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APPENDIX A

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

APPENDIX A

The materials used in headspace study

A = 60 mL vial for headspace study

B = Aluminium foil

C = Aluminium cap

D = Manual hand operated crimper

E = gray septa

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The procedure of sealed serum vial for headspace study.

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APPENDIX B

ศูนย์วิทยทรัพยากร
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Questionnaire for Research on Swimming Pool in Bangkok District

Date of Survey.....Month.....Year.....

---

1. Name of swimming pool.....

   Location : Address.....Road.....Thambon.....

   District.....Telephone No. .....

2. Owner's name.....Surname.....

   Address.....Road.....Thambon.....

   District.....Province.....Telephone No. .....

3. License granted by Bangkok Metropolitan Administration

   ☐ 1) Available ; No.....Code No.....Year.....

   ☐ 2) N/A

   ☐ 3) Not entitled to license

4. Service Hours : from.....to.....

5. Location of swimming pool ☐ 1) indoor ☐ 2) outdoor

6. Size of swimming pool

   6.1 Width.....metres

   6.2 Length.....metres

   6.3 Deepest area.....metres

   6.4 Shallowest area.....metres

   6.5 Width of walkway around swimming pool.....metres

7. Source of water used in swimming pool

   ☐ 1) Tap water

   ☐ 2) Artesian water

   ☐ 3) Canal or river water

   ☐ 4) Others, please indicate :.....

8. Availability of water circulation system

   ☐ 1) Yes

   ☐ 2) No

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9. Type of water circulation system (see the detail in the last page)

□ 1) Type 1

□ 2) Type 2

□ 3) Type 3

□ 4) Type 4

□ 5) Type 5

□ 6) unclassified

10. Drainage of swimming pool

10.1 No. of water inlet pipe.....pipes size.....inches

located at.....of swimming pool

10.2 No. of water outlet pipe.....pipes size.....inches

located at.....of swimming pool

11. Type of water filter

□ 1) Sand fiiter □ 2) Diatomaceous earth filter

12. Cleaning of swimming pool

12.1 Frequency of cleaning.....times/day

12.2Method.....

.....

12.3 Cleaning of filter.....times/day

12.4 Cleaning of drainage pipe around swimming pool.....times/day

13. Rate of water circulation.....

14. Period of water circulation of the swimming pool.....hours

15. Period of drainage of the swimming pool.....months

16. Other facilities

16.1 Bathroom for woman.....rooms

16.2 Bathroom for man.....rooms

16.3 Toilet for woman.....rooms

16.4 Toilet for man.....rooms

16.5 Availability area for cleaning feet prior to swim

□ 1) yes □ 2) No

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17. Using of swimming pool

17.1 Swimming pool is available for service to

□ 1) public □ 2) member

17.2 Physical check for swimming users

□ 1) Yes □ 2) No

17.3 Average number of swimming pool users.....

17.4 High time period for the use of swimming pool.....

Low time period for the use of swimming pool.....

17.5 Age of swimming pool users.....years

17.6 Most of swimming pool users are

□ 1) male □ 2) Female

18. Rules in using swimming pool

□ 18.1 Bathing before using the pool

□ 18.2 Washing feet before using the pool

□ 18.3 Others, please indicate.....

19. Availability of live-rescue equipment

□ 19.1 Kick board

□ 19.2 Buoy

□ 19.3 Others, please indicate.....

20. Availability of swimming pool guard from .....to.....hours

□ 20.1 Undergo training .....Female.....Male.....

□ 20.2 Have not received training.....Female.....Male.....

21. Disinfection method

□ 1) Chlorine gas

□ 2) Calcium hypochlorite

□ 3) Sodium hypochlorite

□ 4) Cyanurate

□ 5) Ozone

□ 6) Others, please indicate.....

21.1 Chemical amount used in disinfection...../time

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21.2 Period of time for chemical adding .....

21.3 Frequency of adding chemicals .....times/week

21.4 Chemical adding method

☐ 1) By automatic system equipment; indicate method.....

.....

☐ 2) Adding without equipment; indicate method.....

.....

22. Availability of chemical in algae control

☐ 1) Yes, indicate type of chemical.....

☐ 2) No

22.1 Amount of chemical being used .....

22.2 Period of time for adding chemical.....

22.3 Frequency of adding chemical.....times/week

22.4 Method .....

23. Availability of chemical in pH control

☐ 1) Yes, please indicate.....

☐ 2) No

23.1 Amount of chemical being used .....

23.2 Period of time for adding chemicals.....

23.3 Frequency of adding chemicals.....times/week

23.4 Method .....

24. Availability of water quality checking

☐ 1) Yes ☐ 2) No

25 Depth level from surface water for collecting water sample.....metres

26. Sample collecting spot.....

27. Availability of report of the checking

☐ 1) Yes ☐ 2) No

28. Checking parameters

28.1 pH : indicate method.....

28.2 Chlorine residual : indicate method.....

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28.3 bacteria specify..... method.....

28.4 Others,please indicate.....

29. Frequency in water quality checking.....times/week

30. Water quality is checked by:

□ 1) swimming pool's staff

□ 2) company, please indicate .....

31. Maintenance of swimming pool.....

32. Problems found in the swimming pool.....

33.Other recommendations.....

Remarks: Distributor's name of chemicals used in swimming pool.....

.....

Interviewed by.....

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Water circulation system types of swimming pool

Type 1. Water inlet pipes are set in alignment with the pool's side lenght and outlet pipes are set at the opposite side.More pipes are set at the shallow area of the pool.

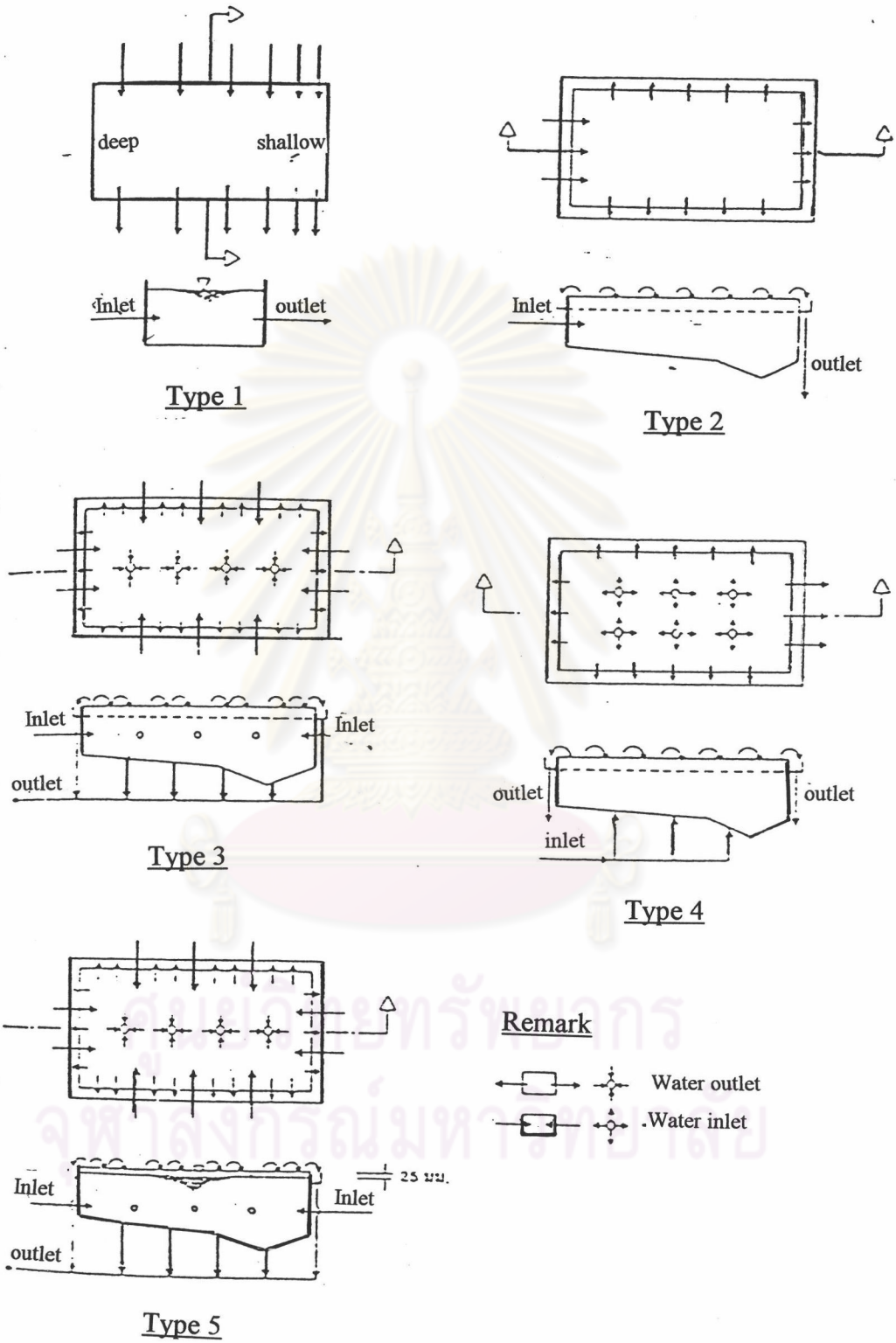
Type 2. At the shallow area, around 4-6 placements of inlet pipes are set at the width's side of the pool.The outlet water should flow through the overflow channel.

Type 3. Overflow channel are set around the pool.More than three outlet pipes are set in the central line of the bootom of the pool. Inlet pipes are distribute to the pool wall.

Type 4. Water flows into the pool through the pipes setting around the bottom of the pool and flows out through the overflow channel around the pool.The water should be replaced by clean water derived from the pool's bottom. Meanwhile,the wastewater, mostly at the water surface will be eliminated within a short time and will not be mixed with most of the pool's water.Thus,this system type is considered perfect. However, it must consist of balancing tank or surge tank for reserving the water which is replaced by the swimmers, and meanwhile used as a water reserve tank for further conveying water to the water cleaning system.

Type 5. This type is for the smaller or middle size of pool.Inlet pipes are set at the side.Water outlet pipes are set at the bottom of the pool and overflow channel are set too.Water level is kept at 25 mm. lower from the edge of the pool.Therefore,when there are swimmers,the water will overflow into the pump to the cleaning system.When there's no swimmiers, water are pumped to the outlet pipe set at the bottom of the pool.This pool is called deck-level pool.

Type 6 Unclassified in any type.



Types of water circulation

Excerpts from Bangkok Metropolitan Administration's Regulations on Commerce which is Disgusting or Harmful to Health :

Type : Swimming Pool - B.C. 2530

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* There shall be walkway, of which the width not less than 1.00 metre measured from the pool edges, around the pool.

* Water quality in the pool shall be as follow :

- In case of chlorine being used, there shall be free chlorine residual in water not less than 0.6 mg/L and not exceed 1 mg/L while the pool is being used by swimmers. There shall be daily collections of water sample for chlorine checking and record them as statistics for investigation by the officials.

- The water shall contain pH not less than 7.2 and not exceed 8.4 while being used by the swimmers.There shall be daily collections of water sample for pH checking and record them as statistics for investigation by the officials.

- There shall be, at least once a week, collection of water sample for biological analysis. Sample collecting shall be made at least at two spots i.e. deep and shallow areas. And collecting time is during the period of highest numbers of swimmers using the pool. The analysis shall be recorded as stastistic, for officials' investigation.

- The turnover rate of water of the whole pool through water circulation system shall not be exceed 8 hours.

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APPENDIX C

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Table A-1 Primary data of swimming pools. (a=available, n/a=not available, *= not indicate)

sampling site	location	pool size (m)	shallow-deep (m)	width of walkway(m)	source of water	type of water circulation	pool cleaning	filter type	filter cleaning
1	outdoor	7 x 10	1.0 - 10.0	2	tap water	4	1 time/day	2	1 time/week
2	outdoor	6 x12	1.0 - 2.4	*	tap water	4	1 time/day	2	1 time/week
3	outdoor	5 x 8	1.0 - 3.0	3	tap water	6	1 time/day	2	2 times/month
4	outdoor	4 x 7	1.0 - 4.0	3	tap water	6	1 time/day	2	1 time/15 days
5	outdoor	5 x 9	1.0 - 3.0	1	tap water	4	1 time/day	1	uncertain
6	outdoor	10 x 10	1.0 - 1.0	1	tap water	4	1 time/day	2	1 time/day
7	outdoor	8 x12	1.5 - 2.5	2	tap water	5	1 time/day	2	1 time/15 days
8	outdoor	10 x 15	1.5 -1.6	1	tap water	5	1 time/day	2	1 time/15 days
9	outdoor	13 x15	0.89 -1.46	1.5	tap water	4	1 time/day	*	*
10	outdoor	8 x 10	1.0 - 2.0	1	tap water	6	1 time/day	1	1 time/week
11	outdoor	7 x 15	1.2 - 1.8	1	tap water	6	1 time/day	1	1 time/3 months
12	outdoor	6 x 11	0.80 - 2.75	1	tap water	1	1 time/day	2	*
13	outdoor	3 x 10	1.2 - 1.2	1	tap water	6	1 time/day	*	*
14	outdoor	5 x 10	1.0 - 2.0	1.2	tap water	5	1 time/day	*	1 time/15-30 days
15	outdoor	6 x 9	0.8 - 2.5	1	tap water	1	1 time/day	2	1 time/week

Table A-1(Continue)

sampling site	period of water circulation(hr)	period of drainage water	physical check	chlorine type	frequency of chlorine used	availability of water quality	frequency of Cl-pH test	frequency of biological test
1	24	36 months	n/a	chlorine 98%	1 time/week	n/a	1 time/week	n/a
2	*	*	n/a	chlorine 90 %	7 time/week	a	7 times/week	n/a
3	*	*	n/a	chlorine 90 %	7 time/week	a	7 times/week	n/a
4	16	*	n/a	chlorine	7 time/week	a	7 times/week	n/a
5	*	*	n/a	chlorine	7 time/week	a	7 times/week	n/a
6	*	*	n/a	chlorine 90 %	7 time/week	a	7 times/week	n/a
7	8 to 9	12 months	n/a	chlorine 90 %	3-4 times/week	a	7 times/week	n/a
8	8 to 9	36 months	n/a	chlorine 90 %	3 times/week	a	7 times/week	n/a
9	*	12 months	n/a	chlorine 90 %	7 time/week	n/a	7 times/week	n/a
10	*	*	n/a	chlorine 60%	7 time/week	n/a	1 time/month	n/a
11	*	*	n/a	chlorine 70%	7 time/week	n/a	7 times/week	n/a
12	*	12 months	n/a	chlorine 90 %	7 time/week	n/a	7 times/week	n/a
13	*	1 month	n/a	*	2 time/week	a	2-3 times/week	n/a
14	4 to 19	18 months	n/a	chlorine 90 %	7 time/week	a	7 times/week	n/a
15	*	12 months	n/a	chlorine 90 %	7 time/week	n/a	*	n/a

Table A-1(Continue)

sampling site	location	pool size (m)	shallow-deep (m)	width of walkway(m)	source of water	type of water circulation	pool cleaning	filter type	filter cleaning
16	outdoor	8 x 10	0.75-1.75	1	tap water	4	2times/day	2	1 time/3 days
17	outdoor	6 x 12	1.0 - 2.5	1 - 2	tap water	6	1 time/day	2	*
18	outdoor	5 x 10	1.0 - 1.5	2	tap water	5	1 time/day	1	1 time/15 days
19	outdoor	3 x 7	1.0 - 3.0	3	tap water	5	1 time/day	2	1 time/week
20	outdoor	3 x 6	1.0 - 3.0	3	tap water	4	1 time/day	2	1 time/week
21	outdoor	5.9 x 11.8	0.9 - 2.6	1	tap water	4	1 time/day	2	1 time/week
22	outdoor	4 x 12	1.5 - 2.0	2	tap water	4	1 time/day	2	1 time/15 days
23	outdoor	6 x 12.5	1.5 - 1.5	2	tap water	4	1 time/day	1	1 time/week
24	outdoor	*	1.5 - 3.5	1	tap water	6	1 time/day	1	1 time/3 days
25	outdoor	8 x 15	0.5 - 3.21	3	tap water	4	1 time/2 days	2	1 time/10 days
26	outdoor	3 x 9	0.9 - 4.5	2	tap water	4	1 time/day	2	1 time/2 days
27	outdoor	5 x 12	1.5 -2.0	*	tap water	6	1 time/day	2	1 time/week
28	outdoor	5 x 14	1.2 - 3.2	2	tap water	6	1 time/day	2	1 time/5 days
29	outdoor	5 x 13	1.5 - 3.0	2.5 -5	tap water	6	1 time/day	2	1 time/week
30	outdoor	3 x 6	0.35-2.65	2.5 - 4	tap water	6	1 time/day	1	1 time day

Table A-1(Continue)

sampling site	period of water circulation(hr)	period of drainage water	physical check	chlorine type	frequency of chlorine used	availability of water quality	frequency of Cl-pH test	frequency of biological test
16	*	*	n/a	chlorine 10 %	2-3 times/week	a	1 time/week	n/a
17	*	*	n/a	chlorine 70 %	7 time/week	n/a	7 times/week	n/a
18	24	6 months	n/a	chlorine 90 %	7 time/week	n/a	7 times/week	n/a
19	*	*	n/a	chlorine 90 %	7 time/week	n/a	7 times/week	n/a
20	*	*	n/a	chlorine 70%	7 time/week	n/a	7 times/week	n/a
21	24	36 months	n/a	chlorine 98%	1 time/week	n/a	1 time/week	n/a
22	24	12 months	n/a	chlorine 90 %	1 time/2 days	n/a	7 times/week	n/a
23	24	12 months	n/a	chlorine 90 %	1 time/week	a	*	1 time/month
24	*	*	n/a	chlorine	7 times/week	a	uncertain	n/a
25	*	*	n/a	chlorine	1 time/5 days	a	1 time/5 days	n/a
26	*	*	n/a	chlorine	7 times/week	n/a	1 time/week	n/a
27	*	3 months	n/a	chlorine	7 times/week	n/a	*	n/a
28	*	12 months	n/a	chlorine 90 %	1 time/2 week	n/a	*	n/a
29	24	12 months	n/a	chlorine 70%	7 times/week	n/a	1 time/week	n/a
30	24	24 months	n/a	chlorine 90 %	7 times/week	n/a	*	n/a

Table A-1(Continue)

sampling site	location	pool size (m)	shallow-deep (m)	width of walkway(m)	source of water	type of water circulation	pool cleaning	filter type	filter cleaning
31	outdoor	6 x 12	1.37-2.55	2 - 4.5	tap water	4	1 time/day	2	1 time/week
32	outdoor	5 x 10	2.0 - 3.0	1.5	tap water	6	1 time/day	2	1 time/2-3 days
33	outdoor	3 x 7	0.5 - 2.5	3	tap water	6	1 time/day	2	*
34	outdoor	7 x 15	0.5 - 2.5	2 - 4	tap water	6	1 time/day	2	1 time/month
35	outdoor	12 x 18	0.9 - 3.0	4	tap water	1	1 time/day	2	1 time/week
36	outdoor	18 x 20	0.4 - 1.5	2	tap water	*	1 time/day	1	1 time/week
37	outdoor	5 x 10	1.2 - 2.7	0.5 - 2	tap water	6	1 time/2 days	1 , 2	1 time/2 days
38	outdoor	6 x 10	0.9 - 2.72	2 - 3	tap water	6	1 time/day	2	*
39	outdoor	12 x 25	1.0 - 3.5	3	tap water	6	1 time/day	2	1 time/week
40	outdoor	12.5 x 25	1.0 - 3.0	2	tap water	6	1 time/day	2	2 times/week
41	outdoor	12.5 x 25	1.2 - 1.8	2	tap water	4	1 time/day	2	1 time/week
42	outdoor	12 x 25	1.45 - 3.0	3	tap water	*	1 time/day	1	1 time/3 days
43	outdoor	12.5 x 25	0.9 - 2.45	3.5	tap water	4	1 time/day	2	1 time/2 days
44	outdoor	13 x 25	0.9 - 3.0	2	tap water	4	1 time/day	2	1-2 times/week
45	outdoor	12.5 x 25	0.85 - 2.60	3	tap water	6	1 time/day	2	1 time/2 days

Table A-1(Continue)

sampling site	period of water circulation(hr)	period of drainage water	physical check	chlorine type	frequency of chlorine used	availability of water quality	frequency of Cl-pH test	frequency of biological test
31	24	*	n/a	chlorine 90 %	7 times/week	a	3 times/week	n/a
32	12	*	n/a	chlorine 70 %	7 times/week	n/a	1 time/month	n/a
33	12	*	n/a	Phosphoric acid 85 %	2-3 times/week	a	2-3 times/day	n/a
34	12	*	n/a	chlorine	2 times/week	a	2-3 times/day	n/a
35	*	1 month	n/a	chlorine	7 times/week	a	7 times/week	n/a
36	8	12 months	n/a	chlorine 90 %	3-4 times/week	a	7 times/week	n/a
37	24	6 months	n/a	chlorine 70 %	4 times/week	a	14 times/week	n/a
38	24	6 months	n/a	chlorine 90 %	7 times/week	a	2-3 times/day	n/a
39	24	12 months	a	chlorine	7 times/week	a	14 times/week	n/a
40	*	12 months	a	chlorine 90 %	7 times/week	n/a	7 times/week	n/a
41	*	*	a	chlorine 90 %	7 times/week	a	14 times/week	1 time/month
42	*	*	a	chlorine60, 70, 90 %	7 times/week	a	7 times/week	1 time/month
43	*	12 months	n/a	chlorine 90 %	7 times/week	a	7 times/week	n/a
44	*	*	n/a	chlorine 90 %	7 times/week	n/a	*	n/a
45	*	*	n/a	chlorine 90 %	7 times/week	a	7 times/week	n/a

Table A-1(Continue)

sampling site	location	pool size (m)	shallow-deep (m)	width of walkway(m)	source of water	type of water circulation	pool cleaning	filter type	filter cleaning
46	outdoor	6 x 12	1.5 - 1.5	1.2	tap water	6	1 time/day	2	1 time/week
47	outdoor	6 x 12	1.2 - 2.3	1.5	tap water	6	1-2 time/week	2	1 time/15-20 days
48	outdoor	6 x 12	1.0 - 1.7	1.5	tap water	4	1 time/day	2	1 time/4 days
49	outdoor	10 x 15	0.5 -2.6	1.5	tap water	6	1 time/day	2	1 time/week
50	outdoor	*	*	3	tap water	4	1 time/day	2	1 time/week
51	outdoor	7 x 12	1.7-2.4	1.5	tap water	4	1 time/day	2	1 time/day
52	outdoor	12.5 x 25	1.3 - 1.5	2	tap water	6	1 time/day	1	1 time/week
53	outdoor	12 x 25	1.5 - 3	3	tap water	*	1 time/day	2	1 time/week
54	outdoor	12.5 x 25	1.0 - 3.0	2.5	tap water	4	1 time/day	1	1 time/day
55	outdoor	12.5 x 25	1.2 - 1.8	2.5	tap water	4	1 time/day	2	1 time/2 days
56	outdoor	12.5 x 25	0.8 - 2.0	2.5	tap water	4	1 time/day	1	1 time/2 days
57	outdoor	12.5 x 25	1.0 - 2.8	4	tap water	3	1 time/day	1	1 time/week
58	outdoor	20 x 25	0.7 - 2.5	2.5	tap water	3	1 time/day	2	1 time/week
59	outdoor	12 x 25	0.9 - 2.8	2	tap water	4	1 time/day	2	1 time/2 days
60	outdoor	15 x 25	1.0 - 2.0	2	tap water	5	1 time/day	2	1 time/week

Table A-1(Continue)

sampling site	period of water circulation(hr)	period of drainage water	physical check	chlorine type	frequency of chlorine used	availability of water quality	frequency of Cl-pH test	frequency of biological test
46	*	*	n/a	chlorine 90 %	7 times/week	a	*	n/a
47	*	*	n/a	chlorine 90 %	3 times/week	a	*	n/a
48	24	*	n/a	chlorine 90 %	uncertain	a	7 times/week	n/a
49	*	*	n/a	chlorine 10-15 %	7 times/week	*	*	n/a
50	24	*	n/a	chlorine 90 %	7 times/week	a	*	n/a
51	>4	*	n/a	ozone+chlorine90%	1 time/week	a	7 times/week	n/a
52	*	12 months	n/a	chlorine 70 %	7 times/week	n/a	7 times/week	n/a
53	*	12 months	a	chlorine 70 %	7 times/week	a	7 times/week	1 time/month
54	6	*	n/a	chlorine 90 %	7 times/week	a	*	n/a
55	*	12 months	n/a	chlorine 90 %	7 times/week	a	*	n/a
56	*	6 months	a	chlorine 90 %	4 times/week	a	*	n/a
57	*	*	a	chlorine 90 %	7 times/week	a	7 times/week	1 time/week
58	*	6-12 months	n/a	chlorine60, 90 %	7 times/week	n/a	7 times/week	n/a
59	12	*	a	chlorine 90 %	7 times/week	n/a	7 times/week	n/a
60	*	*	n/a	chlorine 90 %	7 times/week	a	7 times/week	n/a

Table A-1(Continue)

sampling site	location	pool size (m)	shallow-deep (m)	width of walkway(m)	source of water	type of water circulation	pool cleaning	filter type	filter cleaning
61	outdoor	15 x 25	1.0 - 3.5	4	tap water	6	1 time/day	2	1 time/3 days
62	outdoor	5 x 12	1.5 - 3.5	2	tap water	6	1 time/day	1	1 time/day
63	outdoor	10 x 25	0.6 - 2.9	3	tap water	4	1 time/day	1	1 time/week
64	outdoor	*	*	3	tap water	4	1 time/day	2	1 time/2-3 days
65	outdoor	*	1.0 - 2.5	2	tap water	2	1 time/day	2	1 time/2 days
66	outdoor	15 x 27	1.1 - 2.4	6	tap water	6	1 time/day	1	1 time/3 days
67	outdoor	8.69 x 21	0.5 - 1.8	2.5	tap water	4	1 time/day	1	2 times/day
68	outdoor	12 x 25	1.0 - 2.7	2	Artesian water	6	1 time/day	2	1 time/day
69	outdoor	14 x 25	1.2 - 1.8	4	tap water	4	1 time/day	2	*
70	outdoor	6 x 12	1.2 - 2.4	3	tap water	*	*	2	1 time/month
71	outdoor	12 x 24	1.3 - 2.4	2 to 4	tap water	6	1 time/day	1	1 time/month
72	outdoor	21 x 50	1.5 - 4	2.5	tap water	4	1 time/2 days	1	1 time/month
73	outdoor	5 x 12	0.8 - 1.9	4	tap water	4	1 time/day	2	1 time/3 days
74	outdoor	7 x 12	1.2 - 2.68	4	tap water	6	1 time/day	2	1 time/day
75	outdoor	12.5 x 25	0.9 - 2.6	0.4	tap water	4	1 time/day	2	1 time/week

Table A-1(Continue)

sampling site	period of water circulation(hr)	period of drainage water	physical check	chlorine type	frequency of chlorine used	availability of water quality	frequency of Cl-pH test	frequency of biological test
61	*	*	n/a	chlorine 90 %	7 times/week	n/a	7 times/week	n/a
62	24	*	n/a	*	7 times/week	a	14 times/week	n/a
63	6	*	n/a	chlorine 70,90 %	1 time/week	a	21 times/week	2 times/month
64	6	*	n/a	chlorine 70,90 %	1 time/week	a	21 times/week	2 times/month
65	*	*	n/a	chlorine 10 %	7 times/week	a	*	n/a
66	24	*	n/a	chlorine 10 %	all time	a	21 times/week	1 time/month
67	24	*	n/a	chlorine 10 %	all time	a	7 times/week	1 time/month
68	*	3 months	n/a	chlorine 90 %	7 times/week	a	*	uncertain
69	*	*	n/a	chlorine 70,90 %	uncertain	a	*	n/a
70	24	*	n/a	chlorine 90 %	7 times/week	a	*	1 time/year
71	24	12 months	a	chlorine 90 %	7 times/week	a	7 times/week	2-3 times/month
72	24	*	n/a	chlorine gas	7 times/week	a	1 time/week	1 time/month
73	24	*	n/a	chlorine 90 %	7 times/week	a	7 times/week	1 time/month
74	24	*	n/a	chlorine 90 %	7 times/week	a	7 times/week	1 time/month
75	24	12 months	n/a	chlorine 90 %	7 times/week	a	*	1 time/6 months

Table A-1(Continue)

sampling site	location	pool size (m)	shallow-deep (m)	width of walkway(m)	source of water	type of water circulation	pool cleaning	filter type	filter cleaning
76	outdoor	18 x 25	1.4 - 2.78	3	tap water	2	1 time/day	2	1 time/month
77	outdoor	10 x 25	1.5 - 4.0	1.5	tap water	6	2 times/day	2	1 time/3 days
78	outdoor	5 x 10	0.5 - 1.5	3	tap water	4	1 time/day	2	1 time/week
79	outdoor	13.5 x 25	0.95 - 3.25	3	tap water	6	1 time/day	2	1 time/5 days
80	outdoor	12.5 x 25	1.4 -1.7	1	tap water	*	1 time/day	2	2 times/week
81	outdoor	13.75 x 25	1.3 -3.5	2	tap water	6	1 time/day	1	1 time/week
82	outdoor	12.30 x25	0.6 -2.8	2	tap water	4	1 time/day	1	1 time/week
83	outdoor	17.2 x 25.	0.6 - 2.2	3	tap water	4	*	2	uncertain
84	outdoor	12.5 x 25	1.0 - 3.0	3	tap water	4	1 time/day	2	1 time/week
85	outdoor	12 x 20	0.7 - 1.5	2.5	tap water	5	1 time/2 days	2	1 time/week
86	outdoor	11 x 24	0.9 - 2.8	2	tap water	6	1 time/day	1	1 time/2 days
87	outdoor	12.5 x 25	0.5 - 3.0	1.5	tap water	4	2 times/week	2	2 times/week
88	outdoor	12 x 25	0.6 - 2.9	2	tap water	4	1 time/day	2	1 time/day
89	outdoor	6 x 12	1.2 - 12.0	3	tap water	5	1 time/day	1	1 time/day
90	outdoor	12 x 20	0.82 - 2.1	3	tap water	5	1 time/day	1	1 time/day

Table A-1(Continue)

sampling site	period of water circulation(hr)	period of drainage water	physical check	chlorine type	frequency of chlorine used	availability of water quality	frequency of Cl-pH test	frequency of biological test
76	19-20	*	n/a	chlorine 90 %	5-6 times/week	a	7 times/week	1 time/6 months
77	*	*	n/a	chlorine 70%	all time	a	7 times/week	n/a
78	*	4 months	n/a	chlorine 90 %	7 times/week	a	*	n/a
79	24	12 months	a	chlorine 90 %	7 times/week	a	14 times/day	1 time/month
80	24	12 months	n/a	chlorine 90 %	7 times/week	a	*	n/a
81	24	12 months	a	chlorine70, 90%	1 time/3-4 days	a	1 time/week	n/a
82	24	*	n/a	chlorine70, 90%	7 times/week	a	7 times/week	1 time/month
83	24	*	n/a	chlorine 70%	all time	a	14 times/week	1 time/month
84	8	24 months	n/a	chlorine 90 %	7 times/week	a	28 times/week	2 times/month
85	*	*	n/a	chlorine 70%	uncertain	n/a	*	n/a
86	*	*	n/a	chlorine 90 %	7 times/week	a	*	n/a
87	24	12 months	a	chlorine 90 %	7 times/week	a	3 times/week	n/a
88	24	12 months	n/a	chlorine 60, 90%	7 times/week	n/a	7 times/week	n/a
89	24	*	n/a	chlorine 10 %	7 times/week	n/a	7 times/week	n/a
90	24	*	n/a	chlorine 10 %	7 times/week	n/a	7 times/week	n/a

Table A-1(Continue)

sampling site	location	pool size (m)	shallow-deep (m)	width of walkway(m)	source of water	type of water circulation	pool cleaning	filter type	filter cleaning
91	outdoor	7 x 14	0.8 - 2.55	2	tap water	*	1 time/day	1	1-2 times/month
92	outdoor	10 x 20	0.5 - 3.0	3	tap water	3	1 time/day	2	1 time/2-3 days
93	outdoor	15 x 25	1.35 -1.75	2.5	tap water	4	1 time/day	2	1 time/3-4 days
94	outdoor	8 x 14	1.0 - 3.0	3.5	tap water	5	1 time/day	1	1time/day
95	outdoor	12 x 25	0.9 - 3.5	1.5 - 2	tap water	*	1 time/day	1 , 2	1 time/week
96	outdoor	14 x 25	0.9 - 2.8	2	tap water	*	2 times/day	1	1 time/3-6 months
97	outdoor	12.5 x 25	1.0 - 2.2	3	tap water	4	1 time/2days	2	1 time/month
98	outdoor	9 x 16	1.2 - 1.65	1	tap water	5	1 time/day	2	1 time/week
99	indoor	6 x 10	2.0 -2.0	1	tap water	6	1 time/day	1	1time/day
100	outdoor	12 x 25	1.3 - 1.5	0.7	tap water	4	1 time/2days	2	1time/day
101	outdoor	10 x 20	0.9 - 2.7	3.5	tap water	4	1 time/day	2	1time/day
102	outdoor	12.5 x 25	0.5 - 3.0	1.5	tap water	4	1 time/day	2	1 time/3 days
103	outdoor	R = 40	0.6 - 0.8	3	tap water	4	1 time/day	2	1time/day
104	outdoor	18 x 40	1.2 - 1.8	3	tap water	4	1 time/day	2	1time/day

Table A-1(Continue)

sampling site	period of water circulation(hr)	period of drainage water	physical check	chlorine type	frequency of chlorine used	availability of water quality	frequency of Cl-pH test	frequency of biological test
91	24	*	n/a	chlorine	7 times/week	a	7 times/week	1 time/year
92	24	*	a	chlorine	7 times/week	n/a	uncertain	n/a
93	12	*	n/a	chlorine	7 times/week	n/a	7 times/week	n/a
94	24	12 months	n/a	chlorine 10 %	7 times/week	a	*	1 time/month
95	10	*	n/a	chlorine10 ,90 %	7 times/week	a	7 times/week	n/a
96	24	*	n/a	chlorine gas, 90%	7 times/week	a	21 times/week	1 time/month
97	24	uncertain	a	chlorine 90 %	7 times/week	a	7 times/week	n/a
98	12	5 months	a	chlorine 60%	7 times/week	a	1 time/week	n/a
99	12	6 months	a	chlorine	3 times/week	n/a	3 times/week	n/a
100	*	*	n/a	chlorine 90 %	7 times/week	a	14 times/week	uncertain
101	24	*	n/a	chlorine 90 %	1 time/week	a	14 times/week	uncertain
102	24	3 months	n/a	chlorine 90 %	7 times/week	n/a	7 times/week	n/a
103	24	12 months	n/a	chlorine 70%	7 times/week	a	21 times/week	n/a
104	24	12 months	n/a	chlorine 70%	7 times/week	a	21 times/week	n/a

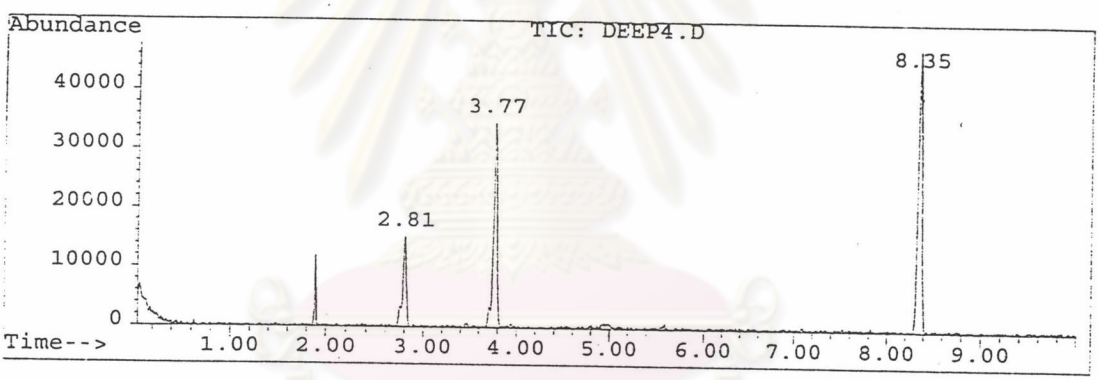
APPENDIX D

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Search Libraries: C:\DATABASE\WILEY138.L Minimum Quality: 0

Unknown Spectrum: Apex
Integration Params: swim

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
1	2.81	14.92	C:\DATABASE\WILEY138.L			
			Methane, dichloro-	116808	000075-09-2	83
			Methane, dichloro-	116807	000075-09-2	83
			Methane, dichloro-	116805	000075-09-2	83
2	3.78	33.04	C:\DATABASE\WILEY138.L			
			Chloroform	3697	000067-66-3	90
			Chloroform	119702	000067-66-3	90
			Chloroform	119703	000067-66-3	90
3	8.36	52.04	C:\DATABASE\WILEY138.L			
			Ethene, tetrachloro-	18146	000127-18-4	97
			Ethene, tetrachloro-	125230	000127-18-4	94
			Ethene, tetrachloro-	125232	000127-18-4	94



Retention Time	Area	Area %	Ratio %
Total Ion Chromatogram			
2.807	413381	14.920	28.673
3.774	915509	33.044	63.501
8.354	1441726	52.036	100.000

Figure 1 The gas chromatogram with MSD detection for headspace of swimming pool sample.

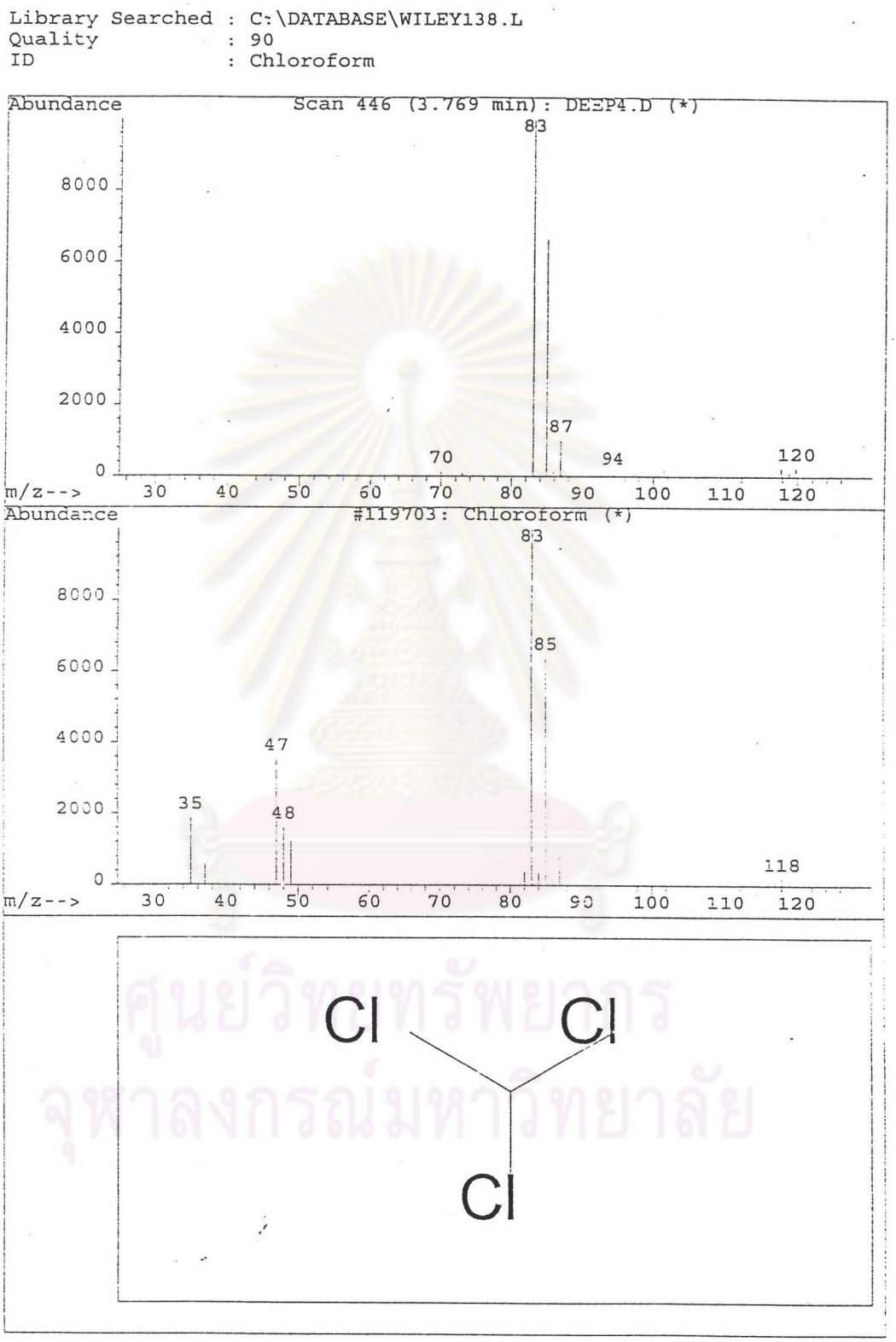


Figure 2 The mass spectrum for headspace of swimming pool sample with the retention time of 3.78 min from the gas chromatography in Figure 1

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

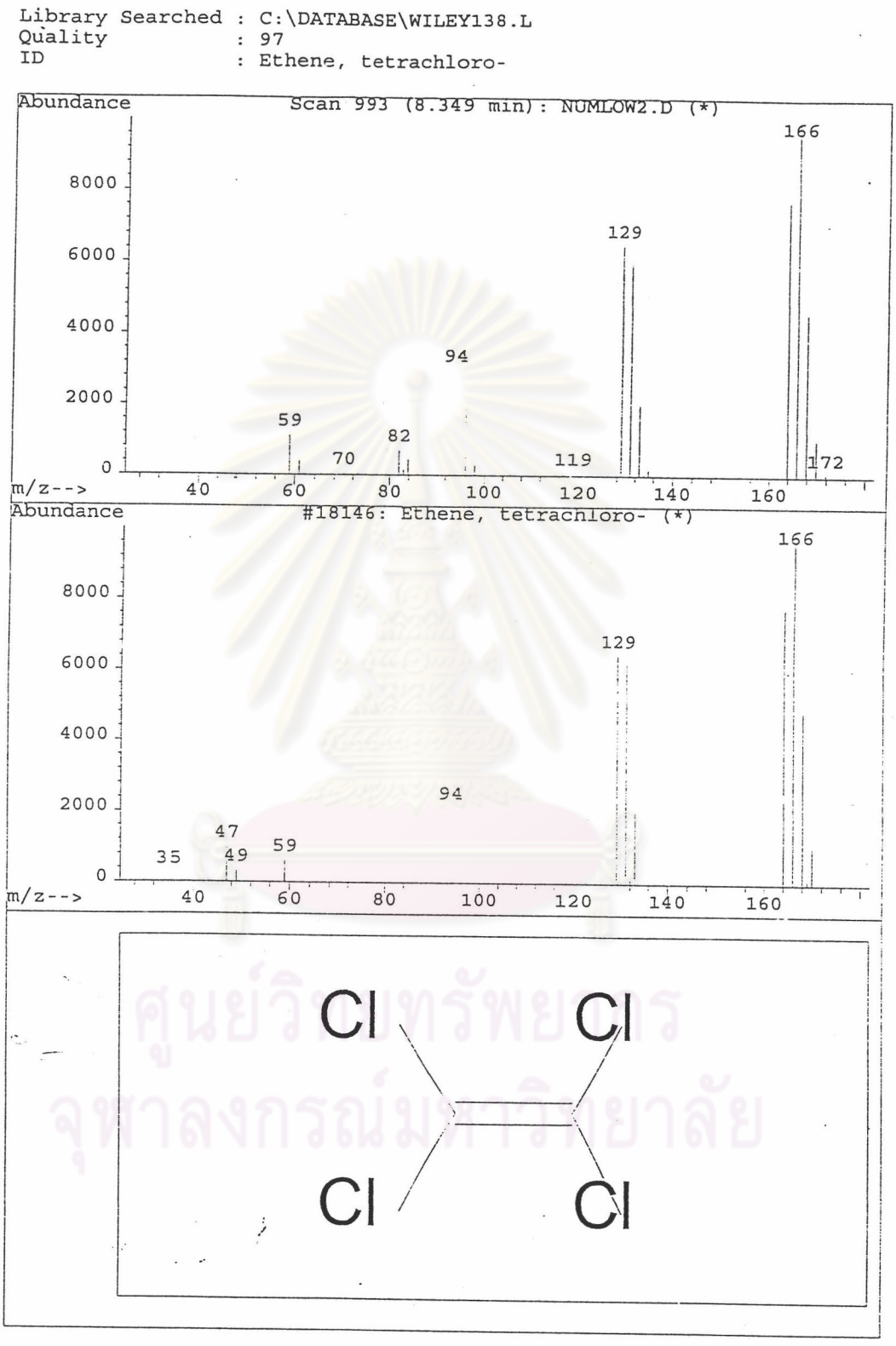


Figure 3 The mass spectrum for headspace of swimming pool sample with the retention time of 8.36 min from the gas chromatography in Figure 1

BIOGRAPHY

Miss Mukda Chea was born on December 4, 1970. She recieved a Bechelor Degree of Science (Public Health) from Faculty of Public Health, Mahidol University, in 1992. After her graduation, she worked as an occupational health officer at the Environmental Health Division, Bangkok Metropolitan Administration. Then, she entered a master degree program at the Inter-department of Environmental Science, Graduate School of Chulalongkorn University.

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย