Application Note

Food & Agriculture

Analytical evaluation of the Agilent IDP-10 Dry Scroll Vacuum Pump and Oil Roughing Pump on the Agilent GC Intuvo 9000 coupled to 7010B Triple Quad Mass Spectrometry.

Multi-residue pesticides analysis in food.

Authors

Alice Borin
Application Specialist - dtoLABs

Michele Pozzebon
Lab Manager - dtoLABs

Abstract

The Agilent IDP-10 Dry Scroll pump was evaluated and compared for analytical performance against the conventional oil roughing pump in the multi-residue pesticides analysis in food. This study used Agilent Intuvo 9000 GC coupled to 7010B Triple Quadrupole Mass Spectrometers (GC/MS-MS). Parameters assessed included vacuum readings and tune reports.

The analysis was focused on 30 pesticides in a lemon matrix and examined the chromatograms, calibration curves, repeatability and S/N produced when using two different configurations.

Introduction

We found that the IDP-10 Pump is more compact, more environmentally friendly and has a lower noise level than the rotary pump. The IDP-10 Pump Dry Scroll is an oil-free vacuum pump that it is easy to maintain. The inverter driven motor provides uniform vacuum performance at all global frequencies and input voltages. The hermetic design, with the motor and all bearings completely isolated from the vacuum path, extends the bearing life and provides clean, dry vacuum. An optional integral inlet protection valve, built into the pump frame, is available and adds no additional height to the pump.

We compared pump performance acquiring data in two separate steps. The first data set was acquired using the oil roughing pump and then a second set was acquired using the IDP-10 Dry Scroll Vacuum Pump. Before each step a tuning was performed.

Analytical Technique

Materials

Intuvo 9000 GC and 7010B triple quadrupole MS system

Inlet: Split/Splitless

Injection mode, injection volume: Pulsed Splitless, 1µL

Compounds: Acrinathrin, Bifenthrin, Bromopropylate, Chlorfenvinphos, Chlorthalonil, Chlorpropham, Chlorpyrifos, Chlorpyrifos-methyl, Coumaphos, Lambda Cyhalothrin, Deltamethrin, Endonulfan I, Endosulfan II, Endosulfan sulfate, Fenvalerate I, Fenvalerate II, Fipronil, Fluquinconazole, Fluvalinate I, Fluvalinate II, Folpet, Indoxacarb, Iprodione, Kresoxim-methyl, Myclobutanil, Penconazole, Pendimethalin, Procymidone, Quinoxyfen, Tefluthrin-cis, Tetraconazole, Tetramethrin I, Tolcophos-methyl, Trifloxistrobin

Internal Standards: Acenaphthene-d10, Chrysene-d12, Perylene-d12, Phenanthrene-d10.

Matrix: lemon

Results & Discussion

Tuning & Vacuum

The MS detector must be tuned to ensure correct m/z alignment. We tuned it using PFTBA (perfluorotributylamine), which we introduced into the ion source by means of a valve. This compound produces a characteristic spectrum and some of these ions are used to set up the MS. The tune reports for the GC/MS-MS setup with the Oil roughing pump and with the Agilent Technologies IDP-10 scroll pump are shown in Table 1. Vacuum readings were similar on both systems. They are also well within the recommended limits set for water (<20%) and air (oxygen <2.5% and nitrogen <10%). Both system passed system verification.

Parameter	Oil Roughing pump	IDP-10 Scroll Pump
Rough Vacuum, mTorr	1.29E+02	1.28E+02
High Vacuum, Torr	8.32E-05	8.27E-05
Turbo Speed, %	100	100
Turbo Power, W	20.2	28.8
EMV, V	901	912
Water, % (<20%)	0.11	0.12
Oxygen, % (<2.5%)	0.18	0.16
Nitrogen, % (10%)	0.67	0.61

Table 1. Comparison of tuning values for both configurations

Matrix preparation (lemon)

Weight 10 g (±0.1 gr) of homogenized lemon sample (without pesticides)

Add 600µL NaOH 5mM and 10 mL of acetonitrile previously cooled at 4°C, vortex for 20 minutes

Add ceramic homogenizer (cod. 5982-9313) and QuEChERS salt EN method (cod. 5982-5650), vortex 1 min, centrifuge

6 mL supernatant into dispersive SPE EN Method (General Fruits and Vegetables cod. 5982-5056), vortex 1 min, centrifuge

1 mL of supernatant into a vial and acquired with GC/MS-MS

Matrix calibration & Repeatability

We performed calibrations using both types of configurations, where each calibration was shown as 0.2-0.5-1-2-5-10-20-50 µg/L in the lemon matrix. Figure 1 shows the TIC chromatograms and MRM transitions of matrix standard (20 µg/L).

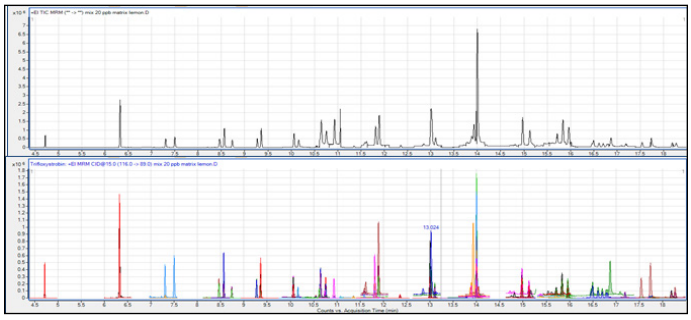

Figure 1. TIC Chromatograms and dynamic MRM transitions (20 µg/L matrix standard).

We calculated intra-day repeatability (RSD%) by analyzing ten replicates of 1 µg/L matrix standard. Table 2 summarizes the average of Area Counts (10 replicate of 1 µg/L), RSD% based on absolute area (ratio between standard deviation and the average about 10 repeated, for 100) and provides a summary of the calibration correlation coefficients, R2. We observed no significant differences in R2 for all compounds, but we observed notable differences in RSD percentage for most compounds, the RSD% of compounds acquired with the IDP-10 Scroll Pump is better than RSD% of compounds acquired with the rotary pump.

	Oil Roughing pump			IDP-10 Scroll Pump		
Compound	Area Counts	RSD%	R2	Area Counts	RSD%	R2
Chlorpropham	32696	7.4	0.994	48989	4.0	0.994
Tefluthrin, cis-	42255	4.5	0.997	58587	3.2	0.999
Chlorothalonil	11714	5.5	0.994	13732	5.6	0.995
Chlorpyrifos-methyl	17268	3.6	0.996	21819	3.7	0.999
Tolclofos-methyl	40012	3.7	0.995	51890	2.7	0.999
Chlorpyrifos	13494	6.0	0.995	17949	3.5	0.998
Tetraconazole	11779	8.1	0.990	15052	5.8	0.995
Pendimethalin	9466	10.0	0.994	11202	6.9	0.994
Penconazole	30970	9.2	0.993	40771	6.9	0.995
Fipronil	6700	13.3	0.996	9487	11.6	0.994
Chlorfenvinphos	19371	10.2	0.990	27897	5.9	0.994
Procymidone	18210	7.7	0.999	25660	5.9	0.998
Folpet	1514	27.1	0.978	2801	12.9	0.994
Endosulfan I	2057	7.3	0.999	2573	7.0	0.999
Myclobutanil	49080	9.4	1.000	53917	6.7	0.999
Endosulfan II	3710	7.1	0.999	5067	6.5	0.999
Quinoxyfen	61561	6.8	1.000	73813	5.7	0.999
Endosulfan sulfate	16348	8.5	1.000	21956	6.3	0.998
Iprodione	1714	12.8	0.995	2206	10.2	0.999
Tetramethrin	56949	7.6	1.000	82908	7.7	0.997
Bromopropylate	29964	8.0	1.000	43623	5.0	0.999
Cyhalothrin (lambda)	20046	8.1	1.000	26726	5.9	0.999
Acrinathrin	7762	8.2	1.000	10306	7.3	0.999
Fluquinconazole	24979	8.4	1.000	28364	6.4	0.999
Coumaphos	11796	6.6	1.000	14196	5.2	0.999
Fenvalerate I	33164	5.7	0.999	38453	5.1	0.999
Fluvalinate-tau I	628	10.5	0.998	1144	8.7	0.998
Fluvalinate-tau II	798	4.9	0.998	1189	10.0	0.998
Indoxacarb	10334	6.3	1.000	13169	4.0	1.000
Deltamethrin	6943	8.2	0.999	9359	8.4	0.996

Table 2. Summary of correlation coefficients (R2) , Area Counts and RSD% obtained using both configurations.

Signal-to-noise & Peak shape

The Signal to Noise (S/N) ratio for each compound with RMS (Root-mean-square) algorithm was calculated. Results showed significant differences in the S/N ratio of most compounds acquired, with better performance using the IDP-10 Scroll Pump than the rotary pump. Table 3 shows the S/N ratio.

Compound	RT	S/N - oil roughing pump	S/N - IDP-10 Scroll Pump
Chlorpropham	7.303	17.4	16.0
Tefluthrin, cis-	8.564	400.5	950.9
Chlorothalonil	8.735	318.1	326.8
Chlorpyrifos-methyl	9.271	580.1	1087.9
Tolclofos-methyl	9.355	334.2	406.2
Chlorpyrifos	10.059	639.0	724.2
Tetraconazole	10.159	791.1	1216.4
Pendimethalin	10.615	315.2	383.5
Penconazole	10.643	829.6	813.4
Fipronil	10.736	229.6	392.9
Chlorfenvinphos	10.754	48.7	20.4
Procymidone	10.930	210.8	517.2
Folpet	10.935	27.5	46.5
Endosulfan I	11.352	48.6	75.3
Myclobutanil	11.808	226.2	174.8
Endosulfan II	12.351	149.0	175.3
Quinoxyfen	12.997	547.2	588.9
Endosulfan sulfate	13.097	423.7	611.9
Iprodione	13.770	57.6	129.7
Tetramethrin	13.884	24.4	25.4
Bromopropylate	13.994	593.8	417.6
Cyhalothrin (lambda)	14.965	125.3	166.3
Acrinathrin	15.118	117.1	26.0
Fluquinconazole	15.952	337.3	331.4
Coumaphos	15.955	120.0	92.8
Fenvalerate I	17.530	36.9	25.9
Fluvalinate-tau I	17.708	24.4	36.3
Fluvalinate-tau II	17.757	26.1	36.2
Indoxacarb	18.178	49.0	37.8
Deltamethrin	18.258	90.3	52.1

Table 3. Signal-to-noise ratio using both configurations.

Figure 2 shows Chlorthalonil peak shape in both configurations. The response and the height of peak in all compounds is similar for both configurations.

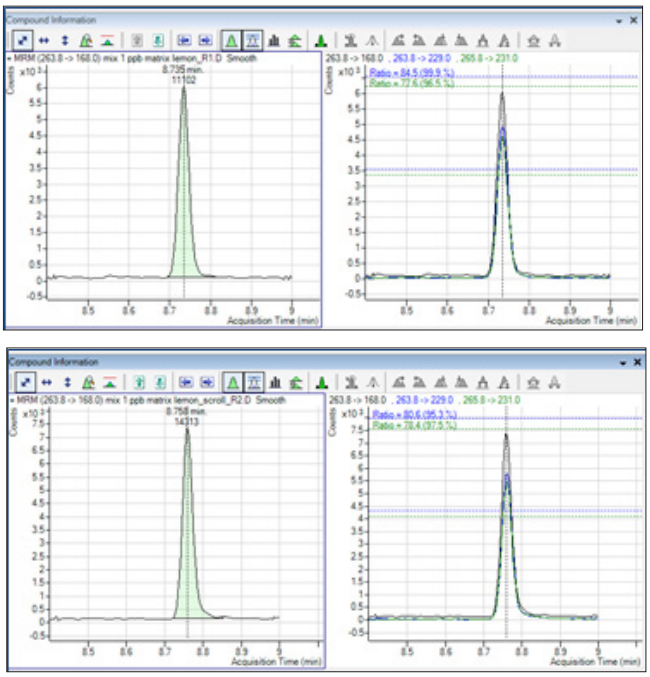

Figure 2. MRM Transitions for Chlorthalonil (1 quantifier and 2 qualifiers) at 1 µg/L.

Conclusion

The analytical performance of the Agilent IDP-10 Dry Scroll Vacuum Pump was assessed against the conventional oil roughing pump. Vacuum readings using both pumps were comparable, as were tune parameters. Analytical performance was also found to be similar when using the Agilent IDP-10 Scroll configuration.

www.agilent.com

Printed in the Europe, March 20, 2018
5991-9201EN

Agilent
Trusted Answers