

超高效液相色谱三重四极杆质谱联用法 同时测定水果中 331 种农药及其代谢物 残留量

LCMSMS-550

摘要：使用岛津超高效液相色谱 - 三重四极杆质谱仪 LCMS-8045 建立了水果基质中 331 种农药及其代谢物同时测定的方法。使用基质加标样品进行了方法的线性考察和低中高三个浓度水平的加标回收率考察。结果显示，该方法线性范围宽，标准曲线相关系数均大于 0.995，低、中、高三个浓度水平下 331 种农药及其代谢物回收率在 60%~120% 之间，6 针重复进样峰面积精密度在 0.5%~15% 之间，均可满足日常检验需求。该方法完全满足国标 GB 23200.121-2021《植物源性食品中 331 种农药及其代谢物残留量的测定 液相色谱 - 质谱联用法》，供相关人员参考。

关键词：超高效液相色谱 - 三重四极杆质谱仪 331 种农药及其代谢物 植物源性食品

2021 年 3 月，由国家卫生健康委、农业农村部、市场监管总局三部门联合发布了 GB 2763-2021《食品安全国家标准 食品中农药最大残留限量》等 5 个国家标准，其中包括 GB 23200.121-2021《植物源性食品中 331 种农药及其代谢物残留量的测定 液相色谱 - 质谱联用法》检测标准。GB 23200.121-2021 标准适用于植物源性食品中 331 种农药及其 44 个代谢物（共计 375 种组分）残留量的测定，将于 2021 年 9 月正式实施。本标准是国内首个单针测定农药残留品种最多的 LC-MS/MS 国标，适用的植物源性食品包括食用菌、水果、水果、糖料、粮食、油料作物、茶叶、坚果和香辛料、植物油类 10 大类农产品，全面覆盖各类植物

源性食品。新标准延续了 GB 23200.113-2018《植物源性食品中 208 种农药及其代谢物残留量的测定 气相色谱 - 质谱联用法》标准中的 QuEChERS 前处理方法，一个样品使用同一个前处理方法即可同时用于 GC-MS/MS 和 LC-MS/MS 检测，大大简化了前处理过程，缩短时间，提高了分析效率。

本文使用岛津超高效液相色谱仪 LC-40 和三重四极杆质谱 LCMS-8045 联用，参考国标前处理方法，建立了水果基质中 331 种农药及其代谢物残留量的液相色谱 - 串联质谱的同时分析方法，完全满足国标 GB 23200.121-2021 测定需求。

■ 实验部分

1.1 仪器

本实验采用岛津 Nexera LC-40 与三重四极杆质谱仪 LCMS-8045 联用系统。具体配置为：

系统控制器：CBM-40A

自动进样器：SIL-40C XR

输液泵：LC-40B XR

柱温箱：CTO-40S

质谱检测器：LCMS-8045

色谱工作站：LabSolutions Ver. 5.99

1.2 分析条件

液相色谱条件：

色谱柱：Shim-pack GIST-HP C18-AQ (100 mm×2.1 mm I.D., 1.9 μm) P/N: 227-30807-02, 岛津（上海）实验器材有限公司

流动相：A 相为 2 mmol/L 甲酸铵 -0.01% 甲酸水溶液；

B 相为 2 mmol/L 甲酸铵 -0.01% 甲酸甲醇

流速：0.3 mL/min

柱温：40°C

进样量：2 μL

SIL 预处理：同时注入 10 μL 水

洗脱方式：梯度洗脱，B 相初始浓度为 3%，时间程序见表 1。

表 1 梯度洗脱时间程序

时间 (min)	泵 A 浓度	泵 B 浓度
1.00	97	3
1.50	85	15
2.50	50	50
18.00	30	70
23.00	2	98
27.00	2	98
27.10	97	3
30.00	97	3

质谱条件：

分析仪器：LCMS-8045

离子源：ESI (±)

雾化气流速：3.0 L/min

加热气流速：10.0 L/min

干燥气流速：10.0 L/min

DL 温度：150°C

加热模块温度：400°C

接口温度：300°C

扫描模式：多反应监测 (MRM)

表 2 MRM 参数

No.	中文名	英文名	电离方式	保留时间 (min)	前体离子	定量离子	Q1 Pre Bias	CE	Q3 Pre Bias	定性离子	Q1 Pre Bias	CE	Q3 Pre Bias
1	甲胺磷	methamidophos	+	3.978	142.1	94.0	-16	-15	-17	125.1	-16	-16	-23
2	乙酰甲胺磷	acephate	+	4.525	184.2	143.0	-20	-8	-15	95.0	-20	-23	-16
3	氧乐果	omethoate	+	4.708	214.1	183.0	-23	-10	-19	155.0	-23	-14	-28
4	杀线威肟	oxamyl oxime	+	4.719	163.0	72.1	-11	-12	-16	90.0	-11	-18	-20
5	霜霉威	propamocarb	+	4.732	189.2	102.1	-30	-20	-23	144.1	-30	-12	-15
6	涕灭威亚砷	aldicarb sulfoxide	+	4.789	207.0	89.0	-13	-15	-19	132.0	-19	-10	-10
7	呋虫胺	dinotefuran	+	4.817	203.1	129.1	-22	-12	-22	113.1	-22	-10	-12
8	涕灭威砷	aldicarb sulfone	+	4.917	240.1	148.0	-15	-12	-29	166.0	-13	-11	-20
9	杀线威	oxamyl	+	4.996	237.1	72.0	-12	-10	-15	90.1	-12	-8	-20
10	烯啶虫胺	nitenpyram	+	5.033	271.1	126.0	-14	-26	-20	189.1	-14	-13	-19
11	亚砷磷	oxydemeton-methyl	+	5.071	247.0	169.0	-30	-24	-30	105.1	-30	-20	-30
12	砷吸磷	demeton-S-methyl-sulfone	+	5.173	263.0	169.0	-30	-24	-30	125.0	-30	-30	-26
13	氟啶虫酰胺	flonicamid	+	5.195	230.1	203.1	-25	-10	-25	174.2	-11	-25	-19
14	噻虫嗪	thiamethoxam	+	5.250	292.0	211.1	-30	-20	-22	181.1	-30	-30	-19
15	灭多威	methomyl	+	5.262	163.1	88.0	-18	-8	-16	106.1	-18	-10	-19
16	久效磷	monocrotophos	+	5.289	224.1	193.0	-15	-9	-22	127.1	-18	-20	-15

No.	中文名	英文名	电离方式	保留时间 (min)	前体离子	定量离子	Q1 Pre Bias	CE	Q3 Pre Bias	定性离子	Q1 Pre Bias	CE	Q3 Pre Bias
17	百治磷	dicrotophos	+	5.435	238.0	112.1	-12	-12	-11	193.0	-12	-9	-20
18	甲基硫环磷	phosfolan-methyl	+	5.453	228.0	168.0	-11	-25	-13	109.0	-11	-15	-22
19	杀虫脒	chlordimeform	+	5.474	197.1	46.2	-21	-35	-19	117.3	-22	-40	-24
20	螺虫乙酯 - 烯醇 - 葡萄糖苷	spirotetramat-enol-glucoside	+	5.521	464.0	302.0	-22	-16	-23	216.0	-22	-42	-16
21	吡虫啉	imidacloprid	+	5.686	256.1	209.1	-29	-14	-22	175.1	-29	-17	-18
22	噻虫胺	clothianidin	+	5.792	250.0	169.1	-29	-12	-17	132.0	-29	-14	-24
23	甲硫威亚砷	methiocarb sulfoxide	+	5.862	242.1	185.1	-30	-24	-19	122.1	-11	-40	-26
24	唑啉草胺	flumetsulam	+	5.858	326.1	129.1	-12	-15	-25	109.0	-12	-51	-23
25	氯噻啉	imidaclothiz	+	5.921	262.1	181.1	-13	-25	-14	122.0	-10	-40	-15
26	蚜灭磷	vamidotion	+	5.932	287.8	118.1	-14	-35	-22	146.1	-14	-26	-16
27	速灭磷 ^a	mevinphos	+	5.976/6.729	225.0	127.1	-25	-17	-23	193.0	-25	-8	-20
28	3-羟基克百威	3-hydroxy carbofuran	+	6.044	238.1	163.1	-27	-14	-17	181.2	-27	-10	-19
29	啶虫脒	acetamiprid	+	6.071	223.1	126.1	-30	-22	-30	56.1	-30	-15	-23
30	敌百虫	trichlorfon	+	6.079	257.0	109.0	-10	-34	-22	220.8	-29	-11	-24
31	胺鲜酯	diethyl aminoethyl hexanoate	+	6.131	216.2	143.3	-24	-25	-10	100.3	-24	-25	-23
32	乐果	dimethoate	+	6.136	230.0	199.0	-26	-15	-21	125.0	-26	-30	-22
33	内吸磷 -S- 亚砷	demeton-S-sulfoxide	+	6.160	275.1	197.0	-10	-17	-15	141.0	-10	-30	-28
34	多菌灵	carbendazim	+	6.140	192.1	160.1	-30	-39	-30	132.1	-30	-40	-24
35	苯噻草酮	metamitron	+	6.164	203.1	175.0	-10	-18	-20	104.0	-10	-23	-22
36	氟啶虫胺腈 ^a	sulfoxaflor	+	6.172/6.280	278.1	174.2	-21	-11	-19	154.1	-20	-26	-25
37	甲硫威砷	methiocarb sulfone	+	6.310	258.1	122.1	-13	-23	-24	201.1	-29	-8	-14
38	内吸磷 -S- 砷	demeton-S-sulfone	+	6.356	291.0	234.8	-14	-15	-18	263.0	-11	-11	-20
39	杀草敏	chloridazon	+	6.364	222.0	92.1	-25	-26	-16	77.1	-25	-36	-30
40	霜脲氰	cymoxanil	+	6.498	199.1	128.1	-21	-8	-25	111.1	-21	-18	-21
41	噻虫啉	thiacloprid	+	6.649	253.0	126.1	-28	-30	-22	99.0	-28	-43	-17
42	异噁唑草酮 - 二腈	isoxaflutole-diketonitrile	-	6.811	358.1	79.0	12	23	26	64.0	12	50	11
43	脱甲基抗蚜威	pirimicarb-desmethyl	+	6.788	225.0	72.1	-30	-42	-30	180.1	-30	-15	-30
44	氧丰索磷	fensulfothion oxon	+	6.875	293.1	237.0	-11	-29	-18	265.0	-11	-23	-20
45	噻菌灵	thiabendazole	+	7.151	202.0	175.1	-30	-35	-30	131.1	-30	-25	-24
46	氧丰索磷砷	fensulfothion oxon sulfone	+	7.153	309.1	175.0	-18	-20	-20	253.0	-15	-25	-20
47	双氟磺草胺	florasulam	+	7.168	360.1	129.1	-24	-23	-23	109.1	-24	-54	-18
48	硫环磷	phosfolan	+	7.203	256.0	228.0	-13	-12	-25	140.0	-13	-15	-26
49	三环唑	tricyclazole	+	7.266	190.0	163.0	-21	-21	-30	136.0	-21	-26	-24
50	涕灭威	aldicarb	+	7.290	207.9	116.0	-14	-6	-12	89.0	-15	-15	-18
51	噁霜灵	oxadixyl	+	7.651	279.1	219.1	-30	-18	-23	133.1	-30	-30	-24

No.	中文名	英文名	电离方式	保留时间 (min)	前体离子	定量离子	Q1 Pre Bias	CE	Q3 Pre Bias	定性离子	Q1 Pre Bias	CE	Q3 Pre Bias
52	氧亚胺硫磷	phosmet oxon	+	7.706	302.0	160.0	-11	-40	-19	133.0	-11	-25	-16
53	磷胺 ^a	phosphamidon	+	7.601/7.776	300.0	174.1	-15	-22	-17	127.0	-15	-40	-22
54	安硫磷	formothion	+	7.701	258.0	199.0	-23	-8	-16	125.0	-10	-23	-25
55	速灭威	metolcarb	+	7.983	166.1	109.1	-18	-20	-20	107.1	-18	-15	-19
56	醚磺隆	cinosulfuron	+	8.089	414.1	183.1	-20	-30	-19	157.1	-20	-15	-16
57	氟菌唑代谢物 FM-6-1	triflumizole metabolite FM-6-1	+	8.188	295.0	43.1	-10	-23	-18	73.0	-10	-18	-15
58	氰草津	cyanazine	+	8.229	241.1	104.0	-30	-31	-19	68.1	-30	-39	-27
59	噻吩磺隆	thifensulfuron-methyl	+	8.338	388.1	167.1	-19	-16	-18	141.1	-19	-22	-27
60	螺虫乙酯 - 单 - 羟基	spirotetramat-mono-hydroxy	+	8.471	304.1	254.1	-11	-18	-29	211.0	-15	-19	-16
61	氟烯菌酯	phenamacril	+	8.498	217.1	104.0	-11	-40	-20	189.1	-11	-17	-22
62	敌敌畏	dichlorvos	+	8.493	238.0	109.1	-12	-21	-20	220.9	-12	-11	-15
63	烯丙苯噻唑	probenazole	+	8.517	224.0	41.0	-16	-42	-18	39.0	-11	-55	-17
64	醚苯磺隆	triasulfuron	+	8.613	402.1	167.1	-20	-18	-30	141.1	-20	-20	-26
65	甲磺隆	metsulfuron-methyl	+	8.653	382.1	167.1	-14	-12	-13	199.0	-13	-20	-15
66	残杀威	propoxur	+	8.681	210.1	111.1	-23	-13	-20	168.1	-23	-7	-18
67	噻苯隆	thidiazuron	+	8.773	221.2	102.0	-15	-16	-18	128.0	-15	-17	-23
68	脱甲基甲酰胺基抗蚜威	pirimicarb-desmethyl-formamido	+	8.794	253.1	72.0	-20	-25	-20	225.0	-17	-10	-18
69	苯线磷亚砷	fenamiphos sulfoxide	+	8.814	319.8	233.0	-30	-23	-26	292.1	-30	-16	-21
70	甲基硫菌灵	thiophanate-methyl	+	8.806	343.0	151.0	-12	-19	-29	311.0	-12	-10	-17
71	噻草酮	metribuzin	+	8.846	215.1	187.1	-25	-18	-18	84.1	-25	-21	-30
72	噁虫威	bendiocarb	+	8.876	224.1	167.1	-25	-15	-18	109.1	-25	-30	-20
73	克百威	carbofuran	+	8.888	222.1	123.1	-25	-30	-22	165.1	-25	-20	-17
74	环嗪酮	hexazinone	+	8.927	253.2	171.1	-30	-20	-18	85.1	-30	-31	-15
75	甲基内吸磷	demeton-S-methyl	+	8.995	231.0	89.0	-21	-24	-19	61.0	-10	-21	-23
76	马拉氧磷	malaoxon	+	9.019	314.9	127.0	-15	-20	-23	99.0	-15	-45	-19
77	丁噻隆	tebuthiuron	+	9.141	229.1	172.1	-30	-20	-30	116.1	-30	-25	-23
78	酰胺磺隆	amidosulfuron	+	9.189	370.2	261.1	-13	-14	-27	218.1	-13	-23	-22
79	西玛津	simazine	+	9.258	202.1	132.0	-30	-19	-25	124.1	-30	-17	-23
80	苯线磷砷	fenamiphos sulfone	+	9.290	335.9	266.0	-16	-14	-29	188.1	-16	-35	-21
81	氯磺隆	chlorsulfuron	+	9.286	358.1	141.1	-18	-17	-15	167.0	-17	-18	-30
82	乙噁酚	ethirimol	+	9.307	210.2	140.1	-13	-22	-25	98.1	-13	-26	-16
83	甲磺草胺	sulfentrazone	-	9.452	385.0	307.1	18	23	21	199.0	18	35	20
84	倍硫磷亚砷	fenthion sulfoxide	+	9.684	295.0	280.0	-11	-25	-10	109.0	-11	-25	-20
85	甲萘威	carbaryl	+	9.890	202.1	145.1	-22	-9	-26	127.1	-22	-27	-22
86	萎锈灵	carboxin	+	10.142	236.1	143.0	-10	-22	-16	87.0	-10	-23	-19

No.	中文名	英文名	电离方式	保留时间 (min)	前体离子	定量离子	Q1 Pre Bias	CE	Q3 Pre Bias	定性离子	Q1 Pre Bias	CE	Q3 Pre Bias
87	抗蚜威	pirimicarb	+	10.170	239.2	72.1	-30	-40	-30	182.2	-30	-19	-30
88	倍硫磷砒	fenthion sulfone	+	10.459	311.0	125.0	-11	-18	-15	233.1	-14	-23	-24
89	五氟磺草胺	penoxsulam	+	10.486	484.1	195.0	-11	-27	-15	444.0	-18	-25	-18
90	噻唑膦	fosthiazate	+	10.545	284.1	104.1	-30	-21	-19	228.0	-30	-15	-24
91	溴氰虫酰胺	cyantraniliprole	+	10.553	475.0	286.0	-11	-19	-22	444.0	-17	-19	-24
92	螺虫乙酯 - 烯醇	spirotetramat-enol	+	10.788	302.1	216.0	-15	-27	-17	270.0	-11	-20	-15
93	甲拌磷亚砒	phorate sulfoxide	+	10.835	277.0	199.0	-10	-10	-15	96.9	-10	-34	-19
94	乙拌磷亚砒	disulfoton sulfoxide	+	10.855	291.0	185.0	-30	-20	-19	213.0	-30	-16	-23
95	绿麦隆	chlortoluron	+	10.898	213.1	72.0	-10	-40	-16	46.1	-13	-25	-19
96	异丙威	isoprocarb	+	11.269	194.1	95.0	-21	-30	-17	137.1	-22	-15	-14
97	乙拌磷砒	disulfoton sulfone	+	11.344	306.8	96.9	-15	-20	-18	125.0	-15	-25	-23
98	西草净	simetryn	+	11.361	214.2	96.2	-25	-24	-21	68.2	-24	-30	-27
99	甲拌磷砒	phorate sulfone	+	11.422	293.0	171.1	-22	-9	-19	115.0	-22	-24	-20
100	三氟甲磺隆	tritosulfuron	+	11.450	446.0	195.0	-16	-20	-23	221.0	-21	-19	-12
101	抑霉唑	imazalil	+	11.428	297.0	159.0	-15	-24	-15	201.0	-15	-18	-21
102	粉唑醇	flutriafol	+	11.494	302.1	123.0	-15	-28	-22	109.0	-15	-31	-19
103	虫螨畏 ^a	methacrifos	+	11.514/13.781	240.8	209.0	-12	-10	-23	125.0	-12	-20	-24
104	吡唑草胺	metazachlor	+	11.752	278.1	210.1	-30	-14	-22	134.1	-30	-35	-24
105	甲基二磺隆	mesosulfuron-methyl	+	11.785	504.1	182.1	-34	-25	-18	139.0	-34	-52	-26
106	异丙隆	isoproturon	+	11.795	207.1	72.0	-23	-40	-28	165.1	-23	-20	-17
107	莠去津	atrazine	+	11.872	216.1	174.1	-30	-17	-18	96.1	-30	-25	-17
108	氯苯胺灵	chlorpropham	+	11.895	214.0	172.0	-10	-10	-18	154.0	-18	-16	-14
109	毒草胺	propachlor	+	11.895	212.1	170.0	-30	-22	-18	94.1	-30	-20	-18
110	甲霜灵	metalaxyl	+	11.969	280.1	220.2	-30	-10	-24	192.2	-30	-25	-20
111	丰索磷	fensulfothion	+	12.304	309.0	281.0	-11	-15	-30	253.0	-11	-18	-26
112	敌草隆	diuron	+	12.293	233.0	72.0	-14	-21	-15	46.0	-12	-16	-19
113	庚烯磷	heptenophos	+	12.339	251.0	127.0	-28	-11	-25	109.0	-28	-29	-20
114	氯吡脞	forchlorfenuron	+	12.343	248.1	129.1	-30	-17	-23	93.1	-30	-34	-17
115	苯磺隆	tribenuron-methyl	+	12.374	396.1	155.0	-19	-30	-30	181.0	-19	-30	-28
116	异噁唑草酮	isoxaflutole	+	12.373	360.1	251.0	-20	-19	-27	144.0	-23	-50	-30
117	噁苯胺磺隆	orthosulfamuron	+	12.435	425.0	199.1	-30	-13	-21	227.0	-30	-15	-24
118	螺虫乙酯 - 酮基 - 羟基	spirotetramat-keto-hydroxy	+	12.451	318.0	300.0	-12	-13	-23	214.0	-12	-25	-16
119	水胺硫磷	isocarbophos	+	12.484	231.0	121.0	-16	-19	-23	109.0	-11	-24	-13
120	甲基磺隆钠盐	iodosulfuron-methyl-sodium	+	12.622	507.9	167.0	-20	-19	-19	83.0	-26	-53	-15
121	苯锈啶	fenpropidin	+	12.775	274.1	147.1	-30	-35	-30	117.2	-14	-53	-21
122	烯草酮砒	clethodim sulfone	+	12.777	392.1	300.0	-11	-14	-22	164.0	-11	-26	-19

No.	中文名	英文名	电离方式	保留时间 (min)	前体离子	定量离子	Q1 Pre Bias	CE	Q3 Pre Bias	定性离子	Q1 Pre Bias	CE	Q3 Pre Bias
123	丰索磷砷	fensulfothion sulfone	+	13.040	325.0	191.0	-12	-23	-11	173.0	-21	-24	-19
124	烯草酮亚砷 ^a	clethodim sulfoxide	+	12.986/13.156	376.1	206.0	-18	-14	-16	164.1	-18	-23	-13
125	氟吗啉	flumorph	+	13.373	372.1	285.1	-17	-15	-29	165.2	-17	-23	-28
126	噁吡嘧磺隆	metazosulfuron	+	13.374	476.1	182.0	-17	-21	-21	295.0	-17	-16	-23
127	杀扑磷	methidathion	+	13.577	303.0	145.0	-21	-8	-15	85.1	-21	-22	-30
128	内吸磷	demeton	+	13.783	259.0	89.0	-13	-9	-18	61.0	-10	-32	-13
129	异噁草酮	clomazone	+	13.842	240.1	125.0	-27	-10	-22	89.1	-27	-35	-16
130	仲丁威	fenobucarb	+	14.103	208.1	95.0	-10	-30	-20	152.0	-18	-15	-12
131	甜菜宁	phenmedipham	+	14.113	318.1	168.0	-11	-20	-19	136.0	-11	-35	-16
132	氟吡磺隆 ^a	flucetosulfuron	+	13.315/14.119	488.0	156.0	-25	-21	-28	273.0	-25	-26	-28
133	苄嘧磺隆	bensulfuron-methyl	+	14.148	411.1	149.2	-20	-14	-28	182.2	-20	-35	-19
134	氯虫苯甲酰胺	chlorantraniliprole	+	14.222	484.0	452.9	-24	-19	-30	285.9	-24	-16	-30
135	苯嘧磺草胺	saflufenacil	+	14.274	501.1	349.0	-20	-28	-23	459.0	-40	-15	-21
136	保棉磷	azinphos-methyl	+	14.457	318.1	132.1	-15	-14	-23	261.0	-15	-7	-28
137	莠灭净	ametryn	+	14.521	228.1	186.1	-30	-25	-19	68.1	-30	-30	-27
138	特丁硫磷亚砷	terbufos sulfoxide	+	14.560	305.0	186.9	-30	-20	-30	97.0	-30	-52	-10
139	敌稗	propanil	+	14.676	218.0	162.0	-24	-15	-17	127.0	-24	-26	-23
140	亚胺硫磷	phosmet	+	14.686	318.0	160.0	-16	-30	-17	133.2	-16	-35	-25
141	特丁硫磷砷	terbufos sulfone	+	14.748	321.0	171.0	-22	-12	-17	115.0	-22	-26	-24
142	丙硫多菌灵	albendazole	+	14.806	266.0	234.0	-12	-30	-23	191.0	-12	-25	-30
143	乙霉威	diethofencarb	+	14.821	268.1	226.1	-30	-15	-24	180.1	-30	-25	-19
144	环酯草醚	pyriftalid	+	14.838	319.0	139.0	-22	-27	-25	179.0	-22	-31	-29
145	利谷隆	linuron	+	14.829	249.0	160.1	-27	-17	-17	182.1	-28	-14	-19
146	草除灵	benazolin-ethyl	+	14.937	272.0	198.0	-13	-15	-25	170.0	-18	-25	-19
147	乙氧呋草黄	ethofumesate	+	14.951	304.1	241.1	-20	-13	-13	259.0	-22	-16	-29
148	嘧霉胺	pyrimethanil	+	14.960	200.1	107.0	-30	-25	-19	168.1	-30	-29	-30
149	甲硫威	methiocarb	+	15.179	226.1	169.1	-25	-19	-18	121.1	-25	-25	-23
150	二甲吩草胺	dimethenamid	+	15.201	276.1	244.1	-14	-23	-25	168.1	-14	-30	-17
151	乙虫腈	ethiprole	+	15.259	397.0	255.0	-20	-45	-26	351.0	-20	-15	-24
152	啉菌噁唑 ^a	pyrisoxazole	+	15.430/16.601	289.1	151.1	-11	-14	-18	120.0	-11	-20	-14
153	特丁津	terbuthylazine	+	15.712	230.1	174.1	-10	-25	-20	104.1	-15	-25	-22
154	呋草酮	flurtamone	+	15.783	334.1	247.1	-12	-35	-19	303.0	-12	-20	-23
155	猛杀威	promecarb	+	15.866	208.2	109.1	-22	-10	-19	151.1	-22	-15	-16
156	多效唑	paclobutrazol	+	16.078	294.1	70.1	-15	-21	-28	125.1	-15	-40	-22
157	丁苯吗啉	fenpropimorph	+	16.045	304.2	147.2	-30	-24	-27	119.1	-30	-30	-22
158	咪唑菌酮	fenamidone	+	16.128	312.1	236.1	-11	-15	-24	92.1	-11	-24	-16
159	氟吡嘧磺隆	halosulfuron-methyl	+	16.110	435.0	182.0	-16	-21	-21	139.0	-10	-40	-16
160	咯菌腈	fludioxonil	+	16.144	266.1	229.0	-10	-14	-18	158.0	-10	-46	-19

No.	中文名	英文名	电离方式	保留时间 (min)	前体离子	定量离子	Q1 Pre Bias	CE	Q3 Pre Bias	定性离子	Q1 Pre Bias	CE	Q3 Pre Bias
161	啉菌酯	azoxystrobin	+	16.199	404.1	372.1	-30	-25	-26	329.0	-30	-28	-23
162	啉酰菌胺	boscalid	+	16.185	343.0	307.1	-12	-18	-30	271.1	-12	-30	-26
163	禾草敌	molinate	+	16.363	188.1	126.1	-21	-13	-13	98.1	-20	-20	-18
164	炔苯酰草胺	propyzamide	+	16.365	256.1	190.0	-28	-13	-20	173.0	-28	-20	-18
165	环丙唑醇	cyproconazole	+	16.463	292.1	70.1	-30	-20	-27	125.1	-30	-30	-22
166	乙氧磺隆	ethoxysulfuron	+	16.786	399.1	261.0	-20	-15	-29	218.0	-20	-26	-23
167	三唑酮	triadimefon	+	16.839	294.1	69.2	-21	-22	-26	197.1	-21	-15	-21
168	氟唑菌酰胺	fluxapyroxad	+	16.831	382.0	362.1	-11	-14	-25	342.1	-11	-21	-22
169	氟酰胺	flutolanil	+	16.864	324.1	262.1	-16	-25	-27	242.0	-16	-20	-25
170	腈菌唑	myclobutanil	+	16.874	289.1	70.1	-30	-21	-28	125.1	-30	-30	-22
171	氯嘧磺隆	chlorimuron-ethyl	+	16.876	415.1	186.0	-20	-20	-19	83.1	-20	-43	-15
172	氟吡菌胺	fluopicolide	+	16.892	382.9	173.0	-17	-22	-30	145.0	-17	-47	-24
173	烯酰吗啉	dimethomorph	+	16.915	388.1	301.0	-19	-30	-21	165.1	-19	-25	-30
174	氟霜唑代谢物 CCIM	cyazofamid metabolite CCIM	-	16.919	216.0	179.1	10	31	16	180.2	15	25	17
175	灭锈胺	mepronil	+	17.058	270.2	119.1	-30	-25	-30	228.1	-30	-18	-30
176	马拉硫磷	malathion	+	17.100	331.0	127.1	-17	-12	-13	125.0	-12	-26	-25
177	氟胺磺隆	triflurosulfuron-methyl	+	17.208	493.1	264.1	-18	-15	-29	96.1	-18	-54	-18
178	双炔酰菌胺	mandipropamid	+	17.240	412.1	328.1	-11	-10	-22	125.0	-11	-25	-20
179	稻瘟灵	isoprothiolane	+	17.296	291.1	231.1	-14	-20	-25	189.1	-14	-30	-20
180	三唑醇	triadimenol	+	17.325	296.1	70.1	-10	-21	-15	99.2	-14	-16	-20
181	丙噻啉磺隆	propyrisulfuron	+	17.356	456.0	261.0	-17	-16	-28	196.0	-17	-15	-20
182	烯效唑	uniconazole	+	17.439	292.1	70.1	-21	-24	-27	125.0	-21	-28	-23
183	氟唑环菌胺 ^a	sedaxane	+	17.629/19.210	332.0	159.0	-13	-38	-28	292.0	-12	-15	-20
184	吡啉磺隆	pyrazosulfuron-ethyl	+	17.831	415.1	182.1	-21	-18	-19	139.1	-21	-42	-24
185	啉啉硫磷	pyridaphenthion	+	17.957	341.1	189.1	-17	-15	-20	205.1	-23	-15	-22
186	扑草净	prometryn	+	17.947	242.2	158.1	-30	-15	-29	200.2	-30	-12	-22
187	甲氧虫酰肼	methoxyfenozide	+	18.053	369.2	149.1	-18	-16	-16	313.1	-18	-8	-22
188	氟吡菌酰胺	fluopyram	+	18.059	397.0	173.0	-28	-20	-18	207.9	-28	-15	-22
189	胺苯吡菌酮	fenpyrazamine	+	18.065	332.0	304.0	-16	-13	-17	272.0	-12	-13	-21
190	苯噻酰草胺	mefenacet	+	18.130	299.1	148.1	-15	-21	-15	120.1	-15	-40	-21
191	环酰菌胺	fenhexamid	+	18.160	301.9	97.1	-15	-23	-19	55.1	-15	-40	-22
192	氯唑磷	isazofos	+	18.246	316.0	164.0	-11	-16	-19	122.0	-11	-26	-10
193	灭菌唑	triticonazole	+	18.304	318.1	70.1	-11	-21	-15	125.1	-11	-26	-25
194	腐霉利	procymidone	+	18.430	284.0	256.0	-23	-18	-27	67.0	-19	-44	-28
195	灭线磷	ethoprophos	+	18.453	243.1	131.0	-26	-20	-23	97.0	-27	-32	-17
196	啉霉威 ^a	iprovalicarb	+	18.269/18.544	321.2	119.1	-30	-19	-22	203.1	-30	-8	-22
197	三唑磷	triazophos	+	18.583	314.1	162.2	-23	-35	-17	119.2	-23	-25	-21

No.	中文名	英文名	电离方式	保留时间 (min)	前体离子	定量离子	Q1 Pre Bias	CE	Q3 Pre Bias	定性离子	Q1 Pre Bias	CE	Q3 Pre Bias
198	氟噻草胺	flufenacet	+	18.628	364.0	152.1	-19	-30	-15	194.1	-19	-16	-20
199	四氟醚唑	tetraconazole	+	18.679	372.0	159.1	-27	-31	-29	70.2	-27	-24	-27
200	乙草胺	acetochlor	+	18.826	270.1	224.1	-10	-8	-17	148.2	-16	-19	-18
201	氟苯嘧啶醇	fenarimol	+	18.875	331.0	268.1	-16	-22	-28	259.1	-17	-26	-26
202	螺虫乙酯	spirotetramat	+	19.028	374.0	302.0	-14	-17	-23	330.0	-14	-15	-25
203	敌草胺	napropamide	+	19.078	272.2	129.2	-30	-16	-23	171.1	-30	-17	-18
204	甲草胺	alachlor	+	19.064	270.1	238.1	-30	-10	-26	162.2	-30	-19	-30
205	氟环唑	epoxiconazole	+	19.162	330.1	121.2	-12	-20	-26	101.0	-12	-43	-21
206	环丙嘧磺隆	cyclosulfamuron	+	19.201	422.2	261.0	-30	-17	-27	218.1	-30	-28	-22
207	异丙甲草胺	metolachlor	+	19.227	284.1	252.1	-30	-25	-27	176.2	-30	-20	-19
208	环虫酰肼	chromafenozide	+	19.444	395.3	175.1	-14	-40	-20	339.2	-15	-7	-19
209	异菌脲	iprodione	+	19.526	330.1	245.0	-13	-16	-25	288.0	-25	-14	-20
210	氟甲腈	fipronil desulfinyl	-	19.623	387.0	351.0	14	17	23	282.0	14	32	17
211	氟霜唑	cyazofamid	+	19.682	325.0	108.1	-11	-12	-21	261.1	-24	-11	-30
212	腈苯唑	fenbuconazole	+	19.710	336.9	125.1	-26	-27	-25	70.0	-26	-20	-28
213	噻氟菌胺	thifluzamide	+	19.783	528.8	148.0	-26	-38	-26	488.9	-34	-24	-21
214	苯线磷	fenamiphos	+	20.025	304.1	217.1	-15	-15	-23	202.0	-15	-45	-21
215	除虫脲	diflubenzuron	+	20.012	311.0	158.0	-11	-15	-30	141.2	-11	-24	-11
216	氟硅唑	flusilazole	+	20.055	316.1	247.1	-30	-18	-27	165.1	-30	-29	-30
217	糠菌唑 ^a	bromuconazole	+	17.238/20.148	377.9	158.9	-19	-28	-30	70.0	-19	-23	-30
218	稻瘟酰胺 ^a	fenoxanil	+	19.862/20.212	329.1	302.1	-17	-12	-30	86.1	-17	-22	-15
219	乙嘧酚磺酸酯	bupirimate	+	20.293	317.1	108.0	-30	-26	-19	210.2	-30	-23	-22
220	氟虫腈	fipronil	-	20.280	435.0	330.0	10	16	21	250.0	10	28	24
221	硅噻菌胺	silthiofam	+	20.464	268.1	252.0	-10	-8	-26	73.1	-10	-27	-30
222	苄氯三唑醇	diclobutrazol	+	20.642	328.0	70.0	-12	-21	-15	70.0	-12	-22	-15
223	苯硫威	fenothiocarb	+	20.650	254.1	72.1	-13	-10	-28	160.1	-13	-14	-16
224	戊菌唑	penconazole	+	20.678	284.1	70.0	-14	-17	-27	159.0	-14	-27	-30
225	异稻瘟净	iprobenfos	+	20.751	289.1	91.1	-30	-21	-16	205.0	-30	-10	-22
226	氟唑菌苯胺	penflufen	+	20.838	318.0	141.0	-12	-20	-16	234.0	-12	-28	-18
227	苯氧威	fenoxycarb	+	20.852	302.1	88.1	-15	-21	-16	116.1	-15	-10	-12
228	虫酰肼	tebufenozide	+	20.892	353.2	133.1	-18	-20	-24	297.1	-18	-8	-15
229	对硫磷	parathion	+	20.873	292.0	236.2	-11	-15	-23	264.0	-11	-10	-26
230	醚菌胺	dimoxystrobin	+	20.938	327.0	205.1	-30	-15	-30	116.0	-30	-35	-30
231	戊唑醇	tebuconazole	+	20.988	308.1	70.1	-11	-23	-15	125.0	-11	-31	-25
232	鱼藤酮	rotenone	+	21.079	395.1	213.1	-14	-22	-23	192.1	-14	-22	-18
233	灭幼脲	chlorbenzuron	+	21.134	309.0	156.0	-21	-17	-18	111.0	-10	-45	-23
234	氟虫腈硫醚	fipronil sulfide	-	21.164	419.0	262.0	16	29	16	383.0	12	13	17
235	啉菌环胺	cyprodinil	+	21.191	226.1	93.1	-30	-34	-16	108.1	-30	-27	-19

No.	中文名	英文名	电离方式	保留时间 (min)	前体离子	定量离子	Q1 Pre Bias	CE	Q3 Pre Bias	定性离子	Q1 Pre Bias	CE	Q3 Pre Bias
236	唑草酮	carfentrazone-ethyl	+	21.224	429.1	412.0	-11	-11	-17	346.0	-15	-26	-29
237	吡噻菌胺	penthiopyrad	+	21.237	360.0	276.0	-18	-11	-28	177.0	-27	-34	-17
238	唑胺菌酯	pyrametostrobin	+	21.260	382.1	194.1	-14	-18	-15	163.0	-14	-15	-19
239	异丙草胺	propisochlor	+	21.308	284.1	224.1	-20	-9	-24	73.1	-20	-12	-29
240	啉氧菌酯	picoxystrobin	+	21.323	368.1	205.1	-10	-13	-16	145.0	-18	-35	-29
241	喹硫磷	quinalphos	+	21.335	299.0	163.1	-15	-20	-30	147.1	-15	-21	-27
242	甲基异柳磷	isofenphos-methyl	+	21.416	332.1	231.0	-23	-14	-25	121.1	-23	-33	-22
243	稻丰散	phenthoate	+	21.425	321.0	247.0	-23	-11	-17	79.1	-23	-41	-30
244	醚菌酯	kresoxim-methyl	+	21.434	314.1	222.2	-16	-13	-24	235.1	-16	-15	-25
245	咪鲜胺-脱咪唑甲酰胺基	prochloraz metabolite BTS44596	+	21.461	353.0	308.0	-12	-14	-17	310.0	-12	-14	-17
246	氟苯虫酰胺	flubendiamide	-	21.498	681.0	254.1	32	26	27	273.8	32	15	28
247	噻草酸甲酯	fluthiacet-methyl	+	21.533	404.0	274.1	-29	-30	-20	344.1	-29	-23	-26
248	丙环唑	propiconazole	+	21.451	342.1	159.1	-12	-25	-19	161.0	-12	-31	-19
249	治螟磷	sulfotep	+	21.547	323.0	115.0	-16	-31	-20	171.1	-16	-15	-18
250	咪鲜胺-脱氨基咪唑	prochloraz metabolite BTS44595	+	21.584	325.0	282.1	-11	-15	-21	284.1	-11	-15	-21
251	苯酰菌胺	zoxamide	+	21.602	335.8	187.0	-16	-24	-20	159.0	-16	-41	-30
252	敌瘟磷	edifenphos	+	21.630	311.0	283.0	-24	-20	-30	111.1	-24	-35	-21
253	乙嘧硫磷	etrimfos	+	21.632	293.0	265.0	-15	-16	-28	125.0	-15	-24	-23
254	莎稗磷	anilofos	+	21.638	368.0	199.0	-18	-20	-21	125.0	-18	-22	-22
255	己唑醇	hexaconazole	+	21.676	314.1	70.2	-15	-21	-28	159.2	-15	-29	-30
256	苯霜灵	benalaxyl	+	21.695	326.2	148.2	-16	-13	-15	294.1	-16	-15	-20
257	苯并烯氟菌唑	benzovindiflupyr	+	21.691	398.0	342.0	-15	-18	-23	378.0	-15	-14	-26
258	毒虫畏 ^a	chlorfenvinphos	+	21.709/22.38	358.9	155.1	-18	-12	-30	99.0	-18	-33	-18
259	地虫硫磷	fonofos	+	21.732	247.1	109.0	-27	-19	-19	137.1	-26	-10	-14
260	倍硫磷	fenthion	+	21.782	279.2	169.1	-30	-17	-18	247.1	-30	-12	-18
261	氟虫腈砒	fipronil sulfone	-	21.784	451.0	415.0	17	17	19	282.0	17	27	18
262	丁吡吗啉	pyrimorph	+	21.853	385.2	242.1	-14	-27	-18	272.1	-14	-33	-21
263	叶菌唑	metconazole	+	21.853	320.0	70.1	-23	-22	-15	125.1	-11	-40	-25
264	二嗪磷	diazinon	+	21.976	305.0	169.1	-30	-15	-18	153.1	-30	-20	-16
265	吡草醚	pyraflufen-ethyl	+	21.977	413.0	339.0	-20	-19	-19	253.0	-15	-34	-30
266	咪鲜胺	prochloraz	+	22.044	376.0	308.0	-19	-11	-21	266.0	-19	-17	-29
267	蝇毒磷	coumaphos	+	22.175	363.0	227.0	-18	-26	-23	307.1	-18	-18	-21
268	杀铃脲	triflumuron	+	22.269	359.1	156.0	-17	-16	-30	139.0	-17	-33	-26
269	甲拌磷	phorate	+	22.291	261.0	75.0	-29	-10	-30	47.0	-17	-55	-11
270	丙炔噁草酮	oxadiargyl	+	22.311	340.9	150.9	-13	-27	-27	223.0	-13	-15	-24
271	噁唑菌酮	famoxadone	+	22.318	392.0	331.0	-11	-12	-25	238.0	-13	-20	-10
272	联苯三唑醇	bitertanol	+	22.352	338.2	269.2	-17	-9	-29	99.1	-17	-15	-18

No.	中文名	英文名	电离方式	保留时间 (min)	前体离子	定量离子	Q1 Pre Bias	CE	Q3 Pre Bias	定性离子	Q1 Pre Bias	CE	Q3 Pre Bias
273	烯唑醇	diniconazole	+	22.368	326.1	70.0	-12	-24	-15	159.0	-12	-27	-18
274	伏杀硫磷	phosalone	+	22.416	368.0	182.1	-30	-14	-19	111.0	-30	-39	-20
275	多杀霉素 A	spinosad A	+	22.547	732.4	142.0	-20	-27	-17	98.1	-20	-55	-21
276	甲基嘧啶磷	pirimiphos-methyl	+	22.549	306.1	108.1	-30	-31	-19	95.0	-30	-29	-17
277	硫线磷	cadusafos	+	22.567	271.1	159.0	-30	-20	-29	97.0	-30	-25	-18
278	吡唑醚菌酯	pyraclostrobin	+	22.580	388.1	194.1	-19	-20	-21	163.1	-19	-35	-30
279	唑啉菌胺	ametoctradin	+	22.589	276.2	176.1	-10	-35	-20	149.0	-10	-35	-17
280	环氟菌胺	cyflufenamid	+	22.598	413.2	295.1	-20	-10	-30	203.0	-20	-30	-20
281	甲基立枯磷	tolclofos-methyl	+	22.611	301.1	125.2	-14	-16	-16	175.1	-20	-23	-20
282	辛硫磷	phoxim	+	22.638	299.0	77.1	-30	-20	-30	129.1	-30	-25	-13
283	乙拌磷	disulfoton	+	22.633	275.2	89.1	-12	-15	-20	60.8	-10	-32	-12
284	戊菌隆	pencycuron	+	22.721	329.1	125.1	-17	-15	-22	218.1	-17	-15	-23
285	唑菌酯	pyraoxystrobin	+	22.733	413.1	205.1	-15	-18	-16	145.0	-15	-10	-17
286	苯菌酮	metrafenone	+	22.769	409.0	209.1	-15	-17	-16	227.1	-20	-22	-18
287	吡唑萘菌胺	isopyrazam	+	22.781	360.1	244.0	-11	-24	-25	320.1	-11	-21	-22
288	苯醚甲环唑 ^a	difenoconazole	+	22.760/22.837	406.1	251.0	-30	-25	-27	337.1	-30	-17	-24
289	甲基毒死蜱	chlorpyrifos-methyl	+	22.838	321.9	125.1	-22	-23	-23	125.1	-28	-15	-24
290	甲羧除草醚	bifenox	+	22.845	359.0	310.0	-12	-15	-17	342.0	-10	-7	-27
291	四螨嗪	clofentezine	+	22.932	303.0	138.1	-21	-14	-26	102.1	-21	-34	-19
292	苯螨特	benzoximate	+	22.972	364.1	199.0	-13	-12	-23	105.0	-27	-26	-21
293	哌草丹	dimepiperate	+	23.008	264.1	146.1	-29	-7	-15	91.1	-29	-36	-16
294	种菌唑 ^a	ipconazole	+	22.724/23.025	334.2	70.1	-22	-26	-21	125.1	-13	-43	-13
295	氟菌唑	triflumizole	+	23.056	346.1	73.1	-17	-25	-30	278.0	-17	-22	-30
296	茚虫威	indoxacarb	+	23.122	528.1	293.0	-26	-15	-21	249.1	-26	-17	-27
297	吡氟酰草胺	diflufenican	+	23.191	395.1	266.0	-14	-35	-21	246.0	-14	-34	-19
298	多杀霉素 D	spinosad D	+	23.228	746.4	142.0	-28	-30	-17	98.0	-22	-55	-12
299	丙草胺	pretilachlor	+	23.202	312.2	252.2	-15	-29	-28	176.2	-15	-35	-18
300	苯硫磷	EPN	+	23.224	324.0	156.9	-12	-20	-18	296.1	-11	-13	-16
301	噻草酮	cycloxydim	+	23.249	326.2	280.2	-12	-12	-21	180.2	-12	-20	-14
302	乙基多杀菌素 J	spinetoram J	+	23.302	748.5	142.1	-40	-33	-14	98.2	-30	-55	-21
303	除虫菊素 II	pyrethrin II	+	23.294	373.2	161.1	-11	-11	-19	133.1	-13	-20	-28
304	乙羧氟草醚	fluoroglycofen-ethyl	+	23.302	465.1	344.0	-17	-15	-26	223.0	-17	-33	-17
305	肟菌酯	trifloxystrobin	+	23.311	409.1	186.1	-20	-40	-20	145.0	-20	-20	-26
306	烯草酮	clethodim	+	23.330	360.2	164.1	-18	-19	-17	268.1	-18	-11	-30
307	氟铃脲	hexaflumuron	-	23.349	459.0	438.9	16	12	29	175.1	16	36	29
308	苄草丹	prosulfocarb	+	23.367	252.0	91.0	-12	-45	-19	128.0	-12	-15	-15
309	氟酰脲	novaluron	+	23.399	493.0	158.0	-15	-18	-28	141.1	-15	-40	-27
310	吡唑磺菌胺	amisulbrom	+	23.423	466.0	227.0	-10	-19	-13	148.0	-10	-47	-29

No.	中文名	英文名	电离方式	保留时间 (min)	前体离子	定量离子	Q1 Pre Bias	CE	Q3 Pre Bias	定性离子	Q1 Pre Bias	CE	Q3 Pre Bias
311	丙溴磷	profenofos	+	23.486	372.9	302.8	-18	-25	-30	345.0	-18	-20	-24
312	噁唑禾草灵	fenoxaprop-ethyl	+	23.514	362.1	288.0	-28	-26	-20	121.1	-28	-30	-23
313	喹禾灵	quizalofop-ethyl	+	23.585	373.0	299.0	-13	-28	-20	270.9	-11	-26	-28
314	丁氟螨酯	cyflumetofen	+	23.616	465.2	173.0	-14	-24	-18	145.0	-14	-55	-28
315	烯肟菌胺	fenaminstrobin	+	23.649	434.1	171.0	-21	-40	-20	212.0	-12	-14	-25
316	吡氟禾草灵	fluazifop-butyl	+	23.658	384.0	328.0	-14	-11	-16	282.0	-14	-10	-30
317	噁嗪草酮	oxaziclomefone	+	23.666	376.1	190.1	-19	-34	-20	161.1	-19	-40	-28
318	噁唑酰草胺	metamifop	+	23.696	441.1	288.0	-16	-24	-16	180.0	-21	-19	-21
319	乙氧氟草醚	oxyfluorfen	+	23.512	362.0	316.0	-18	-19	-25	140.0	-27	-52	-27
320	呋线威	furathiocarb	+	23.769	383.2	252.1	-27	-13	-27	195.0	-27	-10	-21
321	甲氨基阿维菌素苯甲酸盐	emamectin benzoate	+	23.856	886.5	158.1	-40	-25	-17	82.1	-40	-55	-15
322	特丁硫磷	terbufos	+	23.819	289.0	103.2	-14	-9	-18	57.1	-14	-24	-24
323	烯禾啶	sethoxydim	+	23.821	328.1	178.1	-12	-19	-21	282.2	-12	-12	-22
324	氟氟虫腴	metaflumizone	-	23.825	505.1	302.0	24	21	30	285.0	24	48	28
325	乙基多杀菌素 L	spinetoram L	+	23.865	760.7	142.2	-22	-32	-25	98.2	-28	-55	-18
326	禾草灵	diclofop-methyl	+	23.850	358.0	281.0	-25	-15	-22	120.2	-18	-27	-26
327	乳氟禾草灵	lactofen	+	23.861	479.2	344.0	-18	-25	-25	223.1	-18	-25	-25
328	噻嗪酮	buprofezin	+	23.865	306.1	116.1	-30	-23	-12	201.1	-30	-20	-22
329	氟苯脲	teflubenzuron	-	23.865	379.0	339.0	13	11	22	359.0	13	6	24
330	氟啶胺	fluazinam	-	23.887	463.0	416.0	22	20	13	398.0	13	17	17
331	啶草酯	propaquizafop	+	23.931	444.1	100.1	-23	-19	-19	371.0	-23	-16	-18
332	亚胺唑	imibenconazole	+	23.932	411.0	125.1	-20	-31	-22	171.0	-20	-20	-18
333	烯肟菌酯	enestroburin	+	23.942	400.1	178.0	-19	-25	-14	137.0	-15	-15	-16
334	氟吡酰草胺	picolinafen	+	23.975	377.1	238.1	-19	-40	-24	359.1	-19	-25	-17
335	噁草酮	oxadiazon	+	24.004	345.0	303.0	-16	-13	-13	220.0	-24	-18	-23
336	丁草胺	butachlor	+	24.004	312.2	238.1	-23	-11	-28	162.0	-16	-22	-13
337	唑虫酰胺	tolfenpyrad	+	24.080	384.1	197.1	-10	-35	-12	154.1	-10	-35	-29
338	增效醚	piperonyl butoxide	+	24.085	356.3	177.1	-24	-31	-19	119.0	-24	-22	-22
339	虱螨脲	lufenuron	-	24.152	509.0	326.0	36	17	21	339.0	36	11	22
340	噁啉肟草醚	pyribenzoxim	+	24.232	610.1	413.1	-22	-25	-30	180.1	-22	-20	-19
341	丁香菌酯	coumoxystrobin	+	24.258	437.1	205.1	-12	-10	-16	145.1	-12	-35	-17
342	乙硫磷	ethion	+	24.291	385.0	199.0	-19	-15	-22	143.0	-19	-20	-25
343	噻螨酮	hexythiazox	+	24.352	353.1	228.0	-18	-20	-24	168.1	-18	-30	-30
344	野麦畏	triallate	+	24.355	304.0	143.0	-15	-27	-25	86.0	-15	-17	-16
345	甲氟菊酯	fenpropathrin	+	24.365	350.3	97.2	-12	-45	-19	125.2	-10	-23	-28
346	毒死蜱	chlorpyrifos	+	24.366	351.9	199.9	-27	-18	-21	97.0	-27	-25	-18
347	吡丙醚	pyriproxyfen	+	24.440	322.1	96.1	-30	-10	-10	185.1	-30	-20	-20

No.	中文名	英文名	电离方式	保留时间 (min)	前体离子	定量离子	Q1 Pre Bias	CE	Q3 Pre Bias	定性离子	Q1 Pre Bias	CE	Q3 Pre Bias
348	三甲苯草酮	tralkoxydim	+	24.450	330.2	284.2	-16	-10	-30	138.1	-16	-25	-25
349	二甲戊灵	pendimethalin	+	24.481	282.2	212.1	-30	-10	-23	194.0	-30	-18	-20
350	螺甲螨酯	spiromesifen	+	24.499	388.0	273.1	-14	-15	-21	255.2	-14	-27	-19
351	敌螨普	dinocap	-	23.525/23.750/ 24.441/24.505/ 25.012/25.161	295.1	209.0	11	32	22	134.1	21	51	25
352	氟虫脲	flufenoxuron	+	24.515	489.0	158.1	-11	-20	-12	141.2	-11	-39	-17
353	氟氰戊菊酯	flucythrinate	+	24.541	469.0	412.0	-23	-14	-22	181.0	-30	-36	-10
354	炔螨特	propargite	+	24.592	368.2	231.2	-26	-17	-25	175.2	-26	-10	-19
355	乙螨唑	etoxazole	+	24.678	360.1	141.1	-30	-13	-26	113.1	-30	-35	-21
356	仲丁灵	butralin	+	24.702	296.2	240.1	-14	-12	-25	222.1	-14	-21	-24
357	除虫菊素 I	pyrethrin I	+	24.717	329.2	161.1	-11	-10	-19	133.0	-11	-19	-25
358	螺螨酯	spirodiclofen	+	24.869	411.1	71.2	-21	-16	-28	313.1	-21	-11	-22
359	氟啶脲	chlorfluazuron	+	24.931	540.0	382.9	-26	-21	-27	158.0	-26	-20	-30
360	唑螨酯	fenpyroximate	+	25.008	422.2	366.1	-30	-30	-26	138.1	-30	-25	-26
361	氟节胺	flumetralin	+	25.008	422.1	107.1	-22	-54	-22	143.0	-15	-47	-27
362	丙氧喹啉	proquinazid	+	25.049	373.0	331.0	-18	-23	-18	289.0	-14	-40	-22
363	哒螨灵	pyridaben	+	25.200	365.1	147.1	-18	-42	-27	309.0	-18	-23	-22
364	氟戊菊酯	fenvalerate	+	25.221	437.0	167.1	-17	-15	-26	125.0	-16	-40	-24
365	溴氰菊酯	deltamethrin	+	25.176	523.0	281.0	-36	-16	-22	506.0	-38	-11	-28
366	喹螨醚	fenazaquin	+	25.291	307.0	161.1	-15	-10	-30	131.0	-15	-46	-24
367	氟胺氰菊酯	tau-fluvalinate	+	25.364	503.1	208.0	-40	-13	-22	181.0	-40	-30	-18
368	阿维菌素	abamectin	+	25.409	890.5	305.2	-34	-25	-22	567.3	-34	-14	-30
369	生物苜呋菊酯	bioresmethrin	+	25.474	339.2	171.1	-24	-25	-18	128.1	-24	-25	-23
370	烯虫酯	methoprene	+	25.490	279.2	191.2	-10	-9	-15	237.2	-10	-9	-28
371	氯菊酯 ^a	permethrin	+	25.625/25.931	408.2	183.1	-14	-14	-20	355.2	-21	-8	-27
372	联苯菊酯	bifenthrin	+	26.039	440.3	181.1	-16	-21	-18	166.2	-16	-43	-18
373	醚菊酯	etofenprox	+	26.104	394.0	177.1	-19	-26	-20	107.0	-19	-33	-19
374	依维菌素	ivermectin	+	26.251	892.5	569.2	-26	-16	-40	307.1	-26	-28	-20
375	三氟甲吡醚	pyridalyl	+	26.437	491.9	110.9	-18	-27	-19	108.9	-18	-28	-20

注：^a 该农药含两个色谱峰，分别为其顺反异构或者非对映异构体，定量时需将峰面积加和后计算。

1.3 标准品及样品制备

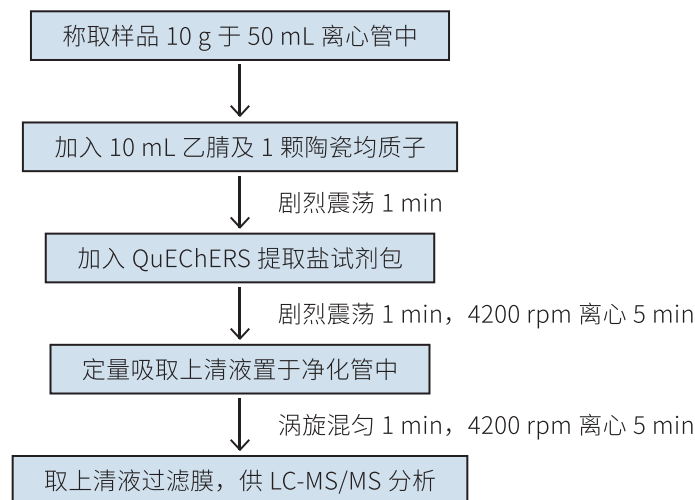
混合标准储备溶液 (20 mg/L)：购于岛津 (上海) 实验器材有限公司 (P/N:380-03635)，为 ABCD 四组。避光 -18 °C 及以下条件保存，有效期 12 个月。

混合标准溶液 (5 mg/L)：分别吸取等体积 ABCD 四组标准储备液混合均匀，得到 5 mg/L 混合标准溶液，避光 -18 °C 及以下条件保存，有效期 1 个月。

基质匹配标准工作曲线：选择水果空白样品按照国标方法进行前处理，得到空白基质溶液。精确吸取一定量的混合标准溶液，逐级用空白基质溶液稀释成质量浓度为 0.002、0.005、0.01、0.02、0.05、0.1 和 0.2

mg/L 的基质匹配标准工作溶液，供液相色谱 - 质谱联用仪测定。以农药定量离子离子的质量色谱图峰面积为纵坐标，相对应的基质匹配标准工作溶液质量浓度为横坐标，绘制基质匹配标准工作曲线。

样品制备：参照国标规定，对水果样品进行前处理。称取 10 g 试样（精确至 0.01 g）于 50 mL 塑料离心管中，加入 10 mL 乙腈及 1 颗陶瓷均质子，剧烈震荡 1 min，加入 4 g 无水硫酸镁、1 g 氯化钠、1 g 柠檬酸钠、0.5 g 柠檬酸氢二钠，剧烈震荡 1 min 后 4200 r/min 离心 5 min。定量吸取上清液至内含除水剂和净化材料的塑料离心管中（每毫升提取液使用 150 mg 无水硫酸镁、25 mg PSA）；对于颜色较深的试样，离心管中另加入 GCB（每毫升提取液使用 2.5 mg），涡旋混匀 1 min。4200 r/min 离心 5 min，吸取上清液过有机相微孔滤膜，用于上机测定。（农残前处理提取包 P/N: PRC-KIT-001-01, 岛津（上海）实验器材有限公司）。



■ 结果讨论

2.1 MRM 色谱图

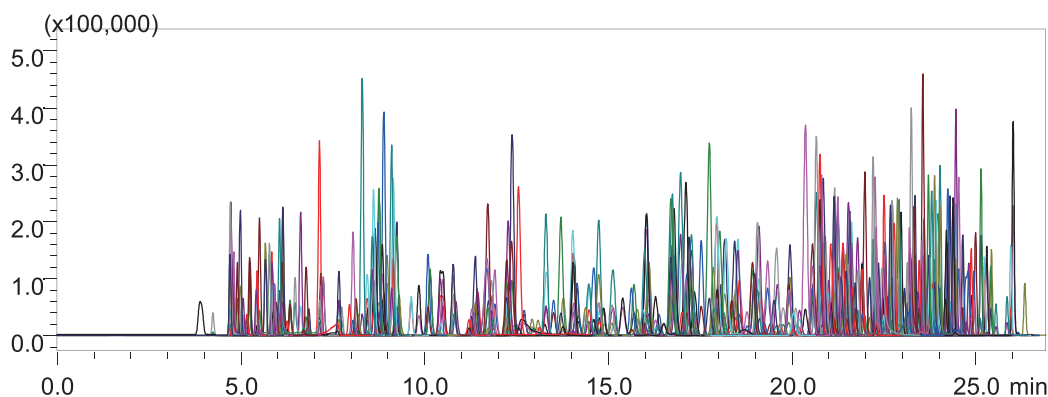
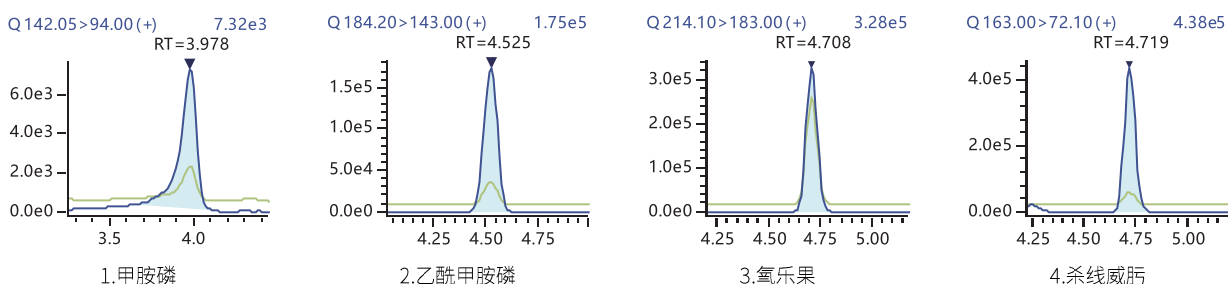
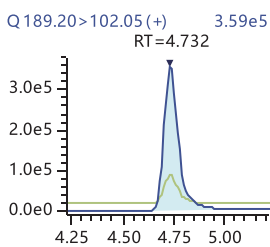
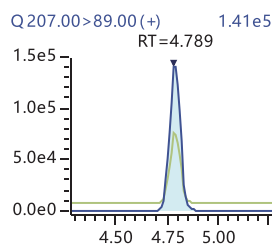


图 1 葡萄基质中 331 种农药及其代谢物 MRM 色谱图（加标浓度 0.01 mg/L）

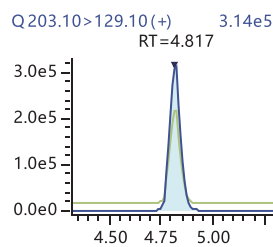




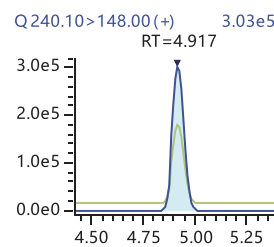
5.霜霉威



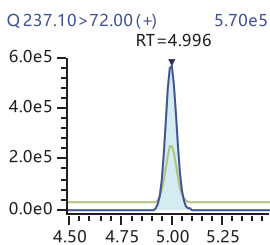
6.涕灭威亚砷



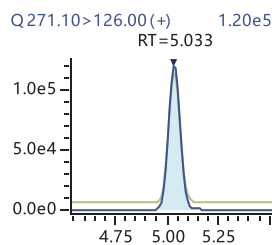
7.呋虫胺



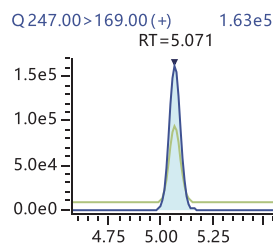
8.涕灭威砷



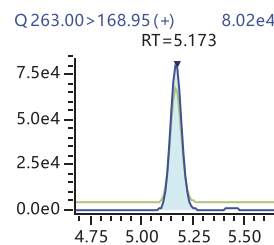
9.杀线威



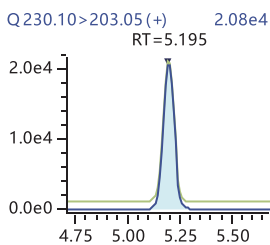
10.烯啶虫胺



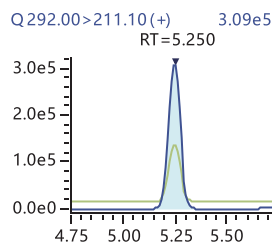
11.亚砷磷



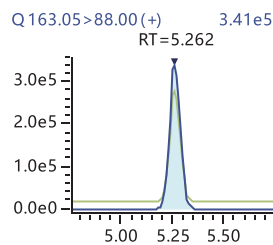
12.虱吸磷



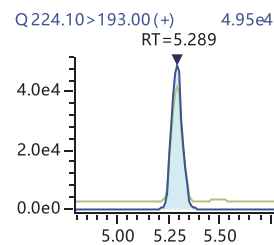
13.氟啶虫酰胺



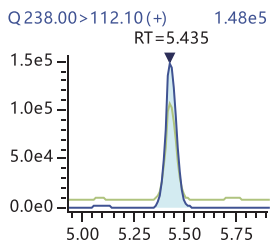
14.噻虫嗪



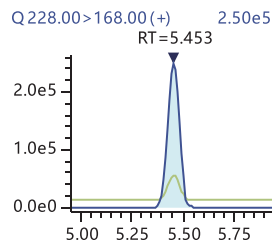
15.灭多威



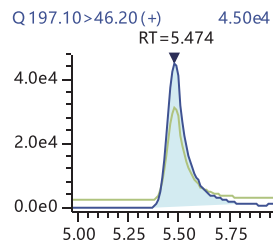
16.久效磷



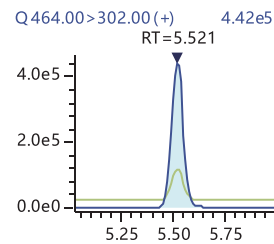
17.百治磷



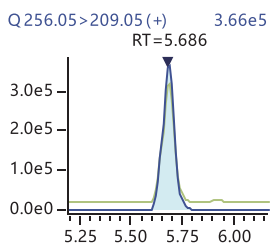
18.甲基硫环磷



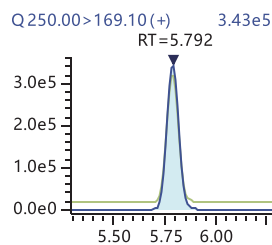
19.杀虫脒



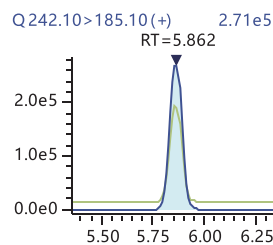
20.螺虫乙酯-烯醇-葡萄糖苷



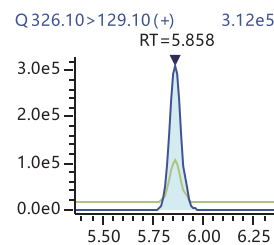
21.吡虫啉



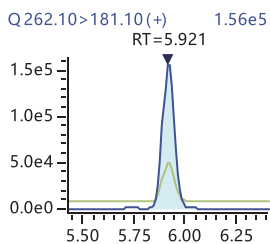
22.噻虫胺



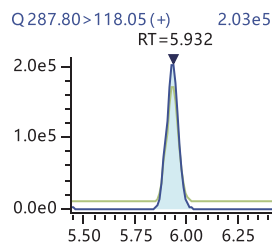
23.甲硫威亚砷



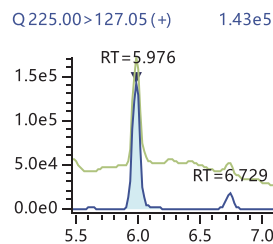
24.啉啉磺草胺



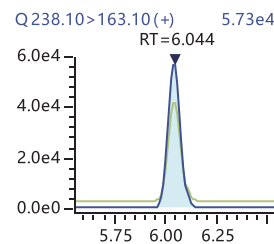
25.氯噻啉



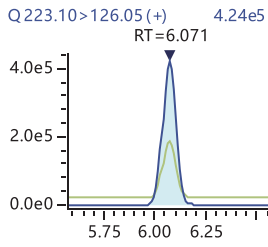
26.蚜灭磷



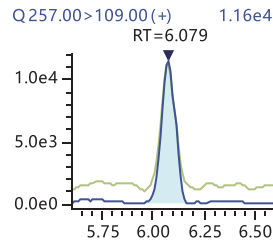
27.速灭磷*



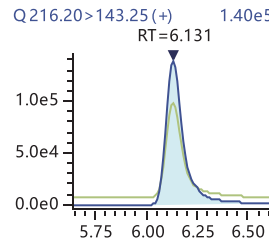
28.3-羟基克百威



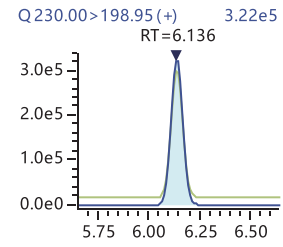
29.啉虫脒



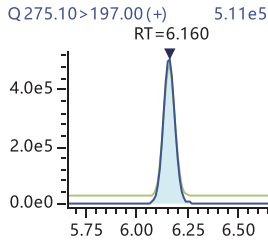
30.敌百虫



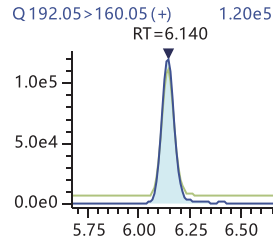
31.胺鲜酯



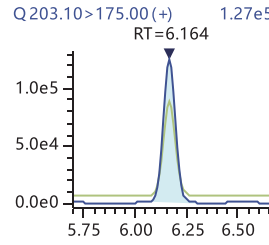
32.乐果



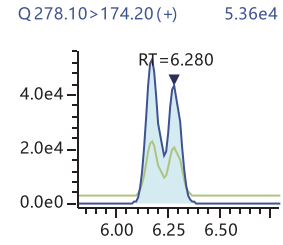
33.内吸磷-S-亚砷



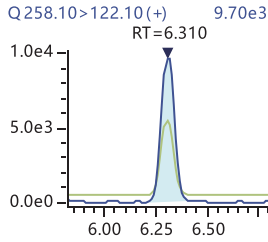
34.多菌灵



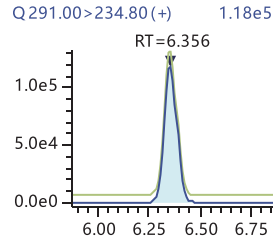
35.苯噻草酮



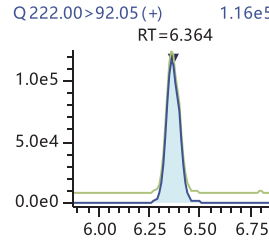
36.氟啶虫胺腈*



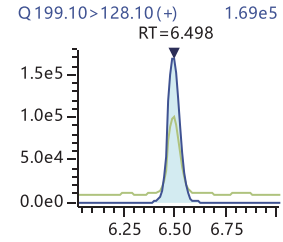
37.甲硫威砷



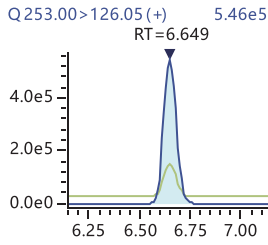
38.内吸磷-S-砷



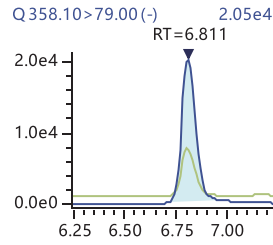
39.杀草敏



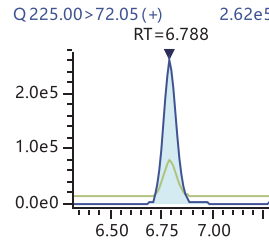
40.霜脲氰



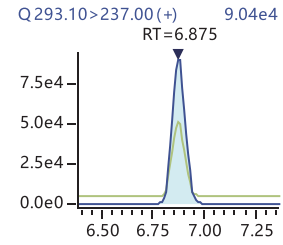
41.噻虫啉



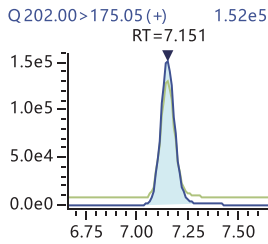
42.异噁唑草酮-二酮腈



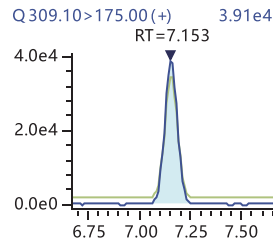
43.脱甲基抗蚜威



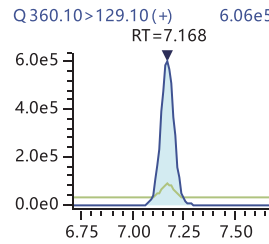
44.氧丰索磷



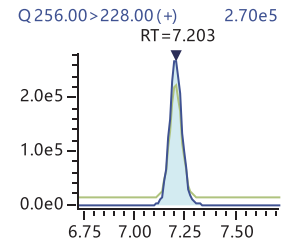
45.噻菌灵



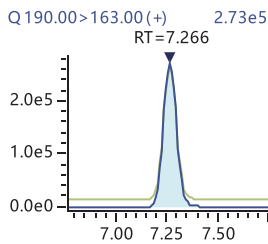
46.氧丰索磷砷



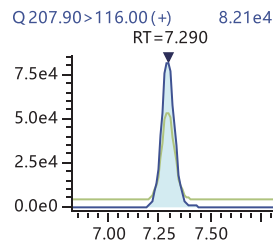
47.双氟磺草胺



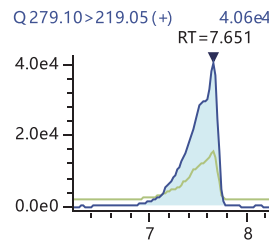
48.硫环磷



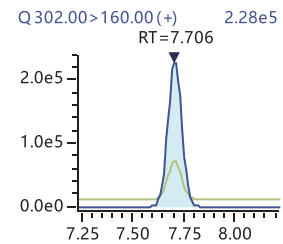
49.三环唑



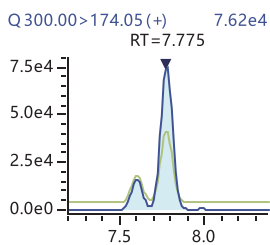
50.涕灭威



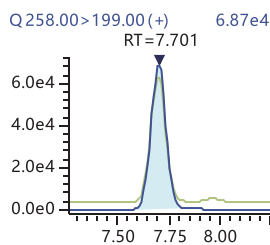
51.噁霜灵



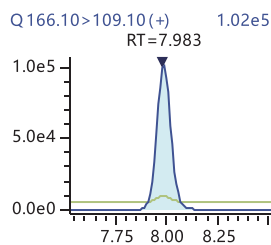
52.氧亚胺硫磷



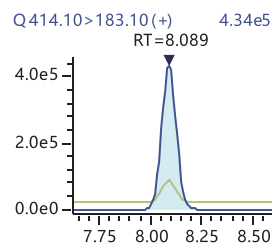
53.磷酸*



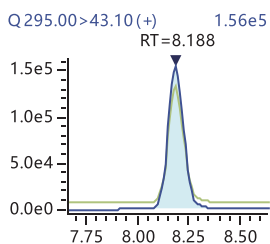
54.安硫磷



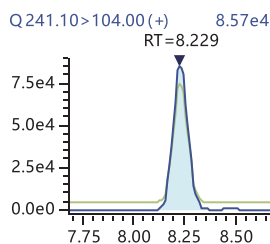
55.速灭威



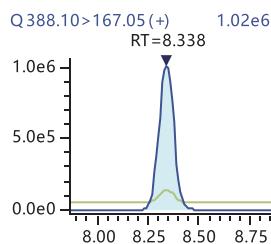
56.醚磺隆



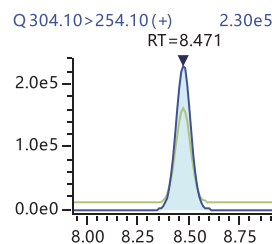
57.氟菌唑代谢物 FM-6-1



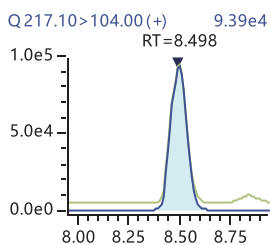
58.氟草津



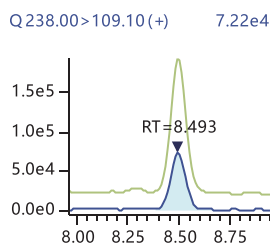
59.噻吩磺隆



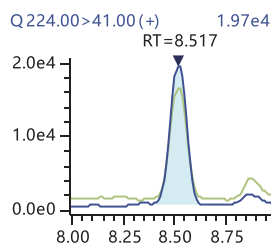
60.螺虫乙酯-单-羟基



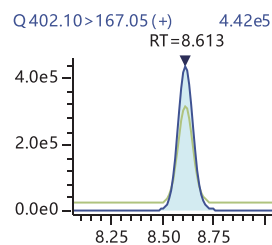
61.氟烯菌酯



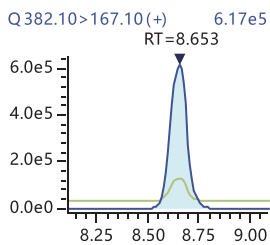
62.敌敌畏



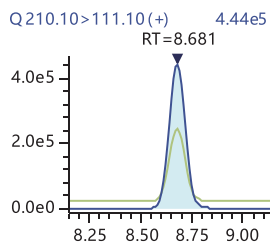
63.烯丙苯噻唑



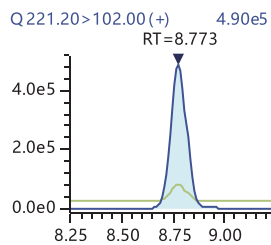
64.醚苯磺隆



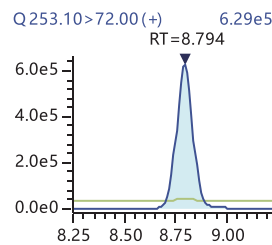
65.甲磺隆



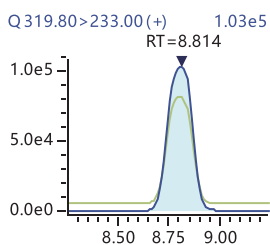
66.残杀威



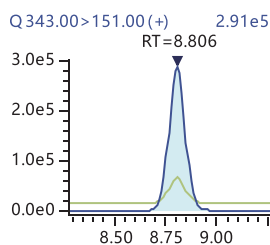
67.噻苯隆



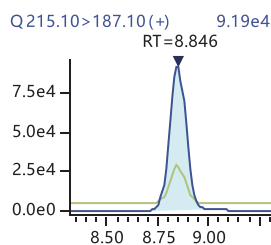
68.脱甲基甲酰胺基抗蚜威



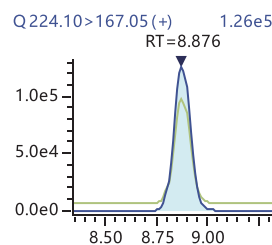
69.苯线磷亚砷



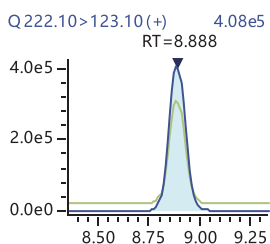
70.甲基硫菌灵



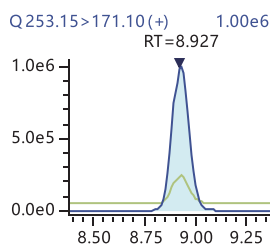
71.噻草酮



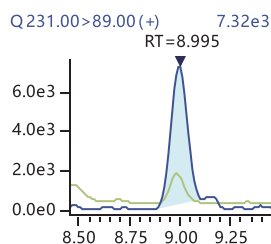
72.噁虫威



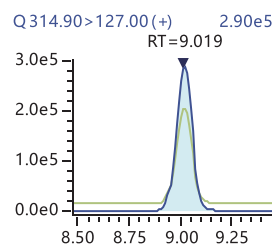
73.克百威



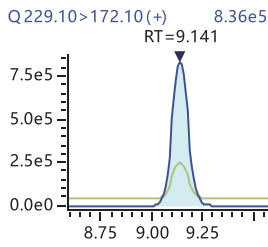
74.环嗪酮



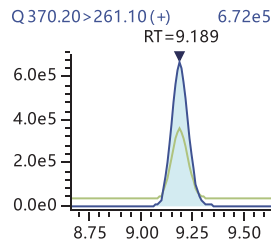
75.甲基内吸磷



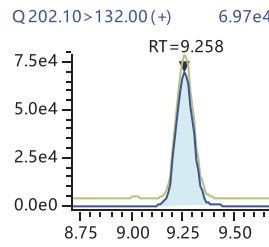
76.马拉氧磷



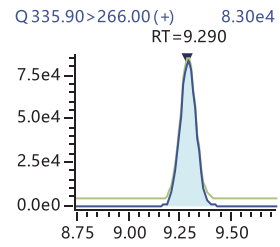
77.丁噻隆



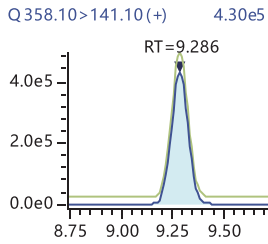
78.酰肼磺隆



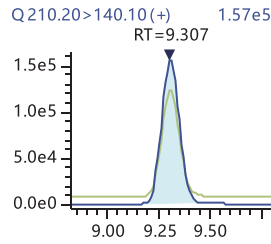
79.西玛津



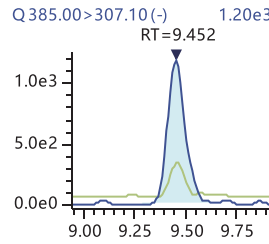
80.苯线磷砷



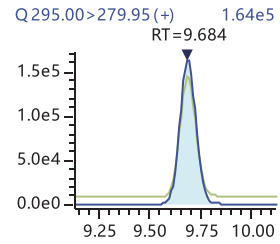
81.氯磺隆



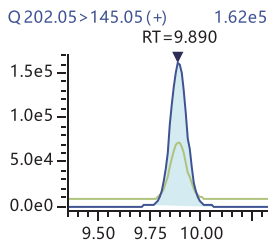
82.乙嘧酚



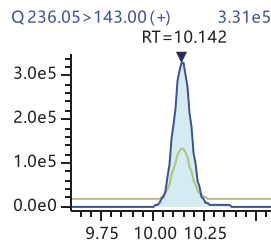
83.甲磺草胺



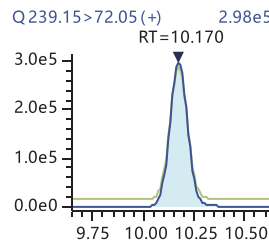
84.倍硫磷亚砷



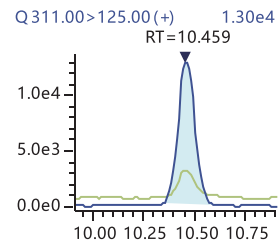
85.甲萘威



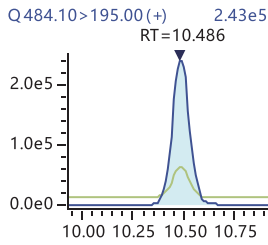
86.萎锈灵



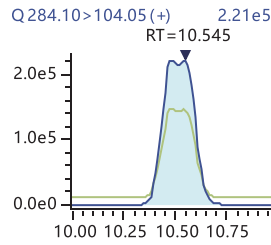
87.抗蚜威



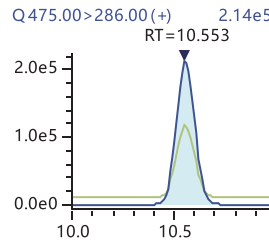
88.倍硫磷砷



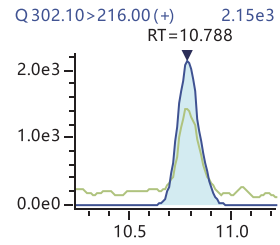
89.五氟磺草胺



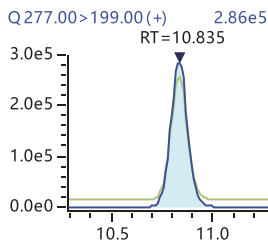
90.噻唑磷



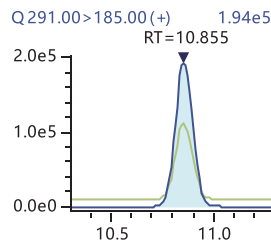
91.溴氟虫酰胺



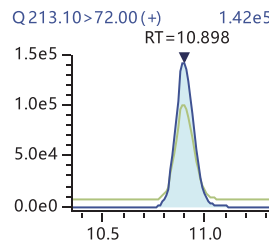
92.螺虫乙酯-烯醇



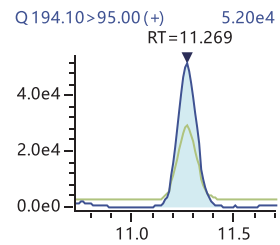
93.甲拌磷亚砷



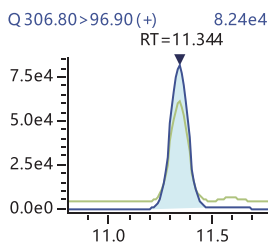
94.乙拌磷亚砷



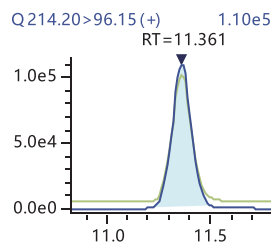
95.绿麦隆



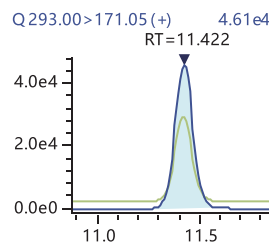
96.异丙威



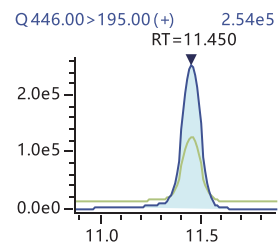
97.乙拌磷砷



98.西草净

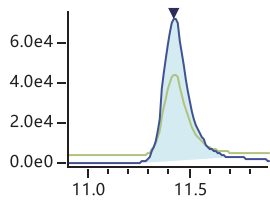


99.甲拌磷砷



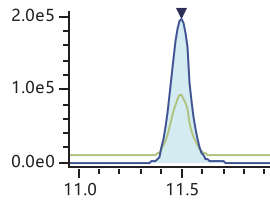
100.三氟甲磺隆

Q 297.00>159.00(+) 7.23e4
RT=11.428



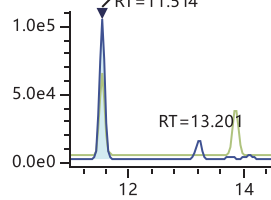
101.抑霉唑

Q 302.10>123.00(+) 1.98e5
RT=11.494



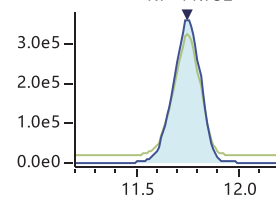
102.粉唑醇

Q 240.80>208.95(+) 1.06e5
RT=11.514



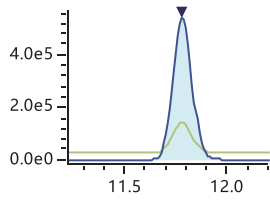
103.虱螨畏*

Q 278.10>210.10(+) 3.63e5
RT=11.752



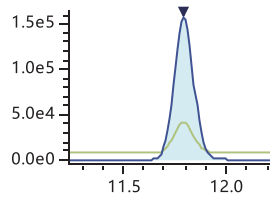
104.吡啶草胺

Q 504.10>182.10(+) 5.44e5
RT=11.785



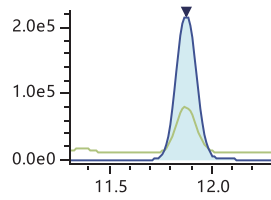
105.甲基二磺隆

Q 207.10>72.00(+) 1.58e5
RT=11.795



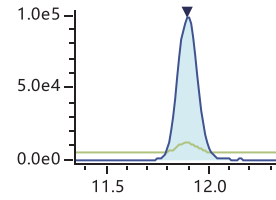
106.异丙隆

Q 216.10>174.05(+) 2.16e5
RT=11.872



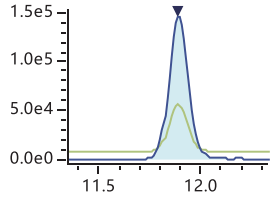
107.莠去津

Q 214.00>172.00(+) 9.88e4
RT=11.895



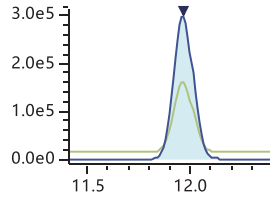
108.氯苯胺灵

Q 212.10>170.00(+) 1.46e5
RT=11.895



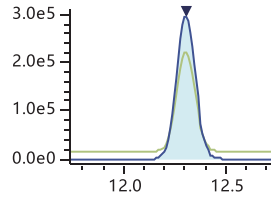
109.毒草胺

Q 280.10>220.20(+) 2.99e5
RT=11.969



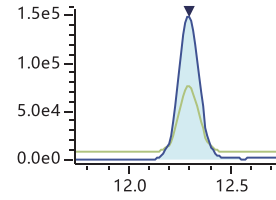
110.甲霜灵

Q 309.00>281.00(+) 2.96e5
RT=12.304



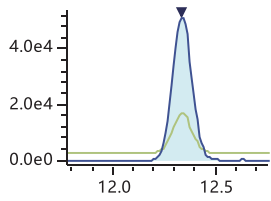
111.三索磷

Q 233.00>72.00(+) 1.50e5
RT=12.293



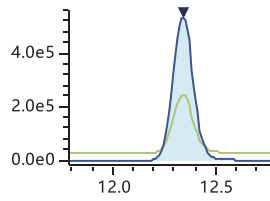
112.敌草隆

Q 251.00>127.00(+) 5.13e4
RT=12.339



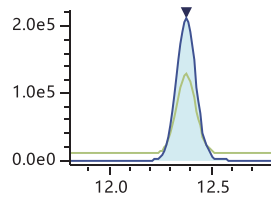
113.庚烯磷

Q 248.10>129.10(+) 5.32e5
RT=12.343



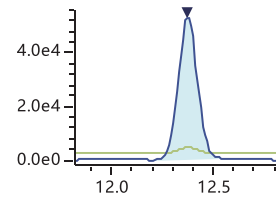
114.氯吡啶

Q 396.10>155.00(+) 2.13e5
RT=12.374



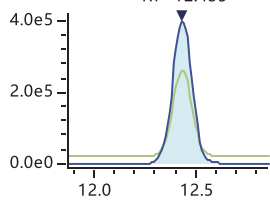
115.苯磺隆

Q 360.10>251.00(+) 5.31e4
RT=12.373



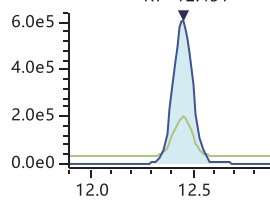
116.异噁唑草酮

Q 425.00>199.05(+) 4.02e5
RT=12.435



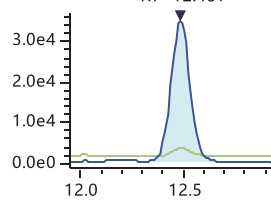
117.噻苯胺磺隆

Q 318.00>300.00(+) 6.09e5
RT=12.451



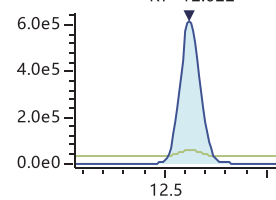
118.螺虫乙酯-酮基-羟基

Q 231.00>121.00(+) 3.52e4
RT=12.484



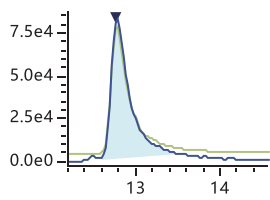
119.水胺硫磷

Q 507.90>167.00(+) 6.22e5
RT=12.622



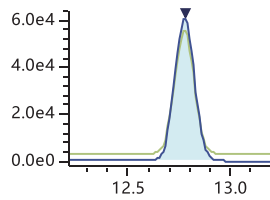
120.甲基磺隆钠盐

Q 274.10>147.10(+) 8.37e4
RT=12.775



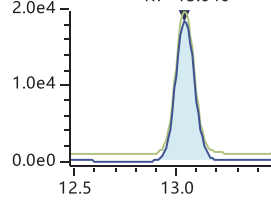
121.苯锈啶

Q 392.10>300.00(+) 6.09e4
RT=12.777



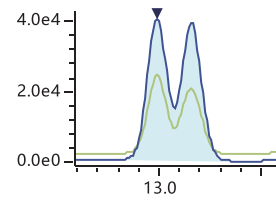
122.烯草酮砒

Q 325.00>191.00(+) 1.83e4
RT=13.040

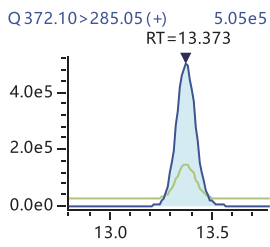


123.三索磷砒

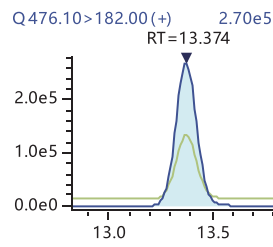
Q 376.10>206.00(+) 4.10e4
RT=12.986



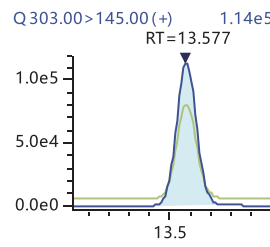
124.烯草酮亚砒*



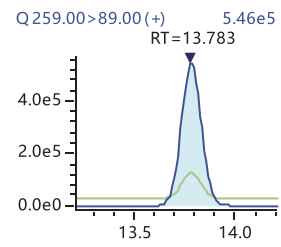
125.氟吗啉



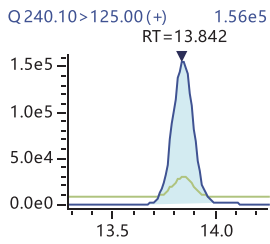
126.噻吡啶磺隆



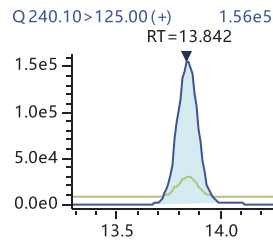
127.杀扑磷



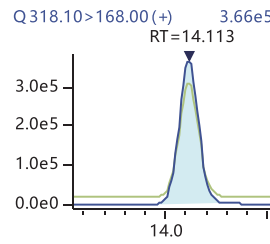
128.丙吸磷



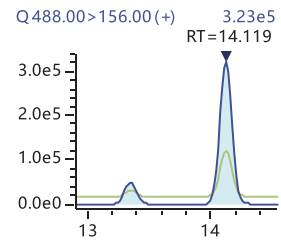
129.异噁草酮



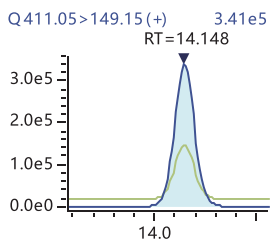
130.仲丁威



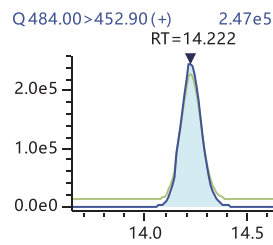
131.甜菜宁



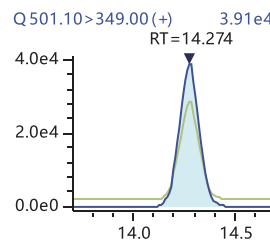
132.氟吡磺隆*



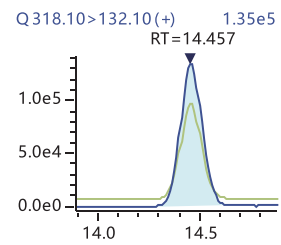
133.苄嘧磺隆



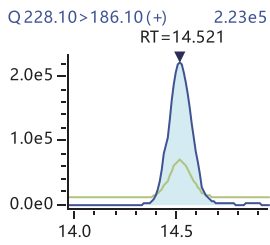
134.氯虫苯甲酰胺



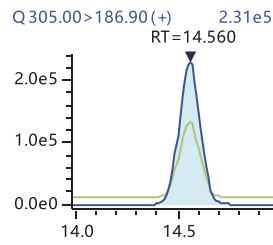
135.苄嘧磺草胺



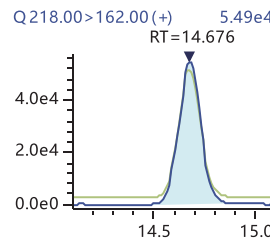
136.保棉磷



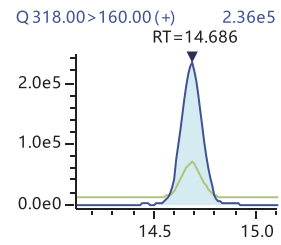
137.莠灭净



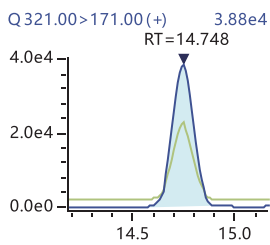
138.特丁硫磷亚砷



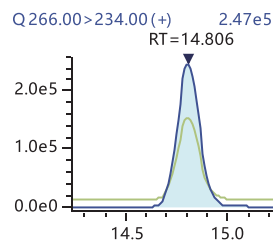
139.敌稗



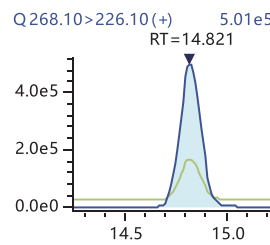
140.亚胺硫磷



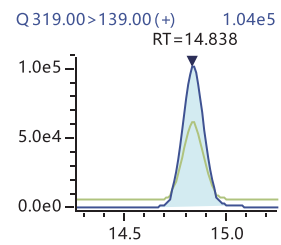
141.特丁硫磷砷



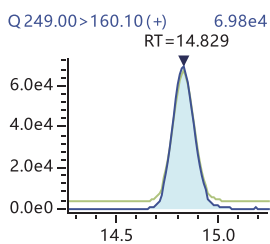
142.丙硫多菌灵



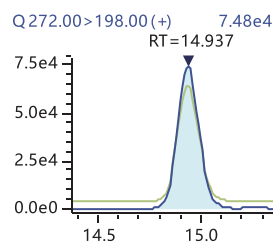
143.乙霉威



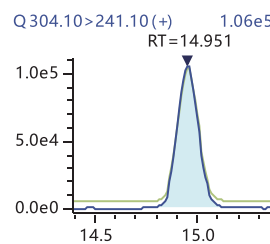
144.环酯砒醚



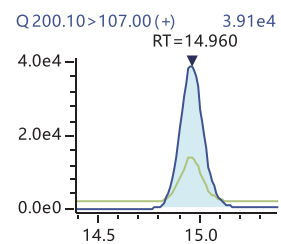
145.利谷隆



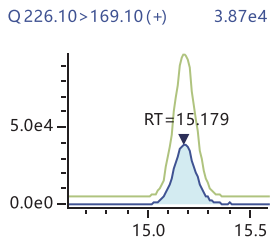
146.草除灵



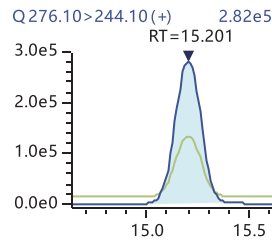
147.乙氧呋草黄



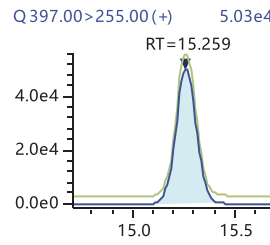
148.啉霉胺



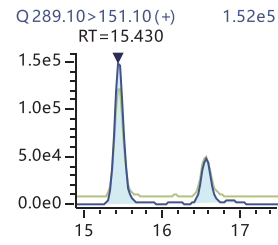
149.甲硫威



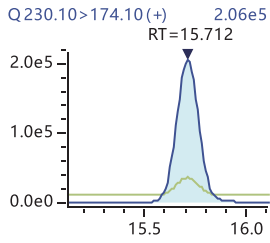
150.二甲吩草胺



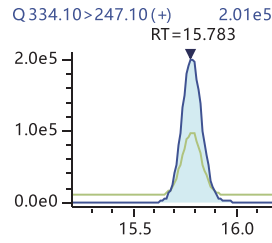
151.乙虫腓



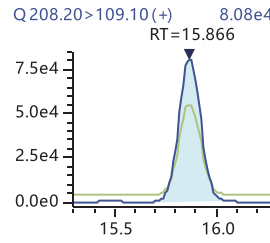
152.啉菌噻唑*



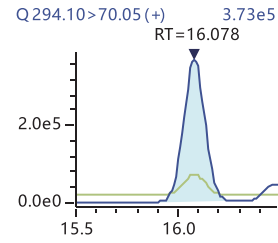
153.特丁津



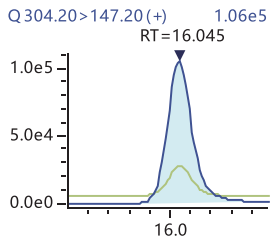
154.呋草酮



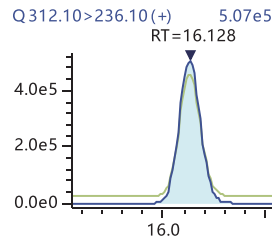
155.猛杀威



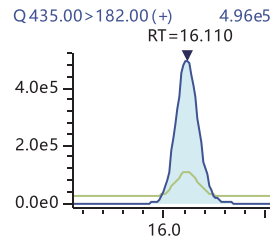
156.多效唑



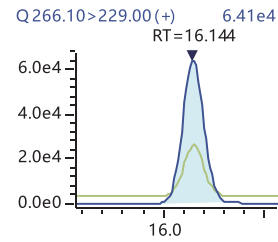
157.丁苯吗啉



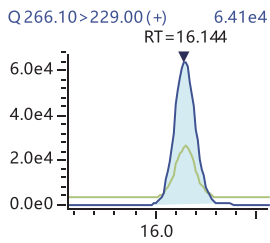
158.咪唑菌酮



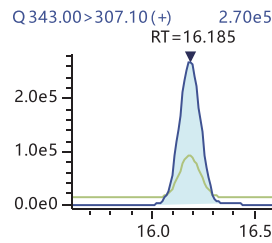
159.氯吡嘧磺隆



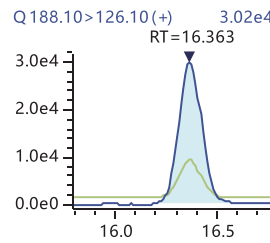
160.咯菌腈



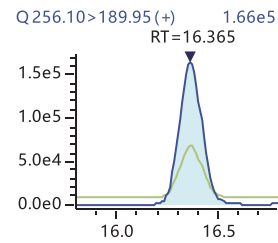
161.啉菌酯



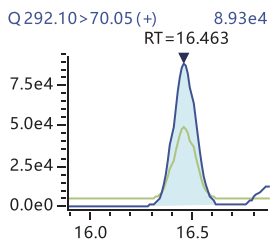
162.啉酰菌胺



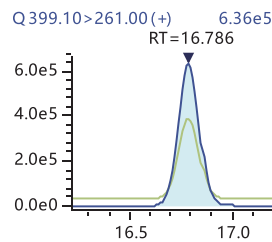
163.禾草敌



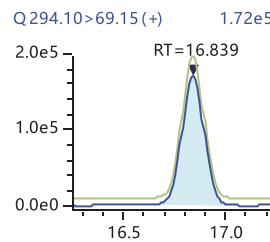
164.炔苯酰草胺



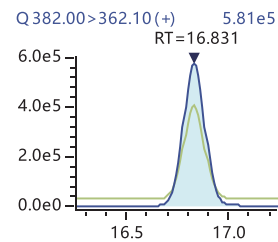
165.环丙唑醇



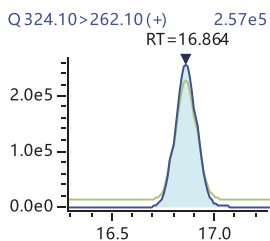
166.乙氧磺隆



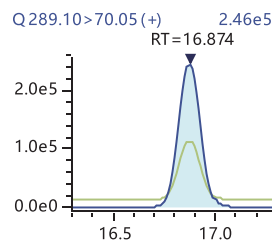
167.三唑酮



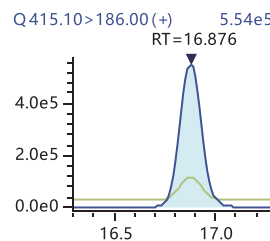
168.氟唑菌酰胺



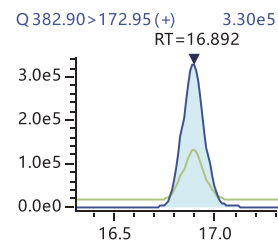
169.氟酰胺



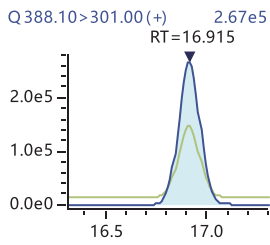
170.腈菌唑



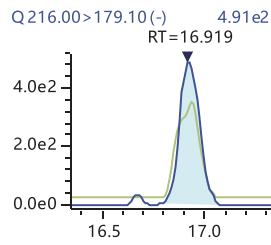
171.氯嘧磺隆



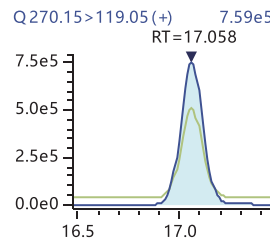
172.氟吡菌胺



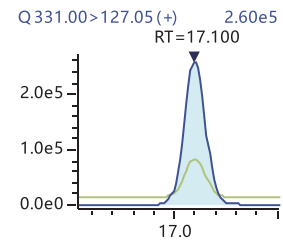
173.烯酰吗啉



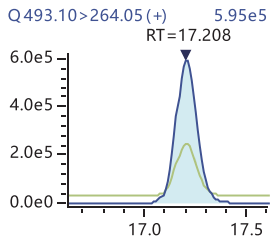
174.氟霜唑代谢物 CCIM



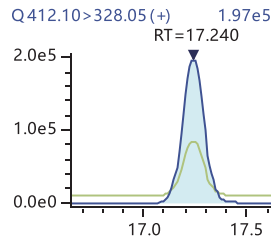
175.灭锈胺



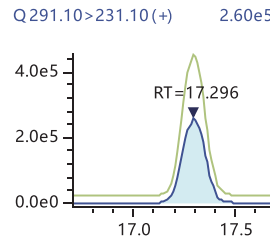
176.马拉硫磷



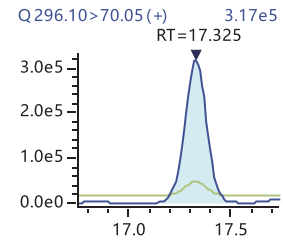
177.氟胺磺隆



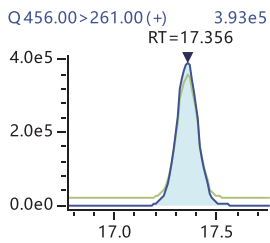
178.双炔酰菌胺



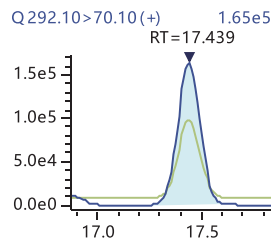
179.稻瘟灵



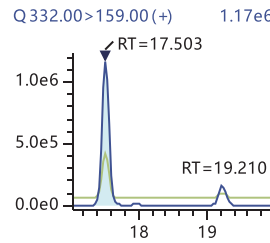
180.三唑醇



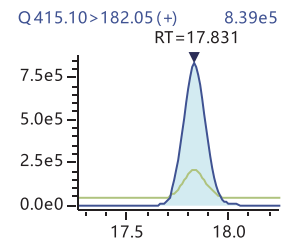
181.丙噻咪磺隆



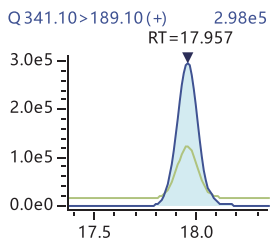
182.烯效唑



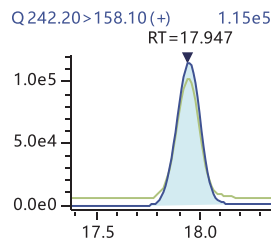
183.氟唑环菌胺*



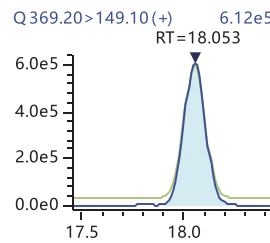
184.吡啶磺隆



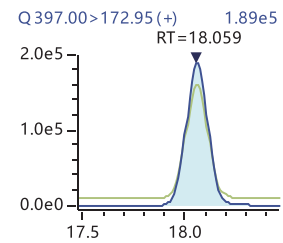
185.吡啶磺隆



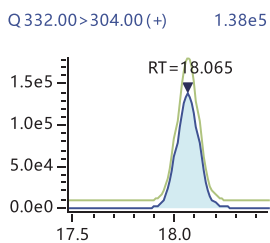
186.扑草净



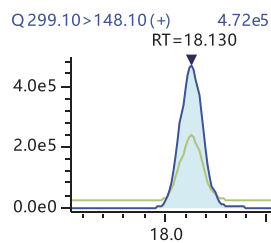
187.甲氧虫酰肼



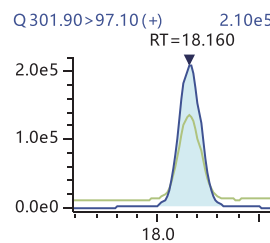
188.氟吡菌酰胺



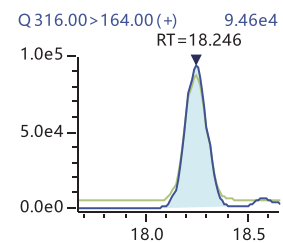
189.胺苯吡菌酮



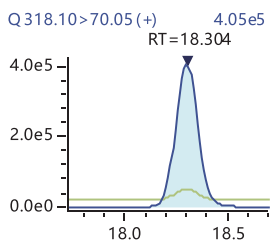
190.苯噻唑草胺



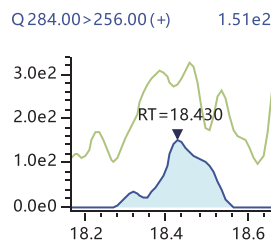
191.环酰菌胺



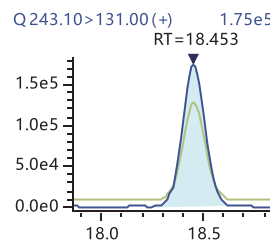
192.氯唑磷



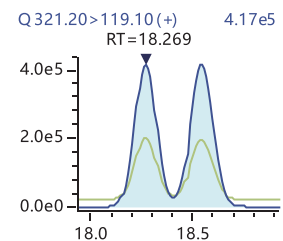
193.灭茵唑



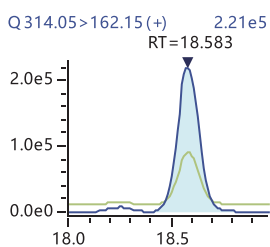
194.腐霉利



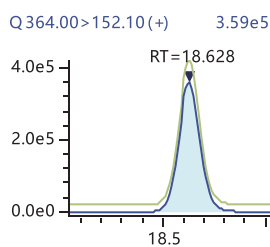
195.灭线磷



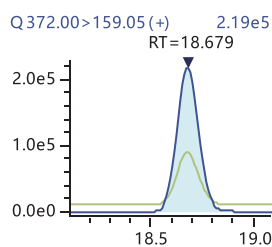
196.缬霉威*



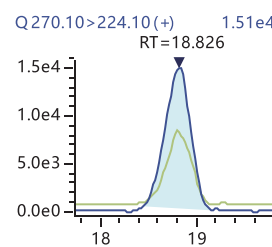
197.三唑磷



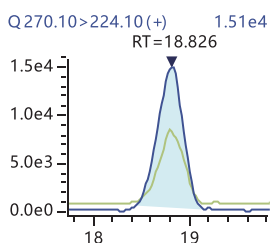
198.氟噻草胺



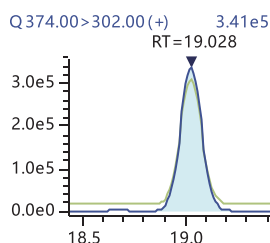
199.四氟醚唑



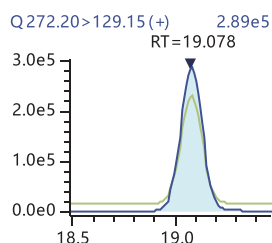
200.乙草胺



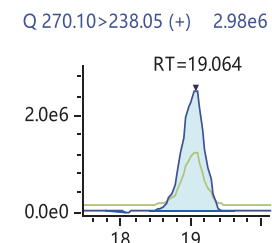
201.氯苯嘧啶醇



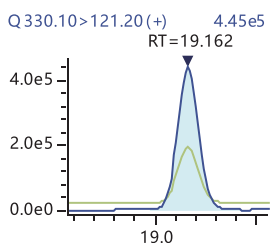
202.螺虫乙酯



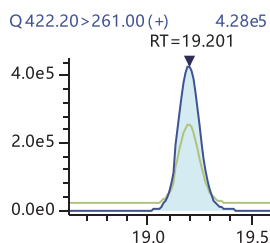
203.敌草胺



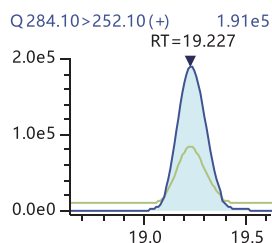
204.甲草胺



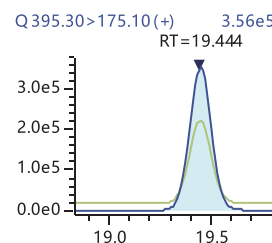
205.氟环唑



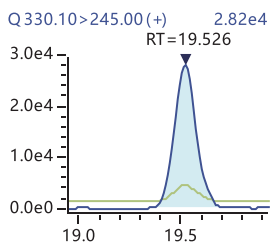
206.环丙嘧磺隆



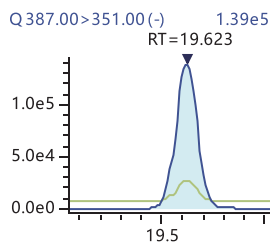
207.异丙甲草胺



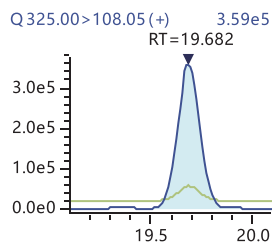
208.环虫酰肼



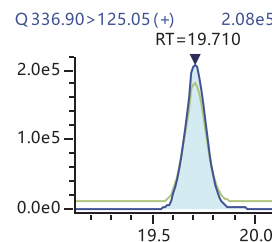
209.异菌脲



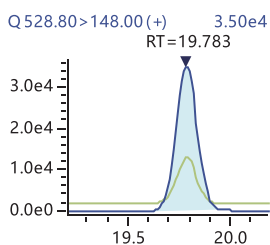
210.氟甲脲



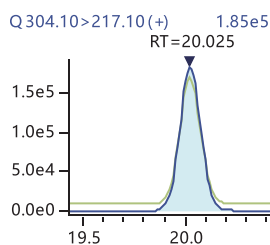
211.氟霜唑



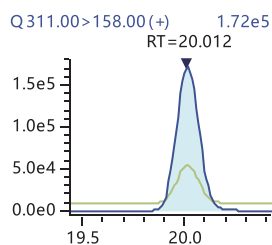
212.腈苯唑



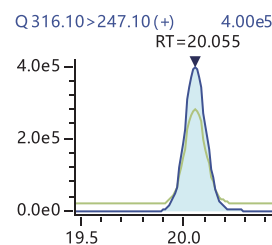
213.噻菌菌胺



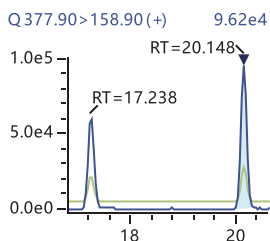
214.苯线磷



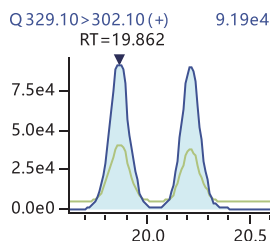
215.除虫脲



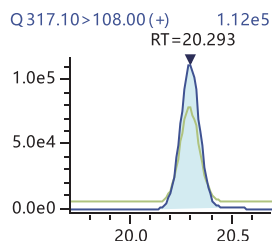
216.氟硅唑



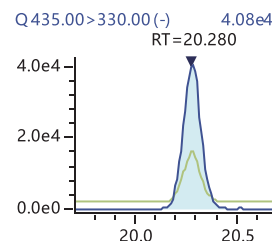
217.糠菌唑



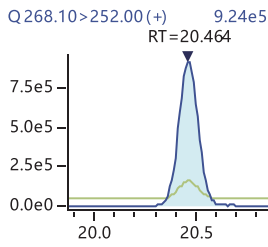
218.稻瘟酰胺*



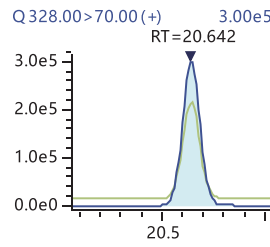
219.乙嘧磺磷酸酯



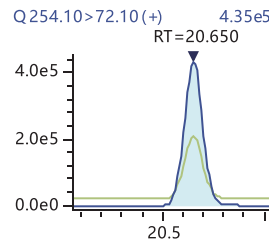
220.氟虫脲



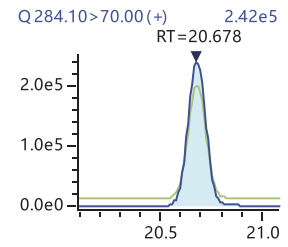
221. 硅噻菌胺



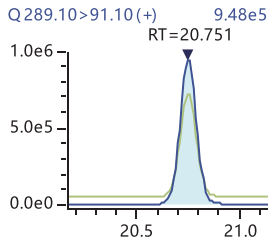
222. 苯氧三唑醇



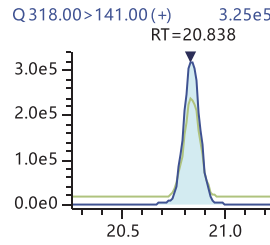
223. 苯硫威



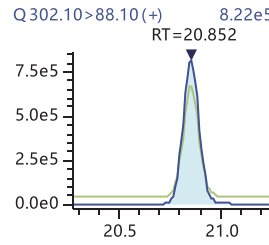
224. 戊菌唑



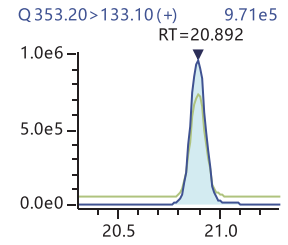
225. 异稻瘟净



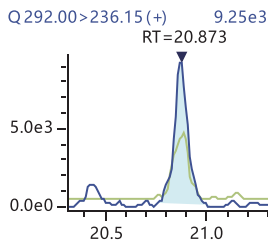
226. 氟唑菌苯胺



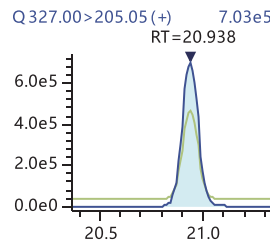
227. 苯氧威



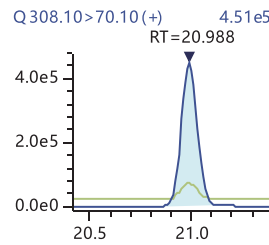
228. 虫酰肼



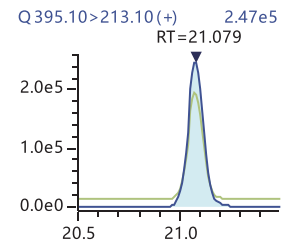
229. 对硫磷



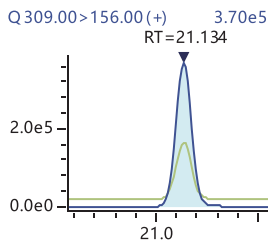
230. 醚菌胺



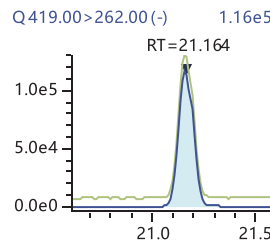
231. 戊唑醇



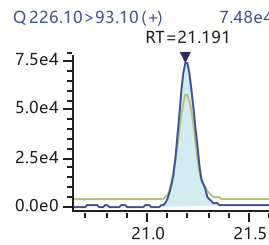
232. 鱼藤酮



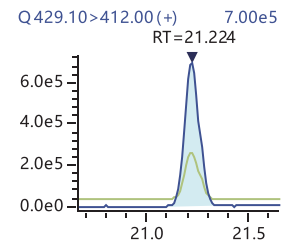
233. 灭幼脲



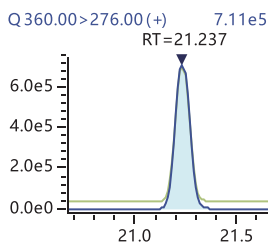
234. 氟虫腈硫醚



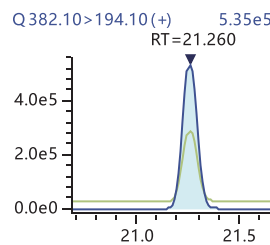
235. 啉菌环胺



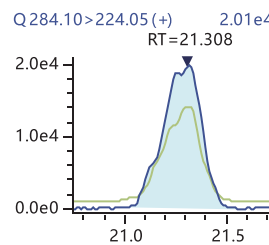
236. 唑草酮



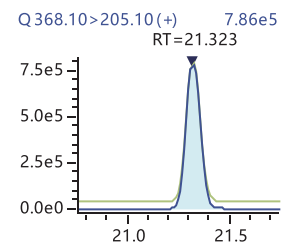
237. 吡噻菌胺



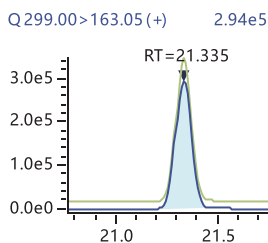
238. 唑胺菌酯



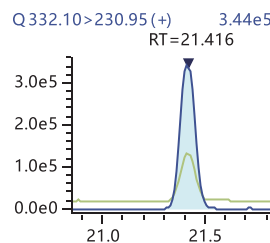
239. 异丙草胺



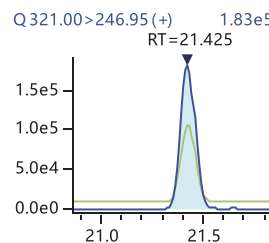
240. 啉氧菌酯



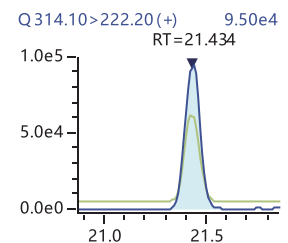
241. 啉硫磷



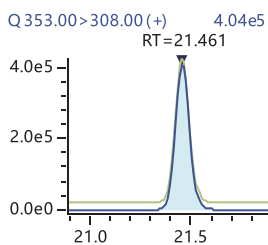
242. 甲基异柳磷



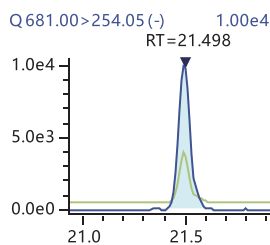
243. 稻丰散



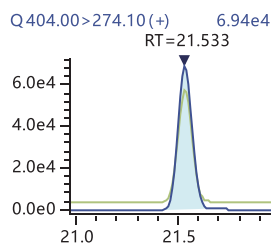
244. 醚菌酯



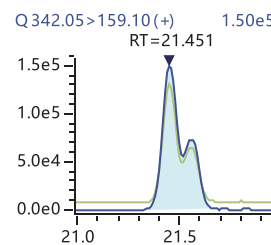
245. 咪鲜胺-脱咪唑甲酰胺基



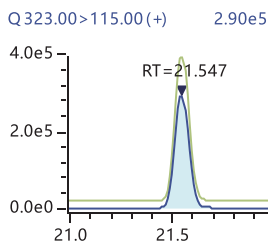
246. 氟苯虫酰胺



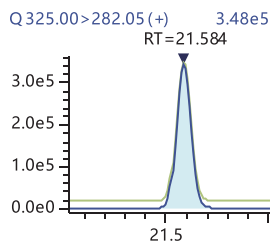
247. 噻草酸甲酯



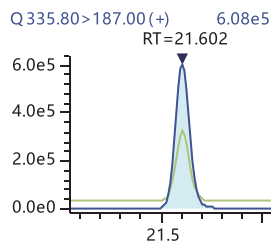
248. 丙环唑



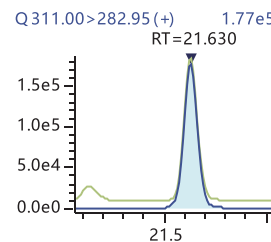
249. 治螟磷



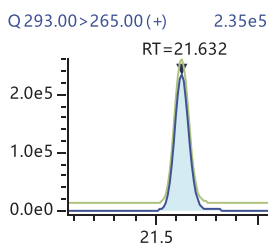
250. 咪鲜胺-脱氨基咪唑



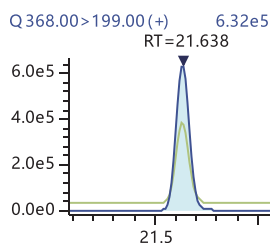
251. 苯酰菌胺



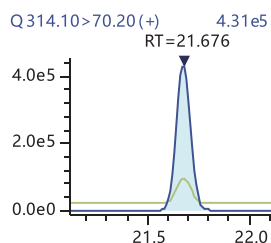
252. 敌瘟磷



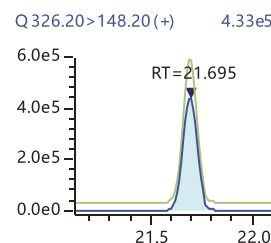
253. 乙嘧硫磷



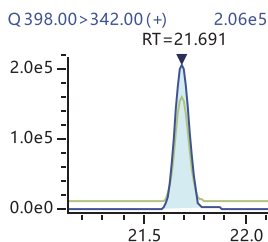
254. 莎稗磷



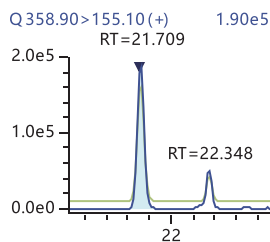
255. 己唑醇



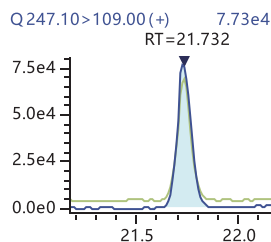
256. 苯霜灵



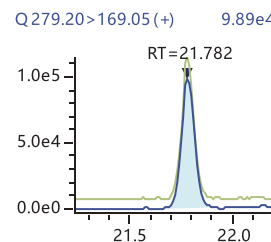
257. 苯并烯氟菌唑



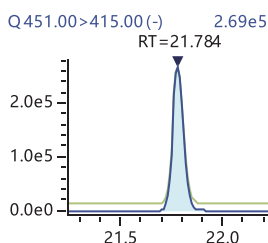
258. 毒虫畏



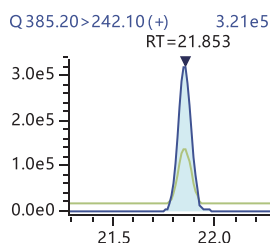
259. 地虫硫磷



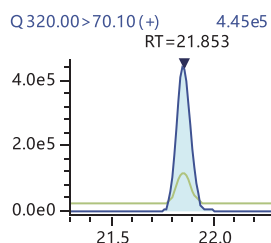
260. 倍硫磷



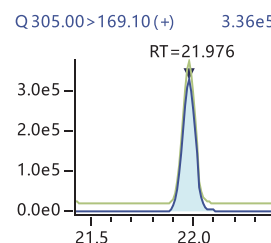
261. 氟虫腈砜



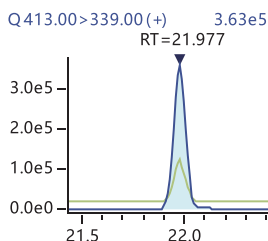
262. 丁吡吗啉



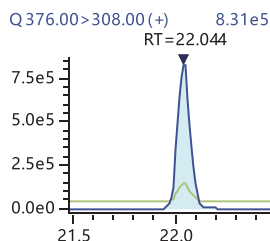
263. 叶菌唑



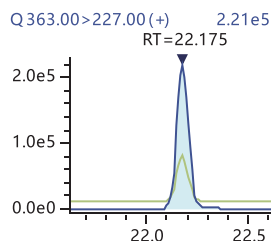
264. 二嗪磷



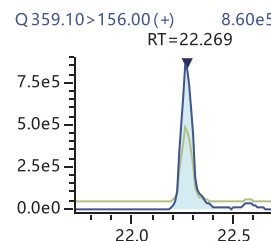
265. 吡草醚



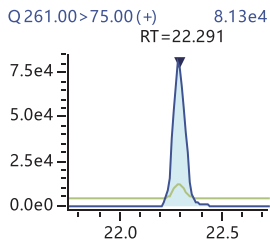
266. 咪鲜胺



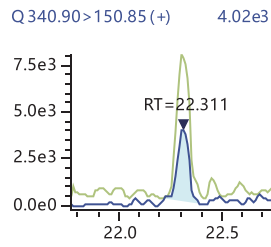
267. 蝇毒磷



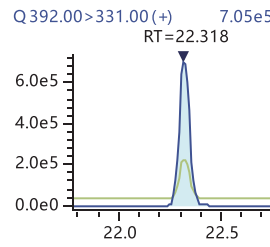
268. 杀铃脲



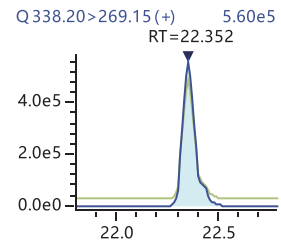
269. 甲拌磷



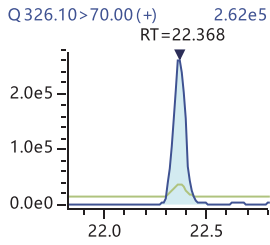
270. 丙炔噁草酮



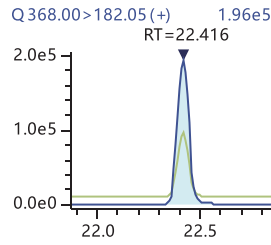
271. 噁唑菌酮



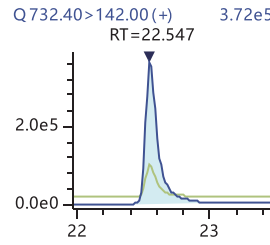
272. 联苯三唑醇



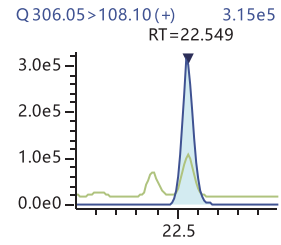
273. 烯唑醇



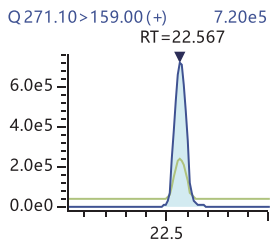
274. 伏杀硫磷



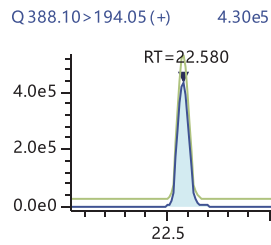
275. 多杀霉素 A



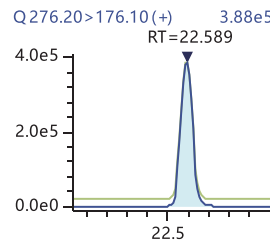
276. 甲基嘧啶醇



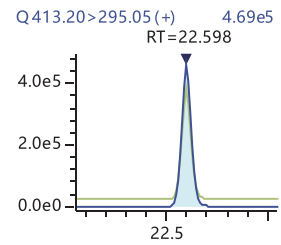
277. 硫线磷



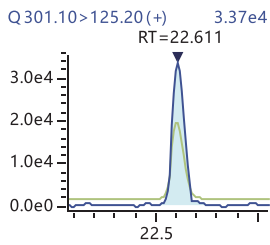
278. 吡唑醚菌酯



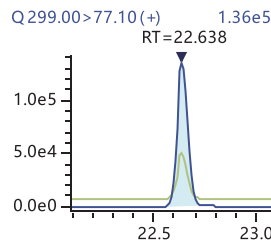
279. 唑啉菌胺



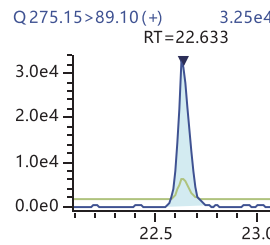
280. 环氟菌胺



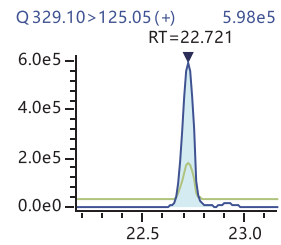
281. 甲基立枯磷



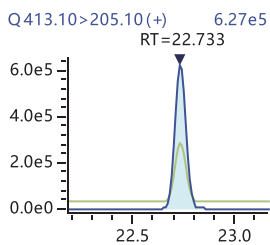
282. 辛硫磷



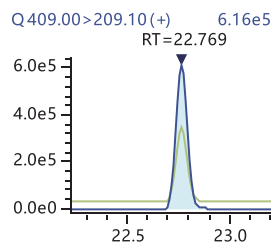
283. 乙拌磷



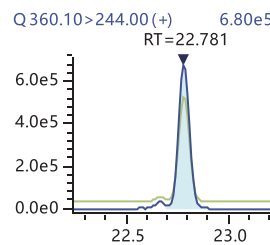
284. 戊菌隆



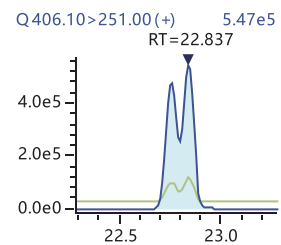
285. 唑菌酯



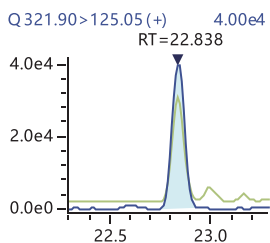
286. 苯菌酮



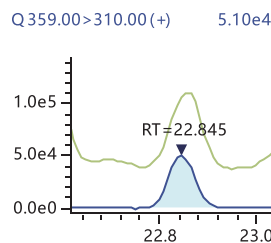
287. 吡唑啉菌胺*



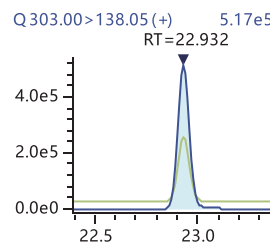
288. 苯醚甲环唑*



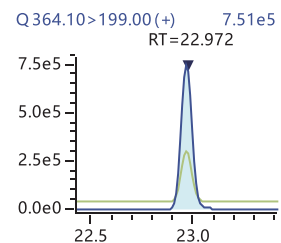
289. 甲基毒死蜱



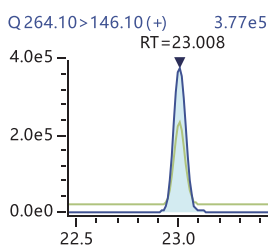
290. 甲羧除草醚



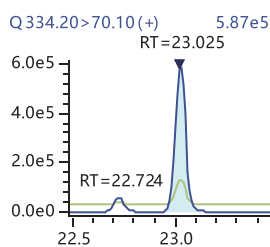
291. 四螨嗪



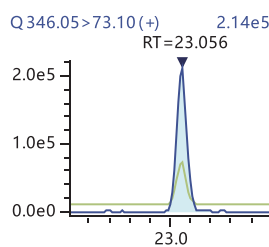
292. 苯螨特



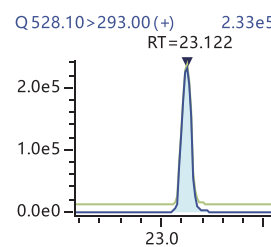
293.哌草丹



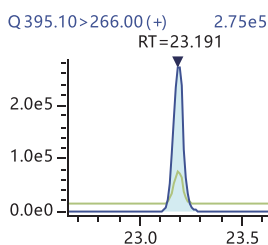
294.种菌唑*



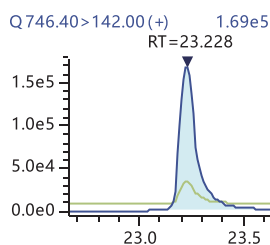
295.氟菌唑



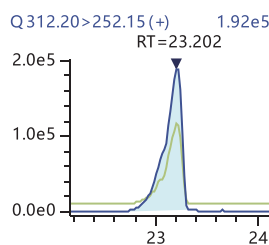
296.茚虫威



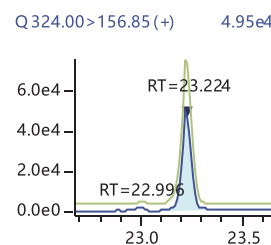
297.吡氟酰草胺



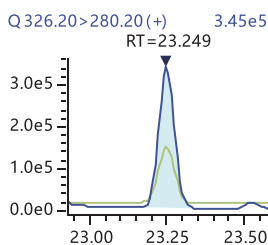
298.多杀菌素 D



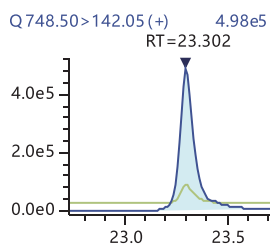
299.丙草胺



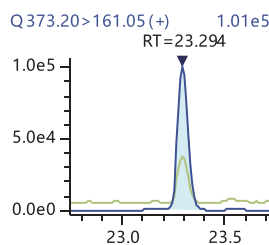
300.苯硫磷



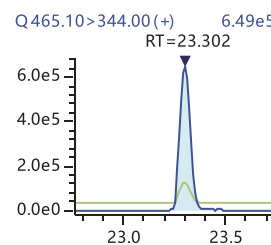
301.噻草酮



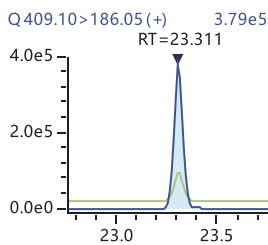
302.乙基多杀菌素 J



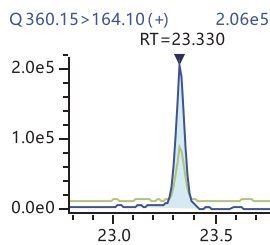
303.除虫菊素 2



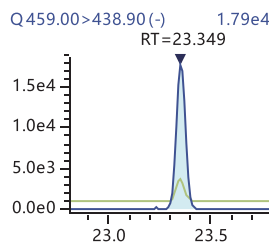
304.乙羧氟草醚



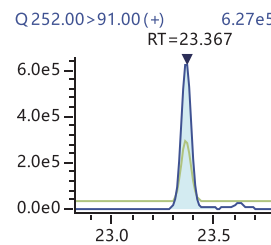
305.腈菌酯



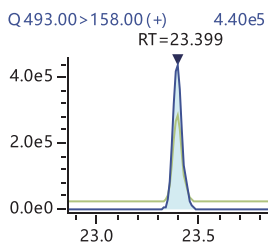
306.烯草酮



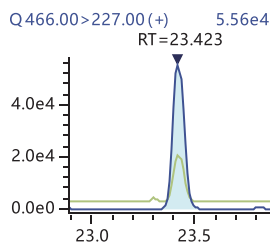
307.氟铃脲



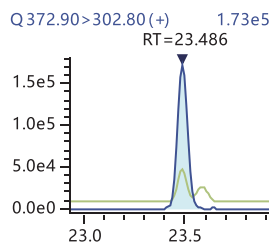
308.苜草丹



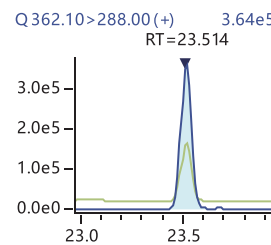
309.氟酰胺



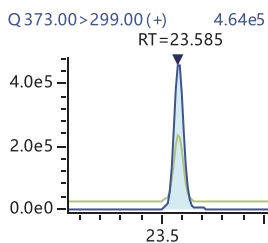
310.吡唑啉酮胺



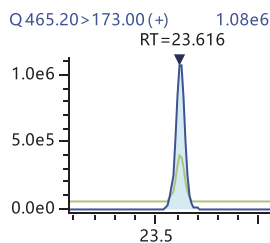
311.丙溴磷



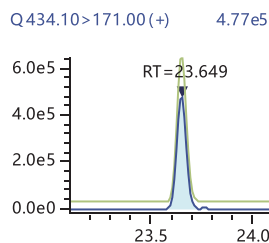
312.噁唑禾草灵



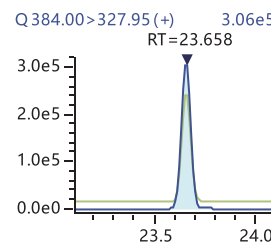
313.啶禾灵



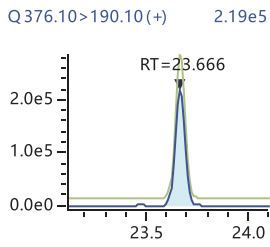
314.丁氟螨酯



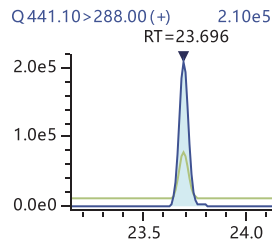
315.烯炔菌胺



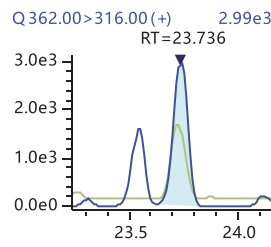
316.吡氟禾草灵



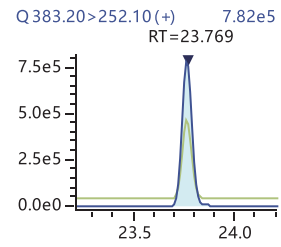
317.噁嗪草酮



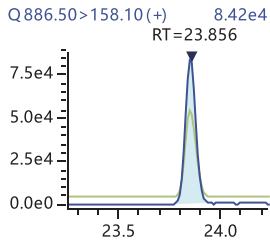
318.噁唑酰草胺



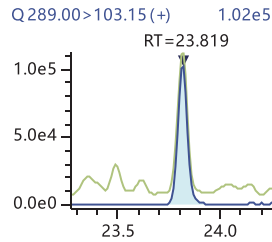
319.乙氧氟草醚



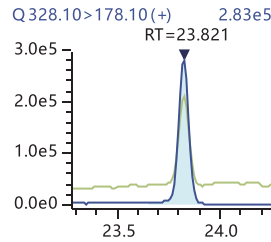
320.吡线威



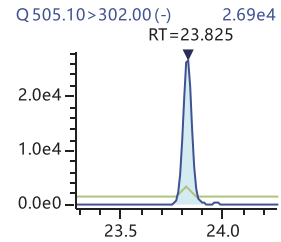
321.甲氨基阿维菌素苯甲酸盐



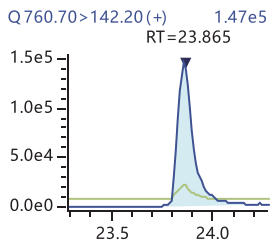
322.特丁硫磷



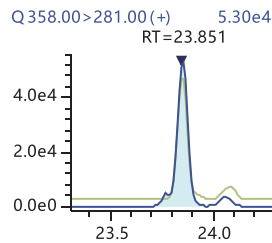
323.烯禾啶



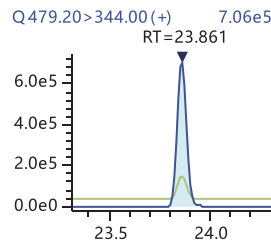
324.氟氯虫脲



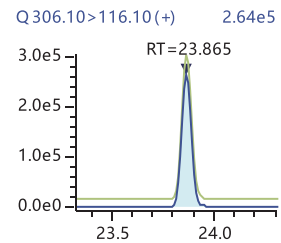
325.乙基多杀菌素 L



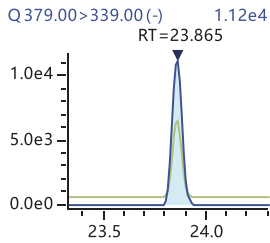
326.禾草灵



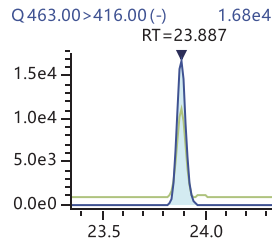
327.乳氟禾草灵



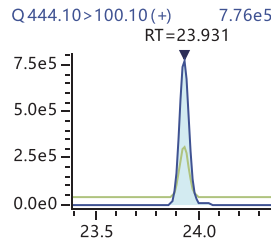
328.噁嗪酮



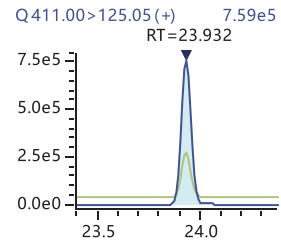
329.氟苯腈



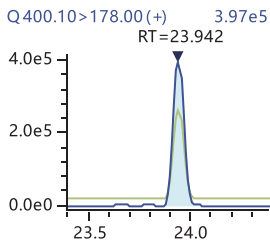
330.氟吡啶胺



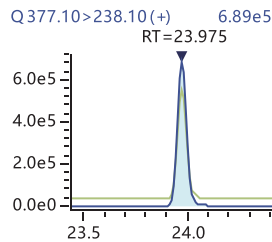
331.噁草酯



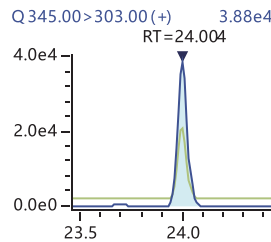
332.亚胺唑



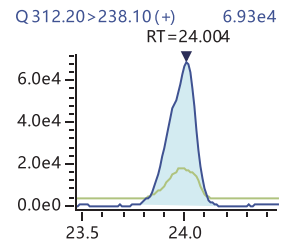
333.烯肟菌酯



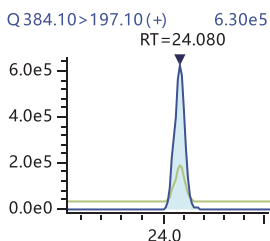
334.氟吡酰草胺



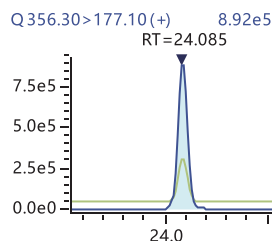
335.噁草酮



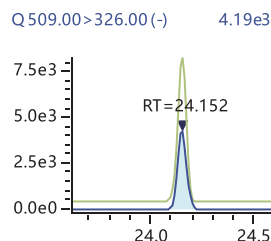
336.丁草胺



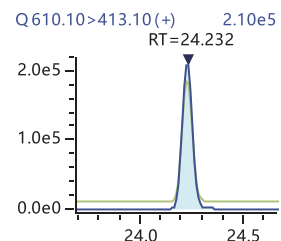
337.唑虫酰胺



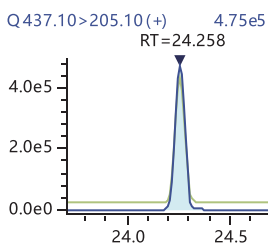
338.增效醚



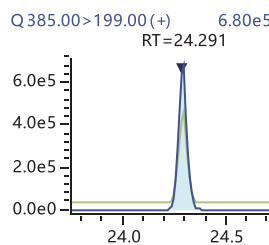
339.虱螨脲



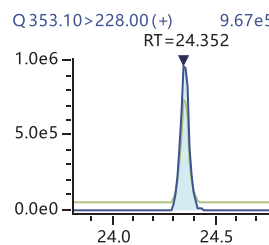
340.噁啶肟草醚



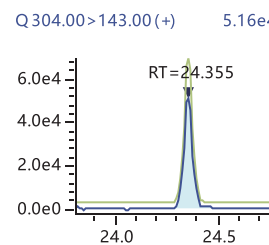
341.丁香茵酯



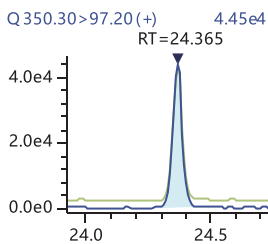
342.乙硫磷



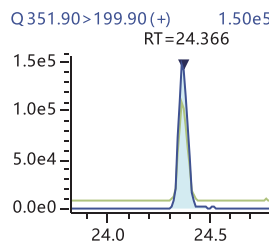
343.噻螨酮



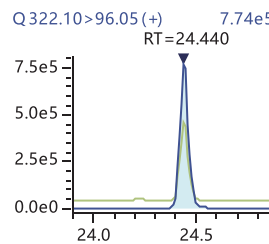
344.野麦畏



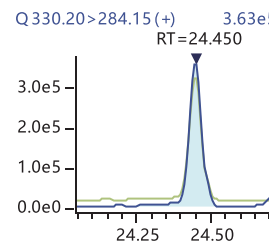
345.甲氰菊酯



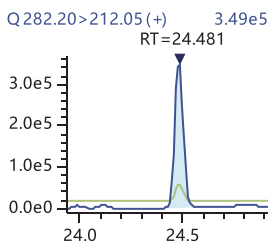
346.毒死蜱



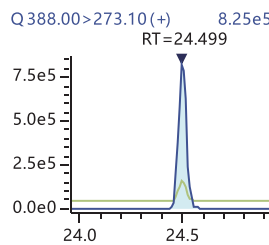
347.吡丙醚



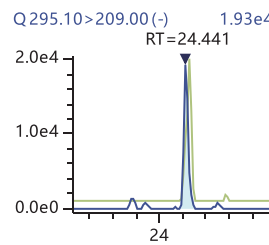
348.三甲苯草酮



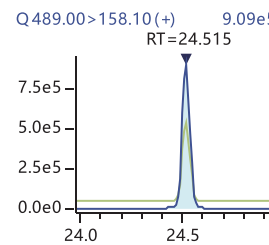
349.二甲戊灵



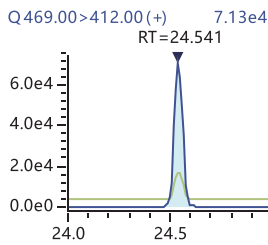
350.螺甲螨酯



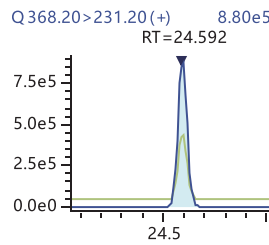
351.敌螨普*



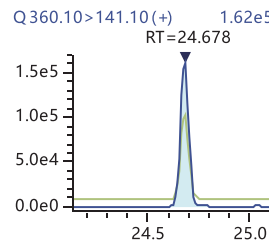
352.氟虫脲



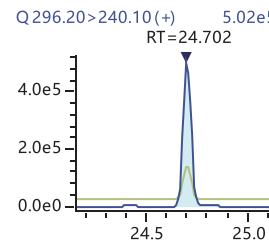
353.氟氧戊菊酯



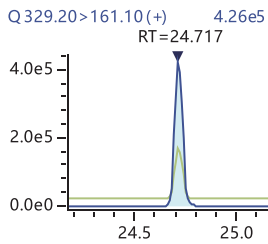
354.炔螨特



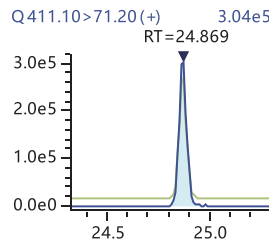
355.乙螨唑



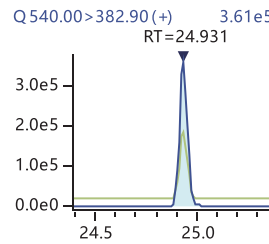
356.仲丁灵



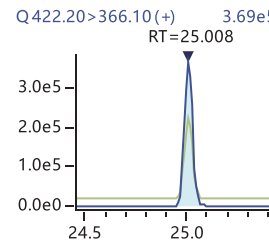
357.除虫菊素 1



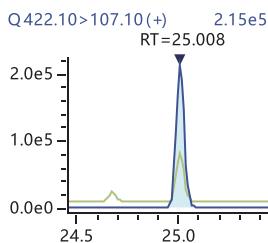
358.螺螨酯



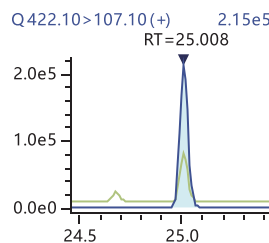
359.氟啶脲



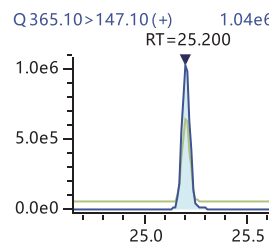
360.啮螨酯



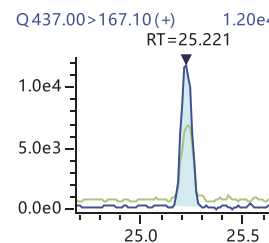
361.氟节胺



362.丙氧喹啉



363.啮螨灵



364.氟戊菊酯

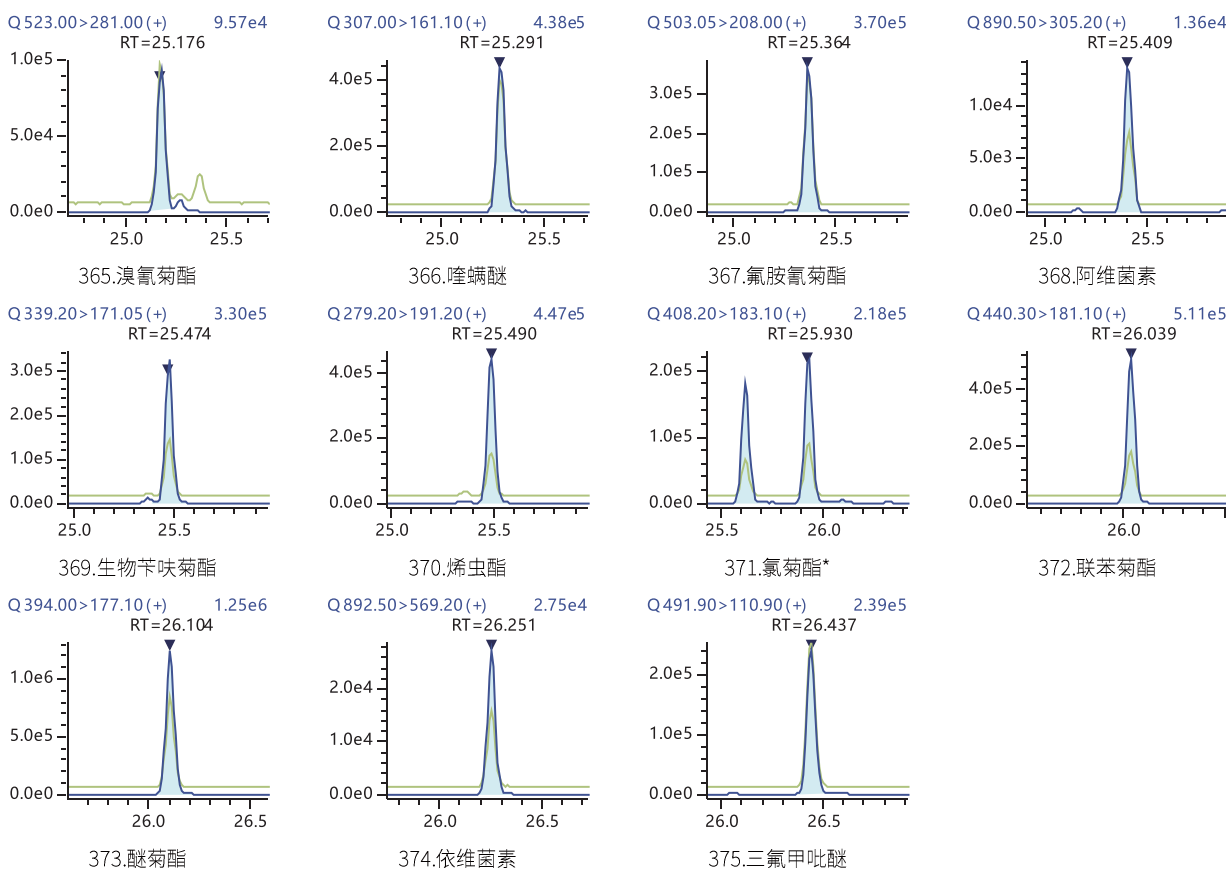


图 2 葡萄基质中 331 种农药及代谢物 MRM 色谱图 (加标浓度 0.01 mg/L)

2.2 线性测定结果

对基质匹配标准品按 1.2 中的分析条件进行分析，外标法制作标准曲线。部分农药标准曲线结果见表 3，331 种农药及其代谢物标准曲线线性相关系数均大于 0.995，曲线各浓度点准确度在 80%~120% 之间，满足方法学验证要求。

表 3 葡萄基质加标标准曲线参数 (部分组分)

名称	线性方程	相关系数	准确度 (%)	线性范围 (mg/kg)
甲胺磷	$Y = (10522.9)X + (28542.8)$	0.9996	94.1~103.9	0.002~0.2
涕灭威砒	$Y = (46316.3)X + (91514.7)$	0.9999	90.3~106.3	0.002~0.2
久效磷	$Y = (66097.2)X + (411857)$	0.9965	90.1~108.1	0.002~0.2
3- 羟基克百威	$Y = (17512.4)X + (33221.7)$	0.9997	99.5~101.9	0.002~0.2
敌敌畏	$Y = (17934.5)X + (48573.8)$	0.9997	92.5~105.4	0.002~0.2
杀铃脲	$Y = (170363)X + (104462.0)$	0.9973	98.6~101.3	0.002~0.2
戊唑醇	$Y = (235855)X + (-2334.1)$	0.9999	96.7~103.9	0.002~0.2
多杀菌素 D	$Y = (88792.4)X + (-103340)$	0.9996	95.6~102.8	0.002~0.2
氯菊酯	$Y = (10643.3)X + (19228.1)$	0.9991	97.4~103.5	0.002~0.2

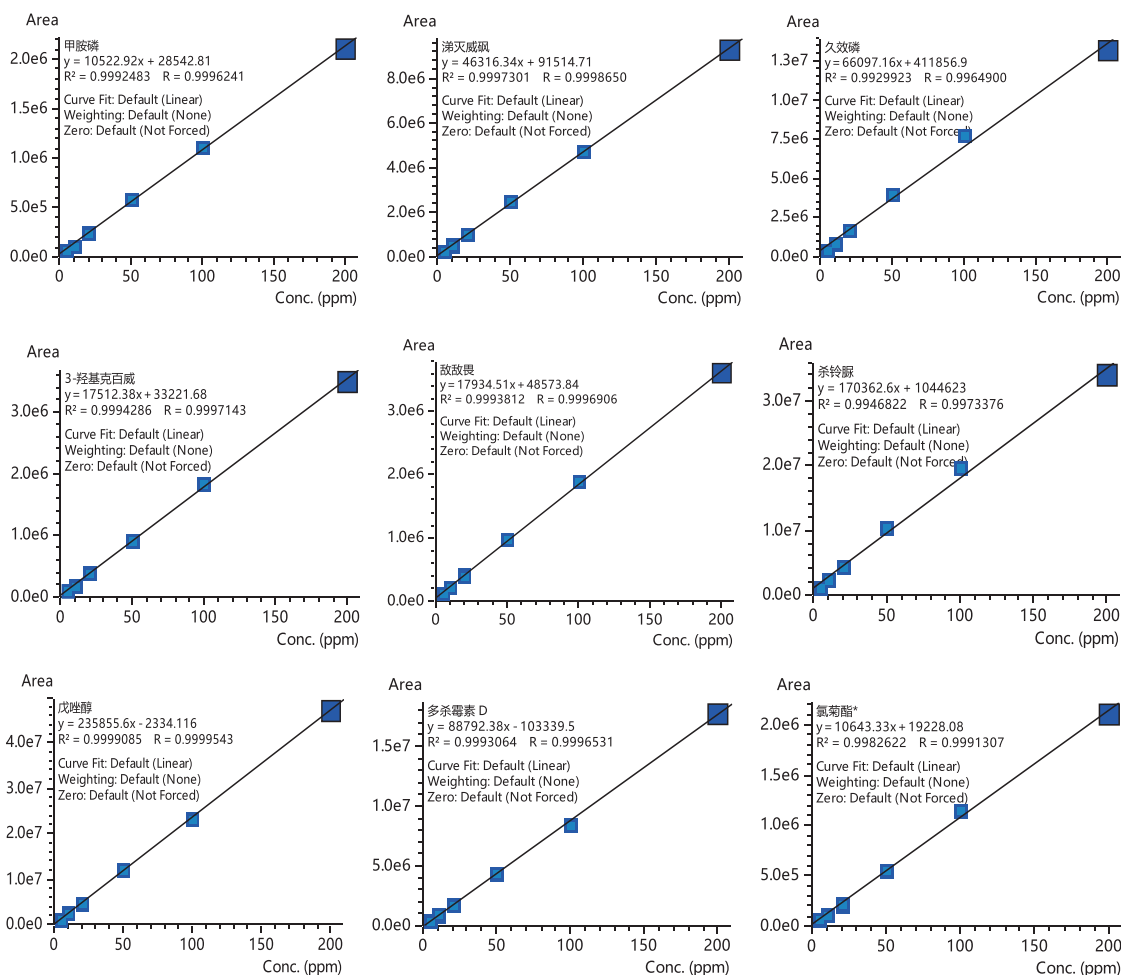
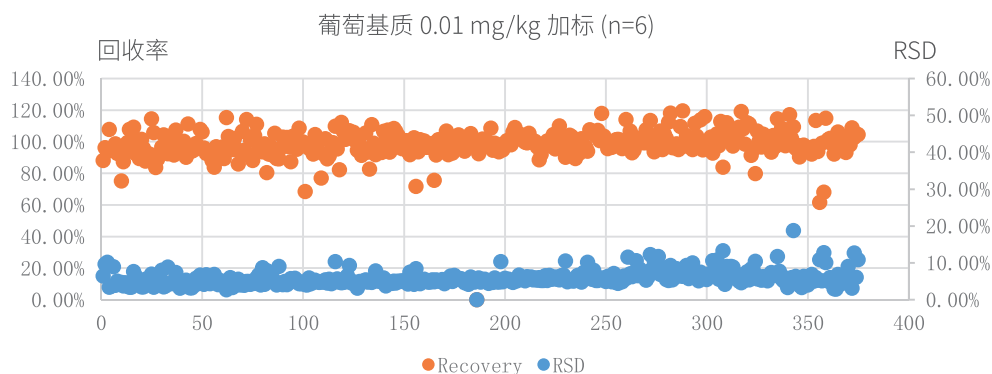


图3 葡萄基质加标校准曲线（部分组分）

注：根据出峰时间早晚，目标物极性大小，ESI 正负模式不同，选取了 9 种农药展示。

2.3 回收率及精密度测定结果

在葡萄空白样品中加入农药混标，添加量为 0.01 mg/kg、0.02 mg/kg 和 0.05 mg/kg 三个浓度水平，按照 1.3 样品前处理流程分别平行处理 6 份后上机，考察回收率和精密度结果。三个浓度水平下的回收率及峰面积精密度 (n=6) 结果见图 4。结果显示，331 种农药及其代谢物回收率在 60%~120% 之间，峰面积精密度在 0.5%~15% 之间，LCMS-8045 测定 331 种农药及其代谢物精密度良好。



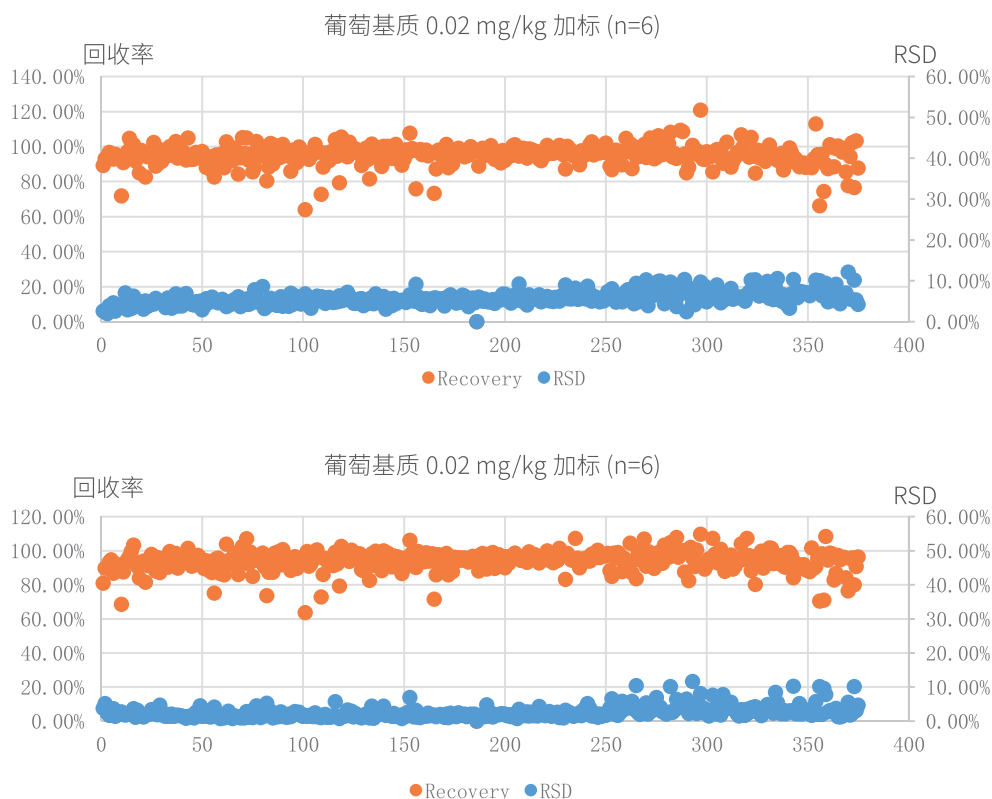


图 4 葡萄基质中 331 种农药及代谢物加标回收率和精密度结果

■ 结论

使用岛津液相色谱仪 LC-40 与三重四极杆质谱仪 LCMS-8045 联用建立了水果基质中 331 种农药及其代谢物同时测定的方法。结果表明, 该方法操作简单、分析速度快、重现性好、准确度高, 完全满足国标 GB 23200.121-2021 农残检测需求, 可供相关人员参考。

岛津应用云

