References

ภาษาไทย

กัลยา วานิชย์บัญชา. การวิเคราะห์สถิติขั้นสูงด้วย SPSS for Windows. พิมพ์ครั้งที่ 3. กรุงเทพมหานคร: ธรรมสาร, 2546.

เต็ม สมิตินันท์. ชื่อพรรณไม้แห่งประเทศไทย. กรุงเทพมหานคร: กรมป่าไม้, 2544.

ราชบัณฑิตยสถาน. อนุกรมวิธานพืช อักษร ก. พิมพ์ครั้งที่ 2. กรุงเทพมหานคร: ราชบัณฑิตยสถาน, 2547.

ภาษาอังกฤษ

Aboul-Enein, H.Y., Stefan, R.L., and Baiulescu G.E. Quality andreliability in analytical chemistry. London: CRC Press, 2000.

Adams, R.P. Identification of essential oil components by gas chromatography/mass spectroscopy. Illinois: Allured, 1995.

Ahmed, A., Choudhary, M.I., Farooq, A., Demirci, B., Demirci, F., and Husun Can Baser, K. Essential oil constituents of the spice *Cinnamomum tamala* (Ham.) Nees & Eberm. Flav. Frag. J. 15 (2000): 388-390.

Baruah, A., Nath, S.C., Hazarika, A.K., and Sarma, T.C. Essential oils of the leaf, stem bark and panicle of *Cinnamomum bejolghota* (Buch.-Ham.) Sweet. J. Essent. Oil Res. 9 (1997): 243-245.

Baruah, A., and Nach, S.C. Leaf essential oils of *Cinnamomum glanduliferum* (Wall) Meissn and *Cinnamomum glaucescens* (Nees) Meissn. J. Essent. Oil Res. 18 (2006): 200-202.

Beebe K.R., Pell, R.J., and Seasholtz, M.B. Chemometrics : A practical guide. New York: John Wiley and Sons, 1998.

Brereton, R.G. Chemometrics : Data analysis for the laboratory and chemical plant. Chichester: John Wiley & Sons, 2003.

Brophy, J.J., Goldsack, R.J., and Forster, P.I. The leaf oils of the Australian species of *Cinnamomum* (Lauraceae). J. Essent. Oil Res. 15 (2001): 332-335.

Canigueral, S., Vila, R., Vicario, G., Tomas, X., and Adzet, T. Chemometrics and essential oil analysis: Chemical polymorphism in two Thymus species. Biochem Syst. Ecol. 22 (1994): 307-315.

Chau, F.T., Liang, Y.Z., Gao, J., and Shao, X.G. Chemometrics: From basics to wavelet transform. New Jersey: John Wiley & Sons, 2004.

Cheng, S.S., Liu, J.Y., Hsui, Y.R., and Chang, S.T. Chemical polymorphism and antifungal activity of essential oils from leaves of different provenances of indigenous cinnamon *(Cinnamomum osmophloeum).* Bioresource Technology 97 (2006): 306-312.

Coppen, W. Flavours and fragances of plant origin. Non-Wood Forest Products 1. Rome: FAO, 1995.

Cotroneo, A., Dugo, G., Favretto, L., and Gabrielli, F. L. Gas chromatrographic separation and chemometric analysis of mandarin essential oils. J. Chrom. 449 (1988): 183-190.

Cotroneo, A., Dugo, G., Favretto, L., and Gabrielli, F. L. Variations in essential oils of mandarine related to processing and ripening. J. Chemom. 4 (1990): 379-385.

Daniel, M. Medicinal Plants: Chemistry and Properties. New York: Science, 2006.

Davies, N.W. Gas chromatographic retention indices of monoterpenes and sesquiterpenes on methyl silicone and carbowax 20M phase. J. Chrom. 503 (1990): 1-24.

Demetzos, C., Anastasaki, T., and Perdetzoglou, D. A chemometric interpopulation study of the essential oils of *Cistus creticus* L. growing in Crete (Greece). Z. Naturforsch 57 (2002): 89-94.

Ding, J., Yu, X., Ding, Z., Cheng, B., Yi, Y., and Yu, W. Essential oils of some Lauraceae species from the southwestern parts of China. J. Essent. Oil Res. 6 (1994): 577-585.

Dung, N.X., Khien, P.V., Chien, H.T., and Leclercq, P.A. The essential oil of *Cinnamomum camphora* (L.) Sieb. var. *linaloolifera* from Vietnam. J. Essent. Oil Res. 5 (1993): 451-453.

Dunlop, P.J., Bignell, C.M., and Hibbert, D.B. Use of gas chromatograms of the essential leaf oils of the genus *Eucalyptus* for taxonomic purpose. Aus. J. Bot. 45 (1997): 1-13.

Dunlop P.J., Bignell C.M., Hibbert D.B., and Brooker M.I.H. Use of Gas Chromatograms of the Essential Oils of the genus *Eucalyptus* for Taxonomic Purposes-Part IV. *Eucalyptus* series *Incrassatae, Corrugatae, Torquatae, Furfuraceae* and *Rufispermae.* [online]. 2004. Available from: http://www.chemistry.adelaide.edu.au/genus-eucalyptus/gpc/pca/63paper2.pdf [2006, Jan 20]

Dunlop, P.J., Bignell, C.M., Jackson, J.F., and Hibbert, D.B. Chemometric analysis of gas chromatographic data of oils from *Eucalyptus* species. Chemom Intell Lab Syst 30 (1995): 59-68.

Fujita, Y. Classification and phylogeny of the genus *Cinnamomum* view from the constituents of essential oils. Bot. Mag. Tokyo 80 (1967): 245-250.

Guzman, C.C., and Siemonsma, I.S. Plant resources of South East Asia No.13 Spice Leiden: Backhvys, 1999.

Harborne, J.B. Phytochemical methods: A guide to modern techniques of plant analysis. 3rd ed. London: Chapman & Hall, 1998.

Hibbert, D.B. Chemometric analysis of data from essential oils. In Linskens, H.F., and Jackson, J.F. (eds.) Plant volatile analysis, pp. 119-140. Germany: Springer, 1997.

Hsiao, J.Y., and Lin, M.L. A chemotaxonomic study of essential oils from the leaves of genus *Clerodendrum* (Verbenaceae) native to Taiwan. Bot. Bull. Acad. Sin. 36 (1995): 247-251.

Jain, A.K., Duin, R.P.W., and Mao, J. Statistical Pattern Recognition: A Review. IEEE Transactions on Pattern Analysis and Machine Intelligence 22 (2000): 4-37.

Jantan, I., Ayop, N., Ali, N.A.M., Ahmad, A.S., Yalvema, M.F., Muhammad, K., and Azizi, A.R. The essential oils of *Cinnamomum rhyncophyllum* Miq. as natural sources of benzyl benzoate, safrole and methyl (*E*)-cinnamate. Flav. Frag. J. 19 (2004): 260-262.

Jantan, I., and Goh, S.H. Essential oils of *Cinnamomum* species from Peninsular Malaysia. J. Essent. Oil Res. 4 (1992): 161-171.

Jantan, I., Ling, Y.E., Romli, S., Ayop, N., Ahad, A.S. A comparative study of the constituents of the essential oils of three *Cinnamomum* species from Malaysia. J. Essent. Oil Res. 15 (2003): 387-391.

Jantan, I., Muhammad, K., and Nee, C.C. Constituents of the leaf and bark oils of *Cinnamomum subavenium* Miq. J. Essent. Oil Res. 17 (2005): 281-283.

Jantan, I., Yalvema, M.F., Ayop, N., and Ahmad, A.S. Constituents of the essential oils of *Cinnamomum sintoc* Blume from a mountain forest of Penninsular Malaysia. Flav.Frag. J. 20 (2005): 601-604.

Jayaprakasha, G.K., Rao, J.M., and Sakariah, K.K. Chemical composition of the flower oil of *Cinnamomum zeylanicum* Blume. J. Agri. Food Chem. 48 (2000): 4294-4295.

Jayatilaka, A., Poole, S.K., Poole, C.F., and Chichila, T.M.P. Simultaneous micro steam distillation/solvent extraction for the isolation of semivolatile flavor compounds from cinnamon and their separation by series coupled-column gas chromatography. Analytica Chimica Acta 302 (1995): 147-162.

Jirovetz, L., Buchbauer, G., Ruzicka, J., Shafi, M.P., and Rosamma, M.K. Analysis of *Cinnamomum zeylanicum* Blume leaf oil from South India. J. Essent. Oil Res. 13 (2001): 442-443.

Ji, X.D., Pu, Q.L., Garraffo, H.M., and Pannell, L.K. Essential oils of the leaf, bark and branch of *Cinnamomum buramannii* Blume. J. Essent. Oil Res. 3 (1991): 373-375.

Lavine B.K. Clustering and classification of analytical data. In Mayers, R.A. (ed.) Encyclopedia of analytical chemistry, pp. 9689-9710. Chichester: John Wiley & Son, 2000.

Lemmens, R.H., Soerianegara, I., and Wong W.C. (eds.) Plant resources of South-East Asia No. 5 Timber trees: Minor commercial timbers. Leiden: Backhuys, 1995.

Li, X. W., Li, J., Huang, P., and Van Der Werff, H. Lauraceae (Draft) [online]. 2005. Available from: http://flora.huh.harvard.edu/china/mss/volume07/Lauraceae-MO_edited.htm#_ftn1 [2006, Jan 20]

Lockwood G.B. The major constituents of the essential oils of *Cinnamomum cassia* Blume growing in Nigeria. Planta Medica 36 (1979): 380-381.

Mabberley D.J. The plant-book: a portable dictionary of the vascular plants. Cambridge: Cambridge University Press, 1997.

McKern, H.H.G. Volatile oils and plant taxonomy. J. R. Soc. N. S. W. 98 (1965): 1-10.

Mallavarapu, G.R., Ramesh, S., Chandrasekhara, R.S., Rao, B.R., Kaul, P.N., and Bhattacharya, A.K. Investigation of the essential oil of cinnamon leaf grown at Bangalore and Hyderabad. Flav. Frag. J. 10 (1995): 239-242.

Massart, D. L., Vandeginste, B. G. M., Deming, S. N., Michotte, Y., and Kaufmann, L. Chemometrics–A Textbook. Amsterdam: Elsevier, 1988.

Mir, S.R., Ali, M., and Kapoor, R. Chemical composition of essential oil of *Cinnamomum tamala* Nee et Eberm. leaves. Flav. Frag. J. 19 (2002): 112-114.

Nath, S.C., Hazarika, A.K., and Singh, R.S. Essential oil of leaves of *Cinnamomum tamala* Nees. & Eberm. from North East India. J. Spice. Aro. Crop. 3 (1994): 33-35.

Nath, S.C., Panthak, M.G., and Baruah, A. Benzyl benzoate, the major component of the leaf and stem bark oil of *Cinnamomum zeylanicum* blume. J. Essent. Oil Res. 8 (1996): 327-328.

Oyen, L. P. A., and Xuan Dung, N., (eds.) Essential Oil Plants. No.19. Plant resources of South East Asia, Leiden: Backhvys, 1999.

Palanuvej, C., Verawatganone, P., and Ruangrungsi, N. Chemical composition and antifungal activity of essential oil from the leaves of *Cinnamomum porrectum* [online]. 2005. Available from: http://www.scisoc.or.th/stt/31/sec_n/paper/stt31_N0003.pdf [2006, Jan 20]

Pelissier, Y., Marion, C., and Prunac, S. Volatile components of leaves, stems and bark of *Cinnamomum camphora* Nee et Ebermaier. J. Essent. Oil Res. 7(1995): 313-315.

Raina, V.K. Essential oil composition of *Cinnamomum zeylanicum* Blume leaves from Little Andaman, India. Flav. Frag. J. 16 (2001): 374-376.

Ravindran, P.N., Nirmal-Babu, K., and Shyraja, M., eds. Cinnamon and Cassia. London : CRC Press, 2003.

Rema, J., Krishnamoorthy, B., and Mathew, P.A. *Cinnamomum tamala* (Buch-Ham.) Nees & Eberm. Spice India (2004) : 15-19.

Roussis, V., Tsoukatou, M., Petrakis, P.V., Chinou, I., Skoula, M., and Harborne, J.B. Volatile constituents of four *Helichrysum* species growing in Greece. Biochemical Systematics and Ecology 28 (2000): 163-165.

Senanayake U.M., The nature, description and biosynthesis of volatiles in *Cinnamomum* spp. Doctoral dissertation, University of New South Wales, 1977. Cited in Guzman, C.C., and Siemonsma, I.S. Spice. No.13. Plant resources of South East Asia. Leiden: Backhvys , 1999.

Senanayake U.M., Lee, T.H., and Wills R.H. Volatile constituents of cinnamon (*Cinnamomum zeylanicum*) oils. J. Agri. Food Chem. 26 (1978): 822-824.

Shi, W.Y., Wei, H., Wen, G.Y., Guo, D.X., Long, G.Y., and Lin, Y.G. Study on chemical constituents of the essential oil and classification of types from *Cinnamomum camphora*. J Integr Plant Biol. 31 (1989): 209-214.

Stubbs B.J. and Brushett D. Leaf oil of *Cinnamomum camphora* (L.) Nees and Eberm. from eastern Australia. J. Essent. Oil Res 13 (2001): 51-54.

Stubbs, B.J., Specht, A., and Brushett D. The essential oil of *Cinnamomum camphora* (L.) Nees and Ebern.- Variation in oil composition throughout the tree in two chemotypes from Eastern Australia. J. Essent. Oil Res 16 (2004): 200-205.

Tao, G.F., and Zong, Y. Study on numerical chemotaxonomy of *Cinnamomum* in Hubei province. Acta Phytotaxonomica Sinica 26 (1988): 409-417.

Ubonnuch, C. Chemical composition and antimicrobial activity of essential oils from Thai Lauraceous plants. Master's Thesis, Department of Pharmacognosy, Pharmaceutical Sciences, Chulalongkorn University, 1998.

Vermuza, K. Applied chemometrics: From chemical data to relevant information. Vienna, 2001. (Unpublished Manuscript)

Webb, A. Statistical pattern recognition. London : Newnes , 1999.

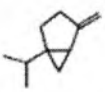
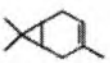
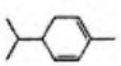
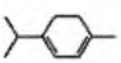
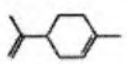
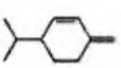
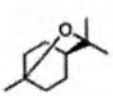
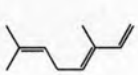
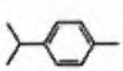
Zhu, L.F., Lu, B.Y., and Li, Y.J. Studies on chemical constituents of essential oil from leaves of Jiang-Zhang. Acta Botanica Sinica 26 (1984): 638-643.

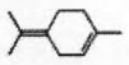
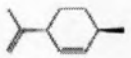
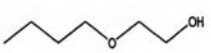
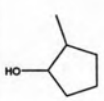
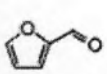
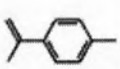
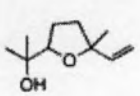
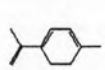
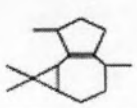
APPENDICES

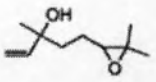
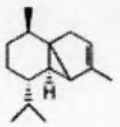
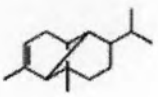
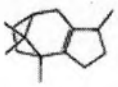
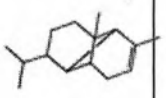
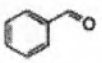
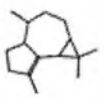
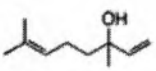
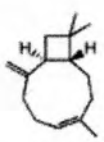
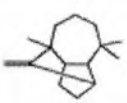
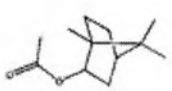
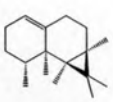
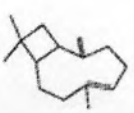
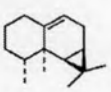
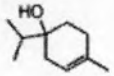
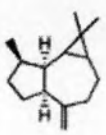
APPENDIX A

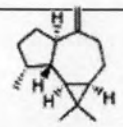
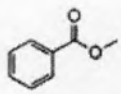
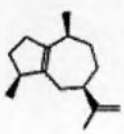
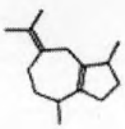
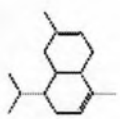
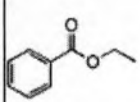
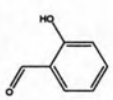
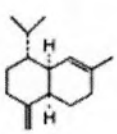
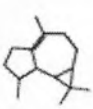
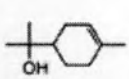
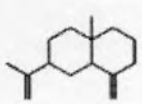
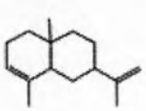
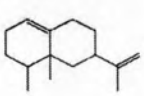
Chemical component identified from

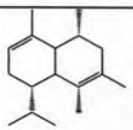
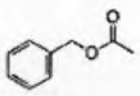
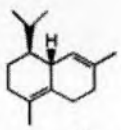
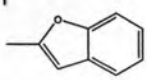
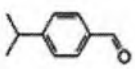
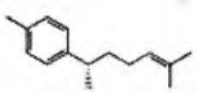
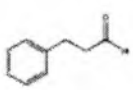
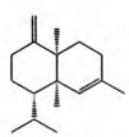
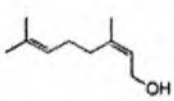
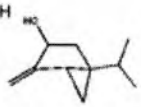
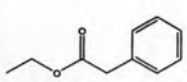
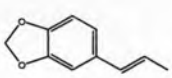
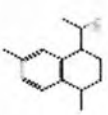
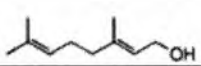
selected *Cinnamomum* species

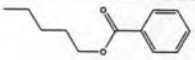
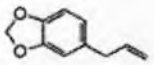
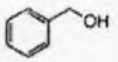
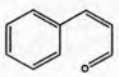
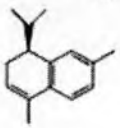
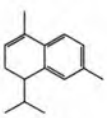
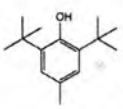
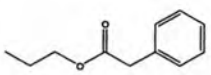
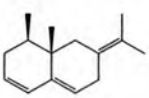
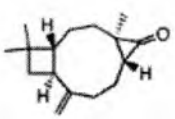
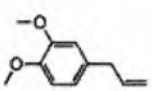
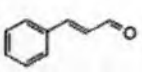
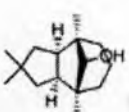
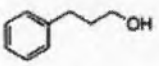
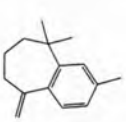
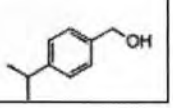
No.	Retention time (min)	Compound	Structure
1	3.18	α-pinene	
2	3.38	unknown	
3	3.58	unknown	
4	3.68	camphene	
5	4.03	unknown	
6	4.22	β-pinene	
7	4.40	sabinene	
8	4.92	3-carene	
9	5.35	α-phyllandrene	
10	5.75	α-terpinene	
11	6.27	limonene	
12	6.48	β-phyllandrene	
13	6.67	1,8-cineol	
14	7.22	unknown	
15	7.55	β-(*Z*)-ocimene	
16	7.90	γ-terpinene	
17	8.10	β-(*E*)-ocimene	
18	8.33	unknown	
19	8.62	*p*-cymene	

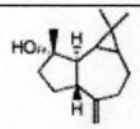
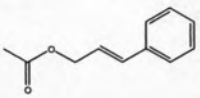
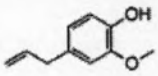
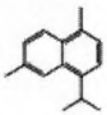
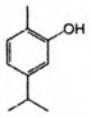
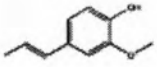
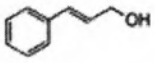
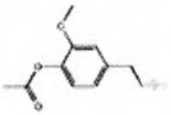
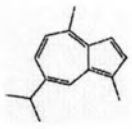
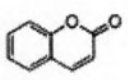
No.	Retention time (min)	Compound	Structure
20	9.05	terpinolene	
21	9.80	(*E*)-isolimonene	
22	9.88	unknown	
23	10.48	2-octanol	
24	10.58	unknown	
25	10.70	unknown	
26	11.15	methylheptenone	
27	11.78	1-hexanol	
28	12.50	α-pyronene	
29	12.97	(*Z*)-3-hexenol	
30	13.08	unknown	
31	13.60	2-butoxy ethanol	
32	13.83	2-methylcyclopentanol	
33	14.22	unknown	
34	14.82	furfural	
35	14.95	dehydro-*p*-cymene	
36	15.05	(*Z*)-linalool oxide	
37	15.40	1,3,8-*p*-menthatriene	
38	15.67	isoledene	

No.	Retention time (min)	Compound	Structure
39	15.98	acetic acid	
40	16.18	*(E)*-Linalool oxide	
41	16.32	α-cubebene	
42	16.63	α-copaene	
43	17.10	β-pachoulene	
44	17.60	camphor	
45	18.08	ylangene	
46	18.33	benzaldehyde	
47	18.92	α-gurjunene	
48	19.45	linalool	
49	22.87	isocaryophyllene	
50	19.92	longifolene	
51	20.30	bornyl acetate	
52	20.50	β-gurjuene	
53	20.73	*(E)*-caryophyllene	
54	21.13	aristolene	
55	21.30	terpinene-4-ol	
56	21.35	alloaromadendrene	

No.	Retention time (min)	Compound	Structure
57	21.70	aromadendrene	
58	21.93	unknown	
59	22.10	methyl benzoate	
60	22.43	α-guaiene	
61	22.70	β-guaiene	
62	22.87	unknown	
63	23.08	β-cadinene	
64	23.52	α-Humulene	
65	23.82	ethyl benzoate	
66	24.05	unknown	
67	24.23	2-hydroxybenzaldehyde	
68	24.28	g-muurolene	
69	24.48	viridiflorene	
70	24.63	unknown	
71	25.03	α-terpineol	
72	25.28	borneol	
73	25.45	β-selinene	
74	25.52	α-selinene	
75	25.65	valencene	

No.	Retention time (min)	Compound	Structure
76	25.75	α-muurolene	
77	26.30	benzyl acetate	
78	26.62	unknown	
79	26.98	δ-cadinene	
80	27.18	2-methylbenzofuran	
81	27.50	unknown	
82	27.58	unknown	
83	27.68	cumin aldehyde	
84	27.75	α-curcumene	
85	27.98	unknown	
86	28.15	hydrocinnamaldehyde	
87	28.52	γ-muurolene	
88	28.98	nerol	
89	29.10	sabinol	
90	29.27	phenyl ethyl acetate	
91	29.35	unknown	
92	29.63	isosafrole	
93	29.75	calamenene	
94	30.73	geraniol	

No.	Retention time (min)	Compound	Structure
95	30.80	pentyl benzoate	
96	31.48	safrole	
97	31.73	benzyl alcohol	
98	32.22	(Z)-cinnamaldehyde	
99	32.32	β-calacorene	
100	32.68	α-calacorene	
101	32.98	butylated hydroxytoluene	
102	33.68	phenyl propyl (3)acetate	
103	34.17	vetivenene	
104	34.67	unknown	
105	35.45	caryophyllene oxide	
106	36.32	unknown	
107	36.38	unknown	
108	36.52	*o*-methyleugenol	
109	37.12	(*E*)-cinnamaldehyde	
110	37.30	α-caryophyllene alcohol	
111	37.50	hydrocinnamic alcohol	
112	37.77	α-dehydro-himachalene	
113	39.17	cuminic alcohol	

No.	Retention time (min)	Compound	Structure
114	39.68	spathulenol	
115	40.95	cinnamyl acetate	
116	41.43	eugenol	
117	42.22	o-eugenol	
118	42.50	unknown	
119	42.80	cadalene	
120	43.03	carvacrol	
121	43.97	isoeugenol	
122	45.03	cinnamyl alcohol	
123	46.85	eugenyl acetate	
124	48.12	guaiazulene	
125	48.97	unknown	
126	49.17	unknown	
127	49.50	cumarin	
128	49.72	unknown	

APPENDIX B

Summary of results from

Hierarchical Cluster Analysis

Table B1 Results of cluster analysis of 128 compounds from 48 samples using pearson correlation and between-group linkage.

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	7	23	.871	0	0	29
2	14	15	.833	0	0	13
3	34	35	.818	0	0	8
4	5	10	.750	0	0	10
5	41	49	.736	0	0	21
6	39	43	.722	0	0	20
7	22	37	.703	0	0	15
8	33	34	.697	0	3	14
9	3	6	.686	0	0	27
10	5	19	.682	4	0	23
11	1	24	.680	0	0	31
12	2	13	.678	0	0	22
13	9	14	.678	0	2	25
14	33	36	.673	8	0	27
15	22	42	.673	7	0	20
16	28	29	.669	0	0	33
17	16	17	.666	0	0	24
18	25	44	.664	0	0	45
19	38	45	.652	0	0	26
20	22	39	.631	15	6	28
21	41	50	.629	5	0	30
22	2	45	.629	12	0	29
23	5	47	.628	10	0	41
24	12	16	.627	0	17	38
25	9	11	.617	13	0	44
26	38	40	.610	19	0	34
27	3	33	.609	9	14	35
28	22	26	.600	20	0	30
29	2	7	.587	22	1	36
30	22	41	.577	28	21	35

Table B1 (Continued)

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
31	1	18	.571	11	0	34
32	21	51	.548	0	0	40
33	28	30	.524	16	0	43
34	1	38	.520	31	26	38
35	3	22	.518	27	30	39
36	2	20	.511	29	0	41
37	4	48	.475	0	0	47
38	1	12	.455	34	24	42
39	3	27	.441	35	0	40
40	3	21	.422	39	32	43
41	2	5	.398	36	23	42
42	1	2	.384	38	41	44
43	3	28	.347	40	33	45
44	1	9	.345	42	25	46
45	3	25	.305	43	18	46
46	1	3	.278	44	45	47
47	1	4	.242	46	37	0

APPENDIX C

Summary of results from

Principal Component Analysis

Summary results of principal component analysis of **48** samples using **128** compounds

Loadings for principal components

Variable	PC1	PC2	PC3	Variable	PC1	PC2	PC3
1	-0.028	-0.038	0.048	26	0.074	0.019	-0.064
2	0.017	0.257	0.035	27	0.102	0.060	-0.063
3	0.036	-0.089	-0.031	28	-0.035	0.004	-0.097
4	0.070	-0.177	0.060	29	0.094	-0.050	-0.129
5	0.093	0.087	-0.064	30	0.002	0.112	-0.016
6	0.102	-0.134	0.060	31	0.033	0.145	-0.026
7	0.058	-0.015	-0.066	32	0.138	0.042	-0.107
8	-0.033	-0.083	-0.073	33	0.085	0.144	0.051
9	-0.087	-0.139	0.051	34	0.015	0.143	-0.028
10	0.087	-0.116	0.127	35	0.125	-0.082	-0.049
11	0.036	-0.189	-0.024	36	-0.095	0.109	0.063
12	0.026	-0.093	0.189	37	-0.079	0.034	-0.120
13	0.077	-0.118	-0.077	38	-0.015	0.100	0.060
14	0.075	0.011	-0.096	39	-0.115	-0.011	0.081
15	0.028	-0.079	-0.088	40	0.154	-0.031	-0.006
16	0.105	0.001	0.058	41	0.105	-0.016	0.054
17	-0.046	-0.067	-0.065	42	0.111	-0.045	0.011
18	-0.017	-0.039	-0.060	43	0.051	-0.013	0.002
19	0.036	-0.157	0.094	44	-0.093	0.026	-0.001
20	0.101	-0.117	-0.090	45	0.149	0.022	-0.005
21	-0.025	0.018	-0.113	46	-0.148	0.062	0.035
22	0.010	0.041	-0.032	47	-0.133	-0.046	-0.101
23	0.010	0.001	0.034	48	0.100	-0.032	0.011
24	0.039	0.210	-0.003	49	0.165	0.051	-0.023
25	0.034	0.108	0.092	50	0.005	-0.058	-0.041

Variable	PC1	PC2	PC3	Variable	PC1	PC2	PC3
51	0.158	0.110	-0.043	81	0.090	0.047	-0.095
52	0.146	-0.026	0.007	82	-0.026	0.182	-0.005
53	0.113	0.144	0.010	83	0.022	0.007	-0.051
54	0.040	-0.138	0.147	84	-0.040	0.061	0.132
55	0.105	0.009	0.016	85	-0.022	-0.016	-0.087
56	0.036	0.226	0.036	86	-0.117	0.041	-0.173
57	0.064	-0.040	0.002	87	-0.005	-0.081	-0.029
58	-0.059	0.075	-0.053	88	-0.046	-0.006	0.154
59	-0.150	0.059	0.059	89	0.139	-0.015	0.063
60	0.152	0.120	0.043	90	0.008	-0.063	-0.013
61	-0.003	0.077	0.077	91	-0.017	-0.026	0.035
62	0.179	-0.029	0.081	92	0.042	0.016	0.127
63	0.061	-0.029	-0.046	93	-0.141	0.017	-0.035
64	0.083	0.061	0.159	94	-0.015	0.037	0.093
65	-0.061	0.113	0.091	95	-0.017	0.213	-0.021
66	0.097	0.031	0.075	96	-0.152	0.091	0.045
67	-0.007	-0.067	0.032	97	-0.054	-0.069	0.070
68	0.163	0.017	0.118	98	0.120	-0.005	-0.025
69	0.165	0.083	0.079	99	0.146	0.013	0.193
70	-0.031	0.128	-0.054	100	0.049	0.051	0.112
71	-0.011	-0.064	-0.024	101	-0.046	-0.006	0.154
72	-0.064	-0.057	0.047	102	0.168	-0.020	0.023
73	0.170	0.050	-0.017	103	0.019	0.178	0.003
74	0.117	0.098	-0.084	104	0.118	0.101	0.080
75	0.025	0.012	0.114	105	0.009	0.179	-0.001
76	0.123	-0.030	0.008	106	0.006	0.182	0.046
77	-0.111	0.170	-0.007	107	-0.065	0.088	0.154
78	0.001	0.014	-0.005	108	-0.115	-0.080	0.079
79	0.075	0.028	0.121	109	0.177	0.019	0.065
80	0.032	-0.050	-0.020	110	-0.084	0.120	0.157

Variable	PC1	PC2	PC3	Variable	PC1	PC2	PC3
111	0.099	-0.036	0.143	120	0.096	-0.044	0.083
112	0.025	0.069	0.093	121	-0.069	-0.006	0.241
113	0.083	-0.039	0.056	122	-0.031	-0.072	0.059
114	-0.046	-0.048	0.098	123	-0.071	-0.021	0.201
115	-0.149	-0.019	0.184	124	0.150	-0.017	-0.002
116	-0.031	-0.037	0.122	125	-0.046	-0.006	0.154
117	-0.005	0.045	-0.008	126	-0.060	-0.049	0.225
118	0.089	0.028	0.115	127	-0.031	-0.084	0.095
119	0.032	-0.110	0.072	128	-0.060	0.001	0.155

Table C1 Score on principal component 1, 2 and 3

Sample	Score_PC1	Score_PC2	Score_PC3
cin01	-2.89983	-3.7282	1.90466
cin02	-2.40571	-1.6644	-1.82009
cin03	3.43924	1.5523	0.62153
cin04	-2.17922	-5.2403	-0.24973
cin05	-0.54437	-1.5620	-1.69650
cin06	2.95498	0.4528	-1.59313
cin07	-2.73513	-0.2992	-4.66950
cin09	-6.25967	2.5028	-2.32216
cin10	-0.43360	-1.3836	-0.24813
cin11	-4.08830	1.9177	-0.50563
cin12	-4.36901	-0.4390	8.04735
cin13	-3.27312	-0.7997	-3.90290
cin14	-7.09543	3.6147	-0.65877
cin15	-6.62028	1.1602	-1.76949
cin16	-4.17416	0.0096	4.60904
cin17	-4.89045	-0.1200	9.55732
cin18	-0.50641	0.1278	0.51338
cin19	-0.48352	1.1851	-1.06536
cin20	-3.66669	1.2987	-0.45433
cin21	6.07837	-2.7417	0.12012
cin22	7.37156	-2.0645	0.67766
cin23	-3.53068	-0.6840	-4.46611
cin24	-1.61289	-1.7610	1.82083
cin25	0.54230	12.5077	2.42131
cin26	2.82834	-1.2791	1.28054
cin27	-1.37278	1.1637	-3.19088
cin28	3.79181	-1.7200	3.44518

Sample	Score_PC1	Score_PC2	Score_PC3
cin29	4.38168	-1.3646	3.25180
cin30	2.52719	0.4391	2.44485
cin33	4.49801	-0.1800	-2.85728
cin34	7.34824	0.2854	-0.38636
cin35	6.52336	0.3961	-1.21005
cin36	5.37873	2.0540	-1.82153
cin37	4.59781	-0.4714	0.21778
cin38	-3.06570	-2.9250	0.05971
cin39	1.13478	-1.0331	-1.37889
cin40	-1.29767	-3.2010	2.38888
cin41	-0.62866	0.1909	-0.42541
cin42	1.66880	-0.1692	-0.53810
cin43	3.24363	-0.7915	-0.70134
cin44	1.78153	12.2768	0.16957
cin45	0.35788	-3.2656	-0.04122
cin46	-2.74799	-1.9788	-3.60174
cin47	-2.29810	-1.2241	-0.36660
cin48	-1.61066	-2.7183	-3.14301
cin49	-0.46344	1.3340	-1.19876
cin50	2.94947	3.0635	-0.11476
cin51	1.85578	-2.7236	2.84624

VITA

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