



# Comprehensive LC/MS/MS Pesticide Residue Scans Maximize Data Quality Using 70-90% Less Sample



ALS Canada is introducing new streamlined LC/MS/MS pesticide scan methods to meet most Canadian pesticide guidelines for waters with fewer tests, improved data quality, and with sample size reduced to only 100 mL, benefitting manual handling, freight, and our sustainability efforts.

## Data Quality Improvements with LC/MS/MS

Historically, most environmental testing for pesticides has utilized single quadrupole GC/MS (Gas Chromatography / Mass Spectrometry), but in recent years LC/MS/MS (Liquid Chromatography with MS/MS detection) has become the instrumentation of choice for most pesticide analysis. LC is preferred over GC for polar, acidic, and thermally labile or reactive substances, and most pesticides (with the notable exception of Organochlorine Pesticides - OCPs) fall in these categories.

ALS Canada has now replaced all our legacy GC/MS single quadrupole pesticide methods with LC/MS/MS (excluding OCP and some soil tests), which can provide significant data quality gains, particularly in complex sample matrices, due to the use of tandem mass spectrometry and Multiple Reaction Monitoring (MRM). LC and GC techniques both isolate test analytes using chromatography prior to detection and measurement. False positives can still occur with single quadrupole mass spectrometric detection,

which measures ions of specifically targeted mass:charge ratio, but with LC/MS/MS and MRM, false detections are practically eliminated. With MRM, a precursor ion is isolated in the 1st stage of the spectrometer, which is then further fragmented in the 2nd stage, with unique “daughter ion” fragments detected in the 3rd stage of the instrument. With MRM, positive detections have very high certainty, because only the correct daughter ions generated from specified precursor ions are measured. LC/MS/MS methods also usually require far less manual handling than GC/MS methods, which reduces many sources of variability and potential for analyte loss – improving precision and accuracy. For most analytes, our new LC/MS/MS pesticide scan methods offer equal or lower detection limits versus our legacy GC/MS tests.

## Reduced Sample Size & Sustainability Benefits

A major advantage of our new LC/MS/MS pesticide methods is that sample volume requirements have been dramatically reduced, typically from 2 x 500 mL down to only 100 mL. For low-level tests, 3 x 100 mL samples are required. This further advances the ALS commitment to sample size reduction, assisting with faster and easier sample collection in the field, and causing less potential for manual handling risk for samplers. Sample size reduction also reduces our carbon footprint through decreased shipping weight and reduced consumable use, while also minimizing shipping and transportation costs.

## Streamlined Tests to Meet Canadian Guidelines

Our new LC/MS/MS pesticide scans have also incorporated several previously separate LC/MS/MS pesticide methods, combining seven different methods to two, and reducing the total cost of analysis where our clients require comprehensive pesticide testing. Table 2 lists 66 different pesticide analytes covered by our two new scans (test codes E755 + E756), showing comparisons with most of the common Canadian pesticide guidelines and standards. Most guidelines can be met with our routine test codes, but a few require our low-level methods. The lowest limits for Chlorpyrifos and Deltamethrin cannot be met using 100 mL sample volumes, but ultra-trace methods for these analytes are being developed.

## Omethoate Testing Meets New Canadian Drinking Water Guidelines

Our new E755 LC/MS/MS pesticide scan also includes testing for Omethoate, which is now required to assess the new Canadian Drinking Water Guidelines for Dimethoate (Sept 2022), which must be evaluated using the sum of Dimethoate + Omethoate (expressed as Dimethoate toxic equivalents). Routine-level test codes may be used to meet all pesticide limits under the Canadian Drinking Water Guidelines.

## Sampling and Test Details

Summary details for the common pesticide tests offered by ALS Canada are provided in Table 1, including test codes, sample container requirements, preservation

Table 1. Sampling Details for Common ALS Canada Pesticide Tests

Pesticide Test Category	Instrument	Test Code	Level	Sample Containers <sup>1</sup>	Hold Time
Pesticide Residue Scan 1	LC/MS/MS	E755	Routine	100 mL amber glass <sup>2</sup>	7 days
		E755-L	Low	3 x 100 mL amber glass	
Pesticide Residue Scan 2	LC/MS/MS	E756	Routine	100 mL amber glass <sup>2</sup>	7 days
		E756-L	Low	3 x 100 mL amber glass	
Phenoxy Herbicides	LC/MS/MS	E706A	Routine	100 mL amber glass <sup>2</sup>	7 days
		E706A-T	Trace	3 x 100 mL amber glass	
Diquat/Paraquat	LC/MS/MS	E723A	Routine	60 mL HDPE <sup>3</sup>	7 days
Glyphosate/AMPA	LC/MS/MS	E716A	Routine	60 mL HDPE <sup>3</sup>	14 days
		E716B-L	Low		
Organochlorine Pesticides	GC/MS/MS	E660F	Routine	2 x 100 mL amber glass	7 days
		E660F-T	Trace		

<sup>1</sup> All tests: Preserve with sodium thiosulfate if chlorinated.

<sup>2</sup> A single 100 mL sample is sufficient for all the E755, E756, and E706A Routine tests.

<sup>3</sup> A single 60 mL sample is sufficient for all the E723 and E716 tests.

details, and recommended hold times. All these tests are offered out of the ALS Waterloo laboratory. ISO 17025 accreditation for our LC/MS/MS Pesticide Residue Scan methods (E755 & E756) is pending, expected Oct 2023. Existing pesticide test methods (E706, E723, E716, and E660 codes) are currently accredited. Please refer to the ALS Waterloo [CALA Scope of Accreditation](#) for current accreditation status and details. For more details about our Phenoxy Herbicides methods, please refer to [EnviroMail 16](#). For more details about our GC/MS/MS Triple Quad Organochlorine Pesticides methods, please refer to [EnviroMail 19](#).

Figure 1. Old vs New Sample Containers - up to 90% reduction



**Please contact your ALS Project Manager for more details, or to request sampling supplies.**

Table 2. LC/MS/MS Pesticide Scan Parameters vs. Common Canadian Guidelines

Pesticide Parameter	Usage	Test Code	Routine LOR (µg/L)	Trace LOR (µg/L)	All Listed	BC CSR	BCAW-WQG	ABT1	EQGASW	SEQG	ON DWR	ON PWQO	RBCA	CCME	CDWG
					Lowest (µg/L)	Lowest (µg/L)	Lowest (µg/L)	Lowest (µg/L)	Lowest (µg/L)	Lowest (µg/L)	Lowest (µg/L)	Lowest (µg/L)	Lowest (µg/L)	Lowest (µg/L)	Lowest (µg/L)
Alachlor	herbicide	E755	0.05	-	3	3	-	-	-	-	5	-	-	-	-
Aldicarb	insecticide	E755	0.1	-	0.15	1.5	0.15	1	1	1	9	-	0.15	0.15	-
Ametryn	herbicide	E755	0.025	-	35	35	-	-	-	-	-	-	-	-	-
Atrazine	herbicide	E755	0.05	-	1.8	5	-	-	-	-	-	-	1.8	-	-
Atrazine + N-dealkylated metabolites	herbicide	E755	0.45	-	1.8	5	1.8	1.8	1.8	1.8	5	-	-	1.8	5
Atrazine, 2-hydroxy-	herbicide	E755	0.05	-	-	-	-	-	-	-	-	-	-	-	-
Atrazine-desethyl	herbicide	E755	0.025	-	-	-	-	-	-	-	-	-	-	-	-
Atrazine-desethyl-desisopropyl	herbicide	E755	0.4	-	-	-	-	-	-	-	-	-	-	-	-
Atrazine-desisopropyl	herbicide	E755	0.05	-	-	-	-	-	-	-	-	-	-	-	-
Azinphos-methyl	insecticide	E755	0.1	0.005	0.005	20	-	0.01	-	0.01	20	0.005	0.01	-	-
Azoxystrobin	fungicide	E755	0.025	-	-	-	-	-	-	-	-	-	-	-	-
Bendiocarb	insecticide	E755	0.025	-	40	-	-	-	-	40	40	-	40	-	-
Benomyl	fungicide	E755	0.025	-	200	200	-	-	-	-	-	-	-	-	-
Boscalid	fungicide	E755	0.05	-	-	-	-	-	-	-	-	-	-	-	-
Carbaryl	insecticide	E755	0.05	-	0.2	2	0.2	0.2	0.2	0.2	90	0.2	0.2	0.2	-
Carbofuran	insecticide	E755	0.025	-	1.8	18	1.8	1.8	1.8	1.8	90	-	1.8	1.8	-
Carboxin	fungicide	E755	0.025	-	400	400	-	-	-	-	-	-	-	-	-
Chlorantraniliprole	insecticide	E755	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Clothianidin	insecticide	E755	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Cyanazine	herbicide	E755	0.1	-	0.2	0.2	0.5	0.5	-	0.5	10	-	2	0.5	-
Deltamethrin	insecticide	E755	0.5	0.02	0.0004	0.1	0.0004	-	0.0004	0.0004	-	-	-	0.0004	-
Diazinon	insecticide	E755	0.025	0.001	0.003	0.03	0.043	0.17	0.17	0.003	20	0.08	0.003	-	-
Diclofop-methyl	herbicide	E755	0.1	-	0.18	0.18	0.18	0.24	0.24	0.18	9	-	6.1	0.18	-
Dimethoate	insecticide	E755	0.05	-	3	3	3	3	3	3	20	-	6.2	3	20*
Dimethoate + Omethoate (as Dimethoate)	insecticide	E755	0.2	-	-	-	-	-	-	-	-	-	-	-	20*
Diuron	herbicide	E755	0.05	-	1.6	150	150	150	-	150	150	1.6	1.6	-	-
Ethyl dipropylthiocarbamate, S- [EPTC]	herbicide	E755	0.5	-	-	-	-	-	-	-	-	-	-	-	-
Fenoxaprop-ethyl	herbicide	E755	0.025	-	-	-	-	-	-	-	-	-	-	-	-
Fluazifop-p-butyl	herbicide	E755	0.025	-	-	-	-	-	-	-	-	-	-	-	-
Fludioxonil	fungicide	E755	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Imazamethabenz-methyl	herbicide	E755	0.025	-	-	-	-	-	-	-	-	-	-	-	-
Imidacloprid	insecticide	E755	0.05	-	0.23	-	0.23	-	-	0.23	-	-	-	0.23	-
Malathion	insecticide	E755	0.025	-	0.1	1	0.1	0.1	0.1	0.1	190	0.1	0.1	-	290
Metalaxyl	fungicide	E755	0.025	-	250	250	-	-	-	-	-	-	-	-	-
Methyl urea, 3-(3,4-dichlorophenyl)-1- [DCPMU]	herbicide	E755	0.025	-	-	-	-	-	-	-	-	-	-	-	-
Metolachlor	herbicide	E755	0.025	-	3	28	7.8	7.8	7.8	7.8	50	3	7.8	7.8	-
Metribuzin	herbicide	E755	0.1	-	0.5	0.5	0.5	0.5	0.5	0.5	80	-	1	0.5	80
Metsulfuron-methyl	herbicide	E755	0.05	-	-	-	-	-	-	-	-	-	-	-	-
Myclobutanil	fungicide	E755	0.1	-	100	100	-	-	-	-	-	-	-	-	-
Omethoate	insecticide	E755	0.05	-	-	-	-	-	-	-	-	-	-	-	20*
Phorate	insecticide	E755	0.25	-	2	2	2	2	-	2	2	-	2	-	-
Prometon	herbicide	E755	0.025	-	60	60	-	-	-	-	-	-	-	-	-
Prometryn	herbicide	E755	0.025	-	1	15	-	-	-	-	1	-	-	-	-
Propachlor	herbicide	E755	0.025	-	50	50	-	-	-	-	-	-	-	-	-
Propanil	herbicide	E755	0.1	-	20	20	-	-	-	-	-	-	-	-	-
Propazine	herbicide	E755	0.025	-	80	80	-	-	-	-	-	-	-	-	-
Propiconazole	fungicide	E755	0.05	-	50	50	-	-	-	-	-	-	-	-	-
Propoxur	insecticide	E755	0.025	-	-	-	-	-	-	-	-	-	-	-	-
Pyraclostrobin	fungicide	E755	0.05	-	-	-	-	-	-	-	-	-	-	-	-
Quizalofop-ethyl	herbicide	E755	0.025	-	35	35	-	-	-	-	-	-	-	-	-
Sethoxydim	herbicide	E755	0.05	-	350	350	-	-	-	-	-	-	-	-	-
Simazine	herbicide	E755	0.1	-	0.5	0.5	0.5	0.5	0.5	0.5	10	10	10	0.5	-
Tebuthiuron	herbicide	E755	0.05	-	0.25	0.25	0.27	0.43	0.43	0.27	-	-	1.6	0.27	-
Temephos	insecticide	E755	0.25	-	80	80	280	-	-	-	280	-	-	-	-
Terbufos	insecticide	E755	0.5	-	1	1	1	1	-	1	1	-	1	-	-
Terbutryn	herbicide	E755	0.025	-	4	4	-	-	-	-	-	-	-	-	-
Thifensulfuron-methyl	herbicide	E755	0.05	-	50	50	-	-	-	-	-	-	-	-	-
Tralkoxydim	herbicide	E755	0.05	-	-	-	-	-	-	-	-	-	-	-	-
Triallate	herbicide	E755	0.1	-	0.24	2.4	0.24	0.24	0.24	0.24	230	-	0.24	0.24	-
Tribenuron-methyl	herbicide	E755	0.05	-	30	30	-	-	-	-	-	-	-	-	-
Trifloxystrobin	fungicide	E755	0.025	-	-	-	-	-	-	-	-	-	-	-	-
Trinexapac-ethyl	herbicide (PGR)	E755	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Triticonazole	fungicide	E755	0.025	-	-	-	-	-	-	-	-	-	-	-	-
Chlorpyrifos	insecticide	E756	0.1	0.015	0.001	0.02	0.002	0.002	0.0035	0.002	90	0.001	0.002	0.002	90
Ethalfuralin	herbicide	E756	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Parathion	insecticide	E756	0.1	0.008	0.008	25	50	0.013	0.013	0.013	50	0.008	0.008	-	-
Parathion-methyl	insecticide	E756	0.1	-	1	1	-	-	-	-	-	-	-	-	-
Trifluralin	herbicide	E756	0.1	-	0.2	2	0.2	0.2	0.2	0.2	45	-	0.2	0.2	-

\* CDWG for Dimethoate & Omethoate applies to their sum (as Dimethoate toxic equivalents)

BC CSR = British Columbia Contaminated Sites Regulations

BCAWWQG = BC Approved and Working Water Quality Guidelines

ABT1 = Alberta Tier 1 Guidelines

EQGASW = Environmental Quality Guidelines for Alberta Surface Waters

SEQG = Saskatchewan Environmental Quality Guidelines

ON DWR = Ontario Drinking Water Regulation

RBCA = Atlantic Canada Risk-Based Corrective Action Environmental Quality Standards

CCME = Canadian Environmental Quality Guidelines

CDWG = Canadian Drinking Water Guidelines

PGR = Plant Growth Regulator