	25	149.0 → 93.0	15	0.22
DBP	11.1	149.0 → 65.0	25	149.0 → 93.0	15	0.13
DMEP	11.386	149.0 → 65.0	25	149.0 → 93.0	15	0.06
BMPP	12.051	149.0 → 65.0	25	149.0 → 93.0	20	0.36
DEEP	12.397	149.0 → 65.0	25	149.0 → 93.0	15	0.11
DPP	12.804	149.0 → 65.0	25	149.0 → 93.0	15	0.01
DHXP	14.869	149.0 → 65.0	25	149.0 → 93.0	15	0.11
BBP	14.99	149.0 → 65.0	25	149.0 → 93.0	15	0.11
DBEP	16.381	149.0 → 65.0	25	149.0 → 93.0	15	0.14
DCHP	17.037	149.0 → 65.0	25	149.0 → 93.0	20	0.04
DEHP	17.205	149.0 → 65.0	25	149.0 → 93.0	20	0.14
DNOP	19.714	149.0 → 65.0	25	149.0 → 93.0	20	0.12
DPHP	20.887	149.0 → 65.0	25	149.0 → 93.0	20	0.44
DNP	22.248	149.0 → 65.0	25	149.0 → 93.0	20	0.11
DINP	19.948	293.0 → 148.9	5	293.0 → 70.9	5	9.52
DIDP	21.745	307.2 → 149.0	5	307.2 → 70.8	10	10.16

Table 4. Agilent consumables and part numbers used in the method for phthalates analysis.

Consumable	Description	Part Number
Injector Syringe	Agilent Blue Line autosampler syringe, 10 µL, fixed needle	G4513-80220
Inlet Septum	Agilent Advanced Green septum, nonstick, 11 mm	5183-4759
Inlet Liner	Agilent universal Ultra Inert mid-frit inlet liner	5190-5105
Gold Seal	GC inlet seal, gold-plated with washer, Ultra Inert	5190-6144
Column	Agilent J&W HP-5Q column, 30 m × 0.25 mm, 0.25 µm	19091S-433Q
Vial	Vial, snap top, amber, write-on spot, 2 mL	5182-0545
Caps	Cap, snap, 11 mm, polyurethane	5181-1512
Large Gas Trap	Agilent big universal trap, helium, 1/8 in, 300 psig	RMSN-2
Gas Clean Filter	Agilent Gas Clean carrier gas purifier	CP17973

An instrument detection limit (IDL) study was performed after the completion of the initial calibration. Eight trials were performed with the 1 ng/mL calibration standard for 17 individual phthalates and the 50 ng/mL standard for DINP and DIDP. The calculated IDLs were obtained by applying the equation below and are listed in Table 3.

$$IDL = s \times t(n - 1, 1 - \alpha = 99) = s \times 2.998$$

Where:

$t(n - 1, 1 - \alpha)$ = t value for 99% confidence level with n – 1 degrees of freedom

n = number of trials (eight)

s = standard deviation of the eight trials

Helium purification

The big universal trap (part number RMSN-2) and the Gas Clean filter system (part number CP17973) are installed in-line to maintain the highest helium purity. The universal trap provides primary contaminant removal, while the Gas Clean cartridge serves as both an additional filtration stage and a performance indicator. This configuration is strongly recommended to ensure ultra-high-purity helium for trace-level analyses.

Sources and mitigation of silicone contamination

Multiple sources of silicone-based contamination can interfere with phthalate determinations. To minimize these risks, bake all vials, caps, septa, transfer pipettes, and any ancillary glassware in a glass oven at 130 °C to remove residual contaminants.

The vial septum in standard caps represents a major source of silicone contamination. Therefore, it is advisable to use either the polyurethane snap cap (part number 5181-1512) with its corresponding vial (part number 5182-0545) or the PTFE crimp cap (part number 5182-0871) with its corresponding vial (part number 5181-3376). The polyurethane snap cap offers ease of use and reseals after puncture, allowing reuse. However, its solvent compatibility is limited. For example, isooctane is acceptable, whereas methylene chloride causes swelling and cap displacement. Always refer to the online compatibility guide prior to use. The PTFE crimp cap provides broader solvent compatibility, but loses airtight integrity after puncture, necessitating immediate recapping if sample reanalysis is planned.

The needle support insert (part number G4513-40525) is another potential contamination source. This component is considered consumable and should be replaced annually at minimum. If contamination is detected in the blanks originating from the needle seat, sonication or vortexing in 20 mL of methanol typically removes residues; however, replacement remains the preferred approach.

For further details and experimental data identifying silicone contamination sources, refer to Agilent application note 5994-8354EN.[8]

Test samples

Various polymeric consumer products, including items intended for use by children, were analyzed to evaluate the phthalates method. Each item was sectioned into small, uniform fragments and transferred into a 20 mL borosilicate glass vial equipped with a PTFE-lined cap. Subsequently, 5 mL of acetone was added to each vial, and the vials were securely sealed. Extraction was performed through gentle rotational agitation for 20 minutes to facilitate solvent interaction with the external surfaces of the polymeric materials. Following extraction, a 1 mL aliquot of the resulting solution was transferred into an autosampler vial and sealed using polyurethane snap caps.

Results and discussion

Chromatography

Excellent resolution was achieved for all 17 target phthalates (Figure 1). Notably, BMPP exhibited a split peak, attributable to isomeric separation. This phenomenon has been previously documented[6], but the enhanced hydrophobicity of the HP-5Q stationary phase facilitates improved resolution of these isomers. In this study, BMPP was integrated using the complete isomeric profile.

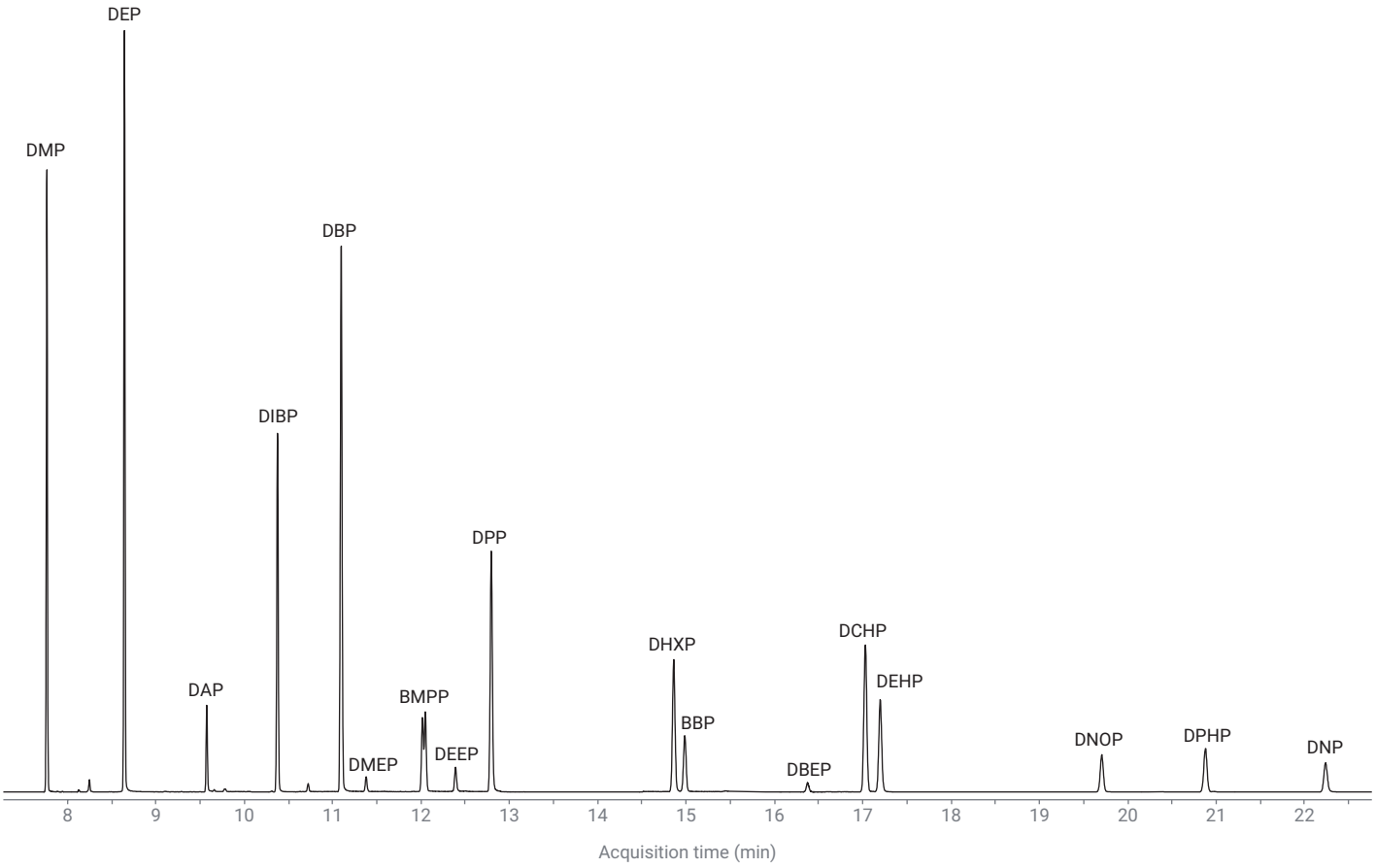

Figure 1. A chromatogram at 100 ng/mL of 17 target phthalates.

The elution pattern of the 17 analytes closely parallels previously reported separations on the Agilent J&W HP5ms column.[6,8] Given the similarity in retention times and elution order, the HP-5Q column serves as a direct replacement for the HP-5ms GC column in this methodology. The advantages of employing the HP-5Q column are twofold:

- **Reduced column bleed:** The lower bleed characteristics minimize background interference, complementing the use of multiple reaction monitoring (MRM) for confident analyte identification.
- **Simultaneous scan and MRM capability:** The 7000E GC/TQ enables concurrent scan and MRM acquisition, allowing targeted quantification while screening for additional phthalates of interest. A rapid scanning approach for sample prioritization has been previously described.[9] Incorporating the HP-5Q column in such workflows reduces interference and improves spectral quality, resulting in higher confidence library matches.

In this study, DINP and DIDP were analyzed using a separate method due to substantial differences in calibration ranges. Nevertheless, both compounds can be incorporated into the primary 17-target phthalate method without technical limitations. Chromatographically, DINP and DIDP present unique challenges because they are complex mixtures of structural isomers. DINP predominantly comprises C8–C9 isomers, whereas DIDP consists primarily of C9–C11 isomers, with C10 being the most abundant. So, their respective chromatographic peaks span approximately a five-minute retention window (Figure 2), complicating reliable integration.

One approach to address this challenge involves defining a fixed retention-time window in Agilent MassHunter and applying the spectral summation function, as implemented in the present study. This technique ensures consistent integration across the designated retention interval. However, spectral summation may still introduce variability and often requires manual adjustment. Alternatively, Agilent AI Peak Integration for MassHunter can be employed for DINP and DIDP (see Agilent application note 5994-7181EN).[11] This machine-learning-based tool uses a training set of user-approved integrations to model and replicate integration behavior, thereby improving consistency and reducing manual intervention.

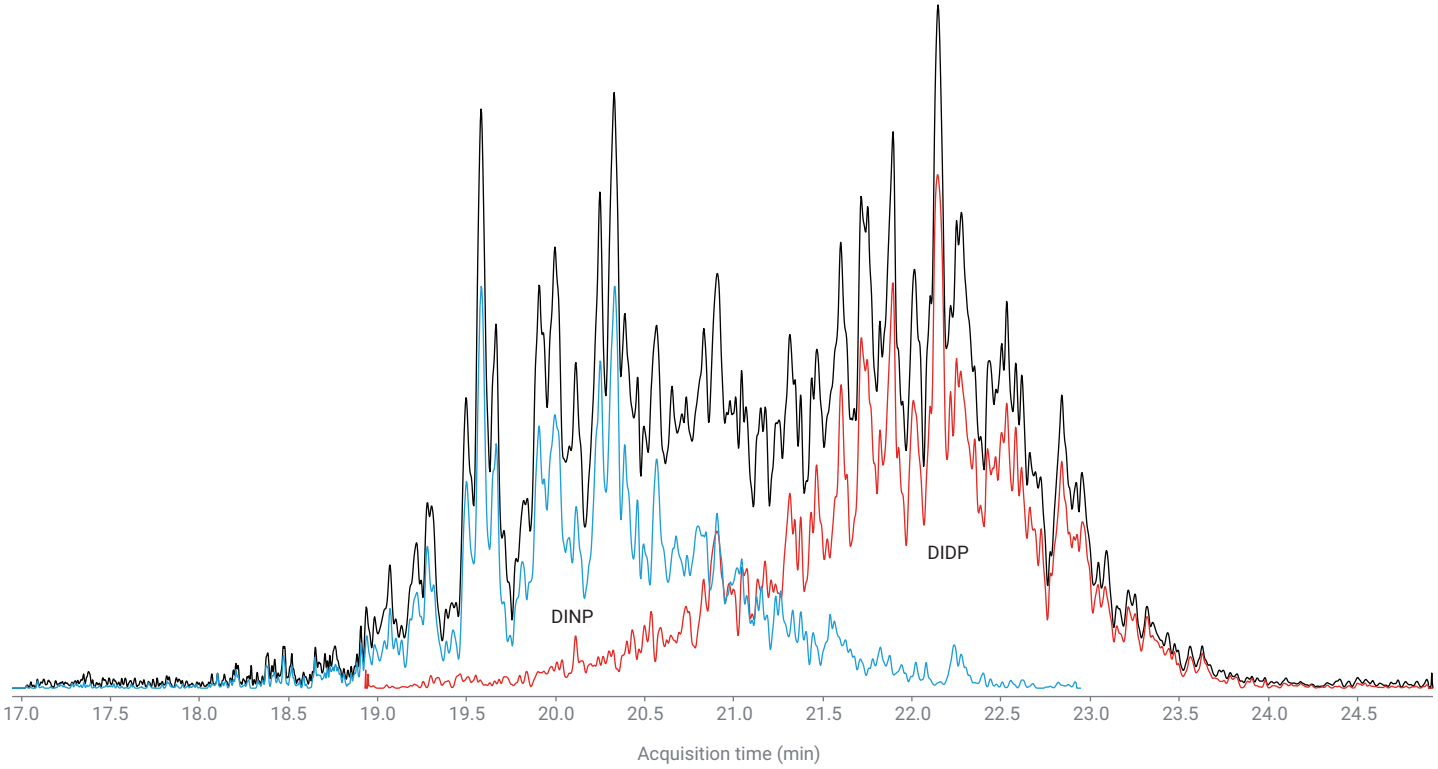

Figure 2. Chromatogram of DINP and DIDP at 1,000 ng/mL.

Calibration

Calibration curves for the 17 target phthalates were established over a concentration range of 0.1 to 1,000 ng/mL, spanning five orders of magnitude. Across this range, a quadratic regression model provided the best fit (Table 5), yielding coefficients of determination (R^2) ≥ 0.995. In cases where analytes were not detected at the lowest concentrations, calibration ranges were adjusted to reflect the applicable range. The observed quadratic behavior in the current method is due to the use of the standard (3 mm) extraction lens and the etune algorithm (extraction modality). Linearity over a larger range can be achieved by changing to the 9 mm extraction lens (part number G3870-20449), using the atune algorithm (repulsion modality), and implementing JetClean in acquire and clean mode.[6] Additionally, running phthalates analysis in hydrogen carrier gas with the 9 mm extraction lens also increases the observed linear range.[8] To evaluate the linear range for each analyte in the current study, high-concentration calibration points were sequentially removed until a linear fit was achieved (Table 6). All linear calibration models were constructed using a minimum of seven data points.

Table 5. Quadratic calibration curves of 19 target phthalates. All curves ignored the origin and were 1/x weighted.

Target Analyte	R^2	Lower Limit	Upper Limit	Number of Points
DMP	0.9990	0.1	1,000	14
DEP	0.9981	0.1	1,000	14
DAP	0.9990	0.1	1,000	14
DIBP	0.9977	0.1	1,000	14
DBP	0.9977	0.1	1,000	14
DMEP	0.9997	1	1,000	11
BMPP	0.9996	0.25	1,000	13
DEEP	0.9997	1	1,000	11
DPP	0.9986	0.1	1,000	14
DHXP	0.9992	0.1	1,000	14
BBP	0.9999	0.1	1,000	14
DBEP	0.9998	1	1,000	11
DCHP	0.9961	0.1	1,000	14
DEHP	0.9986	0.1	1,000	14
DNOP	0.9994	0.1	1,000	14
DPHP	0.9986	1	1,000	11
DNP	0.9997	0.1	1,000	14
DINP	0.9991	10	30,000	12
DIDP	0.9994	10	30,000	12

Table 6. Linear calibration curves of 17 target phthalates. All curves ignored the origin and were 1/x weighted.

Target Analyte	R^2	Lower Limit	Upper Limit	Number of Points
DMP	0.9982	0.1	100	10
DEP	0.9975	0.25	100	9
DAP	0.9966	0.1	100	10
DIBP	0.9952	0.1	100	10
DBP	0.9953	0.1	100	10
DMEP	0.9962	1	100	7
BMPP	0.9961	0.25	100	9
DEEP	0.9947	1	100	7
DPP	0.9962	0.1	100	10
DHXP	0.9966	0.25	100	9
BBP	0.9968	0.1	100	10
DBEP	0.9984	1	100	7
DCHP	0.9951	0.25	100	9
DEHP	0.9954	0.1	100	10
DNOP	0.9985	0.1	100	10
DPHP	0.9964	1	100	7
DNP	0.9989	0.1	100	10

For DINP and DIDP, calibration was performed over a range of 10 to 30,000 ng/mL (four orders of magnitude; Table 5). A robust quadratic fit was obtained using 12 calibration points, and quadratic regression consistently outperformed linear models for these compounds. Attempts to achieve linearity within this range resulted in fewer than five calibration points, which were deemed unacceptable for quantitative reliability. These two compounds, especially, may benefit from earlier suggestions to increase linearity.

Detection in samples

Fifteen of the 19 target phthalates were detected in at least one sample (Table 7). Except DCHP, all regulated compounds were observed. Representative consumer plastic items were selected to reflect potential products subject to various regulatory frameworks. Given the diversity of regulatory protocols and sample preparation techniques, a simplified acetone rinse was employed to demonstrate the applicability of the current instrumental method. Because acetone washing is inherently qualitative, quantitative concentrations were not reported.

A comprehensive evaluation of sample preparation strategies and overall method robustness was beyond the scope of this study. Previous studies have demonstrated that the universal Ultra Inert mid-frit inlet liners provide superior heat transfer, facilitating complete volatilization of phthalates.[8] Additionally, these liners are engineered to manage complex sample matrices efficiently and minimize the transfer of high-boiling matrix components to the column head, thereby improving system performance and longevity.

Table 7. Detections of target phthalates in nine different samples. ND = no detection.

Target Analyte	Medication Syringe	Plastic Spoon	Breast Milk Bottle	Children's Cup	Children's Toy	Pen Cap	Electronics Cable	Baby Bottle Top	Baby Bottle
DMP	ND	ND	Detected	Detected	ND	ND	Detected	Detected	Detected
DEP	ND	ND	Detected	Detected	ND	Detected	Detected	ND	ND
DAP	ND	ND	ND	Detected	ND	ND	Detected	ND	ND
DIBP	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected
DBP	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected
DMEP	ND	ND	ND	ND	ND	ND	Detected	ND	ND
BMPP	ND	ND	ND	ND	ND	ND	ND	ND	ND
DEEP	ND	ND	ND	ND	ND	ND	ND	ND	ND
DPP	ND	ND	ND	ND	ND	ND	Detected	ND	ND
DHXP	ND	ND	ND	Detected	ND	Detected	Detected	Detected	Detected
BBP	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected
DBEP	ND	ND	ND	ND	ND	ND	ND	ND	ND
DCHP	ND	ND	ND	ND	ND	ND	ND	ND	ND
DEHP	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected
DNOP	Detected	ND	Detected	Detected	Detected	Detected	Detected	Detected	Detected
DPHP	Detected	ND	ND	ND	Detected	ND	Detected	Detected	Detected
DNP	ND	ND	Detected	Detected	Detected	Detected	Detected	Detected	Detected
DINP	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected
DIDP	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected

Conclusion

The triple quadrupole GC/MS method for analyzing phthalates using the Agilent J&W HP-5Q column described here demonstrated several improvements:

- Excellent chromatographic peak shape and separation, similar to previous reports, with little or no tailing, demonstrate that the HP-5Q column can function as a drop-in replacement of the Agilent J&W HP-5ms column.
- Lower bleed characteristics of the HP-5Q column minimize background interference, complementing the use of multiple reaction monitoring (MRM) for confident analyte identification.
- Use of MRMs and the HP-5Q column significantly reduces interference from silicone and siloxane contamination.
- Average IDLs are 0.16 ng/mL for 17 phthalates.
- Calibration capability from four to five orders of magnitude, depending on calibration algorithm and need, allows for a large range of screening.

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