




가

가

2000 12

이석주의 보건학석사 학위논문을 인준함

심사위원 신 동 천 
심사위원 서 익 
심사위원 임 영 옥 

연세대학교 보건대학원

2000년 12월 일

가

,

.

,

,

.

,

,

,

,

가

.

.

,

,

,

,

,

,

,

,

,

,

.

,

.

가

2000 12

.....	
.....	
.....	
.....	1
.....	4
1.	4
2.	5
3.	5
가.	5
.....	6
.....	10
.....	11
1. GC/MSD nicotine	11
가. 가	11
..... GC/MSD	12
2.	13
가.	13
..... nicotine	17
..... nicotine	25
.....	27
.....	33
.....	35
.....	41
.....	44

Table 1. Analytical condition for GC/MSD	8
Table 2. The correlation coefficients, slope and intercept of calibration curve	9
Table 3. Contents of questionnaires	10
Table 4. Recovery efficiencies of nicotine	11
Table 5. Retention time and repeatability of GC analysis	12
Table 6. Detection limit for nicotine by GC/MSD	12
Table 7. General characterization of home	14
Table 8. General characterization of smoking type	16
Table 9. Nicotine concentration by smoking home and non-smoking	18
Table 10. Nicotine concentration by resident type for total house	19
Table 11. Nicotine concentration by resident type for the smoking home	19
Table 12. Nicotine concentration by ventilation frequency for total house	20
Table 13. Nicotine concentration by ventilation frequency for the smoking home	20
Table 14. Nicotine concentration by heating type for total house	21
Table 15. Nicotine concentration by heating type for the smoking home	21
Table 16. Nicotine concentration by smoking type	22
Table 17. Nicotine concentration by smoking area	23
Table 18. Nicotine concentration by the number of cigarette smoking in home	24
Table 19. Nicotine concentration by environmental factor in home	26
Table 20. Nicotine concentration of indoor environment in commercial district	31

Figure 1. Scheme of the this study	4
Figure 2. Pretreatment of nicotine	7
Figure 3. Calibration of nicotine sample	9
Figure 4. Distribution of nicotine concentration in indoor home	17
Figure 5. Comparison of nicotine concentration for smoking & nonsmoking home	18
Figure 6. Comparison of indoor nicotine concentration by smoking area ..	23
Figure 7. Comparison of nicotine concentration for indoor environment and home	31

가

(involuntary smoking)

(passive smoking)

ETS(Environmental Tobacco Smoke)

가

30%

3,000

가

가

ETS

가

가

가

가

가

nicotine

ETS

ETS

가

ETS

85가

nicotine

Nicotine (Personal air sampler, Gillian) ,
 4% Sodium bisulfate가 glass fiber filter vapor nicotine
 heptane GC/ MSD .
 Nicotine GC/ MSD 98.73 ± 2.32%
 , retention time 0.002% ,
 1.05% . GC/ MSD
 0.086 µg/ Mℓ , 0.0004 µg/ m³ .
 가 nicotine ND 17.39 µg/ m³
 , 가 2.57 ± 4.19 µg/ m³, 가 0.64 ± 1.31
 µg/ m³ 가 가 가 4
 (p 0.01). nicotine (, ,),
 (, , , 가)
 ,
 (p 0.01). 가 nicotine
 가
 nicotine 가
 가
 가 nicotine 2.57 ± 4.19 µg/ m³
 5 6 가
 5 6 nicotine
 , 1 1 가 6.5

가 nicotine (PC, Restaurant) , 가
 24
 1 .
 가 20m³/ day 1 24
 가 nicotine (2.57μg/ m³) ×
 20m³/ d × 24h/ d=1233.6μg/ m³ , nicotine
 1 2 nicotine (31.48μg/ m³) ×
 20m³/ d × 2h/ d=1259.2μg/ m³ .
 nicotine
 가 가 nicotine
 .
 가 nicotine
 가 , .

•

가

(US EPA, 1996).

4

, 가 , ,

, , , ,

(NRC, 1981).

, ,

가

(Environmental Tobacco Smoke, ETS)

ETS

(US EPA, 1998).

ETS (involuntary smoking) (passive smoking)

NAS(National Advisory Science)

5 10

nicotine

, 가

30% 가 ,

20% (NRC, 1986).

가 가

1 가

(Smoking or Health, 1977).

3000 가

(DHHS, 1986).

가 . 가

(,)

, ,

(Greenberg, 1988). Rosen (1950)

. 가

15 가

2 14.1% 가 8%가

, 16.1 9.6 6.5 ,

5

(, 1984).

가

가

, tar

nicotine nicotine cotinine

가 ,

(Curvall & Enzell, 1986).

1.

nicotine

가

nicotine

Figure 1.

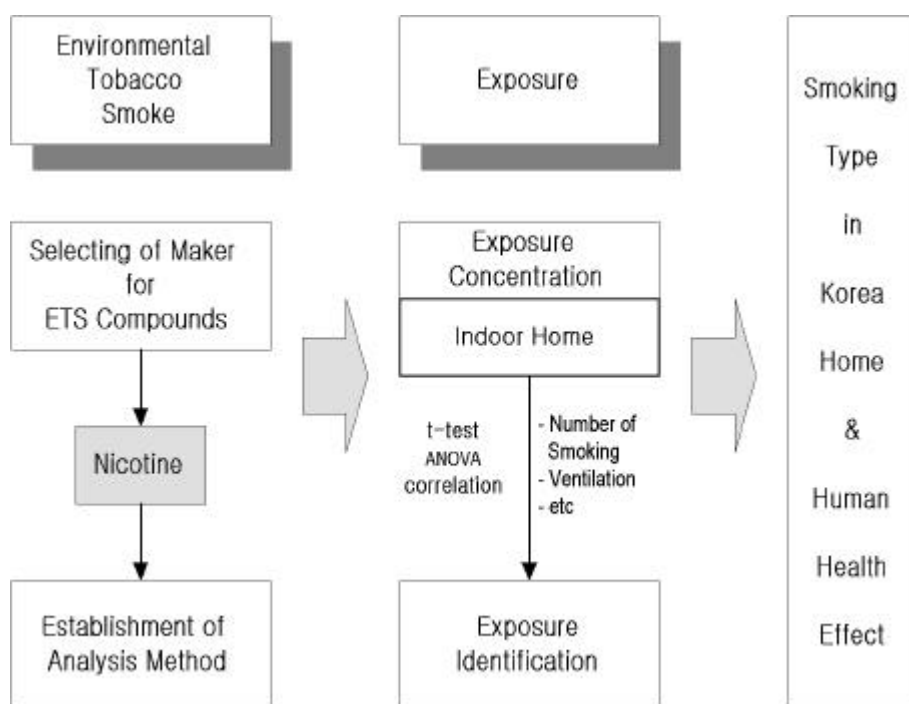


Figure 1. Scheme of the this study

2.

1999 9 11 , 85가
가 , 가 nicotine
24 .

3.

가.
nicotine (Personal air
sampler, Gillian) , 4% Sodium bisulfate
가 glass fiber filter(37mm, Whatman) filter cassette
vapor nicotine 1.5L/ .
20 24
,
1.5m sampler
. filter
3 .

1)
 , argon gas 100mg nicotine
 (Sigma Chemical CO., USA) nicotine-methyl-d₃,
 99 atom % D 50mg (Aldrich Chemical CO., USA) ,
 99.99% n-heptane(J.T.Baker CO., USA) nicotine

ethanol, 10N sodium hydroxide, ammonium
 hydroxide .

2)
 nicotine glass filter filter centrifuge
 tube water 2ml, ethanol 100μl 1

Nicotine free base
 free base 10N sodium hydroxide 2ml 가 1

nicotine
 ammonium hydroxide 100μl 가
 250μl heptane 3 .

Heptane heptane free base
 nicotine 100μl insert vial Gas Chromatogram(GC)

(Figure 2).

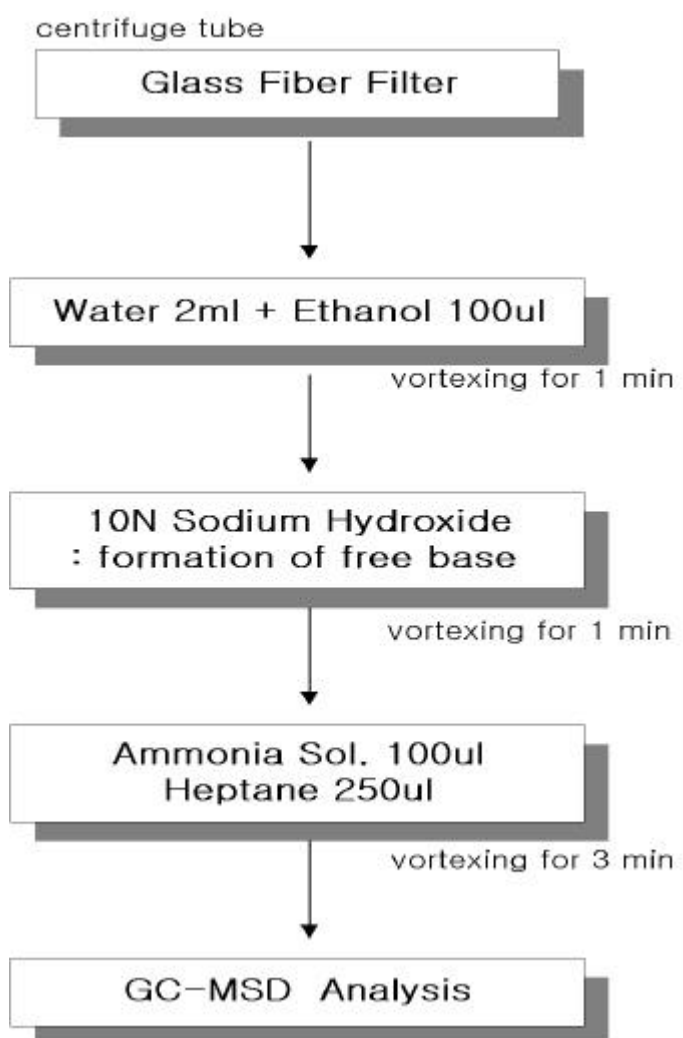


Figure 2. Pretreatment of nicotine

3) GC/MSD

HP 6890 Series Injector, HP 5973 Mass Selective Detector DB5
 capillary column (20m × 0.2mm × 0.33μm) Hewlett Packard 6890 GC
 system .
 column 80 0.5 , 200 20
 injector detector 250, 260 splitless mode
 1.5Mℓ/ min .
 70eV , electron-impact(EI)mode
 autosampler 1.0μℓ .

Table 1. Analytical condition for GC/MSD

Description	Condition
Injector : port tem. volume mode	250 1μℓ splitless
Inlet flow (pressure)	1.5Mℓ/ min, constant
Oven : Initial	80 for 0.5min 20 / min to 200 200 hold on 3min
Column	J&W 123-5062(non-polar) i.d. 0.2mm, 20m, 0.33μm
Total run time	9.5min
Ionization Energy	70eV

Total Ion Chromatogram
 , ion peak 84, 133, 161m/ z(nicotine, Figure 3)
 87, 165m/ z(nicotine-methyl-d₃) SIM(Selective Ion Monitoring) mode
 , nicotine (Figure 4).

4)
 Nicotine 1, 5, 10, 20, 50, 100, 500, 1000, 5000, 10000, 20000,
 40000 $\mu\text{g}/\text{Ml}$

Figure 5

, nicotine , Table
 2
 Nicotine sample nicotine-methyl- d_3 (Aldrich, USA)
 5 $\mu\text{g}/\text{Ml}$ 가

Table 2. The correlation coefficients, slope and intercept of calibration curve

Subject	Slope	Intercept	Correlation coefficient
Nicotine	0.0021	0.761	0.9859

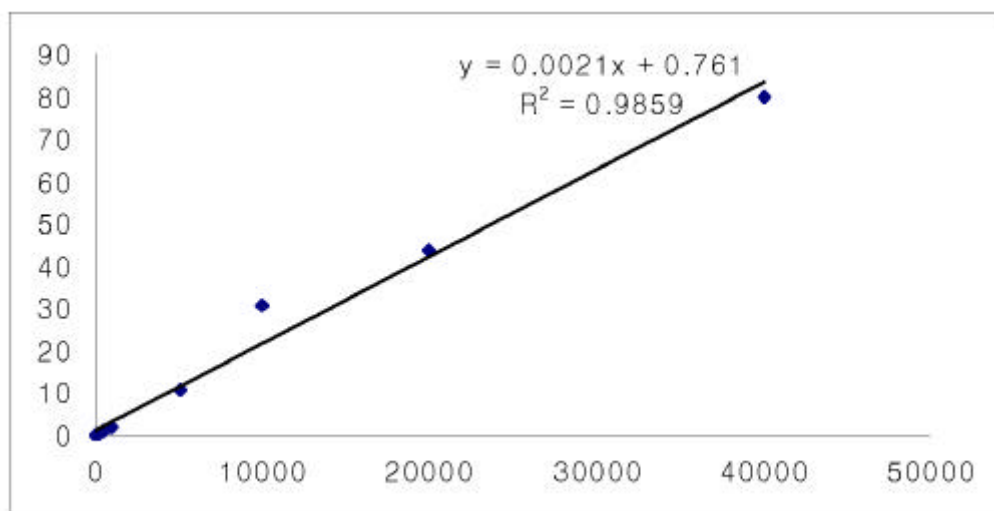


Figure 3. Calibration of nicotine sample

5)
 Filter nicotine nicotine
 (25 , 1atm) personal
 air sampler .

$$\text{nicotine } (\mu\text{g}/\text{m}^3) = \frac{(\mu\text{g}/\text{L}) \times (\text{L})}{\text{Air Vol.}(\text{m}^3)}$$

· ,
 nicotine 가
 (, ,) (, ,
 , 가) (Table 3).
 , nicotine

SAS(Statistical Analysis System) 6.12

Table 3. Contents of questionnaires

Subject	Category	Contents
Home	Habitant type	residence type/ number of ventilation/ heating type
	Smoking type	smoking state/ number of cigarette/ smoking site/ number of cigarette in home

1. GC/MS D

nicotine

가

가.

가

4% sodium bisulfate가

glass fiber filter

nicotine

ammonium hydroxide

Nicotine

가 5, 10, 20µg/ Mℓ가

3

filter spike

, 98.73 ± 2.32%

(Table 4).

Table 4. Recovery efficiencies of nicotine

Concentration	Spiked amount(µg)	Average recovery of nicotine	
		Amount(µg)	Recovery(%)
5 µg/ Mℓ	1.5	1.28 ± 0.08	85.61 ± 5.11
10 µg/ Mℓ	3	3.40 ± 0.26	113.19 ± 8.62
20 µg/ Mℓ	6	5.84 ± 0.25	97.39 ± 4.23
Mean ± S.D.			98.73 ± 2.32

가 retention time
 3
 가 , retention time 0.002% ,
 1.05% (Table 5).

Table 5. Retention time and repeatability of GC analysis

Concentration ($\mu\text{g}/\text{Ml}$)	Retention time(min)		Area
	Average	RSD (%)	RSD (%)
Blank	4.46	0.005	0.09
5000	4.43	0.001	0.54
10000	4.42	0.001	1.81
20000	4.42	0.002	1.78
Mean	4.43	0.002	1.05

. GC/MSD

nicotine
 3
 0.033 $\mu\text{g}/\text{Ml}$, 0.0005 $\mu\text{g}/\text{m}^3$ (Table 6).

Table 6. Detection limit for nicotine by GC/MSD

Std. sol.(100 $\mu\text{g}/\text{Ml}$)		3SD	Detection Limit	
mean	SD		in solution	in air
99.13	0.029	0.086	0.086 $\mu\text{g}/\text{Ml}$	0.0004 $\mu\text{g}/\text{m}^3$

2.

가.

1) 가

가 nicotine 가 가
85가 , Table 7 .
가 가 38가 , 가 47가
.
44%, APT 41%, 15% .
가 4 44가 (52%) 5 17가
(20%), 3 16가 (19%), 2 8가 (9%) .
가 ,
52%가 5
(Table 7). 가 가
13가 ,
가 20가 .
가 가 8가 (9%), 22가
(26%), 가 50가 (59%) .

Table 7. General characterization of home

unit : number of home(%)

	Category	smoking home	non-smoking home	Total
residence type	Detached house	15 (40%)	22 (47%)	37 (44%)
	Apartment	18 (47%)	17 (36%)	35 (41%)
	Tenement house	5 (13%)	8 (17%)	13 (15%)
----- Sum		38 (100%)	47 (100%)	85 (100%)
family number	2 person	3 (8%)	5 (11%)	8 (9%)
	3 person	7 (18%)	9 (19%)	16 (19%)
	4 person	19 (50%)	24 (51%)	43 (51%)
	over 5 person	9 (24%)	9 (19%)	18 (21%)
----- Sum		38 (100%)	47 (100%)	85 (100%)
number of ventilation	0	1 (3%)	0 (0%)	1 (1%)
	1 5th	15 (39%)	28 (60%)	43 (51%)
	over 6th	10 (26%)	7 (15%)	17 (20%)
	no response	12 (32%)	12 (25%)	24 (28%)
----- Sum		38 (100%)	47 (100%)	85 (100%)
heating type	oil boiler	3 (8%)	5 (11%)	8 (9%)
	central heating	13 (34%)	9 (19%)	22 (26%)
	gas boiler	20 (53%)	30 (64%)	50 (59%)
	radiator	0 (0%)	1 (2%)	1 (1%)
	no response	2 (5%)	2 (4%)	4 (5%)
----- sum		38 (100%)	47 (100%)	85 (100%)

2) 가

38가 가 2 가 가

13% , 1 10 7%, 11 20 29%,

21 29% . 11 20 가 47%

가 , 가 53%가

.

가 1 5 가 가 22가 (57.9%), 6 10

9가 (23.7%), 11 3가 (7.9%) , 가

가 4가 (Table 8).

Table 8. General characterization of smoking type

smoking type	category	number of home
number of smoker	1 person	33 (87%)
	over 2 person	5 (13%)
-----		sum
		38 (100%)
smoking duration	1-10 years	7 (18%)
	11-20 years	11 (29%)
	over 21 years	11 (29%)
	no response	9 (24%)
-----		sum
		38 (100%)
number of daily cigarette	1-10th	11 (29%)
	11-20th	18 (47%)
	over 21th	7 (19%)
	no response	9 (24%)
-----		sum
		38 (100%)
smoking site	Veranda & outdoor	20 (53%)
	living room & indoor	13 (34%)
	no response	5 (13%)
-----		sum
		38 (100%)
number of cigarette in home	1-5th	22 (57.9%)
	6-10th	9 (23.7%)
	over 11th	3 (7.9%)
	no response	4 (10.5%)
-----		sum
		38 (100%)

nicotine

1) 가 nicotine

가) 가 nicotine

가 nicotine ND 17.39 $\mu\text{g}/\text{m}^3$

m^3 , 1.51 \pm 3.10 $\mu\text{g}/\text{m}^3$ 가

가 가 nicotine Figure 6 .

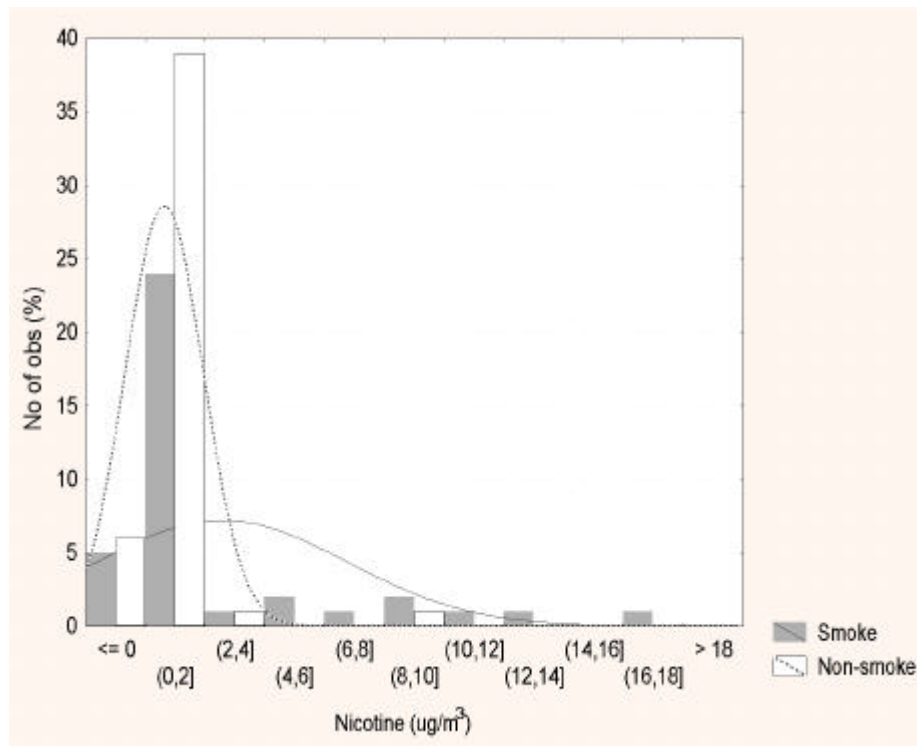


Figure 4. Distribution of nicotine concentration in indoor home

가 (p < 0.01)가
 가 nicotine (2.57 ± 4.19 μg/ m³)가
 가 (0.64 ± 1.31 μg/ m³)
 4 (Table 9).

Table 9. Nicotine concentration by smoking home and non-smoking

unit : μg/ m³

Smoking state	N	Mean ± SD	(Min. Max.)
smoking home	38	2.57 ± 4.19	(ND* 17.39)
non-smoking home	47	0.64 ± 1.31	(ND 8.50)
Total	85	1.51 ± 3.10	(ND 17.39)

*Not Detected

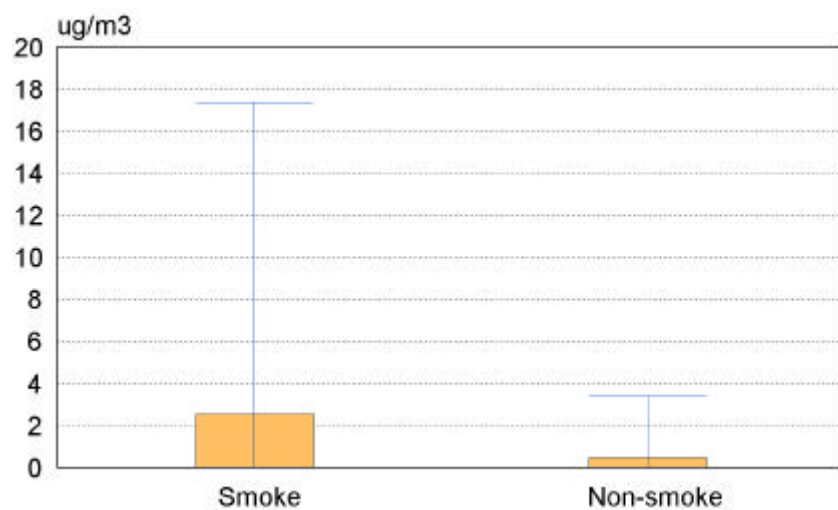


Figure 5. Comparison of nicotine concentration for smoking and nonsmoking home

) nicotine
nicotine 가 1.58 ± 3.57
 $\mu\text{g}/\text{m}^3$, APT 가 1.22 ± 2.15 $\mu\text{g}/\text{m}^3$, 가
2.07 ± 3.94 $\mu\text{g}/\text{m}^3$, 가
가 2.59 ± 5.11 $\mu\text{g}/\text{m}^3$, APT 가 1.91 ± 2.75 $\mu\text{g}/\text{m}^3$,
가 4.88 ± 5.51 $\mu\text{g}/\text{m}^3$.

(Table10, 11).

Table 10. Nicotine concentration by resident type for total house

unit : $\mu\text{g}/\text{m}^3$

Resident type	N	Mean ± SD	(Min. Max.)
Detached house	37	1.58 ± 3.57	(ND 17.39)
Apartment	35	1.22 ± 2.15	(ND 9.64)
Tenement house	13	2.07 ± 3.94	(ND 3.26)

Table 11. Nicotine concentration by resident type for the smoking home

unit : $\mu\text{g}/\text{m}^3$

Resident type	N	Mean ± SD	(Min. Max.)
Detached house	15	2.59 ± 5.11	(ND 17.39)
Apartment	18	1.91 ± 2.75	(ND 9.64)
Tenement house	5	4.88 ± 5.51	(0.13 13.26)

) nicotine
가 nicotine
1 5 가 $0.88 \pm 1.78 \mu\text{g}/\text{m}^3$, 6 가
 $2.40 \pm 3.56 \mu\text{g}/\text{m}^3$, 가 1 5 가
 $1.80 \pm 2.84 \mu\text{g}/\text{m}^3$, 6 가 $2.63 \pm 3.90 \mu\text{g}/\text{m}^3$

(Table12, 13).

Table 12. Nicotine concentration by ventilation frequency for total house

unit : $\mu\text{g}/\text{m}^3$

ventilation frequency	N	Mean \pm SD	(Min. Max.)
1 5th	44	0.88 ± 1.78	(ND 9.64)
over 6th	16	2.40 ± 3.56	(0.22 13.26)

Table 13. Nicotine concentration by ventilation frequency for the smoking home

unit : $\mu\text{g}/\text{m}^3$

ventilation frequency	N	Mean \pm SD	(Min. Max.)
1 5th	15	1.80 ± 2.84	(ND 9.64)
over 6th	10	2.63 ± 3.90	(0.29 13.26)

) nicotine
nicotine 가
0.94 ± 1.41 μg/ m³, 가 1.44 ± 2.56 μg/ m³, 가 가
1.50 ± 3.51 μg/ m³ , 가 가 1.71
± 2.19 μg/ m³, 가 2.04 ± 3.12 μg/ m³, 가 가 2.70 ±
5.70 μg/ m³ .
(Table 14, 15).

Table 14. Nicotine concentration by heating type for total house

unit : μg/ m³

heating type	N	Mean ± SD	(Min. Max.)
oil boiler	8	0.94 ± 1.41	(ND 4.18)
central heating	22	1.44 ± 2.56	(ND 9.64)
gas boiler	50	1.50 ± 3.51	(ND 17.39)

Table 15. Nicotine concentration by heating type for the smoking home

unit : μg/ m³

heating type	N	Mean ± SD	(Min. Max.)
oil boiler	3	1.71 ± 2.19	(ND 4.18)
central heating	13	2.04 ± 3.12	(ND 9.64)
gas boiler	20	2.70 ± 5.70	(ND 17.39)

2) nicotine

가) , , nicotine

가 nicotine 2 가

가 $2.55 \pm 3.31 \mu\text{g}/\text{m}^3$ 1 가 가 ($2.25 \pm 4.41 \mu\text{g}/\text{m}^3$)

m³) .

nicotine

1 10 $1.84 \pm 2.61 \mu\text{g}/\text{m}^3$, 11 20 $2.69 \pm 3.31 \mu\text{g}/\text{m}^3$, 20

$1.94 \pm 3.53 \mu\text{g}/\text{m}^3$.

nicotine 1 10 가

$0.62 \pm 0.55 \mu\text{g}/\text{m}^3$, 11 20 가 $2.73 \pm 4.40 \mu\text{g}/\text{m}^3$, 20

가 $4.98 \pm 4.39 \mu\text{g}/\text{m}^3$.

(Table16).

Table 16. Nicotine concentration by smoking type

smoking type		home	Mean \pm SD (Min. Max.)	unit : $\mu\text{g}/\text{m}^3$
number of smoker	1 person	30	2.25 ± 4.41 (ND 17.39)	
	over 2 person	5	2.55 ± 3.31 (ND 7.62)	
smoking duration	1 10years	7	1.84 ± 2.61 (ND 7.62)	
	11 20years	11	2.69 ± 3.31 (0.29 9.64)	
	over 21years	11	1.94 ± 3.53 (ND 11.89)	
number of daily cigarette	1 10th	11	0.62 ± 0.55 (ND 1.38)	
	11 20th	18	2.73 ± 4.40 (ND 17.39)	
	over 21th	7	4.98 ± 4.39 (0.55 11.89)	

) nicotine
가 가 가
, 가
nicotine 가 $6.08 \pm 5.66 \mu\text{g}/\text{m}^3$,
가 $0.84 \pm 0.99 \mu\text{g}/\text{m}^3$, 99%
가 (Table 17).

Table 17. Nicotine concentration by smoking area for the smoking home

unit : $\mu\text{g}/\text{m}^3$

smoking area	n	Mean \pm SD	(Min. Max.)
indoor home	20	5.14 \pm 4.75	(ND 13.26)
Veranda & outdoor	12	0.84 \pm 0.99	(ND 4.48)

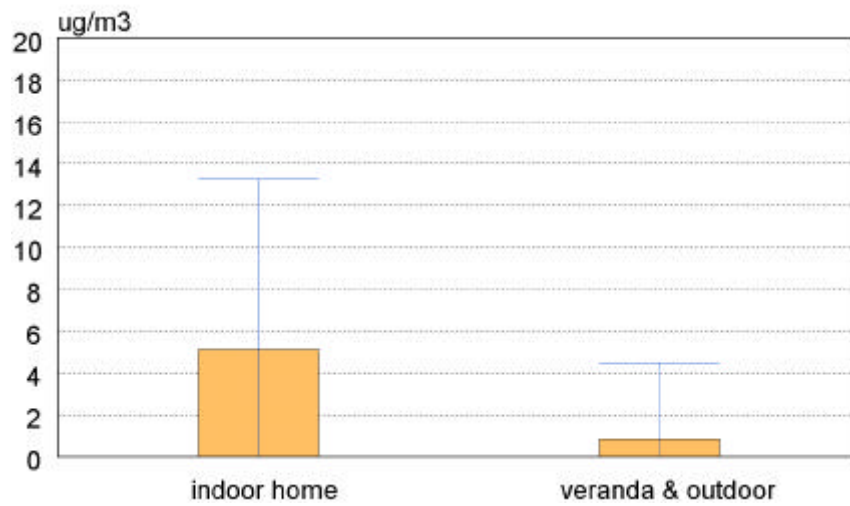


Figure 6. Comparison of indoor nicotine concentration by smoking area

가	nicotine	가	nicotine	5
가	2.34 ± 4.40 μg/ m ³ , 6	10	가	
3.67 ± 4.68 μg/ m ³ , 10	가	가	4.33 ± 3.22 μg/ m ³	

(Table 18).

Table 18. Nicotine concentration by the number of cigarette in the smoking home

unit : μg/ m³

number of cigarette in home	n	Mean ± SD	(Min.	Max.)
1 5th	22	2.34 ± 4.40	(ND	17.39)
6 10th	9	3.67 ± 4.68	(0.26	13.26)
over 11th	3	4.33 ± 3.22	(1.19	7.62)

. **nicotine**
 가
 nicotine ,
 , nicotine .
 가 가 ,
 , nicotine .
 nicotine , nicotine
 , , 가
 .
 nicotine 99%
 가 ,
 가 nicotine 가 (Table
 19).

Table 19. Nicotine concentration by environmental factor in home

Environmental factor		Concentration ($\mu\text{g}/\text{m}^3$)		
Habitant type	residence type	Detached house	1.58 \pm 3.57 (2.59 \pm 5.11)	
		Apartment	1.22 \pm 2.15 (1.91 \pm 2.75)	
		Tenement house	2.07 \pm 3.94 (4.88 \pm 5.51)	
	number of ventilation	1-5th	0.88 \pm 1.78 (1.80 \pm 2.84)	
		over 6th	2.40 \pm 3.56 (2.63 \pm 3.90)	
	Heating type	oil boiler	0.94 \pm 1.41 (1.71 \pm 2.19)	
		central heating	1.44 \pm 2.56 (2.04 \pm 3.12)	
		gas boiler	1.50 \pm 3.51 (2.70 \pm 5.70)	
	Smoking type ¹⁾	smoking duration	1-10years	1.84 \pm 2.61
			11-20years	2.69 \pm 3.31
			over 21years	1.94 \pm 3.53
		number of smoker	1person	2.25 \pm 4.41
over 2person			2.55 \pm 3.31	
number of daily cigarette		1-10th	0.62 \pm 0.55	
		11-20th	2.73 \pm 4.40	
		over 20th	4.98 \pm 4.39	
number of cigarette in home*		1-5th	2.34 \pm 4.40	
	6-10th	3.67 \pm 4.68		
	over 11th	4.33 \pm 3.22		
smoking site**	indoor home	5.14 \pm 4.75		
	Veranda & outdoor	0.84 \pm 0.99		

()smoking home, 1)smoking home only

*p 0.1, **p 0.01

•

Nicotine

ETS

CO(Carbon monoxide), RSP(Respiratory Suspended Particles)

nicotine

nicotine 가 ,

, , ,

GC

RIA(Radio

-immunoassay), HPLC, Gas Chromatography alkali FID(flame ionization

detector), NSD(Nitrogen Sensitive Detector), NPD(Nitrogen Phosphorus

Detector)

sample

,

nicotine

(Hutchinson, 1998).

GC/NSD, NPD

nicotine

nicotine ghost peak ,

GC/MSD

(Otto, 1980).

nicotine

가

nicotine sample ,

GC/MSD

“nicotine ratio”

가 . ,
 nicotine cotinine
 nicotine GC/MSD
 (Otto, 1980).
 nicotine ,
 , nicotine
 가 30 bubbling (Hammond , 1987)
 bubbling .
 GC/MSD nicotine GC/FID,
 NPD (98.73 ± 2.32%) , (Hammond ,
 1987; , 1990)
 . retention time
 0.002% , 1.05%
 .
 가 nicotine ND 17.39µg/ m³
 , 1.51 ± 3.10µg/ m³ , 가 nicotine
 2.57 ± 4.19µg/ m³, 가 0.64 ± 1.31µg/ m³ .
 가 가 nicotine
 가 nicotine .
 APT ,
 가 .

Philips (1997) 36가 nicotine, RSP
 $1.9\mu\text{g}/\text{m}^3$ (10th percentile: 0.28, 90th percentile: 4.9)
, Phillips (1996) 가 $1.1\mu\text{g}/\text{m}^3$, 가
 $0.05\mu\text{g}/\text{m}^3$, Henderson (1989)
가 nicotine
가 15가 , 가 12가 .
가 nicotine $0.34\mu\text{g}/\text{m}^3$ (SEM, $0.07\mu\text{g}/\text{m}^3$)
 m^3 , 가 $3.74\mu\text{g}/\text{m}^3$ (SEM, $0.52\mu\text{g}/\text{m}^3$) nicotine
, .
가 nicotine .
(1995) 12가 $3.17 \pm 3.02\mu\text{g}/\text{m}^3$, 1.60
 $\pm 2.40\mu\text{g}/\text{m}^3$.
가 nicotine
(p 0.01), 가
nicotine 가 가
. , ,
, , 가 , ,
nicotine
, .
가
. nicotine 가

가 ,
 가
 nicotine 1 1mg
 , 145 $\mu\text{g}/\text{m}^3$ nicotine 가 (Nelson
 , 1998) 가 1.51 \pm 3.10 $\mu\text{g}/\text{m}^3$
 nicotine 0.01
 가 0.65

5 6 3 4
 nicotine
 가 nicotine 2.57 \pm 4.19 $\mu\text{g}/\text{m}^3$
 1.06 가
 nicotine 1
 1 nicotine 1mg 가
 가 6.5 1

가
 (PC , Restaurant) nicotine
 3148 \pm 17.19 $\mu\text{g}/\text{m}^3$ (Table 20).
 , nicotine
 (p 0.01).
 nicotine 가 가

Table 20. Nicotine concentration of indoor environment in commercial district

unit : $\mu\text{g}/\text{m}^3$

	subject	Mean \pm SD	(min	max)
PC game room	4	35.44 \pm 12.16	(24.56	46.66)
Restaurant	3	36.45 \pm 17.13	(16.71	47.33)
Korean bar	3	35.02 \pm 25.32	(10.04	60.67)
Korean restaurant	4	16.41 \pm 7.02	(5.88	20.12)
tavern/ inn	3	37.79 \pm 23.10	(11.30	53.73)
Total	17	31.48 \pm 17.19	(5.88	60.67)

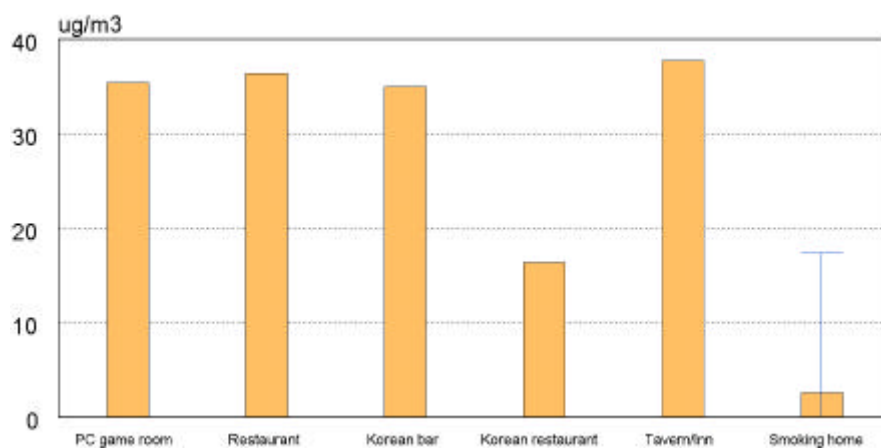


Figure 7. Comparison of nicotine concentration for indoor environment and home

가 nicotine
 가
 24 1
 , 20m³/ day 24 가
 nicotine (2.57μg/ m³) × 20m³/ d × 24h/ d =
 1233.6μg/ m³ , nicotine
 1 2 가 , nicotine (31.48μg/ m³) × 20m³/ d × 2h/ d
 = 1259.2μg/ m³ .
 nicotine
 가 가
 nicotine .

•
 nicotine ,
 가 nicotine
 .
 nicotine GC/MSD 98.73 ± 2.32%
 , 가 retention time
 retention time 0.002% ,
 1.05% . GC/MSD
 0.086µg/ Ml ,
 0.0004µg/ m³ .
 가 nicotine 가 가
 nicotine 가 nicotine 가
 2.57 ± 4.19µg/ m³, 가 nicotine 0.64 ± 1.31µg/ m³ ,
 99% .
 nicotine (, ,), (, , 가)
 , , ,
 (p 0.01).
 145µg/ m³ nicotine 가 ,
 가 5 6 가
 가 1.51 ± 3.10µg/ m³ nicotine 가
 3 4 nicotine , 2.57 ±

4.19 $\mu\text{g}/\text{m}^3$

가

5 6

가

nicotine

.

1

1

nicotine

1mg

가

가 6.5

1

가

ETS

.

ETS

ETS

ETS

가

.

, . 가 . Yonsei Medical
 Journal. 1986; 27(4); 261-270
 . nicotine cotinine
 . 1990
 . (ETS)
 . 1995
 . PC (ETS)
 . 2000

Coultas DB, Samet JM, McCarthy JF, et al. Variability of measures of
 exposure to environmental tobacco smoke in the home. Am Rev
 Respir Dis 1990;142:602-6.

Curvall M, Enzell CR. Monitoring absorption by means of determination of
 nicotine and cotinine. Arch Toxicol Suppl 1986; 9; 88-102

CHANG-CHUAN CHAN, SHU-CHING CHEN, JUNG-DER WANG.
 Relationship between Indoor Nicotine Concentrations, Time-Activity
 Data, and Urine Cotinine-Creatinine Ratios in Evaluating Children's
 Exposure to Environmental Tobacco Smoke. Archives of
 Environmental Health. May/June 1995 Vol 50; No. 3

Environmental tobacco Smoke in the Workplace: Lung Cancer and Other
 Health Effects. Cincinnati, Ohio: National Institute for Occupational
 Safety and Health; 1991. Publication DHHS(NIOSH)91-108.

- Daniel W, Sepkovic R. Elimination from the body of tobacco products by smokers and passive smokers. JAMA. 1986; 256(7); 863
- Dockery DW, Spengler JD. Personal exposure to respirable particulates and sulfates. J Air Pollut Control Assoc 1981a; 31; 153-159
- Doll, R. . Cancer related to somking. proc.2nd World Conf. Smoking and Health, London;1975: Vol. 10-23.
- Greenberg RA, Bauman KE, Glover LH, et al. Ecology of passive smoking by young infants. J pediatr 1988;114:774-80.
- Environmental Protection Agency. Respiratory health effects of passive smoking: lung cancer and other disorders. Washington, Office of Air and Radiation, Office of Environmental Assessment, 1992. (EPA publication no. 600/ 6-90--006F)
- Glantz SA, Parmley WW. Passive smoking and heart disease: epidemiology, physiology and biochemistry. Circulation 1991;83;1-12
- Hirayama T. Non-smoking wives of heavy smokers have a higher risk of lung cancer: a study from japan. Br Med J 1981; 282: 183-5.
- Hoffmann, D., and Hoffmann, . Tobacco consumption and lung cancer. in Lung cancer. advances in basic and clinical research, ed. H. H. Hansen, . Boston: Kluwer Academic.1995Vol 1. 1-42
- HEW. Smoking and Health - A report of surgeon general. Department of health, education and welfare. Pub. 1979 No.(PHS) 79-50066.
- Lambert W.E., Samart J.M., and Spengler J.D. Environmental tobacco smoke concentrations in no-smoking and smoking sections of restaurants. Am Public Health 1993 83; 9; 1339-1341

- Hoegg UR. Cigarette smoke in closed spaces. Environ Health Perspec 1972
October; 2; 117-128
- Hutchinson James, Yousef Tizabi, Robert Taylor. Rapid method for the
simultaneous measurement of nicotine and cotinine in urine and
serum by gas chromatography-mass spectrometry. Journal of gas
chromatography B, 1998 708, 87-93
- Judy S. LaKind, Michael E. Ginevan, Daniel Q. Naiman, Anthony C. James,
Roger A. Jenkins, Michael L. Dourson, Susan P. Felter, Carol G.
Graves, and Robert G. Tardiff. Distribution of Exposure
Concentrations and Doses for Constituents of Environmental
Tobacco Smoke. Risk Analysis, 1999 Vol. 19, No. 3, 375-390
- K. Philips, D.A. Howard, and M.C. Bentley. Assessment of air quality in
Turin by personal monitoring of nonsmokers for respirable
suspended particles and environmental tobacco smoke.
Environmental international, 1997 Vlo. 23, No. 6, 851-871
- Leaderer BP. Assessing exposure to environmental tobacco smoke. Risk Anal
1990;10:19-26.
- Lee.P.N.Lung cancer and passive smoking: Association an artifact due to
misclassification of smoking habits Toxicol. lett.; 1987. 35;157-162
- Leea Kuusimäki, et al. Determination of Nicotine as an Indicator of
Environmental Tobacco Smoke in Restaurants. AMERICAN
JOURNAL OF INDUSTRIAL MEDICINE SUPPLEMENT 1999
1:152-154
- LEILA S. R. BRICKUS ET AL. Distributions of Indoor and Outdoor Air

- Pollutants in Rio de Janeiro, Brazil: Implications to Indoor Air Quality in Bayside Offices Environ. Sci. Technol. 1998, 32, 3458-3490
- Repace JL, Lowrey AH. A quantitative estimate of nonsmokers' lung cancer risk from passive smoking. Environ Int. 1985;11:3-22.
- Repace J.L. and lowrey A.H Indoor air pollution, tobacco smoke, and public health, science,(1980). 208: 464
- Michael Siegel, MD, MPH Involuntary Smoking in the Restaurant Workplace. A Review of Employee Exposure and Health Effects JAMA. 1993 Vol. 270, No. 4 490-493 July 28
- MICHAEL P. MASKARINEC ET AL. Determination of exposure to environmental tobacco smoke in restaurant and tavern workers in one US city. Jr. Exposure Analysis and Environmental Epidemiology 2000 10; 36-49
- National Research Council. Environmental tobacco smoke: measuring exposures and assessing health effects. Washington, DC:National Academy Press, 1986.
- Otto Grubner and Melvin W. First, Gary L. Huber. Gas Chromatographic Determination of Nicotine in Gases and Liquids with Suppression of Adsorption Effects. Anal. Chem. 1980 52, 1755-1758
- Odgen M.W., Heavner D.L., Foster T.L., Maiolo K.C., Cash S.L., Richardson J.D., Martin P., Simmons P.S., Conrad F.W., and Nelson P.R. Personal monitoring system for measuring environmental tobacco smoke exposure. Environ Technol 1996 a 17; 239-250
- Oldaker G.B., Perfetti P.F., Conrad F.C., Jr., Conner J.M., and McBride R.L.

- Results of surveys of environmental tobacco smoke in offices and restaurants. *Int Arch Occup Environ Health* 1990 5; 99-104
- Spengler J.D. Personal Exposure to Respirable Particulates and Sulfates, *J, Airpoll. Contr. Assoc.*(1981), 32: 500-520.
- Spengler J.D. and Jonathan M. Spat Indoor Air Pollution, *The Johns Hopkins Univ*;1991: 34-35.
- Phillips K, Bently MC, Howard DA, Alván G. Assessment of air quality in Stockholm by personal monitoring of nonsmokers for respirable suspended particles and environmental tobacco smoke. *Scand J Work Environ Health* 1996; 22 suppl 1: 1-24.
- Paul R. Nelson et al. Composition of environmental tobacco smoke(ETS) from international cigarettes part : Nine country follow-up *Environmental international*, 1998 Vlo. 24, No. 3, 251-257
- S. KATHARINE HAMMOND, BRIAN P. LEADERER ET AL. Collection and analysis of nicotine as a marker for environmental tobacco smoke. *Atmospheric environment* 1987 21(2), 457-462
- Sterling E.M., Collett C.W., and Ross J.A. Assessment of non-smokers' exposure to environmental tobacco smoke using personal-exposure and fixed location monitoring. *Indoor Built Environ.* 1996 5; 112-125
- Sterling E.M., Collett C.W., and Ross J.A. Assessment of non-smokers' exposure to environmental tobacco smoke using personal-exposure and fixed location monitoring. *Indoor Built Environ.* 1996 5; 112-125
- Trichopoulos D, Kalandidi A, Sparros L, McMahon B. Lung cancer and

passive smoking. *Internat J Cancer* 1981; 27: 1-4.

US Department of Health and Human Services. The health consequences of involuntary smoking, a report of the Surgeon General. Rockville MD: US Department of Health and Human Services, 1986. (DHHS publication no (CDC)87-8398).

White JR, Froeb HF. Small airways dysfunction in non-smokers chronically exposed to tobacco smoke. *New Eng J Med* 1980; 302: 720-3

William E. Lambert, PhD, Jonathan M. Samet, MD, and John D. Spengler, PhD. Environmental Tobacco Smoke Concentrations in No-Smoking and Smoking Sections of Restaurants. *American Journal of Public Health*. September 1993, Vol. 83, No. 9 pp1339-1341



1. 가 가 ?
() ()
2. 가 ?
1 () 2 ()
3. ?
1 10 11 20 21 ()
4. 가 ?
() ()
5. 가 ?
1 10 11 20 21 ()
6. 가 ?
1 5 5 10 11 ()



1. ?

2. 가 ?

2 3 4 5

3. ?

가

4. 가 ?

5. 가 ?

() ()

6. ?

()

7. 가 ?

1 2 3 4 5 ()

8. ?

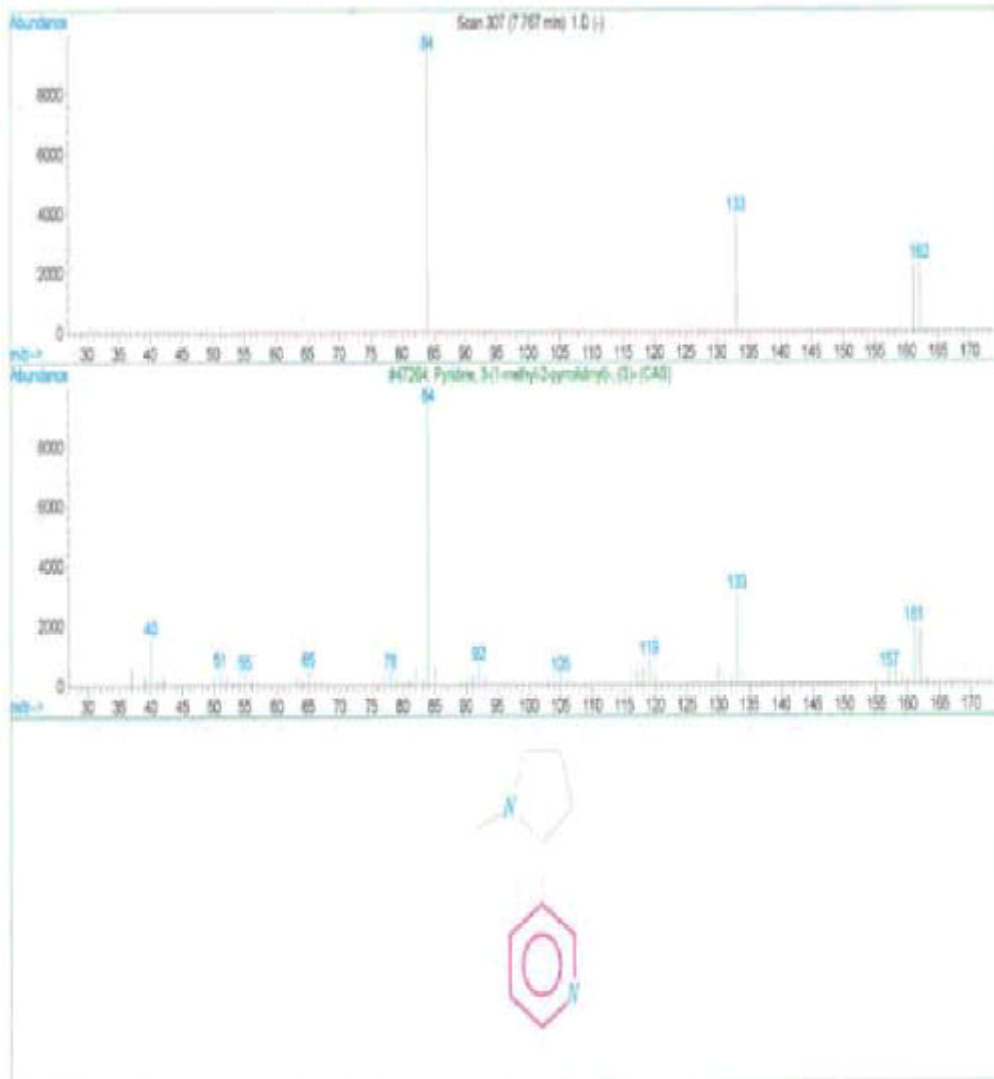
(: - :) (: - :) (: - :)

9. 가 ?

1 1 2 3

4 ()

Library Searched : C:\DATABASE\WILEY275.L
 Quality : 90
 ID : Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)- (CAS) \$\$ Nicotine \$\$ 1-METHYL-2-(3-PYRIDYL)PYRROLIDINE
 NE \$\$ Flux Naag \$\$ L-Nicotine \$\$ (



Ionspectrum of nicotine

ABSTRACT

A Study of Indoor Environmental Tobacco Smoke Exposure in Home

Seok-Ju Lee

Dept. of Environmental Management

The Graduated School

Health Science & Management

Yonsei University

(Directed by Professor Dong Chun Shin, Ph.D)

Various studies have estimated that, each year in the United States, ETS causes the deaths of approximately 3000 nonsmoker from lung cancer. Furthermore, ETS causes respiratory diseases in young children and may contribute to increased risk in adults as well.

This accumulating evidence has resulted in a recent decision by the Environmental Protection Agency(EPA) to declare that environmental tobacco smoke is a human carcinogen.

The main objectives of this study were to determine the range and

degree of exposure of these homes to nicotine by means of air sampling over a 24h period.

Nicotine concentration was assessed in home for 85 subjects during september and novemver 1999. Each home collected air nicotine samples for 24h and surveyed residence type, smoking type.

Nicotine samples analyzed using a capillary gas chromatography(GC) procedure with mass selective detector.

Results of thie study were as follows;

1. The extraction efficiency was average $98.73 \pm 2.32\%$ for 5, 10, $20\mu\text{g}/\text{Ml}$ nicotine. The limit of detection by GC with mass selective detector was $0.086\mu\text{g}/\text{Ml}$; samples collected at 1.5Lpm for 24h would have a LOD of $0.0004\mu\text{g}$ nicotine per m^3

2. Average concentration of nicotine in smoking, nonsmoking home were 2.57 ± 4.19 , $0.64 \pm 1.31\mu\text{g}/\text{m}^3$ respectively(p 0.01).

Concentration of nicotine in home was not statistically significant for resident type, heating type, ventilation frequency

3. Concentration of nicotine in home was not statistically significant for number of smoker, smoking duration, number of daily cigarette, number of cigarette in home but average concentration of nicotine in home was statistically significant by smoking area(p 0.01).

These results of indoor home was lower than concentration of indoor environment in commercial district($31.48 \pm 17.19\mu\text{g}/\text{m}^3$; range 5.88 $60.67\mu\text{g}/\text{m}^3$) but as long term exposure occurred, it is a different matter

Environmental tobacco smoke at several indoor envorinment in korea is

highly exposed than other countries

Therefore the studies of pollution distribution, exposure range and health effect in indoor is necessary to restrict smoking and prevent adverse health effect

Key words : Environmental tobacco smoke, human carcinogen, nicotine
indoor home, exposure