(19) (KR)
(12) (A)

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(21) 10-2008-0100137
(22) 2008 10 13
2008 10 13

(71)

1

(72)

2 3 2
702

3 807

( )

(74)

: 15

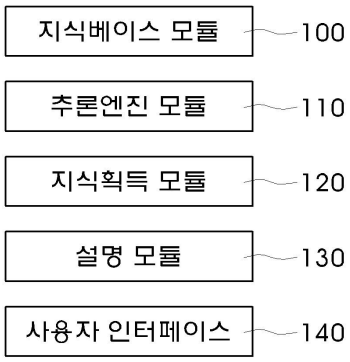
(54)

(57)

, SEM/EDX
. SEM/EDX
SEM/EDX
. , SEM/EDX
,

SEM/EDX . ,
SEM/EDX
.

- 1



(72)

6 113

1 412-19 1304

401

10593

2005 12 01 ~ 2010 11 30

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SEM/EDX .

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SEM/EDX

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SEM/EDX

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4

3 ,

(Au) SEM/EDX

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5

1 ,

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SEM/EDX SEM/EDX

.

6

1 ,

,

,

SEM/EDX .

7

5 ,

,

X- X- ,

X- 0 (log) SEM/EDX

.

8

7 ,

log(1+x) SEM/EDX

.

9

1 ,

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,

SEM/EDX

.

10

9 ,

,

SEM/EDX .

11

10 ,

SEM/EDX

.

12

9 ,

,

SEM/EDX .

13

12 ,

(Si) (Na)/

(Si) , (Mg)/ (Si) , (Al)/ (Si) , (Ca)/ (Si) , (Fe)/

(Si) SEM/EDX .

14

1 ,

, , , , , ,

SEM/EDX

.

15

1 ,

,

,

(Na) , (Mg) , (Al) , (Si) , (K) , (Ca) , (Cr) , (Mn) , (Fe) , (Cu) (Na)/ (Si) , (Mg)/ (Si) , (Al)/ (Si) , (Ca)/ (Si) , (Fe)/ (Si) SEM/EDX .

[0001] , SEM/EDX .

[0002] 2,500 (asbestos) , , , , , , . (lung cancer), (mesothe-lioma), (asbestosis) . , .

[0003] .

, 2009 1 . . . . 0.2 fibers/cc, 2 fibers/cc 2002 (NIOSH, National Institute for Occupational Safety and Health) 0.1 /cc . 0.01 /cc .

[0004] ,

, . , 0.25 , .

[0005] SEM/EDX .

[0006] SEM/EDX .

[0007] , , SEM/EDX .

[0008] , , . , (Au) .

[0009] SEM/EDX , , .

[0010] X- X- , X- 0 (log) . , log(1+x) .

[0011] , . . , . . , (Si) (Na)/ (Si) , (Mg)/ (Si) , (Al)/ (Si) , (Ca)/ (Si) , (Fe)/ (Si) .

[0012] , , , , , , . , , , (Na) , (Mg) , (Al) , (Si) , (K) , (Ca) , (Cr) , (Mn) , (Fe) , (Cu) (Na)/ (Si) , (Mg)/ (Si) , (Al)/ (Si) , (Ca)/ (Si) , (Fe)/ (Si) .

[0013] SEM/EDX SEM/EDX .

[0014] , SEM/EDX , SEM/EDX .

[0015] , SEM/EDX .

[0016] , .

[0017] ,

,

. .

[0018] 1 .

[0019] 1 ,
(knowledge base) (100) , (interface engine) (110) , (knowledge acquisition)
(120) , (explanation) (130) , (user interface) (140) .
,
.

[0020] (100)
. , SEM/EDX ,
x- . , (length) (width) (ratio,
L/W) 4 ,
(Na), (Mg), (Al), (Si), (K), (Ca), (Cr), (Mn), (Fe), (Cu)
(Na)/ (Si), (Mg)/ (Si), (Al)/ (Si), (Ca)/ (Si),
(Fe)/ (Si) 5 .

[0021] (110) , 1
2 .

[0022] 1 . ,
(length) (width) (ratio, L/W) ,
.

[0023] 2 1 , ,
. , (Si)
(Na)/ (Si) , (Mg)/ (Si) , (Al)/ (Si) , (Ca)/ (Si) ,
(Fe)/ (Si) ,
.

[0024] LISP, Prolog, Smalltalk , C FORTRAN
. , Visual C++,
Java, Visual Basic (tool)

.

[0025] SEM/EDX
. SEM/EDX
.

[0026] 2 SEM/EDX , 3
, 4 SEM/EDX SEM
EDX , 5 SEM/EDX SEM EDX
.

[0027] 2 , SEM/EDX
(S_1) , (S_2) , (S_3) ,
(S_4) .

[0028] (S_1) ,
, (S_{1-1}) , (S_{1-2}) , (S_{1-3})
.

[0029] (S_{1-1}) (reference sample) . (standard sample) , , (stub) , . , 1.2 1.5 3 5 L/min 4 . , . , . , , SEM (polycarbonate membrane filter) (preloaded cassette) . , 25mm (pore size) 0.8 .

[0030] (S_{1-2}) . 2 4 .

[0031] (S_{1-3}) . SEM/EDX . , . (plasma sputtering) (sputter coating procedure) . 1/2 1/4 (Au) 20 40 nm . SEM/EDX X- .

[0032] (S_2) SEM/EDX . (stub) SEM/EDX . (phase contrast microscopy, PCM) (polarized light microscopy, PLM) . , . EDX (energy dispersive Xray spectrometer) (scanning electron microscopy, SEM) .

[0033] , , , . , 3 8 , . , EDX X- (noise) X- (count) X- (count) , , 95% X- (count) 0 . , (count) log , 0 log(1+x) .

[0034] , , , , , 5 2 . , SEM/EDX x- , (length) (width) (ratio, L/W) 4 , (Na) , (Mg) , (Al) , (Si) , (K) , (Ca) , (Cr) , (Mn) , (Fe) (Cu) 10 . NIOSH 7402 (Si) 5 .

[0035] , SEM/EDX , , SEM/EDX . , , SEM/EDX (Electron Probe Micro Analyzer, EPMA) .

[0036] (S_3) . , (S_2) , , , , , ,

8 . 6
2 380 .

[0037] 1 . , 1
, , . ,
.

[0038] [1]

종류		섬유 개수	길이(㎛)	폭(㎛)	종횡비	
					최소	범위
석면	백석면	53	88.4	1.4	72.6	15.7~346.7
	첨석면	33	38.4	1.5	34.5	12.1~125.4
	갈석면	35	189.7	2.5	49.7	7.6~143.5
	투감섬석	81	98.2	2.5	43.2	7.2~369.7
	직섬석	16	85.8	3.8	26.3	7.2~80.3
비석면	유리섬유	31	75.2	4.4	20.1	5.3~73.1
	암면	19	81.6	2.4	37.6	9.3~108.0

[0039]

[0040] 1 , 189.7 , , .
, 71.9
. ,
77.4% 30 , 83.9%
5 30 . ,
.

[0041] 4 , (Si) , (Fe) (Mg) (Na)
, 5 , (Si) (Mg) , (Ca) (Fe)
.
, (Mg) (Si) .
, (Si) , (Mg)
(Fe) . , (Si) , (Mg) (Ca) ,
(Fe) . .
(Si) , (Na) , (Ca) . (Si) ,
(Ca) , (Mg) (Fe) (Mn) .
5 ((Na), (Mg), (Al), (Ca),
(Fe)) (Si) . , (Na)/
(Si) 0.8 . (Al)/ (Si) 0.4, 0.2,
0.2 , (Ca)/ (Si) 0.7 .

[0042] (S_4) ,
(S_{4-1}) ,
(S_{4-2}) .

[0043] (S_{4-1}) (source profile)
. ,
,
3 .

[0044] (S_{4-2})
. ,
8 (Si) 5 (Na)/ (Si), (Mg)/
(Si), (Al)/ (Si), (Ca)/ (Si), (Fe)/ (Si)

. , 6
2 . ,
.
(unknown asbestos/nonasbestos) .
.

[0045] , SEM/EDX
. , SEM/EDX
,
. ,
.

[0046] SEM/EDX
.

[0047] 6
, 7 , 8
, 9
.

[0048] , , 3
. SEM/EDX .
.
.

[0049] 2 .

[0050] [2]

샘플	데이터 번호	석면섬유						비 석면섬유		기타 섬유	미상
		백석면	갈석면	청석면	투감섬석	직섬석	녹섬석	유리섬유	암면		
천장재	30	5	4	1	5	0	0	4	0	0	11
다세대 주택	13	1	2	0	0	0	0	0	0	2	8
유치원	20	1	5	0	0	0	0	2	0	3	9
지하상가	13	1	1	0	0	0	0	0	0	7	4

[0051]

[0052] 2 , 30 , 5 , 4 ,
1 , 5 15 4 .
13 1 , 2 . 1 , 5
, 2 . 1 .
, .

[0053] 6 , 4 76 9.3%, 15.4%,
0.8%, 4.2% 29.6% . 5.8%
. 21.1% , , 43.5%
.
, .
.
. .

[0054] 7 , , , .
, 7(d)
. , 8 ,
8(a) (C) 84.9%, (O) 15.1% ,
8(b) (Si) 45.5%, (Ca) 25.0%, (Fe) 29.5%, 8(c)
(N) 78.6% . 8(d) (C) 84.2%,
(O) 14.95%, (S) 0.87% . 8(a) 8(b)
, .

[0055] 9 , 0.0054 f/cc,
0.0104 f/cc, 0.0144 f/cc .
0.0003 f/cc, 0.0006 f/cc 0.0006 f/cc .
0.01 f/cc , SEM/EDX PCM
, .

[0056]
.
4.2% .

[0057] ,
.

[0058] 1 .

[0059] 2 SEM/EDX .

[0060] 3 .

[0061] 4 SEM/EDX SEM EDX .

[0062] 5 SEM/EDX SEM EDX .

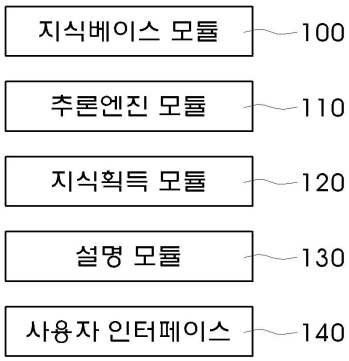
[0063] 6
.

[0064] 7 .

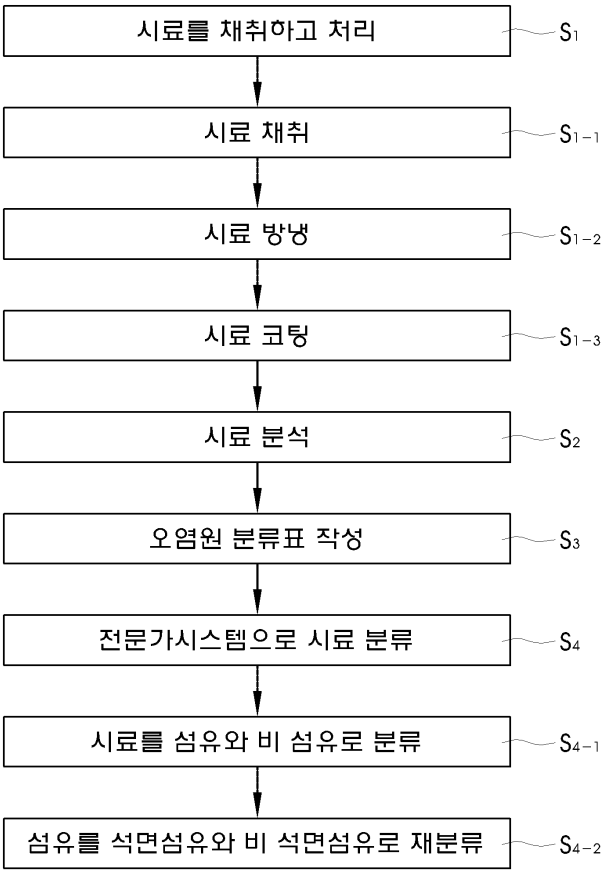
[0065] 8 .

[0066] 9 .

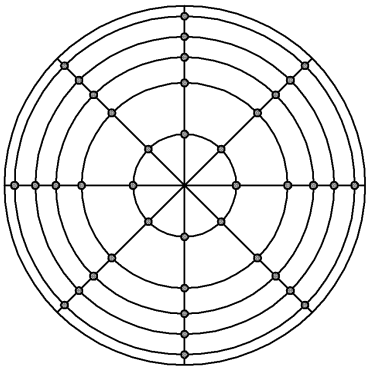
1


지식베이스 모듈
100
추론엔진 모듈
110
지식획득 모듈
120
설명 모듈
130
사용자 인터페이스
140

2

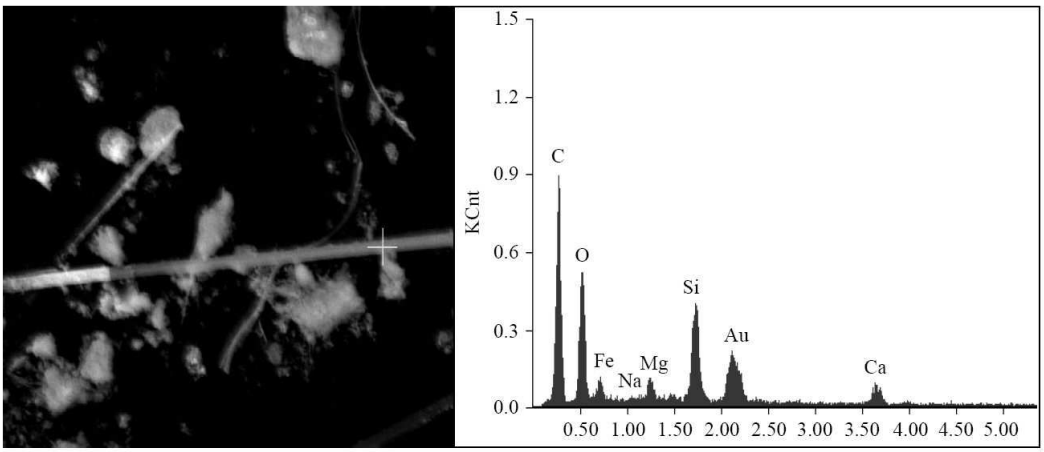

시료를 채취하고 처리
S1
시료 채취
S1-1
시료 방냉
S1-2
시료 코팅
S1-3
시료 분석
S2
오염원 분류표 작성
S3
전문가시스템으로 시료 분류
S4
시료를 섬유와 비 섬유로 분류
S4-1
섬유를 석면섬유와 비 석면섬유로 재분류
S4-2

3

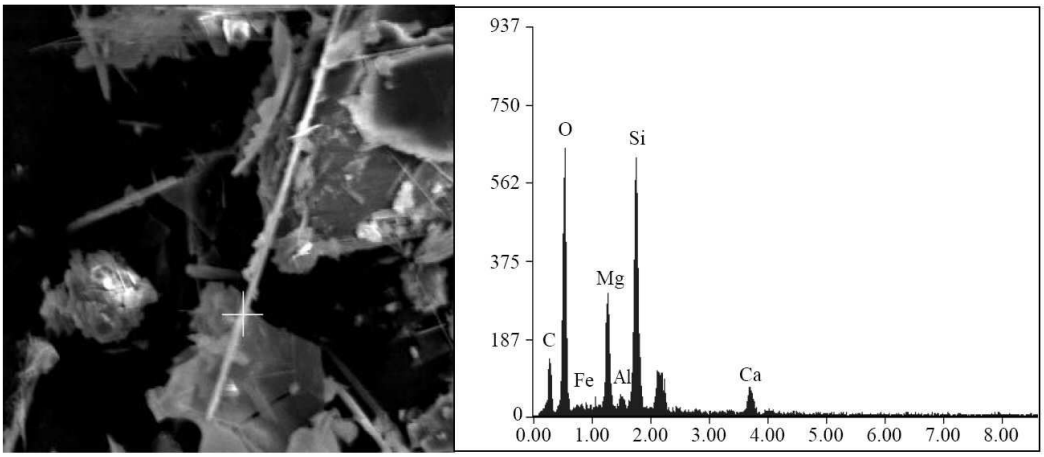


No.	%	45mm
1	2.5	1.125
2	8.2	2.69
3	14.6	6.57
4	22.6	10.17
5	34.2	15.39
6	65.8	29.61
7	77.4	34.83
8	85.4	38.43
9	91.8	41.31
10	97.5	43.87

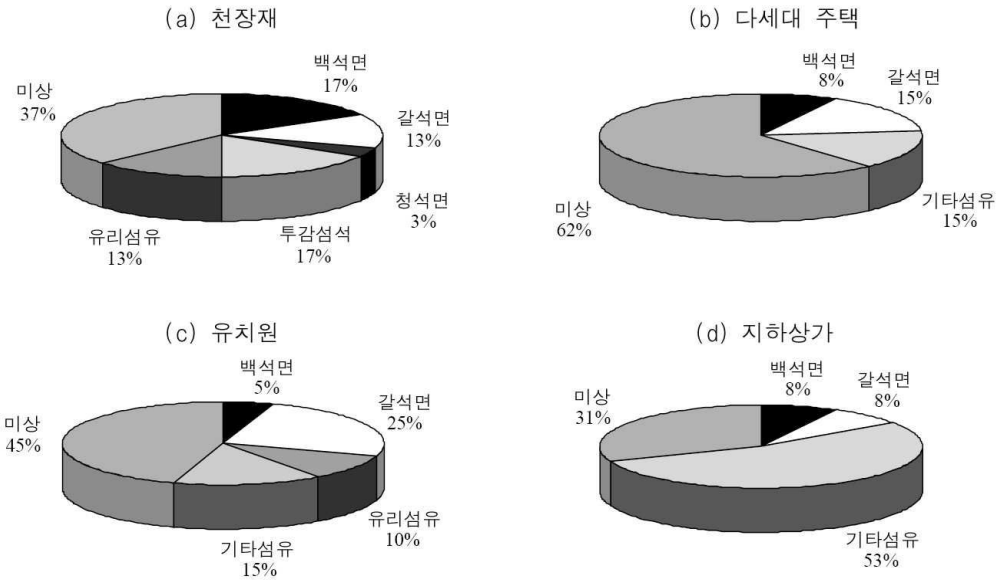
4



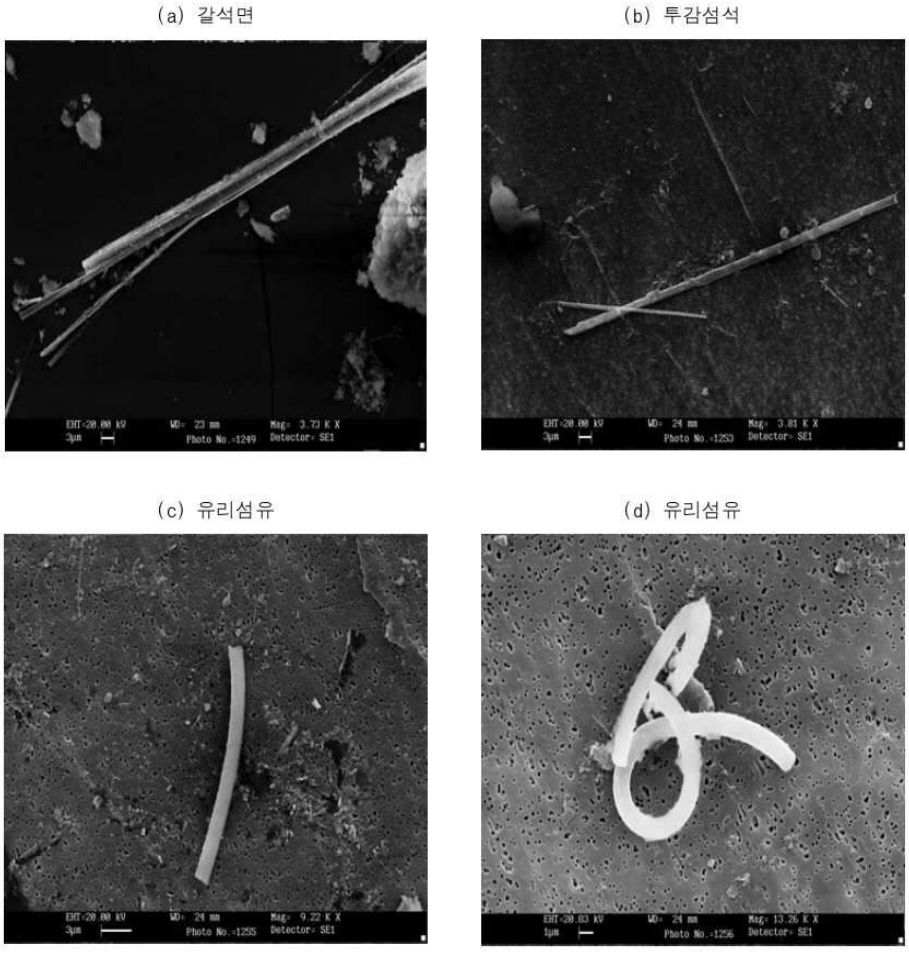
5



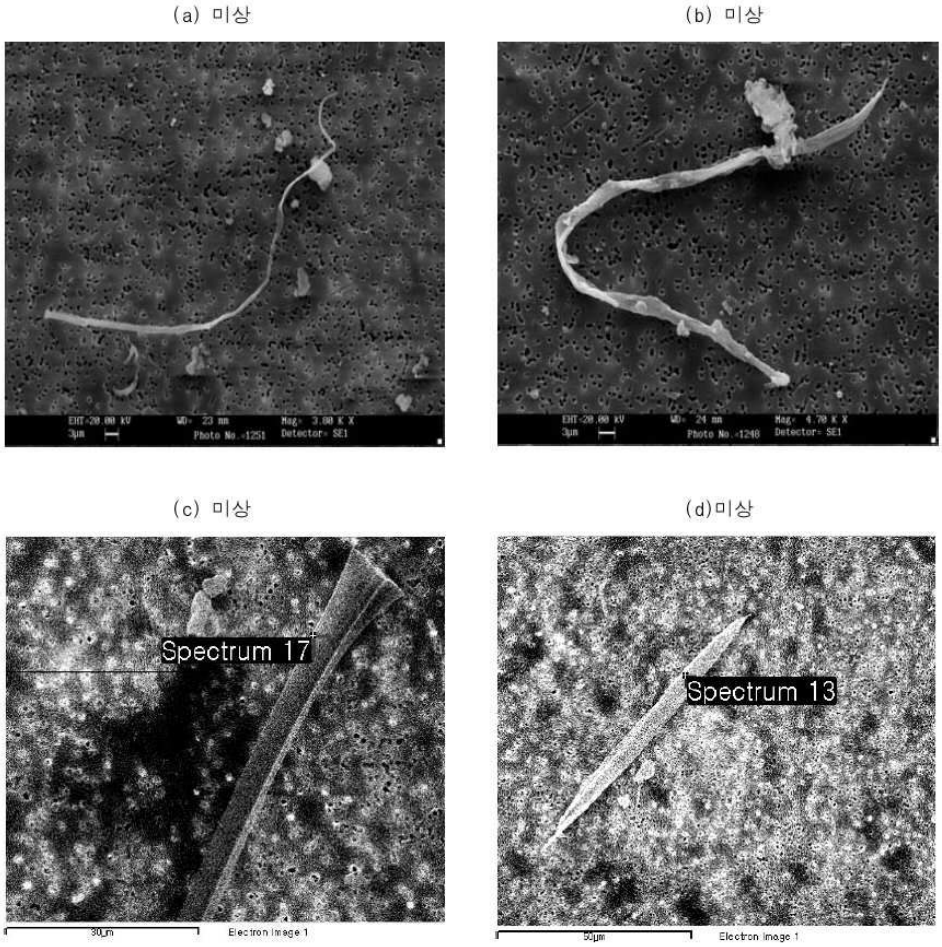
6


(a) 천장재
백석면 17%
갈석면 13%
청석면 3%
투감섬석 17%
유리섬유 13%
미상 37%
(b) 다세대 주택
백석면 8%
갈석면 15%
기타섬유 15%
미상 62%
(c) 유치원
백석면 5%
갈석면 25%
유리섬유 10%
기타섬유 15%
미상 45%
(d) 지하상가
백석면 8%
갈석면 8%
기타섬유 53%
미상 31%

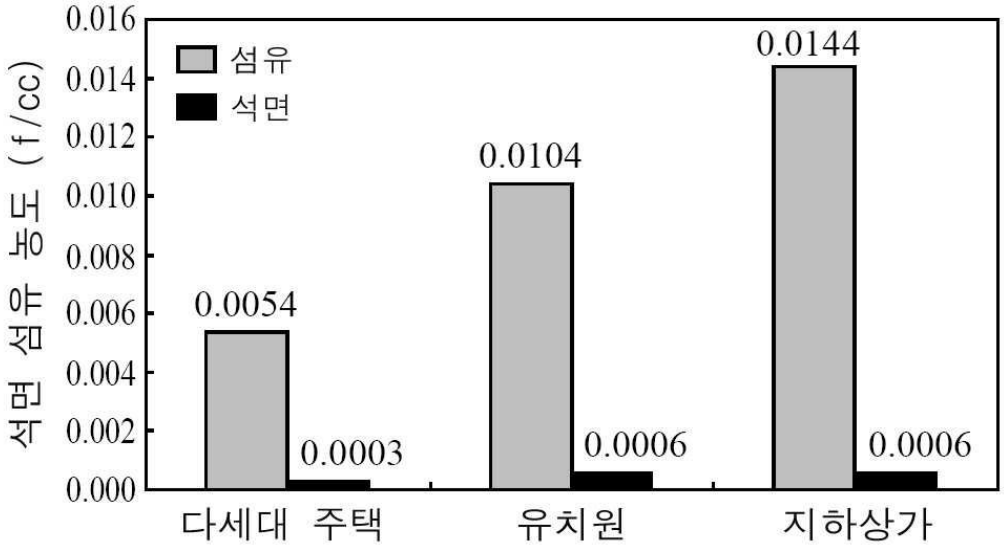
7


(a) 갈석면
(b) 투감섬석
(c) 유리섬유
(d) 유리섬유

8


(a) 미상
(b) 미상
(c) 미상
(d)미상
Spectrum 17
Spectrum 13

9


석면 섬유 농도 (f/cc)
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
섬유
석면
0.0054
0.0003
0.0104
0.0006
0.0144
0.0006
다세대 주택
유치원
지하상가