

PTV-GCMS-TQ8050 检测茶叶中多农药残留

GCMSMS-118

摘要：采用岛津公司 GCMS-TQ8050 三重四极杆气质联用仪，结合岛津农残数据库，无需标准品，建立同时筛查茶叶中 584 种农药残留的 GC-MS/MS 方法。茶叶空白基质用 1% 醋酸乙腈提取后，采用 QuEChERS 样品前处理，添加 58 种农药考察方法的曲线线性、灵敏度、重复性和添加回收率。结果表明：在 1.0 $\mu\text{g/L}$ 浓度时，58 种农药均能被筛查出。在 1.0 $\mu\text{g/L}$ ~100 $\mu\text{g/L}$ 浓度范围内，58 种农药的外标曲线线性关系良好，相关系数均大于 0.994。以 5.0 $\mu\text{g/L}$ 基质配标液按照 3 倍信噪比计算方法检出限，方法检出限为 0.01 $\mu\text{g/kg}$ ~9.0 $\mu\text{g/kg}$ 。以 10 $\mu\text{g/L}$ 基质配标液重复进样 5 次，各组分峰面积相对标准偏差小于 9.0%。该方法操作简单，抗基质干扰强，分析速度快，适合茶叶中多农残的定性定量分析。

关键词：GC-MS/MS PTV 农药残留 茶叶

茶叶作为一种重要的经济作物，因其含有大量的营养物质而深受人们的喜爱。近年来，茶叶中农残超标导致茶叶出口贸易受阻时常发生，饮茶安全日益成为民众关注的焦点。因此建立一种快速筛查茶叶中多农药残留的简便、高效的检测方法具有重要的社会意义。

气相色谱 - 串联质谱技术 (GC-MS/MS) 因适用范围广、灵敏度高、定量准、重现性好、抗基质干扰强而被

广泛应用于茶叶及食品中多农药残留的检测。

本文利用岛津公司的 GCMS-TQ8050 结合岛津 Smart MRM 农药残留数据库，利用 AART 功能，无需使用标准品即可同时建立茶叶中 584 种农药残留的检测方法。结果表明，使用岛津 GCMS-TQ8050 同时分析茶叶中 584 种农残操作简单、灵敏度高、重复性好。

实验部分

1.1 仪器

仪器：岛津 GCMS-TQ8050(配 PTV 进样口)

1.2 分析条件

色谱柱：Rxi-5Sil MS, 30 m \times 0.25 mm \times 0.25 μm

进样口温度程序：65 $^{\circ}\text{C}$ (1 min)_ (200 $^{\circ}\text{C}$ /min)

_300 $^{\circ}\text{C}$ (27.4 min)

分流阀程序：

0-0.9min	Split:20:1
0.9-6.0min	Splitless
6.0min	Split:20:1

柱温程序：40 $^{\circ}\text{C}$ (4 min)_ (25 $^{\circ}\text{C}$ /min)_ 125 $^{\circ}\text{C}$ _ (10 $^{\circ}\text{C}$ /min)_ 300 $^{\circ}\text{C}$ (6 min)

恒线速度方式：36.1 cm/sec

进样量：2 μL

接口温度：280 $^{\circ}\text{C}$

离子源温度：250 $^{\circ}\text{C}$

检测器电压：调谐电压 +0.6 kv

溶剂延迟时间：5 min

采集模式：MRM，特征离子见表 1

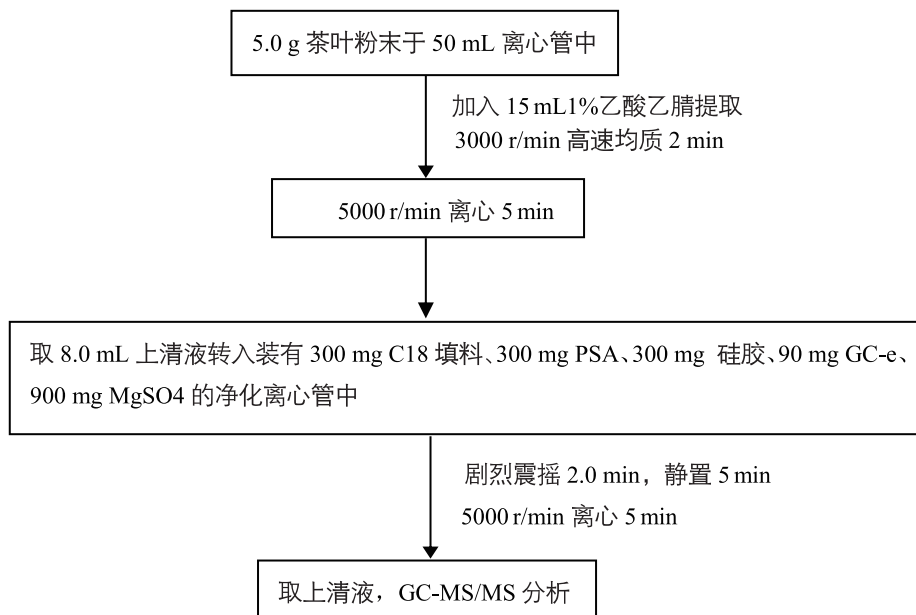


图1 茶叶样品QuEChERS前处理流程

表1 农药组分MRM离子对信息

序号	中文名称	英文名称	保留时间	CAS 号	定量离子对	CE	定性离子对	CE
1	涕灭威分解物	Aldicarb deg.	6.332	0 - 00 - 0	115.1>100.1	8	115.1>68.0	8
2	DCIP	DCIP	8.032	108 - 60 - 1	121.1>45.0	4	121.1>77.0	8
3	涕灭砒分解物	Aldoxycarb deg.	8.732	0 - 00 - 0	80.0>65.0	6	80.0>50.0	4
4	四螨嗪分解物	Chlofentezine deg.	9.283	0 - 00 - 0	137.0>102.0	14	137.0>75.0	26
5	噁霉灵	Hymexazol	9.348	10004 - 44 - 1	99.0>71.0	8	99.0>54.0	26
6	甲胺磷*	Methamidophos	9.738	10265 - 92 - 6	141.0>95.0	8	141.0>126.0	4
7	敌敌畏*	Dichlorvos	9.818	62 - 73 - 7	185.0>93.0	14	185.0>109.0	14
8	沙蚕毒素	Nereistoxin	10.189	0 - 00 - 0	149.1>71.1	8	149.1>102.1	6
9	二丙烯草胺	Allidochlor	10.239	93 - 71 - 0	138.1>96.0	6	138.1>110.1	6
10	敌草腈	Dichlobenil	10.841	1194 - 65 - 6	170.9>100.0	24	170.9>136.0	14
11	EPTC	EPTC	10.956	759 - 94 - 4	189.1>128.1	4	189.1>86.0	12
12	联苯	Biphenyl	11.312	92 - 52 - 4	154.1>128.1	22	154.1>115.1	24
13	霜霉威	Propamocarb	11.323	24579 - 73 - 5	188.2>173.2	4	188.2>72.0	4
14	速灭磷-1	Mevinphos-1	11.604	7786 - 34 - 7	192.0>164.0	4	192.0>127.0	12
15	速灭磷-2	Mevinphos-2	11.637	7786 - 34 - 7	192.0>164.0	4	192.0>127.0	12
16	滴丁酯	Butylate	11.725	2008 - 41 - 5	174.1>146.1	6	174.1>75.0	4
17	氯甲磷	Chlormephos	11.845	24934 - 91 - 6	233.9>121.0	12	233.9>154.0	6
18	乙酰甲胺磷	Acephate	11.922	30560 - 19 - 1	136.0>94.0	14	136.0>119.0	8
19	氯啶	Nitrapyrin	11.944	1929 - 82 - 4	193.9>133.0	16	193.9>157.9	20
20	土菌灵	Etridiazole	11.977	2593 - 15 - 9	210.9>182.9	10	210.9>139.9	22
21	速灭威	Metolcarb	12.053	1129 - 41 - 5	108.0>90.0	14	108.0>80.0	8
22	3-羟基克百威	3-Hydroxycarbofuran	12.064	16655 - 82 - 6	180.1>137.0	10	180.1>162.1	6
23	虫螨畏	Methacrifos	12.480	62610 - 77 - 9	240.0>208.0	4	240.0>180.0	10
24	噻虫胺	Clothianidin	12.502	210880 - 92 - 5	132.0>71.0	14	132.0>45.0	22
25	杀虫环	Thiocyclam	12.579	31895 - 21 - 3	135.0>71.0	8	135.0>56.0	24
26	氯苯甲醚	Chloroneb	12.590	2675 - 77 - 6	206.0>191.0	12	206.0>141.0	20

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27	鼠立死	Crimidine	12.634	535 - 89 - 7	156.1>120.1	8	156.1>66.0	22
28	邻苯基苯酚	2-Phenylphenol	12.756	90 - 43 - 7	170.1>141.1	24	170.1>115.1	28
29	丁噻隆	Tebuthiuron	12.811	34014 - 18 - 1	171.1>156.1	10	171.1>129.1	6
30	异丙威	Isoproc carb	12.910	2631 - 40 - 5	136.0>121.0	10	136.0>103.0	22
31	禾草敌	Molinate	13.009	2212 - 67 - 1	126.1>55.0	14	126.1>83.0	6
32	XMC	XMC	13.196	2655 - 14 - 3	122.1>107.1	14	122.1>77.0	26
33	四氯硝基苯	Tecnazene	13.527	117 - 18 - 0	260.9>202.9	14	260.9>230.9	8
34	氧乐果*	Omethoate	13.604	1113 - 02 - 6	156.0>110.0	8	156.0>141.0	4
35	灭杀威	Xylylcarb	13.604	2425 - 10 - 7	122.1>107.0	14	122.1>77.0	24
36	仲丁威	Fenobucarb	13.680	3766 - 81 - 2	150.1>121.1	10	150.1>103.1	24
37	残杀威	Propoxur	13.702	114 - 26 - 1	152.1>110.1	8	152.1>64.0	28
38	毒草胺	Propachlor	13.702	1918 - 16 - 7	176.1>57.0	8	176.1>120.0	12
39	氯氧磷	Chlorethoxyfos	13.778	54593 - 83 - 8	153.0>97.0	12	153.0>125.0	4
40	甲基内吸磷	Demeton-S-methyl (Methyl demeton)	13.854	919 - 86 - 8	141.9>112.0	6	141.9>79.0	14
41	二苯胺	Diphenylamine	13.920	122 - 39 - 4	169.1>66.0	24	169.1>77.0	28
42	灭线磷*	Ethoprophos	13.996	13194 - 48 - 4	200.0>158.0	6	200.0>114.0	14
43	乙丁烯氟灵(丁氟消草)	Ethalfuralin	14.127	55283 - 68 - 6	316.1>276.0	10	316.1>202.0	24
44	甜菜宁分解物	Phenmedipham deg.	14.170	0 - 00 - 0	167.1>135.1	8	167.1>122.1	14
45	二溴磷	Naled	14.214	300 - 76 - 5	184.9>93.0	14	184.9>109.0	16
46	氯苯胺灵	Chlorpropham	14.247	101 - 21 - 3	213.1>171.1	6	213.1>127.1	14
47	苯氟磺胺代谢物	Dichlofluanid metabolite	14.269	0 - 00 - 0	200.1>45.0	8	200.1>108.0	14
48	氟乐灵	Trifluralin	14.301	1582 - 09 - 8	306.1>264.1	8	306.1>206.1	14
49	百治磷	Dicrotophos	14.323	141 - 66 - 2	127.1>109.0	12	127.1>95.0	18
50	氟硅唑代谢物	Flusilazole metabolite	14.345	0 - 00 - 0	235.0>77.0	22	235.0>95.0	28
51	2,6-二氯苯甲酰胺	2,6-Dichlorobenzamide	14.345	2008 - 58 - 4	188.9>172.9	8	188.9>145.0	26
52	氟草胺	Benfluralin	14.367	1861 - 40 - 1	292.1>264.0	8	292.1>206.0	12
53	蔬果磷	Dioxabenzofos (Salithion)	14.388	3811 - 49 - 2	216.0>201.0	10	216.0>183.0	10
54	恶虫威	Bendiocarb	14.399	22781 - 23 - 3	166.1>151.1	10	166.1>126.1	20
55	治螟磷*	Sulfotep	14.399	3689 - 24 - 5	322.0>202.0	10	322.0>294.0	4
56	久效磷	Monocrotophos	14.519	6923 - 22 - 4	127.1>109.0	12	127.1>95.0	16
57	硫线磷	Cadusafos	14.541	95465 - 99 - 9	158.9>130.9	8	158.9>97.0	18
58	二氯烯丹-1	Di-allate-1	14.606	2303 - 16 - 4	234.1>150.0	20	234.1>192.1	14
59	甲拌磷*	Phorate	14.617	298 - 02 - 2	260.0>75.0	8	260.0>231.0	4
60	alpha-六六六*	alpha-BHC	14.725	319 - 84 - 6	218.9>182.9	8	218.9>144.9	20
61	六氯苯	Hexachlorobenzene	14.778	118 - 74 - 1	283.8>248.8	24	283.8>213.8	28
62	二氯烯丹-2	Di-allate-2	14.799	2303 - 16 - 4	234.1>150.0	20	234.1>192.1	14
63	甲基乙拌磷	Thiometon	14.874	640 - 15 - 3	125.0>47.0	14	125.0>79.0	10
64	氯硝胺	Dicloran	15.001	99 - 30 - 9	206.0>176.0	10	206.0>160.0	16
65	乐果*	Dimethoate	15.001	60 - 51 - 5	125.0>79.0	8	125.0>47.0	14
66	甜菜安分解物	Desmedipham deg.	15.044	0 - 00 - 0	181.1>109.1	14	181.1>122.1	12

67	解草恶唑	Furilazole	15.097	121776 - 33 - 8	262.0>220.0	8	262.0>83.0	24
68	克百威	Carbofuran	15.118	1563 - 66 - 2	164.1>149.1	8	164.1>131.1	18
69	西玛津	Simazine	15.161	122 - 34 - 9	201.1>173.1	6	201.1>186.1	6
70	莠去津	Atrazine	15.246	1912 - 24 - 9	215.1>58.0	14	215.1>200.1	6
71	噻节因	Dimethipin	15.246	55290 - 64 - 7	118.0>58.0	6	118.0>90.0	4
72	灭草灵	Swep	15.257	1918 - 18 - 9	218.9>186.9	8	218.9>173.9	14
73	beta-六六六*	beta-BHC	15.257	319 - 85 - 7	218.9>182.9	8	218.9>144.9	20
74	氯炔灵	Chlorbufam	15.267	1967 - 16 - 4	223.1>171.0	6	223.1>53.0	18
75	异噁草酮	Clomazone	15.289	81777 - 89 - 1	204.1>107.0	20	204.1>78.0	26
76	五氯硝基苯*	Quintozene	15.299	82 - 68 - 8	294.8>236.8	16	294.8>264.8	12
77	扑灭津	Propazine	15.310	139 - 40 - 2	229.1>187.1	6	229.1>58.0	14
78	敌恶磷分解物	Dioxathion deg.	15.395	0 - 00 - 0	270.0>197.0	4	270.0>153.0	12
79	对甲抑菌灵代谢物	Tolylfluaniid metabolite	15.406	0 - 00 - 0	214.1>45.0	8	214.1>106.0	18
80	gamma-六六六*	gamma-BHC (Lindane)	15.406	58 - 89 - 9	218.9>182.9	8	218.9>144.9	20
81	胺丙畏	Propentamphos	15.491	31218 - 83 - 4	236.1>194.0	6	236.1>166.0	16
82	特丁硫磷*	Terbufos	15.501	13071 - 79 - 9	231.0>174.9	14	231.0>128.9	26
83	杀螟腈	Cyanophos	15.512	2636 - 26 - 2	243.0>109.0	14	243.0>116.0	6
84	地虫硫磷	Fonofos	15.576	944 - 22 - 9	246.0>109.1	18	246.0>137.1	6
85	炔苯酰草胺	Propyzamide	15.586	23950 - 58 - 5	172.9>144.9	16	172.9>74.0	28
86	咯嗉酮	Pyroquilon	15.639	57369 - 32 - 1	173.1>130.1	24	173.1>117.1	22
87	二嗉磷*	Diazinon	15.639	333 - 41 - 5	304.1>179.1	10	304.1>162.1	8
88	磷胺-1	Phosphamidon-1	15.714	13171 - 21 - 6	264.1>127.1	14	264.1>193.1	8
89	嘧霉胺*	Pyrimethanil	15.725	53112 - 28 - 0	198.1>183.1	14	198.1>158.1	18
90	百菌清*	Chlorothalonil	15.766	1897 - 45 - 6	265.9>230.8	14	265.9>168.0	22
91	乙拌磷	Disulfoton	15.848	298 - 04 - 4	186.0>97.0	16	186.0>153.0	6
92	茉莉酸丙酯-1	Prohydrojasmon-1	15.868	158474 - 72 - 7	184.1>83.0	8	184.1>96.0	6
93	氯唑磷	Isazofos	15.888	42509 - 80 - 8	257.0>162.0	8	257.0>119.0	18
94	七氟菊酯	Tefluthrin	15.929	79538 - 32 - 2	177.0>127.1	16	177.0>137.1	16
95	特草定	Terbacil	15.939	5902 - 51 - 2	161.0>144.0	14	161.0>118.0	14
96	乙嘧硫磷	Etrimfos	15.970	38260 - 54 - 7	292.1>181.1	8	292.1>153.1	20
97	delta-六六六*	delta-BHC	15.991	319 - 86 - 8	218.9>182.9	10	218.9>144.9	20
98	野麦畏	Tri-allate	16.001	2303 - 17 - 5	268.1>226.0	14	268.1>184.0	20
99	2甲4氯乙硫酯	MCPA-thioethyl	16.031	25319 - 90 - 8	244.0>75.0	14	244.0>155.0	14
100	噻丙磷	Tebupirimfos	16.103	96182 - 53 - 5	318.1>152.1	14	318.1>234.1	12
101	抗蚜威	Pirimicarb	16.134	23103 - 98 - 2	238.1>166.1	12	238.1>72.0	24
102	异稻瘟净	Iprobenfos	16.154	26087 - 47 - 8	204.0>91.0	8	204.0>122.0	12
103	茉莉酸丙酯-2	Prohydrojasmon-2	16.174	158474 - 72 - 7	184.1>83.0	8	184.1>96.0	6
104	解草腈	Oxabetrinil	16.174	74782 - 23 - 3	129.1>77.0	8	129.1>51.0	26
105	解草啉	Benoxacor	16.226	98730 - 04 - 2	259.0>120.0	18	259.0>176.0	8
106	安果	Formothion	16.287	2540 - 82 - 1	224.0>125.0	18	224.0>155.0	12
107	乙基2甲4氯	MCPB-ethyl	16.307	10443 - 70 - 6	115.1>87.0	8	115.1>45.0	18

108	乙硫苯威	Ethiofencarb	16.307	29973 - 13 - 5	168.1>107.0	6	168.1>77.0	28
109	磷胺-2	Phosphamidon-2	16.430	13171 - 21 - 6	264.1>127.1	14	264.1>193.1	8
110	呋草黄	Benfuresate	16.440	68505 - 69 - 1	163.1>121.1	6	163.1>135.1	6
111	除线磷	Dichlofenthion	16.450	97 - 17 - 6	279.0>222.9	14	279.0>250.9	8
112	噻吩草胺	Dimethenamid (Dimethenamid-P)	21.124	87674 - 68 - 8	230.0>154.1	10	230.0>137.1	20
113	特草灵	Terbucarb	16.512	1918 - 11 - 2	220.2>205.2	12	220.2>145.2	24
114	敌稗	Propanil	16.522	709 - 98 - 8	160.9>99.0	24	160.9>90.0	22
115	乙草胺	Acetochlor	16.552	34256 - 82 - 1	223.1>132.1	22	223.1>147.1	10
116	溴丁酰草胺	Bromobutide	16.563	74712 - 19 - 9	232.2>114.1	8	232.2>176.1	10
117	甲基毒死蜱	Chlorpyrifos-methyl	16.573	5598 - 13 - 0	285.9>93.0	22	285.9>270.9	14
118	噻草酮	Metribuzin	16.593	21087 - 64 - 9	198.1>82.0	14	198.1>110.1	10
119	富马酸过甲酸盐分解物	Oxpoconazole-formyl deg.	16.624	0 - 00 - 0	252.1>125.1	28	252.1>72.1	18
120	乙烯菌核利*	Vinclozolin	16.665	50471 - 44 - 8	285.0>212.0	12	285.0>178.0	14
121	螺环菌胺-1	Spiroxamine-1	16.696	118134 - 30 - 8	100.1>72.0	8	100.1>58.0	12
122	甲基对硫磷*	Parathion-methyl	16.716	298 - 00 - 0	263.0>109.0	14	263.0>136.0	8
123	甲基立枯磷	Tolclofos-methyl	16.726	57018 - 04 - 9	264.9>249.9	14	264.9>93.0	24
124	硅氟唑	Simeconazole	16.736	149508 - 90 - 7	211.1>195.1	4	211.1>121.1	14
125	甲草胺	Alachlor	16.736	15972 - 60 - 8	188.1>160.1	10	188.1>132.1	18
126	十三吗啉	Tridemorph	16.796	81412 - 43 - 3	128.1>110.1	12	128.1>70.0	12
127	西草净	Simetryn	16.806	1014 - 70 - 6	213.1>170.1	12	213.1>185.1	8
128	七氯	Heptachlor	16.845	76 - 44 - 8	271.8>236.9	20	271.8>117.0	32
129	甲萘威	Carbaryl	16.855	63 - 25 - 2	144.1>116.1	12	144.1>89.0	38
130	莠灭净	Ametryn	16.884	834 - 12 - 8	227.1>170.1	14	227.1>185.1	6
131	甲霜灵	Metalaxyl (Mefenoxam)	16.884	57837 - 19 - 1	249.2>190.1	8	249.2>146.1	22
132	皮蝇磷	Fenclorphos	16.914	299 - 84 - 3	284.9>269.9	16	284.9>93.0	24
133	环庚草醚	Cinmethylin	16.924	87818 - 31 - 3	169.1>123.1	4	169.1>107.1	8
134	扑草净	Prometryn	16.943	7287 - 19 - 6	241.2>199.1	6	241.2>58.0	14
135	氟硫草定	Dithiopyr	16.983	97886 - 45 - 8	354.1>306.1	8	354.1>286.1	14
136	甲基嘧啶磷	Pirimiphos-methyl	17.150	29232 - 93 - 7	305.1>180.1	8	305.1>290.1	12
137	萘乙酰胺	2-(1-Naphthyl)acetamide	17.179	86 - 86 - 2	185.1>141.1	22	185.1>115.1	30
138	去草净	Terbutryn	17.189	886 - 50 - 0	241.2>185.1	6	241.2>170.1	14
139	螺环菌胺-2	Spiroxamine-2	17.208	118134 - 30 - 8	100.1>72.0	8	100.1>58.0	12
140	杀螟硫磷*	Fenitrothion	17.208	122 - 14 - 5	277.0>260.0	6	277.0>109.1	14
141	灭虫威	Methiocarb	17.248	2032 - 65 - 7	168.1>153.0	8	168.1>109.0	14
142	灭草松	Ethofumesate	17.248	26225 - 79 - 6	286.1>207.1	8	286.1>161.1	18
143	烯丙苯噻唑	Probenazole	17.258	27605 - 76 - 1	130.1>77.0	26	130.1>103.1	18
144	(E)-甲基毒虫畏	(E)-Dimethylvinphos	17.297	2274 - 67 - 1	294.9>109.0	14	294.9>279.9	16
145	利谷隆	Linuron	17.307	330 - 55 - 2	248.0>61.0	16	250.0>61.0	16
146	除草定	Bromacil	17.316	314 - 40 - 9	204.9>187.9	14	204.9>162.0	14
147	抑菌灵	Dichlofluanid	17.336	1085 - 98 - 9	223.9>123.1	8	223.9>77.0	28

148	禾草畏	Esprocarb	17.356	85785 - 20 - 2	222.1>91.0	14	222.1>162.1	8
149	马拉硫磷*	Malathion	17.385	121 - 75 - 5	173.1>99.0	14	173.1>127.0	6
150	灭藻醌	Quinoclamine	17.434	2797 - 51 - 5	207.0>172.0	12	207.0>144.0	20
151	异丙甲草胺	Metolachlor (S-Metolachlor)	17.473	51218 - 45 - 2	238.1>162.1	12	238.1>133.1	26
152	毒死蜱*	Chlorpyrifos	17.513	2921 - 88 - 2	313.9>257.9	14	313.9>285.9	8
153	禾草丹	Thiobencarb	17.542	28249 - 77 - 6	257.1>100.0	8	257.1>72.0	20
154	艾氏剂	Aldrin	17.552	309 - 00 - 2	262.9>193.0	28	262.9>203.0	26
155	(Z)-甲基毒虫畏	(Z)-Dimethylvinphos	17.562	2274 - 67 - 1	294.9>109.0	14	294.9>279.9	16
156	乙霉威	Diethofencarb	17.523	87130 - 20 - 9	267.1>225.1	8	267.1>196.1	14
157	倍硫磷*	Fenthion	17.601	55 - 38 - 9	278.0>109.0	20	278.0>125.0	20
158	氯酞酸甲酯	Chlorthal-dimethyl	17.601	1861 - 32 - 1	300.9>222.9	26	300.9>272.9	14
159	氰草津	Cyanazine	17.621	21725 - 46 - 2	240.1>225.1	6	240.1>172.0	14
160	丁苯吗啉	Fenpropimorph	17.640	67564 - 91 - 4	128.1>110.1	8	128.1>70.0	10
161	对硫磷*	Parathion	17.670	56 - 38 - 2	291.1>109.0	14	291.1>137.0	6
162	氟噻草胺	Flufenacet	17.680	142459 - 58 - 3	210.9>123.0	10	210.9>96.0	14
163	氧异柳磷	Isofenphos oxon	17.699	31120 - 85 - 1	229.1>201.0	10	229.1>121.0	26
164	三唑酮*	Triadimefon	17.729	43121 - 43 - 3	208.1>181.0	10	208.1>127.0	14
165	氟醚唑	Tetraconazole	17.739	112281 - 77 - 3	336.0>218.0	14	336.0>204.0	28
166	水胺硫磷*	Isocarbophos	17.748	24353 - 61 - 5	289.1>136.0	14	289.1>113.0	6
167	菌核净	Dimethachlon	17.748	24096 - 53 - 5	243.0>187.0	10	243.0>215.0	6
168	双酰草胺	Carbetamide	17.795	16118 - 49 - 3	119.1>91.0	14	119.1>64.0	22
169	三氯杀螨醇分解物*	Dicofol deg. (DCBP)	17.814	0 - 00 - 0	250.0>139.0	14	250.0>215.0	8
170	酞菌酯	Nitrothal-isopropyl	17.833	10552 - 74 - 6	254.1>212.0	10	254.1>165.0	22
171	仲丁灵	Butralin	17.852	33629 - 47 - 9	266.1>236.1	8	266.1>190.1	12
172	四氯苯酞	Phthalide	17.852	27355 - 22 - 2	242.9>214.8	14	242.9>178.8	26
173	溴硫磷	Bromophos	17.936	2104 - 96 - 3	330.9>315.9	14	330.9>285.9	28
174	草乃敌	Diphenamid	17.955	957 - 51 - 7	167.1>152.1	20	167.1>128.1	26
175	噻唑磷-1	Fosthiazate-1	17.984	98886 - 44 - 3	283.0>195.0	8	283.0>103.0	18
176	噻唑磷-2	Fosthiazate-2	18.031	98886 - 44 - 3	283.0>195.0	8	283.0>103.0	18
177	甲基异柳磷*	Isofenphos-methyl	18.031	99675 - 03 - 3	199.0>121.0	14	241.1>121.1	22
178	噻虫嗪分解物	Thiamethoxam deg.	18.078	0 - 00 - 0	247.0>212.0	4	247.0>182.0	12
179	二甲戊灵*	Pendimethalin	18.153	40487 - 42 - 1	252.1>162.1	10	252.1>191.1	8
180	(E)-毒虫畏	(E)-Chlorfenvinphos	18.163	470 - 90 - 6	323.0>267.0	16	323.0>295.0	6
181	啞菌环胺	Cyprodinil	18.182	121552 - 61 - 2	224.1>208.1	16	224.1>197.1	22
182	氟虫腈*	Fipronil	18.257	120068 - 37 - 3	366.9>212.9	30	366.9>254.9	22
183	敌菌灵	Anirazine	18.257	101 - 05 - 3	239.0>143.0	12	239.0>178.0	4
184	异戊乙净	Dimethametryn	18.285	22936 - 75 - 0	212.1>122.1	12	212.1>94.0	22
185	戊菌唑	Penconazole	18.285	66246 - 88 - 6	248.1>192.1	14	248.1>157.1	26
186	环氧七氯(exo)	Heptachlor-exo-epoxide	18.314	1024 - 57 - 3	352.8>262.9	14	352.8>281.9	12
187	氧化氯丹	oxy-Chlordane	18.314	27304 - 13 - 8	386.8>287.0	26	386.8>323.0	18
188	乙菌利	Chlozolinate	18.314	84332 - 86 - 5	330.9>258.9	6	330.9>186.0	20

189	硫环磷	Phosfolan	18.314	947 - 02 - 4	255.0>227.0	6	255.0>140.0	22
190	对甲抑菌灵	Tolylfluanid	18.332	731 - 27 - 1	238.0>137.1	14	238.0>91.1	28
191	异丙胺磷	Isofenphos	18.332	25311 - 71 - 1	213.1>121.1	14	213.1>185.1	6
192	(Z)-啞斑肟	(Z)-Pyrifenox	18.342	88283 - 41 - 4	262.0>91.0	16	262.0>227.0	10
193	丙稀菊酯-1,2	Allethrin-1,2	18.361	584 - 79 - 2	136.1>93.1	14	136.1>77.1	26
194	(Z)-毒虫畏	(Z)-Chlorfenvinphos	18.361	470 - 90 - 6	323.0>267.0	16	323.0>295.0	6
195	吡唑酯	Ethychlozate	18.389	27512 - 72 - 7	238.1>165.0	12	238.1>138.0	28
196	环氧七氯(endo)	Heptachlor-endo-epoxide	18.389	28044 - 83 - 9	352.8>289.0	6	352.8>253.0	26
197	灭蚜磷	Mecarbam	18.408	2595 - 54 - 2	329.0>131.1	18	329.0>159.1	4
198	丙稀菊酯-3,4	Allethrin-3,4 (Bioallethrin)	18.436	584 - 79 - 2	136.1>93.1	14	136.1>77.1	26
199	稻丰散	Phenthoate	18.464	2597 - 03 - 7	273.9>125.0	20	273.9>246.0	6
200	双氯氰菌胺-1	Diclocymet-1	18.474	139920 - 32 - 4	277.1>221.1	14	277.1>155.0	26
201	噻硫磷	Quinalphos	18.483	13593 - 03 - 8	157.1>129.0	14	157.1>93.0	10
202	噻菌灵	Thiabendazole	18.511	148 - 79 - 8	201.1>174.1	16	201.1>130.1	26
203	克菌丹	Captan	18.511	133 - 06 - 2	149.1>105.1	4	149.1>79.1	14
204	哌草丹	Dimepiperate	18.549	61432 - 55 - 1	145.1>112.1	8	145.1>69.1	18
205	腐霉利*	Procymidone	18.549	32809 - 16 - 8	283.0>96.0	10	283.0>255.0	12
206	三唑醇-1	Triadimenol-1	18.559	55219 - 65 - 3	168.1>70.0	10	168.1>112.1	4
207	苯酰菌胺分解物	Zoxamide deg.	18.587	0 - 00 - 0	242.0>214.0	10	242.0>187.0	14
208	氟菌唑	Triflumizole	18.587	99387 - 89 - 0	278.1>73.0	6	278.1>55.0	12
209	灭菌丹	Folpet	18.634	133 - 07 - 3	259.9>130.0	14	259.9>95.0	20
210	烯虫酯	Methoprene	18.653	40596 - 69 - 8	191.2>135.1	8	191.2>121.1	8
211	噻菌胺	Ferimzone	18.653	89269 - 64 - 7	239.1>107.0	16	239.1>95.0	16
212	三唑醇-2	Triadimenol-2	18.708	55219 - 65 - 3	168.1>70.0	10	168.1>112.1	4
213	乙基溴硫磷	Bromophos-ethyl	18.735	4824 - 78 - 6	358.9>302.9	16	358.9>330.9	10
214	杀扑磷*	Methidathion	18.754	950 - 37 - 8	145.0>85.0	8	145.0>58.0	14
215	反-氯丹	trans-Chlordane	18.772	5103 - 74 - 2	372.8>336.8	10	372.8>263.9	28
216	杀螨醚	Chlorbenside	18.781	103 - 17 - 3	125.0>89.0	16	125.0>99.0	18
217	双氯氰菌胺-2	Diclocymet-2	18.790	139920 - 32 - 4	277.1>221.1	14	277.1>155.0	26
218	丙虫磷	Propaphos	18.808	7292 - 16 - 2	304.1>140.1	26	304.1>220.1	14
219	灭螨猛	Chinomethionat	18.817	2439 - 01 - 2	234.0>206.0	8	234.0>148.0	24
220	o,p'-DDE	o,p'-DDE	18.826	3424 - 82 - 6	246.0>176.0	30	246.0>211.0	22
221	(E)-啞斑肟	(E)-Pyrifenox	18.844	88283 - 41 - 4	262.0>91.0	16	262.0>227.0	10
222	杀虫威	Tetrachlorvinphos	18.871	22248 - 79 - 9	328.9>109.0	20	328.9>313.9	18
223	水杨菌胺	Trichlamide	18.898	70193 - 21 - 4	148.1>121.1	14	148.1>93.0	22
224	多效唑	Paclobutrazol	18.907	76738 - 62 - 0	236.1>125.0	14	236.1>167.0	10
225	丁草胺	Butachlor	18.934	23184 - 66 - 9	188.1>160.1	12	188.1>146.1	14
226	乙拌磷砒	Disulfoton sulfone	18.943	2497 - 06 - 5	213.0>153.1	6	213.0>125.0	12
227	苯硫威	Fenothiocarb	18.962	62850 - 32 - 2	160.1>72.0	10	160.1>106.1	12
228	顺-氯丹	cis-Chlordane	19.016	5103 - 71 - 9	372.8>336.8	10	372.8>263.9	28
229	alpha-硫丹	alpha-Endosulfan	19.034	959 - 98 - 8	338.9>160.0	18	338.9>266.9	8
230	噻菌胺	Mepanipyrim	19.043	110235 - 47 - 7	223.1>222.1	10	222.1>221.1	6

231	灭菌磷	Ditalimfos	19.061	5131 - 24 - 8	299.0>243.0	8	299.0>148.0	16
232	反式-九氯	trans-Nonachlor	19.070	39765 - 80 - 5	408.8>372.9	16	408.8>145.0	24
233	抑草磷	Butamifos	19.079	36335 - 67 - 8	286.1>202.1	14	286.1>185.0	30
234	咪草酸-1	Imazamethabenz-methyl-1	19.097	81405 - 85 - 8	256.1>187.0	6	256.1>144.0	20
235	咪草酸-2	Imazamethabenz-methyl-2	19.133	81405 - 85 - 8	256.1>187.0	6	256.1>144.0	20
236	粉唑醇	Flutriafol	19.133	76674 - 21 - 0	219.1>123.1	14	219.1>95.0	28
237	苯线磷	Fenamiphos	19.170	22224 - 92 - 6	303.1>195.1	8	303.1>154.1	18
238	萘丙酰草胺	Napropamide	19.188	15299 - 99 - 7	128.1>72.0	6	128.1>57.0	12
239	苯噻氰	TCMTB	19.224	21564 - 17 - 0	179.9>136.0	14	179.9>109.0	26
240	氟酰胺	Flutolanil	19.242	66332 - 96 - 5	173.0>145.0	14	173.0>95.0	26
241	杀螨脂	Chlorfenson	19.251	80 - 33 - 1	301.9>175.0	8	301.9>111.0	24
242	己唑醇	Hexaconazole	19.278	79983 - 71 - 4	214.0>172.0	20	214.0>159.0	20
243	抑霉唑	Imazalil	19.278	35554 - 44 - 0	215.0>173.0	6	215.0>159.0	6
244	(E)-苯氧菌胺	(E)-Metominostrobin	19.278	133408 - 50 - 1	238.1>210.1	14	238.1>197.0	24
245	丙硫磷	Prothiofos	19.287	34643 - 46 - 4	309.0>238.9	14	309.0>280.9	10
246	咯菌腈	Fludioxonil	19.305	131341 - 86 - 1	248.0>182.0	14	248.0>154.0	20
247	稻瘟灵	Isoprothiolane	19.332	50512 - 35 - 1	290.1>118.0	14	290.1>204.1	6
248	丙草胺	Pretilachlor	19.332	51218 - 49 - 6	262.1>202.1	10	262.1>174.1	18
249	噁唑磷 oxon	Isoxathion oxon	19.351	32306 - 29 - 9	105.0>77.0	14	105.0>51.0	26
250	丙溴磷*	Profenofos	19.378	41198 - 08 - 7	336.9>266.9	14	336.9>308.9	6
251	三环唑	Tricyclazole	19.396	41814 - 78 - 2	189.0>161.9	12	189.0>135.0	18
252	p,p'-DDE*	p,p'-DDE	19.450	72 - 55 - 9	246.0>176.0	30	246.0>211.0	22
253	烯效唑	Uniconazole (Uniconazole-P)	19.468	83657 - 17 - 4	234.1>165.0	8	234.1>216.1	12
254	噁草酮	Oxadiazon	19.468	19666 - 30 - 9	258.0>175.0	8	258.0>112.0	28
255	噁氟菌胺	Thifluzamide	19.495	130000 - 40 - 7	448.9>428.9	20	448.9>402.0	34
256	脱叶磷	Tribufos	19.504	78 - 48 - 8	258.0>202.0	4	258.0>147.0	10
257	杀螨特-1	Aramite-1	19.504	140 - 57 - 8	185.0>63.0	14	185.0>59.0	8
258	麦草氟甲酯	Flamprop-methyl	19.504	52756 - 25 - 9	276.1>105.0	10	276.1>77.0	28
259	燕麦灵	Barban	19.531	101 - 27 - 9	222.0>69.0	10	222.0>154.1	14
260	狄氏剂	Dieldrin	19.540	60 - 57 - 1	276.9>241.0	8	276.9>170.0	38
261	杀螨特-2	Aramite-2	19.550	140 - 57 - 8	185.0>63.0	14	185.0>59.0	8
262	腈菌唑	Myclobutanil	19.550	88671 - 89 - 0	179.1>125.0	14	179.1>152.0	8
263	o,p'-DDD*	o,p'-DDD	19.577	53 - 19 - 0	235.0>165.0	24	235.0>199.0	14
264	氟硅唑	Flusilazole	19.577	85509 - 19 - 9	233.1>165.1	14	233.1>152.1	14
265	乙氧氟草醚	Oxyfluorfen	19.586	42874 - 03 - 3	361.0>300.0	14	361.0>252.0	20
266	乙嘧酚磺酸酯	Bupirimate	19.594	41483 - 43 - 6	273.1>193.1	8	273.1>150.1	8
267	噻嗪酮	Buprofezin	19.603	69327 - 76 - 0	172.1>57.0	14	172.1>131.1	6
268	醚菌酯	Kresoxim-methyl	19.621	143390 - 89 - 0	206.1>116.1	6	206.1>131.1	14
269	萎锈灵	Carboxin	19.638	5234 - 68 - 4	235.1>143.0	12	235.1>87.0	24
270	亚胺唑-脱苄基	Imibenconazole-debenzyl	19.638	154221 - 27 - 9	235.1>166.1	10	235.1>138.1	28
271	苄氯三唑醇	Diclobutrazol	19.647	75736 - 33 - 3	270.0>159.0	14	270.0>201.0	8

272	杀螨特-3	Aramite-3	19.655	140 - 57 - 8	185.0>63.0	14	185.0>59.0	8
273	(Z)-苯氧菌胺	(Z)-Metominostrobin	19.655	133408 - 51 - 2	238.1>210.1	14	238.1>197.0	24
274	戊环唑	Azaconazole	19.681	60207 - 31 - 0	216.9>172.9	14	216.9>145.0	26
275	环氟菌胺	Cyflufenamid	19.777	180409 - 60 - 3	412.1>295.1	8	412.1>118.1	26
276	溴虫腈	Chlorfenapyr	19.777	122453 - 73 - 0	247.1>227.0	16	247.1>200.0	24
277	异唑磷	Isoxathion	19.829	18854 - 01 - 8	313.1>177.1	8	313.1>130.1	20
278	环唑醇-1	Cyproconazole-1	19.838	94361 - 06 - 5	222.1>125.1	24	222.1>82.0	12
279	杀螨特-4	Aramite-4	19.847	140 - 57 - 8	185.0>63.0	14	185.0>59.0	8
280	环唑醇-2	Cyproconazole-2	19.864	94361 - 06 - 5	222.1>125.1	24	222.1>82.0	12
281	虫螨磷-1	Chlorthiophos-1	19.873	60238 - 56 - 4	256.9>239.0	14	256.9>193.0	22
282	稻瘟酰胺	Fenoxanil	19.908	115852 - 48 - 7	293.1>198.0	14	293.1>155.0	22
283	除草醚	Nitrofen	19.925	1836 - 75 - 5	282.9>162.0	24	282.9>253.0	12
284	异狄氏剂	Endrin	19.934	72 - 20 - 8	262.9>191.0	30	262.9>193.0	28
285	乙滴涕	1,1-Dichloro-2,2-bis(4-ethylp nyl)ethane	19.942	72 - 56 - 0	223.2>167.1	14	223.2>179.1	22
286	氟哒嗪草酯	Flufenpyr-ethyl	20.056	188489 - 07 - 8	408.0>345.0	16	408.0>321.0	14
287	虫螨磷-2	Chlorthiophos-2	20.056	60238 - 56 - 4	324.9>268.9	14	324.9>296.9	8
288	(Z)-甲基嘧草醚	(Z)-Pyriminobac-methyl	20.064	136191 - 64 - 5	302.1>256.1	18	302.1>230.1	18
289	乙酯杀螨醇	Chlorobenzilate	20.082	510 - 15 - 6	251.0>139.0	14	251.0>111.0	28
290	丙酯杀螨醇	Chloropropylate	20.082	5836 - 10 - 2	251.0>139.0	14	251.0>111.1	26
291	丰索磷	Fensulfothion	20.125	115 - 90 - 2	293.0>153.0	8	293.0>125.0	14
292	beta-硫丹	beta-Endosulfan	20.160	33213 - 65 - 9	338.9>160.0	18	338.9>266.9	8
293	烯唑醇	Diniconazole	20.169	83657 - 24 - 3	268.0>232.0	12	268.0>149.0	24
294	噁霜灵	Oxadixyl	20.230	77732 - 09 - 3	163.1>132.1	8	163.1>117.1	24
295	顺式-九氯	cis-Nonachlor	20.230	5103 - 73 - 1	408.8>372.9	16	408.8>145.0	24
296	p,p'-DDD*	p,p'-DDD	20.247	72 - 54 - 8	235.0>165.0	24	235.0>199.0	14
297	乙硫磷	Ethion	20.247	563 - 12 - 2	230.9>174.9	14	230.9>184.9	12
298	o,p'-DDT*	o,p'-DDT	20.282	789 - 02 - 6	235.0>165.0	24	235.0>199.0	16
299	虫螨磷-3	Chlorthiophos-3	20.282	60238 - 56 - 4	324.9>268.9	14	324.9>296.9	8
300	啮螨酯	Fluacrypyrim	20.404	229977 - 93 - 9	352.1>188.1	10	352.1>320.1	6
301	灭锈胺	Mepronil	20.523	55814 - 41 - 0	269.1>119.1	14	269.1>227.1	6
302	三唑磷*	Triazophos	20.539	24017 - 47 - 8	257.0>162.0	8	257.0>134.0	22
303	硫丙磷	Sulprofos	20.548	35400 - 43 - 2	322.0>156.0	8	322.0>97.0	24
304	除虫菊素 I	Pyrethrin I	20.589	121 - 21 - 1	123.1>81.0	8	123.1>95.0	6
305	伐灭磷	Famphur	20.665	52 - 85 - 7	218.0>109.0	16	218.0>79.0	24
306	双苯恶唑酸	Isoxadifen-ethyl	20.673	163520 - 33 - 0	294.1>204.0	16	294.1>266.0	6
307	甲基吡啶磷	Azamethiphos	20.690	35575 - 96 - 3	214.9>171.0	8	214.9>128.0	28
308	唑草酮	Carfentrazone-ethyl	20.690	128639 - 02 - 1	340.1>312.1	14	340.1>151.1	28
309	苯霜灵	Benalaxyl	20.690	71626 - 11 - 4	148.1>105.1	16	148.1>133.1	14
310	草枯醚	Chlornitrofen	20.715	1836 - 77 - 7	316.9>286.9	14	316.9>235.9	14
311	三硫磷	Carbophenothion	20.748	786 - 19 - 6	341.9>157.0	14	341.9>143.0	18

312	苯腈膦	Cyanofenphos	20.782	13067 - 93 - 1	303.1>141.0	14	303.1>169.0	4
313	肟菌酯	Trifloxystrobin	20.782	141517 - 21 - 7	222.1>190.1	4	222.1>162.1	10
314	敌瘟磷	Edifenphos	20.798	17109 - 49 - 8	310.0>173.0	14	310.0>109.0	26
315	氟草敏	Norflurazon	20.798	27314 - 13 - 2	303.0>145.0	22	303.0>173.0	10
316	丙环唑-1	Propiconazole-1	20.823	60207 - 90 - 1	259.0>69.0	14	259.0>191.0	8
317	喹氧灵	Quinoxifen	20.848	124495 - 18 - 7	237.1>208.1	28	237.1>182.1	28
318	(E)-甲基嘧草醚	(E)-Pyriminobac-methyl	20.873	136191 - 64 - 5	302.1>256.1	18	302.1>230.1	18
319	硫丹硫酸酯	Endosulfan sulfate	20.882	1031 - 07 - 8	386.8>288.8	10	386.8>252.9	16
320	环草定	Lenacil	20.924	2164 - 08 - 1	153.1>136.1	14	153.1>110.1	16
321	丙环唑-2	Propiconazole-2	20.932	60207 - 90 - 1	259.0>69.0	14	259.0>191.0	8
322	吡草醚	Pyraflufen-ethyl	20.932	129630 - 17 - 7	412.0>349.0	16	412.0>307.0	24
323	p,p'-DDT*	p,p'-DDT	20.949	50 - 29 - 3	235.0>165.0	24	235.0>199.0	16
324	氯草敏	Chloridazon	20.982	1698 - 60 - 8	221.0>77.0	24	221.0>105.0	12
325	环嗪酮	Hexazinone	21.066	51235 - 04 - 2	171.1>71.0	16	171.1>85.0	16
326	噻吩草胺	Thenylchlor	21.124	96491 - 05 - 3	288.1>141.1	14	288.1>174.1	8
327	戊唑醇	Tebuconazole	21.216	107534 - 96 - 3	250.1>125.1	22	250.1>153.1	12
328	禾草灵	Diclofop-methyl	21.233	51338 - 27 - 3	340.0>253.0	14	340.0>281.0	10
329	炔螨特-1	Propargite-1	21.233	2312 - 35 - 8	135.1>107.1	16	135.1>77.0	24
330	炔螨特-2	Propargite-2	21.258	2312 - 35 - 8	135.1>107.1	16	135.1>77.0	24
331	吡氟酰草胺	Diflufenican	21.266	83164 - 33 - 4	394.1>266.0	14	394.1>374.1	4
332	苄呋菊酯-1	Resmethrin-1	21.283	10453 - 86 - 8	171.1>128.1	12	171.1>143.1	6
333	增效醚	Piperonyl butoxide	21.355	51 - 03 - 6	176.1>131.1	12	176.1>117.1	20
334	敌菌丹	Captafol	21.371	2425 - 06 - 1	79.0>77.0	14	79.0>51.0	20
335	甲磺乐灵	Nitralin	21.387	4726 - 14 - 1	316.1>274.0	8	316.1>216.0	14
336	苄呋菊酯-2	Resmethrin-2 (Bioresmethrin)	21.411	10453 - 86 - 8	171.1>128.1	14	171.1>143.1	6
337	氟环唑	Epoxiconazole	21.476	106325 - 08 - 0	192.0>138.0	14	192.0>111.0	26
338	苯酰菌胺	Zoxamide	21.492	156052 - 68 - 5	258.1>187.0	14	258.1>159.0	28
339	吡唑解草酯	Mefenpyr-diethyl	21.508	135590 - 91 - 9	299.0>253.0	10	299.0>227.0	12
340	稗草丹	Pyributicarb	21.564	88678 - 67 - 5	165.1>108.1	10	165.1>93.0	24
341	甲氧除草醚	Chlormethoxyfen (Chlormethoxynil)	21.660	32861 - 85 - 1	312.9>265.9	12	312.9>282.9	6
342	吡嗪硫磷	Pyridaphenthion	21.676	119 - 12 - 0	340.0>199.1	8	340.0>109.1	22
343	丁硫克百威	Carbosulfan	21.676	55285 - 14 - 8	323.1>160.1	8	323.1>118.1	18
344	异菌脲*	Iprodione	21.708	36734 - 19 - 7	314.0>245.0	12	314.0>56.0	22
345	啉虫脒	Acetamiprid	21.749	135410 - 20 - 7	152.0>116.0	18	152.0>89.0	26
346	胺菊酯-1	Tetramethrin-1	21.757	7696 - 12 - 0	164.1>107.1	14	164.1>135.1	8
347	糠菌唑-1	Bromuconazole-1	21.781	116255 - 48 - 2	294.9>172.9	14	294.9>145.0	28
348	亚胺硫磷*	Phosmet	21.821	732 - 11 - 6	160.0>133.0	14	160.0>77.0	24
349	联苯菊酯*	Bifenthrin	21.845	82657 - 04 - 3	181.1>166.1	12	181.1>153.1	8
350	苯硫磷	EPN	21.869	2104 - 64 - 5	169.1>140.9	8	169.1>77.0	22
351	溴螨酯	Bromopropylate	21.893	18181 - 80 - 1	340.9>182.9	18	340.9>184.9	20

352	啉草磷	Piperophos	21.901	24151 - 93 - 7	320.1>122.1	14	320.1>82.0	26
353	氟吡草胺	Picolinafen	21.909	137641 - 05 - 5	376.1>239.1	12	376.1>348.1	8
354	胺菊酯-2	Tetramethrin-2	21.917	7696 - 12 - 0	164.1>107.1	14	164.1>135.1	8
355	苯氧威	Fenoxycarb	21.941	79127 - 80 - 3	186.1>109.1	14	186.1>129.1	14
356	联苯肼酯	Bifenazate	21.965	149877 - 41 - 8	300.1>258.1	8	300.1>199.1	20
357	甲氧滴滴涕	Methoxychlor	21.989	72 - 43 - 5	227.1>169.1	24	227.1>212.1	14
358	氯虫苯甲酰胺	Chlorantraniliprole	21.989	500008 - 45 - 7	278.0>249.0	20	280.0>251.0	20
359	乙螨唑	Etoxazole	21.997	153233 - 91 - 1	359.1>187.1	14	359.1>340.1	12
360	甲氰菊酯*	Fenpropathrin	22.037	39515 - 41 - 8	265.1>210.1	12	265.1>172.1	14
361	咪唑菌酮	Fenamidone	22.062	161326 - 34 - 7	268.1>180.1	16	268.1>77.0	28
362	吡螨胺	Tebufenpyrad	22.125	119168 - 77 - 3	333.1>171.1	20	333.1>276.1	8
363	茚草酮	Indanofan	22.132	133220 - 30 - 1	310.1>139.0	6	310.1>105.0	16
364	莎稗磷	Anilofos	22.156	64249 - 01 - 0	226.1>184.0	6	226.1>157.0	14
365	氟萘禾草灵	Bifenox	22.186	42576 - 02 - 3	340.9>309.9	10	340.9>280.9	12
366	氟菌唑代谢物	Etoxazole metabolite	22.186	0 - 00 - 0	246.1>84.1	14	246.1>57.1	16
367	糠菌唑-2	Bromuconazole-2	22.202	116255 - 48 - 2	294.9>172.9	14	294.9>145.0	28
368	喹螨酯	Fenazaquin	22.217	120928 - 09 - 8	160.2>145.1	8	145.2>115.1	24
369	氯甲酰草胺	Clomeprop	22.264	84496 - 56 - 0	288.1>120.1	22	288.1>169.1	16
370	呋吡菌胺	Furametpyr	22.272	123572 - 88 - 3	298.1>176.1	24	298.1>123.1	22
371	苯醚菊酯-1	Phenothrin-1	22.295	26002 - 80 - 2	183.1>168.1	14	183.1>153.1	14
372	呋线威	Furathiocarb	22.295	56907 - 30 - 4	325.1>194.0	6	325.1>163.0	12
373	异菌脲代谢物	Iprodione metabolite	22.365	63637 - 89 - 8	329.0>142.0	10	329.0>127.0	14
374	三氯杀螨砜	Tetradifon	22.380	116 - 29 - 0	355.9>228.9	12	355.9>159.0	18
375	苯醚菊酯-2	Phenothrin-2	22.403	26002 - 80 - 2	183.1>168.1	14	183.1>153.1	14
376	环戊恶草酮	Pentoxazone	22.473	110956 - 75 - 7	285.0>70.0	14	285.0>187.0	10
377	灭菌唑	Triticonazole	22.488	131983 - 72 - 7	235.1>217.1	6	235.1>182.1	14
378	伏杀硫磷*	Phosalone	22.488	2310 - 17 - 0	182.0>111.0	14	182.0>138.0	8
379	溴苯磷	Leptophos	22.496	21609 - 90 - 5	376.9>361.9	24	376.9>268.9	36
380	甲基谷硫磷	Azinphos-methyl	22.566	86 - 50 - 0	160.1>132.1	6	160.1>77.0	20
381	吡丙醚	Pyriproxyfen	22.659	95737 - 68 - 1	136.1>78.0	20	136.1>96.0	14
382	氯氟氰菊酯-1*	Cyhalothrin-1	22.659	68085 - 85 - 8	197.0>161.0	8	197.0>141.0	12
383	氰氟草酯	Cyhalofop-butyl	22.705	122008 - 85 - 9	357.1>256.1	10	357.1>229.1	14
384	苯噻草胺	Mefenacet	22.736	73250 - 68 - 7	192.0>136.0	14	192.0>109.0	24
385	呋吡菌胺代谢物	Furametpyr metabolite	22.744	0 - 00 - 0	296.1>278.1	14	296.1>263.1	22
386	氟丙菊酯-1	Acrinathrin-1	22.798	101007 - 06 - 1	289.1>93.0	14	289.1>77.0	26
387	双甲脒	Amitraz	22.806	33089 - 61 - 1	293.1>162.1	8	293.1>147.1	12
388	lambda-氯氟氰菊酯	lambda-Cyhalothrin	22.821	91465 - 08 - 6	181.1>152.1	24	163.1>127.0	14
389	氯氟氰菊酯-2*	Cyhalothrin-2	22.829	68085 - 85 - 8	197.0>161.0	8	197.0>141.0	12
390	灭蚁灵	Mirex	22.942	2385 - 85 - 5	271.8>236.8	18	273.8>238.8	18
391	氟丙菊酯-2	Acrinathrin-2	23.009	101007 - 06 - 1	289.1>93.0	14	289.1>77.0	26
392	定菌磷	Pyrazophos	23.009	13457 - 18 - 6	221.1>193.1	12	221.1>149.1	14

393	氯苯嘧啶醇	Fenarimol	23.032	60168 - 88 - 9	251.0>139.0	14	251.0>111.0	26
394	丙硫克百威	Benfuracarb	23.047	82560 - 54 - 1	353.1>190.1	12	353.1>90.0	16
395	乙基谷硫磷	Azinphos-ethyl	23.158	2642 - 71 - 9	160.1>132.1	4	160.1>77.0	18
396	氯亚磷	Dialifos	23.211	10311 - 84 - 9	208.0>181.0	8	208.0>130.0	22
397	吡唑硫磷	Pyraclifos	23.300	77458 - 01 - 6	360.1>194.0	14	360.1>139.0	14
398	噁唑草禾灵	Fenoxaprop-ethyl (Fenoxaprop-P-ethyl)	23.367	66441 - 23 - 4	361.1>288.1	12	361.1>261.1	12
399	氨磺乐灵	Oryzalin	23.419	19044 - 88 - 3	317.0>258.0	14	317.0>217.0	12
400	螺螨酯	Spirodiclofen	23.486	148477 - 71 - 8	312.0>109.0	20	312.0>277.0	6
401	联苯三唑醇-1	Bitertanol-1	23.568	55179 - 31 - 2	170.1>141.1	22	170.1>115.1	28
402	氯菊酯-1*	Permethrin-1	23.628	52645 - 53 - 1	183.1>168.1	14	183.1>165.1	14
403	联苯三唑醇-2	Bitertanol-2	23.692	55179 - 31 - 2	170.1>141.0	22	170.1>115.0	28
404	蝇毒磷*	Coumaphos	23.743	56 - 72 - 4	362.0>109.0	16	362.0>226.0	14
405	氯菊酯-2*	Permethrin-2	23.757	52645 - 53 - 1	183.1>168.1	14	183.1>165.1	14
406	氟啶唑	Fluquinconazole	23.764	136426 - 54 - 5	340.0>298.0	20	340.0>313.0	14
407	哒螨灵*	Pyridaben	23.786	96489 - 71 - 3	147.1>117.1	22	147.1>132.1	14
408	敌恶磷	Dioxathion	23.800	78 - 34 - 2	271.0>153.0	8	271.0>125.0	14
409	咪鲜胺	Prochloraz	23.822	67747 - 09 - 5	180.1>138.1	12	180.1>69.0	20
410	恶咪唑	Oxpoconazole	23.836	134074 - 64 - 9	294.1>179.1	12	294.1>197.1	6
411	丙啉草酯	Butafenacil	23.944	134605 - 64 - 4	331.0>180.0	14	331.0>152.0	28
412	乙氧苯草胺	Etobenzanid	24.074	79540 - 50 - 4	179.1>59.0	10	179.1>149.0	6
413	苯酮唑	Cafenstrole	24.081	125306 - 83 - 4	188.1>119.1	20	188.1>82.0	18
414	腈苯唑	Fenbuconazole	24.153	114369 - 43 - 6	198.1>129.1	10	198.1>102.1	24
415	氟氯氰菊酯-1*	Cyfluthrin-1	24.168	68359 - 37 - 5	226.1>206.1	14	226.1>199.1	6
416	氟氯氰菊酯-2*	Cyfluthrin-2	24.268	68359 - 37 - 5	226.1>206.1	14	226.1>199.1	6
417	氟氯氰菊酯-3*	Cyfluthrin-3	24.326	68359 - 37 - 5	226.1>206.1	14	226.1>199.1	6
418	氟氯氰菊酯-4*	Cyfluthrin-4	24.375	68359 - 37 - 5	226.1>206.1	14	226.1>199.1	6
419	氯氰菊酯-1*	Cypermethrin-1	24.494	52315 - 07 - 8	181.1>152.1	22	181.1>127.1	22
420	苄螨醚	Halfenprox	24.550	111872 - 58 - 3	263.0>235.0	14	263.0>117.0	14
421	啶酰菌胺	Boscalid	24.557	188425 - 85 - 6	342.1>140.1	14	342.1>112.1	28
422	氯氰菊酯-2*	Cypermethrin-2	24.598	52315 - 07 - 8	181.1>152.1	22	181.1>127.1	22
423	氯氰菊酯-3*	Cypermethrin-3	24.647	52315 - 07 - 8	181.1>152.1	22	181.1>127.1	22
424	氟氰戊菊酯-1*	Flucythrinate-1	24.661	70124 - 77 - 5	199.1>157.1	10	199.1>107.1	22
425	精啶禾灵	Quizalofop-ethyl	24.668	76578 - 14 - 8	372.1>299.1	14	372.1>272.1	10
426	氯氰菊酯-4*	(Quizalofop-P-ethyl) Cypermethrin-4	24.696	52315 - 07 - 8	181.1>152.1	22	181.1>127.1	22
427	醚菊酯	Etofenprox	24.808	80844 - 07 - 1	163.1>135.1	10	163.1>107.1	18
428	啶虫丙醚	Pyridalyl	24.829	179101 - 81 - 6	204.1>148.1	20	204.1>176.1	12
429	氟氰戊菊酯-2*	Flucythrinate-2	24.857	70124 - 77 - 5	199.1>157.1	10	199.1>107.1	22
430	硅醚菊酯	Silafluofen	24.948	105024 - 66 - 6	286.1>258.1	14	286.1>207.1	14
431	氟啶草酮	Fluridone	25.054	59756 - 60 - 4	328.1>259.0	24	328.1>313.0	22

432	噻虫啉	Thiacloprid	25.195	111988 - 49 - 9	251.0>224.0	18	251.0>191.0	20
433	噁嗪醚	Pyrimidifen	25.217	105779 - 78 - 0	184.1>169.0	14	184.1>157.0	14
434	丙炔氟草胺	Flumioxazin	25.403	103361 - 09 - 7	354.1>326.1	8	354.1>176.1	20
435	氟戊菊酯-1*	Fenvalerate-1	25.410	51630 - 58 - 1	419.1>225.1	6	419.1>167.1	12
436	吡唑醚菌酯	Pyraclostrobin	25.521	175013 - 18 - 0	164.1>132.1	14	164.1>77.0	28
437	tau-氟胺氰菊酯-1	tau-Fluvalinate-1	25.529	102851 - 06 - 9	250.1>200.1	16	250.1>55.0	18
438	氟胺氰菊酯-1	Fluvalinate-1	25.536	69409 - 94 - 5	250.1>55.0	20	250.1>200.0	20
439	tau-氟胺氰菊酯-2	tau-Fluvalinate-2	25.603	102851 - 06 - 9	250.1>200.1	16	250.1>55.0	18
440	氟胺氰菊酯-2	Fluvalinate-2	25.610	69409 - 94 - 5	250.1>55.0	20	250.1>200.0	20
441	氟戊菊酯-2*	Fenvalerate-2 (Esfenvalerate)	25.633	51630 - 58 - 1	419.1>225.1	6	419.1>167.1	12
442	苯醚甲环唑-1*	Difenoconazole-1	25.917	119446 - 68 - 3	323.0>265.0	14	323.0>202.0	28
443	苯醚甲环唑-2*	Difenoconazole-2	25.985	119446 - 68 - 3	323.0>265.0	14	323.0>202.0	28
444	苄草唑	Pyrazoxyfen	26.019	71561 - 11 - 0	367.1>105.0	14	367.1>119.0	16
445	溴氰菊酯-1*	Deltamethrin-1 (Tralomethrin deg.-1)	26.036	52918 - 63 - 5	252.9>93.0	20	252.9>171.9	8
446	茚虫威	Indoxacarb	26.103	144171 - 61 - 9	264.0>176.0	14	264.0>232.0	6
447	溴氰菊酯-2*	Deltamethrin-2 (Tralomethrin deg.-2)	26.281	52918 - 63 - 5	252.9>93.0	20	252.9>171.9	8
448	氟烯草酸	Flumiclorac-pentyl	26.458	87546 - 18 - 7	423.1>318.1	12	423.1>308.1	14
449	啉菌酯	Azoxystrobin	26.500	131860 - 33 - 8	344.1>183.1	24	344.1>329.1	16
450	烯酰吗啉-1	Dimethomorph-1	26.658	110488 - 70 - 5	301.1>165.1	14	301.1>139.0	14
451	噁唑酮菌	Famoxadone	26.756	131807 - 57 - 3	330.1>224.1	10	330.1>196.1	22
452	唑虫酰胺	Tolfenpyrad	26.863	129558 - 76 - 5	383.1>171.1	20	383.1>197.1	20
453	烯酰吗啉-2	Dimethomorph-2	27.088	110488 - 70 - 5	301.1>165.1	14	301.1>139.0	14
454	亚胺唑	Imibenconazole	27.509	86598 - 92 - 7	375.0>260.0	22	375.0>306.0	12
455	吡啶酮草酯	Cinidon-ethyl	27.690	142891 - 20 - 1	358.1>330.1	14	358.1>302.1	28
456	氟噻甲草酯	Fluthiacet-methyl	28.060	117337 - 16 - 6	403.0>56.0	24	403.0>84.0	14
457	恶草酸	Propaquizafop	28.615	111479 - 05 - 1	443.1>371.1	8	443.1>299.1	16
458	磺吸磷	dioxydemeton-S-methyl	7.879	17040-19-6	77.00>58.90	9	92.00>66.00	9
459	灭多威(硫双威分解)	Thiodicarb	8.050	59669-26-0	105.00>88.00	6	105.00>58.10	12
460	氯化苦	nitrotrichloromethane	8.203	76-02-2	117.00>81.90	27	119.00>84.00	24
461	除虫脲 1	Hexaflumuron 1	8.814	86479-06-3	153.00>124.90	12	153.00>90.10	27
462	辛硫磷	phoxim	9.081	14816-18-3	130>103	10	103>76	15
463	四螨嗪	clofentezine	9.127	74115-24-5	102>76	15	137>102	15
464	异丙隆产物	Isoproturon	9.668	34123-59-6	146.00>128.10	9	161.00>146.10	9
465	除虫脲 2	Hexaflumuron 2	10.485	86479-06-3	157.00>141.10	12	141.00>113.00	12
466	氟虫脲	flufenoxuron	10.517	101463-69-8	157>141	10	141>113	15
467	乙拌磷亚砷	Disulfoton-sulfoxide	10.611	2497-07-6	97.00>65.00	21	153.00>97.00	15
468	苯胺灵	propham	12.042	122-42-9	179>137	5	120>77	15
469	克菌丹代谢物	cis-1,2,3,6-tetrahydrophthalimide	12.436	27813-21-4	123>105	10	79>65	20
470	麦草畏甲酯	Dicamba methyl ester	12.689	6597-78-0	203>188	15	203>160	25

471	庚烯磷	heptenophos	13.262	23560-59-0	124>89	15	215>200	10
472	内吸磷	demeton(O&S)	14.959	8065-48-3	88>60	5	89>60	5
473	伏草隆	fluometuron	13.909	2164-17-2	232>72	20		
474	草灭特(环草敌)	cycloate	14.029	1134-23-2	83>55	10	154>83	10
475	杀虫脒	chlordimeform free base	14.236	6164-98-3	196>181	10	181>140	15
476	氟氯苯菊酯	Flumethrin	14.552	69770-45-2	187>159	10	216>187	10
477	猛杀威	promecarb	14.574	2631-37-0	150>135	10	135>91	15
478	戊菌隆	pencycuron	14.585	66063-05-6	180>125	10	209>180	10
479	五氯甲氧基苯	pentachloroanisole	14.938	1825-21-4	265>237	15	280>265	10
480	甜菜安	desmedipham	14.938	13684-56-5	181>109	10	122>94	10
481	内吸磷	demeton(O&S)	14.959	8065-48-3	88>60	5	89>60	5
482	促长啉/乙氧喹啉	ethoxyquin	15.055	91-53-2	202>174	15	202>145	25
483	氯谷隆	monolinuron	15.225	1746-81-2	126>99	15	214>61	10
484	五氯苯胺	Pentachloroaniline	16.307	527-20-8	262.80>191.90	21	264.80>193.90	21
485	脱甲基抗蚜威	Pirimicarb-desmethyl	16.307	30614-22-3	152.00>96.10	12	224.00>152.10	12
486	2,4-滴丁酯	2,4-D butyl ester	16.614	94-80-4	185.00>155.00	15	276.00>185.00	9
487	马拉氧磷	malaoxon	16.624	1634-78-2	127>99	10	268>127	10
488	八氯二丙醚	S421	17.071	127-90-2	130>95	20	181>85	10
489	苯锈啶	1-(3-(4-tert-Butylphenyl)-2-methylpropyl)piperidine	17.159	67306-00-7	98.00>55.10	15	98.00>70.00	9
490	甲基五氯苯基硫醚	methyl pentachlorophenyl sulfide	17.326	1825-19-0	296>263	15	246>211	20
491	甲拌磷亚砷	Phorat-sulfoxide	17.375	2588-03-6	153.00>97.00	12	199.00>171.10	6
492	噻草啶	thiazopyr	17.415	117718-60-2	363>300	15	327>277	30
493	甲拌磷砷*	Phorat sulfone	17.503	2588-04-7	153.00>97.00	12	153.00>125.00	6
494	乙霉威	Diethofencarb	17.523	87130-20-9	267.1>225.1	8	267.1>168.1	18
495	Z 甲基毒虫威	(Z) -dimethylvinphos	17.542	67628-93-7	297>109	15	295>280	15
496	粉锈啉	Fenpropimorph	17.650	67564-91-4	128.00>70.10	12	128.00>110.10	12
497	四氯苯酞	Tetrachlorophthalide	17.852	27355-22-2	272.00>242.90	9	243.00>214.90	9
498	乙基虫螨磷/噻啶磷	pirimiphos-ethyl	17.927	23505-41-1	304>168	10	318>166	15
499	噻虫嗪分解物	Thiamethoxam	18.040	153719-23-4	212.00>139.10	21	212.00>182.10	6
500	氟啶胺	fluazinam	18.116	79622-59-6	371.90>336.90	22	417.85>336.90	40
501	特丁硫磷砷	Terbufos sulfone	18.248	56070-16-7	153.00>97.00	21	199.00>97.00	21
502	呋霜灵	furalaxyl	18.493	57646-30-7	242>95	15	301>224	20
503	氟吡甲禾灵	haloxyfop-methyl	18.763	69806-40-2	316>91	20	288>180	25
504	噻螨酮	hexythiazox	18.817	78587-05-0	184>149	10	156>112	15
505	蚜灭磷	vamidothion	18.871	2275-23-2	145>87	10	145>58	15
506	氟节胺	Flumetralin	18.925	62924-70-3	143.00>107.00	21	143.00>83.00	18
507	缬霉威(丙森锌)-1	iprovalicarb-1	19.504	140923-17-7	158>116	5	134>93	15
508	缬霉威(丙森锌)-2	iprovalicarb-2	19.681	140923-17-7	158>116	5	134>93	15
509	环丙唑醇	Cyproconazol	19.873	113096-99-4	222.00>125.00	27	139.00>111.00	15

510	精吡氟禾草灵	fluazifop-p-butyl	19.908	79241-46-6	383>282	15	282>91	20
511	倍硫磷亚砷	Fenthionsulfoxide	20.090	3761-41-9	278.00>108.90	18	278.00>125.10	24
512	丙炔恶草酮	oxadiargyl	20.116	39807-15-3	150.00>123.00	15	340.00>150.10	24
513	倍硫磷砷	Fenthion-sulfone	20.186	3761-42-0	310.00>105.20	12	310.00>109.00	21
514	哒菌酮/哒菌清	diclomezine	20.748	62865-36-5	254>163	20	197>126	20
515	炔草酯/炔草酸	Clodinafop-propargyl ester	20.940	105512-06-9	349>266	10	349>238	15
516	环酰菌胺	fenhexamid	20.957	126833-17-8	177>113	15	177>78	25
517	氯氟吡氧乙酸异辛酯	starane	21.191	81406-37-3	255.00>209.00	12	209.00>181.00	9
518	吡氟甲禾灵	Haloxypop-2-ethoxyethyl	21.339	87237-48-7	302>274	15	316>272	20
519	敌螨普-1	dinocap-1	21.411	39300-45-3	69.00>41.00	15	69.00>39.10	24
520	螺甲螨酯	Spiromesifen	21.556	283594-90-1	272.05>254.10	4	254.00>209.20	12
521	苯线磷亚砷	fenamiphos-sulfoxide	21.596	31972-43-7	304>196	10	319>304	5
522	敌螨普-2	dinocap-2	21.652	39300-45-3	69.00>41.00	15	69.00>39.10	24
523	苯胺磷砷(苯线磷砷)	fenamiphos-sulfone	21.684	31972-44-8	320>292	10	320>214	15
524	异菌脲	iprodione	21.708	36734-19-7	314>56	25	316>56	25
525	醚菌胺	Dimoxystrobin PESTANAL	21.716	149961-52-4	116.00>89.00	18	205.00>116.10	18
526	敌螨普-3	dinocap-3	21.869	39300-45-3	69.00>41.00	15	69.00>39.10	24
527	解毒啉	cloquintocet-1-methylhexyl ester	21.981	99607-70-2	192>162	25	192>126	25
528	苯螨特	Benzomate	21.989	29104-30-1	199.00>141.00	27	199.00>184.00	21
529	叶菌唑	Metconazole	22.217	125116-23-6	125.00>89.00	18	153.00>125.10	18
530	乳氟禾草灵	lactofen	22.837	77501-63-4	344>223	15	344>300	10
531	乙羧氟草醚	Benzofluorfen	23.061	77501-60-1	344.00>223.00	15	447.00>345.00	9
532	苯菌酮	metrafenone	23.166	220899-03-6	393>363	20	379>364	10
533	恶霉灵	Hymexazol	7.861	10004-44-1	99.00>71.10	10	99.00>54.00	20
534	乙蒜素	Ethylcin	8.122	682-91-7	154.00>95.10	5	95.00>77.00	10
535	苦参碱	Matrine	21.091	519-02-8	247.00>150.20	15	248.00>205.20	10
536	苯氟磺胺	Methanesulfenamide	17.346	1085-98-9	224.00>123.00	18	226.00>123.00	18
537	氟吡甲禾灵	Haloxypop-methyl	18.763	69806-40-2	375.00>316.00	12	316.00>91.10	18
538	野燕枯	Difenzoquat	19.629	49866-87-7	234.00>130.10	21	234.00>104.10	21
539	吡氟禾草灵	Fluazifop-butyl	19.916	69806-50-4	282.00>91.10	18	282.00>238.10	18
540	苯草醚	Aclonifen	20.325	74070-46-5	212.00>182.10	15	264.00>194.10	18
541	地胺磷	Mephosfolan	18.511	950-10-7	196.00>140.00	12	256.00>170.10	21
542	对氧磷	Paraoxon	17.130	311-45-5	109.00>81.00	12	109.00>91.00	6
543	阿特拉通	Atraton	15.023	1610-17-9	211.00>169.20	6	211.00>154.10	15
544	异丙净	Dipropetryn	17.454	4147-51-7	255.00>222.20	9	255.00>180.20	18
545	甲氧丙净	Methoprotryne	19.681	841-06-5	256.00>170.10	21	256.00>212.10	15
546	异丙草胺	Propisochlor	16.875	86763-47-5	162.00>120.10	18	162.00>147.10	18
547	毒壤磷	Trichloronat	17.852	327-98-0	297.00>269.00	15	299.00>271.00	15
548	苯胺	Aniline	7.382	62-53-3	93>66	10	93>65	20
549	溴苯烯磷	Bromfenvinfos	19.179	33399-00-7	267.00>159.00	15	269.00>161.00	21
550	环丙氟灵	Profluralin	15.427	26399-36-0	318.00>199.10	18	318.00>55.10	18

551	八甲磷	Schradan	15.055	152-16-9	243.00>153.10	12	199.00>135.10	18
552	氟丁酰草胺	Beflubutamid	18.474	113614-08-7	176.00>91.10	15	221.00>193.00	12
553	巴毒磷	Crotoxyphos	18.662	7700-17-6	193.00>127.00	9	127.00>109.00	15
554	敌草净	Desmetryn	16.481	1014-69-3	213.00>171.10	6	213.00>58.10	18
555	硫草敌	Ethiolate	9.358	2941-55-1	100.00>72.10	6	161.00>100.10	9
556	三氟硝草醚	Fluorodifen	19.197	15457-05-3	190.00>126.00	12	190.00>75.00	21
557	特丁津	Terbuthylazine	15.512	5915-41-3	214.00>71.10	18	229.00>173.10	6
558	虫线磷	Thionazin	13.625	297-97-2	143.00>79.10	12	175.00>79.10	12
559	氟甲腈*	fipronil-desulfinyl	16.409	205650-65-3	387.95>332.90	18	333.00>231.00	27
560	氟虫腈硫醚*	fipronil-sulfide	17.974	120067-83-6	350.95>255.00	18	419.95>350.90	15
561	氟啶脲	chlorfluazuron	18.916	71442-67-8	320.95>303.80	30	322.95>305.60	36
562	氟虫腈砒*	fipronil-sulfone	19.179	120068-36-2	382.95>255.00	24	382.95>213.00	36
563	抗倒酯	trinexapac-ethyl	17.130	95266-40-3	151.00>95.10	10	224.00>151.10	8
564	氟吡菌酰胺	fluopyram	18.332	658066-35-4	223.00>196.00	20	396.00>223.10	12
565	2 甲 4 氯异辛酯	MCPA-isooctyl	18.880	26544-20-7	200.00>141.00	12	200.00>77.10	30
566	2,4-滴异辛酯	2,4-D-ethylhexyl Ester	19.550	25168-26-7	220.00>162.00	12	220.00>98.10	30
567	三氯吡氧乙酸	triclopyr	19.612	55335-06-3	255.00>182.00	12	255.00>146.00	30
568	苯噻草酮	metamitron	19.621	41394-05-2	202.00>174.10	6	202.00>104.10	14
569	甲磺草胺	sulfentrazone	21.893	122836-35-5	351.00>181.10	32	351.00>272.00	16
570	啞啞菌胺	ametocradin	23.136	865318-97-4	246.00>188.20	28	246.00>174.10	28
571	啞啞草酯	pinoxaden	23.606	243973-20-8	400.00>299.30	6	299.00>183.10	30
572	噻草酸甲酯	fluthiacet-methyl	27.886	117337-19-6	403.00>56.20	18	403.00>84.00	10
573	噁唑酰草胺	metamifop	29.054	256412-89-2	440.00>180.30	8	440.00>123.10	20
574	阿拉酸式苯-S-甲基	Acibenzolar-S-methyl	16.855	135158-54-2	135.00>107.00	9	135.00>63.00	27
575	棉隆	Dazomet	14.927	533-74-4	162.00>89.10	6	162.00>129.00	6
576	二溴氯丙烷	DBCP	8.383	96-12-8	157.00>75.00	9	155.00>75.00	9
577	甲氟磷	Dimefox	7.780	115-26-4	154.00>88.20	6	154.00>58.10	9
578	异丙乐灵	Isopropalin	18.012	33820-53-0	280.00>238.20	6	280.00>119.10	27
579	甲硫威砒	Methiocarb sulfone	15.929	2179-25-1	121.00>77.10	12	200.00>121.10	15
580	兹克威	Mexacarbate	17.061	315-18-4	165.00>134.10	12	165.00>150.20	12
581	杀线威	Oxamyl	12.822	23135-22-0	162.00>115.10	9	162.00>145.10	3
582	氟苯脲	Teflubenzuron	11.145	83121-18-0	197.00>135.00	27	197.00>142.00	27
583	敌百虫	Trichlorfon	12.097	52-68-6	109.00>79.00	9	145.00>109.00	9
584	杀铃脲(杀虫脲)	Triflumuron	11.988	64628-44-0	139.00>111.00	15	139.00>75.10	27

结果讨论

2.1 筛查方法线性考察

选择部分农药组分, 使用茶叶空白基质溶液配制农药标准系列, 浓度分别为 1、5、10、20、50、100 $\mu\text{g/L}$ 。以浓度为横坐标, 峰面积为纵坐标, 制作外标曲线。部分农药质量色谱图见图 2 所示 (浓度 10.0 $\mu\text{g/L}$), 部分农药外标曲线如图 3 所示, 各组分外标曲线相关系数见表 3。

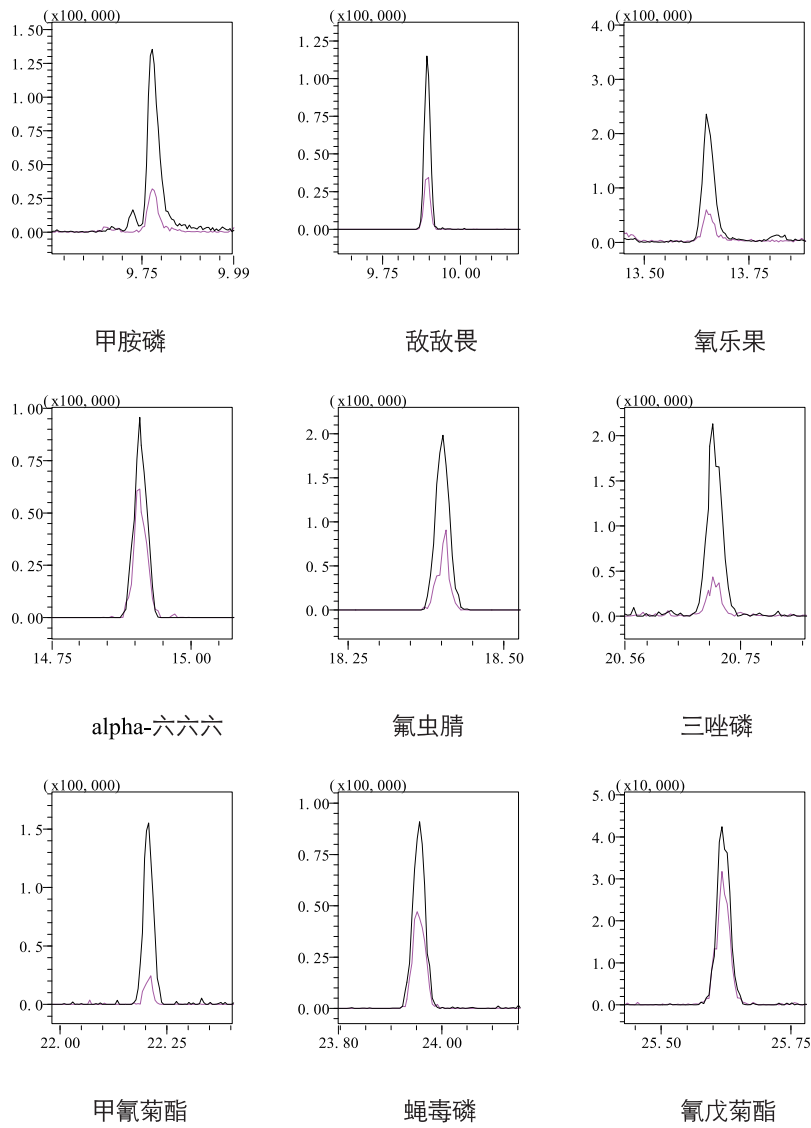
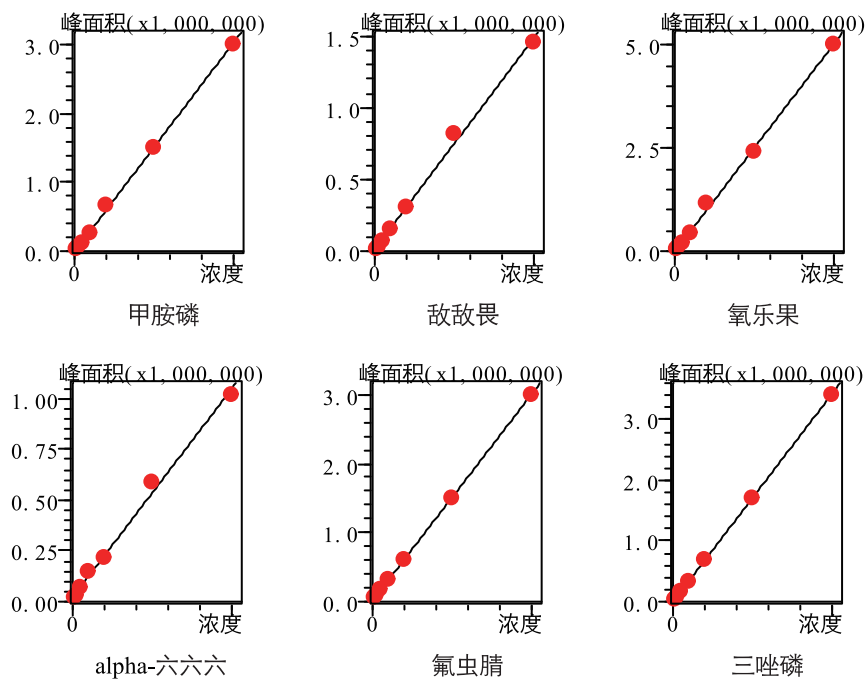


图2 部分农药质量色谱图(浓度: 10.0 µg/L)



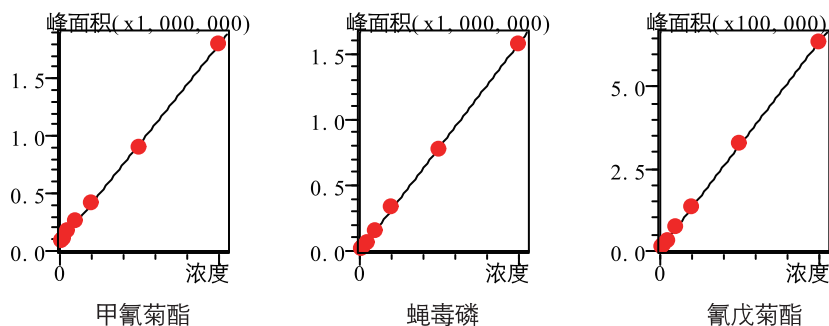


图3 部分农药标准曲线图

2.2 筛查方法检出限及重复性考察

进样分析 5.0 $\mu\text{g/L}$ 茶叶空白基质标准溶液，以 3 倍信噪比（峰峰比）计算方法检出限。以 10 $\mu\text{g/L}$ 空白茶叶基质标准溶液重复测定 5 次，考察仪器重现性。各组分检出限及重现性见表 3。

表3 外标曲线相关系数、检出限及重现性

No.	化合物	相关系数	LOD ($\mu\text{g/kg}$)	RSD% (n=5)	No.	化合物	相关系数	LOD ($\mu\text{g/kg}$)	RSD% (n=5)
1	甲胺磷	0.9991	1.09	1.95	37	p,p'-DDE	0.9999	0.15	1.84
2	敌敌畏	0.995	0.02	6.87	38	o,p'-DDD	0.996	0.70	4.75
3	氧乐果	0.997	0.98	3.02	39	p,p'-DDD	0.997	0.09	1.96
4	灭线磷	0.999	1.13	1.37	40	o,p'-DDT	0.998	0.73	4.42
5	治螟磷	0.996	0.01	3.72	41	三唑磷	0.99995	0.81	2.77
6	甲拌磷	0.996	0.03	2.05	42	p,p'-DDT	0.998	0.01	6.80
7	alpha-六六六	0.995	0.02	8.91	43	异菌脲	0.9991	0.09	6.23
8	乐果	0.9993	5.01	6.10	44	亚胺硫磷	0.999	1.75	2.42
9	beta-六六六	0.998	0.02	3.99	45	联苯菊酯	0.9997	0.34	1.28
10	五氯硝基苯	0.995	0.03	4.55	46	甲氧菊酯	0.9993	0.10	2.60
11	gamma-六六六	0.998	0.02	7.84	47	伏杀硫磷	0.9998	1.31	1.11
12	特丁硫磷	0.996	0.24	2.35	48	氯氟氰菊酯-1	0.997	4.33	5.65
13	二嗪磷	0.9995	0.01	2.51	49	氯氟氰菊酯-2	0.9995	1.88	4.78
14	噁霉胺	0.9998	2.81	4.12	50	氯菊酯-1	0.994	9.00	5.64
15	百菌清	0.9997	0.03	2.92	51	蝇毒磷	0.9994	0.18	3.62
16	delta-六六六	0.9993	0.02	3.73	52	氯菊酯-2	0.9996	4.20	6.17
17	氟甲腈	0.9997	0.01	1.60	53	哒螨灵	0.997	1.67	1.47
18	乙烯菌核利	0.9992	0.06	6.20	54	氟氯氰菊酯-1	0.996	0.53	3.35
19	甲基对硫磷	0.9996	0.34	2.16	55	氟氯氰菊酯-2	0.9993	0.43	5.18
20	杀螟硫磷	0.9999	0.02	3.44	56	氟氯氰菊酯-3	0.9996	1.41	2.58
21	马拉硫磷	0.9997	0.28	4.18	57	氟氯氰菊酯-4	0.997	1.54	4.44
22	甲拌磷砒	0.9999	6.08	6.31	58	氯氰菊酯-1	0.9996	4.48	6.22
23	毒死蜱	0.9996	0.02	4.37	59	氯氰菊酯-2	0.998	5.78	3.67
24	倍硫磷	0.9998	0.84	2.94	60	氯氰菊酯-3	0.9998	3.76	3.03
25	对硫磷	0.9996	0.33	6.64	61	氟氰戊菊酯-1	0.9999	1.55	5.02

26	三唑酮	0.9996	5.18	2.54	62	氯氰菊酯-4	0.998	9.00	6.32
27	水胺硫磷	0.9991	0.45	5.85	63	氰戊菊酯-2	0.9994	2.43	4.98
28	三氯杀螨醇 分解物	0.995	0.13	6.05	64	氰戊菊酯-1	0.9996	0.06	6.04
29	氟虫腈硫酸酯	0.9996	0.01	4.24	65	氟胺氰菊酯-1	0.9999	0.88	1.57
30	甲基异柳磷	0.9995	0.14	2.08	66	氟胺氰菊酯-2	0.9997	0.24	3.44
31	二甲戊灵	0.9997	0.02	1.74	67	氰戊菊酯-2	0.9991	0.08	5.27
32	氟虫腈	0.9998	0.01	4.73	68	苯醚甲环唑-1	0.9998	0.90	3.79
33	腐霉利	0.9997	0.79	5.41	69	苯醚甲环唑-2	0.9995	1.15	4.08
34	杀扑磷	0.9996	0.79	4.26	70	溴氰菊酯-1	0.9991	4.89	2.06
35	氟虫腈砒	0.9991	0.02	6.94	71	溴氰菊酯-2	0.9991	3.39	1.71
36	丙溴磷	0.9992	0.10	7.18					

2.3 回收率

在茶叶空白样品中添加浓度为 0.03 mg/kg 农药混标, 按照 1.3 样品前处理流程分别平行处理 3 份, 茶叶样品的加标回收率结果见表 4。

表4 茶叶样品加标回收率(n=3)

编号	化合物	加标量 0.03 mg/kg		编号	化合物	加标量 0.03 mg/kg	
		平均回收率 (%)	RSD (%)			平均回收率 (%)	RSD (%)
1	甲胺磷	75.0	5.5	37	p, p' - DDE	102.7	4.0
2	敌敌畏	85.0	3.5	38	o, p' - DDD	93.3	11.1
3	氧乐果	77.8	6.7	39	p, p' - DDD	104.6	1.8
4	灭线磷	103.3	4.8	40	o, p' - DDT	87.5	15.0
5	治螟磷	115.1	4.5	41	三唑磷	98.9	3.1
6	甲拌磷	83.4	13.3	42	p, p' - DDT	86.9	17.0
7	alpha-六六六	101.2	10.0	43	异菌脲	93.0	14.0
8	乐果	103.7	5.2	44	亚胺硫磷	100.9	3.3
9	beta-六六六	124.5	8.7	45	联苯菊酯	79.4	3.6
10	五氯硝基苯	95.9	3.1	46	甲氰菊酯	72.1	11.7
11	gamma-六六六	94.6	14.5	47	伏杀硫磷	103.4	3.7
12	特丁硫磷	104.3	2.6	48	氯氟氰菊酯-1	104.3	3.4
13	二嗪磷	115.2	9.4	49	氯氟氰菊酯-2	99.8	1.5
14	啉霉胺	108.6	6.5	50	氯菊酯-1	121.8	3.5
15	百菌清	114.8	2.7	51	蝇毒磷	101.6	3.4
16	delta-六六六	121.3	2.7	52	氯菊酯-2	110.2	8.4
17	氟甲腈	98.8	1.8	53	哒螨灵	103.3	1.9
18	乙烯菌核利	121.0	5.9	54	氟氯氰菊酯-1	100.1	4.7
19	甲基对硫磷	115.4	6.7	55	氟氯氰菊酯-2	99.9	2.4
20	杀螟硫磷	119.5	6.3	56	氟氯氰菊酯-3	103.1	4.1

21	马拉硫磷	107.7	2.2	57	氟氯氰菊酯-4	112.7	8.5
22	甲拌磷砒	122.9	6.5	58	氯氰菊酯-1	98.6	8.6
23	毒死蜱	123.4	3.5	59	氯氰菊酯-2	94.7	4.9
24	倍硫磷	110.9	2.4	60	氯氰菊酯-3	105.3	3.0
25	对硫磷	108.8	3.0	61	氟氰戊菊酯-1	100.6	4.4
26	三唑酮	105.9	6.1	62	氯氰菊酯-4	100.4	6.6
27	水胺硫磷	92.0	16.7	63	氟氰戊菊酯-2	93.2	11.8
28	三氯杀螨醇分解物	120.1	4.3	64	氰戊菊酯-1	100.6	4.5
29	氟虫腈硫醚	99.2	5.2	65	氟胺氰菊酯-1	103.7	3.8
30	甲基异柳磷	101.0	4.2	66	氟胺氰菊酯-2	112.0	3.7
31	二甲戊灵	115.8	6.5	67	氰戊菊酯-2	86.8	4.2
32	氟虫腈	99.7	7.6	68	苯醚甲环唑-1	101.9	6.5
33	腐霉利	103.9	3.3	69	苯醚甲环唑-2	106.5	3.1
34	杀扑磷	107.0	1.0	70	溴氰菊酯-1	100.6	6.5
35	氟虫腈砒	88.2	3.5	71	溴氰菊酯-2	116.3	8.8
36	丙溴磷	107.4	4.3				

结论

结合 PTV 进样，采用岛津公司三重四极杆气质联用仪 GCMS-TQ8050 建立了茶叶基质中 584 种农药的 GC-MS/MS 筛查方法。通过茶叶空白基质中添加 58 种农药考察筛查方法的线性、灵敏度、重复性和添加回收率。结果表明：茶叶基质中 58 种农药峰形线性良好，方法检出限低，回收率稳定，峰面积重复性测试相对标准偏差均小于 10%。该方法能够快速、准确地检测茶叶中的多农药残留，能够有效排除基质的影响。