

LC-MS/MS 法同时测定水果中 352 种农药及其代谢物残留量

LCMSMS-833

摘要：使用岛津超高效液相色谱 - 三重四极杆质谱仪建立了水果基质中 352 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 352 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 23200.121-2026《植物源性食品中 352 种农药及其代谢物残留量的测定 液相色谱 - 质谱联用法》要求，供相关人员参考。

关键词：液质联用仪 352 种农药及其代谢物 植物源性食品

技术特点：

- ◆ 一针进样同时完成正负离子模式下的 352 种农药及其代谢物的分析。
- ◆ 使用自动进样器预处理程序，有效消除溶剂效应，改善色谱峰形。

GB 23200.121-2026《植物源性食品中 352 种农药及其代谢物残留量的测定 液相色谱 - 质谱联用法》于 2026 年 2 月正式发布。与 2021 年发布的 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》相比，增加了 21 种农药及其代谢物，达到 352 种农药及其 46 个代谢物（共计 398 种组分）残留量的测定。该标准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。与 GB 23200.113-2026《植物源性食品中 242 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 前处理方法相同，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 352 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，完全满足标准测定需求，供相关人员参考。

■ 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 C18-AQ HP(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 进样量：2 μL

柱温：40°C 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

离子源 : ESI (±)	DL 温度 : 150°C
雾化气流速 : 3.0 L/min	加热模块温度 : 400°C
加热气流速 : 10.0 L/min	接口温度 : 300°C
干燥气流速 : 10.0 L/min	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
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	spirotetra-mat-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	唑啉磺草胺	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	啉虫脒	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	氟啶虫胺胍 ^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-二酮腈	isoxaflutole-diketoneitrile	-	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
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	螺乙虫酯 - 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-desmeth- yl-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	环噻酮	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	酰嘧磺隆	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	乙嘧酚	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
87	抗蚜威	pirimicarb	+	10.170	239.2	72.1	-30	-40	-30	182.2	-30	-19	-30
88	倍硫磷砷	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	甲拌磷亚砷	phorate sulfoxide	+	10.835	277.0	199.0	-10	-10	-15	96.9	-10	-34	-19
94	乙拌磷亚砷	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	乙拌磷砷	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	甲拌磷砷	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	噻苯胺磺隆	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	甲基碘磺隆钠盐	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	烯草酮砷	clethodim sulfone	+	12.777	392.1	300.0	-11	-14	-22	164.0	-11	-26	-19
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	噻吡嘧磺隆	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	pyrifthalid	+	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	啶菌噁唑 ^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
161	嘧菌酯	azoxystrobin	+	16.199	404.1	372.1	-30	-25	-26	329.0	-30	-28	-23
162	啶酰菌胺	boscalid	+	16.185	343.0	307.1	-12	-18	-30	271.1	-12	-30	-26
163	禾草敌	molinat	+	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	丙炔嘧磺隆	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	吡嘧磺隆	pyrazosulfuron-ethyl	+	17.831	415.1	182.1	-21	-18	-19	139.1	-21	-42	-24
185	哒嗪硫磷	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	缬霉威 ^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
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	氯苯嘧啶醇	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	氰霜唑	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	噻呋酰胺	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	啞菌环胺	cyprodinil	+	21.191	226.1	93.1	-30	-34	-16	108.1	-30	-27	-19
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 metabo- lite 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	噁草酸甲酯	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 metabo- lite 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	氟虫腴	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
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	呱草丹	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	噁草酮	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	氟酰胺	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
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	烯禾啉	sethoxydim	+	23.821	328.1	178.1	-12	-19	-21	282.2	-12	-12	-22
324	氟氟虫脞	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	噁草酸	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	嘧啶肟草醚	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	trilalate	+	24.355	304.0	143.0	-15	-27	-25	86.0	-15	-17	-16
345	甲氰菊酯	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
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	-	23.525/23.75/ 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	生物苜蓿菊酯	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
376	环氧虫啉	cycloxaprid	+	5.320	323.0	126.0	-16	-22	-26	289.0	-13	-14	-28
377	氟吡呋喃酮	flupyradifurone	+	5.743	289.0	126.0	-14	-20	-24	99.0	-14	-44	-20
378	8-羟基灭草松	8-hydroxybentazone	-	5.762	255.0	108.0	17	27	18	106.0	17	25	19
379	灭草松	bentazone	-	6.147	239.1	132.1	11	26	22	197.0	11	19	19
380	噻酮磺隆	thiencarbazone-methyl	+	6.309	391.0	359.0	-14	-10	-24	130.0	-14	-15	-22
381	单啞磺隆	monosulfuron	+	6.883	338.1	136.1	-17	-19	-27	110.0	-12	-21	-21
382	氨唑草酮	amicarbazone	+	7.803	242.2/ 259.2	143.1	-26	-9	-15	143.1	-26	-9	-15
383	啞磺草胺	pyroxsulam	+	8.242	434.9	195.0	-16	-27	-20	194.1	-16	-36	-20
384	氟酮磺草胺	triafamone	+	9.117	407.0	245.0	-12	-25	-19	160.0	-12	-45	-18
385	甲酰氨基啞磺隆	foramsulfuron	+	9.220	453.1	182.0	-14	-22	-19	272.0	-13	-14	-21
386	胺苯磺隆	ethametsulfuron-methyl	+	10.266	411.1	196.1	-20	-16	-21	168.1	-20	-28	-17
387	氟氯吡啶酯	halauxifen-methyl	+	14.957	345.0	285.0	-10	-22	-22	250.0	-10	-33	-19
388	氟噻唑吡乙酮	oxathiapiprolin	+	17.219	540.0	500.0	-26	-25	-32	163.0	-26	-52	-28
389	脱硫丙硫菌唑	prothioconazole-desthio	+	17.824	312.0/ 314.0	70.1	-16	-23	-27	70.1	-16	-22	-27
390	氟醚菌酰胺	fluopimomide	+	18.283	417.0	207.0	-15	-30	-15	399.0	-15	-18	-15
391	茚草酮	indanofan	+	18.548	341.1	175.1	-17	-15	-17	187.1	-17	-12	-19

392	四氯虫酰胺	tetrachlorantraniliprole	+	18.304	537.9 /535.9	319.7	-20	-15	-24	317.7	-20	-18	-24
393	杀虫畏	tetrachlorvinphos	+	19.329	366.9	127.2	-11	-16	-27	205.9	-11	-36	-22
394	环溴虫酰胺	cyclaniliprole	+	20.399	603.9 /601.9	285.9	-30	-19	-22	283.9	-30	-19	-22
395	异丙酯草醚	pyribambenz- isopropyl	+	23.215	424.0	364.0	-12	-15	-28	185.0	-12	-30	-22
396	氯啶菌酯	triclopyricarbe	+	23.528	393.0 /391.0	194.1	-11	-10	-11	194.1	-11	-10	-11
397	羟基-灭螨醌	acequinocyl-hydroxy	+	27.033	343.0	189.0	-16	-22	-13	171.0	-17	-32	-19
398	灭螨醌	acequinocyl	+	27.647	402.2	343.2	-16	-13	-13	189.1	-16	-30	-13

注：° 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。以农药定量用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

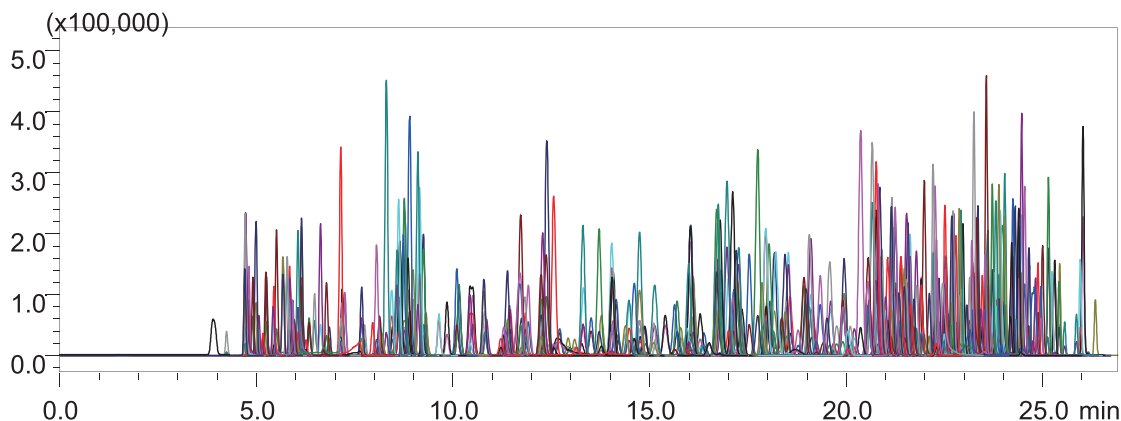
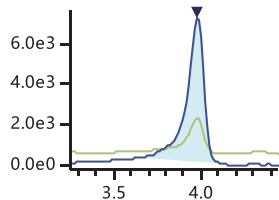
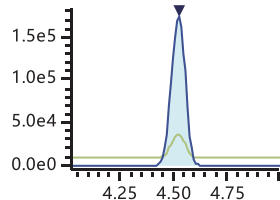


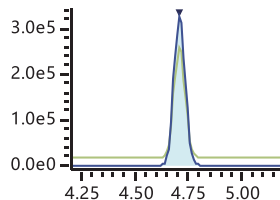
图 1 葡萄基质中 352 种农药及其代谢物 MRM 色谱图 (加标浓度 0.01 mg/L)

Q 142.05>94.00(+) 7.32e3
 RT=3.978


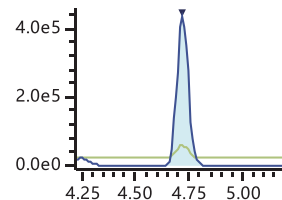
1. 甲胺磷

 Q 184.20>143.00(+) 1.75e5
 RT=4.525


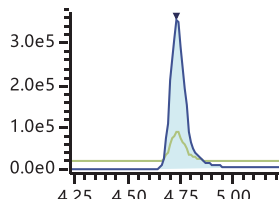
2. 乙酰甲胺磷

 Q 214.10>183.00(+) 3.28e5
 RT=4.708


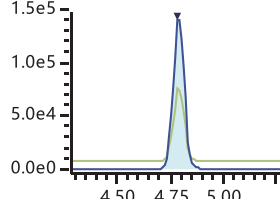
3. 氧乐果

 Q 163.00>72.10(+) 4.38e5
 RT=4.719


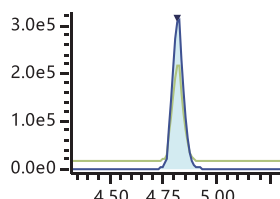
4. 杀线威钠

 Q 189.20>102.05(+) 3.59e5
 RT=4.732


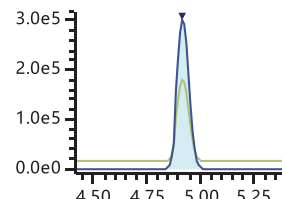
5. 霜霉威

 Q 207.00>89.00(+) 1.41e5
 RT=4.789


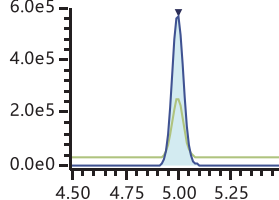
6. 涕灭威亚砷

 Q 203.10>129.10(+) 3.14e5
 RT=4.817


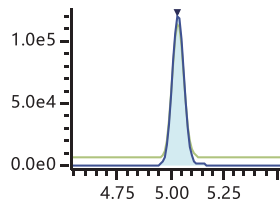
7. 呋虫胺

 Q 240.10>148.00(+) 3.03e5
 RT=4.917


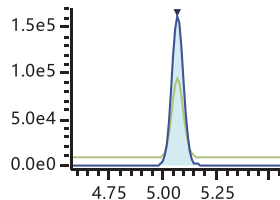
8. 涕灭威砷

 Q 237.10>72.00(+) 5.70e5
 RT=4.996


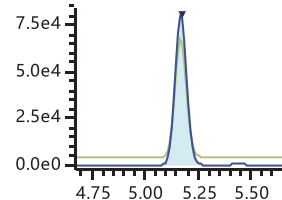
9. 杀线威

 Q 271.10>126.00(+) 1.20e5
 RT=5.033


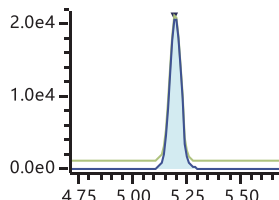
10. 烯啶虫胺

 Q 247.00>169.00(+) 1.63e5
 RT=5.071


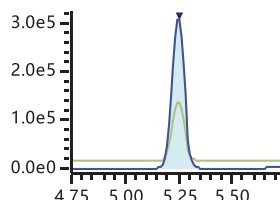
11. 亚砷磷

 Q 263.00>168.95(+) 8.02e4
 RT=5.173


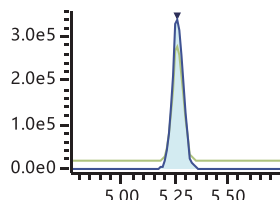
12. 吸吸磷

 Q 230.10>203.05(+) 2.08e4
 RT=5.195


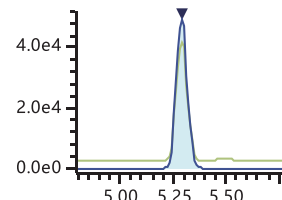
13. 氟啶虫酰胺

 Q 292.00>211.10(+) 3.09e5
 RT=5.250


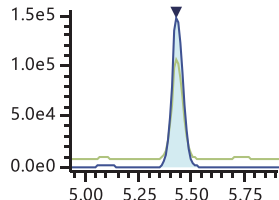
14. 噻虫嗪

 Q 163.05>88.00(+) 3.41e5
 RT=5.262


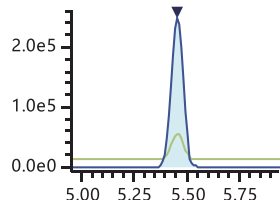
15. 灭多威

 Q 224.10>193.00(+) 4.95e4
 RT=5.289


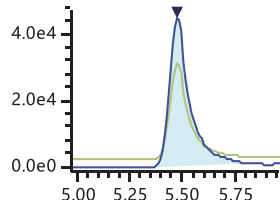
16. 久效磷

 Q 238.00>112.10(+) 1.48e5
 RT=5.435


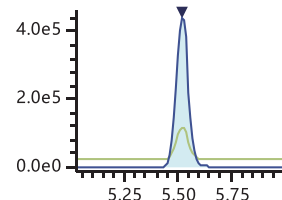
17. 百治磷

 Q 228.00>168.00(+) 2.50e5
 RT=5.453


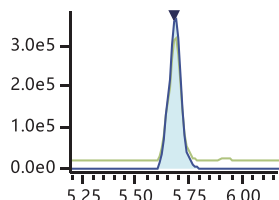
18. 甲基硫环磷

 Q 197.10>46.20(+) 4.50e4
 RT=5.474


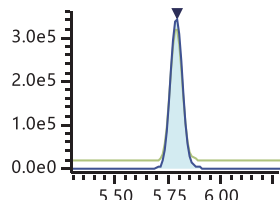
19. 杀虫脒

 Q 464.00>302.00(+) 4.42e5
 RT=5.521


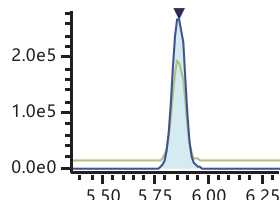
20. 螺虫乙酯-烯醇-葡萄糖苷

 Q 256.05>209.05(+) 3.66e5
 RT=5.686


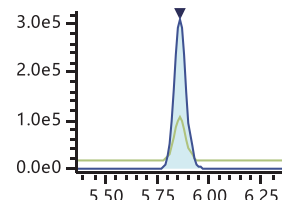
21. 吡虫啉

 Q 250.00>169.10(+) 3.43e5
 RT=5.792


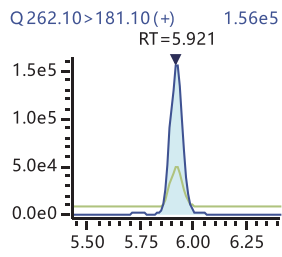
22. 噻虫胺

 Q 242.10>185.10(+) 2.71e5
 RT=5.862


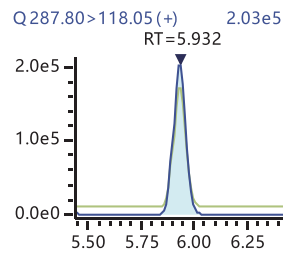
23. 甲硫威亚砷

 Q 326.10>129.10(+) 3.12e5
 RT=5.858


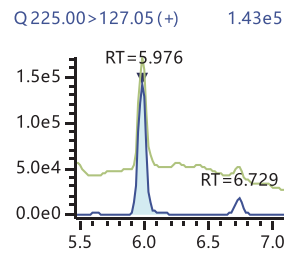
24. 啉啉砷草胺



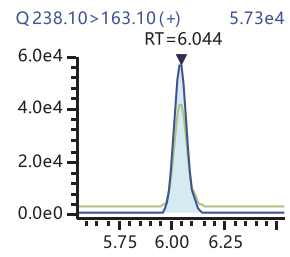
25. 氯噻啉



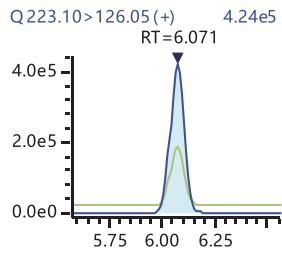
26. 蚜灭磷



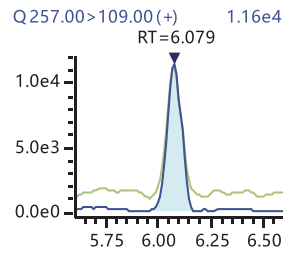
27. 速灭磷*



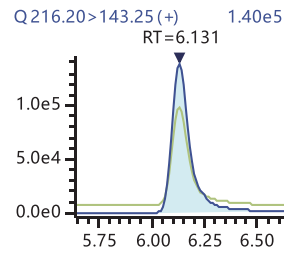
28. 3-羟基克百威



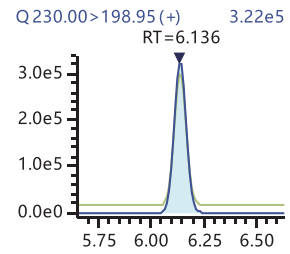
29. 啉虫脒



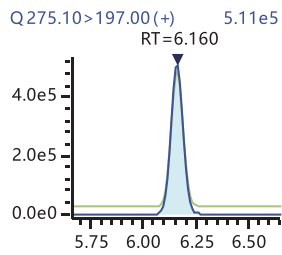
30. 敌百虫



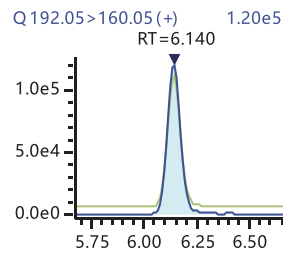
31. 胺鲜酯



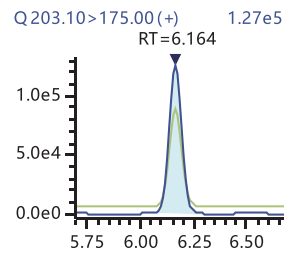
32. 乐果



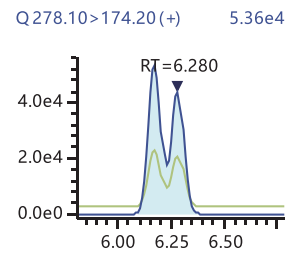
33. 内吸磷-S-亚砷



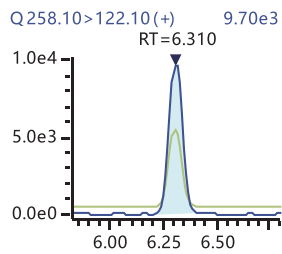
34. 多菌灵



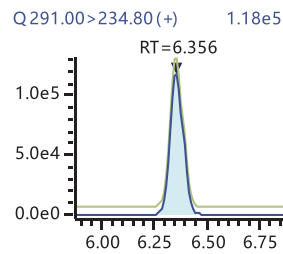
35. 苯噻草酮



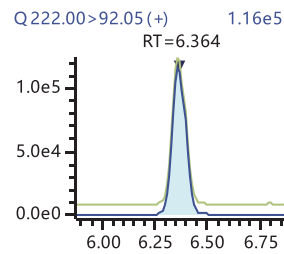
36. 氟啶虫胺脒*



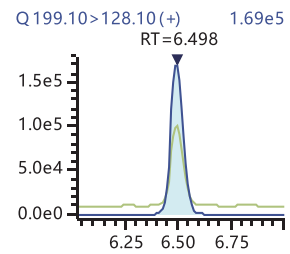
37. 甲硫威砷



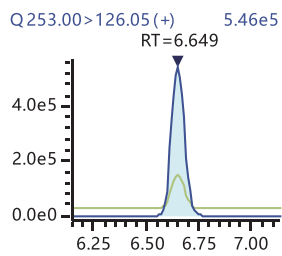
38. 内吸磷-S-砷



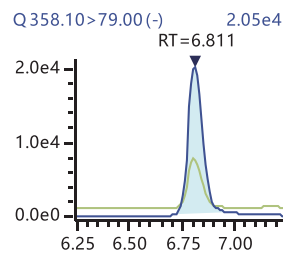
39. 杀草敏



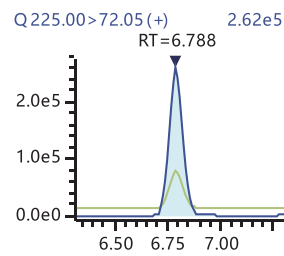
40. 霜腺甙



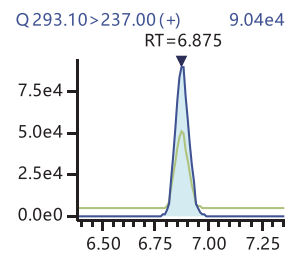
41. 噻虫啉



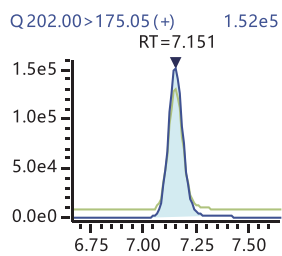
42. 异噁唑草酮-二酮脒



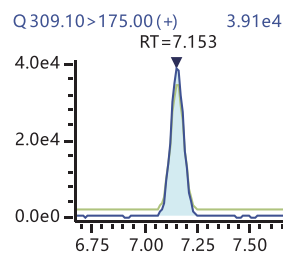
43. 脱甲基抗蚜威



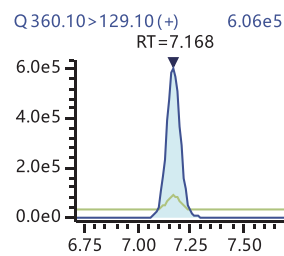
44. 氧丰索磷



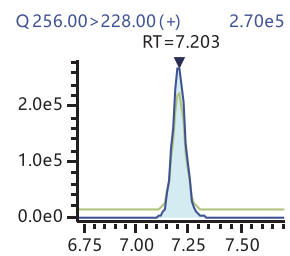
45. 噻菌灵



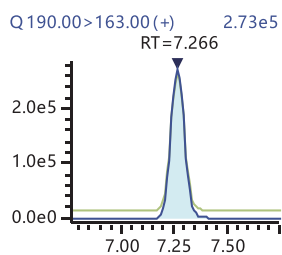
46. 氧丰索磷砷



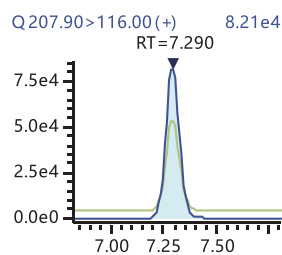
47. 双氟磺草胺



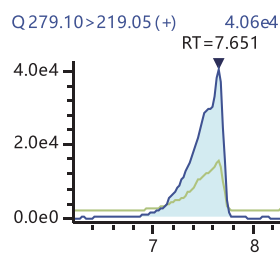
48. 硫环磷



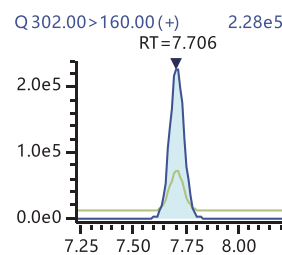
49.三环唑



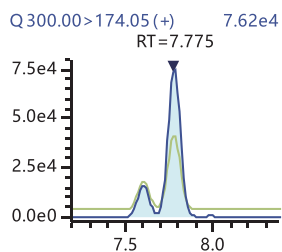
50.涕灭威



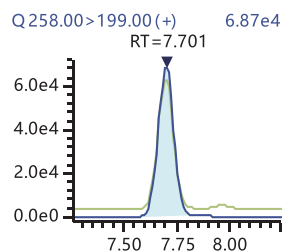
51.噁霜灵



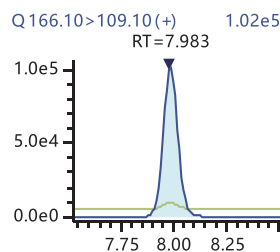
52.氧亚胺硫磷



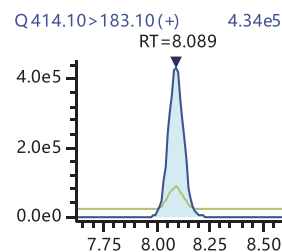
53.磷胺*



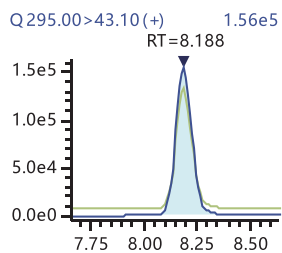
54.安硫磷



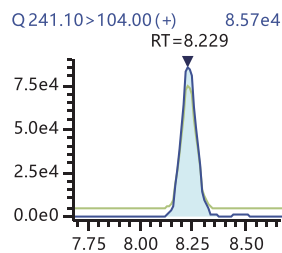
55.速灭威



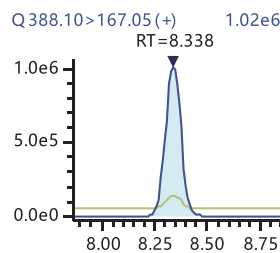
56.醚磺隆



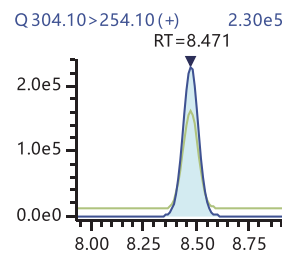
57.氟菌唑代谢物 FM-6-1



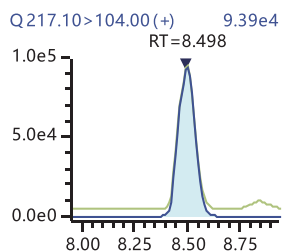
58.氟草津



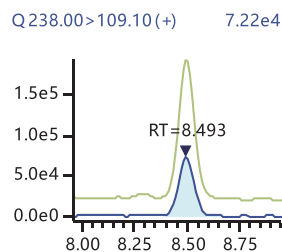
59.噁吩磺隆



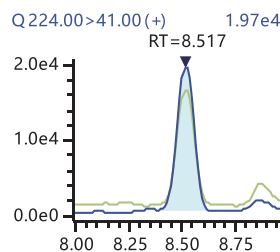
60.螺虫乙酯-单-羟基



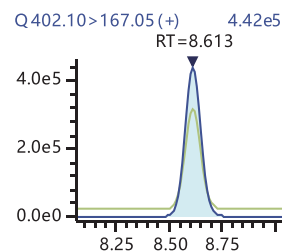
61.氟烯菌酯



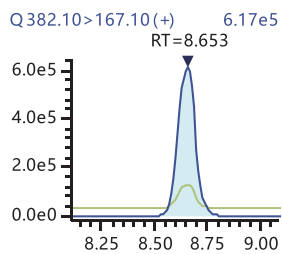
62.敌敌畏



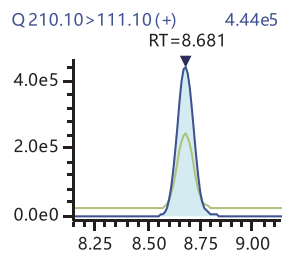
63.烯丙苯噻唑



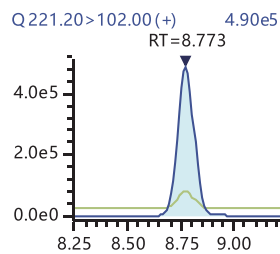
64.醚苯磺隆



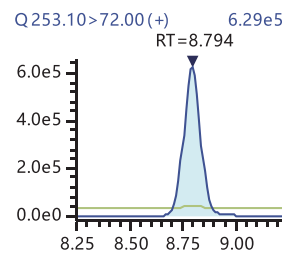
65.甲磺隆



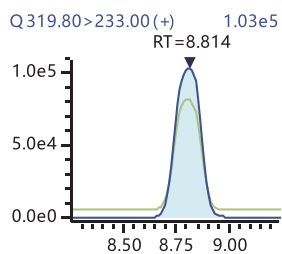
66.残杀威



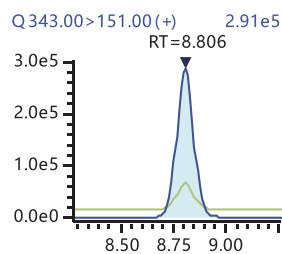
67.噁苯隆



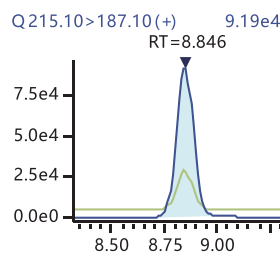
68.脱甲基甲酰胺基抗蚜威



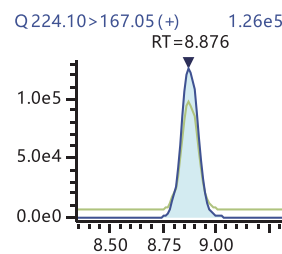
69.苯线磷亚砷



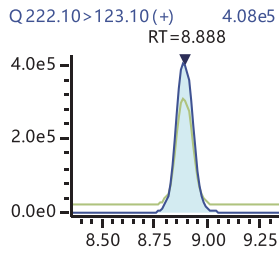
70.甲基硫菌灵



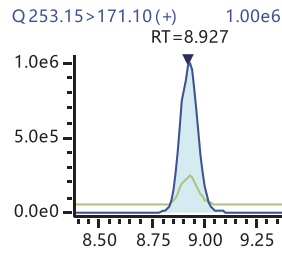
71.噁草酮



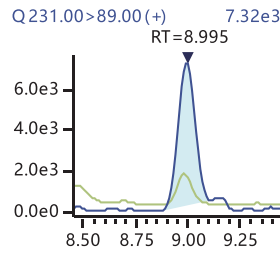
72.噁虫威



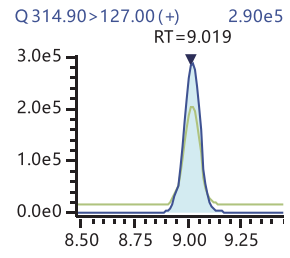
73.克百威



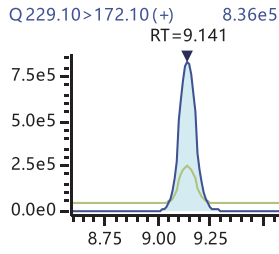
74.环磷酮



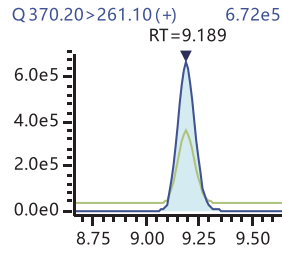
75.甲基内吸磷



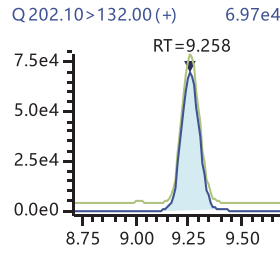
76.马拉氧磷



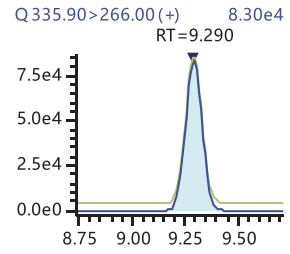
77.丁噻隆



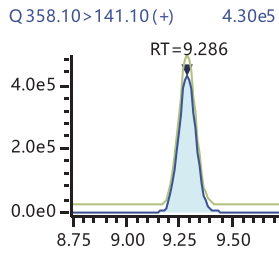
78.酰肼磷隆



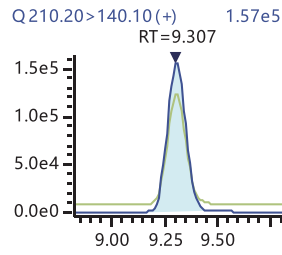
79.西玛津



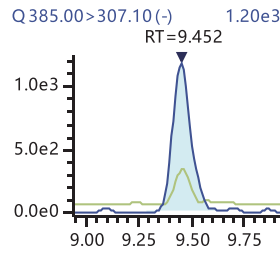
80.苯线磷砷



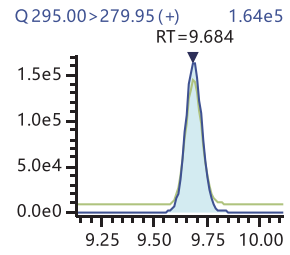
81.氯磺隆



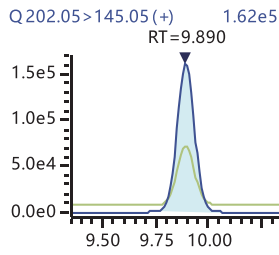
82.乙嘧酚



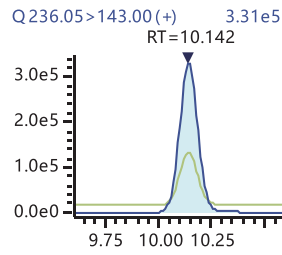
83.甲磺草胺



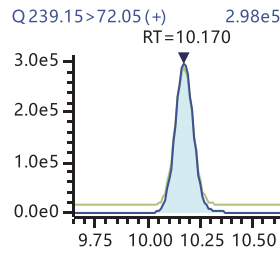
84.倍硫磷亚砷



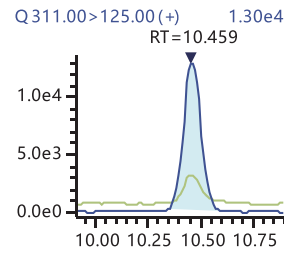
85.甲萘威



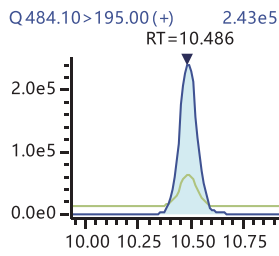
86.萎锈灵



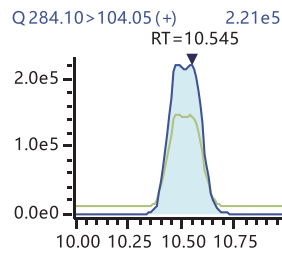
87.抗蚜威



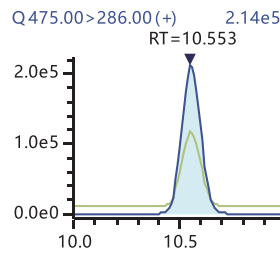
88.倍硫磷砷



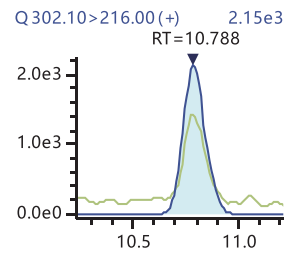
89.五氟磺草胺



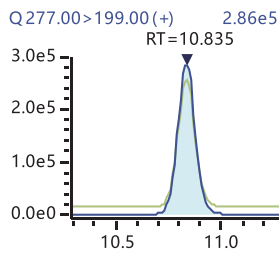
90.噻唑磷



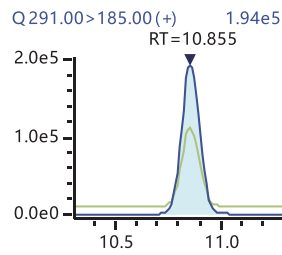
91.溴氟虫酰胺



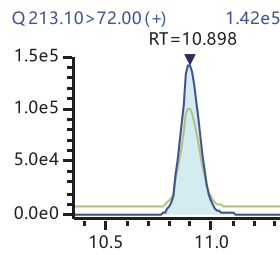
92.螺虫乙酯-烯醇



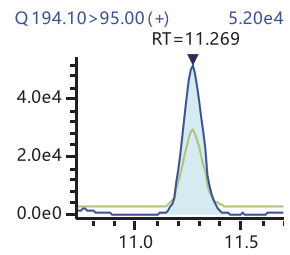
93.甲拌磷亚砷



94.乙拌磷亚砷

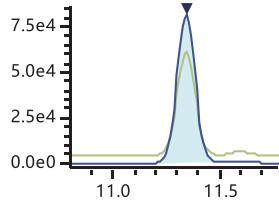


95.绿麦隆



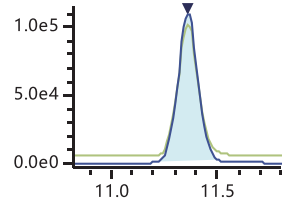
96.异丙威

Q 306.80>96.90(+) 8.24e4
RT=11.344



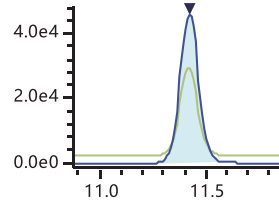
97.乙拌磷砒

Q 214.20>96.15(+) 1.10e5
RT=11.361



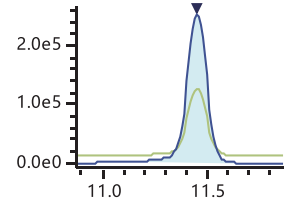
98.西草净

Q 293.00>171.05(+) 4.61e4
RT=11.422



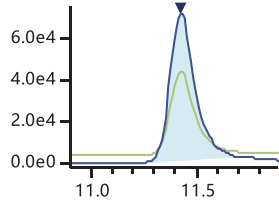
99.甲拌磷砒

Q 446.00>195.00(+) 2.54e5
RT=11.450



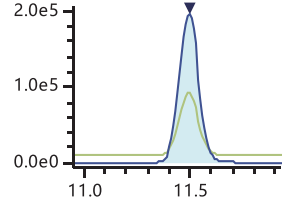
100.三氟甲磺隆

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



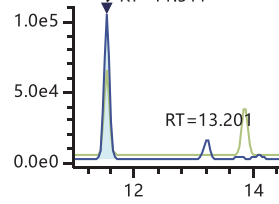
101.抑霉唑

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



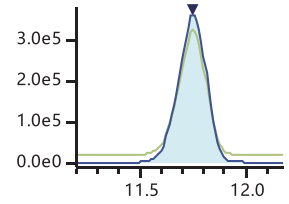
102.粉唑醇

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



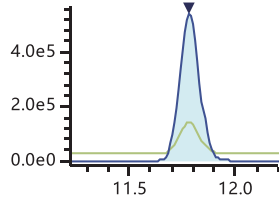
103.虫螨畏*

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



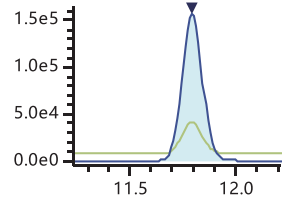
104.吡唑草胺

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



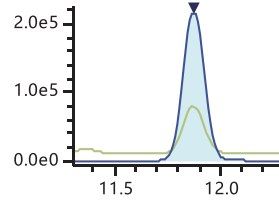
105.甲基二磺隆

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



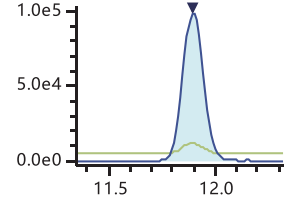
106.异丙隆

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



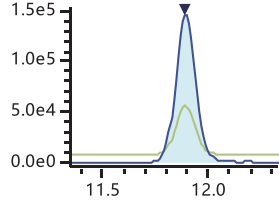
107.莠去津

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



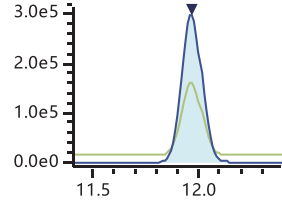
108.氯苯胺灵

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



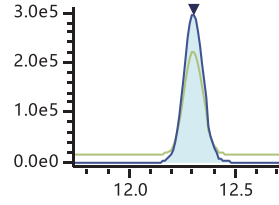
109.毒草胺

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



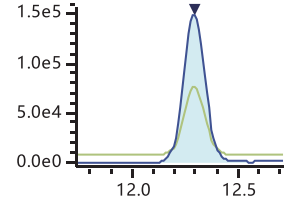
110.甲霜灵

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



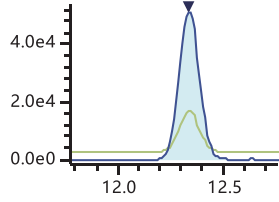
111.三索磷

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



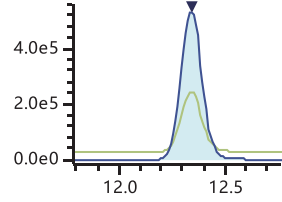
112.敌草隆

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



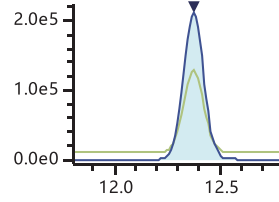
113.庚烯磷

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



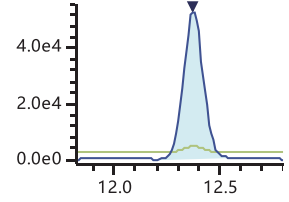
114.氯吡脞

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



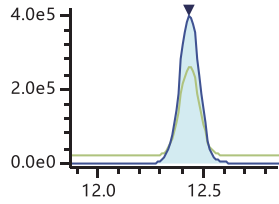
115.苯磺隆

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



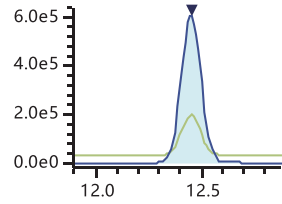
116.异噁唑草酮

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



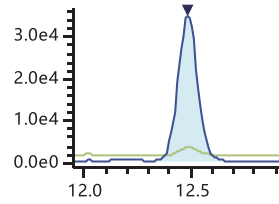
117.噁苯胺磺隆

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



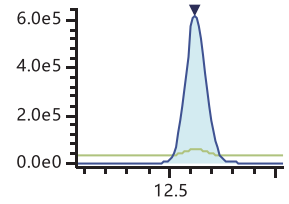
118.螺虫乙酯-酮基-羟基

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

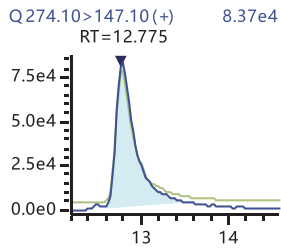


119.水胺硫磷

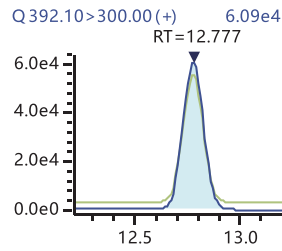
Q 507.90>167.00(+) 6.22e5
RT=12.622



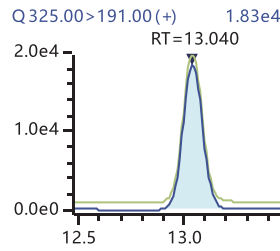
120.甲基磺隆钠盐



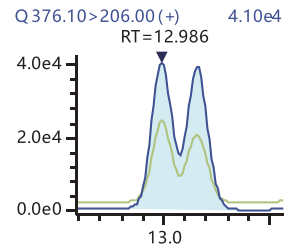
121.苯锈啉



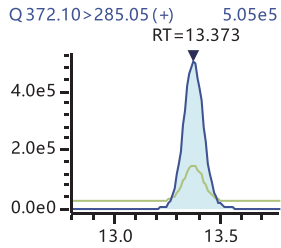
122.烯草酮砒



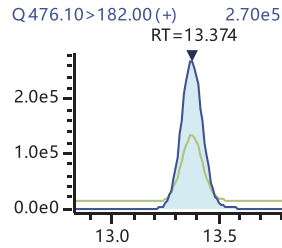
123.丰索磷砒



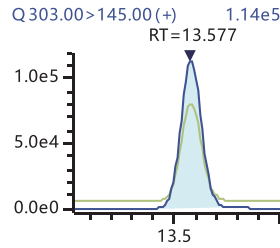
124.烯草酮亚砒*



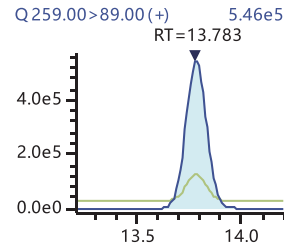
125.氟吗琳



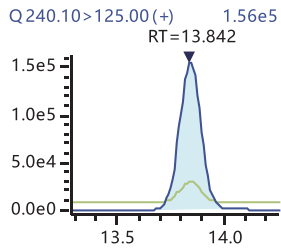
126.噻吡嘧磺隆



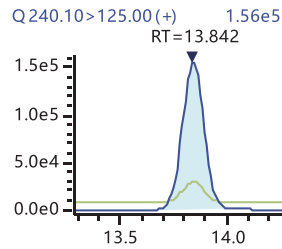
127.杀扑磷



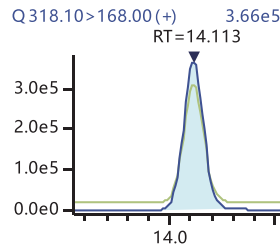
128.内吸磷



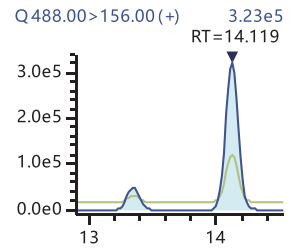
129.异噁草酮



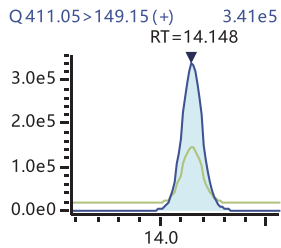
130.仲丁威



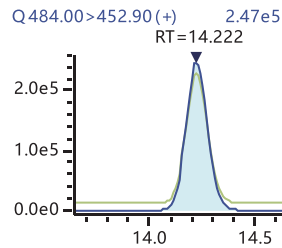
131.甜菜宁



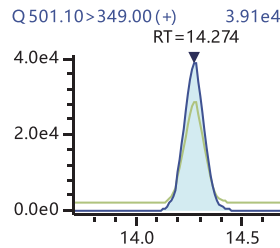
132.氟吡嘧磺隆*



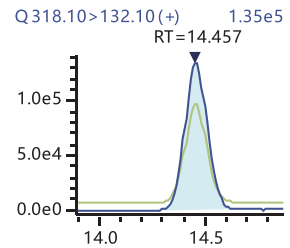
133.苜嘧磺隆



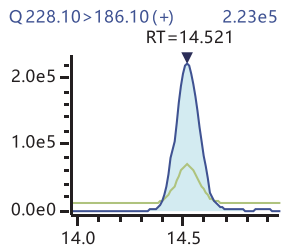
134.氯虫苯甲酰胺



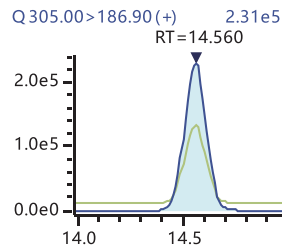
135.苯嘧磺草胺



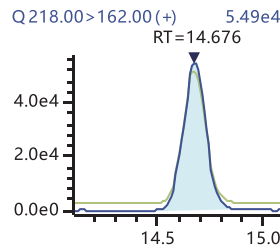
136.保棉磷



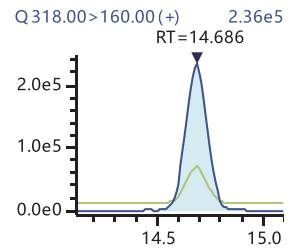
137.莠灭净



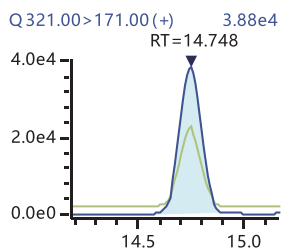
138.特丁硫磷亚砒



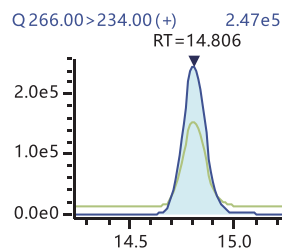
139.敌稗



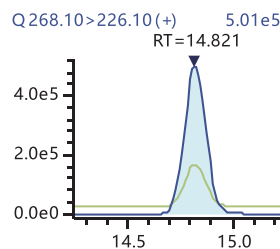
140.亚胺硫磷



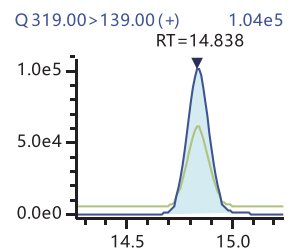
141.特丁硫磷砒



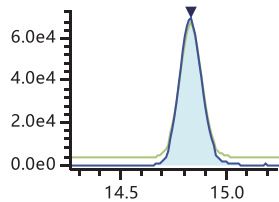
142.丙硫多菌灵



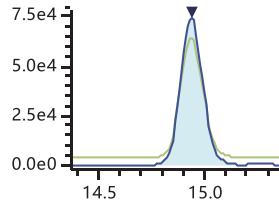
143.乙霉威



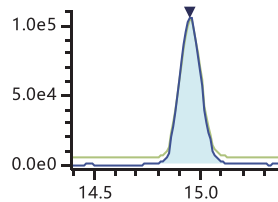
144.环酯草醚

Q 249.00>160.10(+) 6.98e4
 RT=14.829


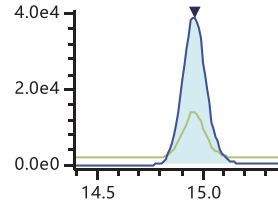
145.利谷隆

 Q 272.00>198.00(+) 7.48e4
 RT=14.937


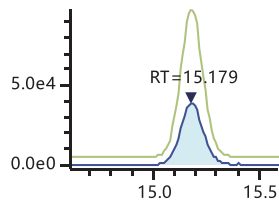
146.草除灵

 Q 304.10>241.10(+) 1.06e5
 RT=14.951


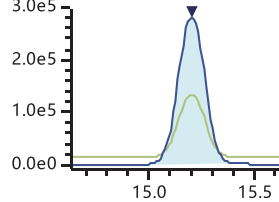
147.乙氧呋草黄

 Q 200.10>107.00(+) 3.91e4
 RT=14.960


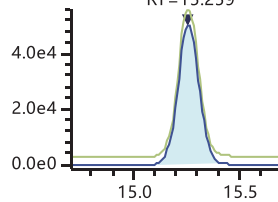
148.啉霉胺

 Q 226.10>169.10(+) 3.87e4
 RT=15.179


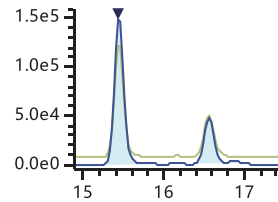
149.甲硫威

 Q 276.10>244.10(+) 2.82e5
 RT=15.201


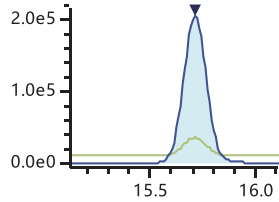
150.二甲吩草胺

 Q 397.00>255.00(+) 5.03e4
 RT=15.259


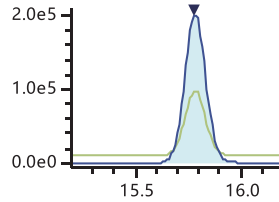
151.乙虫腓

 Q 289.10>151.10(+) 1.52e5
 RT=15.430


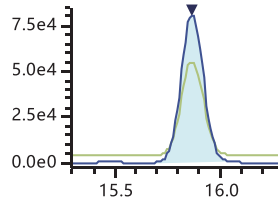
152.啉菌噻唑*

 Q 230.10>174.10(+) 2.06e5
 RT=15.712


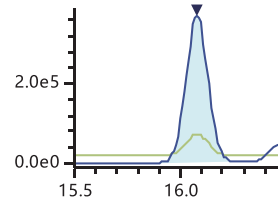
153.特丁津

 Q 334.10>247.10(+) 2.01e5
 RT=15.783


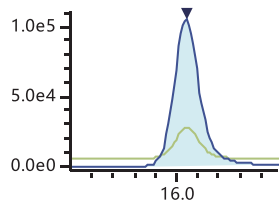
154.咪草酮

 Q 208.20>109.10(+) 8.08e4
 RT=15.866


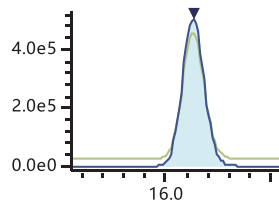
155.猛杀威

 Q 294.10>70.05(+) 3.73e5
 RT=16.078


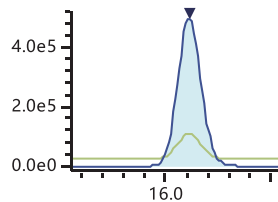
156.多效唑

 Q 304.20>147.20(+) 1.06e5
 RT=16.045


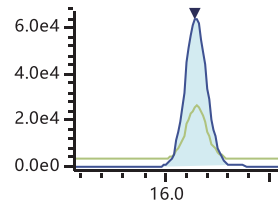
157.丁苯吗啉

 Q 312.10>236.10(+) 5.07e5
 RT=16.128


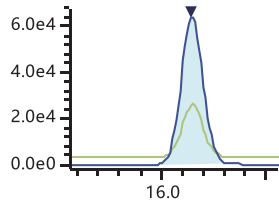
158.咪唑菌酮

 Q 435.00>182.00(+) 4.96e5
 RT=16.110


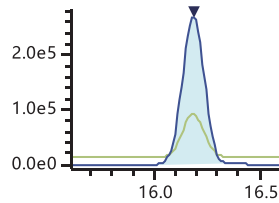
159.氯吡嘧磺隆

 Q 266.10>229.00(+) 6.41e4
 RT=16.144


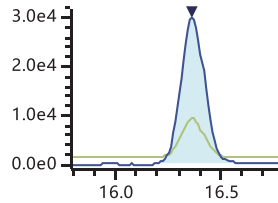
160.啉菌腓

 Q 266.10>229.00(+) 6.41e4
 RT=16.144


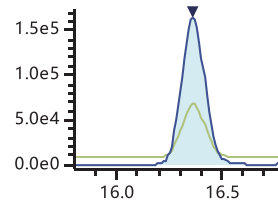
161.啉菌酯

 Q 343.00>307.10(+) 2.70e5
 RT=16.185


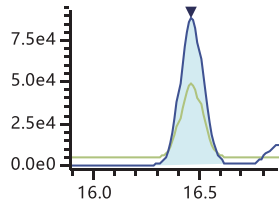
162.啉酰菌胺

 Q 188.10>126.10(+) 3.02e4
 RT=16.363


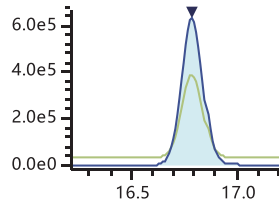
163.禾草敌

 Q 256.10>189.95(+) 1.66e5
 RT=16.365


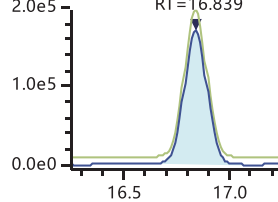
164.炔苯酰草胺

 Q 292.10>70.05(+) 8.93e4
 RT=16.463


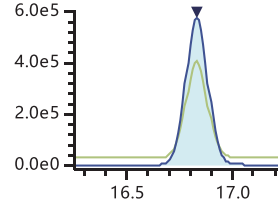
165.环丙唑醇

 Q 399.10>261.00(+) 6.36e5
 RT=16.786


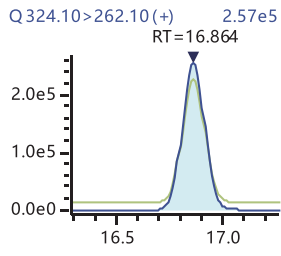
166.乙氧磺隆

 Q 294.10>69.15(+) 1.72e5
 RT=16.839


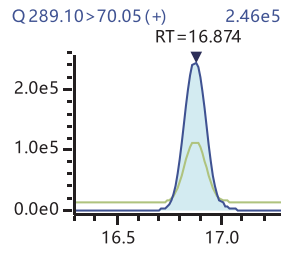
167.三唑酮

 Q 382.00>362.10(+) 5.81e5
 RT=16.831


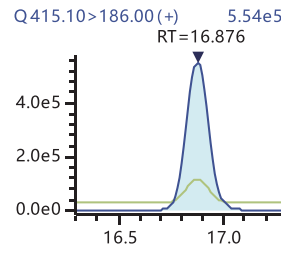
168.氟啉唑酰胺



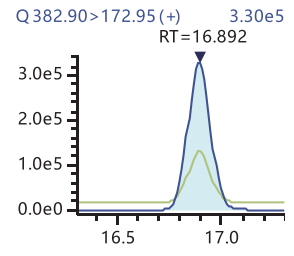
169.氟酰胺



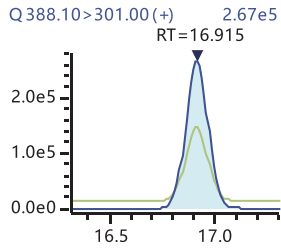
170.腈菌唑



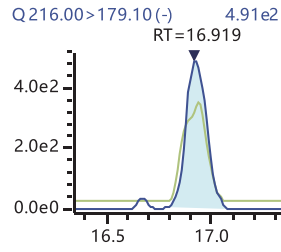
171.氯嘧磺隆



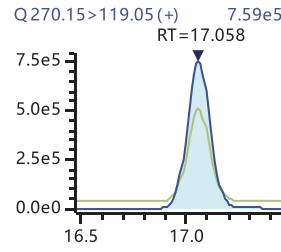
172.氟吡菌胺



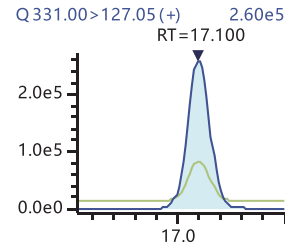
173.烯酰吗啉



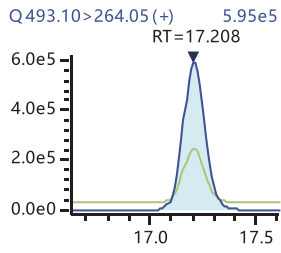
174.氟霜唑代谢物 CCIM



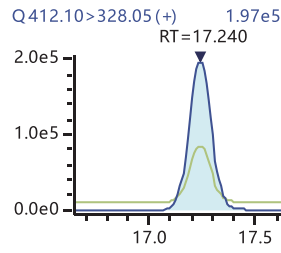
175.灭锈胺



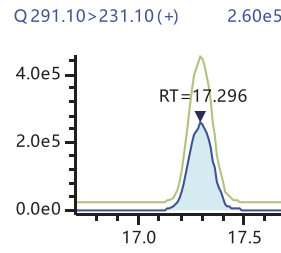
176.马拉硫磷



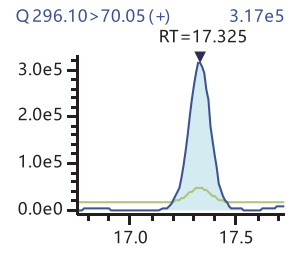
177.氟胺磺隆



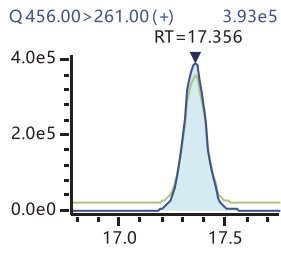
178.双炔酰菌胺



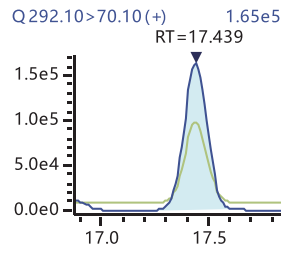
179.稻瘟灵



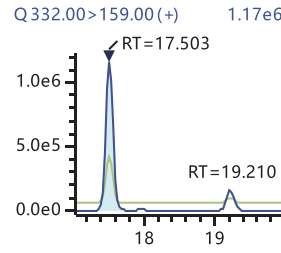
180.三唑醇



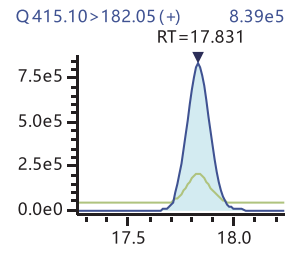
181.丙炔噁磺隆



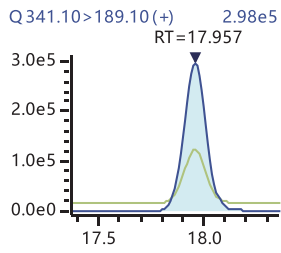
182.烯效唑



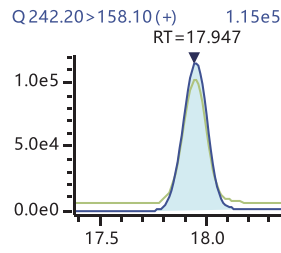
183.氟唑环菌胺*



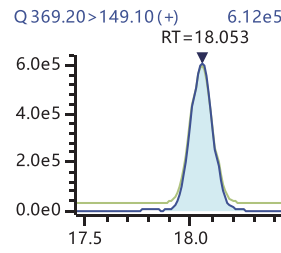
184.吡嘧磺隆



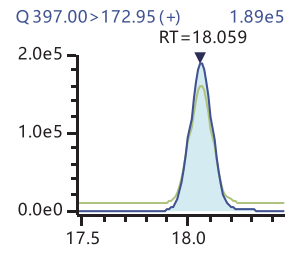
185.哒嗪磺隆



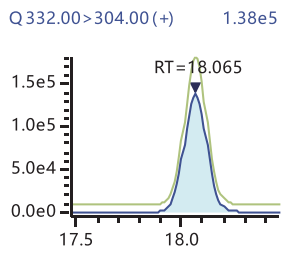
186.扑草净



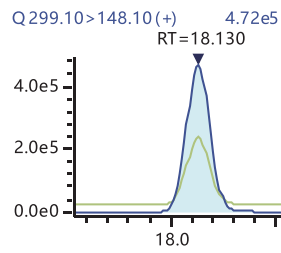
187.甲氧虫酰肼



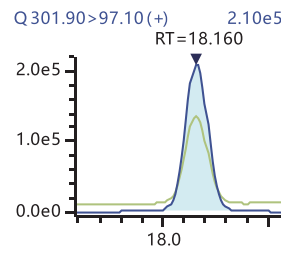
188.氟吡菌酰胺



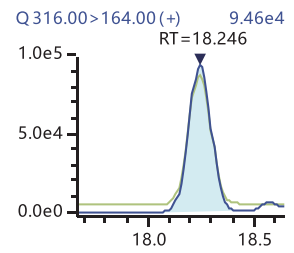
189.胺苯吡菌酮



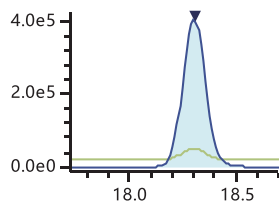
190.苯噻酰草胺



191.环酰菌胺

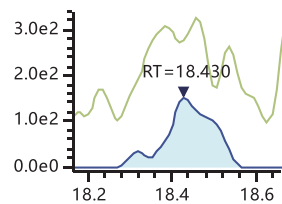


192.氯唑磷

Q 318.10>70.05(+) 4.05e5
 RT=18.304


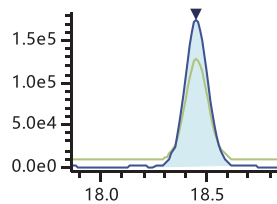
193. 灭菌唑

Q 284.00>256.00(+) 1.51e2



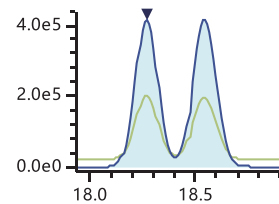
194. 腐霉利

Q 243.10>131.00(+) 1.75e5

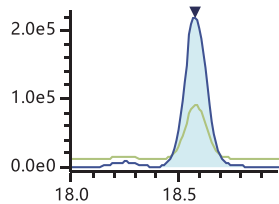


195. 灭线磷

Q 321.20>119.10(+) 4.17e5

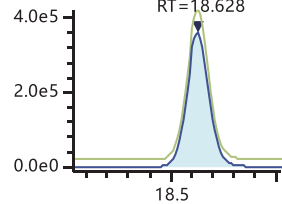


196. 缬霉威*

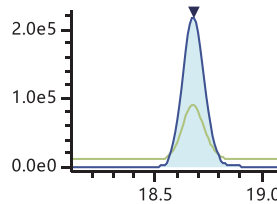
 Q 314.05>162.15(+) 2.21e5
 RT=18.583


197. 三唑磷

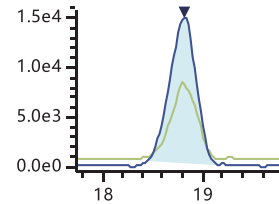
Q 364.00>152.10(+) 3.59e5



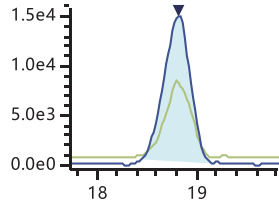
198. 氟噻草胺

 Q 372.00>159.05(+) 2.19e5
 RT=18.679


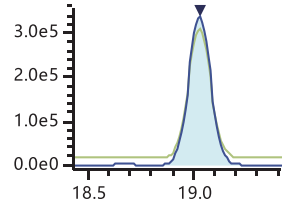
199. 四氟醚唑

 Q 270.10>224.10(+) 1.51e4
 RT=18.826


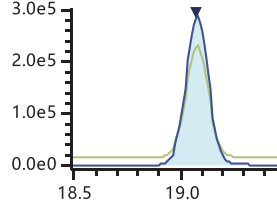
200. 乙草胺

 Q 270.10>224.10(+) 1.51e4
 RT=18.826


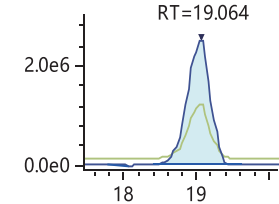
201. 氯苯嘧啶醇

 Q 374.00>302.00(+) 3.41e5
 RT=19.028


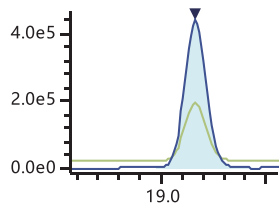
202. 螺虫乙酯

 Q 272.20>129.15(+) 2.89e5
 RT=19.078


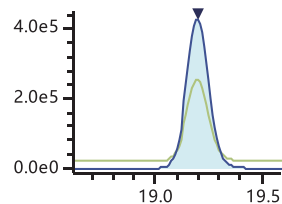
203. 敌草胺

 Q 270.10>238.05(+) 2.98e6
 RT=19.064


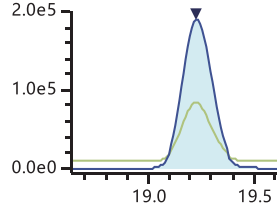
204. 甲草胺

 Q 330.10>121.20(+) 4.45e5
 RT=19.162


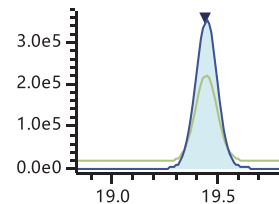
205. 氟环唑

 Q 422.20>261.00(+) 4.28e5
 RT=19.201


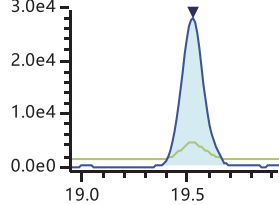
206. 环丙嘧磺隆

 Q 284.10>252.10(+) 1.91e5
 RT=19.227


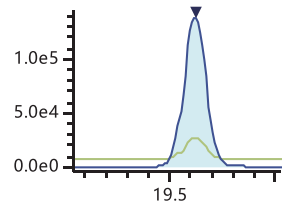
207. 异丙甲草胺

 Q 395.30>175.10(+) 3.56e5
 RT=19.444


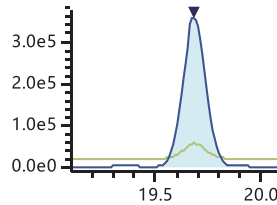
208. 环虫酰胺

 Q 330.10>245.00(+) 2.82e4
 RT=19.526


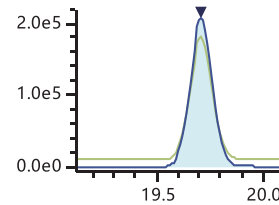
209. 异菌脲

 Q 387.00>351.00(-) 1.39e5
 RT=19.623


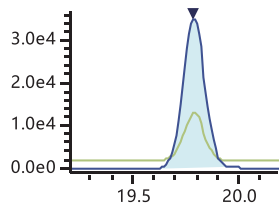
210. 氟甲脲

 Q 325.00>108.05(+) 3.59e5
 RT=19.682


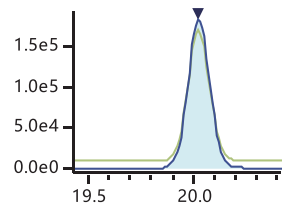
211. 氟霜唑

 Q 336.90>125.05(+) 2.08e5
 RT=19.710


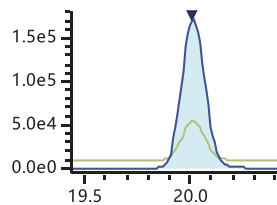
212. 腈苯唑

 Q 528.80>148.00(+) 3.50e4
 RT=19.783


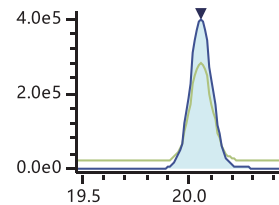
213. 噻唑酰胺

 Q 304.10>217.10(+) 1.85e5
 RT=20.025


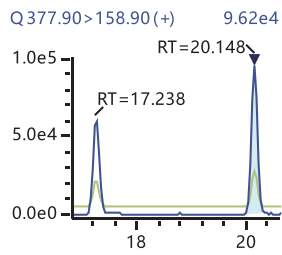
214. 苯线磷

 Q 311.00>158.00(+) 1.72e5
 RT=20.012


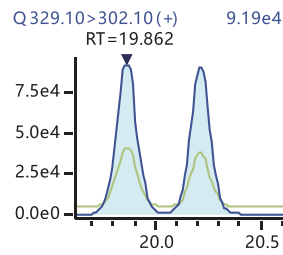
215. 除虫脲

 Q 316.10>247.10(+) 4.00e5
 RT=20.055


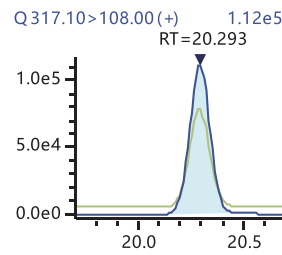
216. 氟硅唑



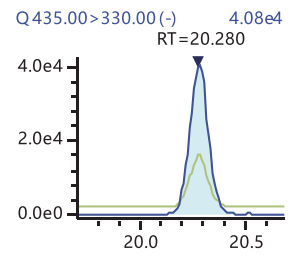
217. 糠菌唑



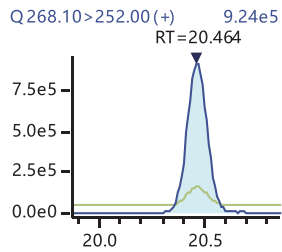
218. 稻瘟酰胺*



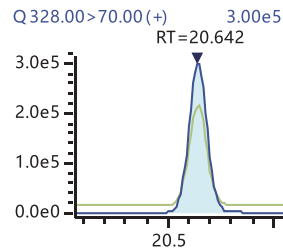
219. 乙唑啉磷酸酯



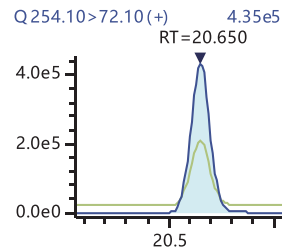
220. 氟虫脞



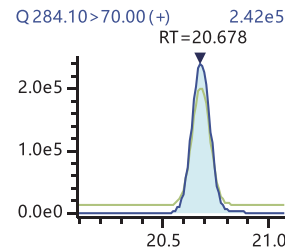
221. 硅噻菌胺



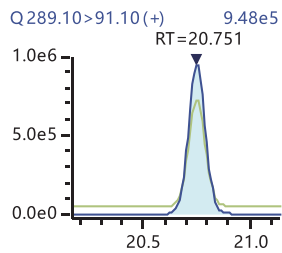
222. 苯氧三唑醇



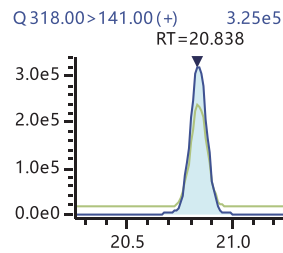
223. 苯硫威



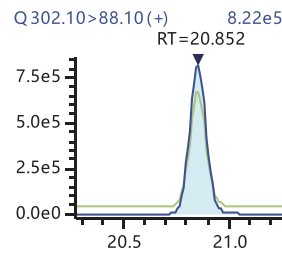
224. 戊唑啉



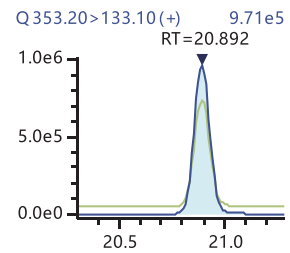
225. 异稻瘟净



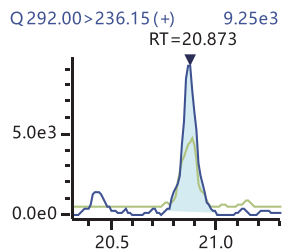
226. 氟唑菌苯胺



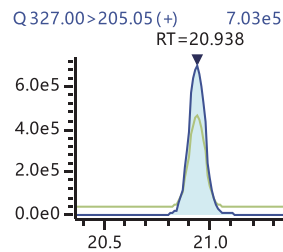
227. 苯氧威



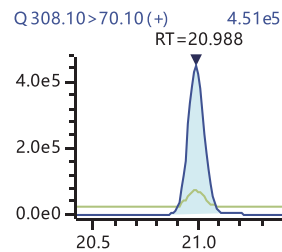
228. 虫酰肼



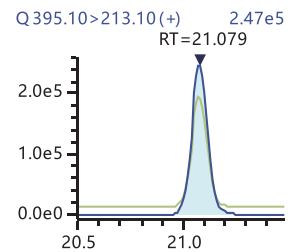
229. 对硫磷



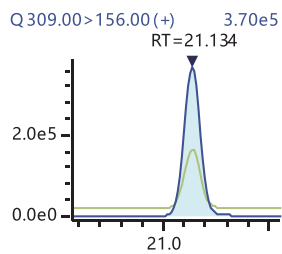
230. 醚菌胺



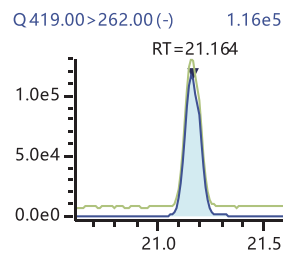
231. 戊唑醇



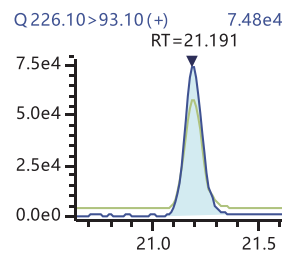
232. 鱼藤酮



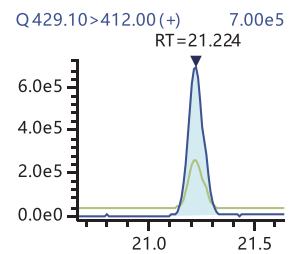
233. 灭幼脲



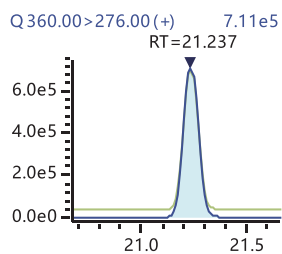
234. 氟虫脞硫醚



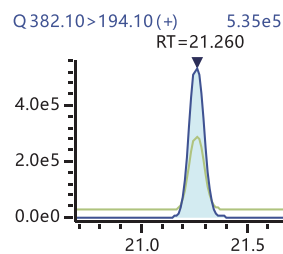
235. 啉菌环胺



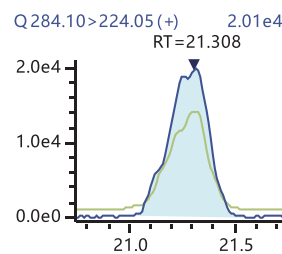
236. 唑草酮



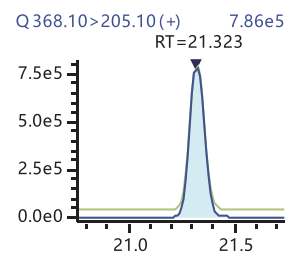
237. 吡噻菌胺



238. 唑啉菌酯

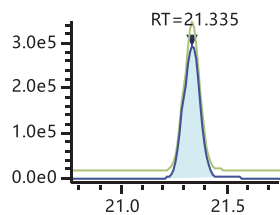


239. 异丙草胺



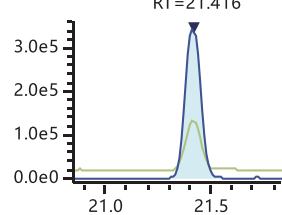
240. 啉氧菌酯

Q 299.00>163.05(+) 2.94e5



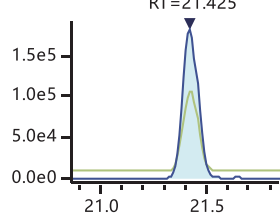
241. 噻硫磷

Q 332.10>230.95(+) 3.44e5



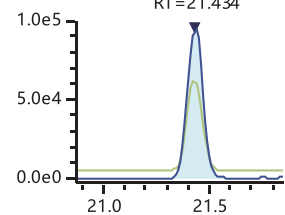
242. 甲基异柳磷

Q 321.00>246.95(+) 1.83e5



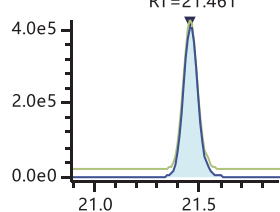
243. 稻丰散

Q 314.10>222.20(+) 9.50e4



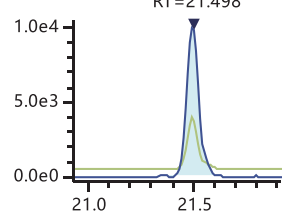
244. 醚菌酯

Q 353.00>308.00(+) 4.04e5



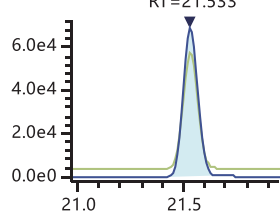
245. 咪鲜胺-脱咪唑甲酰胺基

Q 681.00>254.05(-) 1.00e4



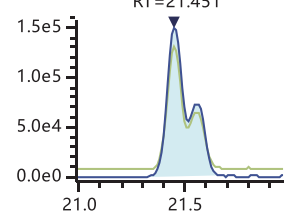
246. 氟苯虫酰胺

Q 404.00>274.10(+) 6.94e4



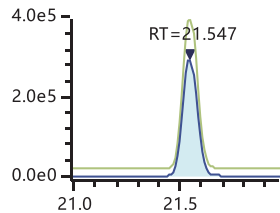
247. 噁草酸甲酯

Q 342.05>159.10(+) 1.50e5



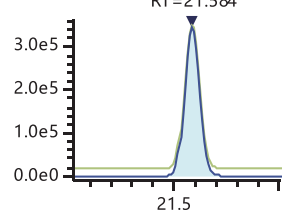
248. 丙环唑

Q 323.00>115.00(+) 2.90e5



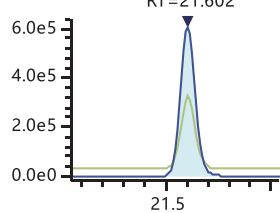
249. 治螟磷

Q 325.00>282.05(+) 3.48e5



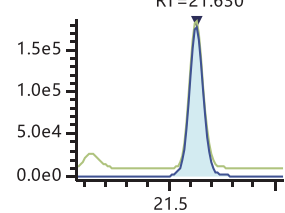
250. 咪鲜胺-脱氨基咪唑

Q 335.80>187.00(+) 6.08e5



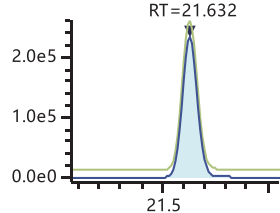
251. 苯酰菌胺

Q 311.00>282.95(+) 1.77e5



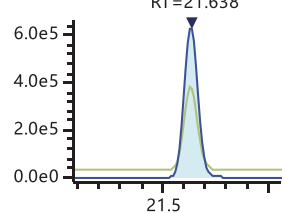
252. 敌瘟磷

Q 293.00>265.00(+) 2.35e5



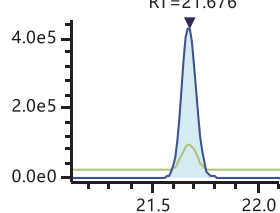
253. 乙嘧硫磷

Q 368.00>199.00(+) 6.32e5



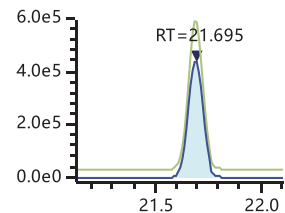
254. 莎稗磷

Q 314.10>70.20(+) 4.31e5



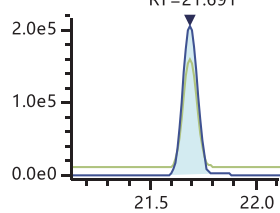
255. 己唑醇

Q 326.20>148.20(+) 4.33e5



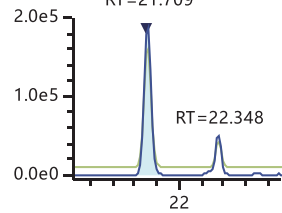
256. 苯霜灵

Q 398.00>342.00(+) 2.06e5



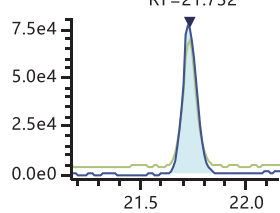
257. 苯并烯氟菌唑

Q 358.90>155.10(+) 1.90e5



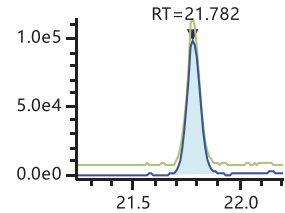
258. 毒虫畏

Q 247.10>109.00(+) 7.73e4



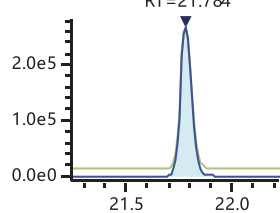
259. 地虫硫磷

Q 279.20>169.05(+) 9.89e4



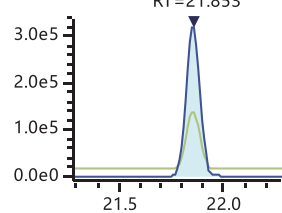
260. 倍硫磷

Q 451.00>415.00(-) 2.69e5



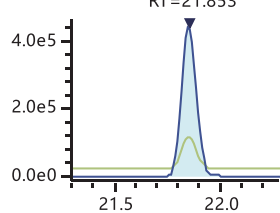
261. 氟虫腈砒

Q 385.20>242.10(+) 3.21e5



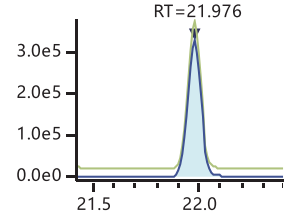
262. 丁吡吗啉

Q 320.00>70.10(+) 4.45e5

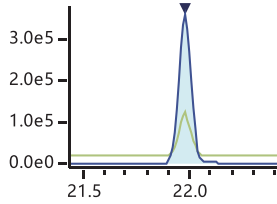


263. 叶菌唑

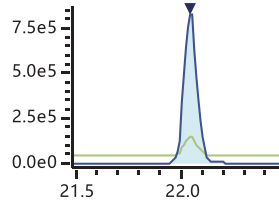
Q 305.00>169.10(+) 3.36e5



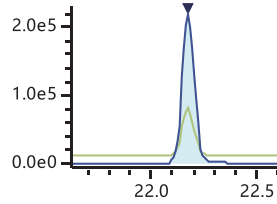
264. 二嗪磷

Q 413.00>339.00(+) 3.63e5
 RT=21.977


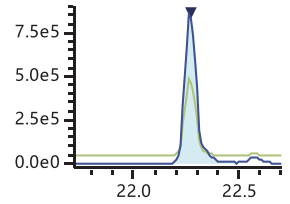
265. 吡草醚

 Q 376.00>308.00(+) 8.31e5
 RT=22.044


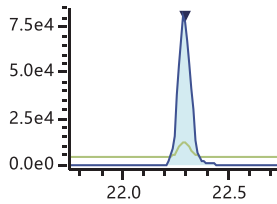
266. 咪鲜胺

 Q 363.00>227.00(+) 2.21e5
 RT=22.175


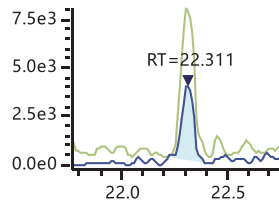
267. 蝇毒磷

 Q 359.10>156.00(+) 8.60e5
 RT=22.269


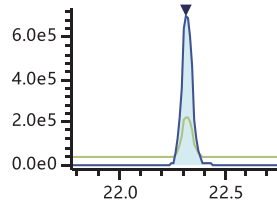
268. 杀铃脲

 Q 261.00>75.00(+) 8.13e4
 RT=22.291


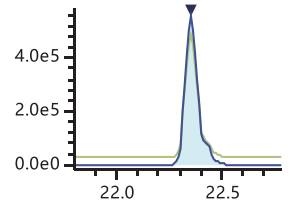
269. 甲拌磷

 Q 340.90>150.85(+) 4.02e3
 RT=22.311


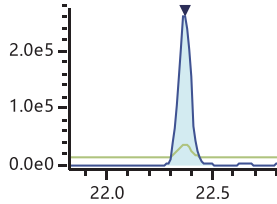
270. 丙炔噁草酮

 Q 392.00>331.00(+) 7.05e5
 RT=22.318


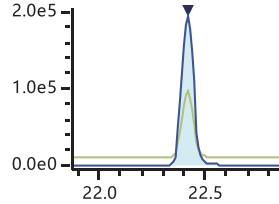
271. 噁唑菌酮

 Q 338.20>269.15(+) 5.60e5
 RT=22.352


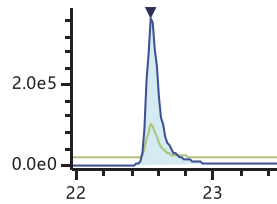
272. 联苯三唑醇

 Q 326.10>70.00(+) 2.62e5
 RT=22.368


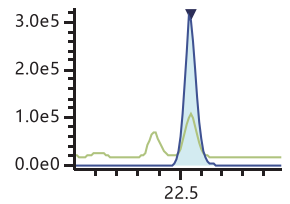
273. 烯唑醇

 Q 368.00>182.05(+) 1.96e5
 RT=22.416


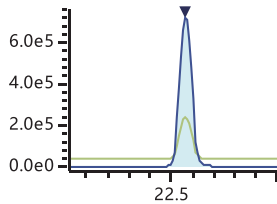
274. 伏杀硫磷

 Q 732.40>142.00(+) 3.72e5
 RT=22.547


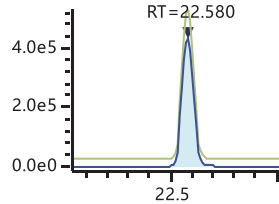
275. 多杀霉素 A

 Q 306.05>108.10(+) 3.15e5
 RT=22.549


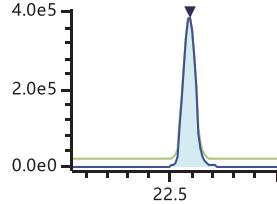
276. 甲基嘧啶磷

 Q 271.10>159.00(+) 7.20e5
 RT=22.567


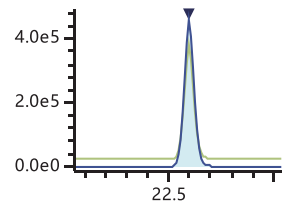
277. 硫线磷

 Q 388.10>194.05(+) 4.30e5
 RT=22.580


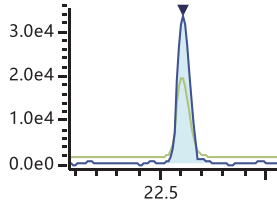
278. 吡唑醚菌酯

 Q 276.20>176.10(+) 3.88e5
 RT=22.589


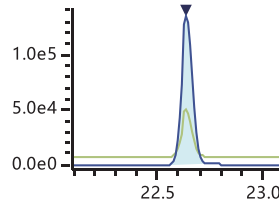
279. 唑啉菌胺

 Q 413.20>295.05(+) 4.69e5
 RT=22.598


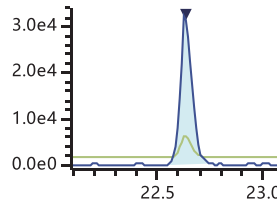
280. 环氟菌胺

 Q 301.10>125.20(+) 3.37e4
 RT=22.611


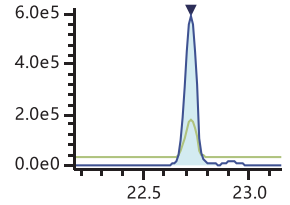
281. 甲基枯磷

 Q 299.00>77.10(+) 1.36e5
 RT=22.638


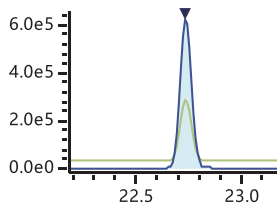
282. 辛硫磷

 Q 275.15>89.10(+) 3.25e4
 RT=22.633


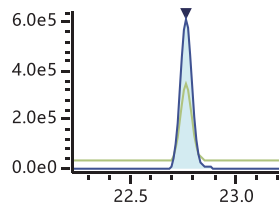
283. 乙拌磷

 Q 329.10>125.05(+) 5.98e5
 RT=22.721


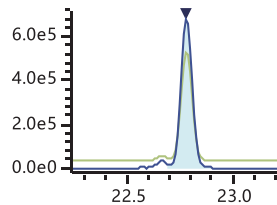
284. 戊菌隆

 Q 413.10>205.10(+) 6.27e5
 RT=22.733


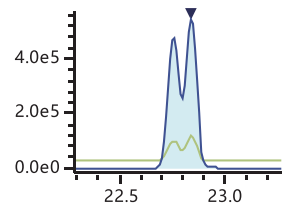
285. 唑菌酯

 Q 409.00>209.10(+) 6.16e5
 RT=22.769


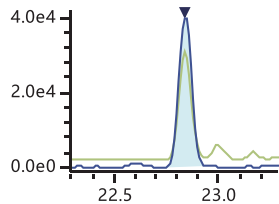
286. 苯菌酮

 Q 360.10>244.00(+) 6.80e5
 RT=22.781


287. 吡唑萘菌胺*

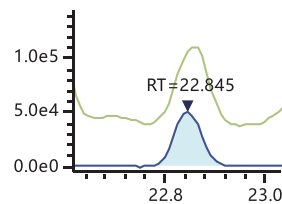
 Q 406.10>251.00(+) 5.47e5
 RT=22.837


288. 苯醚甲环唑*

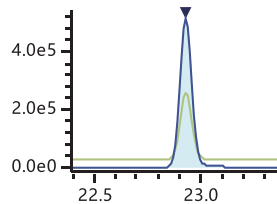
Q 321.90>125.05 (+) 4.00e4
 RT=22.838


289.甲基毒死蜱

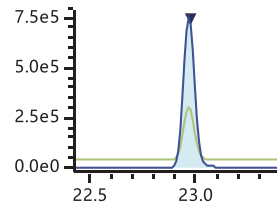
Q 359.00>310.00 (+) 5.10e4



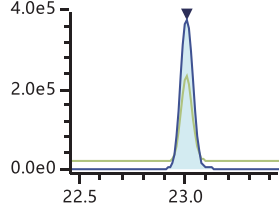
290.甲羧除草醚

 Q 303.00>138.05 (+) 5.17e5
 RT=22.932


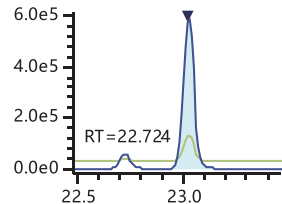
291.四螨嗪

 Q 364.10>199.00 (+) 7.51e5
 RT=22.972


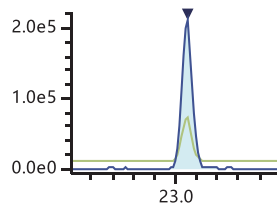
292.苯螨特

 Q 264.10>146.10 (+) 3.77e5
 RT=23.008


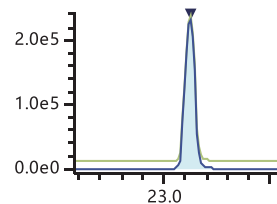
293.呋草丹

 Q 334.20>70.10 (+) 5.87e5
 RT=23.025


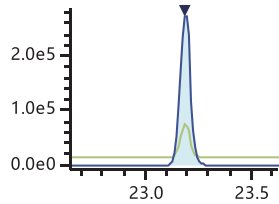
294.种菌唑*

 Q 346.05>73.10 (+) 2.14e5
 RT=23.056


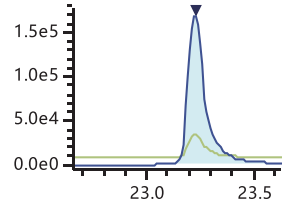
295.氟菌唑

 Q 528.10>293.00 (+) 2.33e5
 RT=23.122


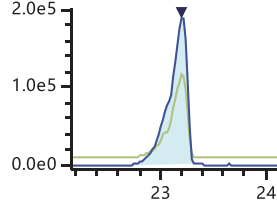
296.杀虫威

 Q 395.10>266.00 (+) 2.75e5
 RT=23.191


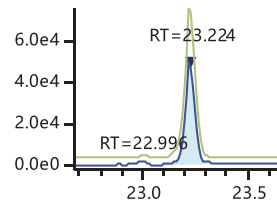
297.吡氟酰草胺

 Q 746.40>142.00 (+) 1.69e5
 RT=23.228


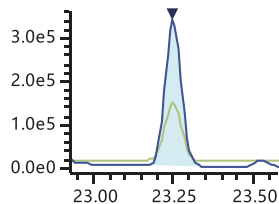
298.多杀霉素 D

 Q 312.20>252.15 (+) 1.92e5
 RT=23.202


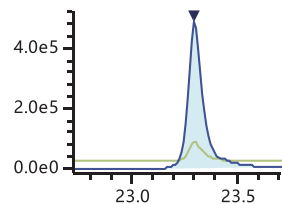
299.丙草胺

 Q 324.00>156.85 (+) 4.95e4
 RT=23.224


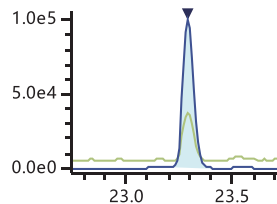
300.苯硫磷

 Q 326.20>280.20 (+) 3.45e5
 RT=23.249


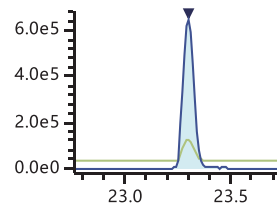
301.噻草酮

 Q 748.50>142.05 (+) 4.98e5
 RT=23.302


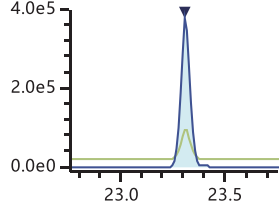
302.乙基多杀菌素 J

 Q 373.20>161.05 (+) 1.01e5
 RT=23.294


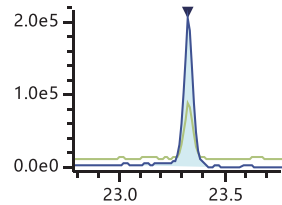
303.除虫菊素 2

 Q 465.10>344.00 (+) 6.49e5
 RT=23.302


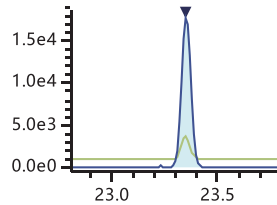
304.乙羧氟草醚

 Q 409.10>186.05 (+) 3.79e5
 RT=23.311


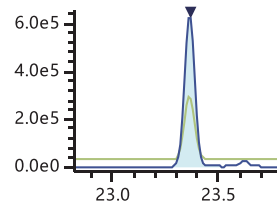
305.脐菌酯

 Q 360.15>164.10 (+) 2.06e5
 RT=23.330


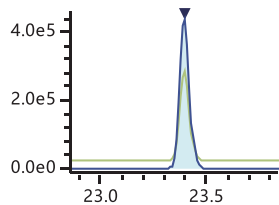
306.烯草酮

 Q 459.00>438.90 (-) 1.79e4
 RT=23.349


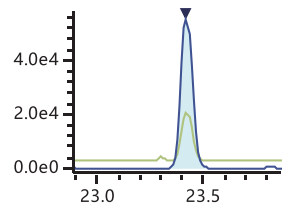
307.氟铃脲

 Q 252.00>91.00 (+) 6.27e5
 RT=23.367


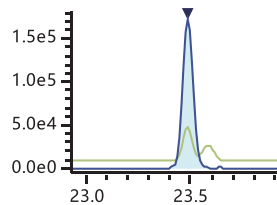
308.苄草丹

 Q 493.00>158.00 (+) 4.40e5
 RT=23.399


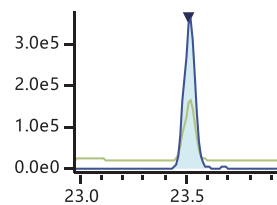
309.氟酰胺

 Q 466.00>227.00 (+) 5.56e4
 RT=23.423


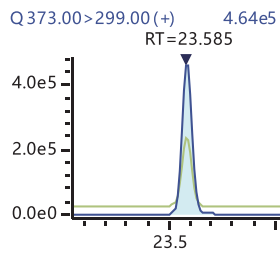
310.吡唑磺菌胺

 Q 372.90>302.80 (+) 1.73e5
 RT=23.486


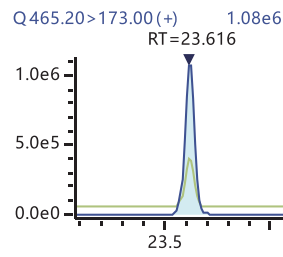
311.丙溴磷

 Q 362.10>288.00 (+) 3.64e5
 RT=23.514


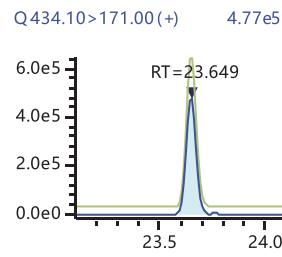
312.噁唑禾草灵



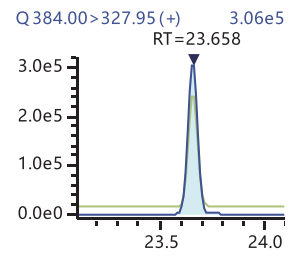
313.噻禾灵



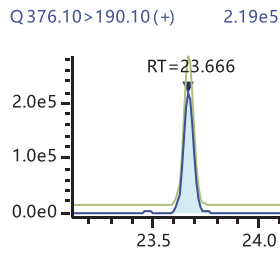
314.丁氟螨酯



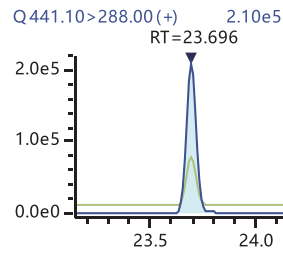
315.烯肟菌胺



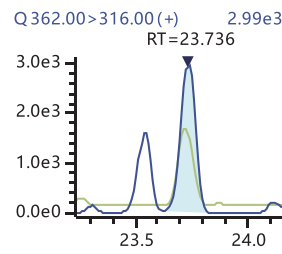
316.吡氟禾草灵



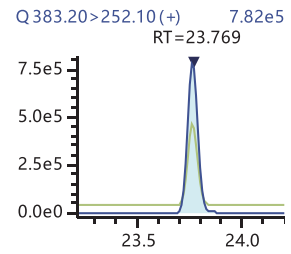
317.噁嗪草酮



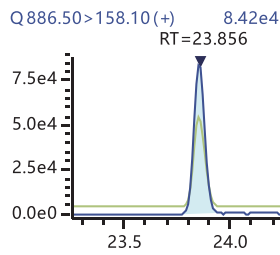
318.噁唑酰草胺



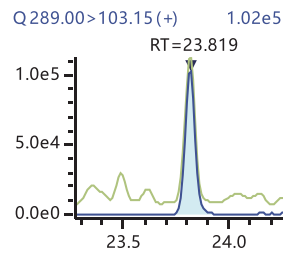
319.乙氧氟草醚



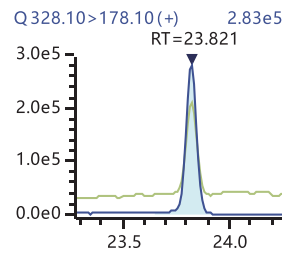
320.吡线威



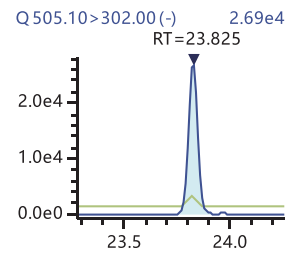
321.氨基阿维菌素苯甲酸盐



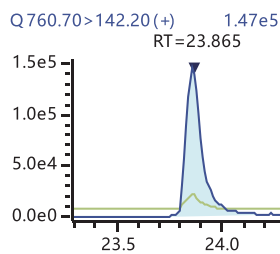
322.特丁硫磷



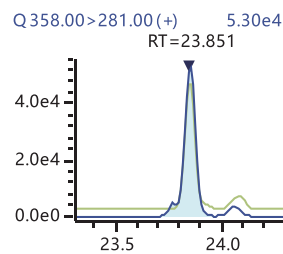
323.烯禾啶



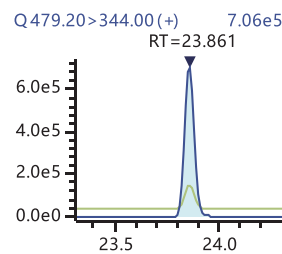
324.氟氟虫脞



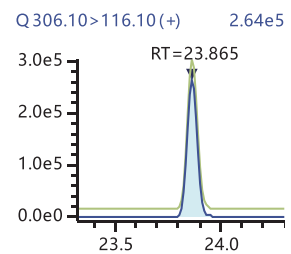
325.乙基多杀菌素 L



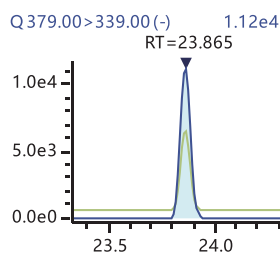
326.禾草灵



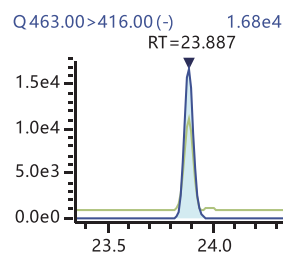
327.乳氟禾草灵



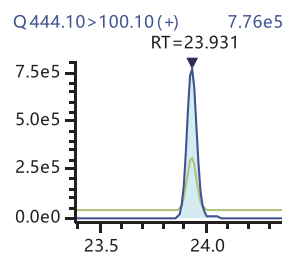
328.噁嗪酮



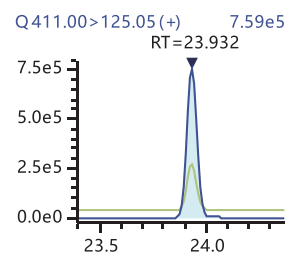
329.氟苯脲



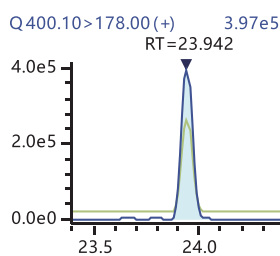
330.氟吡啶胺



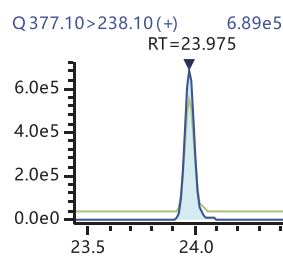
331.噁草酸



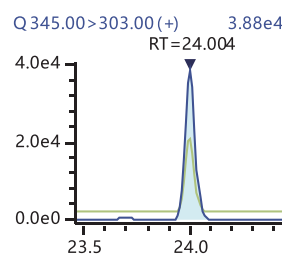
332.亚胺唑



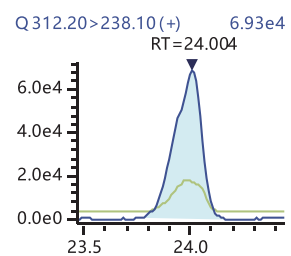
333.烯肟菌酯



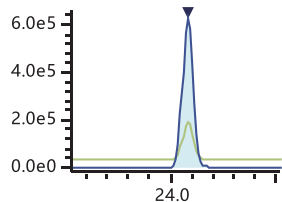
334.氟吡酰草胺



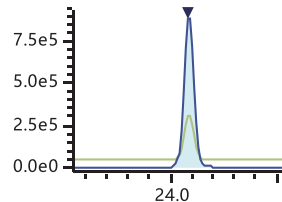
335.噁草酮



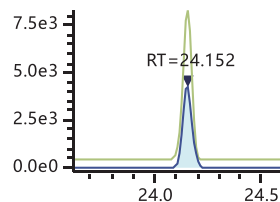
336.丁草胺

Q 384.10>197.10(+) 6.30e5
 RT=24.080


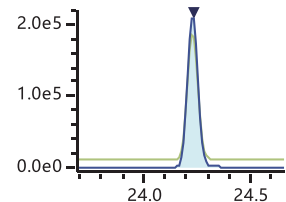
337.啮虫酰胺

 Q 356.30>177.10(+) 8.92e5
 RT=24.085


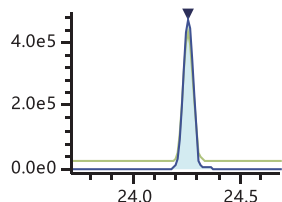
338.增效醚

 Q 509.00>326.00(-) 4.19e3
 RT=24.152


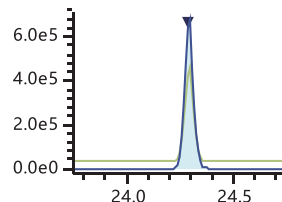
339.虱螨脲

 Q 610.10>413.10(+) 2.10e5
 RT=24.232


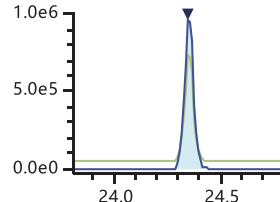
340.啞啞脲草醚

 Q 437.10>205.10(+) 4.75e5
 RT=24.258


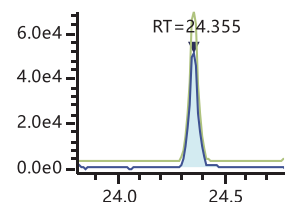
341.丁香菌酯

 Q 385.00>199.00(+) 6.80e5
 RT=24.291


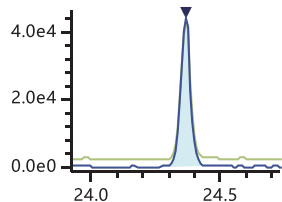
342.乙硫磷

 Q 353.10>228.00(+) 9.67e5
 RT=24.352


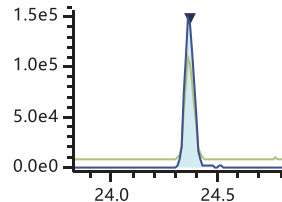
343.噻螨酮

 Q 304.00>143.00(+) 5.16e4
 RT=24.355


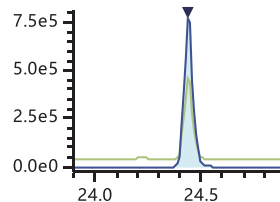
344.野麦畏

 Q 350.30>97.20(+) 4.45e4
 RT=24.365


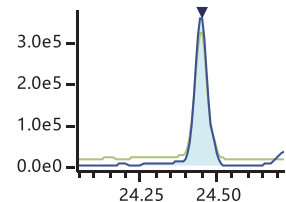
345.甲氧菊酯

 Q 351.90>199.90(+) 1.50e5
 RT=24.366


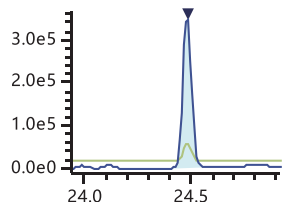
346.毒死蜱

 Q 322.10>96.05(+) 7.74e5
 RT=24.440


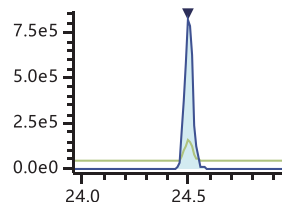
347.吡丙醚

 Q 330.20>284.15(+) 3.63e5
 RT=24.450


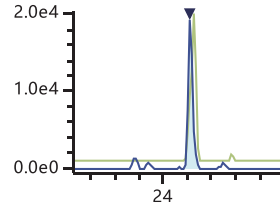
348.三甲苯草酮

 Q 282.20>212.05(+) 3.49e5
 RT=24.481


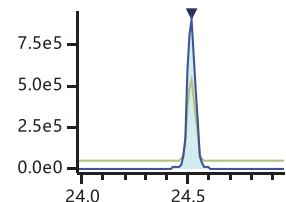
349.二甲戊灵

 Q 388.00>273.10(+) 8.25e5
 RT=24.499


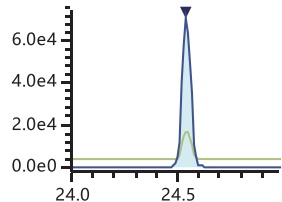
350.螺甲螨酯

 Q 295.10>209.00(-) 1.93e4
 RT=24.441


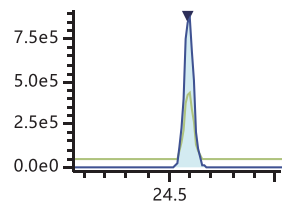
351.敌螨普*

 Q 489.00>158.10(+) 9.09e5
 RT=24.515


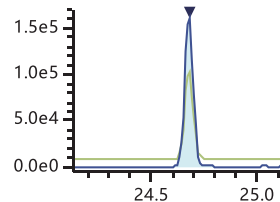
352.氟虫脲

 Q 469.00>412.00(+) 7.13e4
 RT=24.541


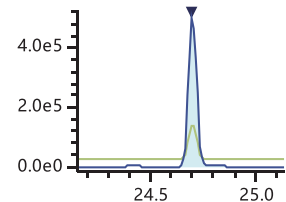
353.氟氧戊菊酯

 Q 368.20>231.20(+) 8.80e5
 RT=24.592


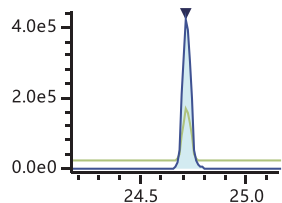
354.炔螨特

 Q 360.10>141.10(+) 1.62e5
 RT=24.678


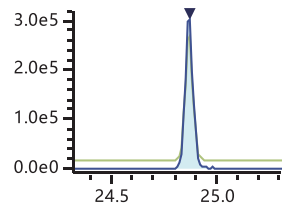
355.乙螨唑

 Q 296.20>240.10(+) 5.02e5
 RT=24.702


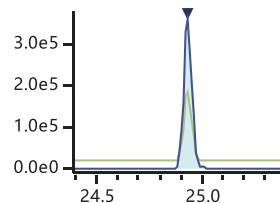
356.仲丁灵

 Q 329.20>161.10(+) 4.26e5
 RT=24.717


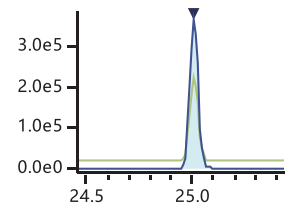
357.除虫菊素 1

 Q 411.10>71.20(+) 3.04e5
 RT=24.869


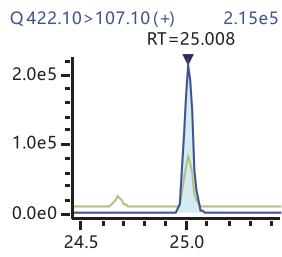
358.螺螨酯

 Q 540.00>382.90(+) 3.61e5
 RT=24.931


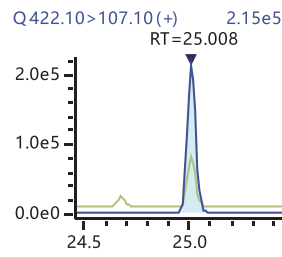
359.氟啶脲

 Q 422.20>366.10(+) 3.69e5
 RT=25.008


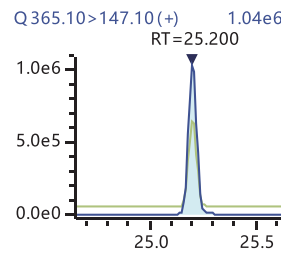
360.啞啞脲



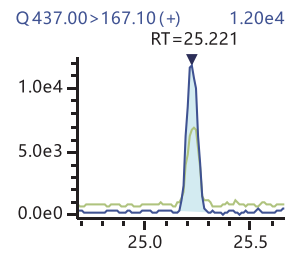
361.氟节胺



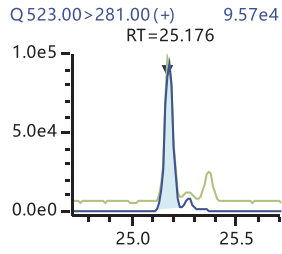
362.丙氧喹啉



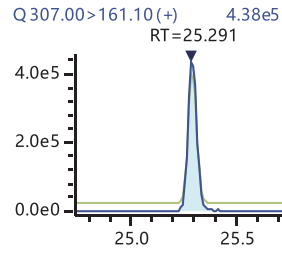
363.吡螨灵



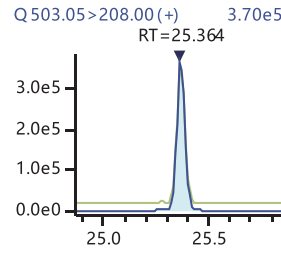
364.氰戊菊酯



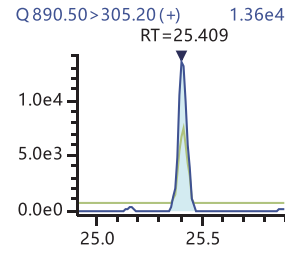
365.溴氰菊酯



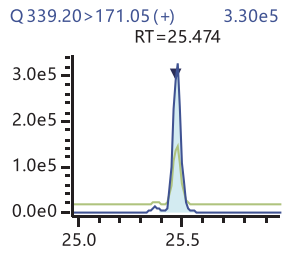
366.啶螨醚



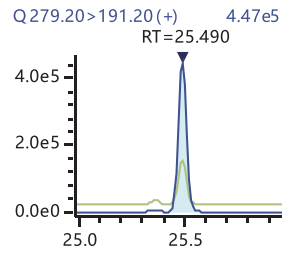
367.氟胺氰菊酯



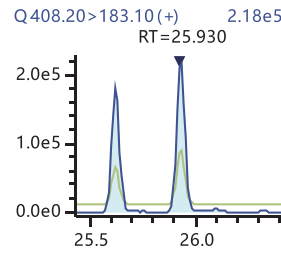
368.阿维菌素



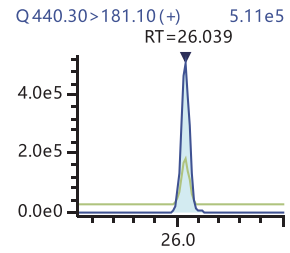
369.生物苧呋菊酯



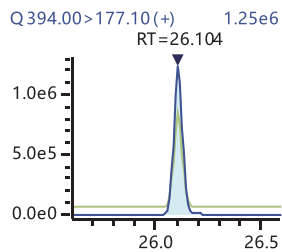
370.烯虫酯



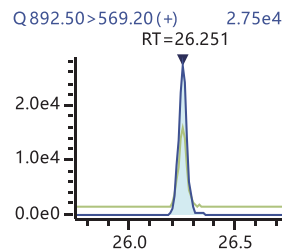
371.氯菊酯*



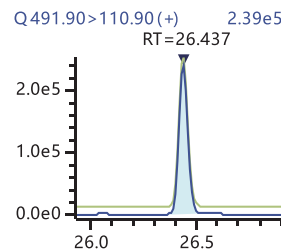
372.联苯菊酯



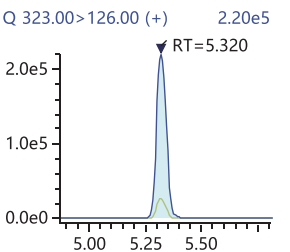
373.醚菊酯



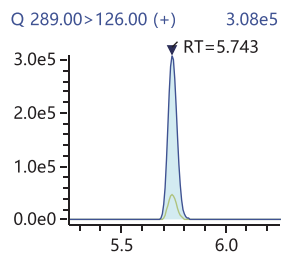
374.依维菌素



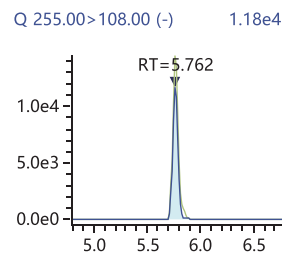
375.三氟甲吡醚



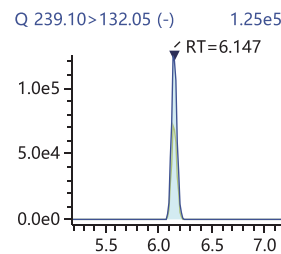
376.环氧虫啉



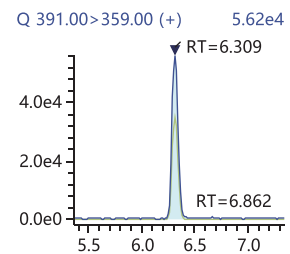
377.氟吡呋喃酮



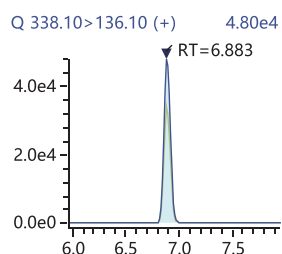
378.8-羟基灭草松



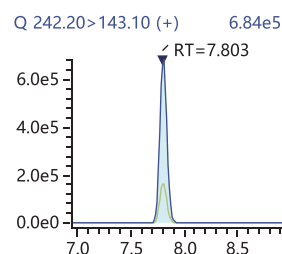
379.灭草松



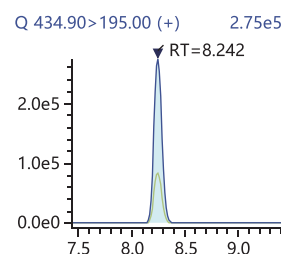
380.噻酮磺隆



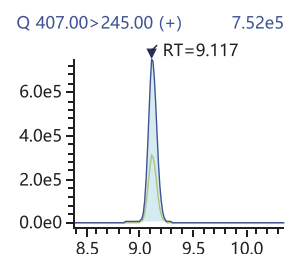
381.单啮磺隆



382.氨基草酮



383.啶磺草胺



384.氰酮磺草胺

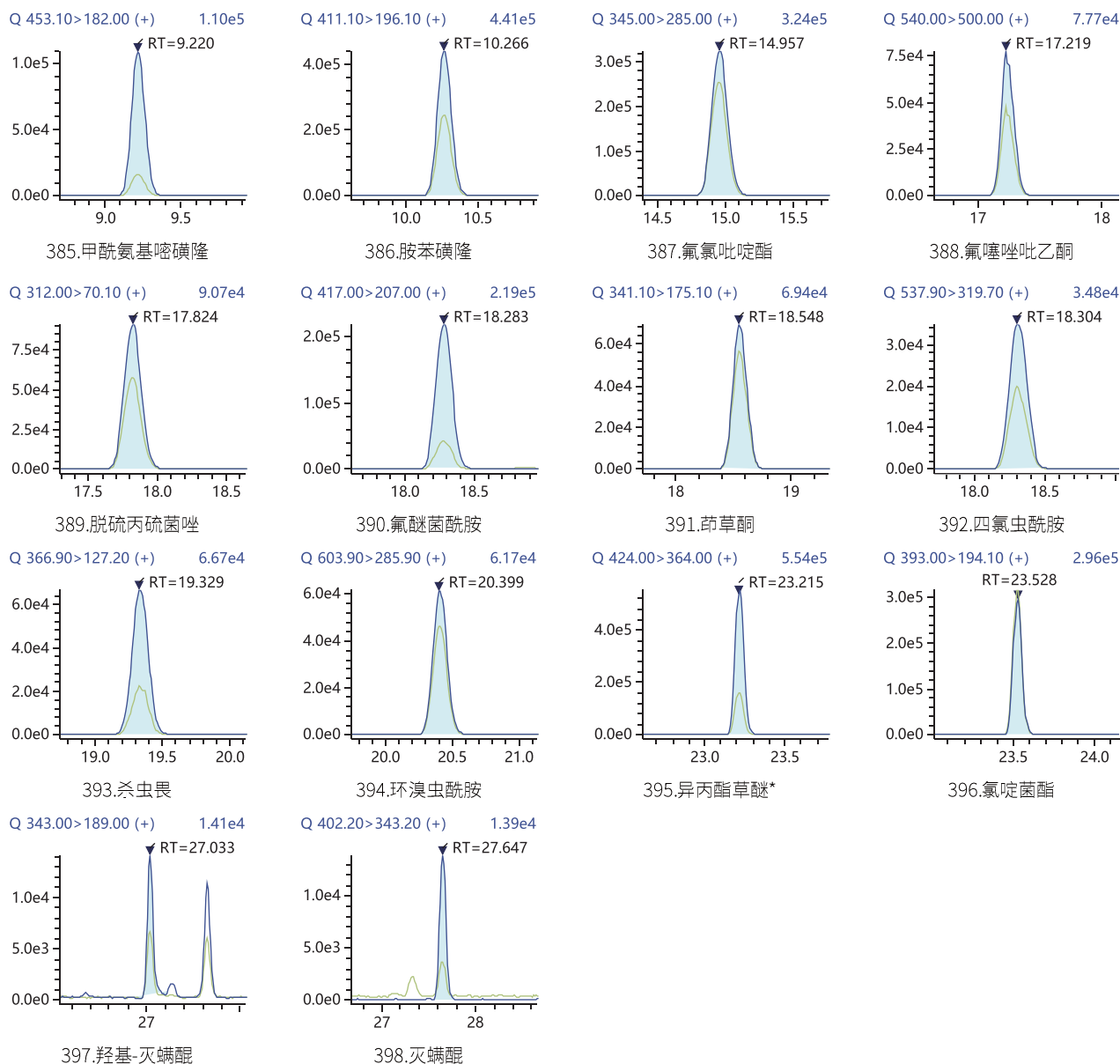


图2 葡萄基质中 352 种农药及代谢物 MRM 色谱图 (加标浓度 0.01 mg/L)

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 3，352 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)

No.	名称	线性方程	相关系数	准确度 (%)	线性范围 (mg/kg)
1	甲胺磷	$Y = (10522.9)X + (28542.8)$	0.9996	94.1~103.9	0.002~0.2
2	涕灭威砒	$Y = (46316.3)X + (91514.7)$	0.9999	90.3~106.3	0.002~0.2
3	久效磷	$Y = (66097.2)X + (411857)$	0.9965	90.1~108.1	0.002~0.2
4	3- 羟基克百威	$Y = (17512.4)X + (33221.7)$	0.9997	99.5~101.9	0.002~0.2
5	敌敌畏	$Y = (17934.5)X + (48573.8)$	0.9997	92.5~105.4	0.002~0.2
6	杀铃脲	$Y = (170363)X + (104462.0)$	0.9973	98.6~101.3	0.002~0.2
7	戊唑醇	$Y = (235855)X + (-2334.1)$	0.9999	96.7~103.9	0.002~0.2
8	多杀菌素 D	$Y = (88792.4)X + (-103340)$	0.9996	95.6~102.8	0.002~0.2
9	氯菊酯	$Y = (10643.3)X + (19228.1)$	0.9991	97.4~103.5	0.002~0.2

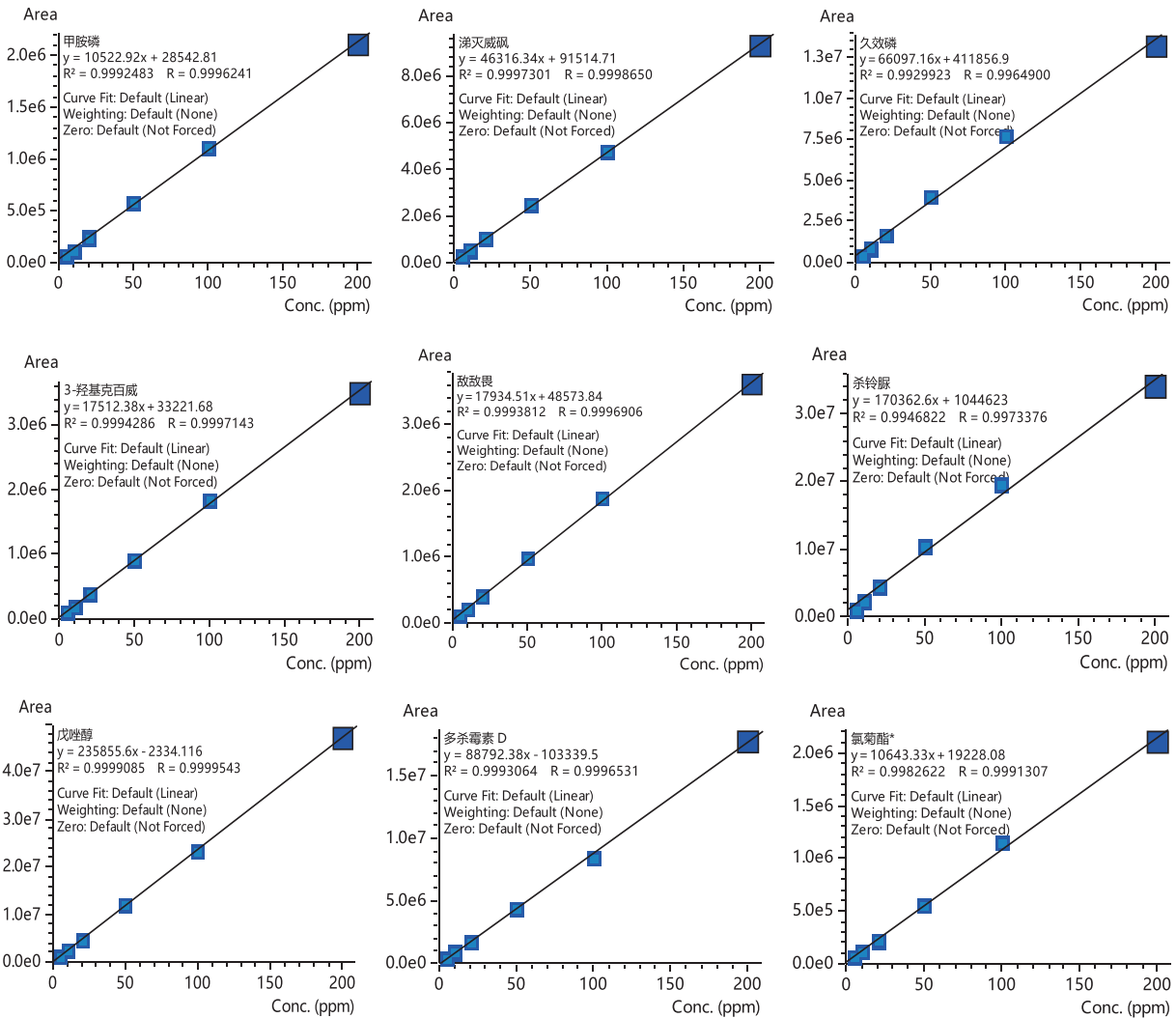
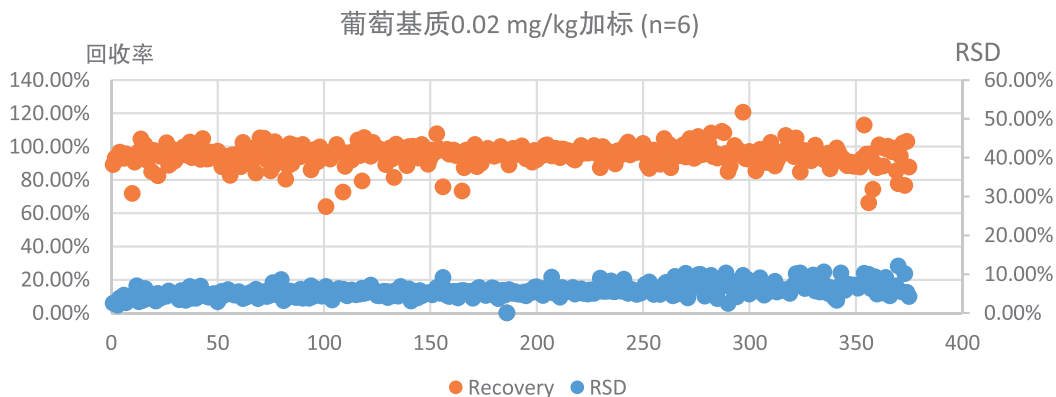


图3 葡萄基质加标校准曲线（部分组分）

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，352 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 352 种农药及其代谢物精密度良好。



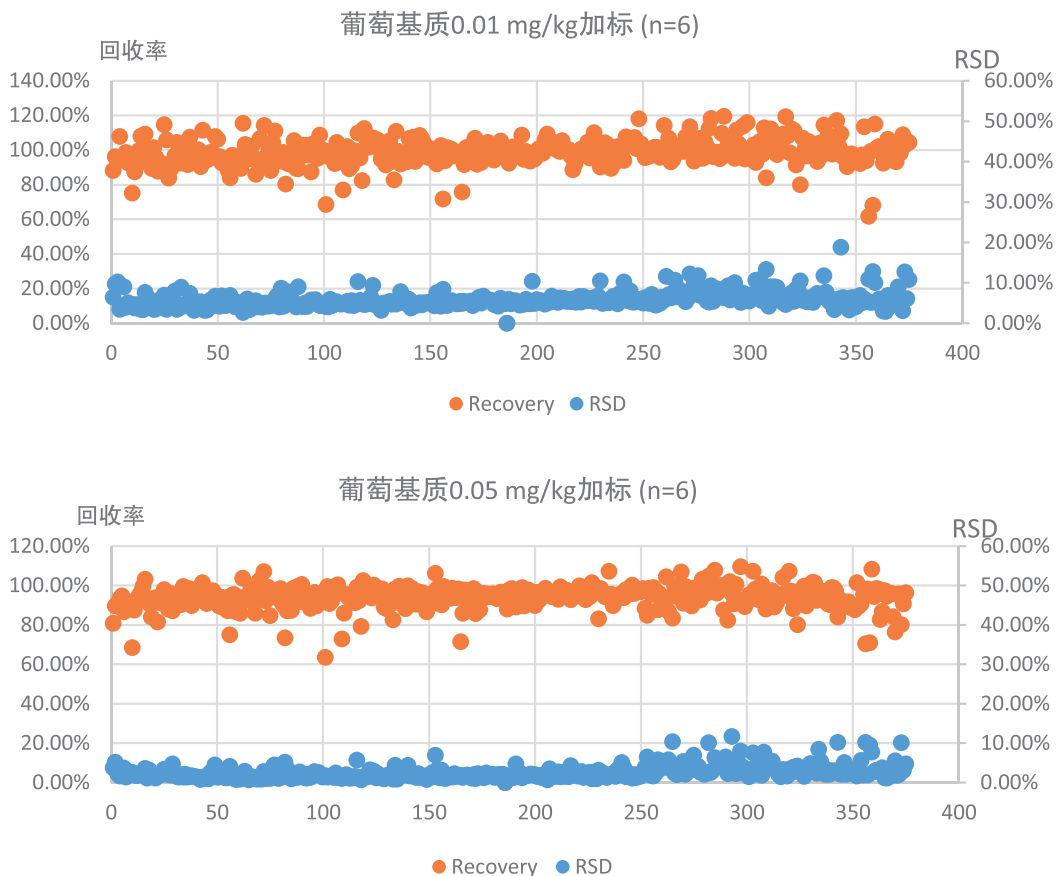


图4 葡萄基质中 352 种农药及代谢物加标回收率和精密度结果

■ 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 352 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《植物源性食品中 352 种农药及其代谢物残留量的测定 液相色谱 - 质谱联用法》中要求，可供相关人员参考。

岛津应用云

