REFERENCES

1. Brydson, J. A. Rubber Chemistry. Essex,England: Applied Science Publishers. 1978. pp. 11-24.

2. Muller, E. Current Rubber Industries Situation in Thailand and the Need for Structural Changes, *The rubber International* **2, 14** (2000): 71-78.

3. Loyen, G. Prospective for Natural rubber in the Early 21st century, *The Rubber International* **2, 3** (2000): 71-78.

4. Fulton, W. S. Avoiding The Problems of Odor During Rubber Processing, *Rubber Developments* **46, 3/4** (1993): 35-37.

5. Andrew, G., Biopolymers-Natural rubber Available from: http://www.naturalrubber.cjb.net

6. Dunbrook, R. F. Rubber, Colliers Encyclopedia CD-Rom, **20**, Feburary 28, 1996.

7. Eng, A. H., Tangpakdee, J., Kawahara, S., and Tanaka, Y., Distribution and Origin of Abnormal Group in Natural Rubber, *J. nat. Rubb.* Res., **12, 1** (1997): 11-20.

8. Gregg, Jr. E. C., and Macey, J.H., The Relationship of Properties of Synthetic Poly(isoprene) and Natural Rubber in the Factory. The Effect of Non-rubber Constitutents of Natural Rubber, *Rubber. Chem. Technol.*, **46**, (1973): 47.

9. Burfield, D. R., Epoxy Groups Responsible for Crosslinking in Natural Rubber, *Nature*, **249** (1974): 29-30.

10. Burfield, D. R., Chew, L.C., and Gan, S.N., Distribution of Abnormal Group in Natural Rubber, *Polymer*, **17** (1976): 713-716.

11. Eng, A. H., Kawahara, S., and Tanaka, Y., Trans-isoprene Units in Natural Natural Rubber, *Rubb. Chem. Technol.*, **67** (1993): 159-168.

12. Tangpakdee, J., Structure Characterization of Natural Rubber: Analysis of Biosynthesis Mechanism, Branching Formation and Role of rubber in Hevea tree, PhD Thesis on Engineering submitted to the Tokyo University of Agriculture and technology, Japan. 1998.

13. Rubber Research Institute of Malaysia. RRIM training manual on latex and rubber analysis May 1979. Rubber Research Institute of Malaysia, Kuala lumphur, **24** (1979): 31-32, 44-53, 63.

14. Blackley, D. C. Polymer Lattices Science and Technology, Vol. 2 Types of Lattices, 2nd ed., London, Chapman & Hall. 1977. p. 79.

15. Auzac, J., Jacob, J. L., and Chrestin, H. Physiology of Rubber Tree Latex. Florida CRC Press. 1989. pp. 23-25.

16. Mourice, M. Rubber Technology. Litton Education Publishing. 1973. pp.152-175.

17. James, E. M., Burak, E., and Frederick.R. E. Science and Technology of Rubber, Academic Press. 2nd ed. 1994. pp. 419-432.

18. Rubber Research Institute of Thailand; Department of Agriculture. Revisions to Thai Technically Specified Rubber Scheme, 2 nd. 1999. pp. 4-6.

19. Ernst, T. T. Fragrance Chemistry-The Science of the Sense of Smell, Academic Press. 1982. p. 28.

20. Karl, L., and Carl, B. F. Antiperspirants and Deodorants (Cosmetic Science and Technology Series), New York: Marcel Dekker. **71**, 1988. pp. 345-348.

21. CTD, Inc. Cyclodextrin Resource. Available from: http://wwwcyclodextrin.com/natural_cyclodextrins.

22. Fred, W. Barlow Rubber Compounding: Principles, Material and Techniques, Marcel Dekker. 2nd, 1993. pp. 121-143.

23. Knorr, D. Use of Chitinous Polymers in Food, Food Technology, 1984. pp.38-85.

24. Park, S.Y., Park, H. J., and Sano, Y. Relation between Biopolymer Film Properties and Molecular Structure of Chitosan in Solution by Light-Scattering Method, Korea University, **1**, pp. 76-79.

25. Mario, L. O., and Harry, E. R. Zeolite Synthesis, ACS symposium Series 398, American Chemical Society. 1988. pp. 1-9.

26. Milton, J. R. Surfactants and Interfacial Phenomena, Surfactant Research Institute Brooklyn College, John Wiley & Sons. 2nd, 1993. pp. 1-5.

27. Isa, Z., Control of Mal-odour in SMR Factory, Planter's Bulletin, No.215, 1993. pp. 56-63.

28. Fabienne, F. V. and Linda, J. F., Release of Volatile Odor Compounds from Full-Fat and Reduced-Fat Frankfurters, *J. Agric. Food Chem*, **47** (1999): 5161-5168.

29. Reed, T., Improved Methods, Compositions and Articles for Odor Control, International Application Published Under The patent Cooperation Treaty (PCT), WO 01-1624 A2, March, 8 (2001).

APPENDICES

Appendix A

Table.A-1 The components of mal-odor from DPNR as identified by GC-MS

Symbol	Retention time (mins)	MW (amu)	Compound Description
a	1.00	45	N-methyl-Methanamine
b	2.31	86	2-Pentanone
c	3.19	100	Hexanal
d	4.14	122	Benzylhydrazine
e	12.10	88	Pentanol
f	13.24	73	N,N-dimethylformamide
g	14.56	87	N,N-dimethylacetamide
h	16.25	60	Acetic acid
i	18.02	74	Isobutyric acid
j	18.53	88	Butyric acid
k	19.30	88	Isovaleric acid
l	19.59	100	2-Methoxy phenol
m	20.28	102	Valeric acid
n	22.66	94	Phenol
o	23.36	130	Heptanoic acid

Table.A-2 The components of mal-odor from STR5L as identified by GC-MS

Symbol	Retention time (mins)	MW (amu)	Compound Description
a	1.10	45	Ethylamine
b	1.38	75	1-amino-2-propanol
c	2.15	86	Pentanal
d	4.17	122	Benzylhydrazine
e	9.26	114	Heptanone
f	11.14	88	Trans-hexene
g	11.49	120	1,2,4-trimethylbenzene
h	12.10	88	Pentanol
i	16.28	60	Acetic acid
j	17.39	74	Propionic aicd
k	19.32	88	Isobutyric acid
l	20.01	128	Naphthalene
m	22.67	94	Phenol
n	27.38	85	Piperidine

Table.A-3 The components of mal-odor from STR5 as identified by GC-MS

Symbol	Retention time (mins)	MW (amu)	Compound Description
a	1.08	45	Ethylamine
b	1.44	72	2-Butanone
c	16.25	60	Acetic acid
d	17.40	74	Propionic aicd
e	18.02	88	Isobutyric acid
f	18.56	88	Butyric acid
g	19.30	102	Isovaleric acid
h	20.25	102	Valeric acid
i	20.59	84	Cyclopentanone
j	22.08	94	Naphthalene
k	22.67	94	Phenol
l	24.36	108	p-Cresol
m	25.29	154	Acenaphthene
n	26.04	200	Lauric acid

Table.A-4 The components of mal-odor from STR10 as identified by GC-MS

Symbol	Retention time (mins)	MW (amu)	Compound Description
a	1.08	45	Ethylamine
b	1.41	72	2-Butanone
c	2.27	88	2-Pentanone
d	3.02	100	Hexanone
e	4.16	122	Benzylhydrazine
f	16.27	60	Acetic acid
g	17.40	74	Propionic acid
h	18.04	88	Isobutyric acid
i	18.56	88	Butyric acid
j	19.29	102	Isovaleric acid
k	20.25	102	Valeric acid
l	21.51	116	Hexanoic acid
m	23.15	106	1-Dodecyne
n	23.52	99	Piperidinone
o	24.58	172	Carpic acid

Table.A-5 The components of mal-odor from Smoke1 as identified by GC-MS

Symbol	Retention time (mins)	MW (amu)	Compound Description
a	1.08	45	Ethylamine
b	2.25	75	1-Amino-2-propanol
c	4.16	122	Benzylhydrazine
d	16.27	60	Acetic acid
e	16.56	106	Benzaldehyde
f	18.03	88	Isobutyric acid
g	18.38	88	Butyric acid
h	19.32	88	Isovaleric acid
i	20.01	128	Naphthalene
j	23.29	186	Lauryl alcohol / Oleic acid (282)

Table.A-6 The components of mal-odor from Smoke2 as identified by GC-MS

Symbol	Retention time (mins)	MW (amu)	Compound Description
a	0.57	45	Ethylamine
b	2.30	86	Pentanal
c	4.04	122	Benzylhydrazine
d	7.24	106	Ethylbenzene
e	13.22	120	1,2,3 Trimethylbenzene
f	16.25	60	Acetic acid
g	19.34	88	Isovaleric acid
h	20.00	128	Naphthalene
i	23.28	186	Lauryl alcohol
j	24.93	122	Diethylsulfone

Table.A-7 The components of mal-odor from Smoke3 as identified by GC-MS

Symbol	Retention time (mins)	MW (amu)	Compound Description
a	1.00	45	N-Methyl -methanamine
b	2.02	85	Thiazole
c	2.76	88	Pentanal
d	4.14	122	Benzylhydrazine
e	7.28	106	Ethylbenzene
f	8.45	106	1,4 Dimethylbenzene
g	9.20	114	2-Heptanone
h	10.53	106	tert-Butylbenzene
i	11.27	134	Isopropyl methylbenzene
j	11.49	120	1,2,4 Trimethylbenzene
k	16.28	60	Acetic acid
l	17.40	74	Propionic acid
m	19.07	126	Acetothiophenone
n	20.03	128	Naphthalene
o	21.51	124	p-Methoxyphenol
p	24.47	165	N,propional-p-aminophenol

Table.A-8 The components of mal-odor from Smoke4 as identified by GC-MS

Symbol	Retention time (mins)	MW (amu)	Compound Description
a	2.25	58	Propionaldehyde
b	4.12	122	Benzylhydrazine
c	7.26	106	Ethylbenzene
d	8.47	106	1,4-Dimethylbenzene
e	10.18	106	o-Xylene
f	10.50	106	tert-Butylbenzene
g	11.51	106	1,2,4-Trimethylbenzene
h	14.85	106	1,2,3-Trimethylbenzene
i	16.06	116	1-Phenyl propadiene
j	16.52	60	Acetic acid
k	17.36	74	Propionic acud
l	19.07	88	Butyric acid
m	20.04	128	Naphthalene
n	21.50	124	p-Methoxy phenol
o	23.47	94	Phenol
p	23.57	150	Piperinal
q	24.36	108	p-Cresol

Appendix B

Kinetic Study

Table B-1 The quantity of odor from STR5 as characterized by GC

Peak No.	Retention time (min)	Peak area				
		Week 1	Week 2	Week 3	Week 4	Week 5
1	0.892	15.376	18.153	15.685	25.767	35.561
2	0.930	29.199	32.924	32.195	40.649	41.343
3	0.994	72.016	82.155	99.650	106.306	110.748
4	1.060	7.7087	8.7708	11.075	12.111	12.614
5	1.126	58.828	64.778	80.739	85.041	84.388
6	1.225	11.191	12.651	13.886	16.370	15.235
7	1.279	10.299	10.469	12.461	13.381	12.150
8	1.424	3.703	4.028	5.370	5.746	5.693
9	6.344	4.954	4.869	11.499	10.810	11.722
10	7.301	1.712	1.787	3.773	3.122	2.800
11	7.660	1.932	1.760	2.821	2.744	3.453
12	8.333	0.663	0.804	1.303	1.148	1.147
13	8.615	0.900	1.091	1.390	1.446	1.606
14	9.496	0.447	0.535	1.444	0.677	0.890

Table B-2 The quantity of odor from Smoke3 as characterized by GC.

Peak No.	Retention time (min)	Peak area				
		Week 1	Week 2	Week 3	Week 4	Week 5
1	0.891	5.339	6.309	6.444	7.853	8.437
2	0.928	14.907	16.989	14.158	16.771	17.955
3	0.992	40.460	41.334	49.417	52.236	52.088
4	1.069	3.010	3.252	2.409	2.813	2.957
5	1.123	31.374	37.313	47.999	48.545	46.179
6	1.211	4.238	4.982	3.778	4.871	3.912
7	1.278	4.173	4.967	4.942	5.291	5.556
8	1.423	2.469	2.499	3.041	3.095	3.008
9	6.341	0	0.808	1.249	1.507	2.613
10	7.327	0	0.877	0.629	0.740	0
11	7.655	0	0.564	0.423	2.084	2.034
12	8.333	0	0.689	0.840	1.134	2.325
13	8.774	0	0.487	0.507	0.575	0.945
14	11.881	0	0.668	0.710	0.819	1.173

Table B-3 Peak areas and their percentages of the volatile component from STR20. Methyl valerate was added as an internal standard.

Retention time	Bottle1		Bottle2		Bottle3		Bottle4		Bottle5	
	Peak area	Percent area	Peak area	Percent area	Peak area	Percent area	Peak area	Percent area	Peak area	Percent area
0.932	4.69	3.13	4.92	3.24	4.85	3.17	4.88	3.22	4.76	3.14
0.994	7.36	4.91	7.08	4.66	7.25	4.73	7.27	4.80	7.14	4.71
1.060	0.75	0.50	0.73	0.48	0.75	0.49	0.76	0.50	0.72	0.47
1.132	0.8	0.53	0.86	0.57	0.81	0.53	0.83	0.55	0.84	0.55
1.225	1.37	0.91	1.39	0.92	1.39	0.91	1.38	0.91	1.37	0.90
1.277	0.77	0.51	0.67	0.44	0.71	0.46	0.72	0.48	0.68	0.45
1.331	0.26	0.17	0.22	0.14	0.25	0.16	0.26	0.17	0.23	0.15
1.423	0.55	0.37	0.61	0.40	0.59	0.39	0.58	0.38	0.6	0.40
1.650	0.38	0.25	0.41	0.27	0.41	0.27	0.42	0.28	0.4	0.26
1.819	130.11	86.76	132.05	86.96	133.25	86.99	131.56	86.82	131.94	87.03
6.350	1.03	0.69	1.13	0.74	1.09	0.71	1.06	0.70	1.08	0.71
7.335	0.55	0.37	0.51	0.34	0.52	0.34	0.53	0.35	0.51	0.34
8.312	0.58	0.39	0.48	0.32	0.51	0.33	0.49	0.32	0.53	0.35
9.497	0.77	0.51	0.8	0.53	0.79	0.52	0.79	0.52	0.81	0.53

Table B-4 Peak areas and their percentages of the volatile component from Smoke5. Methyl valerate was added as an internal standard.

Retention time	Bottle1		Bottle2		Bottle3		Bottle4		Bottle5	
	Peak area	Percent area	Peak area	Percent area	Peak area	Percent area	Peak area	Percent area	Peak area	Percent area
0.919	4.05	2.61	4.08	2.59	4.33	2.75	4.11	2.58	4.15	2.64
0.997	11.61	7.49	11.63	7.37	11.86	7.54	12.01	7.53	11.96	7.61
1.084	1.87	1.20	1.89	1.20	2.03	1.29	1.95	1.22	1.98	1.26
1.134	58.06	37.46	59.01	37.39	58.08	36.95	59.12	37.06	58.61	37.28
1.228	47.88	30.89	49.12	31.13	48.63	30.94	49.31	30.91	48.35	30.76
1.815	20.09	12.96	20.05	12.71	20.15	12.82	19.96	12.51	20.12	12.80
2.292	4.21	2.72	4.54	2.88	4.67	2.97	4.65	2.91	4.59	2.92
6.350	1.04	0.67	1.05	0.67	0.98	0.62	0.95	0.60	0.96	0.61
7.327	0.45	0.29	0.48	0.30	0.46	0.29	0.53	0.33	0.49	0.31
8.312	0.31	0.20	0.3	0.19	0.33	0.21	0.31	0.19	0.32	0.20
8.776	0.36	0.23	0.4	0.25	0.41	0.26	0.43	0.27	0.40	0.25
9.495	4.72	3.04	5.02	3.18	4.99	3.17	5.94	3.72	4.96	3.16
11.897	0.3	0.19	0.24	0.15	0.28	0.18	0.269	0.17	0.31	0.20

Appendix C

Table C-1 The amounts of mal-odor of STR20

No. of sample	Peak area for each Retention time													
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	214.53	207.469	474.241	56.0260	420.491	68.323	24.289	29.145	82.040	48.096	5.1135	12.038	9.113	6.314	1.022
2	268.038	165.875	560.057	53.3028	496.597	49.003	60.999	30.787	256.571	150.890	9.694	30.546	14.967	14.154	0
3	387.546	197.964	684.147	65.446	559.907	71.684	69.488	28.998	120.319	78.535	11.864	19.001	13.117	8.969	0
4.	435.17	207.184	834.234	83.913	532.533	111.369	108.269	40.319	312.537	123.585	30.745	38.383	22.216	16.919	0
5.	525.326	227.053	1021.85	102.069	880.789	116.110	183.290	50.997	250.955	121.936	25.345	25.863	15.262	13.937	0

Table C-2 The amounts of mal-odor from STR20 mixed with SDS

No. of sample	Peak area for each retention time													
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	16.856	72.275	163.149	22.899	178.265	42.791	33.973	12.740	102.290	51.512	3.033	9.260	0	3.5221	0
2	24.006	81.451	235.029	88.242	249.566	51.529	47.591	15.995	69.961	35.820	6.445	5.420	4.334	11.595	0
3	158.625	206.676	781.980	60.091	655.203	118.262	83.205	31.102	171.597	94.080	16.678	21.403	14.401	12.430	24.599
4.	197.238	178.167	834.602	54.223	709.745	98.489	93.572	34.290	274.207	118.436	12.641	24.429	13.310	12.536	24.882
5.	210.397	169.451	786.845	49.084	670.146	96.599	96.111	25.378	427.481	215.013	30.098	46.827	24.643	21.111	21.513

Table C-3 The amounts of mal-odor from STR20 mixed with cyclodextrin

No.of sample	Peak area of each retention time														
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	38.662	103.034	262.825	14.606	224.323	22.142	17.540	18.182	31.303	20.146	0	10.147	6.689	5.6627	0
2	74.398	138.568	409.951	32.490	371.666	43.173	44.534	20.155	68.384	38.372	5.047	10.161	9.004	5.8021	0
3	232.821	472.872	788.085	84.034	768.074	99.063	82.166	38.741	117.968	61.560	20.324	19.514	15.364	13.529	0
4.	284.617	223.334	831.225	64.041	719.093	72.453	79.361	35.449	137.361	61.619	17.202	17.787	13.319	10.569	0
5.	310.523	217.629	901.591	68.948	786.883	76.392	100.745	35.162	161.965	78.143	21.335	21.531	17.315	11.649	0

Table C-4 The amounts of mal-odor from STR20 mixed with carbon black

No. of sample	Peak area of each retention time														
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	87.532	122.699	339.044	23.747	311.554	56.523	15.476	278.224	59.848	29.264	5.529	8.820	13.516	13.097	0
2	225.206	123.732	553.171	29.993	585.683	80.411	29.010	364.067	95.964	45.308	6.587	14.456	11.775	7.886	0
3	353.655	238.818	1088.78	44.912	1059.73	141.149	53.797	683.483	256.725	115.647	41.854	33.158	31.008	24.125	0
4.	365.483	168.424	956.070	41.038	949.753	119.985	37.713	511.727	120.166	58.322	28.060	18.719	21.588	11.687	0
5.	383.949	154.148	1022.34	34.865	1008.51	124.821	56.285	567.122	117.181	52.390	19.434	16.161	12.526	10.447	0

Table C-5 The amounts of mal-odor from STR20 mixed with chitosan

No. of sample	Peak area of each retention time														
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	47.738	80.761	229.929	21.380	235.113	29.465	19.957	12.061	50.641	32.256	0	5.907	7.157	11.070	0
2	70.536	67.760	347.608	23.810	275.034	31.979	35.127	17.160	30.070	20.160	4.400	7.848	4.533	5.894	0
3	110.742	95.795	495.297	166.163	383.064	50.082	43.568	21.904	15.451	10.07	0	5.665	5.679	5.748	0
4.	154.101	119.661	594.156	48.4503	567.074	66.762	76.237	30.831	40.880	25.272	10.983	11.321	8.935	7.733	0
5.	184.981	144.956	782.593	55.769	651.365	74.872	93.504	32.476	46.625	37.388	14.709	13.214	12.521	12.903	0

Table C-6 The amounts of mal-odor from STR20 mixed with zeolite13X

No. of sample	Peak area of each retention time														
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	72.464	90.676	122.172	31.533	111.539	29.233	27.835	0	0	0	0	0	0	0	0
2	231.478	175.349	283.605	59.256	270.224	48.112	67.995	31.111	0	0	0	0	0	0	0
3	411.771	178.718	505.670	103.350	474.802	75.722	115.535	60.409	8.156	0	13.048	0	15.628	0	0
4.	497.411	159.356	515.732	87.324	532.582	86.989	114.973	53.167	7.126	13.999	14.469	0	0	0	0
5.	606.363	186.717	609.599	101.484	581.336	90.194	152.428	54.993	8.142	13.250	16.622	0	0	0	0

Table C-7 The amounts of mal-odor from STR20 mixed with benzakonium chloride

No. of sample	Peak area of each retention time														
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	565.975	304.332	1468.000	109.218	1095.200	96.640	60.680	0	112.708	46.452	0	15.375	14.350	5.797	43.540
2	723.574	123.703	1225.040	74.152	882.035	49.592	107.173	13.967	168.922	78.796	10.419	18.331	11.721	19.780	9.109
3	1158.590	330.993	1769.420	94.737	1268.823	60.859	149.739	21.507	211.605	91.262	38.844	26.009	21.899	14.873	123.246
4.	1068.707	144.925	1677.640	70.231	1169.083	53.172	123.162	18.765	196.909	80.203	23.766	20.671	16.017	10.854	72.476
5.	1186.800	167.008	1923.140	67.755	1386.001	59.858	147.444	28.813	425.580	180.998	32.414	46.780	35.691	27.216	144.613

Table C-8 The amounts of mal-odor from Smoke5

No. of sample	Peak area of each retention time														
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	28.763	137.692	207.342	16.877	200.976	25.228	12.508	11.906	16.045	5.182	5.525	0	0	0	0
2	27.768	72.003	130.758	7.418	106.305	10.323	10.901	4.095	8.431	12.445	3.318	5.201	0	0	0
3	35.830	113.335	239.065	13.727	211.182	19.855	26.256	6.006	18.749	18.644	6.524	0	0		
4.	44.435	139.745	298.212	15.624	255.473	17.470	32.858	6.085	20.393	26.007	8.864	6.840	6.411	5.976	0
5.	44.772	110.410	262.973	14.301	220.924	13.609	31.870	18.089	21.189	37.086	0	0	0	0	0

Table C-9 The amounts of mal-odor from Smoke5 mixed with SDS

No. of sample	Peak area of each retention time														
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	12.425	59.420	78.561	11.967	84.578	49.841	5.074	10.084	11.558	0	0	0	0	8.704	0
2	19.349	91.830	162.579	14.745	162.458	44.962	19.381	7.169	17.450	24.587	4.398	7.533	7.812	15.245	0
3	34.992	127.422	258.224	15.140	235.430	53.329	24.948	4.373	22.410	25.311	6.311	5.575	0	12.581	12.581
4.	45.810	176.435	386.266	20.627	358.100	51.193	37.412	9.408	29.016	34.466	10.711	12.142	13.591	16.461	16.461
5.	41.494	124.707	303.184	12.756	257.855	39.589	28.162	7.282	21.105	38.467	9.172	7.663	8.597	12.401	0

Table C-10 The amounts of mal-odor from Smoke5 mixed with cyclodextrin

No. of sample	Peak area of each retention time														
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	18.956	68.225	114.974	10.127	108.803	20.731	6.900	10.974	4.751	0	0	0	0	0	0
2	34.849	92.047	181.112	13.506	167.639	16.943	24.776	4.279	14.982	7.414	0	0	0	3.365	0
3	49.175	103.877	222.434	12.871	562.047	15.087	26.084	5.321	12.384	9.196	0	0	0	0	2.201
4.	71.192	156.385	362.734	22.056	333.274	27.290	47.519	7.316	25.594	15.673	4.491	9.015	12.546	0	4.627
5.	77.060	171.920	428.509	23.827	386.513	24.338	57.403	11.007	30.150	23.477	5.103	11.407	8.269	6.284	0

Table C-11 The amounts of mal-odor from Smoke5 mixed with carbon black

No. of sample	Peak area of each retention time														
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	109.946	80.344	292.192	0	378.878	0	0	0	2.022	0	6.250	5.257	0	0	0
2	206.773	45.870	195.350	8.709	316.186	13.081	7.194	8.969	7.530	5.251	0	8.068	5.142	0	0
3	246.254	89.007	334.592	11.084	556.007	23.198	9.665	14.208	13.167	7.343	13.284	5.442	0	0	0
4.	261.722	76.009	350.412	11.240	587.260	21.733	12.132	17.731	25.930	5.126	12.644	10.704	0	0	0
5.	332.272	52.130	238.961	8.769	628.376	22.561	11.631	16.620	16.310	15.961	14.799	12.295	1.384	0	0

Table C-12 The amounts of mal-odor from Smoke5 mixed with chitosan

No. of sample	Peak area of each retention time														
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	20.829	54.569	136.674	6.629	114.934	12.653	6.051	6.838	0	0	0	0	0	0	0
2	36.247	50.758	206.412	10.196	176.537	11.952	20.455	7.536	14.833	0	0	0	0	0	0
3	38.487	60.240	244.369	43.419	221.593	14.513	31.080	8.636	19.807	6.326	0	0	0	0	0
4.	48.003	85.616	322.827	17.124	278.543	17.915	44.061	10.880	22.349	11.274	9.103	4.605	5.179	3.393	0
5.	57.400	74.839	345.340	18.107	301.596	14.628	50.943	11.874	26.835	7.079	7.925	9.141	6.039	0	0

Table C-13 The amounts of mal-odor from Smoke5 mixed with zeolite13X

No. of sample	Peak area of each retention time														
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	101.653	82.843	119.600	28.517	57.911	16.207	39.587	18.568	0	0	0	0	0	0	0
2	152.813	54.178	143.272	28.868	57.796	12.552	46.110	2.595	16.641	0	0	0	0	0	0
3	225.852	81.801	195.829	38.328	90.522	13.806	67.399	2.495	21.088	0	0	0	0	0	0
4.	319.973	119.602	301.028	60.174	116.827	14.892	102.771	6.585	26.686	0	0	0	0	0	0
5.	366.129	77.393	339.428	60.145	119.949	14.329	105.419	2.931	28.410	0	0	0	0	0	0

Table C-14 The amounts of mal-odor from Smoke5 mixed with benzalkonium chloride

No. of sample	Peak area of each Retention time														
	0.890	0.929	0.994	1.063	1.131	1.235	1.290	1.444	6.426	7.417	7.750	8.409	8.865	9.590	10.495
1	179.820	248.843	777.919	41.195	687.424	53.884	34.534	18.705	38.636	15.121	38.732	0	0	0	0
2	357.498	217.743	992.246	42.879	766.792	49.934	38.025	19.352	22.161	49.105	19.012	36.016	0	0	0
3	519.348	154.537	1106.152	44.267	833.490	53.039	49.584	23.948	28.467	65.370	0	32.572	44.107	0	0
4.	585.835	177.923	1354.149	60.439	1038.700	73.300	75.162	29.185	36.745	89.253	8.725	15.087	36.796	53.039	2.753
5.	631.581	163.812	1199.187	48.430	908.112	61.971	59.708	21.252	32.522	80.749	35.816	56.502	0	0	0

VITA

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