

食品中残留農薬分析における固相抽出法を用いた自動前処理装置の開発 -第3報-

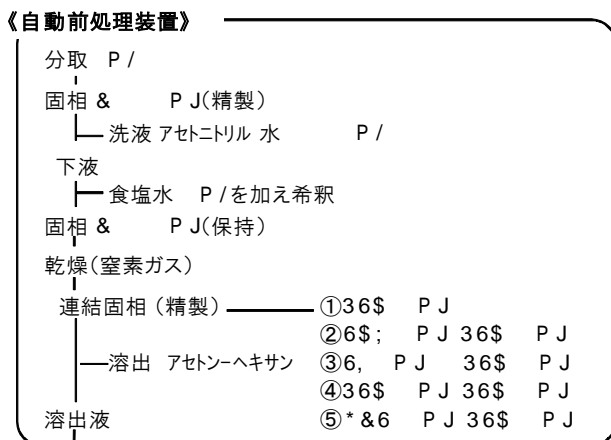
○佐々野僚一，谷澤春奈

株式会社アイスティサイエンス

【目的】食品中の残留農薬分析においてはポジティブリスト制度の導入以降，多種多様な食品と大幅に増加した農薬数への対応が求められている。今回は自動前処理装置を用いた精製の効率化を目的とし，固相ミキサムの種類と溶出溶媒種類による農薬の回収率や夾雑成分の除去効果の違いについて知見が得られたので報告する。

【方法】1. 自動前処理装置：STQ-L200，固相カートリッジ：Smart-SPE（アイスティサイエンス社製）
2. 対象農薬：ポジティブリスト制度GC/MS対象混合標準液22, 31, 34, 48, 51（関東化学社製）
3. 測定条件：前回と同様（第97回日本食品衛生学会講演要旨参照p. 33）

試料 10g（穀類5g, 抹茶2g + 水 10mL）
↓
アセトニトリル 10mL
↓
ホモジナイズ 食塩 1g
クエン酸 1D 水和物 J
クエン酸水素 1D 水和物 J
↓
攪拌（手で振とう 分）無水硫酸マグネシウム J
↓
遠心分離（分 LSP）
↓
アセトニトリル層をアセトニトリル-水(1/1)で倍希釈
↓
抽出液



— 添加 フェナントレンG体+3(*
— アセトン-ヘキサンで P / に定容

* & 0 6(6&\$1) 大量注入(μ /)

6FK-PH 試験溶液の調製法

【結果と考察】

1. PSAミキサムと溶出溶媒アセトン-ヘキサンの比率

溶出溶媒アセトン-ヘキサンの比率と回収率分布の関係を下記に示す。

表1. 回収率分布表

回収率	溶出溶媒アセトン-ヘキサン比率					
	(3/7)	(1/4)	(15/85)	(1/9)	(5/95)	(0/100)
%以上-未満	(30%)	(20%)	(15%)	(10%)	(5%)	(0%)
30-50	7	7	8	10	15	31
50-70	13	14	15	16	23	29
70-120	246	245	244	239	216	66

(単位:成分)

アセトン-ヘキサンの比率は(3/7)～(15/85)までは，回収率への影響はほとんど見られなかった。(5/95)でも多くの農薬が回収されることが分かった。夾雑物に関してはアセトンの比率を下げるほど精製効果としての機能が増し，(15/85)で十分な精製効果を得ることが分かった。特に，(5/95)に関しては更にその精製効果を発揮し，夾雑物が多い食品においても対応可能であると考えられたが，特に極性の農薬で回収率が低下するものがあり，それらはLC/MS(/MS)対象で測定するなどの検討が必要であると思われる。

2. SAX・SI(シカゲル)・PSA・GCS(ケラファイトカーボン)+PSAミキサムと溶出溶媒の比率

既に報告されている各種固相の夾雑物の除去効果を基に本装置での実証実験を行った。各固相と溶媒比率を夾雑物により適切に選択することでその効果が得られた。

今回，固相ミキサムと溶出溶媒の種類による農薬の挙動や夾雑成分の除去効果について得られた知見は，その他の多成分一斉分析や個別分析・確認分析においても応用できるものと考えられる。

【参考文献】1) 秋山ら，食衛誌，Vol. 37(1996)，p351
2) 大藤ら，京都府保健年報，第43号(1998)，p16
3) 飯島ら，日本農薬学会誌，Vol. 31(2006)，p190



食品中残留農薬分析における 固相抽出法を用いた自動前処理装置の開発 — 第3報 —

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目的

■ 自動前処理装置を用いた精製の効率化

- ① 固相ミニカラムと溶出溶媒による農薬の回収率について
- ② 固相ミニカラムと溶出溶媒による夾雑成分の除去効果について

固相ミニカラム

- PSA-30mg
- SAX-30mg + PSA-30mg
- SI-30mg + PSA-30mg
- PSA-30mg + PSA-30mg
- GCS-20mg + PSA-30mg

溶出溶媒

- アセトン-ヘキサン(各比率)
- トルエン-アセトン-ヘキサン(各比率)

対象農薬

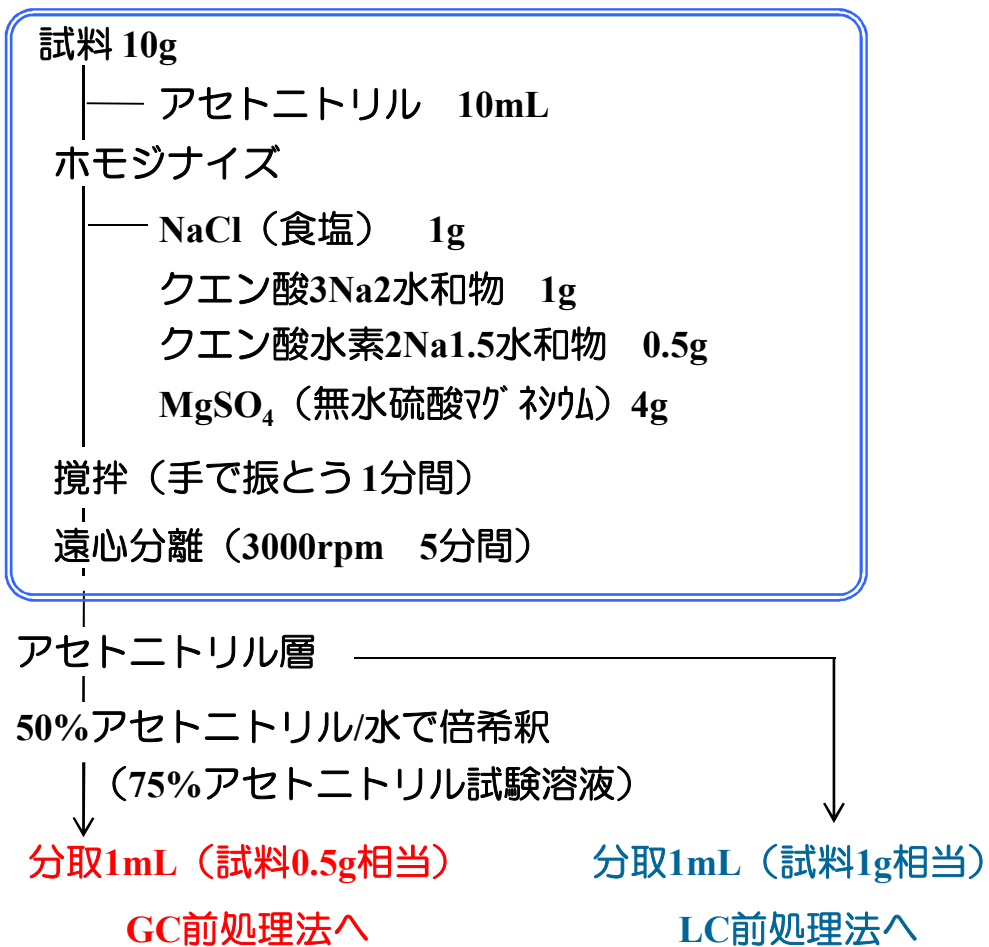
ポジティブリスト制 GC/MS対象農薬

製品名		農薬数	濃度
農薬混合標準液	22	50種	10ppm
農薬混合標準液	31	85種	10ppm
農薬混合標準液	34	46種	10ppm
農薬混合標準液	48	61種	10ppm
農薬混合標準液	51	26種	10ppm
合計		268種	

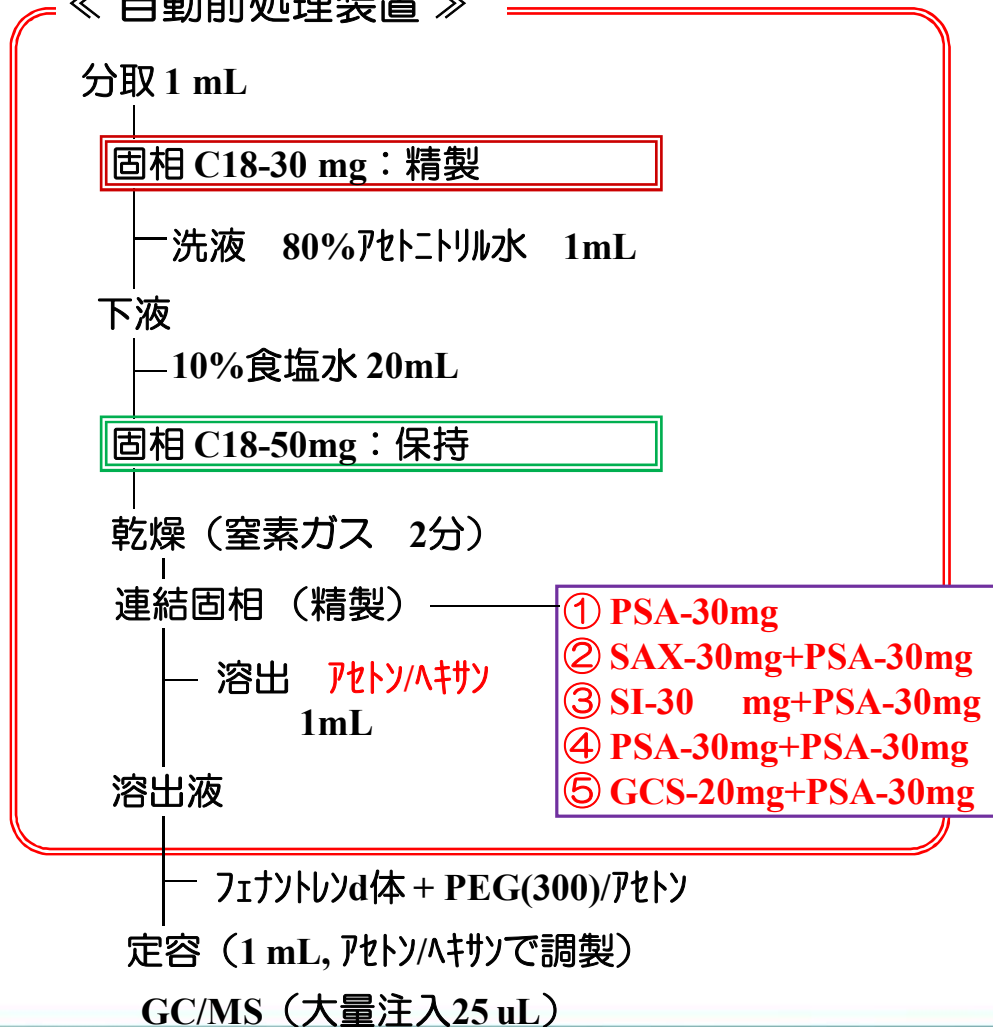
*いずれも関東化学社製

前処理フロー

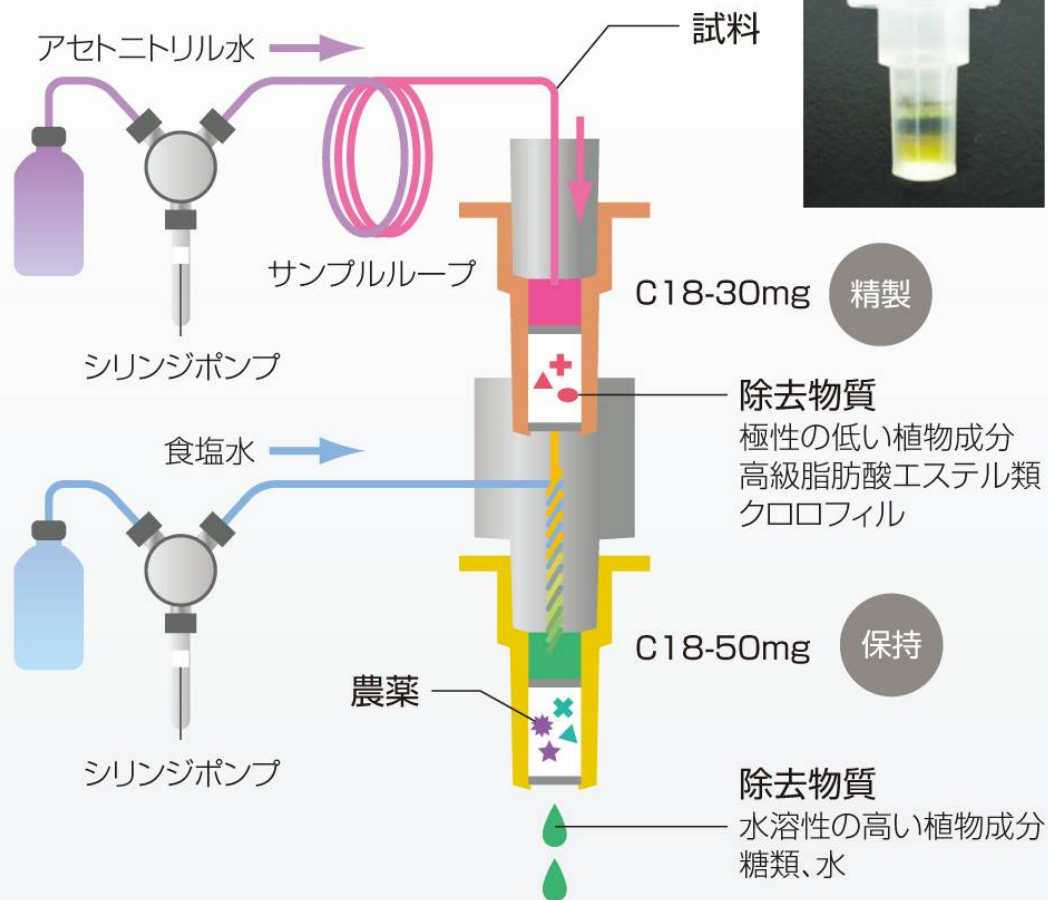
◎前処理フロー 抽出



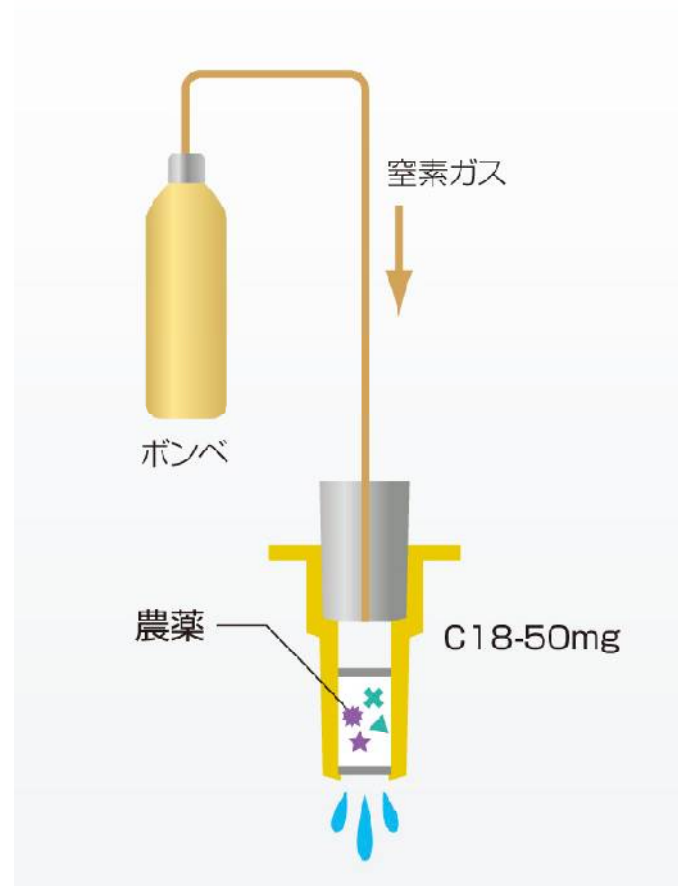
◀ 自動前処理装置 ▶



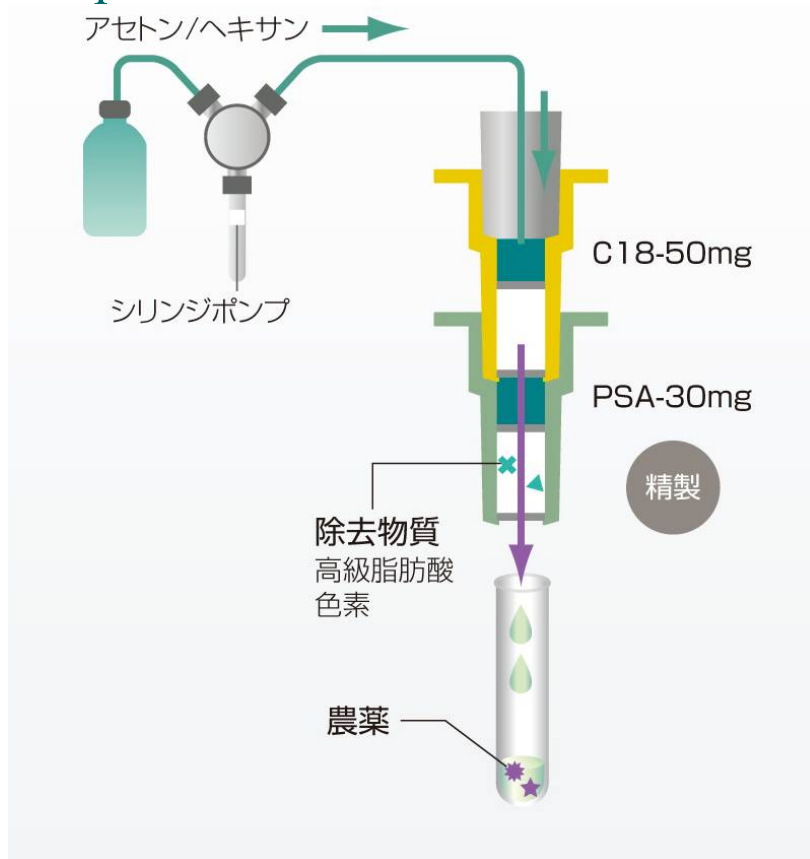
Step. 1 精製・保持



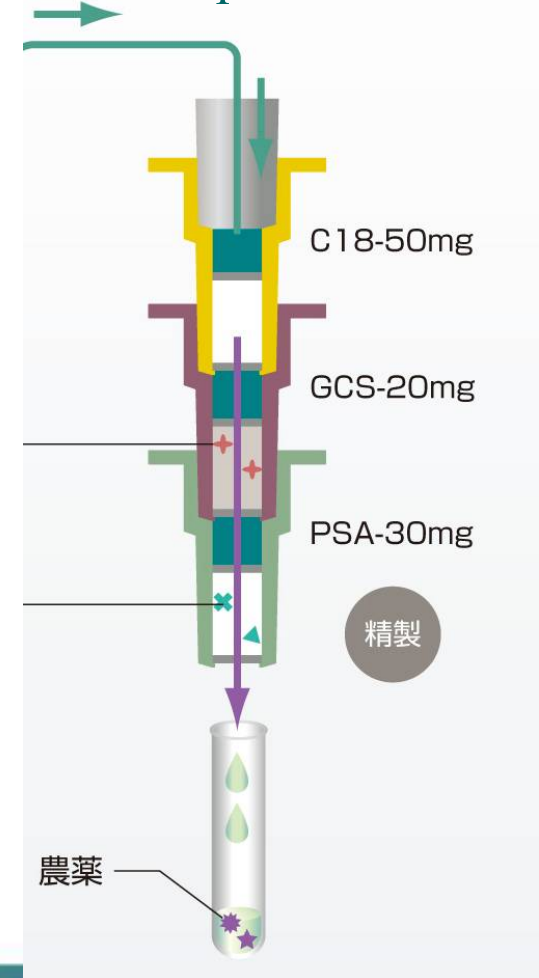
Step. 2 乾燥



Step. 3-1 連結精製



Step. 3-2 連結精製



GC/MS測定条件

自動前処理装置

使用溶媒

STQ-L200 (AiSTI Science)

アセトン

アセトン:ヘキサン

アセトニトリル:水 (4:1)

水

食塩水(10%)

乾燥ガス

窒素 (圧力 0.6MPa)



GC/MS

PTV Injector

LVI-S200 (AiSTI Science); Spiral Insert

Injector Temp.

70°C-120°C/min-240°C-50°C/min-290°C (38min)

Solvent Purge Time

0.27 min

Auto Samplor

CombiPAL; 50 µL Syringe (AMR)

Injection Volume

25 µL

GC

Agilent 6890N

Column

BPX5, 0.25mm i.d. × 30m, df; 0.25mm

Column Oven Temp.

60°C (4min) -20°C/min-160°C-5°C/min-220°C-3°C/min-235°C-7°C/min-310°C (8.3min)

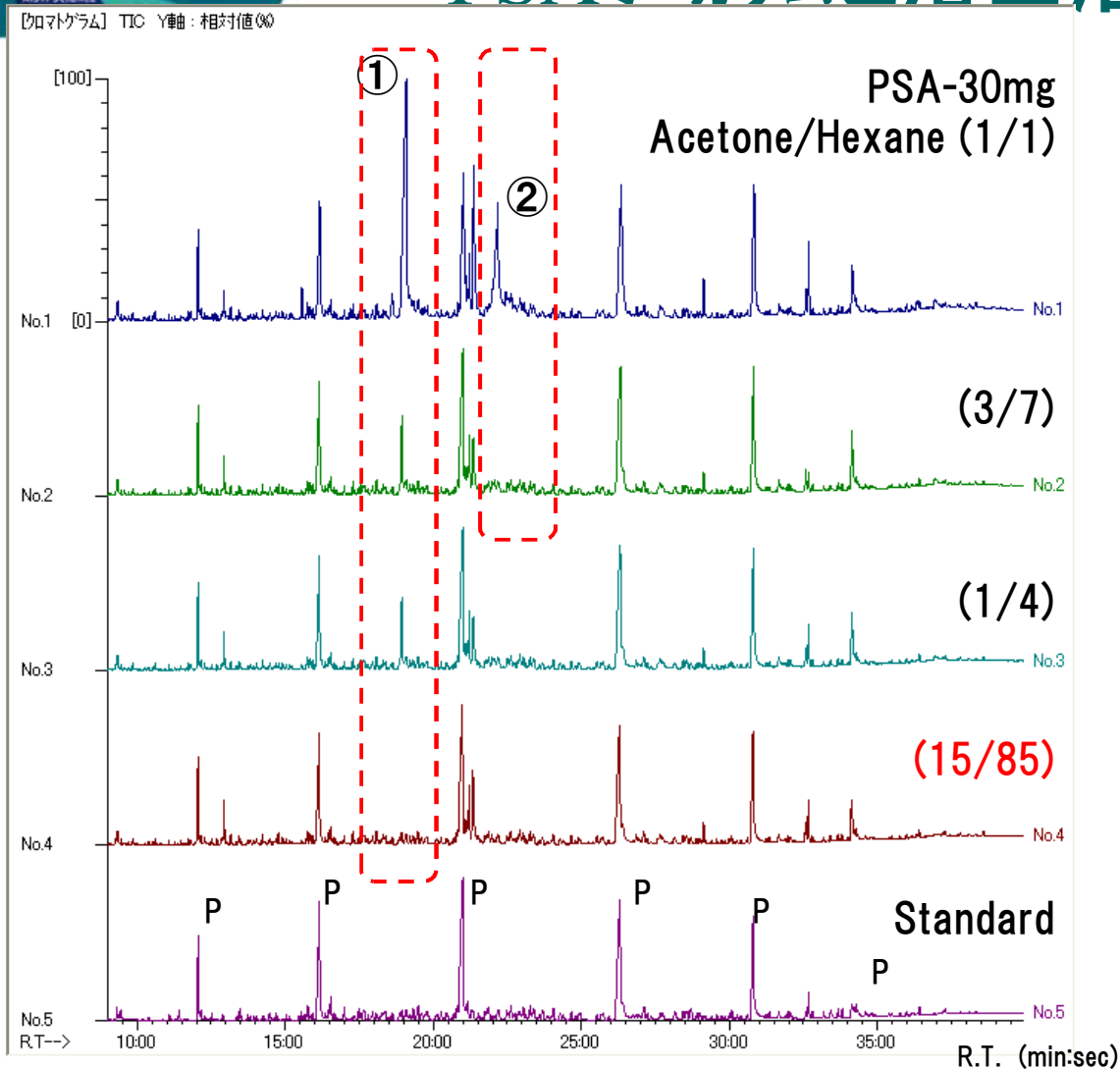
MS

JMS-Q1000GC (JEOL)

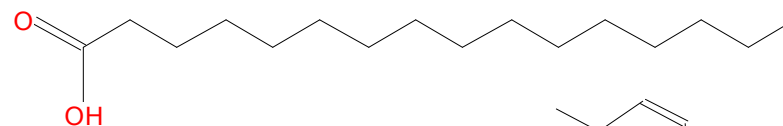
MS Method

SCAN; 70 - 450 m/z

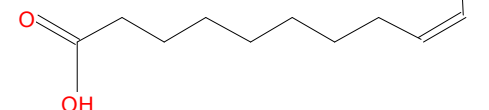
PSAミニカラムと溶出溶媒による精製効果



① Hexadecanoic acid



② Linolenic acid



PSA
 $-\text{Si}-\text{CH}_2\text{CH}_2\text{CH}_2\text{NHCH}_2\text{CH}_2\text{NH}_2$
 N-プロピルエチレンジアミン
 一次相互作用：極性・陰イオン交換

➤アセトンの比率を下げるとPSAによる脂肪酸の除去効果が高くなる

➤アセトン-ヘキサン (15/85)が最適

図3. ほうれん草を用いたPSAミニカラムと溶出溶媒アセトン-ヘキサンによるSCANトータルイオンクロマトグラム比較

PSAミニカラムと溶出溶媒による回収率①

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
1	1-Naphthylacetamide	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
2	3-Hydroxycarbofuran	55.5	60.9	55.5	58.5	59.3	48.6	0.0		
3	4,4'-Dichlorobenzophen	98.0	91.4	86.1	87.2	85.2	80.0	81.0		
4	Acephate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
5	Acetamidpride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
6	Acetochlor	100.9	96.7	91.4	93.1	93.7	83.3	67.1		
7	Acrinathrin	99.6	96.2	91.1	91.1	88.6	81.6	56.8		
8	Alachlor	98.1	93.7	88.5	91.5	90.3	81.2	63.7		
9	Allethrin-1,2	100.5	83.7	76.0	78.5	77.5	75.6	78.9		
10	Allethrin-3,4	94.4	88.1	84.8	83.5	83.4	78.1	66.8		
11	Ametryn	76.7	87.2	81.9	84.5	85.6	75.0	0.9		
12	Anilofos	106.7	100.2	94.5	95.5	89.7	83.1	0.7		
13	Aramite-3	97.6	87.0	85.4	86.5	82.9	77.7	59.9		
14	Aramite-4	100.7	90.4	85.9	89.5	82.7	76.2	57.8		
15	Atrazine	60.8	70.7	61.7	66.1	67.1	51.7	0.1		
16	Azaconazole	88.7	89.5	84.3	85.4	84.3	52.6	0.7		
17	Azinphos-Methyl	119.4	111.0	105.0	102.1	93.0	86.3	1.3		
18	Benalaxyl	101.3	97.0	91.4	93.9	91.8	84.9	9.2		
19	Bendiocarb	30.7	42.6	34.4	36.5	35.4	19.7	0.3		
20	Benfluranlin	108.4	103.0	93.8	92.3	96.5	90.2	84.0		
21	Benfuresate	95.3	91.6	87.7	89.3	90.6	82.7	21.3		
22	Benoxacor	92.3	89.7	84.5	87.5	89.6	81.3	34.5		
23	BHC-alpha	97.2	95.7	87.7	87.6	90.4	83.6	82.1		
24	BHC-beta	94.8	92.8	87.5	87.1	86.7	81.3	78.0		
25	BHC-delta	97.6	91.8	87.3	91.4	88.8	85.2	0.0		
26	BHC-gamma	80.1	90.6	86.8	89.5	88.7	80.6	8.5		
27	Bifenox	101.7	94.7	88.3	89.3	85.5	79.3	28.3		
28	Bifenthrin	92.9	86.8	82.3	83.8	80.6	76.7	75.4		
29	Bitertanol-1	110.6	108.9	101.7	100.0	76.2	12.8	0.3		
30	Bitertanol-2	112.8	111.9	105.0	97.5	64.8	6.5	0.8		

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
31	Bromacil	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
32	Bromobutide	94.0	90.6	85.5	86.8	88.1	79.0	44.4		
33	Bromofos methyl	99.9	91.1	86.5	86.3	84.1	79.5	78.0		
34	Bromofos-ethyl	95.2	89.6	85.1	85.1	82.5	80.4	81.1		
35	Bromopropylate	100.2	93.6	89.1	89.9	86.1	80.1	17.7		
36	Buprimate	94.9	92.7	87.3	90.7	90.1	83.4	1.9		
37	Buprofezin	98.0	92.1	86.6	89.2	87.0	77.7	62.0		
38	Butachlor	91.4	88.2	84.4	86.0	82.4	78.0	75.4		
39	Butamifos	106.3	97.9	92.7	90.2	87.3	82.8	30.9		
40	Butylate	128.5	108.7	95.6	90.9	107.4	98.1	84.6		
41	Cadusafos	115.5	109.1	99.3	98.2	103.9	91.3	61.7		
42	Cafenstrole	125.1	118.4	109.6	110.1	103.2	81.1	2.4		
43	Captafol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
44	Captan	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
45	Carbaril	55.6	70.2	56.4	56.2	56.2	28.0	0.2		
46	Carbofuran	30.1	39.0	32.5	33.7	32.6	19.9	0.0		
47	Carboxin	49.1	62.7	51.2	54.4	53.6	33.3	0.5		
48	Carfentrazone ethyl	100.9	95.7	89.9	92.8	90.2	82.3	27.8		
49	Chlorbenside	94.3	90.0	84.6	86.6	84.7	78.7	79.3		
50	Chlorbufam	109.1	101.4	96.1	98.2	97.2	88.8	1.6		
51	Chlorethoxyphos	120.6	107.9	96.8	92.3	103.4	97.4	82.4		
52	Chlorfenapyr	92.6	87.9	85.9	85.4	82.9	74.0	56.0		
53	Chlorfenson	92.8	89.4	85.6	86.7	87.0	76.6	77.3		
54	Chlorfenvinphos-1	106.0	99.1	92.6	93.4	93.6	88.1	5.5		
55	Chlorfenvinphos-2	95.1	93.2	88.3	94.1	90.7	81.6	2.1		
56	Chlorobenzilate	103.4	95.7	91.0	92.7	89.5	85.2	7.4		
57	Chloroneb	111.5	105.6	97.2	93.9	104.0	95.2	92.4		
58	Chlorpropham	103.8	99.9	95.0	96.7	96.5	88.0	7.7		
59	Chlorpyrifos	100.0	92.4	86.7	86.6	84.4	81.6	77.9		
60	Chlorpyrifos-methyl	102.3	96.2	90.7	89.9	89.4	84.0	81.3		

PSAミニカラムと溶出溶媒による回収率②

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
61	Chlorthal-dimethyl	95.3	90.6	86.0	87.6	85.4	80.5	82.4		
62	Chlozolate	103.1	93.5	90.2	94.2	90.5	86.2	51.1		
63	Cinidon-ethyl	112.9	107.0	101.0	101.6	92.2	85.0	21.3		
64	Clomazone	95.1	93.8	87.5	89.0	90.9	80.5	51.4		
65	Cyanazine	19.4	28.3	23.8	25.5	20.9	4.7	0.0		
66	Cyanophos	93.9	94.1	89.0	90.3	90.8	83.2	14.4		
67	Cyfluthrin-1	94.5	101.7	91.3	90.2	80.7	57.0	57.8		
68	Cyfluthrin-2	92.9	94.4	90.5	91.3	89.4	79.2	47.4		
69	Cyfluthrin-3	98.7	94.6	87.4	90.5	84.4	84.1	53.9		
70	Cyfluthrin-4	125.6	97.6	96.1	88.7	76.0	50.9	44.8		
71	Cyhalofop-butyl	99.2	93.9	88.3	90.1	87.7	80.1	44.0		
72	Cyhalothrin-1	101.4	95.5	89.6	90.2	86.7	80.1	68.3		
73	Cyhalothrin-2	101.6	92.3	87.8	87.9	82.9	77.6	61.7		
74	Cypermethrin-1	100.3	98.5	92.1	90.2	85.9	79.1	69.7		
75	Cypermethrin-2	99.7	98.2	89.0	90.6	85.3	77.5	60.5		
76	Cypermethrin-3	88.7	87.7	86.6	85.8	82.0	77.0	63.7		
77	Cypermethrin-4	111.2	115.1	112.1	103.8	87.6	80.2	60.3		
78	Cyproconazole-1	112.8	95.9	91.5	92.3	92.3	49.1	0.0		
79	Cyproconazole-2	103.1	95.4	92.5	91.6	86.2	39.1	18.4		
80	DEF	98.9	91.8	84.7	84.3	82.6	76.1	70.8		
81	Deltamethrin	94.6	96.1	92.7	94.6	73.6	85.3	50.7		
82	Demeton-S-methyl	26.3	35.5	27.5	27.7	28.4	16.1	0.9		
83	Diallate-1	111.5	105.4	95.7	93.4	101.2	93.4	85.0		
84	Diallate-2	113.7	106.4	96.8	94.4	102.5	94.0	86.4		
85	Diazinone	100.1	97.9	91.2	92.8	94.2	84.2	77.9		
86	Dichlofenthion	97.1	89.0	83.8	85.5	89.5	84.5	82.7		
87	Dichlofluanid	94.8	86.7	84.2	89.7	63.8	80.7	20.4		
88	Dichlorvos	14.3	18.3	14.5	13.6	14.2	8.3	1.6		
89	Diclocymet-1	100.6	96.0	89.8	93.9	96.4	70.7	1.7		
90	Diclocymet-2	86.3	93.2	89.4	93.8	93.6	54.6	0.0		

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
91	Diclofop-methyl	94.2	87.5	83.9	86.2	83.6	77.0	72.0		
92	Dicloran	68.3	72.6	64.6	66.6	66.1	56.0	0.0		
93	Dicrotofos	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
94	Diethofencarb	96.7	97.8	93.8	91.9	91.2	87.9	1.7		
95	Difenoconazole-1	112.4	106.8	99.6	87.7	86.1	59.7	0.4		
96	Difenoconazole-2	109.3	103.1	95.0	95.9	92.6	76.4	0.0		
97	Diflufenican	95.4	89.8	85.3	88.2	85.6	79.3	27.0		
98	Dimepiperate	99.3	94.0	89.1	90.2	89.6	80.7	81.0		
99	Dimethametryn	96.9	91.8	88.4	88.6	86.3	78.8	1.4		
100	Dimethenamid	99.6	95.6	89.9	91.9	91.6	83.1	32.5		
101	Dimethipin	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
102	Dimethoate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
103	Dimethylvinphos-z	101.0	94.5	89.8	91.0	89.1	85.1	1.2		
104	Dioxathion	99.6	97.9	89.9	92.0	91.0	83.9	26.7		
105	Diphenamide	94.0	92.9	87.9	89.9	88.7	82.1	0.2		
106	Disulfoton	102.7	99.0	92.4	92.5	94.9	86.0	85.9		
107	Disulfoton sulfone	101.0	94.8	91.3	86.2	85.5	78.0	1.4		
108	Edifenphos	122.1	99.0	93.0	96.7	91.5	84.9	1.3		
109	Endosulfan	90.9	85.4	81.2	82.8	80.4	79.6	78.4		
110	Endosulfan II	91.5	88.5	86.3	87.4	83.0	77.9	22.9		
111	Endosulfan sulfate	98.7	94.6	89.8	92.2	89.5	83.1	0.0		
112	EPN	104.4	97.2	90.4	90.5	85.5	77.8	50.8		
113	Epoxiconazole	101.9	97.8	92.4	94.3	92.7	76.0	2.0		
114	EPTC	120.0	118.9	103.6	96.5	116.6	103.6	87.5		
115	Esprocarb	94.5	93.9	88.3	88.3	85.9	81.7	78.7		
116	Ethalfuralin	111.2	106.2	94.7	93.4	101.5	92.5	85.6		
117	Ethiofencarb	70.9	90.7	72.5	76.2	78.1	48.6	0.8		
118	Ethion	105.4	95.4	90.3	91.3	86.9	80.1	70.9		
119	Ethofumesate	98.6	97.0	92.8	90.8	89.6	85.9	4.7		
120	Ethoprophos	109.5	106.5	95.8	93.8	101.7	88.9	34.7		

PSAミニカラムと溶出溶媒による回収率③

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
121	Etofenprox	95.6	89.6	85.5	85.9	81.6	77.6	77.6		
122	Etozazole	94.3	89.2	85.2	85.1	81.4	74.9	59.2		
123	Etrimfos	99.7	94.0	87.1	89.9	90.8	83.0	81.7		
124	Fenamidone	98.6	95.6	90.6	92.0	92.2	63.9	0.0		
125	Fenamiphos	110.3	102.5	97.0	94.9	92.3	46.8	0.9		
126	Fenarimol	95.3	93.5	89.8	91.8	87.6	46.3	0.8		
127	Fenbuconazole	105.1	100.9	95.1	95.2	84.7	13.8	0.6		
128	Fenchlorphos	93.6	88.2	83.2	84.0	82.9	79.7	76.4		
129	Fenitrothion	110.1	103.6	97.7	93.6	94.4	92.8	45.8		
130	Fenobucarb	102.4	100.2	94.1	94.5	97.5	88.7	0.5		
131	Fenothiocarb	97.3	95.1	90.3	91.4	89.7	82.8	47.5		
132	Fenoxanil	101.6	95.7	91.5	92.1	91.1	84.3	0.6		
133	Fenpropathrin	92.3	84.8	81.3	81.9	79.2	74.0	71.7		
134	Fenpropemorph	97.6	91.9	86.5	86.6	87.0	79.6	40.0		
135	Fensulfothion	116.7	105.2	98.0	97.2	94.9	52.3	1.2		
136	Fenthion	106.0	99.2	92.9	95.8	95.5	89.3	77.3		
137	Fenvalerate-1	89.1	89.9	86.1	88.0	84.2	80.4	59.2		
138	Fenvalerate-2	117.3	96.9	90.0	86.9	81.9	74.3	53.0		
139	FIPRONIL	62.4	88.3	84.6	88.8	89.0	44.5	0.0		
140	Flamprop-methyl	101.6	95.2	90.3	93.8	93.4	89.0	2.9		
141	Fluacrypyrim	102.4	95.6	90.6	93.1	88.7	82.1	27.9		
142	Flucythrinate-1	97.8	94.1	88.9	89.4	85.3	79.5	17.7		
143	Flucythrinate-2	103.7	97.2	92.0	90.8	85.6	79.2	13.2		
144	Fludioxonil	93.1	84.9	79.4	82.1	85.0	77.1	54.6		
145	Flufenpyl-ethyl	109.8	100.1	94.6	94.9	94.0	85.2	17.0		
146	Flumiclorac-pentyl	115.6	110.5	104.9	102.0	94.9	86.1	4.6		
147	Flumioxazin	119.2	111.9	108.0	106.4	101.6	74.8	0.0		
148	Fluquinconazole	101.8	98.2	93.1	94.0	92.0	80.6	0.2		
149	Fluridone	106.8	100.7	95.9	86.3	40.5	0.6	0.1		
150	Flusilazole	101.1	96.2	91.9	94.4	93.1	72.8	0.4		

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
151	Fluthiacet-methyl	150.4	141.7	125.1	117.6	105.0	87.3	0.0		
152	Flutolanil	104.5	96.7	92.4	93.8	92.8	61.1	1.9		
153	Flutriafol	90.7	94.8	85.8	79.5	54.7	6.0	0.2		
154	Fluvalinate-1	95.3	93.8	88.4	88.4	83.9	78.5	27.8		
155	Fluvalinate-2	99.2	94.7	89.2	89.3	86.1	80.3	29.3		
156	Formothion	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
157	Fosthiazate-1	76.9	84.4	73.3	76.0	75.8	55.2	3.5		
158	Fosthiazate-2	78.8	86.6	75.2	78.3	78.4	59.4	2.1		
159	Halfenprox	95.6	89.1	82.9	83.5	79.0	74.5	74.0		
160	Hexaconazole	101.1	97.6	93.8	92.8	89.1	43.2	0.3		
161	Hexazinone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
162	Imazamethabenz methyl	33.9	43.4	33.4	33.2	32.0	6.2	0.7		
163	Imibenconazole	148.4	134.1	119.2	116.4	92.8	41.0	0.0		
164	Imibenconazole-des-b	14.0	16.4	12.3	9.7	4.6	0.1	0.3		
165	Iprobenfos	101.5	96.0	90.1	90.9	90.1	82.4	12.9		
166	Iprodione	104.5	102.0	95.5	96.4	93.2	82.8	1.0		
167	Isazofphos	96.4	94.3	87.9	90.0	90.7	82.5	72.7		
168	Isofenphos	102.5	93.6	88.8	91.0	87.9	82.5	66.2		
169	Isofenphos P=O	111.1	101.4	95.7	93.6	93.0	76.9	0.3		
170	Isoprocarbe	75.8	84.7	74.8	77.8	81.5	64.4	0.3		
171	Isoprothiolane	100.5	95.7	91.2	91.8	91.0	84.0	2.8		
172	Isoxathion	93.5	84.7	78.6	81.9	79.0	72.6	39.5		
173	Isoxathion-ox	97.0	93.3	89.8	85.8	83.1	72.5	2.5		
174	Kresoxim-methyl	99.5	93.6	87.7	90.1	86.8	79.0	47.7		
175	Lenacil	44.8	57.9	46.2	48.6	39.8	4.0	0.1		
176	Malathion	107.2	101.1	94.5	94.2	91.3	85.9	39.4		
177	Mecarbam	97.7	93.1	87.2	91.1	90.3	82.3	49.1		
178	Mefenacet	103.8	98.0	91.4	92.3	89.5	81.1	0.0		
179	Mefenpyr-diethyl	101.9	96.9	92.8	95.4	91.4	81.2	35.8		
180	Mepronil	119.3	108.5	100.7	96.8	99.6	86.2	4.4		

PSAミニカラムと溶出溶媒による回収率④

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
181	Metalaxyl	78.4	87.6	80.1	85.3	85.5	70.4	0.5		
182	Methamidophos	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
183	Methidathion	96.8	93.1	89.5	89.4	87.0	80.7	13.8		
184	Methiocarb	119.9	109.8	102.9	95.5	96.0	87.5	0.0		
185	Methoprene-1	97.7	91.8	85.7	87.0	84.7	79.4	80.1		
186	Methoprene-2	75.7	78.1	74.5	77.0	75.4	72.2	74.7		
187	Methoxychlor	62.9	61.8	62.4	71.1	65.9	65.4	46.3		
188	Metolachlor	101.4	96.4	92.2	91.6	92.3	84.1	46.9		
189	Metominostrobin	99.0	96.0	91.0	89.6	89.8	80.9	0.2		
190	Metominostrobin-z	86.7	89.2	81.9	84.1	83.8	62.7	0.0		
191	Mevinphos	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
192	Monocrotophos	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
193	Myclobutanil	99.7	95.2	91.0	92.3	90.5	37.0	0.5		
194	Napropamide	99.7	94.7	89.7	92.4	91.9	84.0	10.5		
195	Nitrothal-isopropyl	101.8	93.6	89.2	88.9	87.7	81.1	80.8		
196	Norflurazon	82.6	87.6	82.7	83.9	68.6	3.4	0.1		
197	Oryzalin	35.5	59.3	56.3	28.9	0.0	0.0	0.0		
198	Oxadiazone	90.1	87.1	83.0	84.7	82.6	78.4	76.8		
199	Oxadixyl	20.2	23.6	20.1	20.9	19.2	8.0	2.0		
200	Oxyfluorfene	100.2	91.5	86.1	85.4	82.6	77.4	59.1		
201	p,p'-DDD	98.5	90.0	85.3	87.5	83.2	78.3	73.4		
202	p,p'-DDE	91.0	85.6	81.4	82.0	78.6	76.0	77.9		
203	Paclobutrazol	91.7	99.7	94.3	99.3	94.6	53.7	0.0		
204	Parathion	104.4	94.7	88.4	87.0	85.4	80.0	72.7		
205	Parathion-methyl	108.2	102.2	95.4	95.2	95.0	87.9	35.4		
206	Penconazole	96.5	92.9	88.4	90.4	89.5	77.9	0.3		
207	Pendimethalin	100.9	92.5	87.0	87.0	84.0	80.1	77.3		
208	Permethrin-cis	97.5	92.8	87.0	87.5	81.1	74.7	76.0		
209	Permethrin-trans	99.4	92.7	87.3	88.2	82.7	75.8	77.0		
210	Perthane	98.3	87.7	84.2	84.2	80.9	77.2	76.2		

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
211	Phenothrin-1	98.5	91.8	85.9	88.0	84.5	79.6	77.2		
212	Phenothrin-2	98.0	91.0	85.9	87.2	82.1	78.2	77.6		
213	Phenthoate	100.5	100.6	99.3	101.3	89.9	93.4	82.5		
214	Phorate	113.0	109.6	97.0	95.6	102.3	92.4	88.4		
215	Phosalone	112.5	104.8	97.2	96.1	90.0	82.0	7.1		
216	Phosmet	111.0	104.3	99.2	98.7	93.8	86.8	1.1		
217	Phosphamidon	29.2	38.4	28.8	29.1	31.7	15.2	0.0		
218	Phthalide	100.4	92.9	89.9	90.9	90.2	84.8	57.3		
219	Picolinafen	97.1	91.1	87.1	87.6	85.2	79.7	15.4		
220	Piperonyl butoxide	97.4	91.9	87.9	89.1	85.8	79.0	62.3		
221	Piperophos	105.8	98.2	91.6	94.8	90.1	81.2	11.0		
222	Pirimicarb	33.9	38.6	30.1	30.0	33.2	22.0	1.1		
223	Pirimiphos methyl	102.2	91.5	86.2	88.8	90.0	86.5	73.9		
224	Pretilachlor	100.4	95.1	89.3	92.4	89.3	81.4	60.6		
225	Procymidone	94.0	89.6	86.0	89.6	89.5	82.7	48.8		
226	Profenofos	105.7	98.5	91.5	92.3	89.2	81.7	43.4		
227	Prohydrojasmon-1	96.7	94.0	89.9	93.8	94.8	86.6	83.6		
228	Prohydrojasmon-2	97.2	95.2	85.5	88.2	92.6	82.3	78.5		
229	Prometryn	85.2	90.8	85.7	88.6	88.4	80.6	5.8		
230	Propachlor	84.0	91.9	79.7	80.1	87.4	70.4	26.1		
231	Propanil	89.9	90.7	85.8	89.6	88.3	50.4	7.7		
232	Propaphos	101.6	96.3	88.6	91.3	90.1	84.4	1.0		
233	Propargite(BPPS)	97.5	94.7	89.9	93.4	85.7	82.7	78.6		
234	Propazine	90.8	89.1	84.5	87.1	87.5	79.1	1.0		
235	Propiconazole-1	105.1	99.5	94.0	97.9	96.3	86.1	0.0		
236	Propiconazole-2	103.4	99.8	94.4	97.0	96.0	86.8	0.0		
237	Propoxur	19.1	27.4	22.5	23.2	22.2	12.3	0.0		
238	Propyzamide	89.2	89.7	86.9	88.5	87.6	79.9	11.8		
239	Prothiophos	95.4	88.5	82.8	83.4	82.1	78.4	76.8		
240	Pyraclofos	107.9	101.1	94.7	94.4	89.2	82.0	0.0		

PSAミニカラムと溶出溶媒による回収率⑤

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下:(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
241	Pyraflufen-ethyl	98.9	93.6	89.3	91.4	90.8	82.9	0.5		
242	Pyrazophos	102.0	102.9	94.0	95.3	90.8	81.4	31.1		
243	Pyributicarb	105.3	94.1	88.6	88.3	82.1	73.9	78.3		
244	Pyridaben	91.5	90.9	85.9	86.7	81.0	74.8	66.7		
245	Pyridafenthion	111.7	104.1	97.6	97.8	94.5	83.9	0.1		
246	Pyrifenox-1	92.3	91.1	86.1	89.0	89.0	79.7	2.1		
247	Pyrifenox-2	75.1	87.2	85.9	89.2	88.7	77.7	6.6		
248	Pyrimethanil	89.3	89.4	85.8	87.2	87.3	77.6	14.7		
249	Pyrimidifen	97.2	93.2	87.9	89.4	85.7	78.5	2.1		
250	Pyriminobac-methyl-1	99.9	94.8	89.6	91.8	90.9	82.6	4.0		
251	Pyriminobac-methyl-2	96.8	92.9	87.7	89.4	88.5	82.2	4.1		
252	Pyriproxyfen	95.0	89.7	85.2	85.8	82.2	76.7	72.0		
253	Pyroquilon	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
254	Quinoclamine	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
255	Quinolphos	98.1	94.7	87.3	92.0	87.9	83.0	69.5		
256	Quinomethionate	99.7	91.4	86.0	78.9	73.4	58.8	10.8		
257	Quinoxifen	92.3	86.9	82.7	84.9	81.3	76.5	43.5		
258	Quintozen	98.1	93.9	87.0	85.6	88.1	82.4	74.1		
259	Resmethrin-1	79.1	77.6	74.0	76.9	70.3	58.4	58.0		
260	Resmethrin-2	88.7	83.4	78.3	76.8	69.6	59.2	58.4		
261	Silafluofen	85.3	75.9	71.5	73.8	70.5	67.8	69.5		
262	Simazin	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
263	Simetryn	38.2	62.0	52.7	55.5	57.1	36.8	0.3		
264	Spirodiclofen	80.4	78.8	78.8	82.7	79.2	75.0	56.6		
265	Spiroxamine-1	108.8	101.8	93.5	91.0	95.4	75.7	2.1		
266	Spiroxamine-2	115.1	100.9	93.6	91.0	92.8	79.9	2.2		
267	TCMTB	115.9	98.6	90.7	86.3	84.2	75.8	2.4		
268	Tebuconazole	98.3	95.4	89.3	91.6	89.9	37.5	0.5		
269	Tebufenpyrad	97.1	90.2	86.5	87.7	84.0	78.4	24.1		
270	Tecnazene	105.3	98.5	88.8	86.8	94.2	85.9	81.3		

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下:(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
271	Tefluthrine	93.8	88.3	83.2	83.6	85.1	79.6	79.6		
272	Terbacil	85.7	81.9	78.5	76.6	80.9	76.0	71.7		
273	Terbufos	108.8	103.6	94.6	94.0	98.3	90.6	83.7		
274	Terbutryn	96.8	93.8	89.6	91.2	90.7	85.3	3.0		
275	Tetraclorvinphos	98.7	95.6	90.6	92.6	90.7	84.8	2.5		
276	Tetraconazole	95.5	92.7	88.5	92.1	90.0	52.5	0.4		
277	Tetradifon	95.4	89.4	85.9	87.4	83.8	76.5	76.5		
278	Thenylchlor	94.3	88.8	84.3	87.7	85.2	78.4	7.4		
279	Thiobencarb	100.3	94.3	87.9	89.1	87.2	81.3	79.2		
280	Thiometon	115.4	109.0	99.9	100.9	104.9	91.7	89.8		
281	Tolclofos-methyl	97.7	93.5	88.6	89.8	89.4	83.7	83.5		
282	Tolfenpyrad	98.7	94.3	89.4	90.7	84.9	79.6	2.3		
283	Toriadimefon	106.1	103.3	97.2	97.7	95.5	89.0	2.3		
284	Triadimenol-1	108.9	101.3	95.0	104.1	97.8	31.3	2.0		
285	Triadimenol-2	86.5	97.4	93.3	97.9	81.2	13.0	0.7		
286	Triallate	99.3	92.4	86.4	85.9	88.5	85.2	81.4		
287	Triazophos	114.5	106.0	99.5	99.1	97.6	88.1	0.2		
288	Tricyclazole	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
289	Trifloxystrobin	105.6	97.5	92.0	94.1	90.4	82.4	27.2		
290	Trifluralin	107.3	99.4	92.2	91.2	97.0	86.6	80.0		
291	Trifluzamide	102.0	95.9	89.0	73.3	30.1	2.1	0.1		
292	Uniconazole	119.3	108.5	101.0	102.6	94.0	26.2	0.0		
293	Vinclozoline	98.5	94.7	90.3	95.0	92.7	86.3	83.8		
294	XMC	50.5	65.1	52.4	55.4	58.4	38.2	0.1		
295	Zoxamide	103.2	101.3	95.8	99.1	91.2	82.2	3.4		

(単位: %)

試料: ほうれん草
 添加濃度: 試料中0.05ppm (分取後に添加)

PSAミニカラムと溶出溶媒による回収率分布

表 ほうれん草を用いたPSAミニカラムと溶出溶媒アセトン-ヘキサンによる回収率分布

回収率	溶出溶媒アセトン-ヘキサン比率				上(アセトン/ヘキサン比)		下(アセトン含有率%)	
	(1/1)	(3/7)	(1/4)	(15/85)	(1/9)	(5/95)	(0/100)	
%以上 - %未満	50%	30%	20%	15%	10%	5%	0%	
30 - 50	8	6	5	5	8	15	23	
50 - 70	7	7	9	7	13	22	36	
70 - 120	247	257	255	257	249	217	71	
120 -	8	2	1	0	0	0	0	

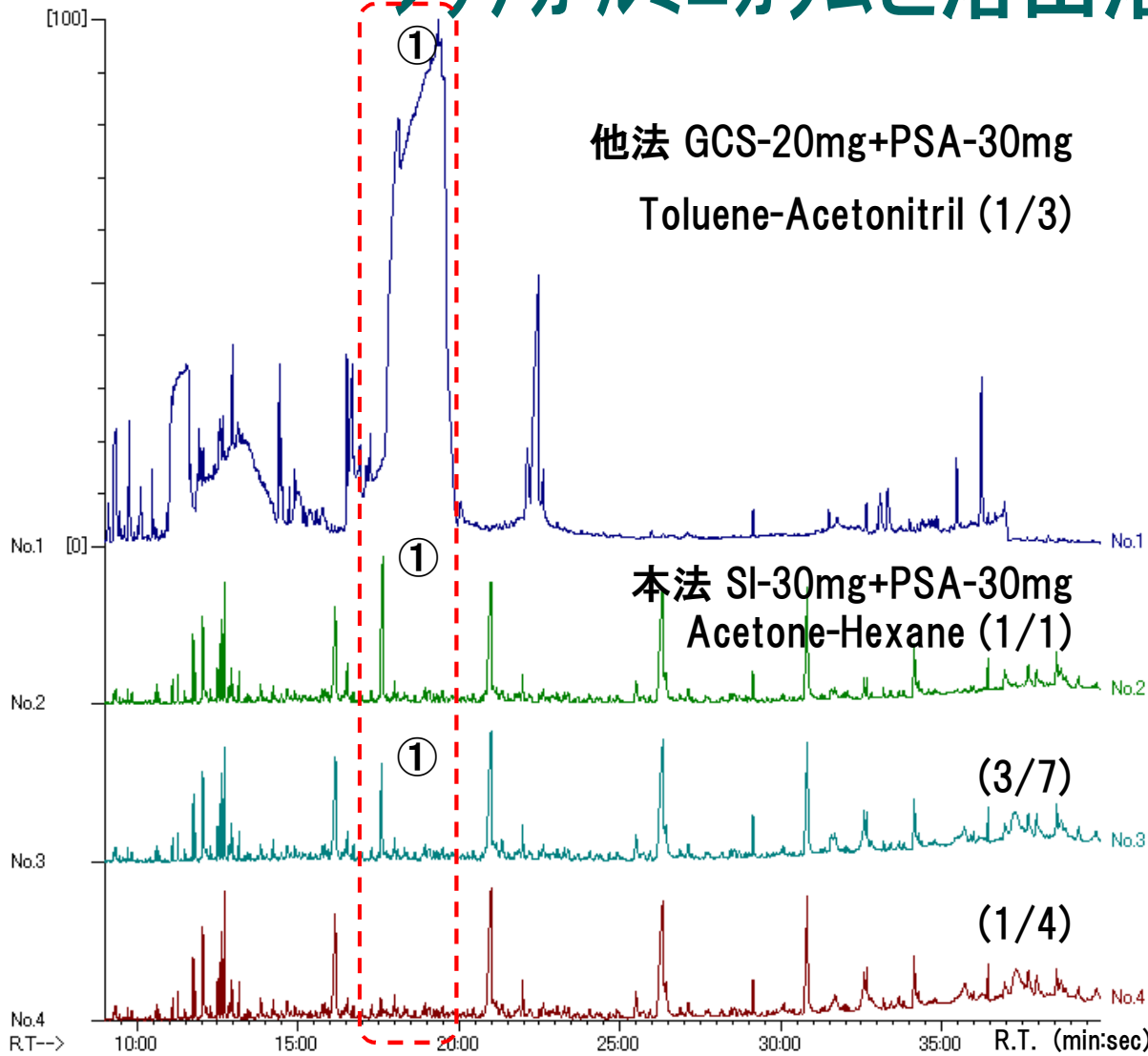
(単位:成分)

アセトンの比率が15%より低くなると一部の農薬の回収率が悪くなることが分かった。

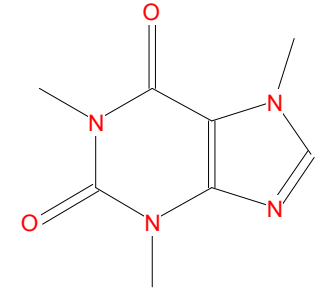
通常の商品対応のメソッドとしてはPSA-30mg・アセトン-ヘキサン(15/85)が最適であると思われる。

[クロマトグラム] TIC Y軸: 相対値(%)

シリカゲルミニカラムと溶出溶媒による精製効果



① Caffeine



SI
-Si-OH
活性シリカゲル
一次相互作用: 極性

- アセトンの比率を下げるとSIによるカフェインの除去効果が高くなる。
- アセトン-ヘキサン (1/4) が最適と考えられる。

図3. 抹茶を用いたSI+PSAミニカラムと溶出溶媒アセトン-ヘキサンによるSCANトータルイオンクロマトグラム比較



SI+PSAミニカラムと溶出溶媒による回収率①

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	5%	0%
		50%	30%	20%	15%	10%	5%	0%		
1	1-Naphthylacetamide	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2	3-Hydroxycarbofuran	49.9	50.8	52.9	46.9	41.1	0.5	0.0		
3	4,4'-Dichlorobenzophen	95.7	103.3	106.4	97.9	92.0	91.5	73.8		
4	Acephate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
5	Acetamidpride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
6	Acetochlor	98.7	107.9	110.5	106.8	101.1	97.6	0.0		
7	Acrinathrin	97.5	111.4	115.7	101.8	92.3	93.9	0.0		
8	Alachlor	99.5	108.5	110.4	105.8	100.2	91.4	0.0		
9	Allethrin-1,2	146.2	173.9	175.9	168.2	154.9	157.2	20.9		
10	Allethrin-3,4	89.3	98.3	100.6	92.9	85.7	78.3	0.0		
11	Ametryn	91.0	97.4	101.5	93.3	93.0	48.8	0.3		
12	Anilofos	107.6	119.8	121.3	120.2	109.9	27.7	0.1		
13	Aramite-3	90.8	101.9	103.6	97.4	89.7	91.6	0.1		
14	Aramite-4	93.1	101.5	107.8	99.4	90.6	92.2	0.8		
15	Atrazine	73.4	72.6	81.3	63.8	72.3	35.9	0.7		
16	Azaconazole	91.6	88.1	40.2	7.6	0.9	0.6	0.3		
17	Azinphos-Methyl	126.2	147.0	141.6	138.4	117.5	11.1	1.1		
18	Benalaxyl	97.5	106.2	108.9	106.2	100.0	81.7	0.0		
19	Bendiocarb	41.3	39.0	48.4	28.2	34.0	1.9	0.8		
20	Benfluranlin	110.4	118.7	121.3	108.1	102.3	101.6	130.5		
21	Benfuresate	97.9	106.2	106.7	102.3	98.1	90.8	1.0		
22	Benoxacor	100.3	107.8	112.4	105.0	102.0	97.3	0.2		
23	BHC-alpha	101.8	107.0	109.5	100.6	98.3	94.7	123.0		
24	BHC-beta	100.2	106.3	106.8	102.3	98.0	95.6	85.6		
25	BHC-delta	94.8	103.4	108.5	101.3	96.8	93.2	0.8		
26	BHC-gamma	89.8	98.3	103.0	100.3	97.6	94.4	2.1		
27	Bifenox	96.0	107.6	111.3	100.1	93.2	89.2	0.3		
28	Bifenthrin	86.2	96.0	101.8	93.1	84.7	84.8	86.5		
29	Bitertanol-1	112.3	121.0	86.4	23.8	0.8	0.3	0.2		
30	Bitertanol-2	115.4	124.6	96.0	26.3	0.8	0.8	0.2		

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	5%	0%
		50%	30%	20%	15%	10%	5%	0%		
31	Bromacil	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
32	Bromobutide	96.9	104.8	107.3	102.0	97.6	95.7	0.0		
33	Bromofos methyl	97.1	107.5	109.1	99.7	92.1	94.1	108.3		
34	Bromophos-ethyl	87.9	96.8	99.8	89.3	82.3	87.1	110.6		
35	Bromopropylate	98.1	107.8	109.5	101.4	93.6	92.0	0.0		
36	Buprimate	91.8	102.5	106.2	102.1	96.2	16.3	0.1		
37	Buprofezin	100.6	109.0	112.7	106.2	101.4	99.4	0.1		
38	Butachlor	91.4	97.8	99.6	95.5	88.7	91.7	0.0		
39	Butamifos	98.0	108.3	112.7	104.3	98.2	94.9	1.6		
40	Butylate	134.3	125.5	121.2	106.3	113.0	102.2	11.1		
41	Cadusafos	118.9	127.1	127.5	121.5	115.2	106.5	0.2		
42	Cafenstrole	126.8	143.5	146.0	138.3	94.4	4.2	1.6		
43	Captafol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
44	Captan	78.9	87.2	87.5	96.6	84.5	39.2	2.8		
45	Carbaril	70.6	72.4	84.6	50.4	48.3	0.2	0.4		
46	Carbofuran	37.8	36.4	45.6	26.5	32.5	1.5	0.1		
47	Carboxin	72.2	69.1	86.2	54.5	65.7	32.7	0.0		
48	Carfentrazone ethyl	98.4	107.6	110.8	106.9	101.6	91.4	0.1		
49	Chlorbenside	88.1	96.6	98.8	89.9	83.7	84.6	104.7		
50	Chlorbufam	100.3	111.5	117.2	109.9	104.0	77.0	1.9		
51	Chlorethoxyphos	123.9	130.3	127.8	112.7	110.8	106.8	129.1		
52	Chlorfenapyr	94.8	107.5	111.3	100.3	95.0	95.1	0.2		
53	Chlorfenson	94.5	101.6	103.2	94.6	90.5	90.9	16.0		
54	Chlorfenvinphos-1	114.4	126.2	126.8	121.3	114.6	30.9	0.8		
55	Chlorfenvinphos-2	92.9	103.9	105.0	102.4	97.8	21.5	0.1		
56	Chlorobenzilate	100.7	110.7	112.5	105.3	99.0	92.7	0.0		
57	Chloroneb	113.8	117.2	117.7	106.6	109.3	104.3	126.5		
58	Chlorpropham	106.9	117.7	123.2	115.0	110.8	104.8	0.1		
59	Chlorpyrifos	92.8	104.5	108.2	96.6	90.8	93.8	110.9		
60	Chlorpyriphos-methyl	101.1	110.4	110.9	102.2	95.7	96.1	101.7		

SI+PSAミニカラムと溶出溶媒による回収率②

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)	
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	0%
		50%	30%	20%	15%	10%	5%		
61	Chlorthal-dimethyl	96.7	102.2	104.7	96.9	92.5	93.9	20.5	
62	Chlozolate	99.1	104.6	106.3	103.8	99.7	100.4	0.5	
63	Cinidon-ethyl	107.6	119.6	122.8	112.4	104.6	97.4	0.1	
64	Clomazone	100.8	107.0	110.5	102.4	100.7	96.3	0.3	
65	Cyanazine	25.0	23.6	30.0	17.2	12.3	0.1	0.4	
66	Cyanophos	95.6	104.5	107.3	101.0	99.1	88.2	0.3	
67	Cyfluthrin-1	98.9	108.5	113.2	105.0	89.5	79.3	0.0	
68	Cyfluthrin-2	99.3	107.7	113.6	100.9	88.1	91.9	0.0	
69	Cyfluthrin-3	93.8	112.7	124.6	96.3	86.6	75.3	9.4	
70	Cyfluthrin-4	112.4	119.4	124.9	89.1	85.8	91.2	20.3	
71	Cyhalofop-butyl	96.9	107.3	109.4	102.2	95.9	93.9	0.1	
72	Cyhalothrin-1	97.9	109.8	113.1	100.1	90.7	96.4	0.4	
73	Cyhalothrin-2	97.3	110.0	111.8	98.1	90.1	93.9	0.0	
74	Cypermethrin-1	127.2	136.6	148.4	123.7	118.0	117.8	4.7	
75	Cypermethrin-2	122.8	125.7	125.1	121.8	93.1	107.5	6.9	
76	Cypermethrin-3	85.7	92.6	97.2	77.5	84.8	91.3	7.5	
77	Cypermethrin-4	91.0	92.3	94.7	85.2	70.9	85.1	24.9	
78	Cyproconazole-1	100.9	113.1	108.0	63.5	0.5	0.0	0.0	
79	Cyproconazole-2	102.1	103.4	86.3	41.8	15.2	20.3	26.1	
80	DEF	90.2	99.4	104.3	95.4	86.0	88.3	0.6	
81	Deltamethrin	98.1	114.2	85.5	91.5	93.6	95.9	0.2	
82	Demeton-S-methyl	36.7	34.5	45.1	25.7	29.6	1.0	1.0	
83	Diallate-1	114.5	120.5	121.4	110.1	106.6	102.6	82.6	
84	Diallate-2	115.7	122.7	125.6	111.7	111.4	106.5	40.7	
85	Diazinone	100.7	109.0	112.2	107.6	102.2	98.2	0.3	
86	Dichlofenthion	90.6	98.8	101.8	92.0	86.3	89.5	112.4	
87	Dichlofluanid	117.6	125.3	97.2	118.6	111.4	97.1	0.4	
88	Dichlorvos	20.2	16.0	20.5	9.9	16.3	3.5	0.3	
89	Diclocymet-1	90.6	100.7	101.7	98.1	90.5	7.2	0.0	
90	Diclocymet-2	95.2	103.8	104.7	100.7	91.1	1.0	0.0	

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)	
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	0%
		50%	30%	20%	15%	10%	5%		
91	Diclofop-methyl	90.9	100.9	102.5	94.9	88.3	89.9	0.0	
92	Dicloran	98.5	103.4	116.0	87.4	95.0	70.2	1.7	
93	Dicrotufos	14.2	13.4	15.4	8.8	11.7	1.6	2.7	
94	Diethofencarb	95.0	107.6	110.2	106.2	101.9	89.4	0.1	
95	Difenoconazole-1	132.6	145.9	87.0	24.0	1.4	0.1	0.2	
96	Difenoconazole-2	114.9	125.4	100.3	45.5	3.4	0.0	0.0	
97	Diflufenican	93.9	102.3	105.1	97.2	90.6	85.2	0.0	
98	Dimepiperate	91.4	99.2	101.3	97.0	92.2	92.6	0.4	
99	Dimethametryn	96.1	103.5	105.9	103.7	97.7	69.1	0.1	
100	Dimethenamid	94.4	101.1	112.0	105.5	101.3	95.8	0.2	
101	Dimethipin	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
102	Dimethoate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
103	Dimethylvinphos-z	100.7	108.1	110.7	106.5	92.2	3.0	0.3	
104	Dioxathion	105.4	116.9	117.7	107.7	99.4	92.9	0.1	
105	Diphenamide	98.0	106.2	108.6	102.1	97.6	11.1	0.0	
106	Disulfoton	106.1	112.7	116.8	107.9	101.6	96.5	19.1	
107	Disulfoton sulfone	95.9	105.6	110.5	103.0	82.0	0.3	0.3	
108	Edifenphos	97.2	108.9	109.7	108.4	102.9	57.1	0.3	
109	Endosulfan	84.3	92.2	92.2	85.3	83.9	83.9	105.4	
110	Endosulfan II	91.0	97.5	100.9	95.1	87.3	86.3	0.9	
111	Endosulfan sulfate	99.7	107.2	110.0	103.0	95.5	54.4	0.5	
112	EPN	101.4	111.5	113.2	102.7	94.5	91.5	0.2	
113	Epoxiconazole	100.8	110.2	101.9	59.0	7.5	3.9	0.1	
114	EPTC	145.0	135.2	130.6	113.8	124.5	112.5	1.9	
115	Esprocarb	97.0	105.5	107.9	98.8	93.9	93.6	0.9	
116	Ethalfuralin	111.2	122.3	123.1	108.0	106.5	103.1	128.5	
117	Ethiofencarb	92.7	95.8	120.1	74.5	84.4	9.4	1.2	
118	Ethion	97.6	107.9	108.4	97.1	88.1	90.2	3.4	
119	Ethofumesate	98.7	107.7	110.0	106.8	101.0	68.2	0.6	
120	Ethoprophos	124.3	133.0	135.1	126.2	124.5	106.6	0.0	



SI+PSAミニカラムと溶出溶媒による回収率③

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
121	Etofenprox	89.5	100.4	106.3	95.1	87.6	89.4	4.6		
122	Etoazole	91.0	98.4	101.0	89.9	82.4	85.6	0.0		
123	Etrimfos	97.1	105.6	109.6	103.8	99.4	100.3	0.0		
124	Fenamidone	102.9	113.8	117.2	112.8	96.9	5.8	0.0		
125	Fenamiphos	101.4	114.1	98.5	46.9	1.1	0.1	0.0		
126	Fenarimol	94.8	101.2	102.8	88.5	25.8	0.5	0.1		
127	Fenbuconazole	109.1	111.0	35.9	3.4	1.5	0.7	0.1		
128	Fenchlorphos	93.3	103.3	105.6	94.5	89.5	90.1	108.7		
129	Fenitrothion	105.0	118.6	121.6	111.5	107.2	106.6	0.0		
130	Fenobucarb	110.3	116.5	120.3	112.1	109.9	68.0	0.5		
131	Fenothiocarb	94.8	101.9	104.5	100.2	95.6	93.9	0.2		
132	Fenoxanil	94.7	107.7	109.4	106.0	99.2	22.8	0.4		
133	Fenpropathrin	106.5	114.0	116.2	103.8	94.9	100.9	1.9		
134	Fenpropemorph	97.6	104.5	105.7	102.7	95.7	89.9	0.2		
135	Fensulfothion	107.7	109.8	30.6	4.3	1.6	1.4	0.0		
136	Fenthion	99.0	108.9	109.2	101.6	96.2	97.2	0.5		
137	Fenvalerate-1	90.1	99.2	104.0	91.0	85.2	88.7	0.2		
138	Fenvalerate-2	99.9	100.2	102.1	88.7	80.7	86.0	0.0		
139	FIPRONIL	91.7	95.7	94.4	97.1	79.0	0.5	0.1		
140	Flamprop-methyl	98.7	107.5	108.7	104.9	99.5	34.9	0.2		
141	Fluacrypyrim	102.7	111.7	115.4	108.0	101.0	89.3	0.2		
142	Flucythrinate-1	99.5	109.5	113.7	101.1	90.3	90.9	0.0		
143	Flucythrinate-2	100.8	111.3	114.6	101.2	91.0	88.4	1.5		
144	Fludioxonil	89.9	95.6	96.4	90.5	85.7	86.1	1.1		
145	Flufenpyl-ethyl	106.3	116.2	120.6	115.6	110.9	89.9	0.1		
146	Flumiclorac-pentyl	114.5	130.4	134.9	126.5	113.5	87.6	0.0		
147	Flumioxazin	118.6	131.4	131.5	115.7	32.1	0.0	0.0		
148	Fluquinconazole	100.8	112.4	113.5	107.9	56.0	0.2	0.1		
149	Fluridone	101.8	109.9	70.6	9.7	0.1	0.1	0.0		
150	Flusilazole	97.3	105.0	86.1	33.7	1.0	0.0	0.2		

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
151	Fluthiacet-methyl	146.0	164.7	160.5	154.2	98.5	0.4	0.3		
152	Flutolanil	98.9	106.1	109.6	108.0	86.9	5.5	1.0		
153	Flutriafol	95.7	87.4	22.2	1.3	0.1	0.0	0.0		
154	Fluvalinate-1	97.9	108.8	111.6	99.2	90.1	92.4	0.0		
155	Fluvalinate-2	97.4	109.1	112.9	99.9	90.8	93.4	0.0		
156	Formothion	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
157	Fosthiazate-1	97.2	95.0	103.8	68.3	14.5	0.5	0.2		
158	Fosthiazate-2	92.7	93.7	101.7	70.2	24.2	4.0	1.5		
159	Halfenprox	195.9	220.4	228.2	210.4	185.8	187.4	124.3		
160	Hexaconazole	101.5	108.7	100.0	57.9	5.3	0.8	0.3		
161	Hexazinone	22.7	18.6	5.9	1.3	0.1	0.1	0.0		
162	Imazamethabenz methyl	43.3	41.2	49.5	25.9	4.8	1.4	0.2		
163	Imibenconazole	141.3	154.8	114.8	44.1	1.0	1.0	2.8		
164	Imibenconazole-des-b	20.4	8.9	1.4	0.7	0.2	0.5	0.7		
165	Iprobenfos	102.1	111.5	114.2	110.7	106.1	59.8	0.0		
166	Iprodione	105.0	117.4	121.1	114.9	106.0	17.6	0.0		
167	Isazophos	98.7	105.3	108.2	104.1	98.3	96.0	0.0		
168	Isofenphos	106.1	116.7	120.1	112.4	107.0	107.9	1.9		
169	Isofenphos P=O	105.8	117.5	113.4	79.0	7.7	0.2	0.1		
170	Isoprocarbe	100.4	98.3	108.1	83.3	94.2	46.2	0.3		
171	Isoprothiolane	96.2	105.5	109.6	104.3	98.0	65.0	0.0		
172	Isoxathion	93.8	108.0	111.9	103.3	95.0	89.5	0.6		
173	Isoxathion-ox	93.8	109.8	114.8	105.9	74.2	13.2	0.6		
174	Kresoxim-methyl	96.1	104.2	107.3	101.5	95.7	91.9	0.0		
175	Lenacil	58.6	55.5	64.0	38.4	9.4	0.0	0.0		
176	Malathion	100.0	109.8	113.5	107.5	103.3	99.4	0.5		
177	Mecarbam	97.0	101.9	106.6	102.6	96.9	99.0	0.4		
178	Mefenacet	103.4	114.9	118.3	112.6	100.2	5.4	0.0		
179	Mefenpyr-diethyl	100.0	109.6	113.4	109.1	102.1	96.3	0.0		
180	Mepronil	119.6	128.2	130.4	128.5	117.3	80.7	0.1		

SI+PSAミニカラムと溶出溶媒による回収率④

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率 下(アセトン含有率)						
		(50/50) (30/70) (20/80) (15/85) (10/90) (5/95) (0/100)						
		50%	30%	20%	15%	10%	5%	0%
181	Metalaxyl	90.9	92.8	100.3	86.5	75.8	0.2	0.3
182	Methamidophos	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
183	Methidathion	97.6	104.6	107.5	101.8	97.5	90.8	0.0
184	Methiocarb	114.5	128.8	132.2	117.4	107.9	24.4	0.0
185	Methoprene-1	94.6	101.5	104.8	96.4	91.1	89.7	71.6
186	Methoprene-2	83.0	90.9	97.3	89.1	83.6	86.1	0.0
187	Methoxychlor	74.7	81.3	83.2	80.7	74.4	77.6	0.4
188	Metolachlor	98.8	106.7	108.6	105.3	100.7	97.8	0.0
189	Metominostrobin	97.7	106.5	110.2	103.4	84.1	2.3	0.2
190	Metominostrobin-z	94.5	98.4	105.4	89.1	56.9	0.1	0.1
191	Mevinphos	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
192	Monocrotophos	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
193	Myclobutanil	96.6	103.7	69.0	13.8	1.5	0.9	0.0
194	Napropamide	94.9	104.4	105.5	102.6	96.3	61.4	0.1
195	Nitrothal-isopropyl	95.2	106.1	109.8	101.1	95.6	97.3	0.1
196	Norflurazon	90.4	95.4	90.0	37.0	3.7	0.1	0.0
197	Oryzalin	13.7	27.6	24.3	10.1	12.9	2.6	0.2
198	Oxadiazon	87.7	97.6	101.3	95.9	89.3	91.9	0.0
199	Oxadixyl	23.6	23.2	21.1	8.0	6.5	6.4	0.2
200	Oxyfluorfen	93.9	103.1	107.4	95.9	88.8	89.7	0.0
201	p,p'-DDD	93.9	100.8	104.9	92.9	83.9	89.6	98.0
202	p,p'-DDE	79.1	87.4	92.7	82.7	76.4	78.6	105.1
203	Paclbutrazol	91.6	102.6	104.7	91.4	16.6	0.0	0.2
204	Parathion	93.9	105.1	110.2	103.4	100.9	97.4	0.0
205	Parathion-methyl	110.0	120.9	123.8	116.6	109.6	104.1	2.3
206	Penconazole	96.1	104.9	101.7	73.5	10.6	0.2	0.3
207	Pendimethalin	86.2	96.2	102.0	91.6	83.3	93.6	68.0
208	Permethrin-cis	91.1	100.1	103.9	92.0	84.0	86.5	61.9
209	Permethrin-trans	92.4	102.3	105.7	92.3	84.9	88.0	18.2
210	Perthane	86.2	94.9	97.8	86.5	78.6	84.2	109.0

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率 下(アセトン含有率)						
		(50/50) (30/70) (20/80) (15/85) (10/90) (5/95) (0/100)						
		50%	30%	20%	15%	10%	5%	0%
211	Phenothrin-1	90.5	102.4	106.1	95.2	86.6	90.8	32.4
212	Phenothrin-2	89.1	100.8	105.6	94.6	86.3	89.1	27.2
213	Phenthoate	95.0	112.5	94.5	100.9	104.2	105.2	1.5
214	Phorate	116.0	124.5	128.1	115.7	113.6	105.7	74.5
215	Phosalone	116.4	132.5	133.4	124.6	114.1	102.5	0.0
216	Phosmet	111.9	124.9	122.7	120.9	109.1	22.7	0.0
217	Phosphamidon	35.9	33.6	20.0	2.8	0.6	0.6	0.7
218	Phthalide	103.6	109.4	111.4	104.7	101.9	97.8	0.1
219	Picolinafen	95.4	104.1	107.0	97.0	90.6	80.8	0.0
220	Piperonyl butoxide	94.1	103.5	106.7	100.7	93.9	93.3	0.0
221	Piperophos	99.8	114.5	118.3	112.6	104.0	78.4	0.0
222	Pirimicarb	35.1	33.8	42.9	28.3	33.6	14.2	0.7
223	Pirimiphos methyl	97.9	106.5	109.8	100.8	97.9	98.5	0.0
224	Pretilachlor	98.4	107.2	109.5	105.6	100.6	99.0	1.0
225	Procymidone	92.7	100.3	105.0	100.5	95.0	94.3	0.3
226	Profenofos	101.0	110.7	115.0	108.6	99.7	96.8	0.3
227	Prohydrojasmon-1	88.2	97.7	105.2	98.7	100.1	98.4	2.8
228	Prohydrojasmon-2	106.8	108.3	96.5	103.6	102.0	96.5	2.5
229	Prometryn	94.2	103.4	106.5	101.0	96.6	86.1	0.5
230	Propachlor	109.0	108.0	114.7	94.9	104.4	92.5	0.1
231	Propanil	113.6	120.4	124.8	111.6	103.6	23.6	0.3
232	Propaphos	96.9	109.4	111.1	108.2	102.2	11.7	0.1
233	Propargite(BPPS)	100.5	106.8	108.1	97.8	90.3	92.6	0.3
234	Propazine	93.4	99.3	102.5	96.2	94.2	85.1	0.0
235	Propiconazole-1	101.3	111.0	109.7	85.7	17.3	0.1	0.1
236	Propiconazole-2	146.7	165.3	168.8	156.6	71.5	5.2	0.2
237	Propoxur	26.4	24.4	31.7	17.4	24.8	2.7	0.0
238	Propyzamide	91.3	99.3	102.7	97.0	93.4	92.0	0.1
239	Prothiophos	100.5	111.2	117.6	103.0	94.7	98.8	121.9
240	Pyraclifos	125.7	142.4	143.8	137.8	125.3	20.4	0.0

SI+PSAミニカラムと溶出溶媒による回収率⑤

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下:(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
241	Pyraflufen-ethyl	96.8	106.4	109.9	104.3	98.5	9.1	0.0		
242	Pyrazophos	107.5	121.3	124.0	116.4	106.4	97.4	0.0		
243	Pyributicarb	94.0	104.8	106.9	92.4	75.1	75.5	0.3		
244	Pyridaben	88.3	103.1	106.0	93.9	86.3	90.3	0.0		
245	Pyridafenthion	107.4	122.5	125.5	119.7	57.9	0.0	0.1		
246	Pyrifenox-1	92.6	100.6	102.3	97.6	80.4	4.9	0.1		
247	Pyrifenox-2	95.4	105.4	106.5	101.1	94.8	25.1	0.0		
248	Pyrimethanil	91.9	98.4	102.8	95.7	94.3	85.5	0.1		
249	Pyrimidifen	103.1	112.5	114.8	109.5	102.4	29.1	0.0		
250	Pyriminobac-methyl-1	96.9	106.4	111.0	108.5	103.5	49.9	0.1		
251	Pyriminobac-methyl-2	93.2	100.7	103.0	100.4	95.4	65.9	0.0		
252	Pyriproxyfen	92.3	102.3	105.1	96.5	88.6	91.3	0.0		
253	Pyroquilon	13.9	14.4	16.4	10.0	6.3	1.5	0.0		
254	Quinoclamine	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
255	Quinolphos	90.0	101.6	102.5	97.5	93.6	92.5	0.4		
256	Quinomethionate	94.8	98.5	99.1	89.1	83.4	76.8	1.3		
257	Quinoxifen	87.6	94.3	95.5	89.7	83.3	80.7	0.2		
258	Quintozen	97.1	106.7	108.8	96.1	91.0	89.1	112.5		
259	Resmethrin-1	87.5	99.7	100.6	87.1	79.4	76.6	19.1		
260	Resmethrin-2	85.8	96.2	99.6	88.3	79.3	78.1	14.5		
261	Silafluofen	84.3	100.9	100.5	102.4	87.3	87.5	89.5		
262	Simazin	16.1	15.7	19.3	11.9	16.0	0.7	0.8		
263	Simetryn	63.8	61.6	72.1	54.9	60.3	2.9	0.4		
264	Spirodiclofen	82.6	92.2	97.3	90.8	84.1	89.2	0.0		
265	Spiroxamine-1	61.6	33.3	33.2	16.8	4.2	0.1	0.3		
266	Spiroxamine-2	70.3	42.9	43.3	24.2	6.9	0.2	0.0		
267	TCMTB	104.4	119.1	123.1	111.3	100.8	86.0	0.2		
268	Tebuconazole	167.6	182.1	161.4	77.1	3.6	0.7	0.3		
269	Tebufenpyrad	94.9	105.4	107.9	103.5	95.4	90.6	0.0		
270	Tecnazene	117.8	122.2	122.9	109.8	108.7	102.5	139.6		

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下:(アセトン含有率)		
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)		
		50%	30%	20%	15%	10%	5%	0%		
271	Tefluthrine	87.6	93.9	97.9	87.6	82.4	85.8	109.6		
272	Terbacil	79.2	88.3	99.0	86.0	81.2	83.5	106.0		
273	Terbufos	108.6	117.9	121.3	110.1	106.9	103.4	90.7		
274	Terbutryn	99.7	107.8	110.4	106.5	100.3	83.2	0.0		
275	Tetrachlorvinphos	99.0	109.8	113.2	108.8	101.5	32.2	0.0		
276	Tetraconazole	95.8	104.1	79.9	21.6	0.6	0.2	0.1		
277	Tetradifon	95.6	104.3	107.5	97.7	91.6	91.7	11.3		
278	Thenylchlor	117.5	125.8	129.8	120.1	105.8	89.8	0.2		
279	Thiobencarb	95.8	104.6	107.1	100.6	97.5	94.9	0.2		
280	Thiometon	124.0	127.6	131.3	122.5	116.9	109.3	5.6		
281	Tolclofos-methyl	99.4	108.0	110.1	102.0	95.5	96.2	73.0		
282	Tolfenpyrad	544.0	595.8	608.7	566.9	520.0	295.0	0.3		
283	Toriadimefon	106.1	112.9	115.6	111.9	103.1	14.9	0.3		
284	Triadimenol-1	88.6	98.2	88.8	44.7	0.9	0.6	0.7		
285	Triadimenol-2	94.5	104.1	99.4	53.8	2.4	0.7	0.5		
286	Triallate	96.9	105.3	108.9	98.4	92.5	93.6	84.0		
287	Triazophos	109.2	122.1	123.9	119.2	104.6	5.9	0.0		
288	Tricyclazole	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		
289	Trifloxystrobin	103.1	113.2	116.7	109.7	101.8	91.9	0.1		
290	Trifluralin	109.4	119.1	123.5	110.1	104.1	102.3	133.5		
291	Trifluzamide	97.1	105.2	92.0	52.7	5.8	0.2	0.2		
292	Uniconazole	94.2	111.5	112.4	87.0	9.7	0.1	0.2		
293	Vinclozoline	99.7	108.4	110.5	104.8	100.3	98.7	0.6		
294	XMC	68.7	67.3	79.3	51.5	64.0	23.2	0.1		
295	Zoxamide	104.3	118.1	105.6	117.5	106.3	72.0	0.0		

試料：抹茶

添加濃度：試料中0.05ppm（分取後に添加）

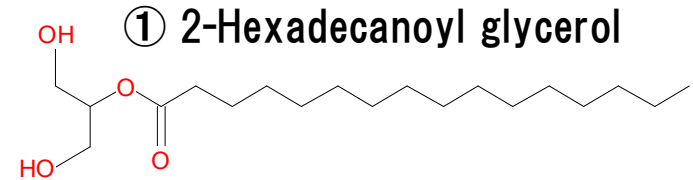
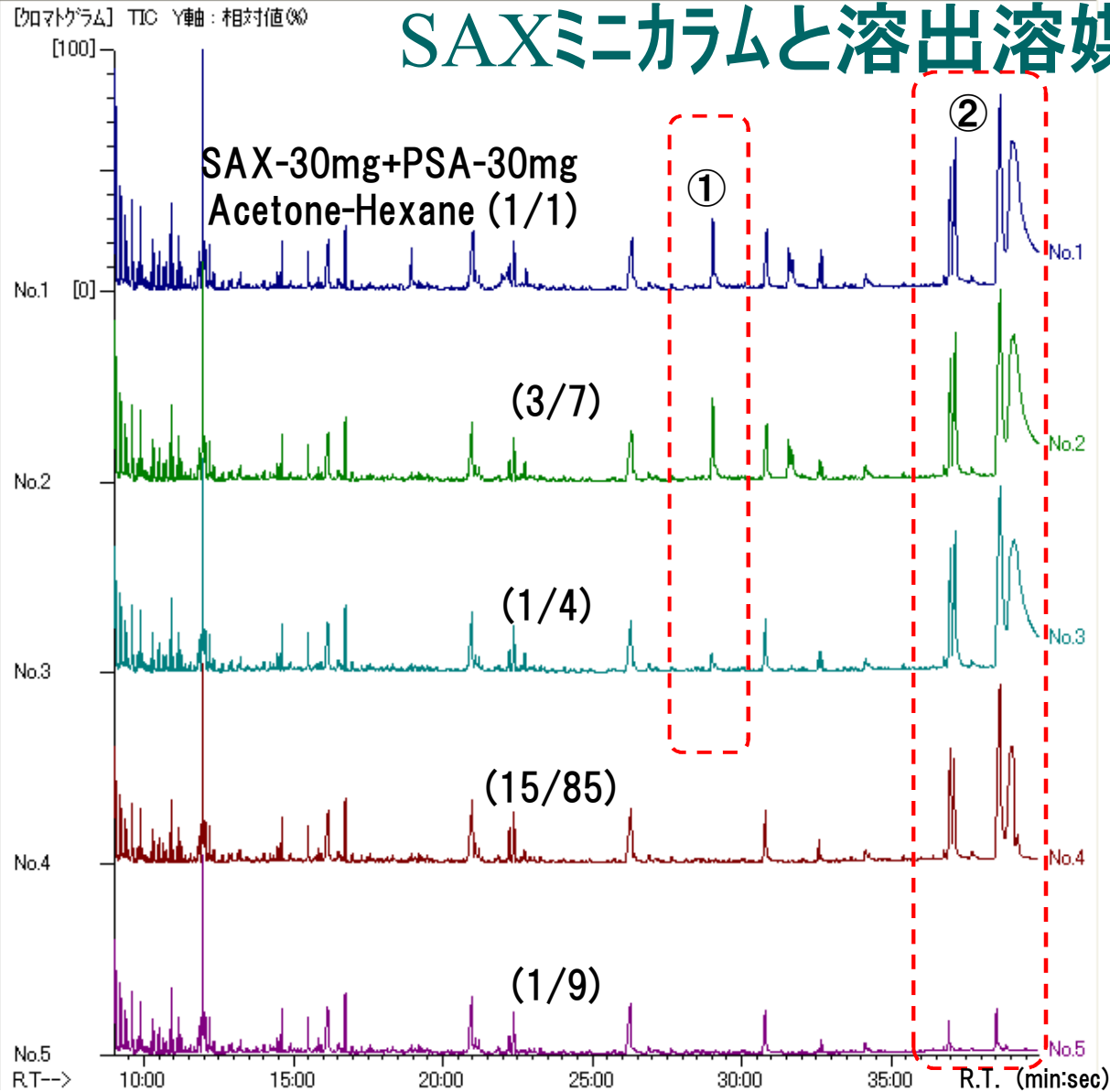
シリカゲルミニカラムと溶出溶媒による回収率分布

表1. 抹茶を用いたシリカゲルミニカラムと溶出溶媒アセトン-ヘキサンによる回収率分布

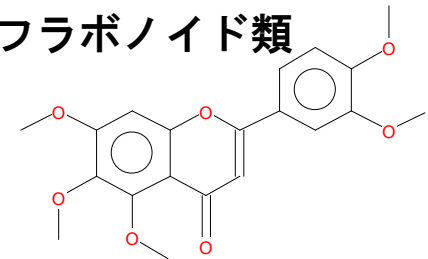
回収率	溶出溶媒アセトン-ヘキサン比率		上(アセトン/ヘキサン比)		下(アセトン含有率%)		
	(1/1)	(3/7)	(1/4)	(15/85)	(1/9)	(5/95)	(0/100)
%以上 - %未満	50%	30%	20%	15%	10%	5%	0%
30 - 50	7	8	11	9	6	9	2
50 - 70	4	5	3	11	6	9	2
70 - 120	244	219	208	215	218	171	24
120 -	18	41	50	20	6	3	10

(単位:成分)

SAXミニカラムと溶出溶媒による精製効果



② フラボノイド類



SAX
 $-\text{Si}-\text{CH}_2\text{CH}_2\text{CH}_2\text{N}^+(\text{CH}_3)_3$
 トリメチルアミノプロピル
 一次相互作用: 陰イオン交換

図3. オレンジを用いたSAX+PSAミニカラムと溶出溶媒アセトン-ヘキサンによるSCANトータルイオンクロマトグラム比較



SAX+PSAミニカラムと溶出溶媒による回収率①

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)	
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	
		50%	30%	20%	15%	10%	5%	0%	
1	1-Naphthylacetamide	2.8	0.4	0.1	0.0	0.3	0.0	0.3	
2	3-Hydroxycarbofuran	56.9	52.9	54.3	54.6	44.6	4.5	0.0	
3	4,4'-Dichlorobenzophen	101.9	97.7	103.8	102.3	95.2	99.6	6.2	
4	Acetaphate	20.6	17.4	14.9	13.5	14.3	13.7	19.0	
5	Acetamidpride	18.8	18.2	19.5	20.7	18.7	17.9	0.1	
6	Acetochlor	106.5	104.8	110.4	108.9	100.3	101.8	0.0	
7	Acrinathrin	103.0	108.3	116.8	115.2	98.4	61.5	0.0	
8	Alachlor	106.8	103.6	110.8	107.3	93.8	94.1	0.3	
9	Allethrin-1,2	121.8	112.1	123.4	117.1	116.9	122.0	0.6	
10	Allethrin-3,4	106.3	100.9	107.0	103.1	95.6	95.2	0.0	
11	Ametryn	92.3	92.0	96.3	96.0	85.0	46.7	0.1	
12	Anilofos	110.4	112.2	117.8	117.7	99.7	14.3	0.0	
13	Aramite-3	105.4	98.8	104.5	105.3	94.4	92.8	0.8	
14	Aramite-4	108.6	102.7	109.6	107.3	98.5	95.8	0.2	
15	Atrazine	82.5	78.9	81.0	77.7	63.3	16.4	0.1	
16	Azaconazole	103.0	97.6	101.1	81.0	15.5	1.4	0.9	
17	Azinphos-Methyl	120.5	128.0	132.8	139.3	73.3	1.5	0.0	
18	Benalaxyl	103.8	100.1	107.4	109.3	98.8	49.7	0.0	
19	Bendiocarb	60.2	55.4	56.8	46.5	20.2	8.5	0.6	
20	Benfluranlin	130.5	123.6	135.0	126.4	118.8	120.1	52.8	
21	Benfuresate	101.0	98.4	104.0	105.2	94.9	47.7	0.1	
22	Benoxacor	104.2	100.4	107.7	107.2	96.7	52.6	0.0	
23	BHC-alpha	107.0	103.3	111.1	105.4	97.2	97.8	15.8	
24	BHC-beta	103.0	99.4	107.5	105.2	95.8	96.8	3.4	
25	BHC-delta	74.0	87.3	95.2	101.3	84.8	2.7	1.0	
26	BHC-gamma	100.4	97.2	105.3	106.8	99.1	5.3	0.2	
27	Bifenox	113.3	111.2	120.5	115.1	96.9	66.0	0.0	
28	Bifenthrin	99.8	96.1	100.9	100.7	91.6	96.5	0.6	
29	Bitertanol-1	125.1	121.0	111.9	40.1	1.2	0.4	0.1	
30	Bitertanol-2	130.2	127.6	98.1	18.5	1.1	0.7	0.2	

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)	
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	
		50%	30%	20%	15%	10%	5%	0%	
31	Bromacil	7.1	8.3	6.2	2.4	0.4	0.1	0.0	
32	Bromobutide	103.2	101.3	107.3	108.1	95.5	10.6	0.0	
33	Bromofos methyl	104.7	101.7	108.5	108.5	102.3	106.8	2.4	
34	Bromophos-ethyl	101.8	97.7	104.2	104.3	95.7	102.2	40.4	
35	Bromopropylate	111.1	107.5	113.7	114.6	102.0	64.7	0.1	
36	Buprimate	100.6	95.0	100.2	105.5	96.7	18.4	0.0	
37	Buprofezin	103.8	99.3	105.2	104.5	95.2	96.9	0.1	
38	Butachlor	99.3	96.5	103.1	102.6	96.2	100.1	0.1	
39	Butamifos	128.3	118.1	128.5	127.2	113.5	62.6	3.9	
40	Butylate	138.8	119.9	109.6	91.8	98.0	91.7	118.8	
41	Cadusafos	135.0	126.9	133.1	128.3	118.2	119.0	0.3	
42	Cafenstrole	157.7	151.3	164.5	168.1	48.9	3.7	2.3	
43	Captafol	2017.4	1896.1	2074.6	2025.0	1800.4	1819.6	0.7	
44	Captan	93.6	83.9	90.6	108.2	77.0	4.8	0.8	
45	Carbaril	71.3	73.7	78.7	60.0	8.4	0.0	0.3	
46	Carbofuran	48.5	44.0	44.2	35.1	13.3	0.0	0.0	
47	Carboxin	81.4	74.4	76.7	64.2	32.5	0.8	0.0	
48	Carfentrazone ethyl	105.8	102.8	108.7	111.8	98.9	54.6	0.0	
49	Chlorbenside	99.0	97.0	104.4	102.3	95.8	99.5	4.0	
50	Chlorbufam	109.0	108.4	114.1	116.0	84.5	0.7	0.9	
51	Chlorethoxyphos	139.6	131.8	136.8	122.5	114.7	108.4	90.4	
52	Chlorfenapyr	98.4	95.0	100.9	103.5	95.6	94.9	0.9	
53	Chlorfenson	78.7	109.1	116.5	87.4	108.0	110.6	1.5	
54	Chlorfenvinphos-1	111.4	106.6	115.3	115.1	103.2	83.5	2.6	
55	Chlorfenvinphos-2	99.8	100.5	109.2	109.0	98.7	60.1	0.2	
56	Chlorobenzilate	103.2	100.2	107.6	109.4	97.3	33.1	0.0	
57	Chloroneb	120.5	110.4	114.8	105.3	97.9	98.1	25.2	
58	Chlorpropham	114.8	113.4	122.5	118.6	109.1	83.0	0.0	
59	Chlorpyrifos	109.3	106.4	113.7	110.0	102.5	108.9	12.5	
60	Chlorpyriphos-methyl	108.0	103.7	111.7	111.3	102.6	105.6	1.1	



SAX+PSAミニカラムと溶出溶媒による回収率②

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)	
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	
		50%	30%	20%	15%	10%	5%	0%	
61	Chlorthal-dimethyl	102.1	99.3	105.7	105.0	97.5	103.4	1.8	
62	Chlozolate	101.2	99.3	106.9	107.9	101.2	73.9	0.3	
63	Cinidon-ethyl	128.7	127.8	140.1	140.3	107.1	65.2	0.1	
64	Clomazone	107.2	104.0	108.5	106.2	97.0	100.9	0.0	
65	Cyanazine	34.6	30.3	29.6	21.3	2.4	0.3	0.6	
66	Cyanophos	99.2	96.1	103.4	103.9	95.0	40.5	0.1	
67	Cyfluthrin-1	130.7	127.0	124.3	121.7	101.8	91.4	2.2	
68	Cyfluthrin-2	95.6	100.5	113.9	111.3	94.2	54.3	0.0	
69	Cyfluthrin-3	100.9	106.4	101.4	102.3	98.8	65.8	16.4	
70	Cyfluthrin-4	156.3	140.0	119.8	122.2	113.0	65.8	43.2	
71	Cyhalofop-butyl	107.7	104.5	110.0	109.5	97.8	72.7	0.0	
72	Cyhalothrin-1	111.3	110.8	117.2	114.4	100.3	94.7	1.2	
73	Cyhalothrin-2	119.7	112.7	116.0	111.6	100.9	87.3	0.1	
74	Cypermethrin-1	117.1	113.2	119.9	116.8	104.1	101.2	1.1	
75	Cypermethrin-2	104.1	102.1	106.3	103.8	93.5	79.3	4.8	
76	Cypermethrin-3	112.0	107.0	112.5	105.1	94.7	81.7	6.0	
77	Cypermethrin-4	125.7	112.5	107.2	111.2	93.9	48.3	4.8	
78	Cyproconazole-1	117.1	101.7	107.9	61.5	0.2	0.0	0.1	
79	Cyproconazole-2	99.8	104.8	96.6	50.1	19.1	22.8	0.4	
80	DEF	106.3	102.6	108.7	104.3	97.2	101.0	0.6	
81	Deltamethrin	129.4	134.4	142.2	143.8	96.1	57.2	4.3	
82	Demeton-S-methyl	46.3	41.4	40.6	32.5	21.0	12.7	0.3	
83	Diallate-1	135.0	129.2	134.4	125.4	117.5	119.8	123.7	
84	Diallate-2	132.5	125.9	134.0	124.2	116.1	119.5	33.7	
85	Diazinone	107.6	105.9	112.7	109.7	102.8	106.6	0.2	
86	Dichlofenthion	102.3	100.9	111.4	109.1	99.9	103.2	6.5	
87	Dichlofluanid	83.0	82.4	83.6	103.8	99.8	46.8	1.0	
88	Dichlorvos	23.0	18.5	14.7	10.5	6.8	7.4	0.2	
89	Diclocymet-1	106.5	92.0	93.6	50.3	0.7	0.1	0.5	
90	Diclocymet-2	84.9	98.9	100.3	39.4	0.4	0.4	0.1	

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)	
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	
		50%	30%	20%	15%	10%	5%	0%	
91	Diclofop-methyl	102.0	99.2	105.9	104.9	95.8	99.9	0.0	
92	Dicloran	95.4	89.9	93.8	86.7	67.8	14.9	1.1	
93	Dicrotofop	1.4	2.5	2.7	1.8	1.9	2.3	1.3	
94	Diethofencarb	108.5	104.3	111.2	112.0	100.9	22.4	0.0	
95	Difenoconazole-1	114.1	108.1	119.4	102.3	22.4	0.5	0.0	
96	Difenoconazole-2	115.8	111.0	115.0	109.1	42.7	0.5	0.0	
97	Diflufenican	100.1	97.9	104.1	105.7	95.0	45.5	0.0	
98	Dimepiperate	103.7	101.0	107.1	105.3	98.8	102.6	0.0	
99	Dimethametryn	99.1	100.6	107.7	108.0	97.7	72.8	0.0	
100	Dimethenamid	107.7	103.7	110.4	108.5	100.4	103.1	0.4	
101	Dimethipin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
102	Dimethoate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
103	Dimethylvinphos-z	102.7	104.0	111.4	111.9	96.0	13.7	0.2	
104	Dioxathion	110.7	109.7	119.4	113.7	102.8	70.4	0.2	
105	Diphenamide	102.2	99.6	105.7	106.8	80.1	2.7	0.0	
106	Disulfoton	118.5	115.4	121.9	116.4	111.1	113.5	2.6	
107	Disulfoton sulfone	111.1	98.7	101.8	99.1	32.6	14.5	4.8	
108	Edifenphos	97.9	108.5	103.8	109.7	96.9	30.7	0.0	
109	Endosulfan	102.7	98.5	108.3	109.5	97.9	103.0	42.4	
110	Endosulfan II	100.5	97.0	101.6	106.3	93.2	55.2	0.5	
111	Endosulfan sulfate	73.4	83.5	90.6	101.6	60.1	0.6	0.1	
112	EPN	113.0	109.9	120.2	118.5	100.8	90.4	4.3	
113	Epoxiconazole	108.2	105.5	111.1	102.9	26.3	0.8	0.2	
114	EPTC	152.5	124.5	110.0	91.9	97.7	93.3	77.3	
115	Esprocarb	107.9	105.1	110.3	107.5	101.1	105.3	1.0	
116	Ethalfuralin	121.0	122.4	134.4	126.9	116.6	118.1	33.9	
117	Ethiofencarb	113.1	114.1	120.1	101.8	52.0	3.3	1.2	
118	Ethion	109.4	105.1	111.3	109.3	96.9	99.7	0.0	
119	Ethofumesate	107.0	102.5	109.0	112.0	97.2	12.1	2.0	
120	Ethoprophos	129.4	123.1	130.2	123.6	114.3	112.4	0.0	



SAX+PSAミニカラムと溶出溶媒による回収率③

番号	化合物名	アセトン-ヘキサン比率						下(アセトン含有率)	
		溶出溶媒		アセトン-ヘキサン比率				下(アセトン含有率)	
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	
		50%	30%	20%	15%	10%	5%	0%	
121	Etofenprox	103.9	101.1	104.9	103.8	93.3	98.7	0.0	
122	Etoxazole	98.6	92.2	93.2	88.7	77.4	80.9	0.0	
123	Etrimfos	107.0	104.3	111.2	107.9	102.8	106.4	0.0	
124	Fenamidone	112.7	111.0	117.2	88.6	9.3	0.3	0.0	
125	Fenamiphos	121.0	113.6	117.8	98.5	13.1	1.0	0.0	
126	Fenarimol	100.0	97.4	102.8	86.3	14.0	1.0	0.1	
127	Fenbuconazole	123.4	117.0	84.8	15.6	9.3	8.7	0.1	
128	Fenchlorphos	100.1	99.1	104.8	105.2	97.7	101.3	5.8	
129	Fenitrothion	109.5	106.9	115.5	117.1	108.9	89.0	0.1	
130	Fenobucarb	119.3	114.6	121.3	119.3	103.5	14.1	0.3	
131	Fenothiocarb	101.0	95.7	102.3	102.1	95.5	99.2	0.1	
132	Fenoxanil	106.1	103.0	107.1	110.4	55.6	0.8	0.4	
133	Fenpropathrin	105.6	103.8	109.3	108.9	98.2	101.1	0.0	
134	Fenpropemorph	105.0	102.0	107.6	105.6	98.9	100.7	0.1	
135	Fensulfothion	122.6	113.9	117.7	65.5	5.1	2.0	0.0	
136	Fenthion	103.8	103.4	112.8	113.5	104.2	106.8	0.1	
137	Fenvalerate-1	94.8	96.8	104.4	107.8	93.4	70.7	10.3	
138	Fenvalerate-2	137.7	127.2	124.7	118.1	100.2	65.5	2.3	
139	FIPRONIL	87.9	90.8	95.7	67.9	2.5	0.2	0.1	
140	Flamprop-methyl	103.3	100.5	107.8	110.1	95.9	11.6	0.1	
141	Flucrypyrim	105.5	100.9	108.8	110.2	99.2	59.6	0.0	
142	Flucythrinate-1	107.1	106.0	110.7	110.9	92.1	3.8	0.0	
143	Flucythrinate-2	115.5	112.2	115.6	116.6	93.1	3.0	0.0	
144	Fludioxonil	87.4	89.7	93.0	100.0	91.8	90.2	0.2	
145	Flufenpyl-ethyl	111.7	107.4	114.8	115.0	102.6	30.5	0.0	
146	Flumiclorac-pentyl	121.9	122.4	129.1	131.1	104.1	14.5	0.3	
147	Flumioxazin	124.7	123.1	129.1	73.3	3.1	0.4	0.4	
148	Fluquinacozazole	109.7	107.5	112.3	107.6	44.2	0.2	0.1	
149	Fluridone	112.9	97.2	42.8	1.1	0.0	0.1	0.1	
150	Flusilazole	107.6	102.7	109.4	93.9	16.7	0.4	0.2	

番号	化合物名	アセトン-ヘキサン比率						下(アセトン含有率)	
		溶出溶媒		アセトン-ヘキサン比率				下(アセトン含有率)	
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	
		50%	30%	20%	15%	10%	5%	0%	
151	Fluthiacet-methyl	174.2	177.8	189.8	186.8	68.8	0.0	0.3	
152	Flutolanil	108.9	104.1	111.1	98.3	12.0	1.3	0.6	
153	Flutriafol	109.6	74.7	19.6	0.1	0.1	0.1	0.0	
154	Fluvalinate-1	96.3	98.9	107.5	108.9	94.4	26.0	0.0	
155	Fluvalinate-2	93.5	98.2	107.8	112.0	93.3	26.6	0.0	
156	Formothion	43.7	48.7	52.2	48.1	24.7	21.2	6.5	
157	Fosthiazate-1	90.0	92.1	97.3	91.9	43.3	0.0	0.5	
158	Fosthiazate-2	99.0	93.5	96.7	93.1	49.9	7.6	0.2	
159	Halfenprox	100.5	97.7	101.1	100.2	87.5	91.7	0.0	
160	Hexaconazole	110.4	108.6	103.8	47.1	3.0	0.4	0.6	
161	Hexazinone	39.6	34.8	32.7	18.5	8.6	3.6	0.1	
162	Imazamethabenz methyl	49.9	44.4	42.1	19.5	2.0	1.4	0.4	
163	Imibenconazole	175.9	176.8	176.3	91.9	7.7	0.0	0.0	
164	Imibenconazole-des-b	25.1	12.8	1.5	0.3	0.0	0.4	0.9	
165	Iprobenfos	113.6	110.0	117.5	115.6	105.5	103.8	0.0	
166	Iprodione	111.3	112.1	118.0	117.5	94.4	6.4	0.0	
167	Isazophos	104.2	101.4	107.3	107.0	98.7	102.3	0.2	
168	Isofenphos	108.6	104.3	111.9	111.2	105.4	101.0	0.5	
169	Isofenphos P=O	114.4	110.2	118.2	111.1	38.7	0.4	0.0	
170	Isoprocarbe	101.0	95.0	97.0	90.5	69.5	5.1	0.1	
171	Isoprothiolane	101.7	100.5	108.0	111.6	96.1	22.7	0.3	
172	Isoxathion	112.1	103.4	108.4	112.8	96.7	82.0	0.2	
173	Isoxathion-ox	128.4	120.3	131.7	135.2	85.4	9.3	4.1	
174	Kresoxim-methyl	103.3	99.0	105.1	103.4	94.3	72.9	0.0	
175	Lenacil	65.5	60.4	57.8	35.5	1.6	2.0	1.2	
176	Malathion	106.2	103.7	110.5	111.9	103.2	89.6	0.1	
177	Mecarbam	99.9	96.9	102.9	99.9	98.9	91.7	1.5	
178	Mefenacet	113.3	112.3	115.7	112.8	81.0	1.8	0.0	
179	Mefenpyr-diethyl	109.0	106.0	111.9	114.0	102.3	93.6	0.0	
180	Mepronil	117.0	111.8	115.3	116.9	85.4	1.8	1.1	



SAX+PSAミニカラムと溶出溶媒による回収率④

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)	
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	
		50%	30%	20%	15%	10%	5%	0%	
181	Metalaxyl	96.4	93.7	99.2	97.6	78.6	9.4	0.7	
182	Methamidophos	18.8	14.4	10.7	8.7	9.5	7.0	1.9	
183	Methidathion	96.5	93.5	99.0	103.8	95.1	67.1	0.1	
184	Methiocarb	103.8	107.9	122.4	117.6	87.9	1.6	0.0	
185	Methoprene-1	100.0	97.3	101.3	101.3	93.9	99.7	7.0	
186	Methoprene-2	89.4	90.5	95.9	94.3	88.7	92.8	0.0	
187	Methoxychlor	87.3	83.5	90.0	99.2	90.9	77.6	0.0	
188	Metolachlor	107.4	103.4	110.8	109.5	101.8	105.8	0.0	
189	Metominostrobin	113.3	107.8	112.5	110.2	54.0	0.5	0.4	
190	Metominostrobin-z	104.1	98.5	102.5	87.0	17.6	0.0	0.1	
191	Mevinphos	5.7	4.6	4.3	3.6	3.0	2.2	3.5	
192	Monocrotophos	0.3	0.4	0.9	0.3	0.8	0.4	0.8	
193	Myclobutanil	103.3	100.0	101.8	35.7	1.1	0.5	0.2	
194	Napropamide	101.6	99.9	106.8	107.8	97.8	75.6	0.0	
195	Nitrothal-isopropyl	101.4	99.3	107.8	105.2	97.3	103.7	0.0	
196	Norflurazon	94.4	94.5	83.7	19.8	3.4	0.0	0.0	
197	Oryzalin	0.7	3.4	0.4	1.7	0.1	0.1	1.8	
198	Oxadiazone	100.9	98.3	103.1	102.9	95.9	100.2	0.5	
199	Oxadixyl	28.0	26.1	22.3	8.6	6.8	4.1	0.0	
200	Oxyfluorfen	107.1	100.8	109.2	107.9	96.9	94.8	0.0	
201	p,p'-DDD	104.3	101.4	108.0	107.0	97.1	97.3	0.0	
202	p,p'-DDE	93.7	90.6	96.2	94.9	88.0	93.4	112.0	
203	Paclobutrazol	99.0	103.2	109.9	91.2	10.3	0.0	0.3	
204	Parathion	109.5	103.1	112.4	109.9	103.2	103.8	0.3	
205	Parathion-methyl	104.1	105.1	113.7	117.1	104.6	69.0	0.5	
206	Penconazole	101.0	99.5	105.9	106.2	58.6	0.5	0.2	
207	Pendimethalin	107.3	103.8	112.0	108.9	100.5	104.8	3.0	
208	Permethrin-cis	108.2	105.1	108.0	101.9	90.0	95.1	1.6	
209	Permethrin-trans	110.2	106.8	107.9	104.4	93.5	98.5	1.0	
210	Perthane	102.4	98.2	103.3	101.1	93.2	97.3	0.0	

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)	
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	
		50%	30%	20%	15%	10%	5%	0%	
211	Phenothrin-1	116.4	112.7	114.3	105.5	95.1	101.6	1.6	
212	Phenothrin-2	110.9	107.4	111.4	106.4	98.1	104.0	1.5	
213	Phenthoate	92.0	98.0	106.7	116.5	110.8	115.7	0.2	
214	Phorate	128.4	124.5	131.9	123.4	115.3	116.0	5.1	
215	Phosalone	112.1	113.2	121.9	124.0	103.9	24.1	0.1	
216	Phosmet	99.8	104.9	111.7	121.9	73.5	2.1	0.0	
217	Phosphamidon	45.9	43.0	43.2	27.0	2.6	0.1	0.0	
218	Phthalide	98.2	97.5	104.7	104.6	95.7	95.0	0.2	
219	Picolinafen	106.8	102.4	107.6	108.7	96.9	52.8	0.0	
220	Piperonyl butoxide	104.0	101.4	107.0	106.5	98.8	102.7	0.0	
221	Piperophos	111.9	110.1	114.8	115.3	102.5	87.3	0.0	
222	Pirimicarb	29.4	27.3	28.2	22.6	17.7	21.1	1.8	
223	Pirimiphos methyl	106.6	103.0	111.6	109.3	102.4	106.0	0.1	
224	Pretilachlor	104.0	103.5	107.8	105.0	97.3	102.8	0.6	
225	Procymidone	98.2	95.5	101.3	101.8	96.7	87.8	0.2	
226	Profenofos	115.8	109.3	117.3	116.2	104.7	106.2	0.1	
227	Prohydrojasmon-1	108.2	105.9	114.4	106.7	97.9	103.1	4.7	
228	Prohydrojasmon-2	119.0	109.5	120.7	110.3	105.9	110.0	6.4	
229	Prometryn	96.9	96.8	102.9	103.1	94.3	89.7	0.5	
230	Propachlor	104.2	99.1	103.1	94.3	80.3	84.1	0.4	
231	Propanil	99.8	96.5	101.6	89.8	13.5	8.5	0.5	
232	Propaphos	107.5	104.8	111.6	113.5	103.0	55.5	2.2	
233	Propargite(BPPS)	86.9	82.6	88.0	90.3	85.8	95.0	0.3	
234	Propazine	97.2	97.1	100.9	101.2	93.5	75.0	0.1	
235	Propiconazole-1	107.3	106.2	114.0	116.6	86.8	2.6	0.0	
236	Propiconazole-2	100.1	98.0	105.2	107.0	90.4	16.0	0.0	
237	Propoxur	32.0	28.4	28.1	21.7	8.5	0.0	0.0	
238	Propyzamide	97.5	96.6	102.4	101.8	94.8	32.9	0.1	
239	Prothiophos	99.3	94.8	101.8	99.3	92.3	98.8	26.4	
240	Pyraclufos	121.0	120.8	127.8	127.3	100.2	22.7	0.0	



SAX+PSAミニカラムと溶出溶媒による回収率⑤

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下:(アセトン含有率)	
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	
		50%	30%	20%	15%	10%	5%	0%	
241	Pyraflufen-ethyl	103.7	101.3	108.9	110.2	86.0	1.9	0.1	
242	Pyrazophos	120.5	106.6	121.4	115.9	102.6	96.2	2.3	
243	Pyributicarb	112.4	107.5	112.3	112.9	102.8	108.5	0.0	
244	Pyridaben	106.1	104.3	106.3	104.1	93.3	97.2	0.0	
245	Pyridafenthion	111.3	110.9	118.0	120.4	57.7	0.2	0.1	
246	Pyrifenox-1	97.2	94.4	101.4	100.8	91.5	72.5	0.1	
247	Pyrifenox-2	94.0	99.6	106.1	105.7	94.7	90.0	0.0	
248	Pyrimethanil	97.2	95.9	98.9	96.9	89.1	90.7	0.0	
249	Pyrimidifen	104.2	100.8	105.3	105.0	93.8	89.9	0.0	
250	Pyriminobac-methyl-1	104.8	101.1	108.7	108.3	94.7	21.2	0.1	
251	Pyriminobac-methyl-2	98.5	96.0	102.3	103.0	87.6	11.8	0.1	
252	Pyriproxyfen	108.3	105.4	110.3	107.5	97.8	103.2	0.0	
253	Pyroquilon	15.7	14.1	14.2	12.2	8.2	4.7	0.0	
254	Quinoclamine	10.1	9.3	8.8	5.6	2.0	0.0	0.1	
255	Quinolphos	101.8	98.0	104.6	100.9	92.8	101.7	0.3	
256	Quinomethionate	101.4	90.8	94.4	94.1	83.8	83.5	7.8	
257	Quinoxifen	96.8	92.7	98.8	97.0	90.7	94.0	0.1	
258	Quintozen	106.6	101.4	109.8	103.7	94.6	94.1	121.0	
259	Resmethrin-1	91.2	89.9	99.4	97.7	91.1	97.6	0.0	
260	Resmethrin-2	97.8	97.5	105.9	105.0	98.3	102.4	0.0	
261	Silafluofen	83.7	82.6	84.2	88.9	74.8	79.8	0.0	
262	Simazin	19.9	18.2	17.2	14.4	8.3	0.0	0.0	
263	Simetryn	64.0	62.2	62.1	57.0	40.9	2.7	0.1	
264	Spirodiclofen	18.8	40.0	44.3	59.4	83.6	97.4	0.0	
265	Spiroxamine-1	121.8	108.3	111.8	103.1	81.3	13.9	0.7	
266	Spiroxamine-2	118.5	106.4	109.4	102.3	84.8	25.6	0.0	
267	TCMTB	125.0	113.8	121.8	121.3	96.1	41.4	0.2	
268	Tebuconazole	104.7	101.9	105.3	60.6	3.8	0.8	0.0	
269	Tebufenpyrad	109.6	105.5	110.0	107.9	96.9	100.0	0.0	
270	Tecnazene	115.8	107.4	112.1	100.7	94.6	91.9	125.1	

番号	化合物名	溶出溶媒 アセトン-ヘキサン比率						下(アセトン含有率)	
		(50/50)	(30/70)	(20/80)	(15/85)	(10/90)	(5/95)	(0/100)	
		50%	30%	20%	15%	10%	5%	0%	
271	Tefluthrine	104.6	100.8	106.9	103.6	98.5	102.4	69.2	
272	Terbacil	126.4	143.5	167.1	169.9	128.6	110.0	7.7	
273	Terbufos	123.6	118.0	126.2	119.6	112.0	114.1	14.2	
274	Terbutryn	105.6	103.6	110.4	110.1	100.6	88.0	0.0	
275	Tetrachlorvinphos	103.2	102.1	108.5	112.4	100.6	56.0	0.0	
276	Tetraconazole	104.0	101.5	105.7	53.8	2.0	0.4	0.0	
277	Tetradifon	104.8	102.1	106.8	104.5	93.9	99.3	0.0	
278	Thenylchlor	106.0	105.1	113.5	116.2	102.4	30.1	0.2	
279	Thiobencarb	104.9	101.2	107.4	106.5	97.9	102.1	0.2	
280	Thiometon	129.1	125.5	132.6	126.5	115.1	117.6	1.5	
281	Tolclofos-methyl	105.1	102.5	110.9	108.9	100.3	105.4	0.0	
282	Tolfenpyrad	105.8	102.7	108.1	109.6	94.2	46.9	0.4	
283	Toriadimefon	112.3	108.0	115.8	115.1	93.2	4.2	0.2	
284	Triadimenol-1	98.8	101.3	105.1	70.6	4.2	0.7	0.4	
285	Triadimenol-2	99.0	101.5	99.4	45.8	2.3	1.5	1.6	
286	Triallate	111.7	108.1	114.0	109.8	103.5	107.1	121.2	
287	Triazophos	112.5	109.8	117.9	120.5	70.4	0.5	0.2	
288	Tricyclazole	4.3	2.4	1.2	0.2	0.0	0.0	0.7	
289	Trifloxystrobin	109.9	105.7	112.1	113.4	101.9	47.1	0.0	
290	Trifluralin	129.7	124.4	135.7	127.8	116.8	120.1	64.9	
291	Trifluzamide	104.1	100.4	83.9	38.3	0.8	0.2	0.3	
292	Uniconazole	117.6	114.7	117.1	72.1	3.4	0.8	1.2	
293	Vinclozoline	104.5	102.7	111.1	109.2	101.8	104.4	0.0	
294	XMC	80.8	75.2	75.5	65.9	47.2	2.3	3.6	
295	Zoxamide	88.8	90.9	97.8	112.9	79.7	16.3	0.1	

試料：オレンジ

添加濃度：試料中0.05ppm（分取後に添加）

SAX-PSAミニカラムと溶出溶媒による回収率分布

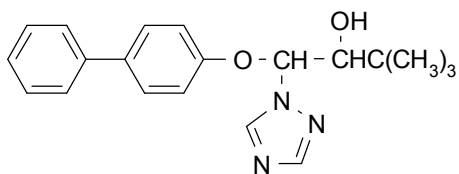
表1. オレンジを用いたSAX-PSAミニカラムと溶出溶媒アセトン-ヘキサンによる回収率分布

回収率	溶出溶媒アセトン-ヘキサン比率						
	上 (アセトン/ヘキサン比)	下 (アセトン含有率%)					
	(1/1)	(3/7)	(1/4)	(15/85)	(1/9)	(5/95)	(0/100)
%以上 - %未満	50%	30%	20%	15%	10%	5%	0%
30 - 50	8	8	7	11	11	15	5
50 - 70	4	4	5	13	10	20	3
70 - 120	224	236	224	216	210	134	4
120 -	40	28	38	28	2	4	5

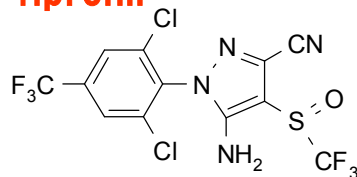
(単位: 成分)

SAX+PSAミニカラムとアセトン-ヘキサン() で回収率が低下する農薬

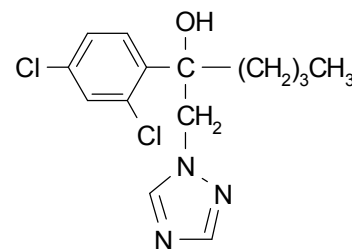
bitertanol



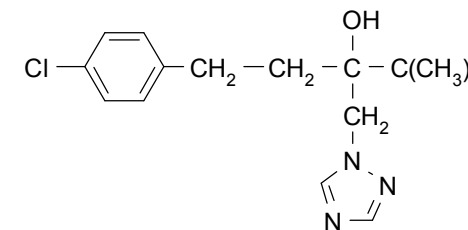
fipronil



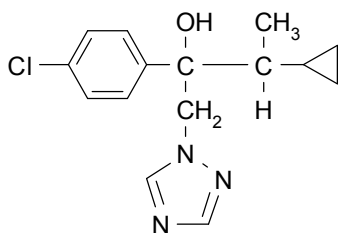
fipronil



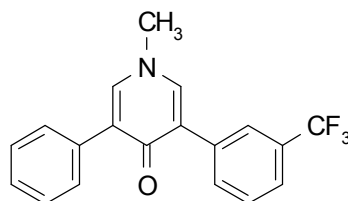
tebuconazole



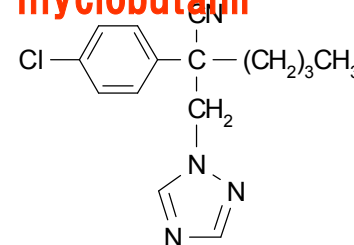
cyproconazole



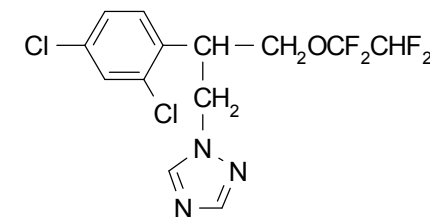
fluridone



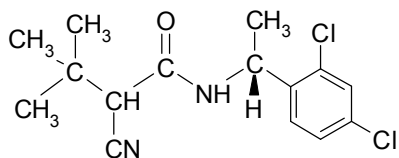
myclobutanil



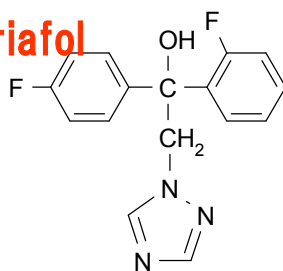
tetraconazole



diclocymet



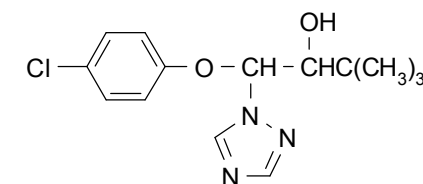
flutriafol



norflurazon

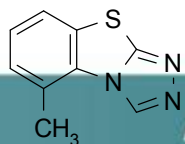


triadimenol



fensulfothion

tricyclazole



各固相ミニカラムと溶出溶媒による精製効果

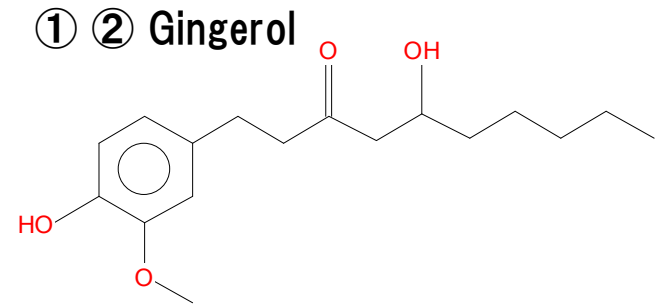
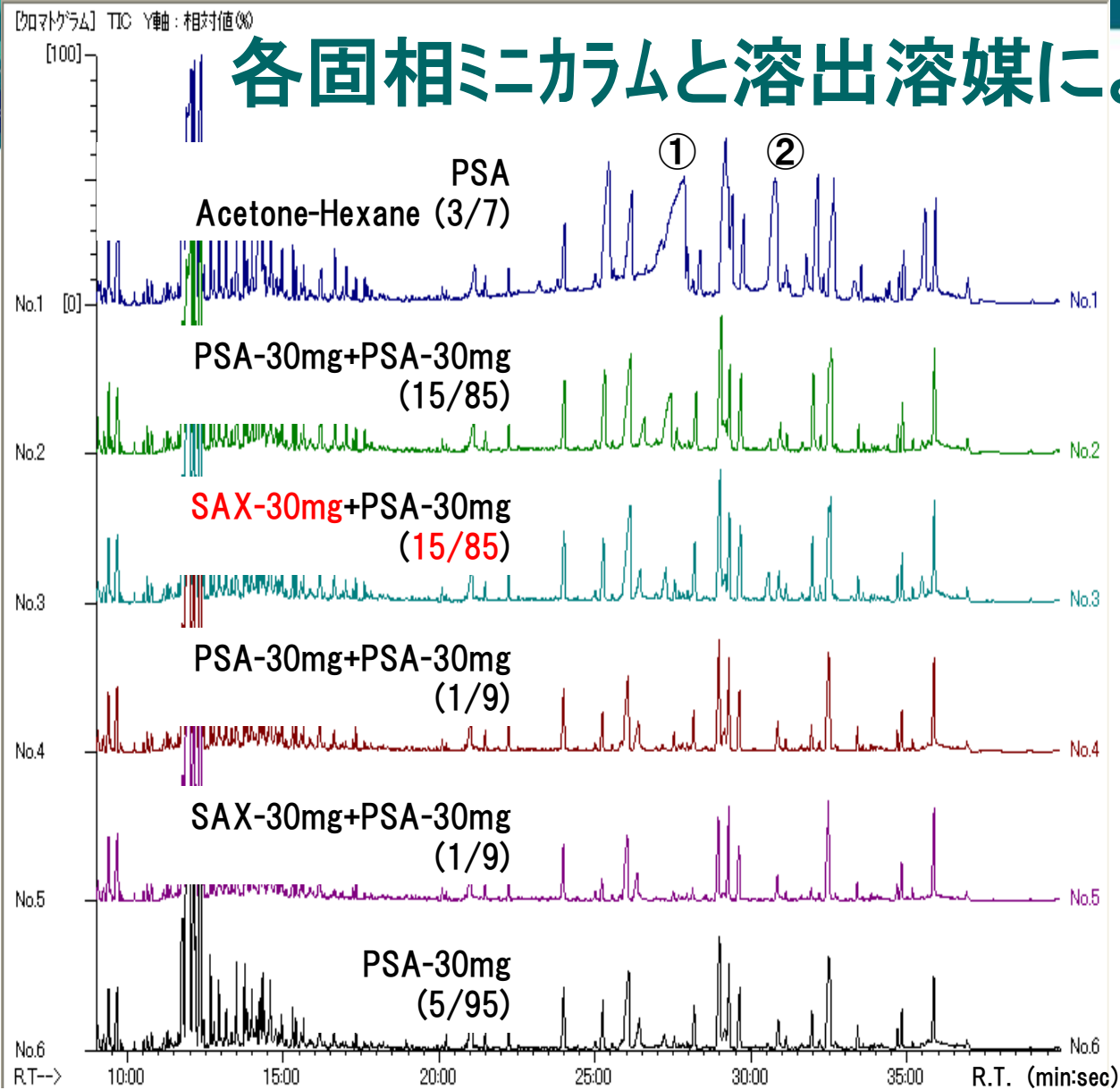


図3. 生姜を用いた各固相ミニカラムと溶出溶媒アセトン-ヘキサンによるSCANトータルイオンクロマトグラム比較

各固相ミニカラムと溶出溶媒による回収率分布

表1 生姜を用いた各固相ミニカラムと溶出溶媒アセトン-ヘキサンによる回収率分布

回収率	固相ミニカラム					
	PSA	SAX +PSA	PSA +PSA	SAX +PSA	PSA +PSA	PSA
	溶出溶媒 アセトン-ヘキサン (アセトン含有率)					
%以上 - %未満	5%	10%	10%	15%	15%	30%
30 - 50	10	16	8	7	7	12
50 - 70	31	13	17	15	12	16
70 - 120	207	204	219	227	220	201
120 -	8	11	15	16	25	26

(単位:成分)

精製効果と定量解析について

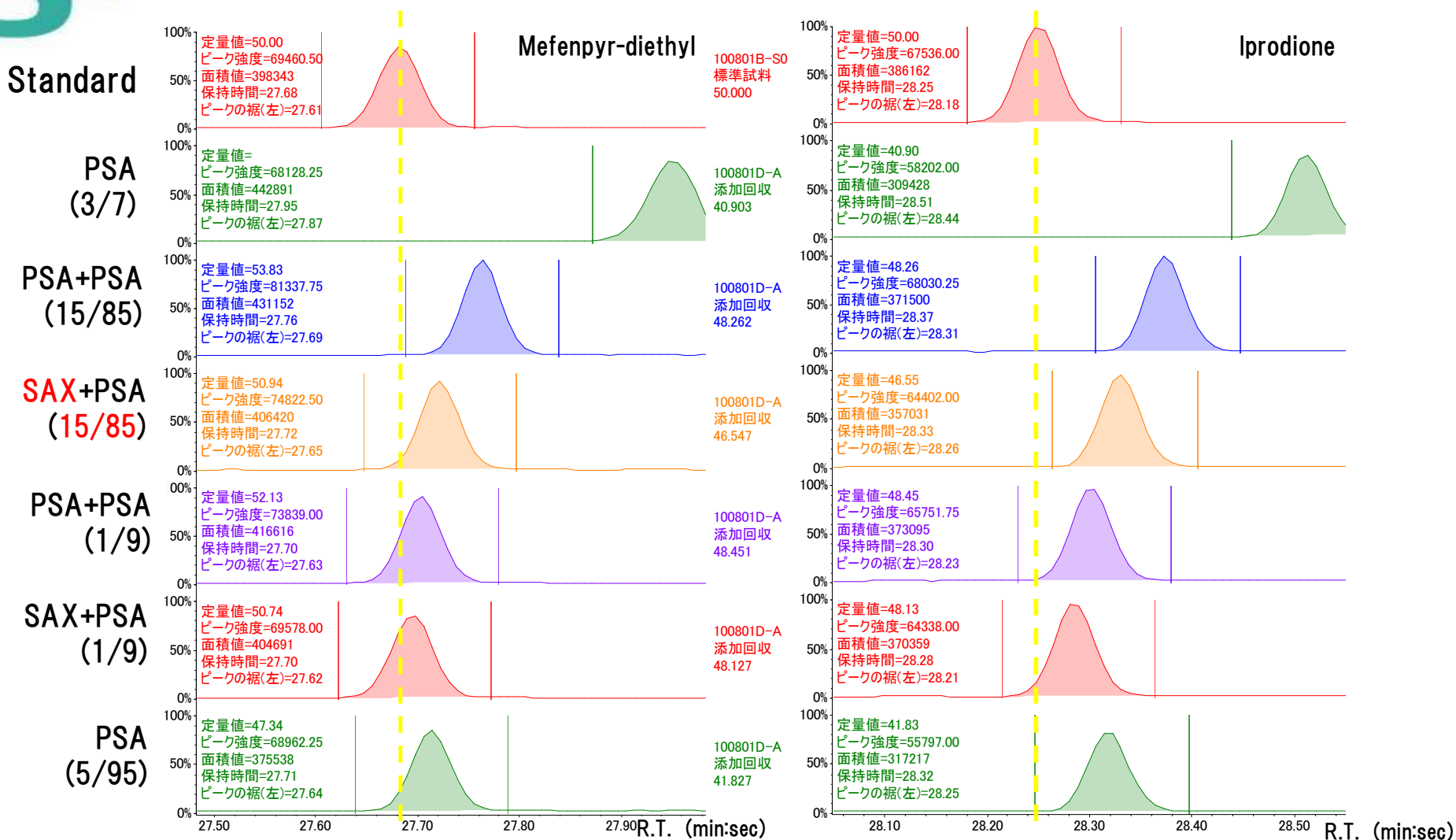
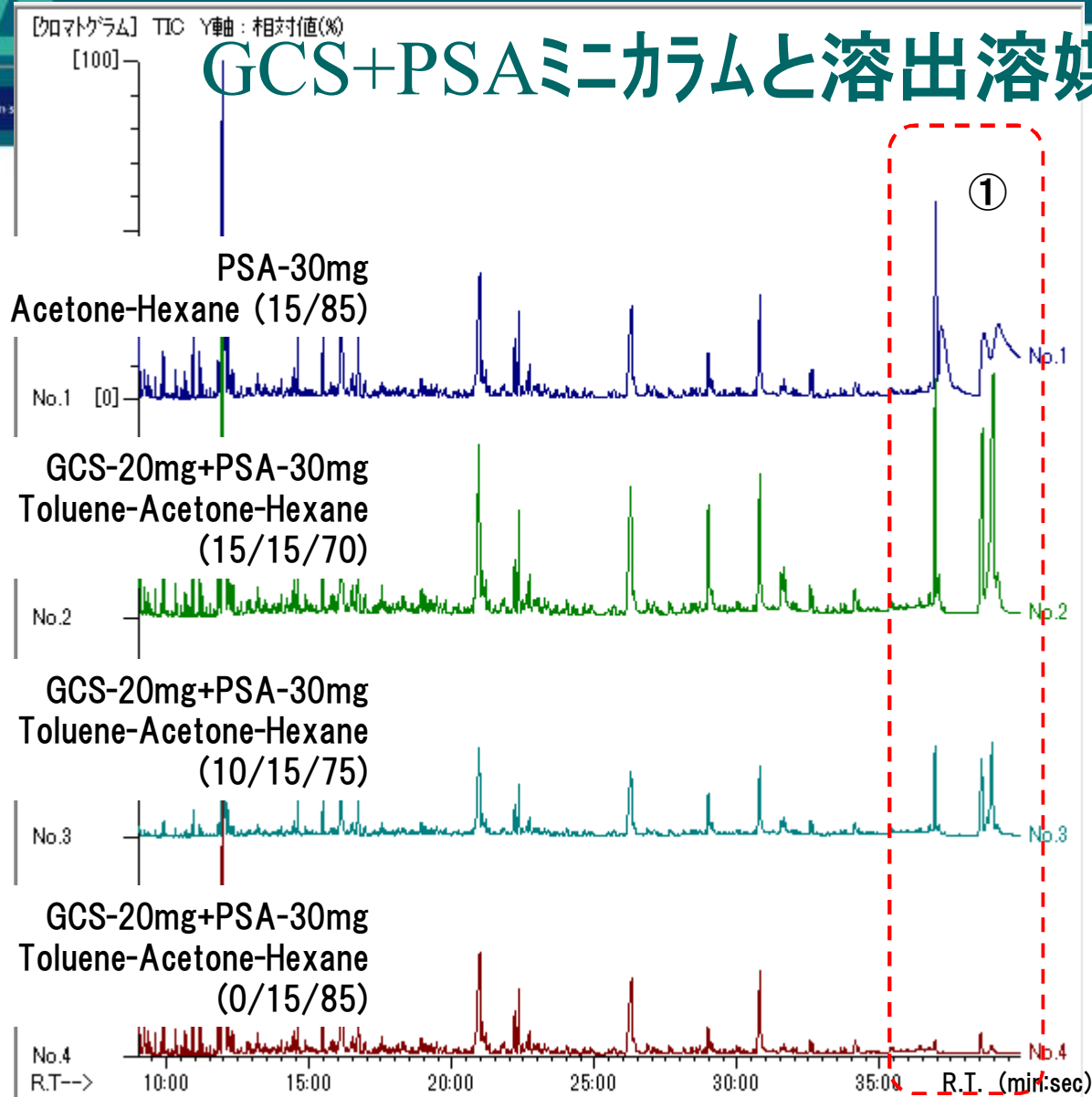
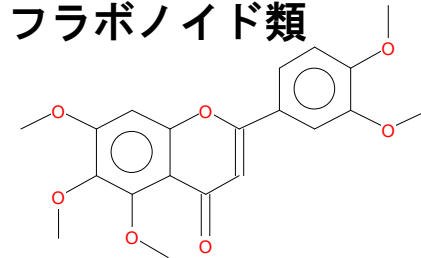


図3. 生姜を用いた各固相ミニカラムと溶出溶媒アセトン-ヘキサンによる定量イオンクロマトグラム比較

GCS+PSAミニカラムと溶出溶媒による精製効果



① フラボノイド類



GCS
 グラファイトカーボン
 一次相互作用：平面構造、無極性

図3. オレンジを用いたGCS+PSAミニカラムと溶出溶媒アセトン-ヘキサンによるSCANトータルイオンクロマトグラム比較



GCS+PSAミニカラムと溶出溶媒による回収率①

番号	化合物名	溶出溶媒 トルエン-アセトン-ヘキサン比率			
		(20/15/65)	(15/15/70)	(10/15/75)	(0/15/85)
		20%	15%	10%	0%
1	1-Naphthylacetamide	N.D.	N.D.	N.D.	N.D.
2	3-Hydroxycarbofuran	46.8	47.7	40.2	27.2
3	4,4'-Dichlorobenzoph	98.8	98.6	98.8	92.4
4	Acephate	LC	LC	LC	LC
5	Acetamidipide	LC	LC	LC	LC
6	Acetochlor	107.1	103.9	103.7	97.0
7	Acrinathrin	94.0	100.0	94.8	95.0
8	Alachlor	105.9	103.9	104.5	94.7
9	Allethrin-1,2	98.8	98.1	101.1	95.9
10	Allethrin-3,4	96.6	95.9	99.1	96.8
11	Ametryn	97.3	97.2	92.4	74.0
12	Anilofos	114.0	110.0	113.5	111.6
13	Aramite-3	101.9	97.7	98.7	93.8
14	Aramite-4	99.6	99.7	95.9	97.5
15	Atrazine	75.8	79.9	58.6	33.5
16	Azaconazole	97.5	97.9	89.4	67.4
17	Azinphos-Methyl	130.6	121.0	130.4	83.1
18	Benalaxyl	108.1	106.0	106.0	103.0
19	Bendiocarb	42.8	44.8	23.2	10.0
20	Benfluranlin	115.1	112.8	100.5	95.8
21	Benfuresate	103.9	102.1	100.3	84.4
22	Benoxacor	106.0	104.9	96.7	70.9
23	BHC-alpha	109.4	107.0	101.6	94.6
24	BHC-beta	105.5	103.5	99.1	93.2
25	BHC-delta	103.7	105.2	102.0	97.6
26	BHC-gamma	105.5	103.5	99.1	93.2
27	Bifenox	115.9	114.8	115.8	111.8
28	Bifenthrin	93.3	93.4	95.5	92.7
29	Bitertanol-1	120.0	116.7	118.0	106.7
30	Bitertanol-2	117.1	114.1	114.6	97.6

番号	化合物名	溶出溶媒 トルエン-アセトン-ヘキサン比率			
		(20/15/65)	(15/15/70)	(10/15/75)	(0/15/85)
		20%	15%	10%	0%
31	Bromacil	LC	LC	LC	LC
32	Bromobutide	104.1	102.3	103.8	96.7
33	Bromofos methyl	96.2	96.5	100.8	97.0
34	Bromophos-ethyl	91.9	93.1	99.3	94.0
35	Bromopropylate	102.9	98.1	102.6	100.0
36	Buprimate	105.8	102.3	103.0	100.4
37	Buprofezin	100.0	98.5	97.8	95.4
38	Butachlor	100.4	97.5	98.2	97.6
39	Butamifos	104.1	102.5	103.5	98.8
40	Butylate	112.6	159.5	48.0	50.7
41	Cadusafos	114.1	114.7	98.1	90.9
42	Cafenstrole	111.3	105.6	110.0	105.3
43	Captafol	LC	LC	LC	LC
44	Captan	77.9	-	62.7	37.1
45	Carbaril	59.5	66.3	41.8	19.9
46	Carbofuran	39.8	41.5	21.9	9.4
47	Carboxin	63.0	67.5	38.6	14.6
48	Carfentrazone ethyl	110.9	107.1	107.1	102.2
49	Chlorbenside	97.2	98.9	101.0	90.8
50	Chlorbufam	102.0	100.3	98.8	86.8
51	Chlorethoxyphos	102.9	109.6	80.7	80.1
52	Chlorfenapyr	98.8	94.5	96.3	94.2
53	Chlorfenson	100.4	99.4	99.7	95.4
54	Chlorfenvinphos-1	107.7	107.3	107.2	102.3
55	Chlorfenvinphos-2	107.2	105.2	101.5	102.9
56	Chlorobenzilate	104.7	101.4	102.8	99.3
57	Chloroneb	108.4	107.7	81.2	77.8
58	Chlorpropham	113.3	109.1	105.6	95.8
59	Chlorpyrifos	93.3	94.7	95.3	91.7
60	Chlorpyriphos-methyl	104.3	104.2	105.2	100.6

番号	化合物名	溶出溶媒 トルエン-アセトン-ヘキサン比率			
		(20/15/65)	(15/15/70)	(10/15/75)	(0/15/85)
		20%	15%	10%	0%
61	Chlorthal-dimethyl	100.2	100.4	99.7	98.7
62	Chlozolinate	101.9	98.8	101.0	96.0
63	Cinidon-ethyl	100.2	92.9	88.2	37.7
64	Clomazone	107.2	105.7	96.0	72.4
65	Cyanazine	LC	LC	LC	LC
66	Cyanophos	106.5	103.9	100.0	79.1
67	Cyfluthrin-1	130.4	115.5	131.7	122.0
68	Cyfluthrin-2	94.7	99.5	95.0	96.2
69	Cyfluthrin-3	97.4	93.9	92.6	95.5
70	Cyfluthrin-4	107.8	84.6	103.2	102.5
71	Cyhalofop-butyl	105.7	103.5	103.9	100.7
72	Cyhalothrin-1	101.6	101.2	100.6	99.5
73	Cyhalothrin-2	106.4	98.7	103.6	100.7
74	Cypermethrin-1	98.4	95.7	99.7	96.0
75	Cypermethrin-2	92.8	91.2	95.1	89.4
76	Cypermethrin-3	99.9	99.4	102.0	96.5
77	Cypermethrin-4	96.0	93.5	95.2	90.1
78	Cyproconazole-1	99.9	103.8	97.7	88.0
79	Cyproconazole-2	77.9	74.1	76.0	71.3
80	DEF	98.8	99.4	98.6	95.8
81	Deltamethrin	83.4	-	87.8	88.8
82	Demeton-S-methyl	37.8	38.5	19.1	9.2
83	Diallate-1	110.3	111.5	94.1	90.6
84	Diallate-2	112.2	110.1	98.2	93.4
85	Diazinone	113.5	109.4	105.5	99.5
86	Dichlofenthion	97.3	98.8	95.7	90.4
87	Dichlofluanid	114.2	-	102.4	99.9
88	Dichlorvos	LC	LC	LC	LC
89	Diclocymet-1	93.3	90.9	90.3	87.4
90	Diclocymet-2	103.9	103.6	102.7	99.8



GCS+PSAミニカラムと溶出溶媒による回収率②

番号	化合物名	溶出溶媒 トルエン-アセトン-ヘキサン比率				番号	化合物名	溶出溶媒 トルエン-アセトン-ヘキサン比率				番号	化合物名	溶出溶媒 トルエン-アセトン-ヘキサン比率			
		(20/15/65)	(15/15/70)	(10/15/75)	(0/15/85)			(20/15/65)	(15/15/70)	(10/15/75)	(0/15/85)			(20/15/65)	(15/15/70)	(10/15/75)	(0/15/85)
91	Diclofop-methyl	97.7	95.2	97.2	93.8	121	Etofenprox	92.1	92.7	94.9	91.3	151	Fluthiacet-methyl	101.2	97.8	99.2	53.4
92	Dicloran	80.4	83.8	53.4	18.4	122	Etoazole	97.4	96.1	97.7	95.6	152	Flutolanil	105.3	105.2	105.3	98.3
93	Dicrotofos	LC	LC	LC	LC	123	Etrimfos	105.5	103.7	101.1	94.8	153	Flutriafol	95.4	97.3	84.0	49.4
94	Diethofencarb	88.2	86.0	84.9	74.8	124	Fenamidone	106.2	104.9	104.5	97.1	154	Fluvalinate-1	92.0	87.3	93.4	93.5
95	Difenoconazole-1	98.1	96.7	100.7	91.4	125	Fenamiphos	102.8	102.0	100.8	95.6	155	Fluvalinate-2	91.3	87.9	93.9	94.0
96	Difenoconazole-2	102.4	98.9	101.0	97.7	126	Fenarimol	103.0	101.7	104.0	98.5	156	Formothion	LC	LC	LC	LC
97	Diflufenican	98.0	92.4	84.6	11.6	127	Fenbuconazole	105.1	102.7	104.1	86.8	157	Fosthiazate-1	86.0	90.4	66.9	37.3
98	Dimepiperate	105.7	104.2	105.2	102.8	128	Fenchlorphos	95.4	95.9	99.4	95.8	158	Fosthiazate-2	88.5	91.7	70.4	42.1
99	Dimethametryn	102.4	101.0	99.7	96.6	129	Fenitrothion	105.8	104.6	105.8	100.8	159	Halfenprox	90.3	91.4	95.6	92.5
100	Dimethenamid	107.8	105.8	103.1	86.8	130	Fenobucarb	110.9	107.0	98.7	76.4	160	Hexaconazole	106.1	105.5	107.0	102.5
101	Dimethipin	LC	LC	LC	LC	131	Fenothiocarb	104.4	102.1	102.7	96.9	161	Hexazinone	LC	LC	LC	LC
102	Dimethoate	LC	LC	LC	LC	132	Fenoxanil	104.2	104.1	100.3	96.1	162	Imazamethabenz meth	39.6	41.1	25.3	13.3
103	Dimethylvinphos-z	98.0	95.0	96.7	94.4	133	Fenpropathrin	97.6	94.9	97.4	94.3	163	Imibenconazole	103.0	91.3	87.4	23.0
104	Dioxathion	115.4	109.2	111.7	110.5	134	Fenpropemorph	101.2	100.9	100.3	95.6	164	Imibenconazole-des-	LC	LC	LC	LC
105	Diphenamide	103.7	102.7	97.4	74.2	135	Fensulfothion	114.1	113.8	111.3	90.3	165	Iprobenfos	107.0	104.1	102.3	98.0
106	Disulfoton	118.4	117.8	113.5	109.3	136	Fenthion	107.8	105.9	105.5	103.5	166	Iprodione	103.1	100.2	101.7	94.8
107	Disulfoton sulfone	102.4	103.0	95.7	68.3	137	Fenvalerate-1	91.0	94.9	93.4	92.1	167	Isazophos	107.0	105.4	103.4	99.8
108	Edifenphos	106.2	101.8	103.8	104.9	138	Fenvalerate-2	104.2	92.7	106.7	98.7	168	Isofenphos	101.8	100.5	101.7	98.4
109	Endosulfan	87.3	91.7	93.4	94.1	139	FIPRONIL	100.2	96.9	97.1	96.1	169	Isofenphos P=O	107.6	105.8	105.4	97.6
110	Endosulfan II	98.8	100.3	99.3	98.1	140	Flamprop-methyl	108.6	104.8	109.0	105.4	170	Isoprocarbe	89.2	89.7	61.9	31.8
111	Endosulfan sulfate	106.3	107.0	104.7	108.0	141	Fluacrypyrim	105.9	105.1	104.9	101.3	171	Isoprothiolane	109.3	105.3	106.3	101.6
112	EPN	112.2	98.4	112.1	103.8	142	Flucythrinate-1	98.6	97.1	96.0	96.3	172	Isoxathion	98.3	93.9	95.0	93.2
113	Epoxiconazole	108.2	105.4	107.2	101.0	143	Flucythrinate-2	103.6	100.3	100.7	99.6	173	Isoxathion-ox	103.4	95.5	100.5	94.8
114	EPTC	121.7	187.7	45.0	49.6	144	Fludioxonil	92.1	94.9	93.5	94.9	174	Kresoxim-methyl	105.4	103.1	103.2	100.0
115	Esprocarb	98.1	97.8	97.5	93.6	145	Flufentpyl-ethyl	108.4	106.5	105.6	99.3	175	Lenacil	59.1	63.9	40.8	22.3
116	Ethalfuralin	111.0	112.5	100.3	98.7	146	Flumiclorac-pentyl	106.7	99.5	102.8	96.7	176	Malathion	112.1	105.9	104.4	103.6
117	Ethiofencarb	75.8	80.6	50.7	23.7	147	Flumioxazin	110.9	108.4	110.3	98.1	177	Mecarbam	105.5	101.2	102.1	97.9
118	Ethion	106.5	105.1	108.8	104.6	148	Fluquinacozole	105.6	102.7	103.4	95.7	178	Mefenacet	109.6	107.3	107.0	96.2
119	Ethofumesate	101.7	99.9	100.1	91.4	149	Fluridone	96.6	92.6	89.2	42.3	179	Mefenpyr-diethyl	111.2	106.4	108.3	102.7
120	Ethoprophos	117.7	113.6	99.4	91.4	150	Flusilazole	104.9	103.6	104.3	100.7	180	Mepronil	112.1	108.5	108.4	99.8



GCS+PSAミニカラムと溶出溶媒による回収率③

番号	化合物名	溶出溶媒 トルエン-アセトン-ヘキサン比率			
		(20/15/65)	(15/15/70)	(10/15/75)	(0/15/85)
		20%	15%	10%	0%
181	Metalaxyl	96.1	98.2	85.2	56.2
182	Methamidophos	LC	LC	LC	LC
183	Methidathion	110.2	106.0	103.0	77.8
184	Methiocarb	103.9	93.7	102.1	87.7
185	Methoprene-1	99.9	98.9	99.1	93.1
186	Methoprene-2	97.0	101.6	101.3	90.1
187	Methoxychlor	89.8	75.7	86.6	83.1
188	Metolachlor	105.2	102.5	102.7	97.3
189	Metominostrobin	104.7	104.9	100.9	76.6
190	Metominostrobin-z	98.6	99.7	85.3	52.6
191	Mevinphos	LC	LC	LC	LC
192	Monocrotophos	LC	LC	LC	LC
193	Myclobutanil	102.6	101.5	102.2	98.0
194	Napropamide	104.2	101.8	102.5	98.3
195	Nitrothal-isopropyl	112.8	114.6	115.9	108.3
196	Norflurazon	96.6	96.4	87.3	48.9
197	Oryzalin	71.1	53.0	68.0	31.1
198	Oxadiazone	99.9	99.3	99.5	96.6
199	Oxadixyl	LC	LC	LC	LC
200	Oxyfluorfene	100.3	99.6	101.2	98.2
201	p,p'-DDD	97.7	98.3	100.5	99.2
202	p,p'-DDE	88.5	90.8	93.6	90.8
203	Paclobutrazol	108.4	107.2	106.8	97.4
204	Parathion	108.2	107.1	104.5	99.3
205	Parathion-methyl	115.6	114.2	116.5	105.7
206	Penconazole	104.3	102.8	102.8	100.2
207	Pendimethalin	99.4	103.2	104.2	98.8
208	Permethrin-cis	99.5	99.3	101.4	97.7
209	Permethrin-trans	98.3	98.1	100.7	97.4
210	Perthane	90.3	91.5	93.4	90.8

番号	化合物名	溶出溶媒 トルエン-アセトン-ヘキサン比率			
		(20/15/65)	(15/15/70)	(10/15/75)	(0/15/85)
		20%	15%	10%	0%
211	Phenothrin-1	96.6	98.9	99.9	97.8
212	Phenothrin-2	94.0	94.3	96.6	93.9
213	Phenthoate	111.4	86.4	109.2	109.8
214	Phorate	121.6	120.8	107.2	101.1
215	Phosalone	112.2	107.6	112.5	67.5
216	Phosmet	115.5	111.9	115.8	79.4
217	Phosphamidon	40.1	41.8	24.5	14.7
218	Phthalide	97.2	94.1	88.4	53.2
219	Picolinafen	100.6	95.7	91.4	9.9
220	Piperonyl butoxide	102.6	100.0	101.2	97.8
221	Piperophos	108.1	105.1	103.8	99.5
222	Pirimicarb	36.9	37.4	23.1	13.7
223	Pirimiphos methyl	100.9	101.8	103.9	99.4
224	Pretilachlor	104.4	103.0	104.0	99.1
225	Procymidone	100.1	99.2	98.7	93.1
226	Profenofos	104.5	105.2	105.5	101.8
227	Prohydrojasmon-1	110.1	106.0	102.7	98.4
228	Prohydrojasmon-2	104.8	103.0	102.6	89.6
229	Prometryn	103.3	101.8	100.6	94.9
230	Propachlor	100.3	98.8	71.0	41.3
231	Propanil	101.1	101.2	92.7	60.9
232	Propaphos	109.0	108.0	107.2	102.7
233	Propargite(BPPS)	93.5	89.8	91.7	92.0
234	Propazine	102.9	101.7	94.3	81.1
235	Propiconazole-1	113.1	110.1	111.3	107.8
236	Propiconazole-2	109.0	106.1	107.1	104.5
237	Propoxur	LC	LC	LC	LC
238	Propyzamide	100.3	97.8	97.2	81.9
239	Prothiophos	92.4	95.5	97.5	95.1
240	Pyraclufos	104.5	101.2	104.5	71.0

番号	化合物名	溶出溶媒 トルエン-アセトン-ヘキサン比率			
		(20/15/65)	(15/15/70)	(10/15/75)	(0/15/85)
		20%	15%	10%	0%
241	Pyraflufen-ethyl	103.5	100.5	100.4	97.6
242	Pyrazophos	108.5	100.5	103.4	70.7
243	Pyributicarb	101.0	99.7	100.8	97.9
244	Pyridaben	100.9	97.3	98.2	95.0
245	Pyridafenthion	121.7	115.1	120.3	112.0
246	Pyrifenox-1	97.5	95.2	97.1	96.5
247	Pyrifenox-2	100.4	97.4	99.6	97.7
248	Pyrimethanil	92.3	84.3	73.3	11.8
249	Pyrimidifen	94.7	89.3	85.7	44.0
250	Pyriminobac-methyl-1	105.2	102.1	101.4	88.5
251	Pyriminobac-methyl-2	102.2	100.3	101.7	95.7
252	Pyriproxyfen	99.6	98.5	100.1	96.0
253	Pyroquilon	LC	LC	LC	LC
254	Quinoclamine	N.D.	N.D.	N.D.	N.D.
255	Quinolphos	103.7	102.8	101.2	97.4
256	Quinomethionate	58.9	48.8	39.8	5.0
257	Quinoxifen	94.2	93.0	95.9	59.5
258	Quintozen	99.7	103.8	95.2	90.8
259	Resmethrin-1	93.8	93.2	96.7	95.2
260	Resmethrin-2	94.9	95.3	97.7	95.7
261	Silafluofen	75.6	73.4	84.3	78.2
262	Simazin	LC	LC	LC	LC
263	Simetryn	64.7	66.3	46.1	19.7
264	Spirodiclofen	92.1	94.5	94.4	93.9
265	Spiroxamine-1	98.9	95.4	97.5	90.9
266	Spiroxamine-2	96.5	93.9	96.7	88.4
267	TCMTB	104.9	98.1	101.2	80.2
268	Tebuconazole	105.7	104.4	106.0	98.6
269	Tebufenpyrad	100.8	98.0	96.6	92.6
270	Tecnazene	102.9	111.4	82.4	82.2

GCS+PSAミニカラムと溶出溶媒による回収率④

番号	化合物名	溶出溶媒 トルエン-アセトン-ヘキサン比率			
		(20/15/65)	(15/15/70)	(10/15/75)	(0/15/85)
		20%	15%	10%	0%
271	Tefluthrine	97.5	97.7	98.1	92.5
272	Terbacil	93.6	93.1	90.7	86.0
273	Terbufos	112.7	113.3	106.0	100.9
274	Terbutryn	100.9	98.5	100.4	96.2
275	Tetrachlorvinphos	107.0	104.9	106.2	104.5
276	Tetraconazole	105.9	104.6	102.0	97.9
277	Tetradifon	97.9	98.5	100.4	96.2
278	Thenylchlor	112.2	108.8	110.6	107.6
279	Thiobencarb	100.7	99.5	100.9	95.4
280	Thiometon	126.4	125.9	116.2	111.3
281	Tolclofos-methyl	102.4	102.0	102.6	99.4
282	Tolfenpyrad	99.0	97.0	98.7	92.3
283	Toriadimefon	95.4	93.6	94.2	88.0
284	Triadimenol-1	109.5	105.0	117.0	104.2
285	Triadimenol-2	103.1	100.3	98.8	91.3
286	Triallate	102.0	103.7	100.2	92.3
287	Triazophos	116.5	112.8	115.9	110.6
288	Tricyclazole	N.D.	N.D.	N.D.	N.D.
289	Trifloxystrobin	109.9	107.0	108.1	105.2
290	Trifluralin	115.2	111.7	100.2	93.5
291	Trifluzamide	100.7	91.9	92.6	73.9
292	Uniconazole	107.5	104.2	107.0	97.2
293	Vinclozoline	108.9	106.7	105.5	100.7
294	XMC	63.1	67.8	37.4	17.0
295	Zoxamide	110.3	104.1	113.5	109.4

試料：ほうれん草

添加濃度：試料中0.05ppm（分取後に添加）

GCS+PSAミニカラムと溶出溶媒による回収率分布

表1 ほうれん草を用いたGCS+PSAミニカラムと溶出溶媒トルエン-アセトン-ヘキサンによる回収率分布

回収率	溶出溶媒トルエン-アセトン-ヘキサン比率 下(トルエン含有率%)			
	(20/15/65)	(15/15/70)	(10/15/75)	(0/15/85)
%以上 - %未満	20%	15%	10%	0%
30 - 50	7	11	9	13
50 - 70	5	13	7	10
70 - 120	224	216	249	231
120 -	38	28	3	1

(単位:成分)

測定対象区分について

GC/MS対象農薬 (300成分)

Methamidofos
Acephate
Monocrotofos
Carbaril
Dichlorvos
Dimethoate

GC/MS対象農薬 (250成分)

LC/MS/MS対象農薬 (250成分)

Methamidofos
Acephate
Monocrotofos
Carbaril
Dichlorvos
Dimethoate

数年前まで、LC/MS/MSは高価でありあまり普及していなかったが、現在は幾分か売値が下がったこともあり、普及し始めている。また、感度も向上してきている。

従来GC/MSで測定していた農薬をLC/MS/MSで測定することで、最適な前処理条件で分析が可能となる！

まとめ

自動前処理装置を用いた精製の効率化を目的とし、固相ミニカラムの種類と溶出溶媒種類による農薬の回収率や夾雑成分の除去効果の違いについて下記の知見が得られた。

- 通常の食品対応のメソッドとしてはPSA-30mg・アセトン-ヘキサン（15/85）を最適とした。
- アセトンの比率を下げることで夾雑成分の除去効果が向上するが、極性の農薬で回収率が低下するものがあり、それらはLC/MS/MS対象で測定するなどの検討が必要である。
- 夾雑物の多い食品に対してはSAXやSIやGCSミニカラムと適切な溶出溶媒を使用することで、効果的な夾雑成分の除去が行えることが分かった。
- 前処理を適切に行うことで、定量解析しやすくなり、測定機器への負担も軽減できると考えられる。
- 固相ミニカラムと溶出溶媒の種類による農薬の挙動や夾雑成分の除去効果について得られた知見は、個別分析・確認分析においても応用できるものと考えられる。