Evaluation of a new technology which enables large volumes to be concentrated directly into a small vial for use in environmental analysis

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Introduction

Leochimica Laboratories were founded in 1980, and are at the cutting edge of research into new methods for environmental analysis. Working in a range of areas under the heading of Environmental Analysis, they cover food toxicology, beverages, occupational hygiene and safety. Working with academic partners, Leochimica seek to continually improve their analytical methodology, to the benefit of all.

This paper follows their evaluation of a new technology, the SampleGenie™, which enables large volumes of solvent to be concentrated directly into a 2ml GC vial. If this technology proves suitable it can be used to eliminate transfer of samples between vessels at the concentration stage, and so can help to eliminate potential sources of loss, common to all laboratories.

SampleGenie

SampleGenie is a device consisting of a glass funnel which has a small vial sealed to the bottom creating a vial with a much larger volume. The SampleGenie and vial assembly (Figure 1) is designed to be used in a Genevac evaporation system and used to concentrate the large sample directly into the small vial eliminating the need to transfer samples between vessels after the concentration stage. A range of volumes are available, 60ml, 120ml, and 200ml. Due to the costs of the precision with which the SampleGenie is made, the parts are re-useable, therefore a key consideration is cleaning of the flask, and the elastomeric material which forms the seal between flask and vial. This study considers these issues, and evaluates the recoveries of a number of analytes when using the SampleGenie system.

Figure 1 – SampleGenie

Selection of systems shown with arrangement sketch to right.

Key
Dark blue – flask
Red – seal
Light blue – vial
Green – adaptor

Evaluation of the SampleGenie

The SampleGenie was evaluated using a Geneva EZ-2 evaporation system (figure 2) to determine the recovery of Polycyclic Aromatic Hydrocarbons (PAHs) and pesticide analytes following concentration from a large volume of solvent. The recoveries were compared to the current methods used. The "memory" effects of reusing the SampleGenie components were also evaluated.

Figure 2 – Genevac EZ-2 Evaporator

Methodology

Standards of PAH mixture, Pentachlorobenzene and Hexachlorobenzene were prepared in two different solvents, Hexane and Dichloromethane (DCM). The concentration of these analytes (when concentrated from 50ml to 1ml) was calculated to be 0,1 mg\l PAH, 0,123 mg\l Pentachlorobenzene, 0,098 mg\l Hexachlorobenzene. A 50ml aliquot of each solution was transferred to a 60ml SampleGenie containers and to 60ml glass ASE vials.

Hexane Solution Concentraiton

Batches of 6 ASE vials (3 per holder) containing the standard hexane solution were evaporated by EZ2 at a constant pressure of 75mbar. The method was programmed to run for 1 hour, this being the standard method which concentrates the sample but does not run to complete dryness. To achieve a final volume of lower than 1ml the same method was used and paused every 10 minutes so to stop when the desired volume was reached. 10 to 20 minutes are normally sufficient.

The same condition of a 75mbar constant pressure were used for the samples in the 60ml SampleGenie system (4 sample into each holder). The evaporation method was allowed to run in automatic mode, where the system determines the end of the method. The SampleGenie system has special adaptor which insulates the vial and thereby all but stops concentration of the sample in the vial. Under this condition the EZ2 ran for just over 1 hour before the stopping automatically, leaving a residual volume of approx 1ml in each vial.

DCM Solution Concentration

Batches of 12 (6 in each holder) samples in ASE tubes, each containing 50ml of the standard solution in DCM, was performed by running a program ramping pressure from 600mbar to 200mbar in 15 minutes, followed by a further 10 minute ramp from 200mbar to 150mbar and then holding at 150mbar. After 90 minutes, the system was paused and the residual volume in the ASE tube was checked, the run continued but was paused every 10 minutes and the vials inspected so not to go to dryness. The result was that an approx. 1ml final volume was achieved after two hours.

The comparative method in the SampleGenie vials was not done at a later stage, the results follow as part of the long term evaluation.

The recoveries in each vial were determined by GC-MS analysis, the results are shown below in tables 1 to 3.

Table 1 - PAH and Pesticides recoveries determined by GC/MS after 50 ml hexane standard evaporated in ASE TUBES.

	RT	Peak Name	Amount 1	Amount 2	Amount 3	Amount 5	Amount 6	Average	Recovery	SD %	Um(t)
1	5,687	Naphthalene d8	0,1	0,1	0,1	0,1	0,1	0,1			
2	8,023	Acetanapthene d10	0,1	0,1	0,1	0,1	0,1	0,1			
3	9,856	Phenanthrene d10	0,1	0,1	0,1	0,1	0,1	0,1			
4	14,743	Chrysene d12	0,1	0,1	0,1	0,1	0,1	0,1			
5	19,627	Perylene d12	0,1	0,1	0,1	0,1	0,1	0,1			
6	5,723	Napthalene	0,0981	0,0937	0,0891	0,0904	0,0924	0,0927	92,74	3,754378	0,01679
7	7,871	Acenaphthylene	0,0981	0,0881	0,0972	0,1023	0,1042	0,098	97,98	6,365326	0,028467
8	8,082	Acenaphthene	0,086	0,0873	0,0825	0,0916	0,0807	0,0856	85,62	4,978132	0,022263
9	8,254	Pentachlorobenzene	0,1241	0,1215	0,1192	0,1162	0,1182	0,1198	97,431	2,546496	0,011388
10	8,708	Fluorene	0,1012	0,0894	0,1071	0,0957	0,1127	0,1012	101,22	9,062065	0,040527
11	9,393	Hexachlorobenzene	0,0871	0,1014	0,0866	0,0775	0,0859	0,0877	92,316	9,817752	0,043906
12	9,885	Phenanthrene	0,0908	0,094	0,0988	0,0988	0,0896	0,0944	94,4	4,583328	0,018711
13	9,945	Anthracene	0,0909	0,0832	0,0874	0,0964	0,0795	0,0875	87,48	7,523508	0,030715
14	11,489	Fluoranthene	0,1038	0,0933	0,1041	0,1017	0,1034	0,1013	101,26	4,489095	0,018327
15	11,868	Pyrene	0,1035	0,0934	0,1031	0,103	0,1052	0,1016	101,64	4,615049	0,018841
16	12,208	p terphenyl d14	0,1023	0,1023	0,101	0,0951	0,1003	0,1002	100,2	2,97231	0,012134
17	14,694	Cyclopenta(cd)pyrene	0,1058	0,1003	0,1029	0,0941	0,0924	0,0991	99,1	5,767235	0,023545
18	14,723	Benzo[a]Anthracene	0,0999	0,0992	0,1034	0,0973	0,0978	0,0995	99,52	2,419309	0,009877
19	14,83	Chrysene	0,1003	0,0997	0,1031	0,0943	0,0979	0,0991	99,06	3,281694	0,013397
20	16,25	5 Methly Chrysene	0,1016	0,1006	0,1051	0,0969	0,0994	0,1007	100,72	2,991269	0,012212
21	18,33	Benzo[b+j]Fluoranthene	0,1036	0,1007	0,1013	0,1062	0,0997	0,1023	102,3	2,54999	0,01041
22	18,424	Benzo[k]Fluoranthene	0,1041	0,0992	0,1019	0,1039	0,1	0,1018	101,82	2,180009	0,0089
23	19,304	Benzo[a+e]Pyrene	0,1011	0,0987	0,0987	0,1032	0,0993	0,1002	100,2	1,940342	0,007921
24	19,487	Perylene	0,1034	0,0999	0,1013	0,1041	0,0986	0,1015	101,46	2,278231	0,009301
25	23,745	Indeno (1,2,3-c,d)Pyrene	0,1004	0,0982	0,1015	0,1073	0,0993	0,1013	101,34	3,504518	0,014307
26	23,883	Dibenzo[a,h]Anthracene	0,0981	0,0969	0,0983	0,1081	0,1001	0,1003	100,3	4,494288	0,018348
27	24,654	Benzo[g,h,i]Perylene	0,108	0,1078	0,1046	0,1082	0,1042	0,1066	106,56	1,859908	0,007593
28	29,108	Dibenzo[a,l] Pyrene	0,0992	0,1051	0,0967	0,1139	0,1051	0,104	104	6,391881	0,026095

Table 2 - PAH and Pesticides recoveries determined by GC/MS after 50ml hexane standard evaporated in SAMPLE GENIE.

	RT	Peak Name	Amount 1	Amount 2	Amount 3	Amount 4	Amount 5	Average	Recovery	SD %	Um(t)
1	5,687	Naphthalened8	0,1	0,1	0,1	0,1	0,1	0,1			
2	8,023	Acenaphthene d10	0,1	0,1	0,1	0,1	0,1	0,1			
3	9,856	Phenanthrene d10	0,1	0,1	0,1	0,1	0,1	0,1			
4	14,743	Chrysene d12	0,1	0,1	0,1	0,1	0,1	0,1			
5	19,627	Perylene d12	0,1	0,1	0,1	0,1	0,1	0,1			
6	5,723	Naphthalene	0,1699	0,1062	0,0894	0,1374	0,1444	0,1295	129,46	24,63183	0,110157
7	7,871	Acenaphthylene	0,095	0,0895	0,0664	0,0889	0,0865	0,0853	85,26	12,89281	0,057658
8	8,082	Acenaphthene	0,0834	0,0864	0,0666	0,0777	0,0778	0,0784	78,38	9,655303	0,04318
9	8,254	Pentachlorobenzene	0,1183	0,1179	0,1119	0,104	0,1145	0,1133	92,13	5,146471	0,023016
10	8,708	Fluorene	0,1014	0,0905	0,074	0,0908	0,0976	0,0909	90,86	11,55509	0,051676
11	9,393	Hexachlorobenzene	0,0714	0,1017	0,0983	0,0683	0,0857	0,0851	89,558	17,82614	0,079721
12	9,885	Phenanthrene	0,0974	0,118	0,0836	0,0915	0,0938	0,0969	96,86	13,27282	0,059358
13	9,945	Anthracene	0,0877	0,0947	0,0685	0,0812	0,0817	0,0828	82,76	11,68183	0,052243
14	11,489	Fluoranthene	0,1046	0,1079	0,0816	0,1105	0,1006	0,101	101,04	11,36367	0,05082
15	11,868	Pyrene	0,1022	0,0965	0,0804	0,1079	0,0996	0,0973	97,32	10,62779	0,047529
16	12,208	p Terphenyl d14	0,1058	0,1062	0,1043	0,1078	0,1037	0,1056	105,56	1,537185	0,006874
17	14,694	Cyclopenta(cd)Pyrene	0,1029	0,1011	0,096	0,109	0,104	0,1026	102,6	4,592805	0,02054
18	14,723	Benzo[a]Anthracene	0,1036	0,1035	0,1065	0,1034	0,0994	0,1033	103,28	2,448905	0,010952
19	14,83	Chrysene	0,0958	0,0909	0,0738	0,1016	0,1009	0,0926	92,6	12,27093	0,054877
20	16,25	5 Methly Chrysene	0,0932	0,0932	0,1018	0,0992	0,101	0,0977	97,68	4,29634	0,019214
21	18,33	Benzo[b+j]Fluoranthene	0,1017	0,101	0,0979	0,1006	0,0964	0,0995	99,52	2,272989	0,010165
22	18,424	Benzo[k]Fluoranthene	0,0987	0,0926	0,0886	0,1005	0,0901	0,0941	94,1	5,588525	0,024993
23	19,304	Benzo[a+e]Pyrene	0,0974	0,0955	0,0912	0,0939	0,0905	0,0937	93,7	3,086693	0,013804
24	19,487	Perylene	0,0983	0,0974	0,0932	0,0978	0,0913	0,0956	95,6	3,292072	0,014723
25	23,745	Indeno (1,2,3-c,d)Pyrene	0,0949	0,095	0,0906	0,0942	0,0919	0,0933	93,32	2,109955	0,009436
26	23,883	Dibenzo[a,h]Anthracene	0,1018	0,1017	0,0953	0,1015	0,0952	0,0991	99,1	3,548325	0,015869
27	24,654	Benzo[g,h,i]Perylene	0,101	0,1	0,088	0,0992	0,0924	0,0961	96,12	5,888142	0,026333
28	29,108	Dibenzo[a,l] Pyrene	0,1011	0,1069	0,0865	0,097	0,0862	0,0955	95,54	9,522103	0,042584

Table 3- PAH and Pesticides recoveries determined by GC/MS after 50 ml DCM standard evaporated in ASE TUBES.

	RT	Peak Name	Amount	Amount1	Amount2	Amount 3	Amount4	Amount5	Average	Recovery	SD %	Um(t)
1	5,687	Naphthalened8	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
2	8,023	Acenaphthene d10	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
3	9,856	Phenanthrene d10	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
4	14,743	Chrysene d12	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
5	19,627	Perylene d12	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
6	5,723	Naphthalene	0,0706	0,1044	0,1129	0,1032	0,1028	0,0986	0,0988	98,75	14,75005	0,065964
7	7,871	Acenaphthylene	0,0821	0,0929	0,0923	0,0874	0,0954	0,0948	0,0908	90,817	5,637653	0,025212
8	8,082	Acenaphthene	0,0838	0,0852	0,0892	0,0867	0,0887	0,0874	0,0868	86,833	2,376569	0,010628
9	8,254	Pentaclorobenzene	0,1139	0,1117	0,1195	0,1168	0,1187	0,1197	0,1167	94,892	2,807515	0,012556
10	8,708	Fluorene	0,0988	0,1018	0,104	0,1004	0,107	0,1117	0,104	103,95	4,575627	0,020463
11	9,393	Hexachlorobenzene	0,0875	0,085	0,0923	0,0964	0,0829	0,0836	0,088	92,579	6,09452	0,027256
12	9,885	Phenanthrene	0,0963	0,0967	0,1067	0,1094	0,1004	0,1008	0,1017	101,72	5,219788	0,023344
13	9,945	Anthracene	0,095	0,0913	0,0957	0,0988	0,096	0,095	0,0953	95,3	2,530575	0,011317
14	11,489	Fluoranthene	0,1022	0,1055	0,1051	0,1046	0,1071	0,1053	0,105	104,97	1,521512	0,006804
15	11,868	Pyrene	0,0991	0,1033	0,1052	0,1038	0,1031	0,102	0,1028	102,75	2,014152	0,009008
16	12,208	p Terphenyl d14	0,1094	0,1044	0,1028	0,1066	0,1095	0,1027	0,1059	105,9	2,919665	0,013057
17	14,694	Cyclopenta(cd)Pyrene	0,0795	0,082	0,0962	0,0943	0,102	0,0992	0,0922	92,2	10,06727	0,045022
18	14,723	Benzo[a]Anthracene	0,1012	0,0911	0,101	0,0971	0,1002	0,0963	0,0978	97,817	3,964399	0,017729
19	14,83	Chrysene	0,1073	0,0979	0,1018	0,1006	0,1068	0,1012	0,1026	102,6	3,605447	0,016124
20	16,25	5 Methly Chrysene	0,1042	0,1014	0,1061	0,1034	0,1047	0,1007	0,1034	103,42	1,977353	0,008843
21	18,33	Benzo[b+j]Fluoranthene	0,1009	0,1063	0,1058	0,1045	0,1025	0,1049	0,1042	104,15	1,982432	0,008866
22	18,424	Benzo[k]Fluoranthene	0,0959	0,1012	0,1008	0,1002	0,0949	0,0973	0,0984	98,383	2,748067	0,01229
23	19,304	Benzo[a+e]Pyrene	0,0956	0,1018	0,1011	0,1011	0,0974	0,1007	0,0996	99,617	2,515169	0,011248
24	19,487	Perylene	0,0923	0,0955	0,0992	0,0991	0,0946	0,0981	0,0965	96,467	2,889694	0,012923
25	23,745	Indeno (1,2,3-c,d)Pyrene	0,0973	0,1001	0,1015	0,1029	0,1028	0,1036	0,1014	101,37	2,315831	0,010357
26	23,883	Dibenzo[a,h]Anthracene	0,1013	0,1048	0,0996	0,1077	0,1047	0,1032	0,1036	103,55	2,761849	0,012351
27	24,654	Benzo[g,h,i]Perylene	0,097	0,1028	0,1015	0,0923	0,0964	0,1	0,0983	98,333	3,93004	0,017576
28	29,108	Dibenzo[a,l] Pyrene	0,1073	0,0982	0,101	0,0995	0,1009	0,1023	0,1015	101,53	3,107454	0,013897

Observations

The EZ2 & Sample Genie performed the concentration of standard solution in Hexane very well; the recoveries are highly consistent and reproducible.

The comparison Sample Genie and ASE tubes shows that both these containers are suitable for methods of evaporation at low final volume, however, SampleGenie permits use of the automatic end run, and leaves the sample in the analytical vial ready for GC-MS analysis injection which is a considerable work saving.

SampleGenie did not exhibit neither cross contamination effect, nor memory effect. However, it was noted that colour leached from the black elastomer which formed the seal between flask and vial. In this case is did not affect our analysis, but may in other cases.

Long Term Evaluation

The above samples were used again to check the intra-run reproducibility after a significant amount of time had passed, 2 months in this study. A new seal material had also been developed which was also assessed, a low leachable white fluoroelastomer.

Methodology

Standards in hexane and DCM were prepared as before and six samples (three in each holder) were placed in the SampleGenie and evaporated as before, in each case the system was allowed to automatically stop. The hexane samples took approx. 1 hour 20 minutes to stop, leaving approx. 1ml in the vial. The DCM solution took approx. 3 hours to stop, again leaving approx. 1ml in the vial. The samples were analysed by GC-MS and are shown below in tables 4 & 5.

Table 4 - PAH and Pesticide recoveries determined by GC-MS from hexane standard evaporated in SampleGenie

Peak Name	Con.PHA 0.1ppm 1 02-04-08.sms	Con.PHA 0.1ppm 02-04-08.sms	Con.PHA 0.1ppm 02-04-08.sms	Con.PHA 0.1ppm 02-04-08.sms	Con.PHA 0.1ppm 02-04-08001.sms	Con.PHA 0.1ppm 02-04-08001.sms	Average	Recovery	SD %	Um(t)
Naphthalened8	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
Acenaphthene d10	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
Phenanthrene d10	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
Chrysene d12	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
Perylene d12	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
Naphthalene	0,094	0,0937	0,0703	0,1137	0,0853	0,0887	0,091	90,95	15,53251	0,069463
Acenaphthylene	0,0878	0,0881	0,0948	0,0828	0,0879	0,0881	0,0883	88,25	4,328998	0,01936
Acenaphthene	0,0785	0,0873	0,084	0,0772	0,0701	0,0765	0,0789	78,933	7,660524	0,034259
Pentaclorobenzene	0,1293	0,1215	0,1538	0,1278	0,1185	0,1249	0,1293	105,12	9,778725	0,043732
Fluorene	0,1095	0,0894	0,1127	0,0993	0,105	0,1118	0,1046	104,62	8,557561	0,038271
Hexachlorobenzene	0,1003	0,1014	0,1089	0,1024	0,0944	0,1004	0,1013	106,63	4,596425	0,020556
Phenanthrene	0,0916	0,094	0,0915	0,0873	0,0885	0,0835	0,0894	89,4	4,198432	0,01714
Anthracene	0,079	0,0832	0,08	0,0819	0,0761	0,0749	0,0792	79,183	4,075379	0,016638
Fluoranthene	0,1136	0,0933	0,1055	0,1038	0,0987	0,1078	0,1038	103,78	6,829472	0,027881
Pyrene	0,1087	0,0934	0,1038	0,093	0,0981	0,1046	0,1003	100,27	6,417687	0,0262
p Terphenyl d14	0,101	0,1023	0,106	0,1079	0,1029	0,0975	0,1029	102,93	3,575693	0,014598
Benzo[a]Anthracene	0,088	0,1003	0,0908	0,088	0,0955	0,088	0,0918	91,767	5,561916	0,022706
Chrysene	0,101	0,0992	0,1022	0,0999	0,0972	0,0931	0,0988	98,767	3,29061	0,013434
Benzo[b+j]Fluoranthene	0,114	0,0997	0,1246	0,1069	0,1002	0,0994	0,1075	107,47	9,441496	0,038545
Benzo[k]Fluoranthene	0,1024	0,1006	0,0999	0,1021	0,0944	0,0976	0,0995	99,5	3,053689	0,012467
Benzo[e]Pyrene	0,1115	0,1007	0,105	0,1059	0,1022	0,1014	0,1045	104,45	3,842367	0,015686
Benzo(a)Pyrene	0,0977	0,0992	0,1035	0,0951	0,0802	0,0886	0,0941	94,05	8,918436	0,036409
Perylene	0,1019	0,0987	0,1042	0,1025	0,0975	0,091	0,0993	99,3	4,798038	0,019588
Indeno (1,2,3-c,d)Pyrene	0,0966	0,0999	0,0948	0,087	0,0908	0,0908	0,0933	93,317	5,00088	0,020416
Dibenzo[a,h]Anthracene	0,1052	0,0982	0,1021	0,0933	0,0881	0,0855	0,0954	95,4	8,179863	0,033394
Benzo[g,h,i]Perylene	0,1012	0,0969	0,0968	0,0957	0,0868	0,086	0,0939	93,9	6,508656	0,026571
Dibenzo[a,l] Pyrene	0,0981	0,1078	0,0959	0,0966	0,0858	0,0807	0,0942	94,15	10,20551	0,041664

Table 5 - PAH and Pesticides recoveries determined by GC-MS from DCM standard evaporated in SampleGenie

Peak Name	Con.PHA 0.1ppm 1 02-04-08.sms	Con.PHA 0.1ppm 02-04-08.sms	Con.PHA 0.1ppm 02-04-08.sms	Con.PHA 0.1ppm 02-04-08.sms	Con.PHA 0.1ppm 02-04-08001.sms	Con.PHA 0.1ppm 02-04-08001.sms	Average	Recovery	SD %	Um(t)
Naphthalened8	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
Acenaphthene d10	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
Phenanthrene d10	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
Chrysene d12	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
Perylene d12	0,1	0,1	0,1	0,1	0,1	0,1	0,1			
Naphthalene	0,0765	0,0757	0,0861	0,102	0,0703	0,0608	0,0786	78,567	18,02134	0,080594
Acenaphthylene	0,0859	0,0764	0,079	0,0781	0,0799	0,0738	0,0789	78,85	5,163896	0,023094
Acenaphthene	0,0977	0,0871	0,0939	0,0954	0,0883	0,089	0,0919	91,9	4,725582	0,021133
Pentaclorobenzene		0,1125	0,1301	0,1252	0,121	0,1037	0,1185	96,341	8,858147	0,039615
Fluorene	0,0963	0,0817	0,0967	0,0868	0,0761	0,0703	0,0847	84,65	12,64939	0,05657
Hexachlorobenzene	0,087	0,0966	0,0991	0,1036	0,0911	0,0917	0,0949	99,842	6,383413	0,028547
Phenanthrene	0,0801	0,0834	0,0892	0,1015	0,0816	0,0816	0,0862	86,233	9,427464	0,038487
Anthracene	0,0867	0,0835	0,0848	0,0946	0,0789	0,08	0,0848	84,75	6,657524	0,027179
Fluoranthene	0,1008	0,1001	0,102	0,1004	0,0904	0,0943	0,098	98	4,686329	0,019132
Pyrene	0,1011	0,0999	0,1026	0,1001	0,0858	0,09	0,0966	96,583	7,167136	0,02926
p Terphenyl d14	0,1004	0,0948	0,0968	0,0998	0,0872	0,0926	0,0953	95,267	5,17769	0,021138
Benzo[a]Anthracene	0,0779	0,0722	0,0791	0,0789	0,0711	0,0809	0,0767	76,683	5,258091	0,021466
Chrysene	0,0861	0,083	0,0906	0,0899	0,0774	0,0823	0,0849	84,883	5,903343	0,0241
Benzo[b+j]Fluoranthene	0,1029	0,1005	0,103	0,1058	0,1001	0,0856	0,0997	99,65	7,207636	0,029425
Benzo[k]Fluoranthene	0,105	0,0872	0,0953	0,1018	0,1025	0,0887	0,0968	96,75	7,799818	0,031843
Benzo[e]Pyrene	0,1018	0,0875	0,0942	0,0998	0,1024	0,0885	0,0957	95,7	6,935075	0,028312
Benzo(a)Pyrene	0,0904	0,0825	0,0923	0,0909	0,0944	0,082	0,0888	88,75	5,887149	0,024034
Perylene	0,081	0,0859	0,0836	0,0852	0,0874	0,081	0,084	84,017	3,13864	0,012813
Indeno (1,2,3-c,d)Pyrene	0,1017	0,0725	0,0818	0,0837	0,0888	0,0813	0,085	84,967	11,47365	0,046841
Dibenzo[a,h]Anthracene	0,0916	0,0767	0,081	0,0823	0,0829	0,075	0,0816	81,583	7,149511	0,029188
Benzo[g,h,i]Perylene	0,0935	0,0751	0,0782	0,0782	0,0839	0,0801	0,0815	81,5	8,035826	0,032806
Dibenzo[a,l] pyrene	0,0933	0,0753	0,0801	0,079	0,078	0,0821	0,0813	81,3	7,745367	0,03162

Conclusions

The EZ2 and the SampleGenie performed the concentration of the hexane and DCM standard very well. Recoveries are highly consistent and reproducible, also for very volatile analytes. The "Inter run" comparison of the hexane Standard Solution evaporation confirms the excellent reproducibility and performances of the EZ2 using the SampleGenie even in different seasons (part 1 was developed in winter while Part 2 was developed in spring).

The comparison SampleGenie and ASE tubes shows that both these containers are suitable for methods of evaporation at low final volume. The advantage of the SampleGenie is that it permits use of the automatic end of run, and leaves the sample in the analytical vial ready for GC-MS injection.

The new seals tested, the first made of a white Viton® material while the second being a white perfluoro-elastomer, were tested. These septa didn't exhibit the same release of contaminants observed when we had been using the black Viton seal. Even after 20 cycles of reuse results were acceptable.

The throughput of the system comprising the EZ2 and the SampleGenie is lower than the one achieved by using ASE tubes: 8 samples compared to 12 and the concentration times is a little longer for the SampleGenie. Nevertheless the SampleGenie offers the advantage of elimination of the need to transfer the residual volume from the ASE tube to the analytical vial. This delicate step requires working time and may decrease recovery. The balance of these advantages and disadvantages is generally in favour of the SampleGenie, particularly for use with delicate assays.