

Application Data Sheet

No. 68

GC-MS

Gas Chromatograph Mass Spectrometer

GC-MS/MS Analysis of Pesticides in Drinking Water

According to Japan's list of drinking water quality control substances, pesticides are included as supplemental items subject to analysis. Designed to complement the standards, the Ministry of Health, Labour and Welfare encourages water utilities to monitor pesticide levels and achieve specified targets. Among the 102 listed pesticides, 84 are simultaneously analyzed using solid-phase extraction and GC-MS. In this datasheet, those pesticides were analyzed using GC-MS/MS and Multiple Reaction Monitoring (MRM) mode.

Experimental

Analytical conditions are shown in Table 1.

Table 1: Analytical Conditions

GC-MS	:GCMS-TQ8030		
Column	:Rtx-5MS (Length 30 m, 0.25 mm I.D., df=0.25 μm)		
Glass liner	:Custom Sky Liner, Splitless Single Taper Gooseneck w/Wool (RESTEK, catalog# 567366)		
[GC]		[MS]	
Injection Temp.	:250°C	Interface Temp.	:250 °C
Column Oven Temp.	:80°C(2 min)→(20°C /min)→180°C →(5°C /min)→280°C(3 min)	Ion Source Temp.	:230 °C
Injection Mode	:Splitless (High Pressure Injection 250 kPa, 2.3 min)	Data Acquisition Mode	:MRM
Flow Control Mode	:Linear Velocity (44.5 cm/sec)		
Injection Volume	:2 μL		

MRM Monitoring *m/z*

Compound Name	Quantitative Transition		Qualitative Transition		Compound Name	Quantitative Transition		Qualitative Transition	
	Precursor>Product	CE (V)	Precursor>Product	CE (V)		Precursor>Product	CE (V)	Precursor>Product	CE (V)
Dichlorvos	184.9>109.0	18	184.9>93.0	13	Isufenphos	213.1>185.1	6	213.1>121.1	18
Dichlobenil	170.9>136.0	13	170.9>100.0	23	Captan	149.0>105.1	5	149.0>79.0	19
Etridiazole	210.9>182.9	10	210.9>139.9	20	Dimepiperate	145.1>112.1	9	145.1>69.1	18
Chloroneb	205.9>190.9	12	205.9>140.9	19	Phenthoate	274.0>121.0	11	274.0>125.0	18
Isoprocarb	136.1>121.1	9	136.1>103.1	23	Procymidone	283.1>96.0	10	283.1>68.1	24
Molinate	126.1>55.0	18	126.1>83.1	6	Butamifos oxon	244.0>216.0	7	244.0>136.1	15
Fenobucarb	150.1>121.1	9	150.1>103.1	23	Methodathion	145.0>85.0	8	145.0>58.0	18
Trifluralin	306.1>264.0	7	306.1>206.1	17	9-Bromoanthracene (ISTD)	256.0>177.1	18	256.0>151.1	30
Benfluralin	292.1>264.0	9	292.1>206.1	14	alpha-Endosulfan	240.9>205.9	13	240.9>170.0	26
Pencycuron	180.1>125.0	10	180.1>89.0	29	Butamifos	286.1>202.1	17	286.1>185.0	27
Dimethoate	125.0>79.0	10	125.0>62.0	8	Napropamide	128.1>72.1	7	128.1>100.1	9
Simazine	201.1>173.1	6	201.1>186.1	7	Flutolanil	173.0>145.0	18	173.0>95.0	27
Atrazine	215.2>200.1	8	215.2>173.1	6	Isoxathion oxon	161.1>105.0	11	161.1>77.0	25
Diazinon oxon	273.1>137.1	18	273.1>217.0	10	Isoprothiolane	290.1>204.1	5	290.1>118.0	14
Propyzamide	172.9>144.9	15	172.9>109.0	27	Pretilachlor	238.1>162.2	11	238.1>146.2	10
Pyroquilon	173.1>130.1	20	173.1>144.1	23	Fenthion oxon sulfoxide	262.1>247.1	11	262.1>109.0	22
Diazinon	304.1>179.2	10	304.1>162.1	9	CNP-amino	287.0>108.1	19	287.0>217.0	13
Anthracene-d10 (ISTD)	188.2>160.1	20	188.2>158.1	30	Fenthion oxon sulfone	294.1>104.1	19	294.1>230.2	8
Disulfoton	274.1>88.0	6	274.1>60.0	22	Buprofezin	172.1>57.1	18	172.1>131.1	6
Chlorothalonil	265.9>230.9	19	265.9>169.9	23	Isoxathion	312.9>177.0	7	312.9>130.0	17
Iprobenfos	204.0>91.0	8	204.0>122.0	15	beta-Endosulfan	240.9>205.9	18	240.9>170.0	23
Tolclofos-methyl oxon	249.0>199.0	26	249.0>233.9	15	Fenthion sulfoxide	278.0>109.0	20	278.0>169.1	14
Fenitrothion oxon	244.0>109.0	16	244.0>90.0	18	Fenthion sulfone	310.0>109.0	24	310.0>105.1	16
Bromobutide	232.2>176.1	10	232.2>114.1	9	Mepronil	269.1>119.1	18	269.1>227.1	5
Terbucarb	205.2>177.1	8	205.2>145.1	18	Chlornitrofen	318.9>288.9	12	318.9>238.0	10
Malaoxon	127.1>99.0	7	127.1>109.0	10	Edifenphos	310.0>173.0	13	310.0>109.1	25
Simetryn	213.2>170.1	10	213.2>185.1	7	Propiconazole-1	259.1>69.0	13	259.1>173.0	18
Tolclofos-methyl	265.0>249.9	15	265.0>219.9	23	Endosulfate	271.8>236.8	18	271.8>234.8	19
Alachlor	188.1>160.1	10	188.1>131.1	22	Propiconazole-2	259.0>69.0	11	259.0>172.9	19
Metalaxyl	249.2>190.2	6	249.2>146.1	18	EPN oxon	141.0>77.0	18	141.0>51.0	30
Fenthion oxon	262.0>247.0	8	262.0>109.0	26	Thenylchlor	288.1>141.0	13	288.1>174.1	7
Dithiopyr	354.1>306.0	7	354.1>286.0	17	Pyributicarb	165.1>108.1	10	165.1>93.0	25
Fenitrothion	277.0>260.1	7	277.0>109.0	20	Iprodione	314.0>244.9	11	314.0>56.0	25
Esprocarb	222.1>91.0	19	222.1>162.2	7	Pyridaphenthion	340.0>199.1	8	340.0>109.0	22
Malathion	173.1>127.1	7	173.1>99.0	18	Chrysenes-d12 (ISTD)	240.2>236.1	30	240.2>238.2	20
Thiobencarb	257.1>100.1	7	257.1>72.1	23	EPN	157.0>77.0	24	157.0>110.0	14
Chlorpyrifos oxon	298.0>241.8	14	298.0>269.9	6	Piperophos	320.2>122.1	10	320.2>81.0	26
Fenthion	278.1>109.0	18	278.1>169.0	18	Bifenox	341.1>309.9	6	341.1>188.8	19
Chlorpyrifos	314.0>257.9	19	314.0>285.9	7	Anilofos	226.1>184.0	5	226.1>157.0	13
Isufenphos oxon	229.1>201.0	10	229.1>121.1	24	Pyriproxyfen	136.1>78.0	20	136.1>96.0	14
Phthalide	242.8>214.8	18	242.8>178.9	26	Mefenacet	192.0>136.0	17	192.0>109.0	28
Dimethametryn	212.1>122.1	13	212.1>94.0	22	Cafenstrole	188.2>119.1	22	188.2>82.0	20
Pendimethalin	252.1>162.1	11	252.1>191.1	8	Etofenprox	163.1>135.1	10	163.1>107.1	19
Methyldymron	107.1>106.1	13	107.1>77.0	25					

Results

The standard sample mixture of 84 pesticides at the concentration of 5 µg/L was analyzed 5 times. The overlay mass chromatograms from 5 injections and the repeatability are shown in Fig. 1 and Table 2, respectively.

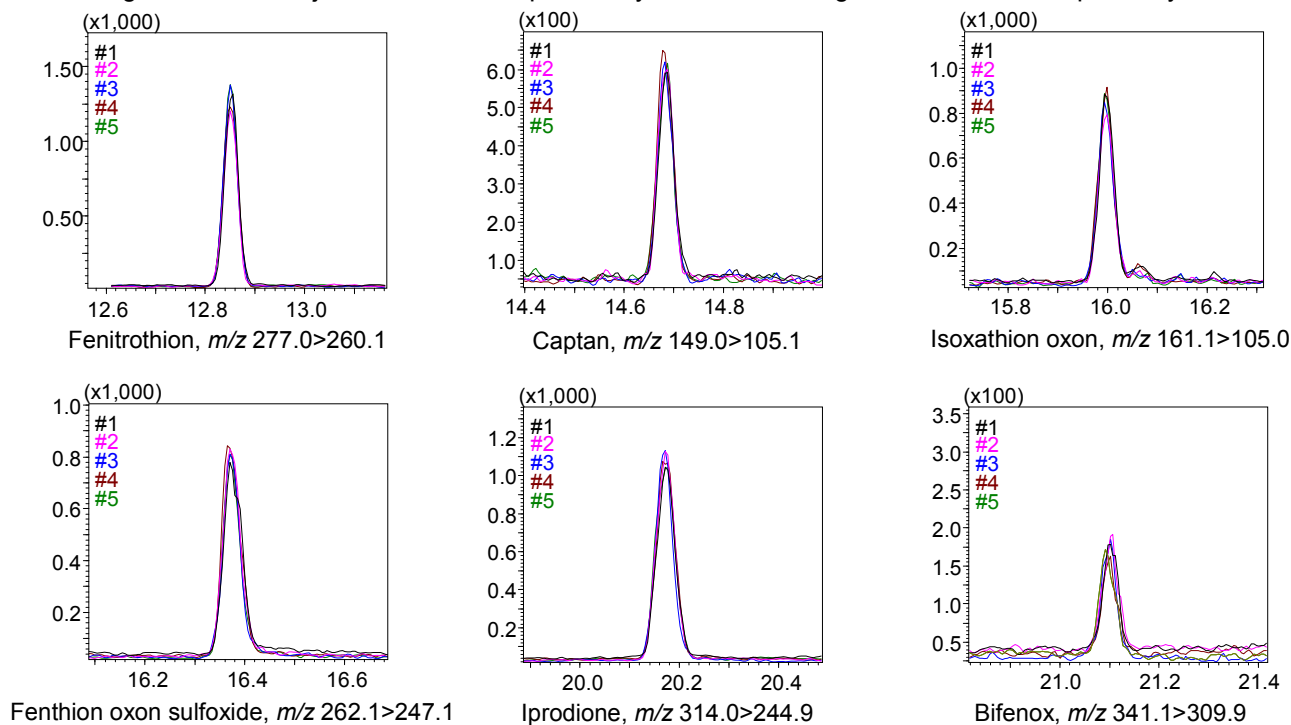


Fig. 1: Overlay mass chromatograms from 5 injections

Table 2: Repeatability (n=5, area ratio)

Compound Name	%RSD	Compound Name	%RSD	Compound Name	%RSD
Dichlorvos	1.62	Metalaxyl	3.01	Pretilachlor	7.26
Dichlobenil	0.73	Fenthion oxon	1.88	Fenthion oxon sulfoxide	5.72
Etridiazole	3.38	Dithiopyr	0.66	CNP-amino	1.04
Chloroneb	0.89	Fenitrothion	5.72	Fenthion oxon sulfone	1.19
Isoprocarb	0.47	Esprocarb	1.30	Buprofezin	2.14
Molinate	1.25	Malathion	0.82	Isoxathion	8.25
Fenobucarb	0.65	Thiobencarb	2.83	beta-Endosulfan	5.28
Trifluralin	1.71	Chlorpyrifos oxon	4.14	Fenthion sulfoxide	3.17
Benfluralin	2.09	Fenthion	1.17	Fenthion sulfone	9.61
Pencycuron	0.23	Chlorpyrifos	2.40	Mepronil	3.62
Dimethoate	2.98	Isofenphos oxon	2.03	Chlornitrofen	1.82
Simazine	1.17	Phthalide	1.03	Edifenphos	1.06
Atrazine	3.51	Dimethametryn	1.37	Propiconazole-1	7.70
Diazinon oxon	1.37	Pendimethalin	3.38	Endosulfate	2.98
Propyzamide	1.39	Methyldymron	2.29	Propiconazole-2	5.75
Pyroquilon	1.36	Isofenphos	2.93	EPN oxon	2.31
Diazinon	3.15	Captan	7.46	Thenylchlor	5.43
Disulfoton	3.37	Dimepiperate	3.64	Pyributicarb	0.88
Chlorothalonil	1.57	Phenthoate	2.65	Iprodione	3.03
Iprobenfos	1.29	Procymidone	0.87	Pyridaphenthion	3.78
Tolclofos-methyl oxon	1.56	Butamifos oxon	4.28	EPN	2.85
Fenitrothion oxon	3.75	Methidathion	2.27	Piperophos	5.48
Bromobutide	4.98	alpha-Endosulfan	1.78	Bifenox	7.02
Terbucarb	1.08	Butamifos	5.57	Anilofos	2.48
Malaoxon	2.64	Napropamide	2.38	Pyriproxyfen	2.39
Simetryn	3.14	Flutolanil	1.40	Mefenacet	1.70
Tolclofos-methyl	2.33	Isoxathion oxon	2.71	Cafenstrole	3.14
Alachlor	1.12	Isoprothiolane	4.96	Etofenprox	1.10