

Analysis of Multiresidue Pesticides Present in Ayurvedic Churna by GC-MS/MS

Manoj Surwade¹, Sunil T Kumar¹, Aarti Karkhanis¹, Manish Kumar¹, Soma Dasgupta¹, Hans-Joachim Huebschmann², Paul Silcock³

¹Thermo Fisher Scientific, Mumbai, India, ²Thermo Fisher Scientific, Singapore, ³Thermo Fisher Scientific, Runcorn, UK

Overview

Purpose

Analysis of Herbal powders or 'churnas' using an optimized GC-MS/MS method is described. As they have high amount of matrix co-extractives, they pose critical analytical problems. The purpose of this work was overcome the effect of the matrix and develop a reliable method.

Methods

Ayurvedic churna samples were extracted by liquid-liquid extraction and cleanup with dispersive solid phase extraction. The analysis was performed by GC-MS/MS using a timed-SRM detection method on Thermo Scientific TSQ 8000™ triple quadrupole GC-MS/MS instrument, employing two SRM transitions for each pesticide compound in a typical MRM method setup. Data processing and reporting are performed by using the Thermo Scientific TraceFinder™ software with one SRM transition used for quantitation and the second one for ion ratio confirmation.

Results

The results show good correlation factors with satisfactory recoveries. Real life samples were analyzed demonstrating the robustness and productivity of the applied method.

Introduction

Ayurveda is a Sanskrit term, made up of the words "ayus" and "veda," meaning life and science; together translating to 'science of life'. A blend of several herbs and spices make up the powdered mixture known as churna. Depending on its intended use for medicinal, beauty, or culinary purpose, the recipe varies. Avipittakara churna is a traditional Ayurvedic formula used widely and almost daily to control vitiated pitta dosha, remove heat in the digestive system, control indigestion, constipation, vomiting and anorexia. A major analytical challenge for these type of samples is mainly addition of multiple herbs with sugar and the natural color of herbs.

The dried leaves result in highly complex extracts from the sample preparation due to the rich content of active ingredients, essential oils and the typical high boiling natural polymer compounds.

Owing to the use of pesticides in the fresh herbs the churna may contain residual pesticides. Analysis of pesticide residues is thus important. Strict quality parameters, have been implemented to preserve the quality and efficacy of these churnas.



The new Trace 1300 Series offers the most **versatile** GC platform in the market, with unique **"instant connect" modularity** for ground-breaking **ease of use and performance**, setting a new era in GC technology

Remove the Source of your Downtime
Allow full source removal without venting. The MS including ion guide surface. No wire connections are necessary, and venting is not necessary to clean your instrument.

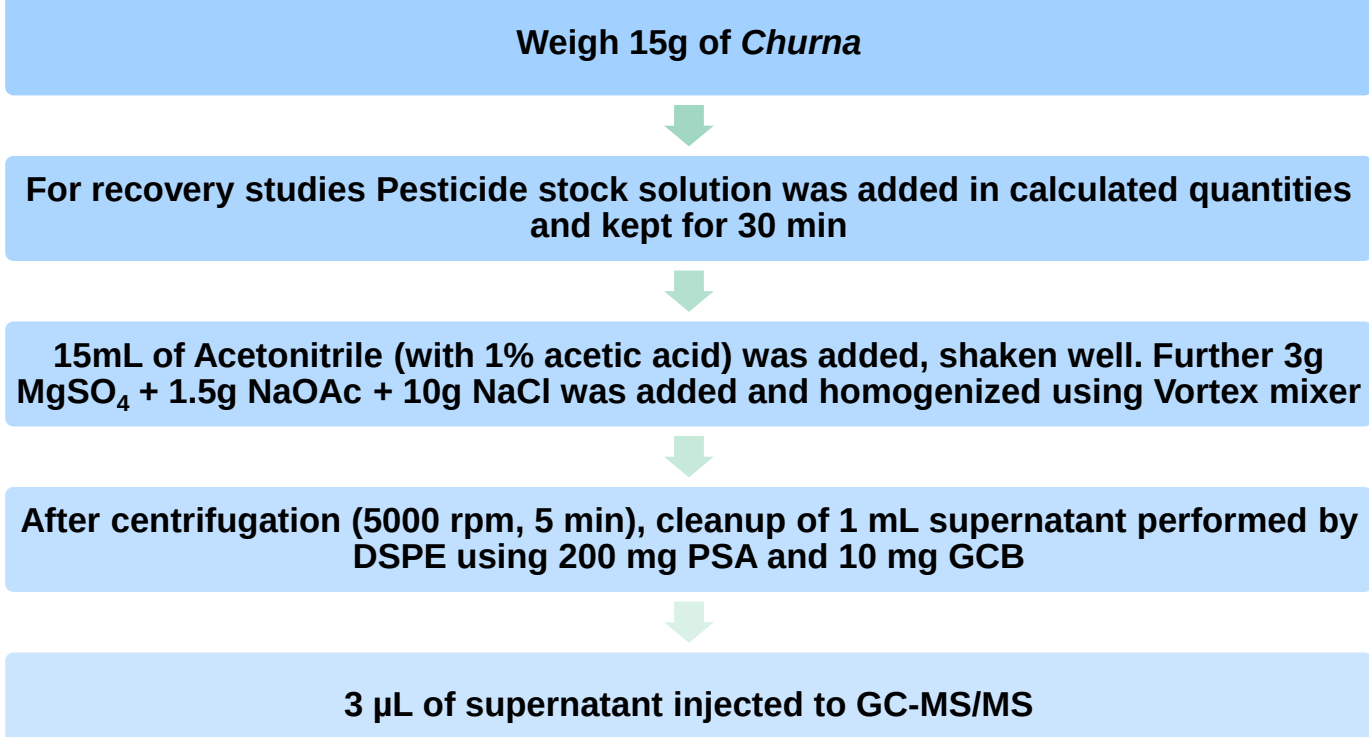
ExtractaBright™ Ion Source Cartridge

Key Feature:
Trace GC1300 series
• Instant connect modularity GC injector & detector ports
• The new Trace 1300 Series offers the most **versatile** GC platform in the market, with unique **"instant connect" modularity** for ground-breaking **ease of use and performance**, setting a new era in GC technology
• GCMS/MS-TSQ-8000
• ExtractaBright Ion source cartridge
• Ion source removal without venting vacuum
• Timed SRM acquisition

FIGURE 1. TSQ™ 8000 GC-MS/MS system with Thermo Scientific TriPlus RSH auto sampler with automated tool/syringe changer

Methods

Sample Preparation



TSQ 8000 GC-MS/MS Method Setup

The analytical method comprises the sample handling using the TriPlus™ RSH liquid auto sampler, Thermo Scientific TRACE 1300 Series gas chromatograph equipped with a temperature programmable PTV injector, and the TSQ 8000 triple quadrupole MS.

TRACE™ 1310 Gas Chromatograph

Column oven program

Ramp rate	Temperature	Hold time
	70°C	2min
10°C/min	200°C	1min
10°C/min	285°C	8.5min

Carrier gas :Helium

Injection mode : PTV Splitless mode

Injection temp: :87°C (0.30 min)-285°C(Rate- 14.5°C/Sec) (2.5min), Cleaning Phase - 290°C (20 min)

Splitless time :3 min, Split flow: 30 ml/min

Column Flow :1.2 ml/min

Column :TG-5 (30 mm x 0.25 mm I.D.x0.25 µm)

TSQ-8000 GCMS/MS

Ion source temp :230°C

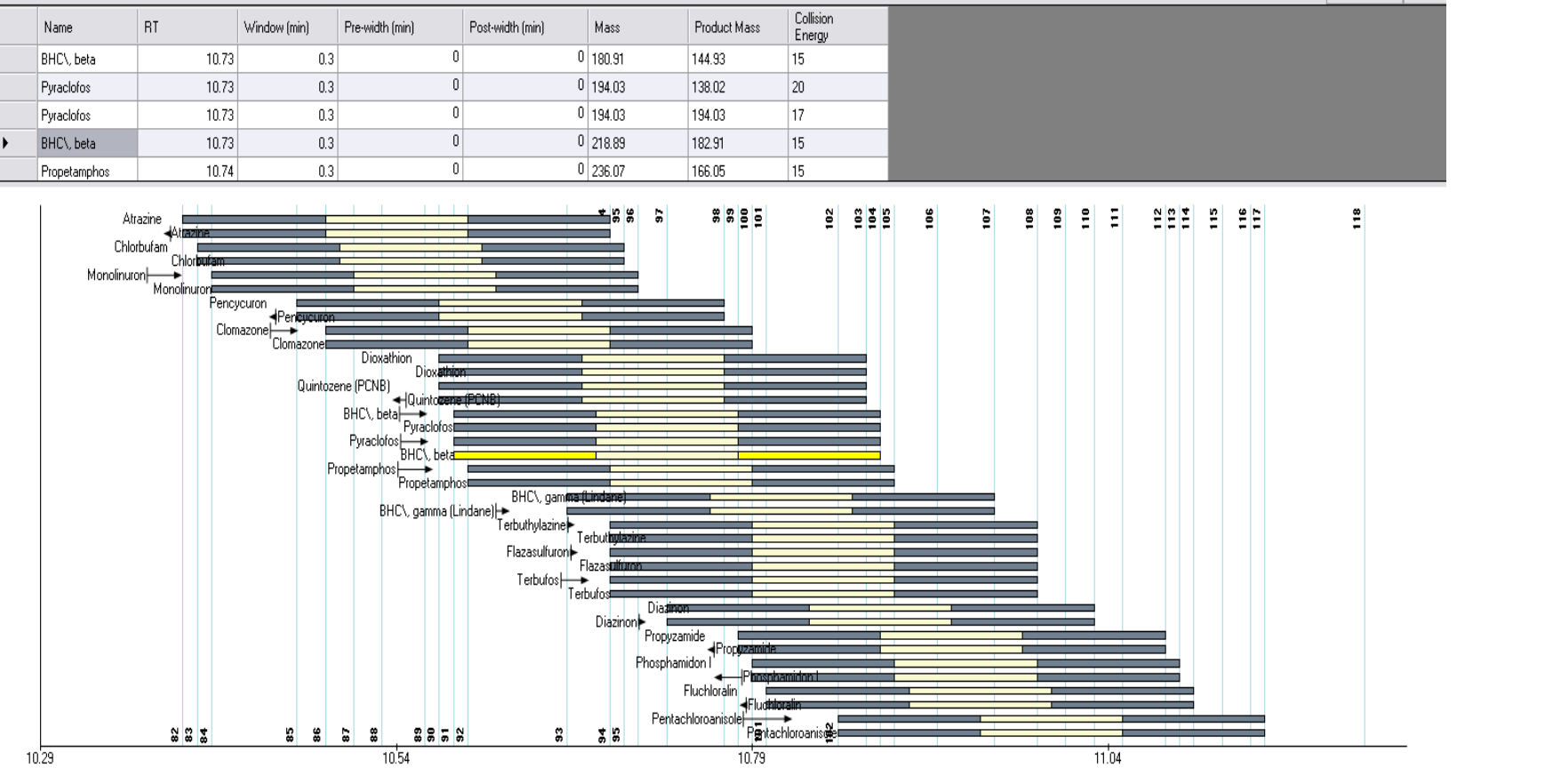
Interface temp :285°C

Acquisition mode :EI

MRM detection :timed SRM mode

TriPlus RSH Auto sampler

Injection Volume :3µL



Data Analysis

The data processing and reporting was done using the Trace Finder™ quantitation and reporting software suite.

Results

Multi-residue pesticide analysis of Ayurvedic churnas using liquid-liquid extraction with GC-MS/MS detection by TSQ 8000 GC-MS/MS system for routine target analyte detection and quantitation is described. Software features of TraceFinder™ software was employed to quickly create the processing method from the ready database of compounds. All standards and samples were processed with high throughput. Around 200 pesticide compounds were considered for this study and included into a routine screening method with ≈28 min run time which was applied for analyzing market samples.

Calibration, Linearity, Recovery and Repeatability

All test compounds had correlation coefficients > 0.99 for the concentration range 2.5 to 50 ng/g. Obtained recoveries were within 70-120% with <20% associated RSDs.

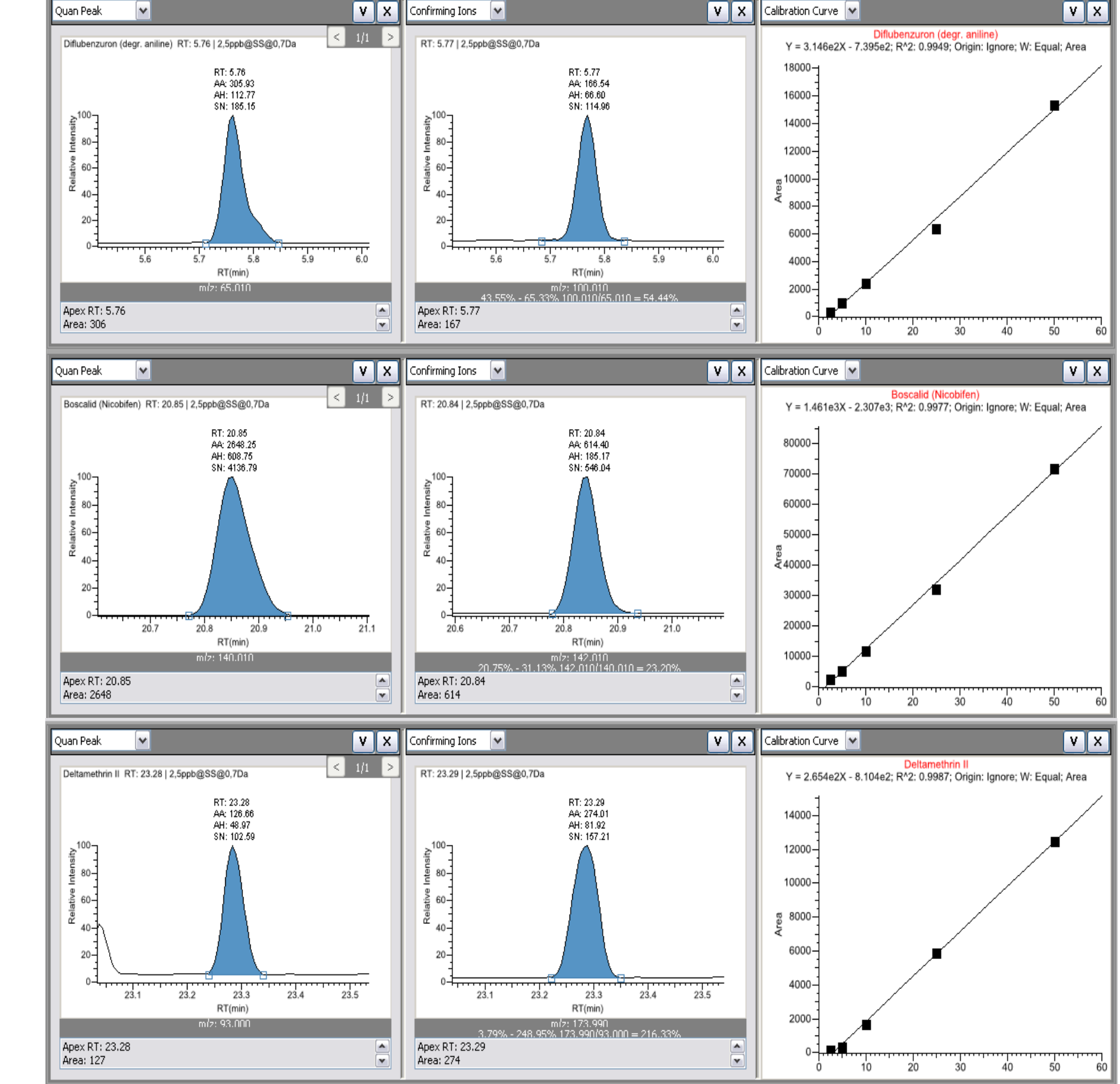


FIGURE 3. Selected chromatograms at 2.5 ng/g and calibration curves for few pesticides.

TABLE 1. MRM transitions, CE, slope, intercept and R2 of matrix standards

Sr. No.	Compound Name	RT (min)	Q1-Q3	Q1-Q3	CE	Q1-Q3	CE	Slope	Intercept	R2
1	Diflufenican (degr. i-cyanat)	5.24	153.02	> 90.01	20	153.02	> 125.01	7.98E+02	-1.19E+03	0.9969
2	Chlorpyrifos (degr. aniline)	5.75	127.01	> 65.01	30	127.01	> 100.01	3.15E+02	-7.40E+02	0.9949
3	Methamidophos	5.87	141.00	> 95.00	10	141.00	> 126.00	5.12E+03	-3.18E+03	0.993
4	Dichlorophos (DDVP)	5.84	184.96	> 92.98	17	219.96	> 184.96	10.22E+02	-9.97E+00	0.996
5	Dichloromethyl	6.82	135.97	> 99.99	10	170.96	> 135.97	8.45E+02	-6.43E+02	0.996
6	Mevinphos	7.39	127.03	> 109.02	10	192.04	> 127.03	1.19E+03	-2.46E+03	0.9964
7	Acetophen	7.50	136.01	> 42.00	10	136.01	> 94.01	7.19E+02	-4.31E+03	0.9904
8	Dichloraniline, 3,5-	7.61	160.98	> 89.99	25	160.98	> 98.99	3.11E+02	-2.47E+02	0.9989
9	Molinate (Ondram)	8.58	126.07	> 55.03	10	187.10	> 126.07	6.48E+02	1.25E+03	0.9941
10	TEPP	8.80	263.03	> 179.04	15	263.06	> 226.06	5.71E+02	-2.50E+03	0.9969
11	Omebate	9.00	110.01	> 79.01	15	156.02	> 110.01	8.09E+02	5.42E+03	0.9969
12	Fenobucarb	9.11	121.07	> 77.06	15	150.09	> 121.07	1.13E+03	1.68E+03	0.9977
13	Propoxur	9.13	110.06	> 64.03	10	152.08	> 110.06	7.90E+02	-6.00E+02	0.9981
14	Propachlor	9.16	176.06	> 120.04	10	196.07	> 120.04	3.51E+02	5.42E+02	0.998
15	Ethionphos	9.38	159.00	> 89.00	15	158.00	> 114.00	5.75E+01	-3.77E+01	0.9949
16	Trifluralin	9.58	268.03	> 160.05	15	268.03	> 156.03	1.37E+02	1.79E+02	0.9991
17	Chlorpropham	9.62	213.00	> 127.00	5	213.00	> 171.00	5.91E+02	-8.39E+02	0.9981
18	Benfluralin	9.63	292.10	> 160.05	21	292.10	> 264.09	3.91E+01	1.36E+02	0.9923
19	Sulfotep	9.70	322.02	> 202.01	15	322.02	> 294.02	1.25E+02	1.13E+03	0.9943
20	Bendiocarb	9.72	166.06	> 151.06	15	166.06	> 166.06	5.28E+03	-7.27E+02	0.9996
21	Monocrotophos	9.80	127.03	> 95.03	20	127.03	> 106.03	25.94E+02	-6.71E+03	0.9971
22	Methidathioniazuron	9.82	164.08	> 136.08	12	198.06	> 164.08	1.07E+03	3.59E+03	0.9974
23	BHCH, alpha	10.15	180.91	> 144.93	15	218.89	> 182.91	3.09E+02	-1.40E+02	0.997
24	Metamitron	10.36	202.09	> 174.07	5	202.09	> 186.08	1.61E+03	-8.25E+03	0.9969
25	Atrazine	10.54	215.09	> 173.08	10	215.09	> 200.09	6.38E+02	-1.38E+03	0.9945
26	Permethrin	10.62	125.05	> 89.04	12	180.07	> 125.05	12.50E+02	2.78E+01	0.9914
27	Dioxathion	10.72	125.00	> 97.00	15	125.00	> 141.00	5.19E+02	-3.03E+02	0.9936
28	BHCH, beta	10.75	180.91	> 144.93	15	218.89	> 182.91	1.14E+03	3.59E+03	0.9974
29	Propoxiphos	10.74	236.07	> 166.05	15	236.07	> 194.06	5.14E+02	5.14E+01	0.9918
30	BHCH, gamma (Lindane)	10.81	180.91	> 144.93	15	218.89	> 180.91	5.11E+03	-3.65E+03	0.9939
31	Terbutylazine	10.84	214.10	> 132.06	10	229.11	> 173.08	10.86E+02	-2.51E+02	0.9935
32	Diazinon	10.88	137.05	> 84.03	10	304.10	> 179.06	5.22E+02	4.48E+02	0.9987
33	Proprymidate	10.93	173.01	> 145.01	15	175.02	> 147.01	15.40E+02	-5.02E+03	0.9939
34	Fenitrothion	10.95	264.04	> 206.03	10	264.06	> 264.04	1.90E+02	-4.78E+02	0.9967
35	Pyriproxyfen	11.07	173.08	> 130.06	20	173.08	> 20	2.25E+03	-2.77E+02	0.9974
36	Pyrimethanil	11.11	198.11	> 158.09	30	198.11	> 183.10	5.18E+02	-2.68E+03	0.9953
37	Tefluthrin	11.16	177.02	> 127.02	20	197.03	> 141.02	1.27E+03	3.14E+03	0.9991
38	Erimofos	11.29	292.06	> 153.03	10	292.06	> 181.04	1.36E+04	-1.23E+02	0.9935
39	Phenacarb	11.50	166.10	> 96.06	10	206.10	> 166.10	4.37E+02	1.79E+02	0.9957
40	BHCH, delta	11.54	180.91	> 144.93	15	218.89	> 182.91	3.09E+02	-1.40E+02	0.997
41	Imidacloprid	11.54	204.07	> 122.04	15	218.89	> 182.91	3.37E+03	-7.26E+03	0.9997
42	Formothion	11.74	126.00	> 93.00	8	172.00	> 93.00	5.25E+03	-7.33E+03	0.9982
43	Phosphamidon II	11.83	227.05	> 127.03	15	264.06	> 193.04	5.32E+02	-2.10E+03	0.9977
44	Dichlorfenthrin	11.90	222.98	> 204.98	10	278.97	> 222.98	5.32E+02	4.94E+01	0.9946
45	Trioxycarb	11.94	197.08	> 136.08	10	198.06	> 156.06	1.37E+02	1.79E+02	0.9957
46	Dimethomorph	11.95	230.06	> 154.04	10	232.06	> 154.04	1.33E+03	-2.33E+03	0.9953
47	Propazine	12.02	214.09	> 172.08	12	214.09	> 214.09	3.77E+02	-9.45E+02	0.997
48	Propanil	12.06	217.01	> 161.00	10	219.01	> 163.00	1.48E+03	-4.04E+02	0.9934
49	Malathion	12.07	127.02	> 99.02	10	127.02	> 109.02	2.47E+02	-2.13E+04	0.9978
50	Chlorpyrifos-methyl	12.08	124.96	> 79.97	10	285.91	> 92.97	1.89E+03	-1.25E+02	0.9945
51	Metidathion	12.13	180.91	> 92.93	20	198.06	> 110.96	1.05E+03	-3.16E+03	0.9997
52	Spiranone I	12.15	190.09	> 58.05	15	100.09	> 72.06	5.98E+02	-2.21E+02	0.9909
53	Vinclozolin	12.16	212.00	> 172.00	15	285.00	> 212.00	1.90E+02	3.40E+02	0.9957
54	Carbaryl, 3-Hydroxy	12.21	137.06	> 81.03	18	180.08	> 137.06	1.05E+03	-2.93E+02	0.9974
55	Parathion-methyl	12.22	263.00	> 109.00	15	263.00	> 246.00	1.19E+03	-2.45E+03	0.9966
56	Alachlor	12.23	161.07	> 146.06	12	188.08	> 160.07	5.03E+02	-2.20E+02	0.9997
57	Toxidithion-methyl	12.25	264.98	> 92.99	20	264.98	> 249.98	1.37E+02	4.71E+02	0.9997
58	Propoxycarb	12.31	162.08	> 144.07	10	223.11	> 147.07	10.60E+02	-8.86E+02	0.9983
59	Metathiazol	12.37	249.13	> 190.10	10	249.13	> 249.13	5.17E+03	-1.45E+03	0.9911
60	Carbaryl	12.41	144.06	> 115.05	20	144.06	> 116.05	1.16E+03	-6.15E+03	0.9919
61	Fenbutadiazol	12.41	183.90	> 156.10	10	183.90	> 183.10	2.19E+03	-3.27E+03	0.9902
62	Fenchlorfos (Ronnell)	12.47	264.91	> 269.92	13	286.91	> 271.91	1.08E+03	6.68E+02	0.994
63	Propoxycarb	12.48	180.91	> 144.93	15	218.89	> 182.91	3.09E+02	-1.40E+02	0.997
64	Pyrimethanil	12.66	290.09	> 233.07	10	305.10	> 290.09	5.29E+02	-3.69E+02	0.9911
65	Spiranone II	12.75	100.09	> 58.05	15	100.09	> 72.06	7.48E+02	6.32E+03	0.9916
66	Ethionphos	12.80	207.08	> 161.06	10	277.02	> 109.01	8.13E+03	-4.50E+01	0.9907
67	Fenitrothion Confirming 1	12.80	277.02	> 260.02	10	286.11	> 207.08	12.66E+02	-2.88E+02	0.9997
68	Methidathion	12.84	168.06	> 109.04	15	168.06	> 153.06	5.88E+02	-2.54E+03	0.9971
69	Metidathion	12.92	127.01	> 99.01	10	173.02	> 127.01	3.28E+02	-4.34E+03	0.9951
70	Dichlorfenthrin	12.95	223.97	> 122.99	15	225.97	> 122.99	5.94E+02	-9.35E+02	0.9971

71	Phorate sulfone	13.01	153.00	> 125.00	5	199.00	> 143.00	10	5.88E+03	-2.71E+04	0.9942
72	Dipropetyl	13.02	241.90	> 149.90	20	254.90	> 180.00	20	7.60E+01	-3.88E+02	0.9990
73	Chlorpyrifos ethyl	13.12	190.96	> 170.96	15	313.93	> 285.94	12	3.17E+03	-7.87E+03	0.9989
74	Chlorpyrifos	13.12	241.90	> 149.90	20	254.90	> 180.00	20	7.60E+01	-3.88E+02	0.9992
75	Chloraldehyde (DCCA)	13.24	300.91	> 300.91	15	331.90	> 300.91	15	9.92E+03	-8.36E+02	0.9998
76	Flutetracel	13.26	211.04	> 202.02	10	211.04	> 183.03	10	5.72E+02	-4.17E+02	0.9995
77	Endosulfan (alpha)	13.43	240.89	> 135.01	20	264.88	> 192.59	22	1.42E+04	-3.61E+01	0.9994
78	Imidaclothpy	13.49	201.92	> 133.00	15	252.00	> 148.90	12	6.80E+02	-8.31E+01	0.9990
79	Phenothiazine	13.49	264.14	> 148.00	20	264.14	> 220.11	18	2.24E+03	-2.24E+03	0.9992
80	Imazethapy	13.54	304.94	> 168.06	15	333.13	> 318.12	15	1.20E+03	-6.20E+02	0.9999
81	Pendimethalin	13.86	252.12	> 167.88	12	252.12	> 219.29	12	7.48E+02	-1.43E+02	0.9991
82	Pipronil	13.87	212.97	> 172.98	16	366.95	> 212.97	25	5.46E+02	-2.17E+03	0.9993
83	Chlorpyrifos	13.91	241.90	> 149.90	20	254.90	> 180.00	20	7.60E+01	-3.88E+02	0.9990
84	Mesathion	13.92	133.05	> 117.04	20	209.97	> 132.05	12	3.44E+02	-4.82E+01	0.9993
85	Permethozin	14.01	248.06	> 154.04	25	248.06	> 126.02	15	7.21E+02	-1.26E+03	0.9997
86	Tolyflandol	14.05	137.05	> 91.03	20	238.09	> 137.05	15	1.20E+03	-2.69E+02	0.9992
87	Chlorfenvinphos-Z	14.05	266.98	> 158.99	15	322.97	> 266.98	15	1.08E+03	-3.43E+03	0.9998
88	Phenothiazine	14.05	264.14	> 148.00	20	264.14	> 220.11	18	2.24E+03	-2.24E+03	0.9992
89	Mecarbin	14.09	226.04	> 188.03	5	329.05	> 260.03	10	2.83E+02	-5.56E+02	0.9997
90	Phenothiazine	14.18	146.01	> 110.01	20	274.03	> 146.02	10	3.93E+03	-1.10E+04	0.9995
91	Methidathion	14.20	199.02	> 140.02	15	196.02	> 184.02	10	2.14E+03	-8.14E+03	0.9997
92	Chlorpyrifos	14.23	146.03	> 125.03	15	183.03	> 128.02	13	1.42E+03	-1.42E+03	0.9999
93	Imidaclothpy	14.31	176.04	> 140.04	15	196.02	> 168.04	15	1.15E+03	-2.46E+03	0.9992
94	Prochlorodan	14.31	283.02	> 90.01	15	283.02	> 255.02	10	2.88E+02	-1.32E+03	0.9999
95	Bromophos-ethyl	14.50	368.99	> 362.99	20	368.99	> 330.90	10	7.85E+02	-6.52E+02	0.9998
96	Methidathion	14.60	124.98	> 97.99	22	144.98	> 84.99	10	1.14E+03	-4.03E+03	0.9994
97	Chlorpyrifos (alpha)	14.61	241.90	> 149.90	20	254.90	> 180.00	20	7.60E+01	-3.88E+02	0.9990
98	DOE up	14.63	245.95	> 189.95	25	317.94	> 244.95	20	9.58E+02	-8.14E+02	0.9994
99	Palladate	14.68	188.02	> 125.02	22	188.02	> 160.02	16	1.39E+03	-2.56E+02	0.9994
100	Sulfobenzazone	14.72	236.10	> 132.06	15	236.10	> 167.07	15	4.12E+03	-1.66E+03	0.9992
101	Disulfoton sulfone	14.74	213.01	> 125.01	10	213.01	> 153.01	10	4.26E+02	-5.26E+02	0.9999
102	Endosulfan (beta)	14.78	271.01	> 135.01	20	283.09	> 209.99	10	1.42E+03	-1.42E+03	0.9993
103	Endosulfan II (beta)	14.88	271.01	> 238.89	18	338.85	> 265.88	18	6.75E+02	-1.81E+02	0.9997
104	Mephosfolan	14.89	222.21	> 207.10	15	223.11	> 208.10	15	1.13E+03	-6.30E+03	0.9996
105	Chlorfenvinphos, gamma (trans)	14.89	378.01	> 265.87	18	374.81	> 267.87	15	1.13E+03	-1.10E+03	0.9999
106	Chlorpyrifos	14.90	241.90	> 149.90	20	254.90	> 180.00	20	7.60E+01	-3.88E+02	0.9990
107	Napropamide	15.00	128.07	> 74.04	10	271.16	> 128.07	5	2.81E+03	-1.30E+02	0.9997
108	Flutastin	15.03	173.06	> 125.05	15	173.06	> 173.06	15	1.04E+04	-1.03E+03	0.9998
109	Prelactarol	15.13	162.09	> 147.08	15	216.05	> 214.04	10	2.00E+02	-9.70E+02	0.9993
110	Hexachlorocyclopentadiene 200	15.13	231.09	> 174.04	10	261.14	> 207.14	10	1.14E+03	-5.55E+03	0.9998
111	Chlorpyrifos	15.13	241.90	> 149.90	20	254.90	> 180.00	20	7.60E+01	-3.88E+02	0.9990
112	Prothionos	15.21	138.98	> 95.98	8	338.94	> 265.95	10	1.21E+03	-4.61E+03	0.9999
113	Oxadiazon	15.26	258.05	> 176.04	10	304.06	> 260.05	10	2.66E+03	-5.04E+03	0.9992
114	DOE up	15.32	224.95	> 177.95	25	317.94	> 244.95	20	7.92E+02	-9.03E+01	0.9998
115	Chlorpyrifos	15.37	176.07	> 153.03	15	153.03	> 125.06	15	1.42E+03	-1.42E+03	0.9999
116	Bupropion	15.43	122.98	> 57.93	10	249.13	> 193.10	10	1.22E+02	-1.70E+02	0.9990
117	Kessom-methyl	15.44	206.99	> 116.95	15	206.99	> 131.06	15	9.50E+02	-1.87E+02	0.9992
118	DOE up	15.47	234.94	> 184.96	15	234.97	> 164.98	20	3.32E+03	-1.73E+03	0.9993
119	DOE up/Confirming I	15.47	234.94	> 184.96	20	236.97	> 164.98	20	2.08E+03	-2.57E+03	0.9996
120	Chlorpyrifos	15.49	266.98	> 158.99	15	322.97	> 266.98	15	1.08E+03	-3.43E+03	0.9998
121	Arame-Z	15.59	185.06	> 63.02	10	319.10	> 185.06	15	1.50E+03	-4.46E+03	0.9997
122	Capronamid	15.78	139.00	> 103.00	10	224.00	> 125.00	18	1.66E+03	-5.53E+03	0.9998
123	Cyproconazole	15.79	222.09	> 125.05	10	222.09	> 127.05	10	1.68E+03	-2.37E+03	0.9998
124	Prochlorodan	15.85	201.99	> 138.99	20	262.98	> 197.99	10	4.80E+03	-9.60E+03	0.9999
125	Chlorfenotol	15.90	213.01	> 125.01	20	253.01	> 213.01	10	4.80E+03	-9.60E+03	0.9997
126	Neodactol	15.99	149.90	> 122.90	10	285.05	> 255.05	14	4.35E+02	-2.11E+03	0.9999
127	Fenitron sulfonate	16.05	279.01	> 232.01	15	284.02	> 279.01	8	5.28E+02	-1.76E+03	0.9995
128	Diniconazole	16.11	268.06	> 155.05	15	270.06	> 234.05	15	1.30E+03	-2.54E+03	0.9998
129	Chlorpyrifos	16.12	241.90	> 149.90	20	254.90	> 180.00	20	7.60E+01	-3.88E+02	0.9990
130	Oxadial	16.16	132.06	> 117.05	15	163.07	> 132.06	10	8.13E+02	-6.96E+02	0.9999
131	DOE up	16.20	234.94	> 184.96	20	234.94	> 164.96	20	1.40E+03	-2.70E+03	0.9997
132	DDO, up	16.20	234.94	> 184.96	20	236.97	> 164.98	20	3.85E+03	-8.78E+03	0.9999
133	Chlorfenvinphos	16.20	324.96	> 268.97	15	324.96	> 268.97	10	4.82E+03	-5.03E+03	0.9995
134	Chlorpyrifos	16.23	123.00	> 91.00	10	269.20	> 123.00	10	1.42E+03	-1.42E+03	0.9999
135	Mepionil	16.45	269.14	> 119.06	10	269.14	> 210.11	10	1.78E+03	-3.67E+03	0.9994
136	Triazophos	16.46	161.03	> 133.03	10	257.05	> 162.03	10	1.85E+03	-4.86E+03	0.9993
137	Orthure	16.58	186.08	> 154.08	10	232.07	> 185.05	10	2.66E+03	-2.54E+03	0.9997
138	Chlorpyrifos	16.59	241.90	> 149.90	20	254.90	> 180.00	20	7.60E+01	-3.88E+02	0.9990
139	Benzalacetyl	16.63	234.12	> 178.09	10	236.14	> 188.05	10	4.85E+02	-2.55E+03	0.9995
140	Triflurozinolone	16.65	116.04	> 69.03	15	190.06	> 130.04	10	2.02E+03	-2.76E+03	0.9996
141	Prochlorodan peak 1	16.77	259.02	> 88.01	20	259.02	> 173.02	20	2.24E+03	-3.36E+03	0.9998
142	Ethionphos	16.78	173.01	> 109.01	15	310.03	> 173.01	10	6.11E+03	-1.86E+04	0.9999
143	Chlorpyrifos	16.79	272.00	> 238.99	20	272.00	> 238.99	10	1.42E+03	-1.42E+03	0.9999
144	Endosulfan sulfate	16.85	271.01	> 238.89	18	273.88	> 238.89	15	3.21E+03	-2.64E+03	0.9992
145	Clodafop-propylate	16.87	349.05	> 280.04	20	349.05	> 266.04	15	4.22E+02	-1.17E+03	0.9999
146	Prochlorodan	16.90	208.80	> 138.00	20	261.00	> 175.03	24	2.06E+03	-4.90E+03	0.9998
147	Prochlorodan	17.00	171.00	> 161.00	10	261.00	> 161.00	10	1.42E+03	-1.42E+03	0.9999
148	Prochlorodan	17.16	135.06	> 107.05	15	156.16	> 201.09	10	1.58E+03	-1.64E+03	0.9999
149	Diflufenican	17.21	266.05	> 246.05	10	394.07	> 266.05	10	8.05E+02	-1.34E+03	0.9998
150	Triphenylphosphite (TPP)	17.26	325.07	> 169.04	25	326.07	> 325.07	10	8.96E+02	-1.73E+03	0.9999
151	Iprodione	17.65	187.02	> 124.01	20	187.02	> 152.02	20	2.74E+02	-1.87E+03	0.9997
152	Chlorpyrifos	17.66	241.90	> 149.90	20	254.90	> 180.00	20	7.60E+01	-3.88E+02	0.9990
153	Picolniten	17.90	376.08	> 238.05	15	376.08	> 239.05	15	4.11E+02	-2.66E+02	0.9998
154	Bromocycloten	17.91	184.98	> 156.98	20	342.96	> 184.98	20	2.07E+03	-7.95E+02	0.9999
155	Fenoxycarb	17.93	186.08	> 156.08	10	255.11	> 186.08	15	4.84E+03	-2.04E+03	0.9999
156	Perchlorophthal	18.01	181.09	> 182.07	23	265.13	> 210.10	15	9.64E+02	-3.86E+03	0.9995
157	Prochlorodan	18.01	238.08	> 188.08	10	188.08	> 188.08	10	3.12E+02	-3.12E+02	0.9999
158	Tetrahydropyrid	18.11	276.13	> 171.08	15	333.16	> 276.13	10	4.29E+03	-2.74E+03	0.9999
159	Fenazacetyl	18.23	145.03	> 117.07	15	160.09	> 117.07	10	7.41E+03	-2.41E+03	0.9995
160	Imazali	18.25	173.03	> 150.02	20	215.04	> 173.03	15	9.76E+02	-3.24E+03	0.9995
161	Chlorpyrifos	18.26	241.90	> 149.90	20	254.90	> 180.00	20	7.60E+01	-3.88E+02	0.9990
162	Flutranone	18.38	199.06	> 145.06	20	333.10	> 120.04	15	4.32E+02	-3.90E+03	0.9994
163	Tetraflandol	18.46	226.93	> 188.94	18	353.88	> 156.95	10	1.47E+02	-1.84E+03	0.9997
164	Phosalone	18.54	181.99	> 111.00	15	181.99	> 138.00	10			