

呼吸防護具密合度測試原理與實務

↳ 微粒的產生

↳ 微粒的量測

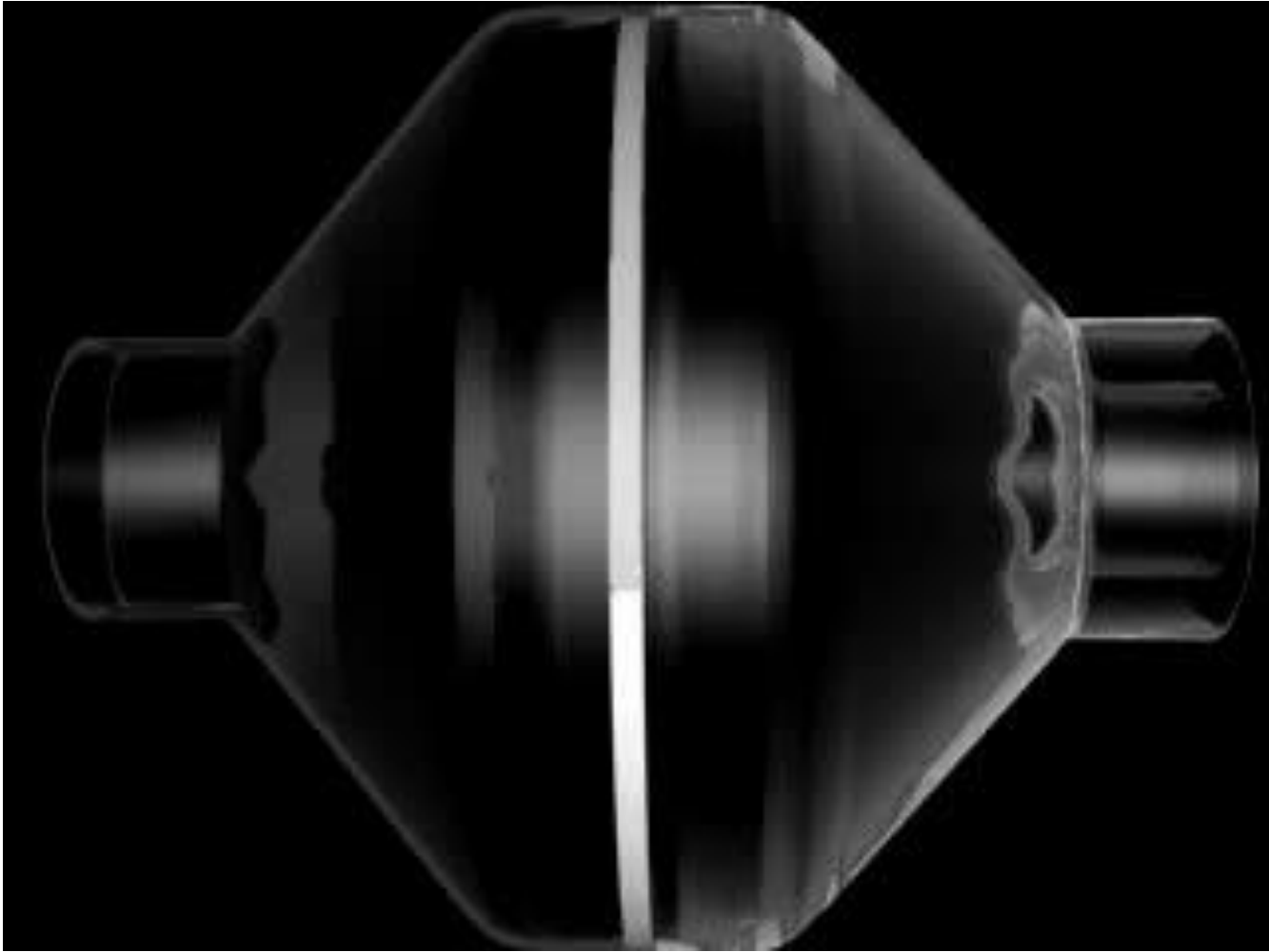
-- Condensation particle counter

-- Differential mobility analyzer

↳ 定性測試方法

↳ 定量測試方法

↳ 密合度測試實作



資料來源：3M公司

機制	圖示	對沈積效率效應	
		粒徑	流速
衝擊沈積		+	+
沉降沈積		+	-
擴散沈積		-	-
攔截沈積		+	?
靜電吸引		- (帶電量與 粒徑無關)	-

影響單位長度纖維微粒沈積因子

- ↳ 微粒粒徑 (d_p)
- ↳ 速度 (氣體流速) (U)
- ↳ 纖維直徑 (d_f)
- ↳ 帶電量
 - 纖維
 - 微粒

影響總纖維長度因子

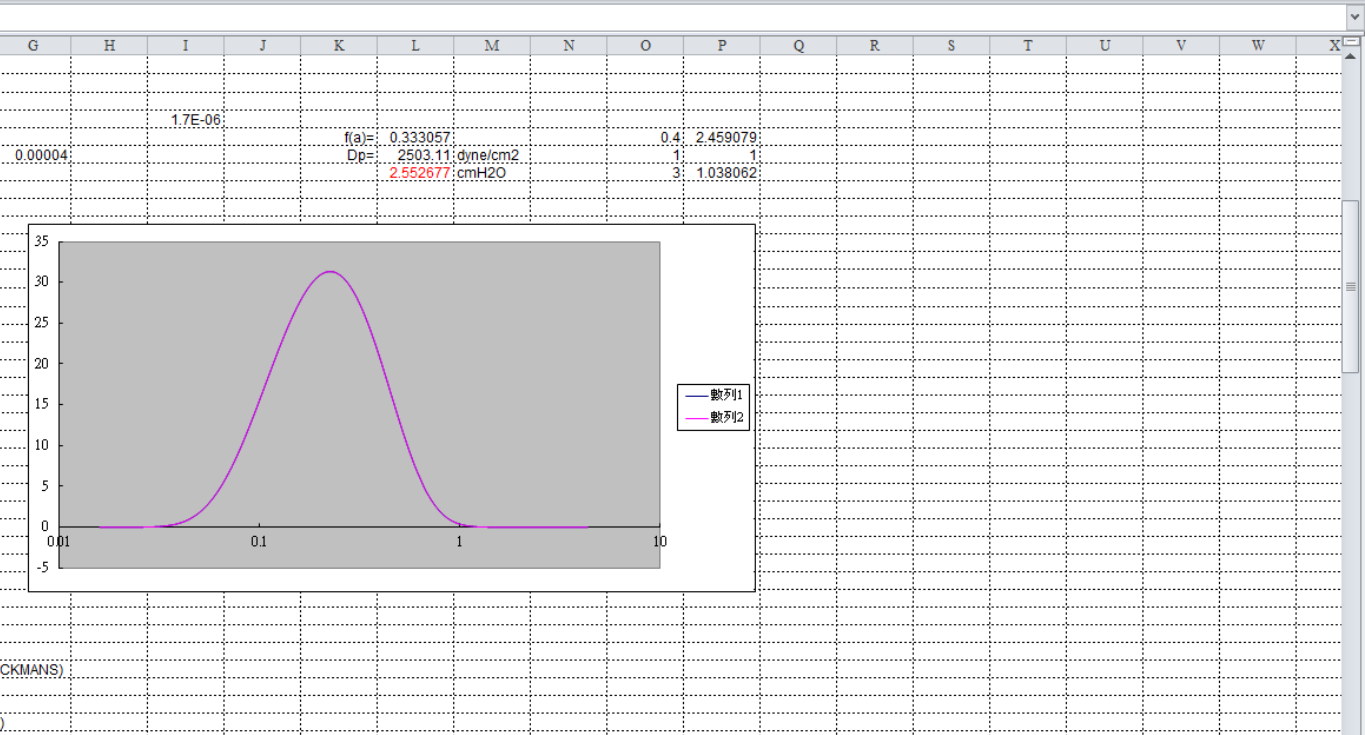
- ↳ 纖維直徑
- ↳ 填充密度
- ↳ 濾材厚度

圖 11.12 微粒在纖維附近流場各種沈積機制以及各種因素對該機制沈積效率之效應一般趨勢，+ 代表對沈積效率具促進效應，- 代表對沈積效率具抑制效應，? 代表不具直接效應。(Bollinger *et al.*, 1987)

Microsoft Excel ribbon: 檔案, 常用, 插入, 版面配置, 公式, 資料, 校閱, 檢視. Font: Arial, 12. Styles: 一般, 中等, 好, 壞, 計算方式, 連結的儲... Storage: 儲存格, 插入, 刪除, 格式. Editing: 自動加總, 填充, 清除, 排序與篩選, 尋找與選取.

INPUT PARAMETERS/FIBER			
1.7	um	DIAMETER	30
2.2		DIELECTRIC CONSTANT	2.2
0.00E+00	C/m2	CHARGE DENSITY	0.0002

INPUT PARAMETERS/FILTER			
0.03		PACKING DENSITY	0.031
1.2	mm	THICKNESS	
10	cm/s	FLOW VELOCITY	2.5



CALCULATED PARAMETERS:			
1.204	kg/m3	DENSITY OF AIR	
0.0000182	Pa s	AIR VISCOSITY	1.81E-05
0.000000066	m	MEAN FREE PATH	
0.938963547		A0 ((1-alpha)/K)	
2.35938E-17	m3/s	A1 (DIFFUSION COEFFICIENT)	
28437942.61	1/ms	A2 (SETTLING VELOCITY)	
7205270883	1/m	A3 (PECLET NUMBER)	
1.70581E+11	1/m2	A4 (STOKES NUMBER)	
284379426.1	1/m2	A5 (SETTLING)	
0	1/m2	A6 (DIELECTROPHORESIS)	1.34E+13
0.975123208		A7 (DIELECTROPHORESIS)	
0	m	A8 (COULOMBIC EFFECT, s=1)	2.65E-07
0.992158578		A9 (COULOMBIC EFFECT, s=1)	
1.14013E-07	m	D0 (ELECTROSTATIC DIAMETER)	1.12E-07
1.26859E-17			
1.033053949		KUWABARA COEFFICIENT K	
0.011246154		REYNOLDS NUMBER	
3.145		Fstk (IMPACTION COEFFICIENT, NGYEN & BEECKMANS)	
0.011246154		Fiber Reynolds Number	
26.96271977		A10 (PENETRATION EXPONENT COEFFICIENT)	

Dp	Dae	Dp	Cc	Cc/Dp	Dp/Cc	Dp ² *Cc	D	Vs	Pe	Stk	R	NMIQp ²	J	Nd	Nc	SIGMA	f(0)	f(1)	f(2)	f(3)	f(4)	f(5)	f(6)
(um)	(um)	(m)	(1/m)	(1/m)	(m)	(m2)	(m2/s)	(m/s)									0	1	2	3	4	5	6
0.015963	1.6E-08	14.28995	8.95E+08	1.12E-09	3.64E-15	2.11E-08	1.04E-07	8.048858	0.000621	0.00939	4.26E+33	0.002271	0	0	0	0.37418	1.066177	0.029984	6.67E-07	1.17E-14	1.63E-25	1.8E-39	1.56E-51
0.016548	1.65E-08	13.80654	8.34E+08	1.2E-09	3.78E-15	1.97E-08	1.08E-07	8.635967	0.000645	0.009734	4.11E+33	0.002439	0	0	0	0.380975	1.047162	0.033412	1.09E-06	3.59E-14	1.21E-24	4.14E-38	1.45E-50
0.017154	1.72E-08	13.34061	7.78E+08	1.29E-09	3.93E-15	1.83E-08	1.12E-07	9.264882	0.00067	0.010091	3.96E+33	0.002619	0	0	0	0.387888	1.028499	0.037064	1.73E-06	1.05E-13	8.32E-24	8.53E-37	1.14E-49
0.017783	1.78E-08	12.89066	7.25E+08	1.38E-09	4.08E-15	1.71E-08	1.16E-07	9.939857	0.000695	0.010461	3.82E+33	0.002812	0	0	0	0.394935	1.010148	0.040943	2.73E-06	2.98E-13	5.36E-23	1.58E-35	7.67E-47
0.018434	1.84E-08	12.45738	6.76E+08	1.48E-09	4.23E-15	1.59E-08	1.2E-07	10.66211	0.000722	0.010844	3.69E+33	0.003019	0	0	0	0.402099	0.992149	0.045034	4.21E-06	8.11E-13	3.22E-22	2.63E-34	4.44E-46
0.01911	1.91E-08	12.03877	6.3E+08	1.59E-09	4.4E-15	1.49E-08	1.25E-07	11.43744	0.00075	0.011241	3.56E+33	0.003242	0	0	0	0.409406	0.974443	0.049343	6.41E-06	2.13E-12	1.82E-21	3.99E-33	2.24E-45
0.01981	1.98E-08	11.63549	5.87E+08	1.7E-09	4.57E-15	1.39E-08	1.3E-07	12.26733	0.000779	0.011653	3.43E+33	0.003481	0	0	0	0.416836	0.957072	0.053851	9.59E-06	5.41E-12	9.66E-21	5.46E-32	9.77E-44
0.020535	2.05E-08	11.24687	5.48E+08	1.83E-09	4.74E-15	1.29E-08	1.35E-07	13.15568	0.000809	0.012079	3.31E+33	0.003737	0	0	0	0.424395	0.940025	0.058548	1.41E-05	1.33E-11	4.82E-20	6.8E-31	3.72E-43

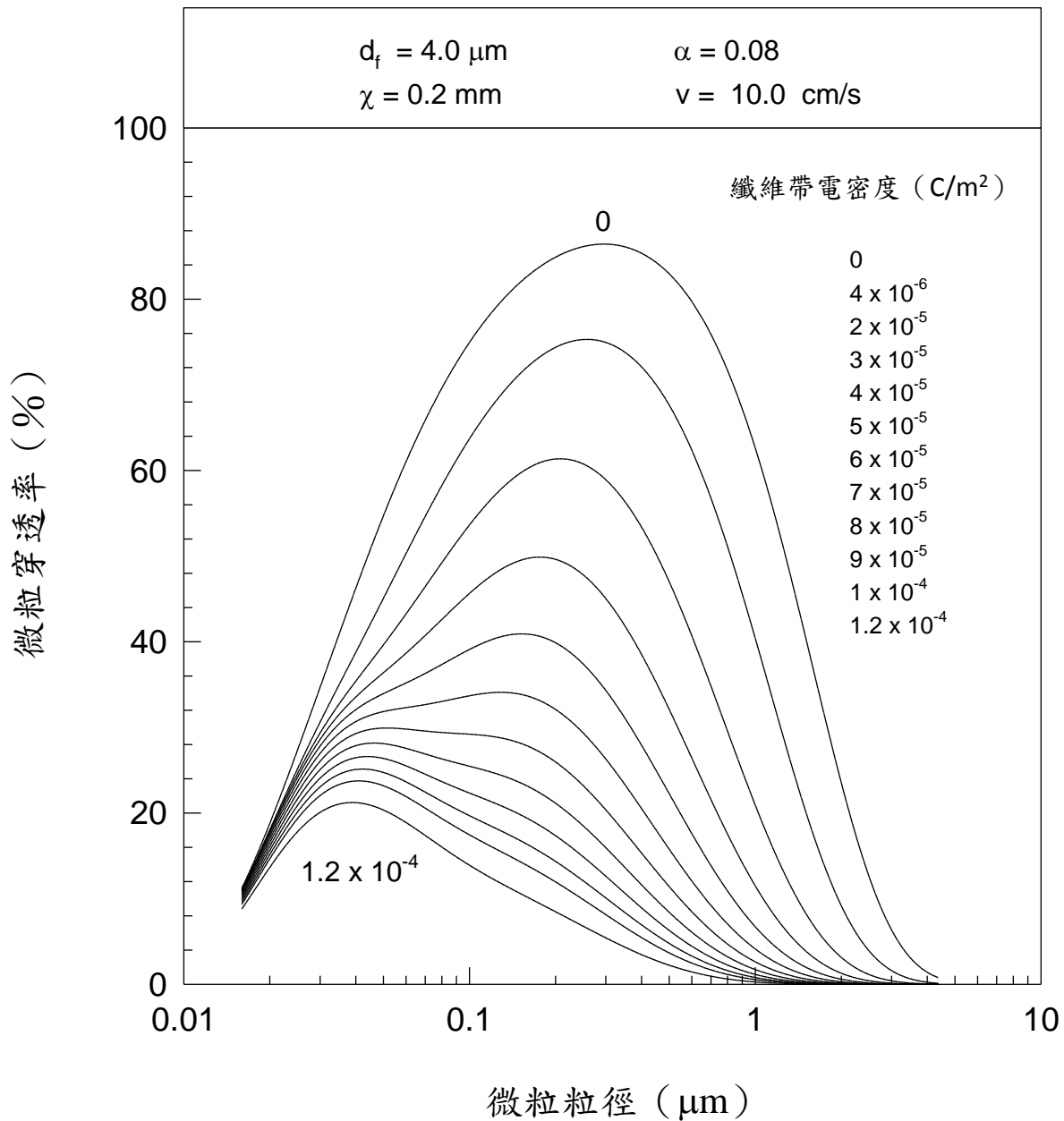


圖5-3 理論推估纖維帶電量與微粒穿透率之關係

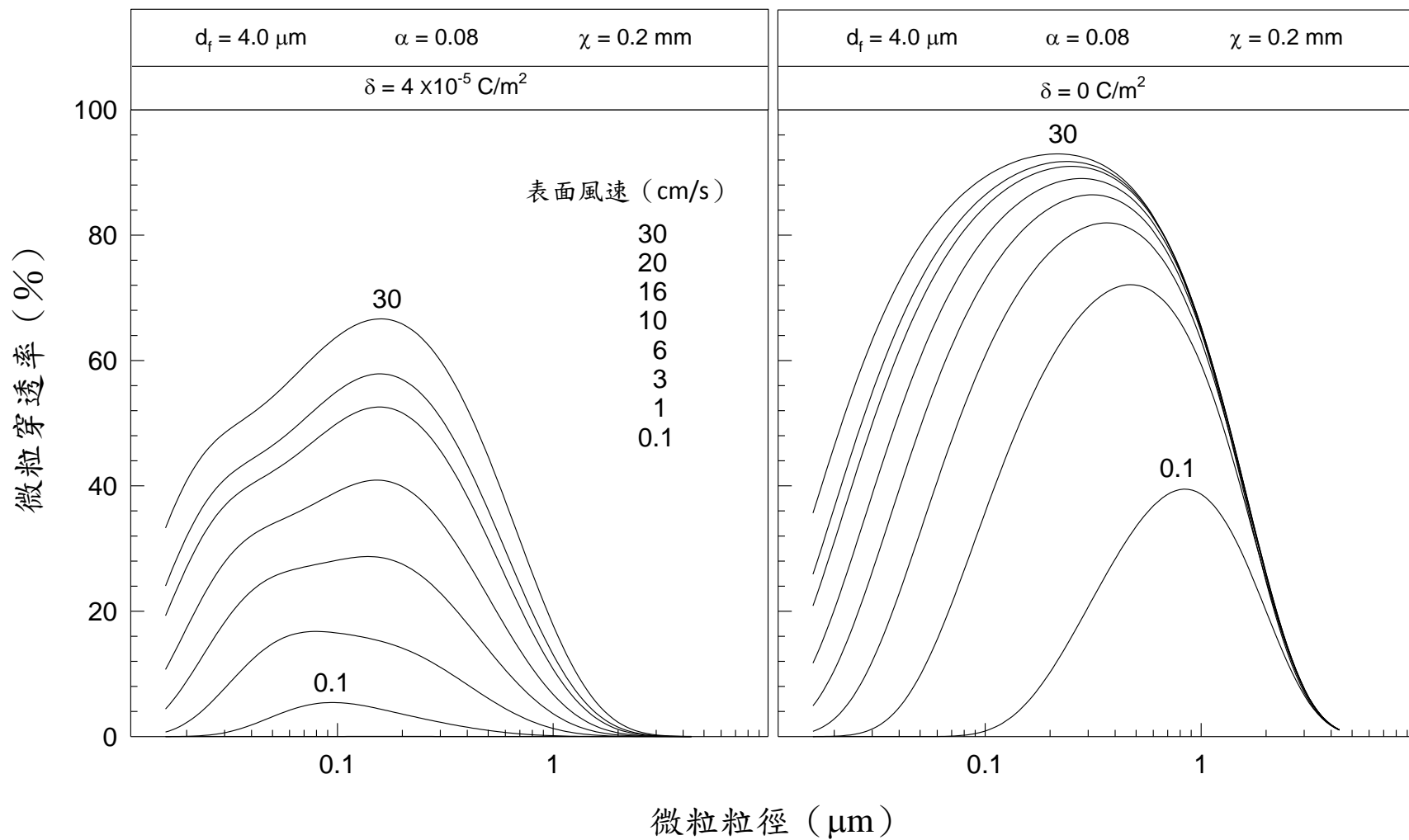


圖5-4 理論推估表面風速與微粒穿透率之關係

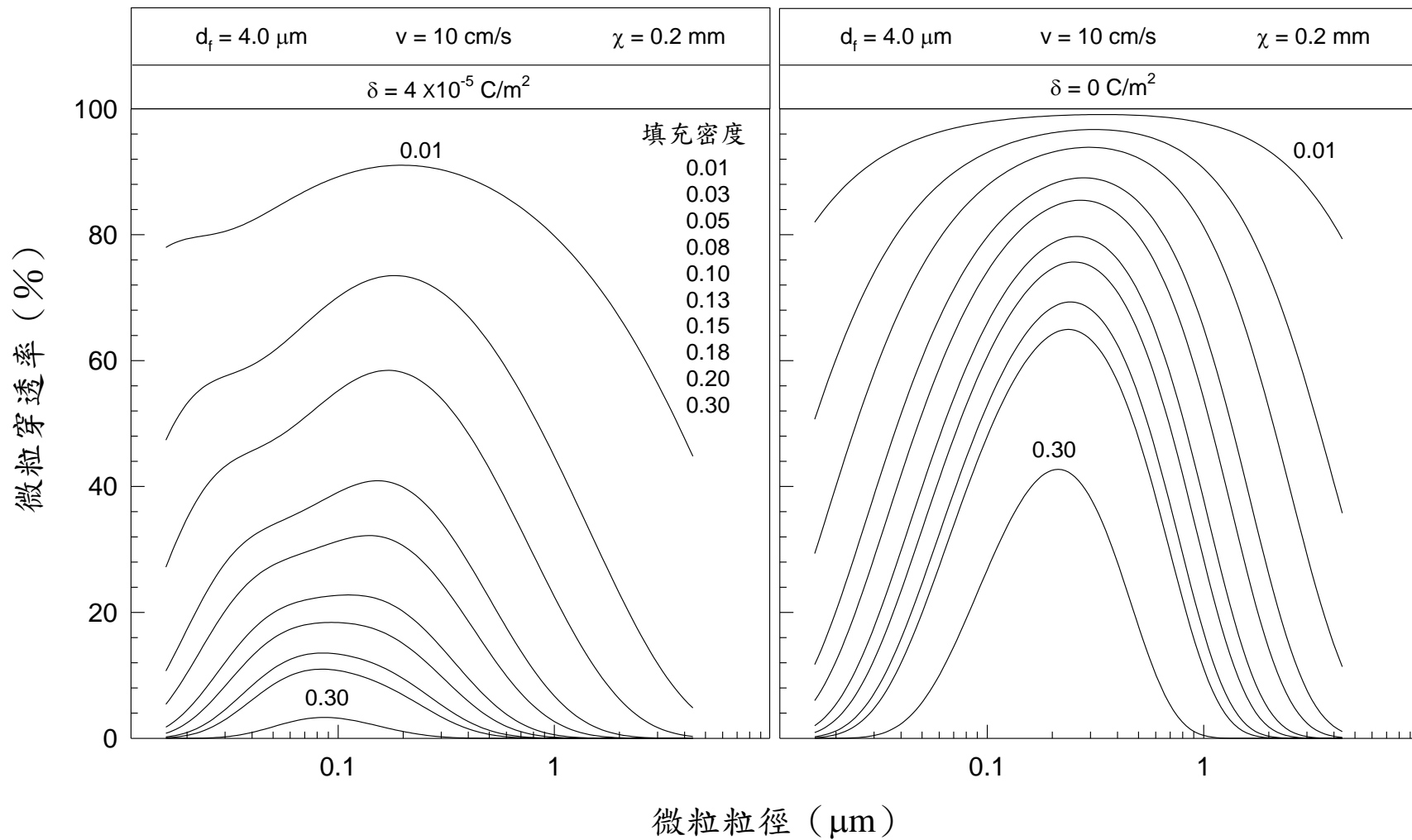


圖5-5 理論推估填充密度與微粒穿透率之關係

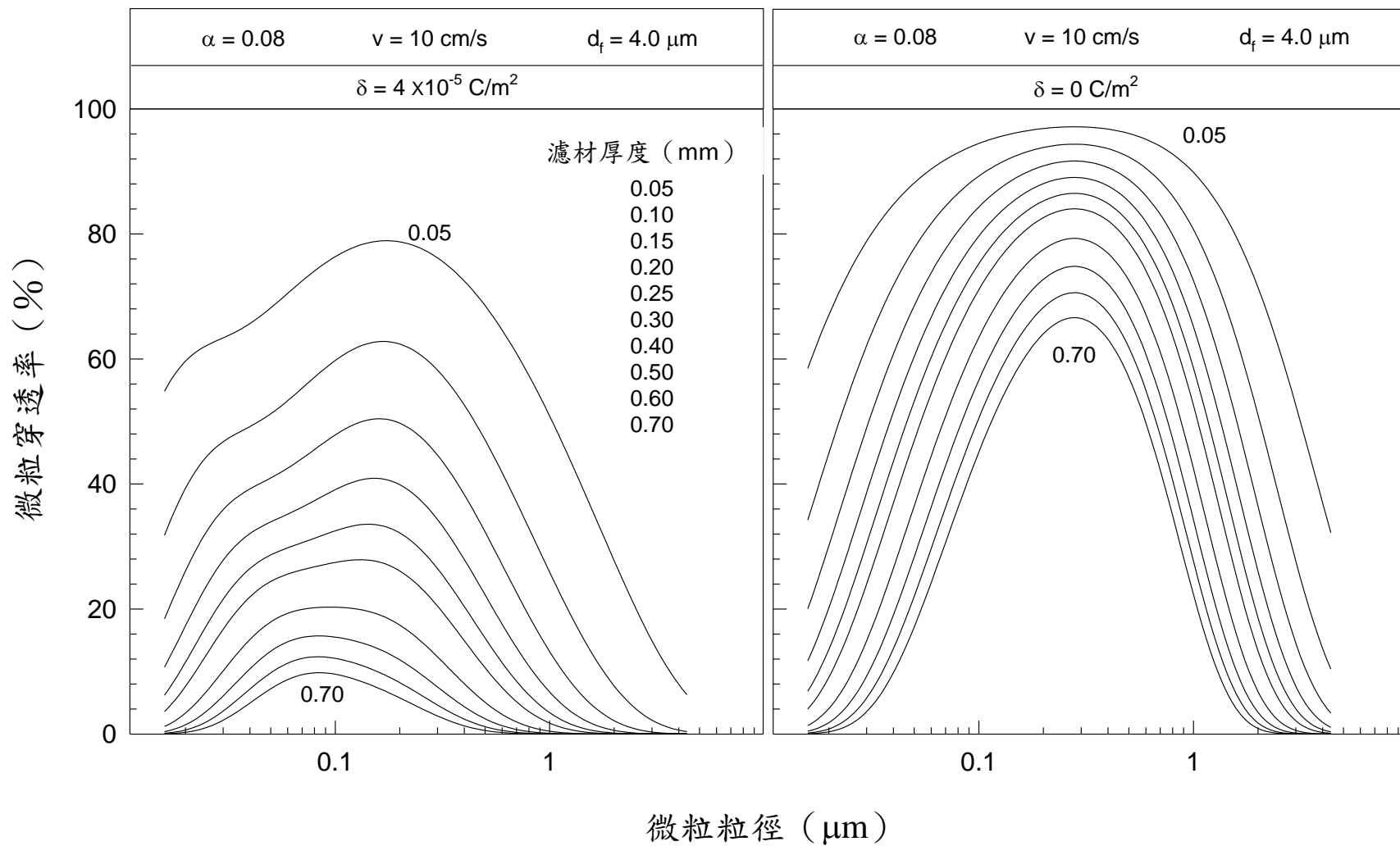


圖5-6 理論推估濾材厚度與微粒穿透率之關係

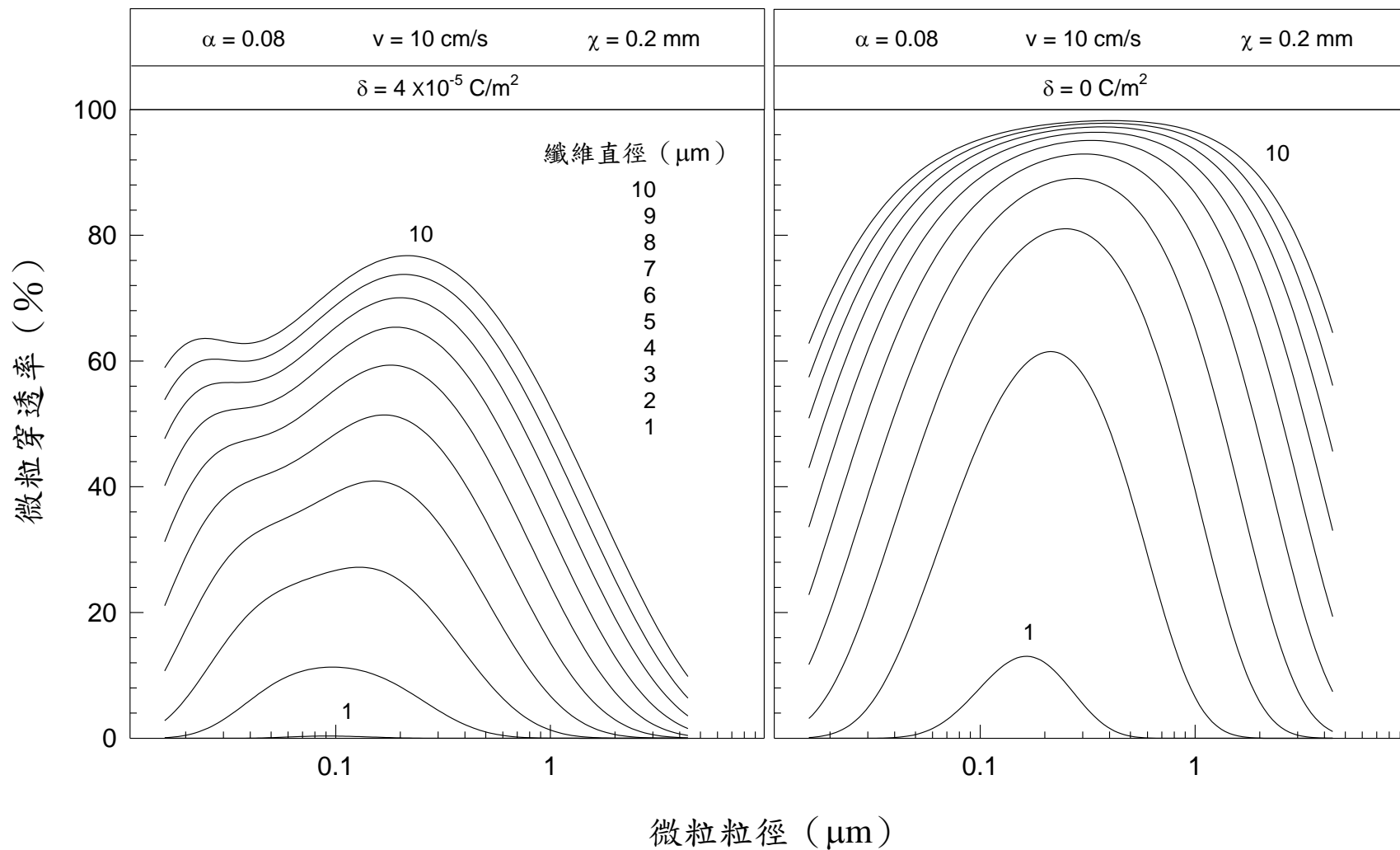


圖5-7 理論推估纖維直徑與微粒穿透率之關係

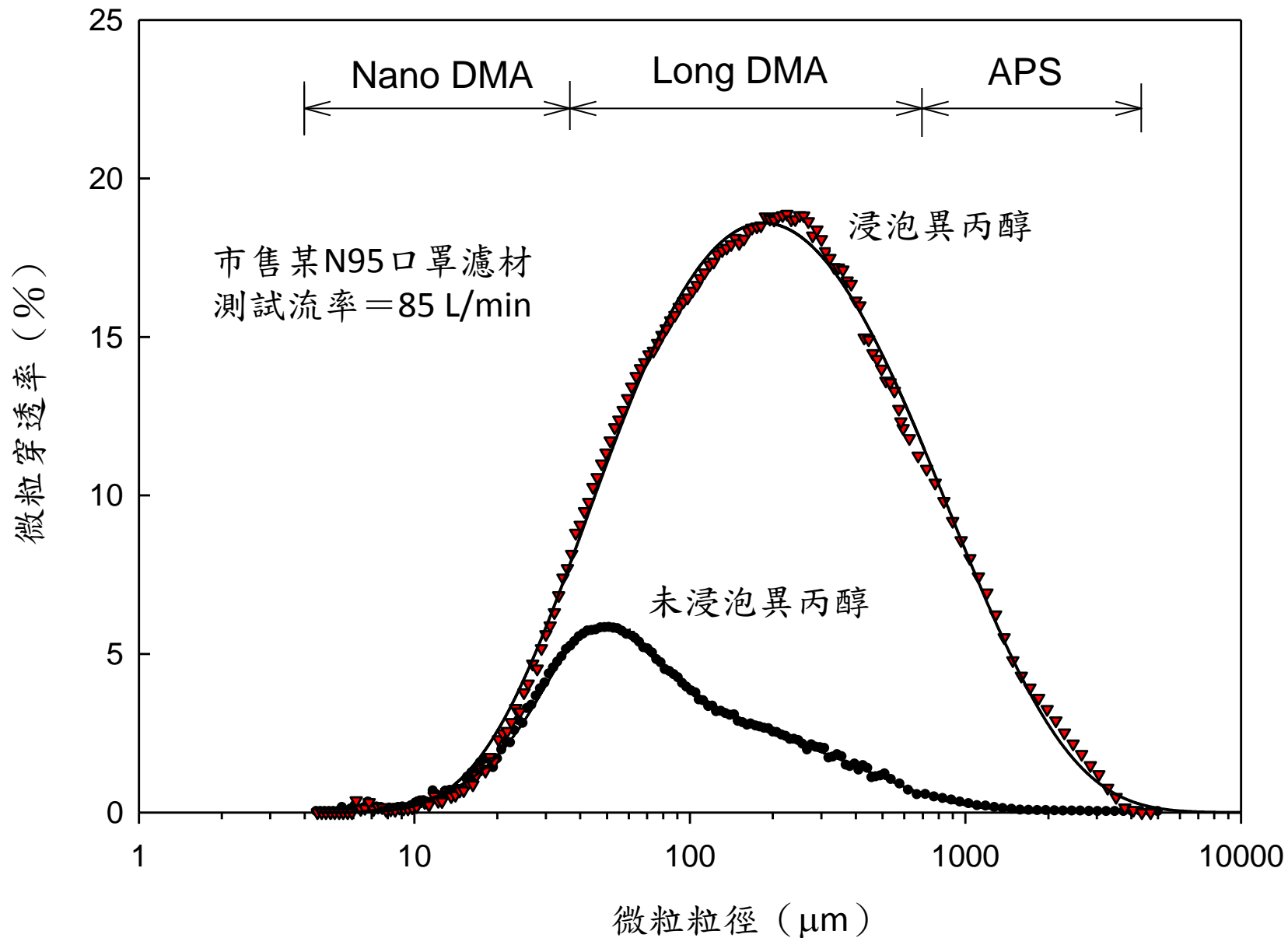


圖5-8 某N95防塵口罩之微粒粒徑與貫穿率圖

濾材厚度 = 6 mm, 填充密度 = 0.035, 纖維直徑 = 13 μm

表面風速 = 8 cm/s, 纖維帶電密度 = $1.2 \times 10^{-6} \text{ C/m}^2$

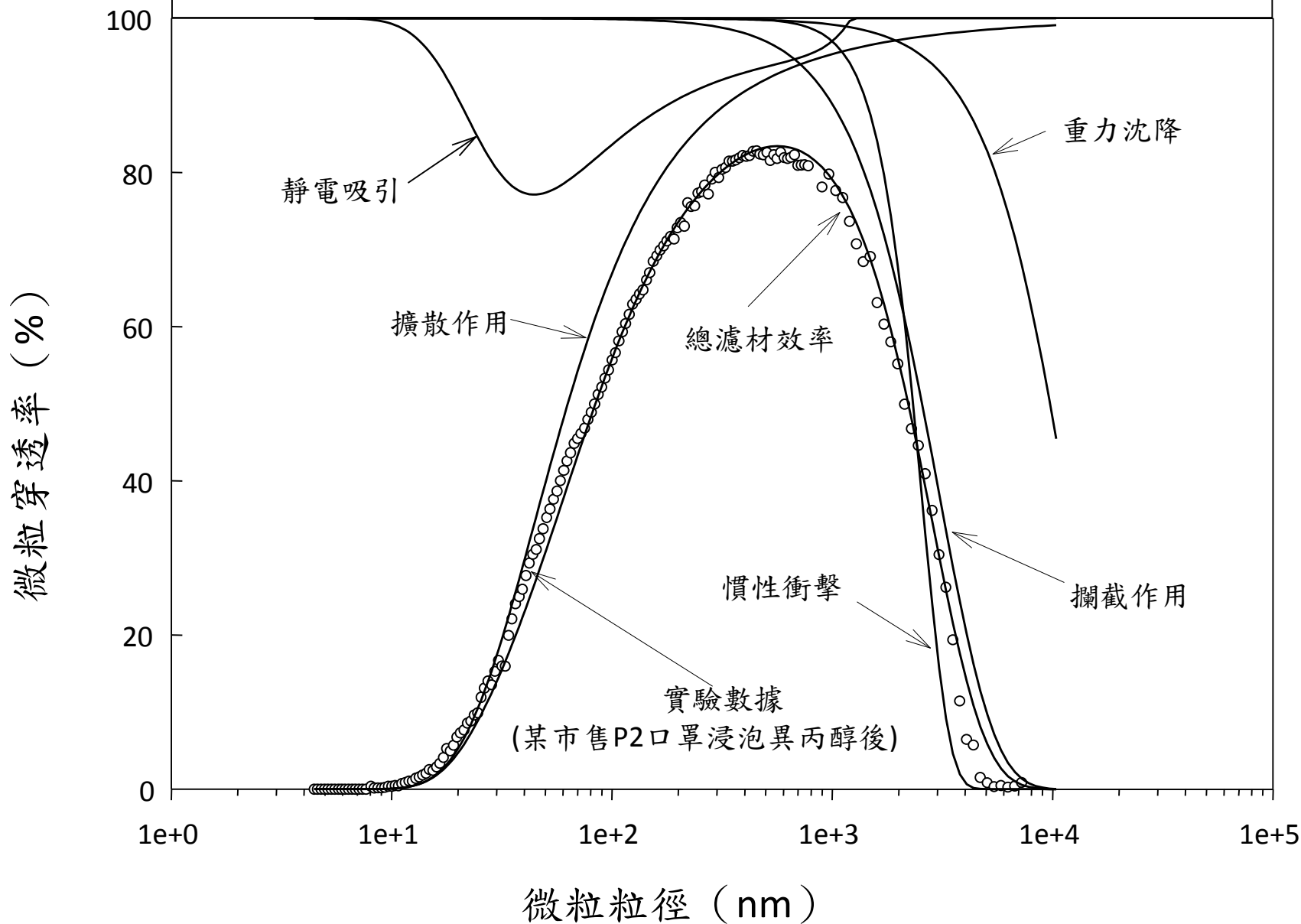


圖5-9 實驗值與單一纖維理論機制之比較

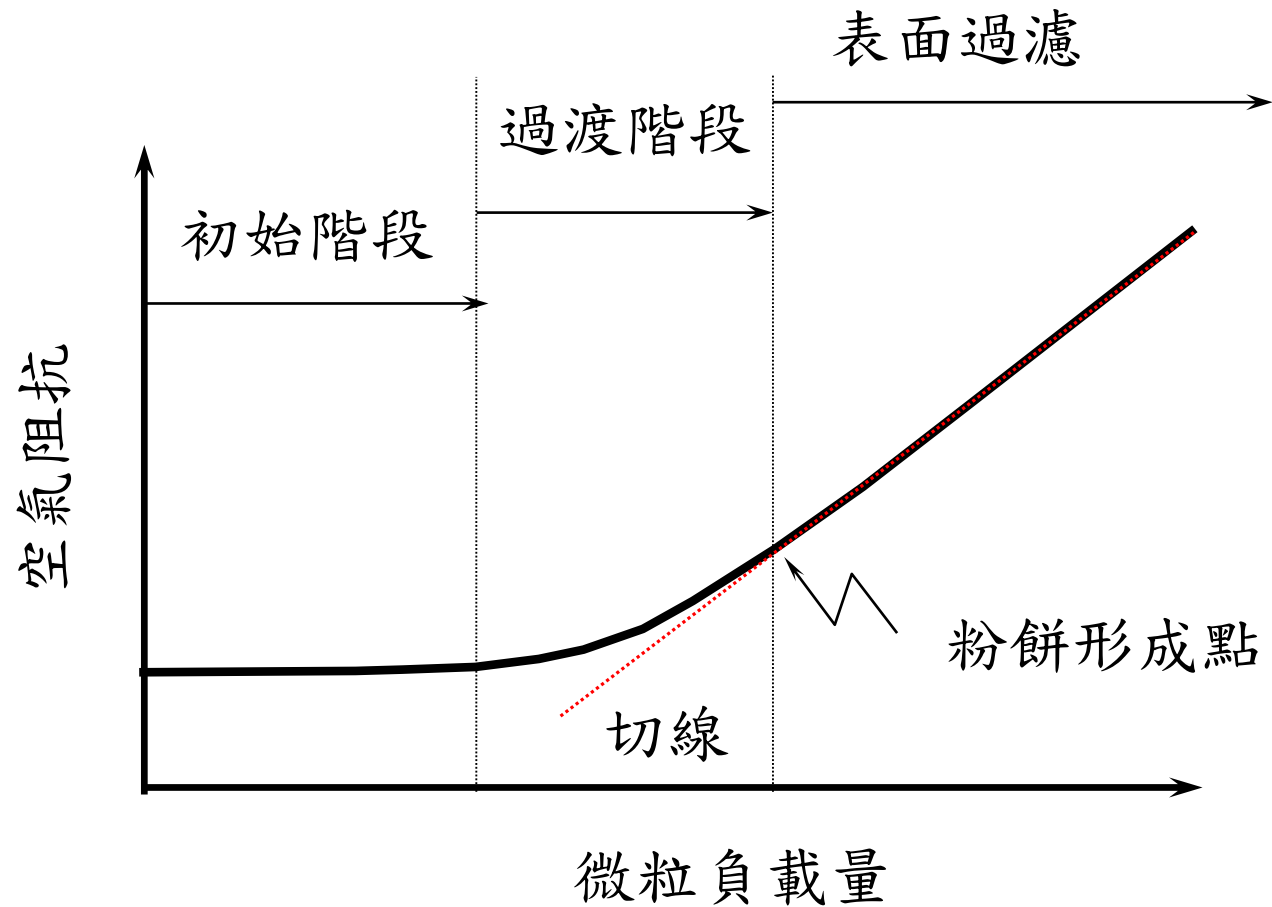


圖5-10 纖維性濾材之空氣阻抗隨著微粒負載量的變化曲線

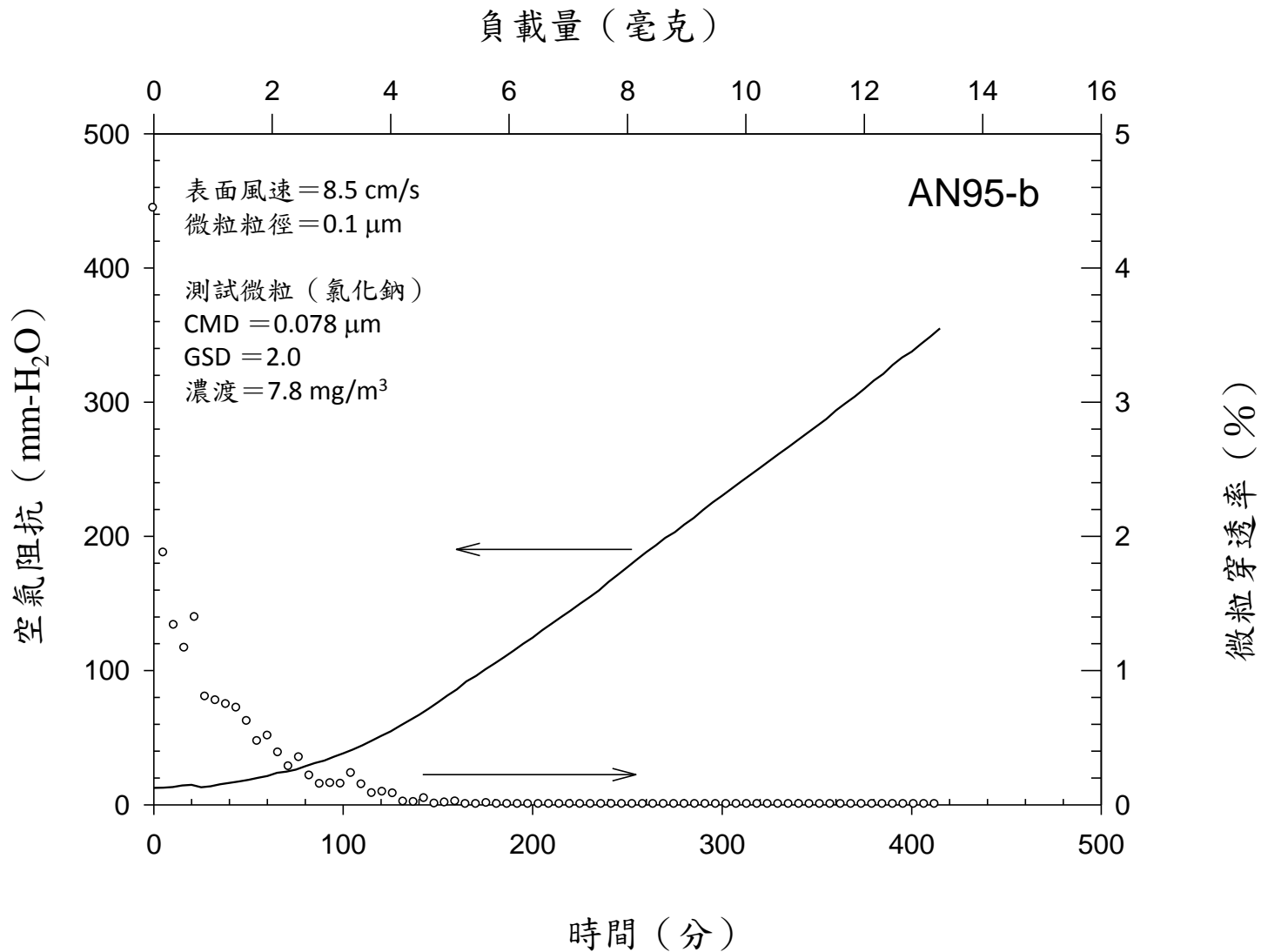


圖5-11 N95口罩濾材在氯化鈉微粒負載下空氣阻抗與微粒穿透率之變化曲線

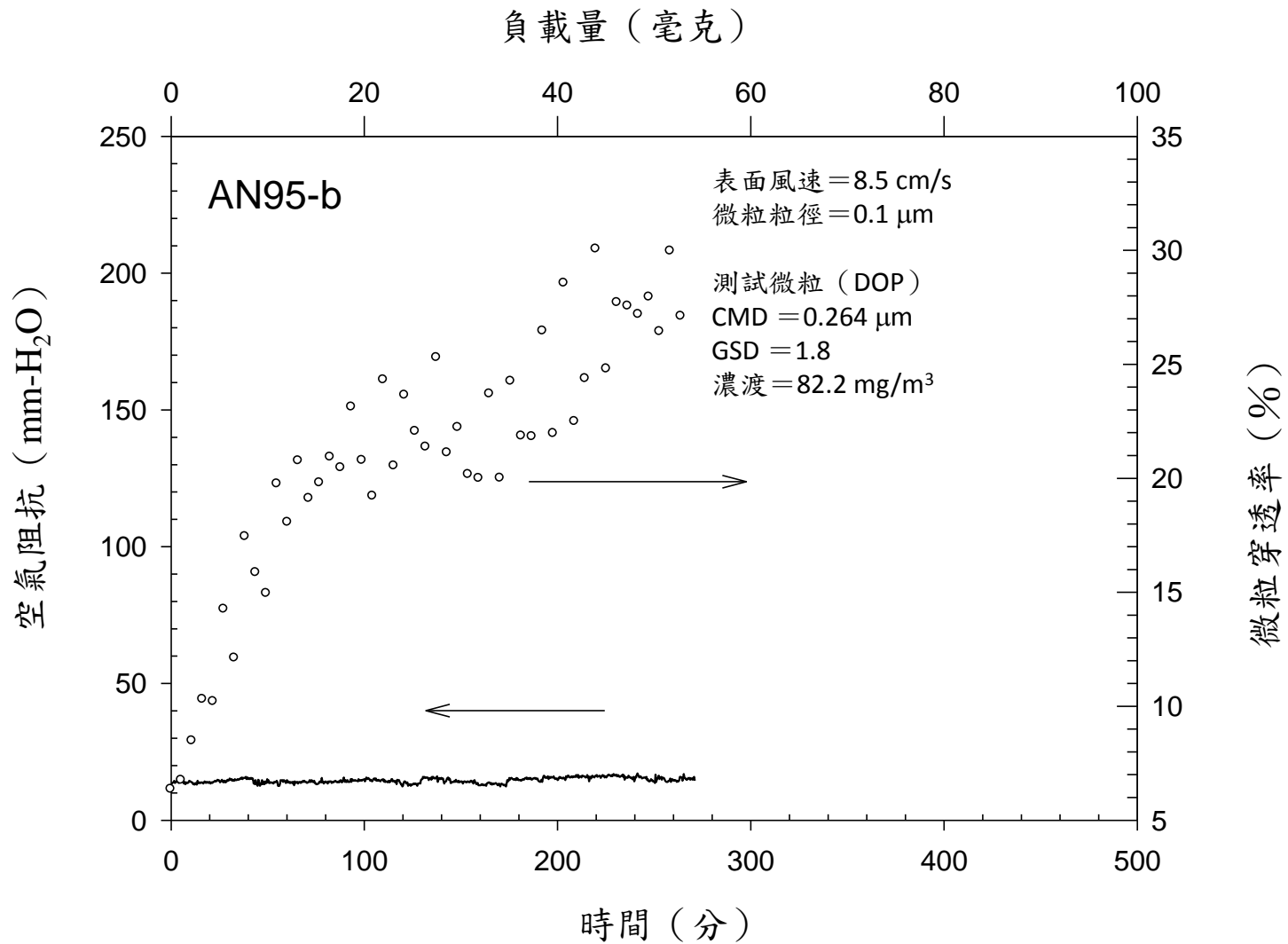
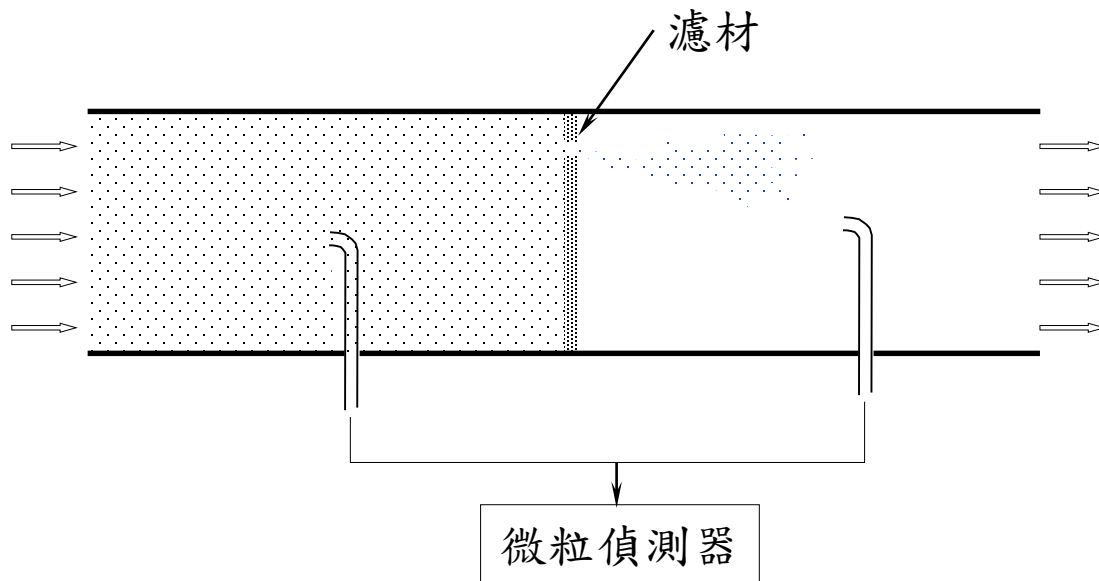


圖5-12 N95口罩濾材在DOP微粒負載下空氣阻抗與微粒穿透率之變化曲線

A.



B.

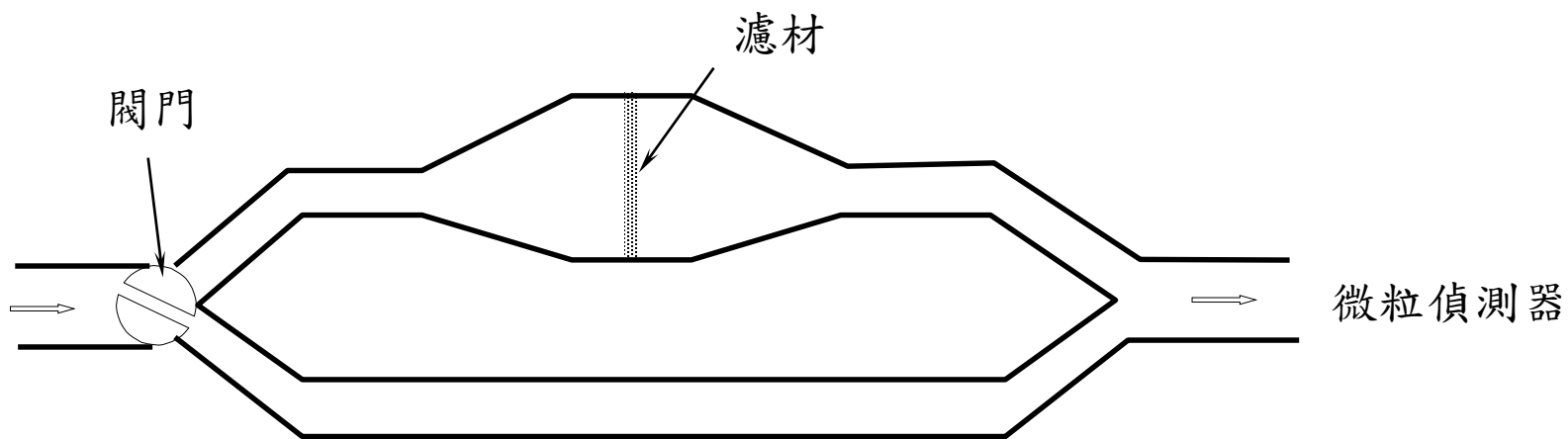


圖5-13 濾材效率測試系統圖

42CFR84 之濾材分類

(Non-powered air-purifying particulate respirators)

1. 初始效率測試

TC-84-XXX Approval number

類別 過濾效率	N-Series Not for oil	R-Series* Resistant to oil	P-Series** Oil Proof
95%	N95	R95	P95
99%	N99	R99	P99
99.97%	N100	R100	P100

* Time restriction of 8 hours continuous or intermittent use if oil is present.

** Manufacturer's time use restrictions apply if oil is present.

42CFR84 之濾材分類

(Non-powered air-purifying particulate respirators)

2. 微粒負載測試

	N-series	R-series	P-series
測試微粒	NaCl	DOP	DOP
合格條件	200mg負載後口罩效率未低於該等級所規定之初始效率。	200mg負載後口罩效率未低於該等級所規定之初始效率。	負載的過程中口罩之最低效率不低於該等級所規定之初始效率。

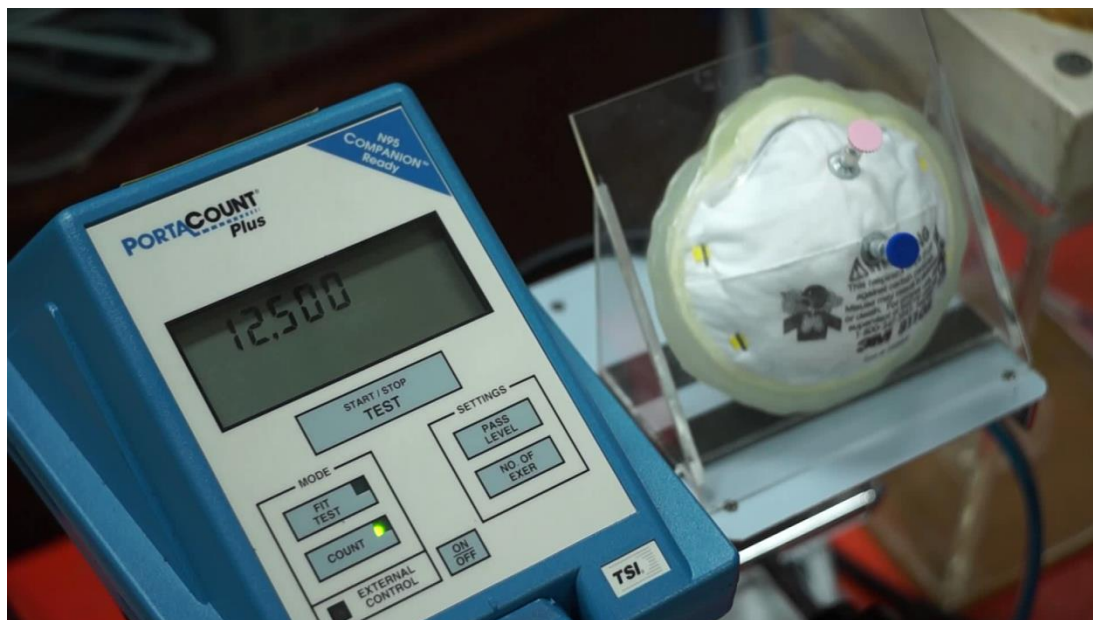
多久後會達到200mg的負載？

- Oil @ $1\text{mg}/\text{m}^3$, $10\text{ m}^3/\text{day}$ takes 20 days
- Lead @ $0.5\text{ mg}/\text{m}^3$, $10\text{ m}^3/\text{day}$ takes 40 days

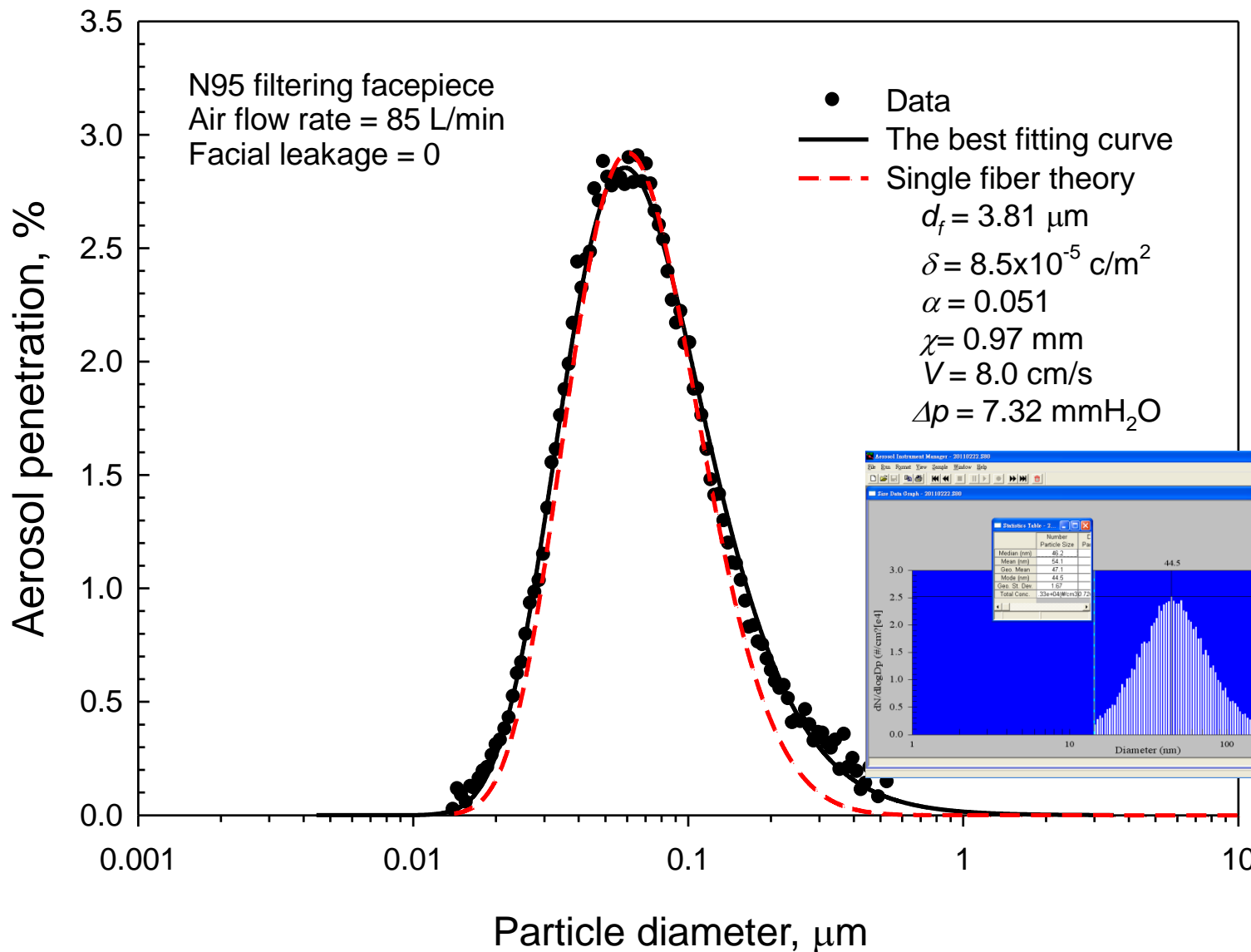
各國濾材測試規範比較表

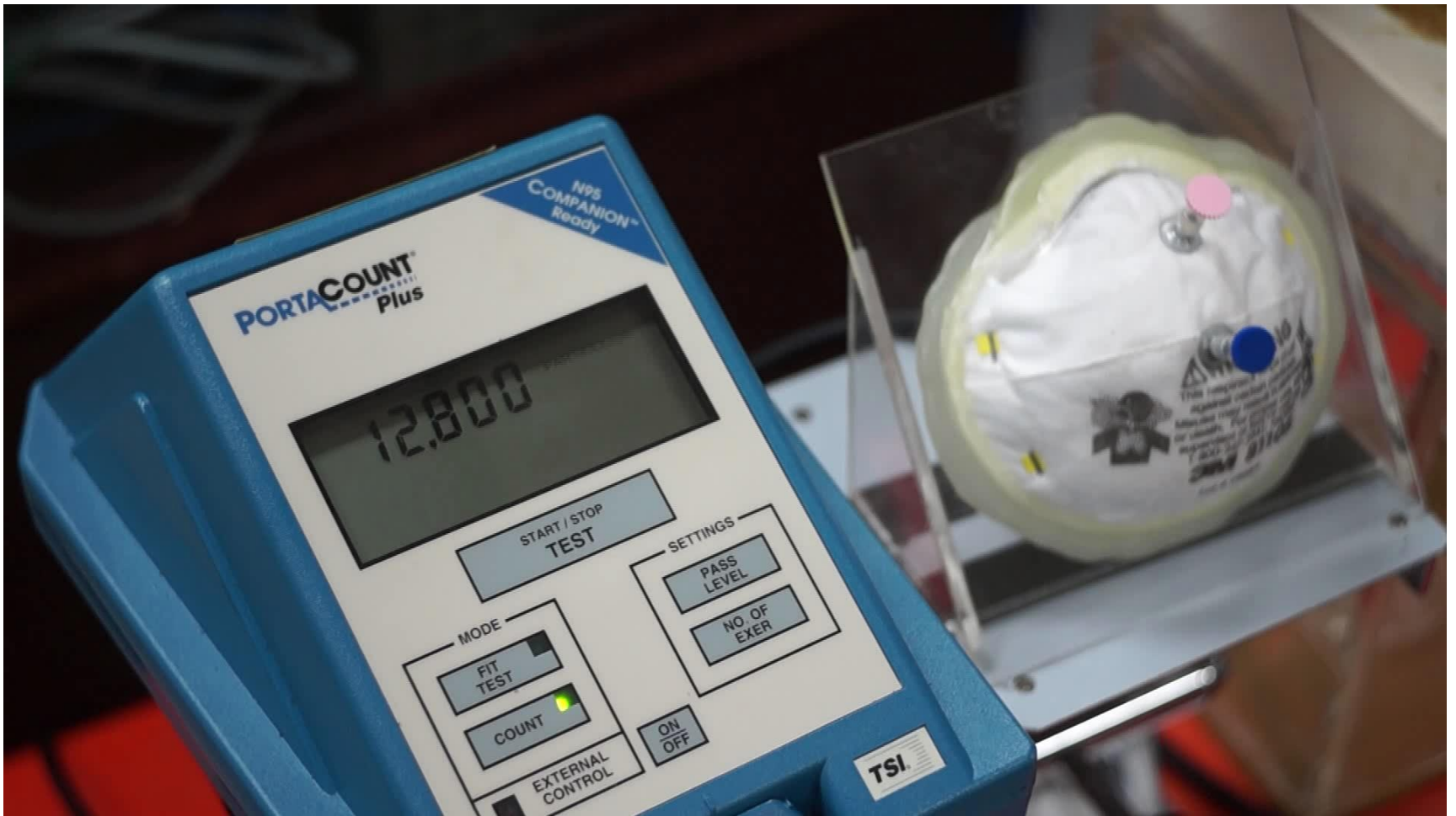
	美規 42 CFR 84 (1996年)			歐盟 EN-149 (2001年)			日 規			紐西蘭/澳州 1716(1994年)			中國國家標準 CNS 拋棄式防塵口罩		
濾材等級	N	R	P	FFP1	FFP2	FFP3	DS1	DS2	DS3	P1	P2	P3	D1	D2	D3
							DL1	DL2	DL3						
測試微粒 種類	NaCl	DOP		NaCl		Paraffin Oil	NaCl		DOP	NaCl			NaCl		
測試微粒 粒徑(μm)	CMD	CMD		MMD	Stokes Dia.		0.06~0.1		0.15~0.2 5	MMD			CMD		
	0.075	0.185		0.6	0.4					0.3~0.6			0.075		
測試流量	85 LPM			95 LPM			85 LPM			95 LPM			85 LPM		
測試環境 溫度	25 ±5°C			25 ±5°C			-			23 ± 2 °C			20± 5 °C		
測試濃度 (mg/m ³)	低於200			8±4		20±5	低於50		低於 100	5~15			低於200		
測試環境 相對濕度	30±10%			<60%			-			> 60 %			30±10%		
吸氣阻抗 (mmH ₂ O)	35			22.3	25.4	31.9	60Pa	70 Pa	150 Pa	21	24	42	35		
呼氣阻抗	25			-	-	-	60 Pa	70 Pa	80 Pa	-			25		
負載測試	200 mg			無			100 mg		200 mg	無			無		
過濾效能 (%)	95, 99, 99.97			80	94	99	80	95	99.9	80	94	99.95	80	95	99

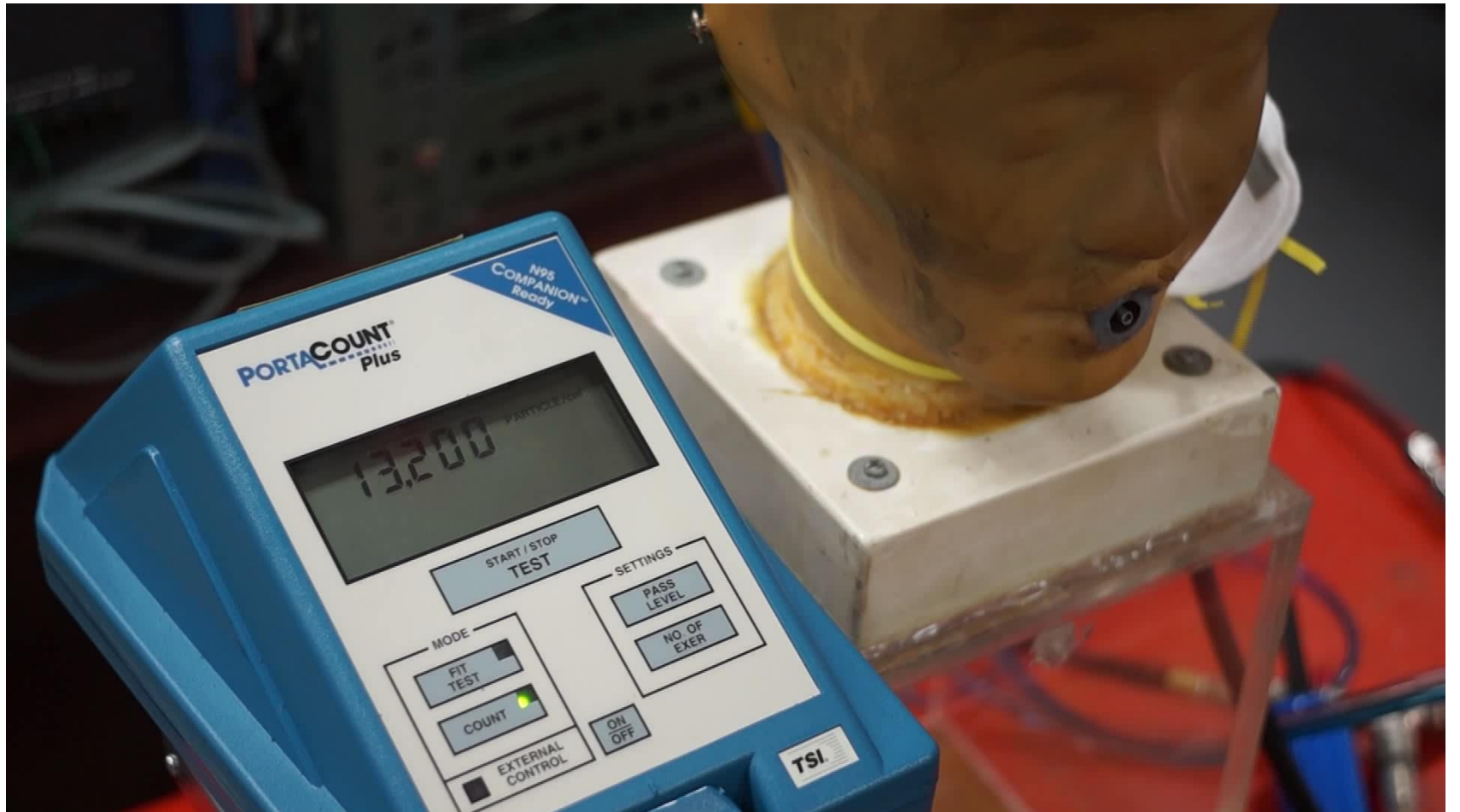
HEPA濾材

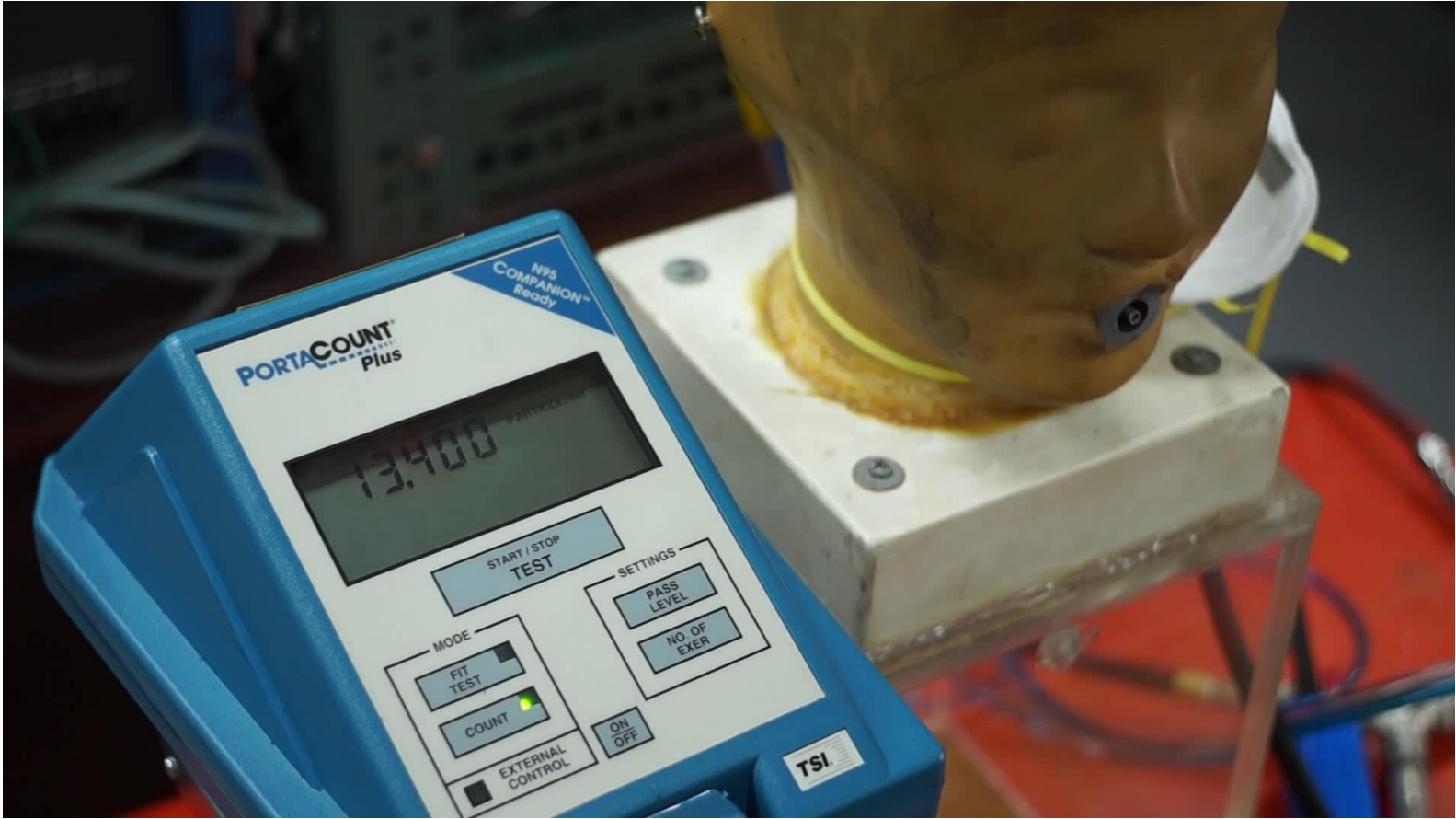


濾材的效率是粒徑的函數！！



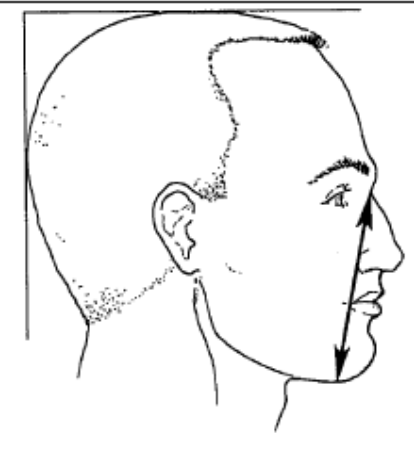




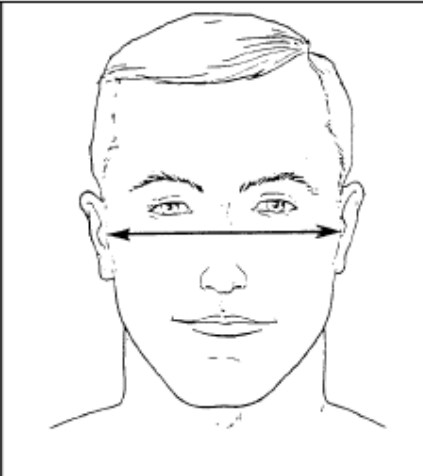


呼吸防護具密合度測試

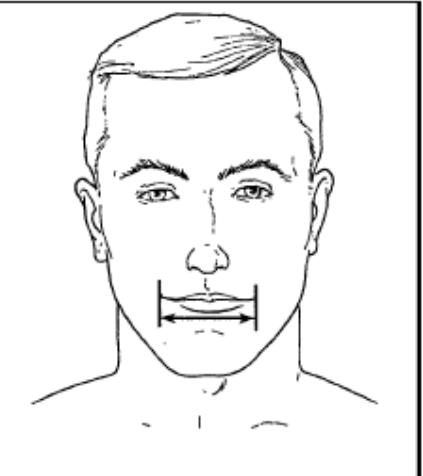
- 密合度測試的目的
 - 測試面體與佩戴者臉部的密合情形
 - 非測試濾材的性能或效率



Face length measurement:
Distance as measured with a sliding caliper in the midsagittal plane between the menton landmark and the sellion landmark.



Face width measurement:
Maximum horizontal breadth of the face as measured with a spreading caliper between the zygomatic arches.



Lip length measurement: The straight-line distance between the right and left Chelion landmarks at the corners of the closed mouth is measured with a sliding caliper.

Total = 97.7%

Face Width (mm)

		Face Width (mm)		
		120.5	132.5	144.5
Face Length (mm)	138.5		5.2%	3.5%
	128.5	5.7%	21.3%	8.7%
	118.5	10.5%	25.0%	7.1%
	108.5	5.5%	5.3%	
	98.5			

(NIOSH, 2013)

在1930年代...



密合係數值的要求



(才能達到 $APF=10$ 的效果)

↙ 半面體呼吸防護具 ≥ 100 (OSHA)



(才能達到 $APF=50$ 的效果)

↙ 全面體呼吸防護具 ≥ 500 (OSHA)
 ≥ 1000 (ANSI)

各國訂定之APF值比較

(Assigned Protection Factor, APF)

表七-5、各國訂定 APF 值之比較表(林濬笙，2012)

Type of respirator	NIOSH	ANSI Z88.2-1992	OSHA/APF final rule	JIS T8150	BS 4275
Air Purifying, Negative Pressure:					
Single use, Filtering Facepiece	5	10	10	3-10	4-20
Half Mask	10	10	10	3-10	4-20
Full Facepiece	50	100	50	4-50	4-20
Powered Air Purifying(PAPR):					
Half mask	50	50	50	4-50	10-40
Full Facepiece	50	1000	1000	4-100	10-40
Helmet/Hood	25	1000	25/1000	4-25	10-40
Loose Fitting Facepiece	25	25	25	4-25	10-40
Continuous Flow; Atmosphere Supplying:					
Half mask	50	50	50	50	20
Full Facepiece	50	1000	1000	100	40
Hood/Helmet	25	1000	25/1000	25	40
Loose Fitting Facepiece	25	25	25	25	10-40

呼吸防護具密合測試方法

↳ 密合度測試 (fit test) 有

定性 (qualitative) 與

定量 (quantitative) 兩種方式。

- 第一次挑選或定期測試時應執行之。

↳ 密合檢點 (fit check) 包括正壓與負壓兩種方式。

- 每次配戴呼吸防護具時均應執行。

定性密合度測試用試劑

(29 CFR 1910.134)

試劑名稱	種類	定量比對測試 ^註
1. 香蕉油 (banana oil) (Isoamyl Acetate)	氣體分子	✓
2. 糖精 (Saccharin) (Sodium saccharin)	粒狀物	✓
3. 苦味劑 (Bitrex) (denatonium benzoate)	粒狀物	✓
4. 刺激性煙霧 (Irritant smoke) (hydrochloric acid fume)	粒狀物	x

註：相當密合度值=100

溶液 \Rightarrow 液滴



市售定性密合度測試用霧化器 (糖精與苦味劑)



3M FT-10

- pneumatic nebulizer
- *hand* aspirate the rubber squeeze bulb to generate aerosols
- particle size distribution??



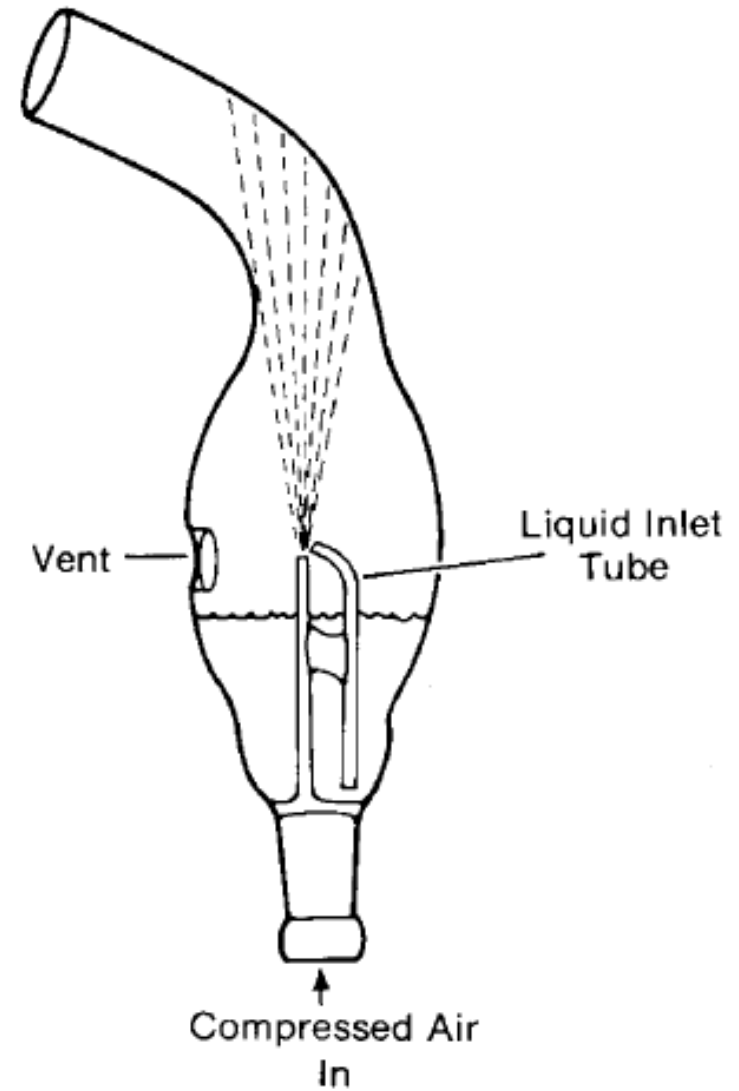
TSI Q-Fit

- pneumatic nebulizer
- using an integral *pump* to generate aerosols
- particle size distribution??

(A) 3M FT-10



(B) DeVilbiss Model 40



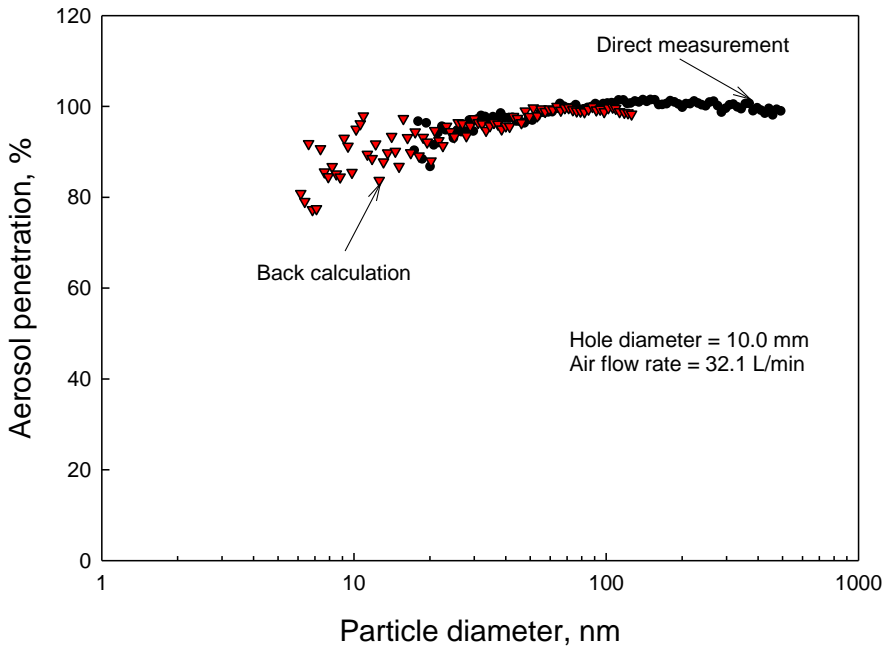
(C) TSI Q-fit



大小很重要！



不密合處微粒之穿透率曲線



(Hinds and Kraske, 1987)

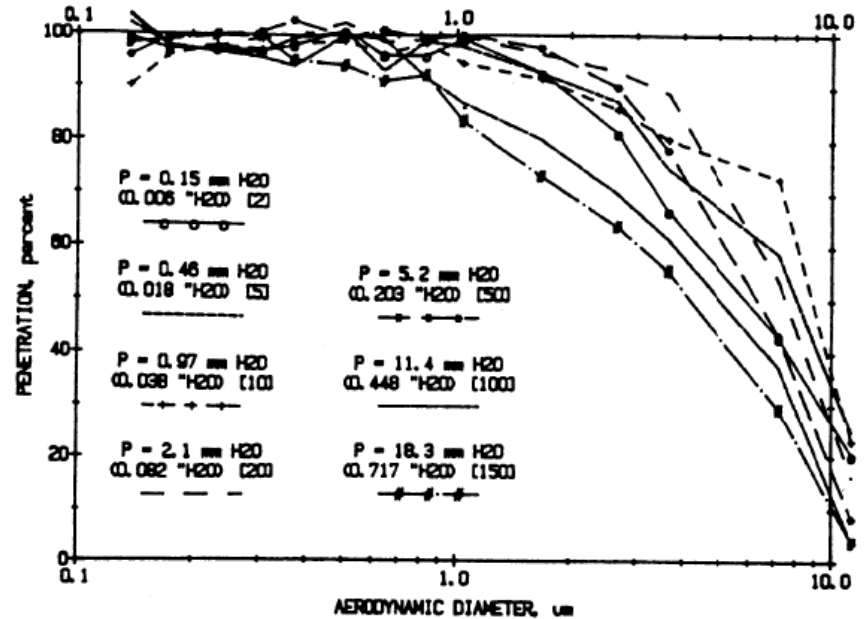
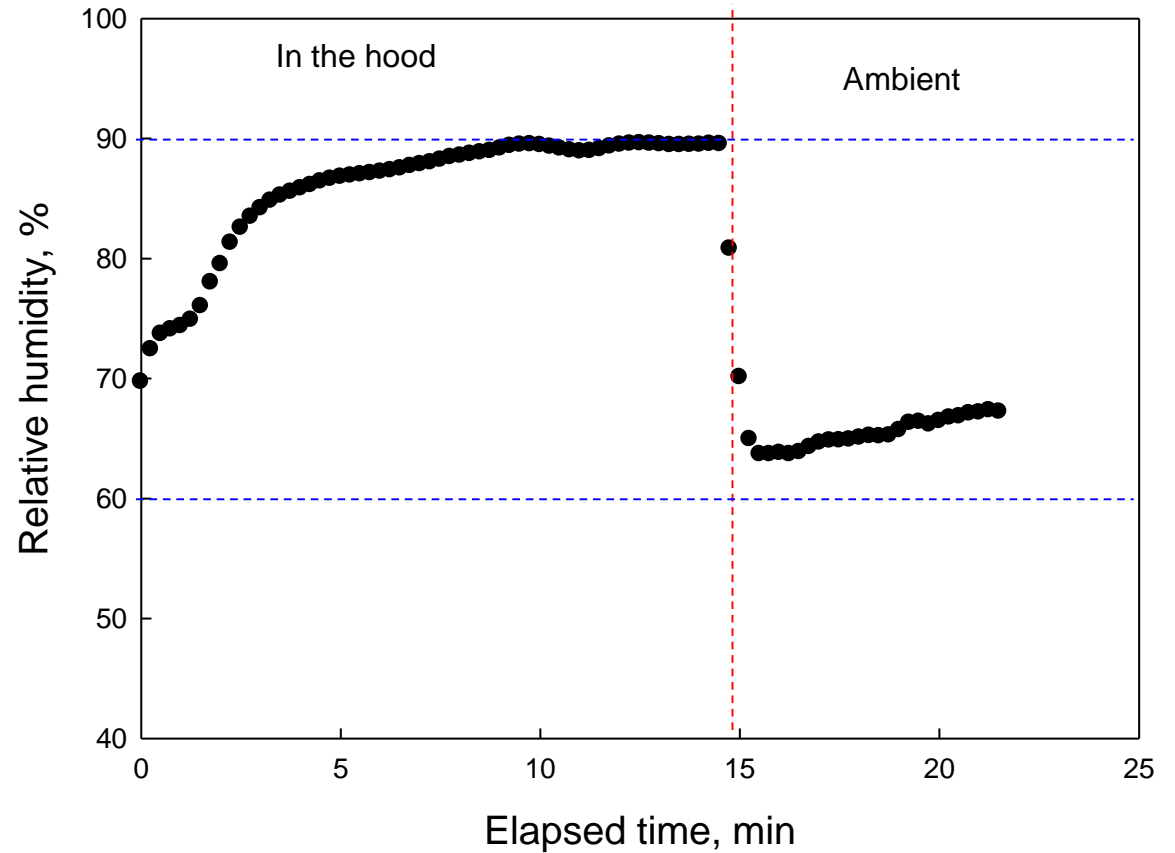
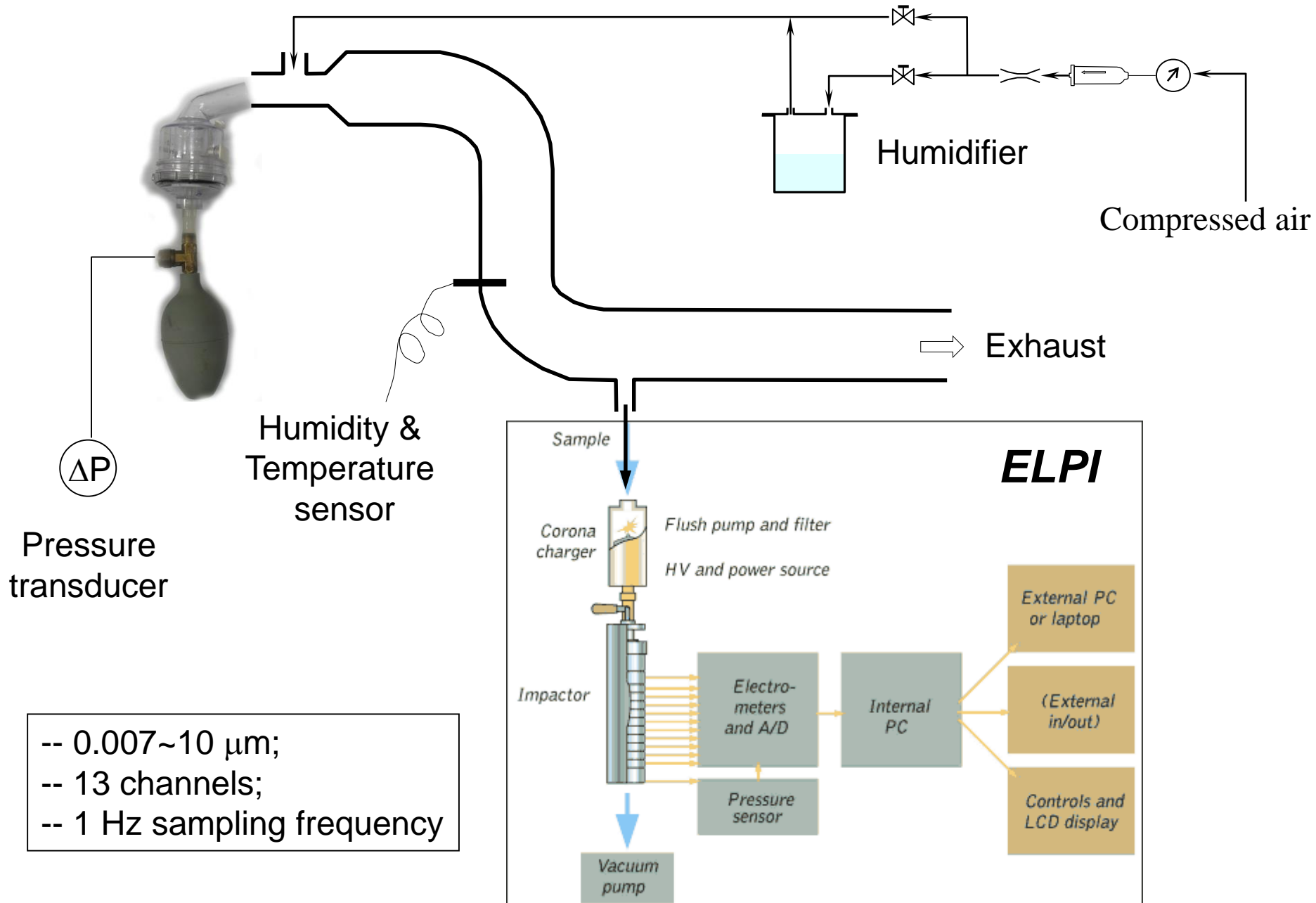


Figure 12 Leak performance, tube leak 1.0 mm ID \times 10 mm long. Numbers in brackets represent the equivalent flow rate (l/m) through a pair of MSA type S filters. (From Reference 3.)

頭罩內相對濕度的變化

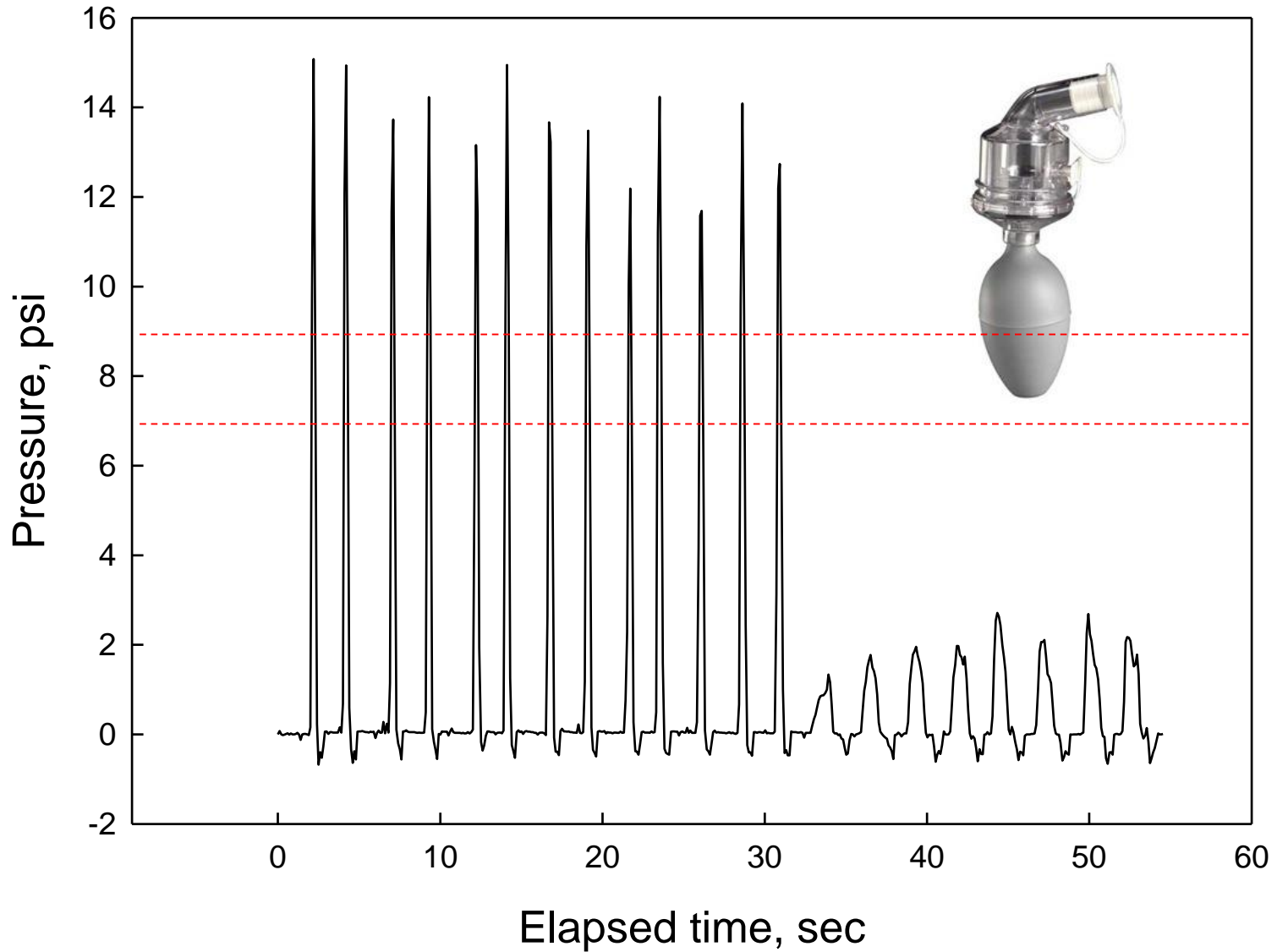


液滴微粒粒徑分布量測系統

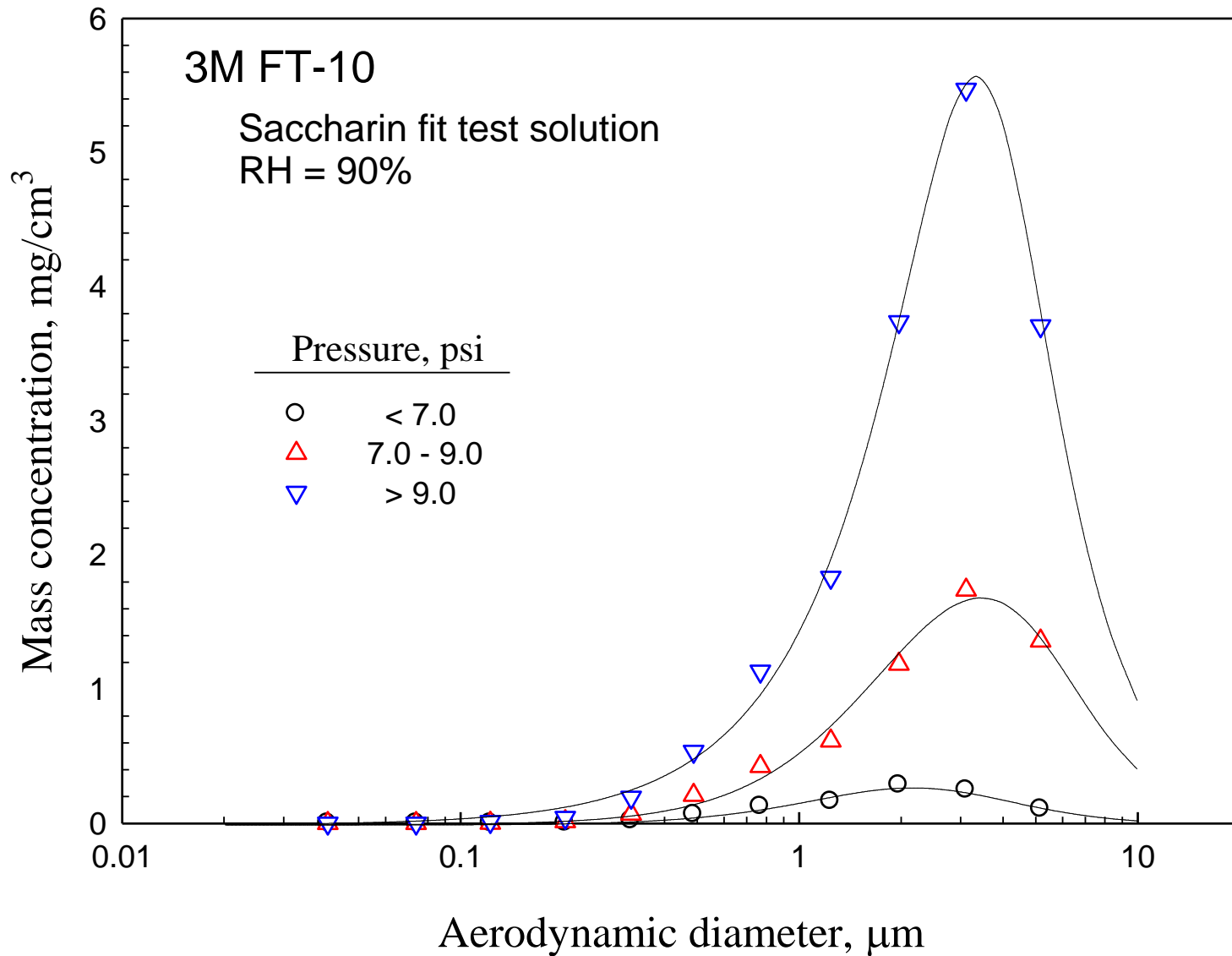


- 0.007~10 μm ;
- 13 channels;
- 1 Hz sampling frequency

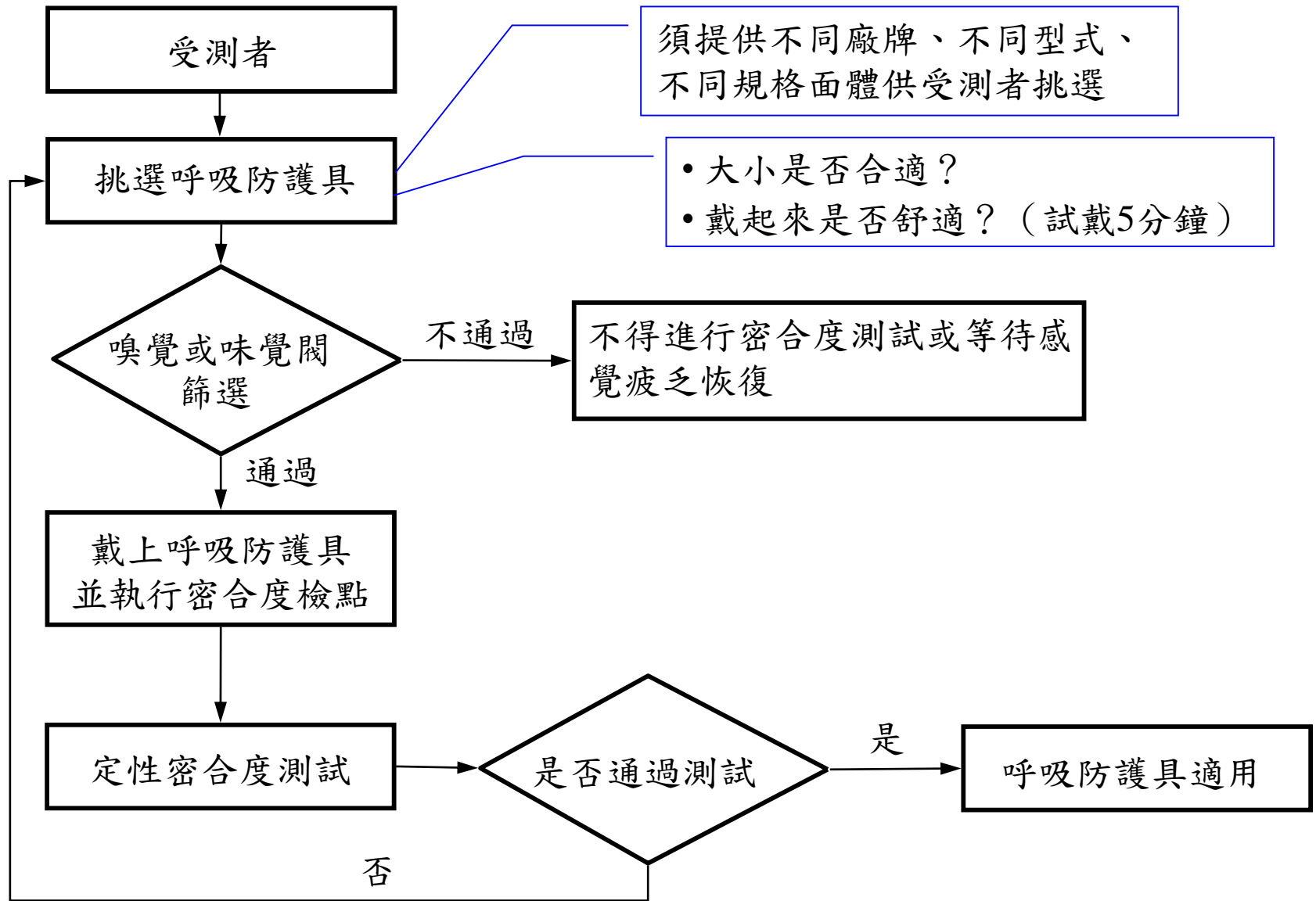
3M FT-10手壓橡膠球速率與霧化壓力之變化



3M FT-10霧化器在不同壓力下產生糖精微粒質量加權分布



定性密合度測試流程



APPENDIX A TO § 1910.134—FIT TESTING PROCEDURES

(糖精與苦味劑溶液的配製)

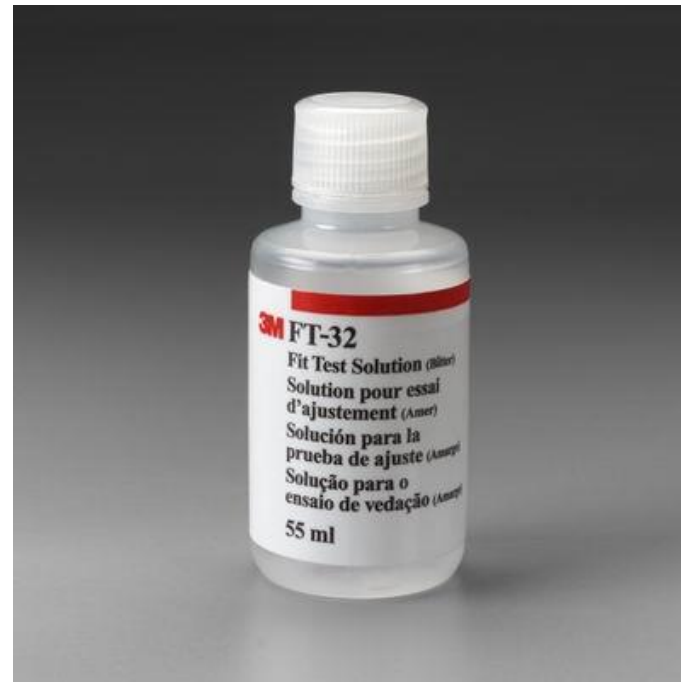
	Sensitivity test sloution	Fit test solution
Saccharin	-- 0.83g sodium saccharin + 100 ml water -- 1 ml Fit test solution + 100 ml water	83g sodium saccharin + 100 ml water
Bitrex	13.5 mg Bitrex + 100 ml 5% NaCl solution	337.5 mg Bitrex + 200 ml 5% NaCl solution

定性密合度測試用品



糖精測試組

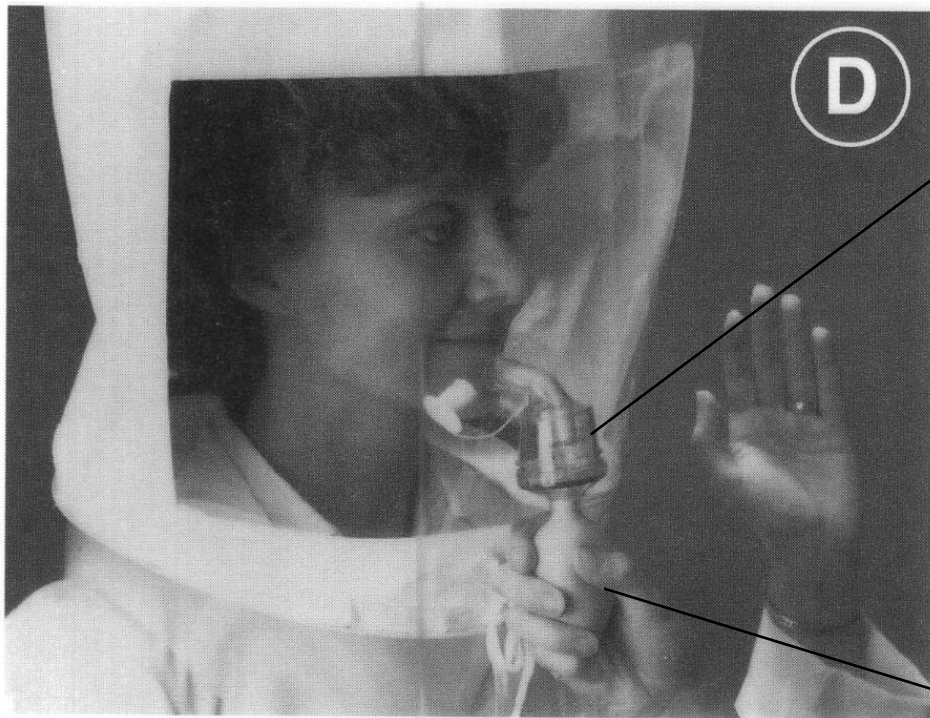
定性密合度測試用品



苦味測試組

定性密合度測試—糖精

1. 嗅覺閾值篩選



0.83 g / 100 ml H₂O

30次是上限值！

以10次為一個基數，對頭罩內產生糖經微粒

動作要點：用嘴巴呼吸！

定性密合度測試—糖精

2. 密合度測試



83 g / 100 ml H₂O

擠壓次數與閾值篩選結果相同，並且每經過30秒追加一半的次數。

拋棄式口罩密合度測試經常使用的方法

定性密合度測試—苦味劑



1. 嗅覺閾值篩選

- 設備與方法同「糖精」測試
- 13.5 mg Bitrex / 100 ml NaCl solution (5%)

2. 密合度測試

- 設備與方法同「糖精」測試
- 337.5 mg Bitrex / 200 ml NaCl solution (5%)
- 要點：用嘴巴呼吸！

定性密合度測試—刺激性煙霧

- ↳ 利用四氯化錫（stannic chloride）與水蒸氣分子反應所生成白色HCl煙霧來進行測試
- ↳ 判定依據：咳嗽或流眼淚（OSHA建議測試時讓受測者閉上眼睛）
- ↳ 沒有測試罩！
- ↳ HCl具腐蝕性！
- ↳ 只能用發煙管！
- ↳ 使用200ml/min打氣pump或橡膠壓球
- ↳ 第一次閾值測試
- ↳ 密合度測試：在距離至少12英吋處，沿著面體的邊緣繞2圈以上（每個動作期間）！
- ↳ 通過第二次閾值測試者，才算通過刺激性煙霧密合度測試！
- ↳ **NIOSH不建議使用！**



定性密合度測試





價錢

表 9 3M FT-10 與 TSI Q-Fit 霧化器產生液滴粒徑分布

RH, %	Sol.	Pressure, psi	3M FT-10-A		3M FT-10-B		TSI Q-Fit	
			MMD, μm	GSD	MMD, μm	GSD	MMD, μm	GSD
60	Sa_fit	< 7.0	2.33	2.04	2.83	1.87	1.82	2.14
		7.0-9.0	2.78	2.17	2.60	1.92	2.55	2.16
		>9.0	2.70	2.25	2.79	2.15	2.55	2.23
	Sa_sen	< 7.0	4.23	2.03	2.09	2.06	2.75	1.82
		7.0-9.0	3.34	2.06	2.05	2.07	2.19	2.07
		>9.0	2.80	2.05	2.12	2.03	2.16	2.02
	Bi_fit	< 7.0	3.06	2.30	2.89	2.11	2.37	2.28
		7.0-9.0	2.86	2.38	2.87	2.27	2.20	2.22
		>9.0	2.44	2.32	2.75	2.27	2.15	2.14
	Bi_sen	< 7.0	2.98	2.21	2.29	2.10	3.20	2.12
		7.0-9.0	2.75	2.28	2.50	2.17	2.16	2.10
		>9.0	2.43	2.29	2.56	2.26	2.15	2.07
90	Sa_fit	< 7.0	2.18	2.03	2.77	1.96	2.77	2.12
		7.0-9.0	2.84	2.24	2.60	2.10	2.52	2.19
		>9.0	2.82	2.30	2.70	2.21	2.49	2.22
	Sa_sen	< 7.0	3.99	1.78	4.50	1.73	2.00	2.20
		7.0-9.0	2.66	1.99	3.11	1.89	1.90	2.03
		>9.0	2.36	1.97	2.48	1.95	1.84	1.99
	Bi_fit	< 7.0	3.48	2.14	3.72	2.11	4.13	2.23
		7.0-9.0	3.06	2.45	3.12	2.33	2.85	2.24
		>9.0	2.74	2.42	2.84	2.38	2.44	2.13
	Bi_sen	< 7.0	3.13	2.07	3.23	1.88	3.27	2.06
		7.0-9.0	3.01	2.30	2.96	2.17	2.47	2.10
		>9.0	2.64	2.32	2.80	2.29	2.38	2.10

Sa_fit: Saccharin fit test solution;

Sa_sen: Saccharin sensitivity test solution;

Bi_fit: Bitrax fit test solution;

Bi_sen: Bitrax sensitivity test solution;

定量密合度測試

- Generated Aerosol (oil-mist/chamber)
- **Condensation Nuclei (PortaCount)**
- Controlled Negative Pressure (CNP)
- CNP REDON

定量密合度測試

- Generated Aerosol (oil-mist/chamber)

- ↳ 經常使用玉米油

- [polyethylene glycol 400, di-ethyl hexyl sebacate, NaCl (RH< 50%)]

- ↳ 使用光度計 (photometer) 量測微粒的濃度

- ☹ 需要較高的濃度

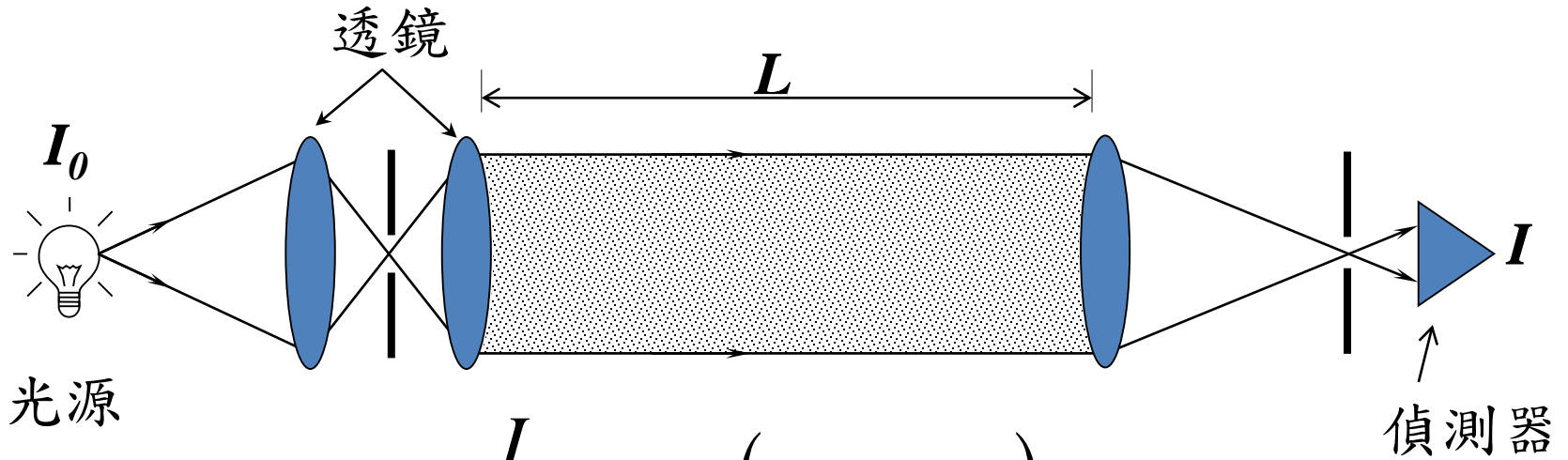
- ☹ 需要搭配微粒產生器使用

- ↳ 使用HEPA濾材



消光式光度計

Light-attenuating Photometer



$$\frac{I}{I_0} = \exp(-C_p Q_e L)$$

C_p : 微粒濃度

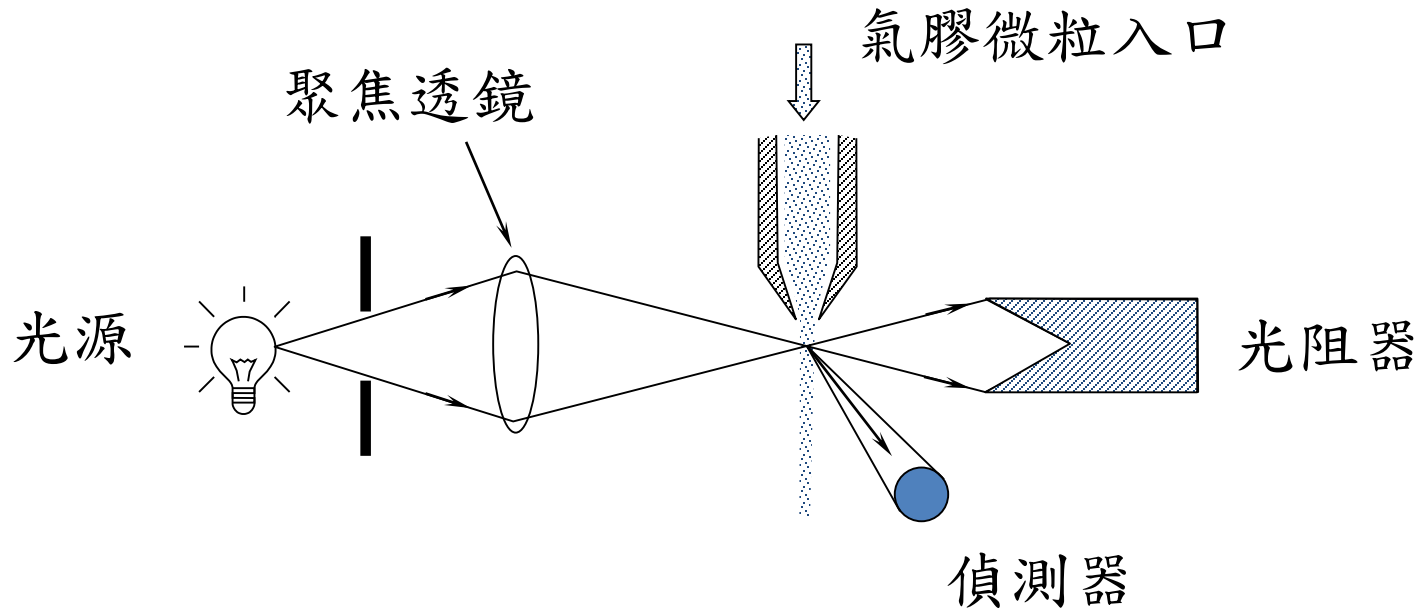
Q_e : 消光效率

適合微粒濃度較高的環境，例如：煙道排氣或較長偵測路徑，如空氣濁度測試等。

散光式微粒光度計

Light-scattering Photometer

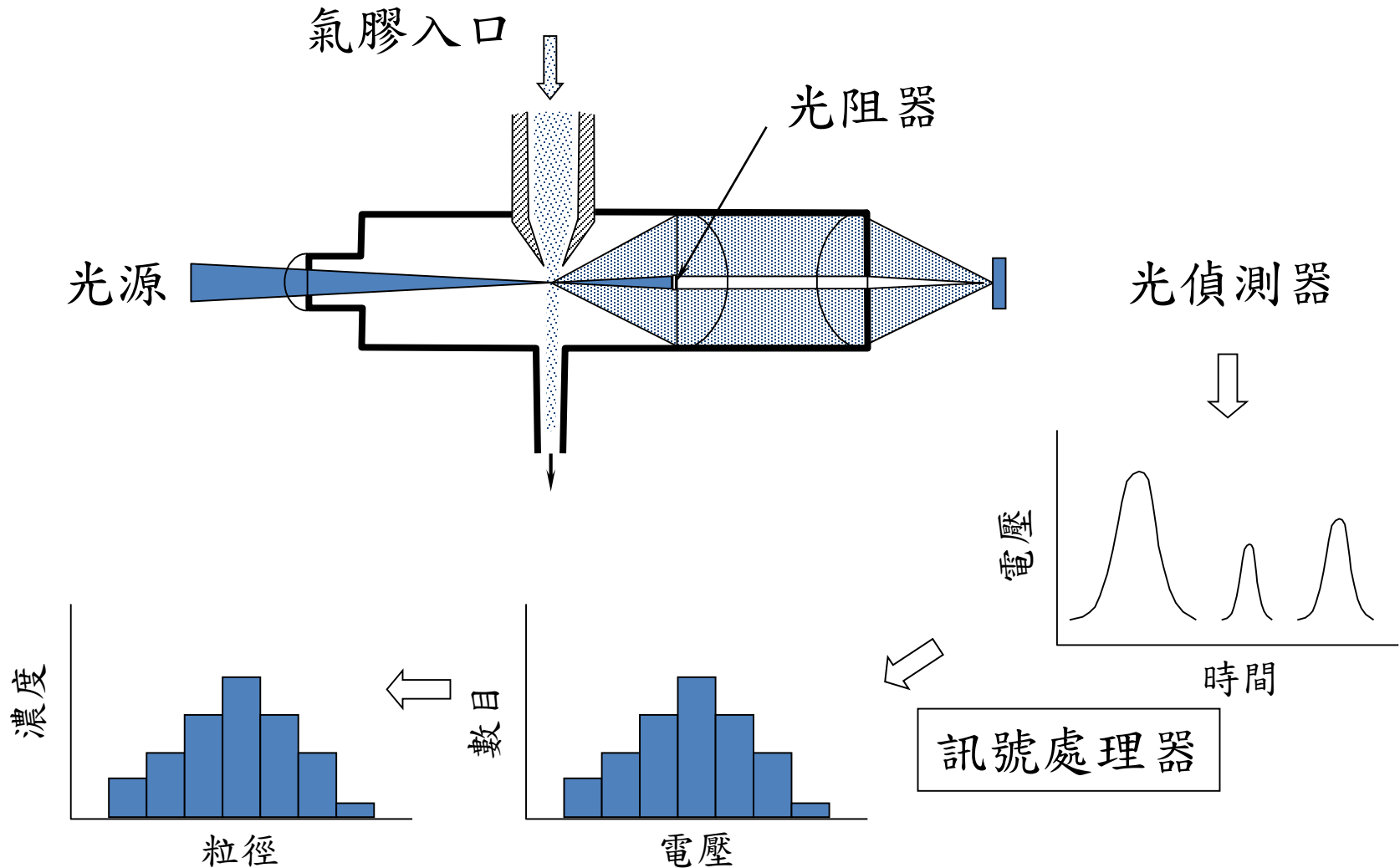
- 依據一群氣膠微粒之散光特性量測微粒之濃度（質量濃度）。



- 無法分辨微粒的粒徑。

光學微粒計數器

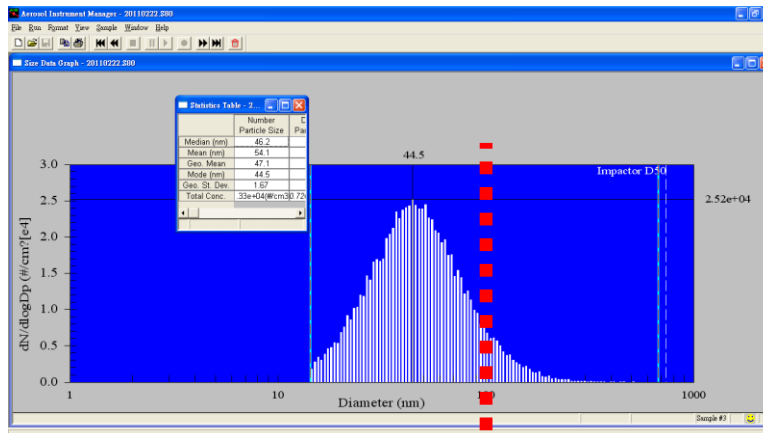
Optical Particle Counter



定量密合度測試

• Condensation Nuclei (PortaCount)

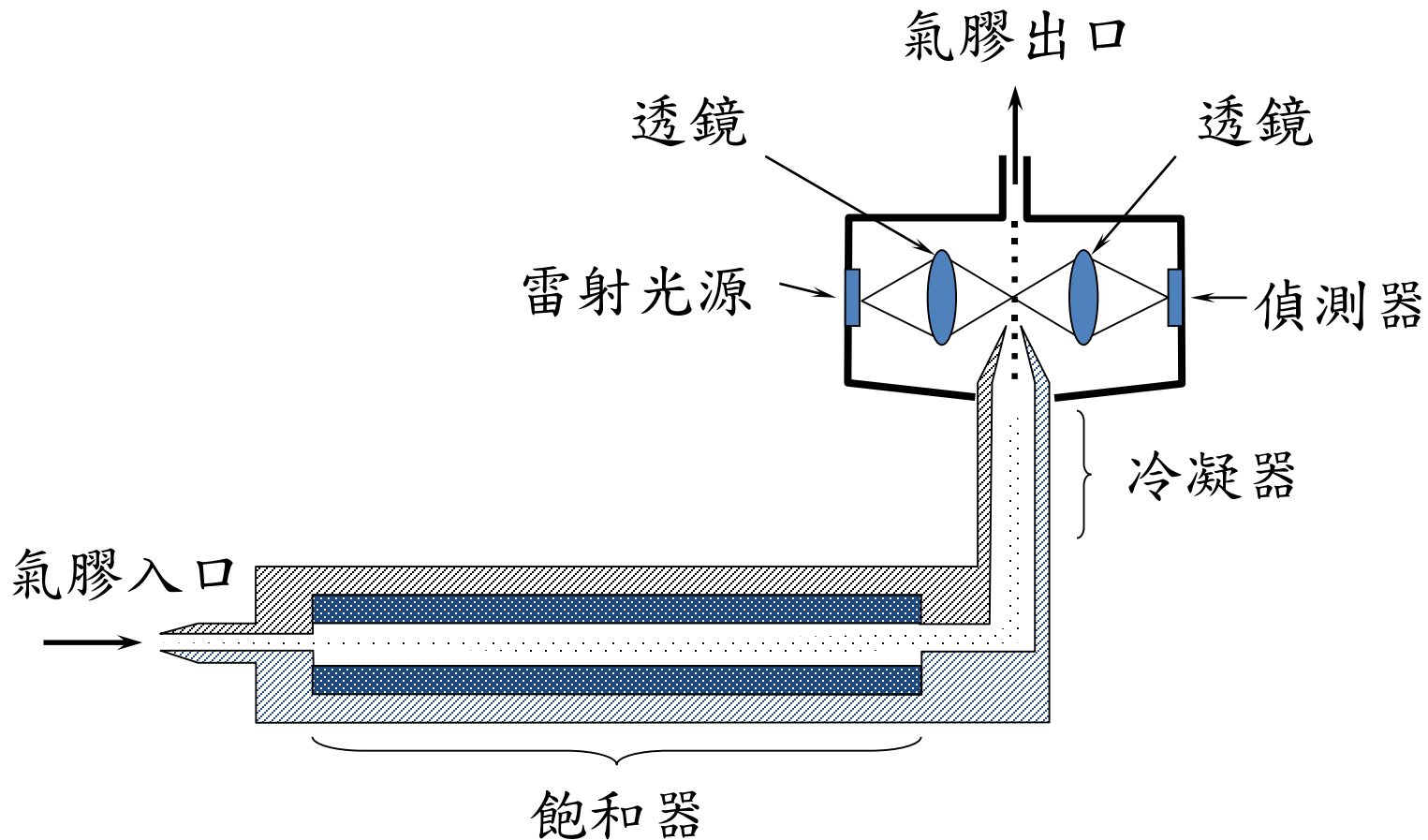
- ↳ 不需要微粒產生器☺
- ↳ 使用微粒計數器 (particle counter) 量測微粒的濃度☺
- ↳ 非高效率等級之拋棄式口罩測試
 - 搭配N95-Companion
 - 使用粒徑40nm的微粒



OPC的限制!

凝結核微粒計數器

Condensation Particle Counter

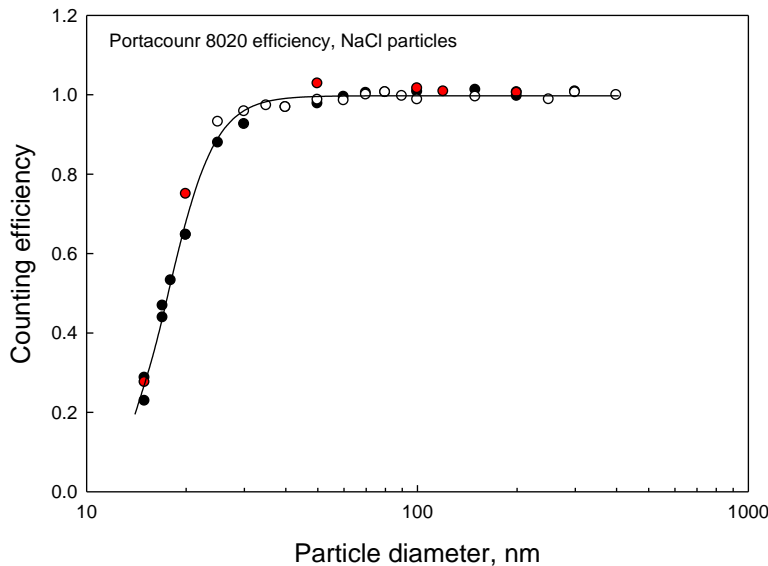


凝結核微粒計數器

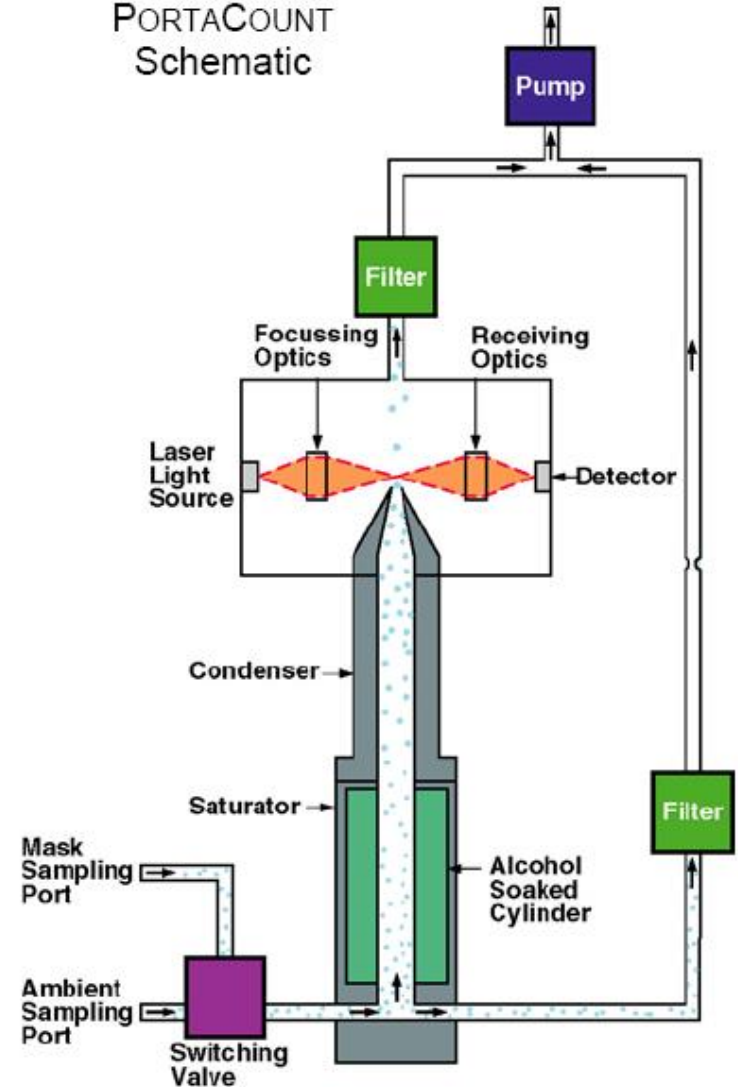
Condensation Particle Counter



TSI 8020 Portacount



PORTACOUNT Schematic



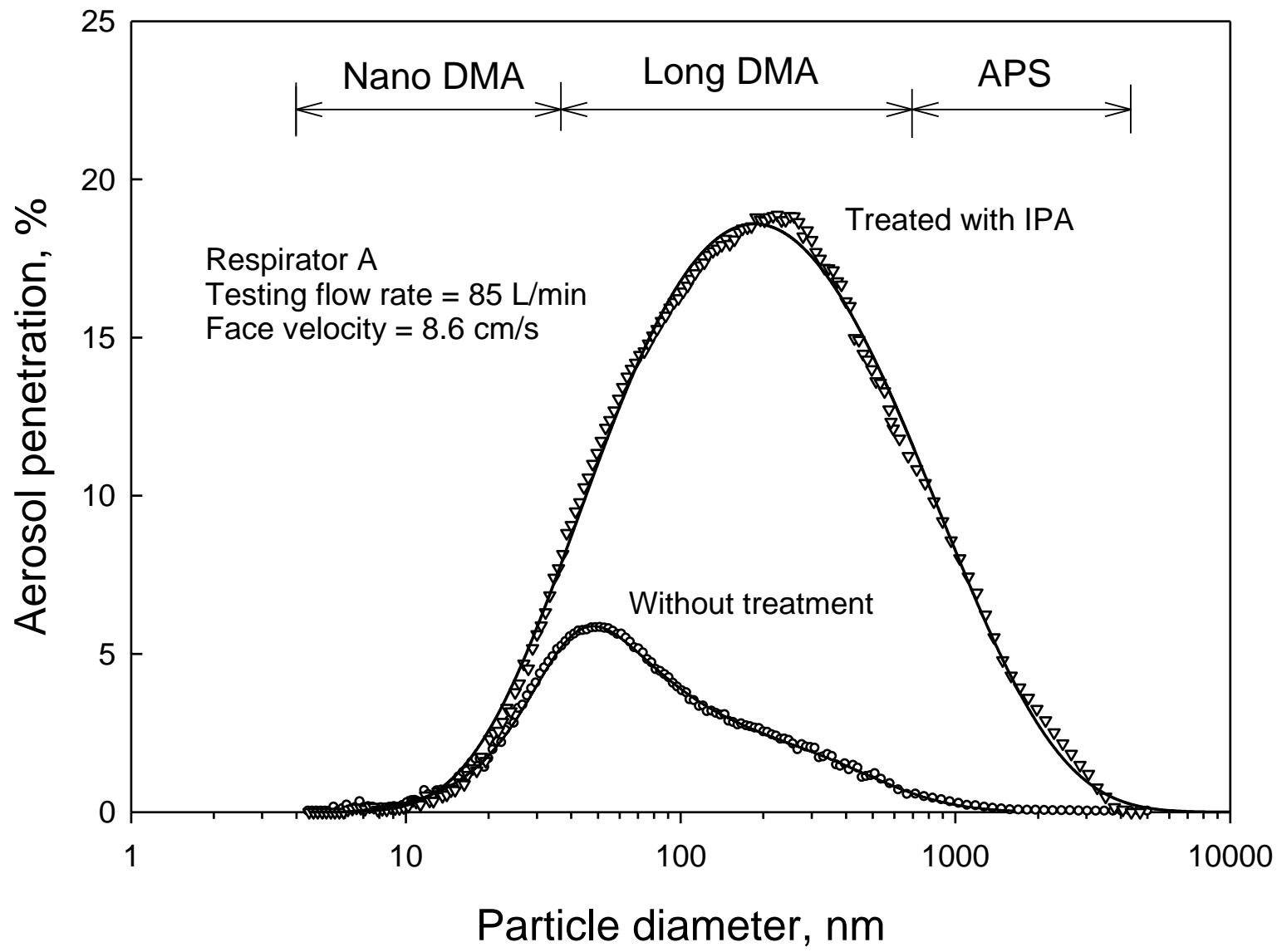
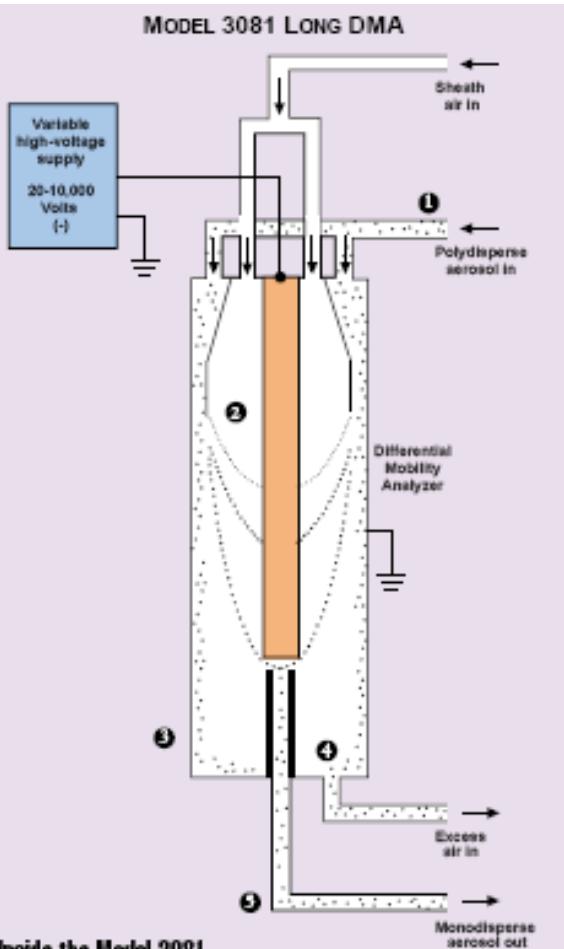


Figure 2. Aerosol penetration through respirator A with and without isopropanol dip for a flow rate of 85 L/min (face velocity = 8.6 cm/s).

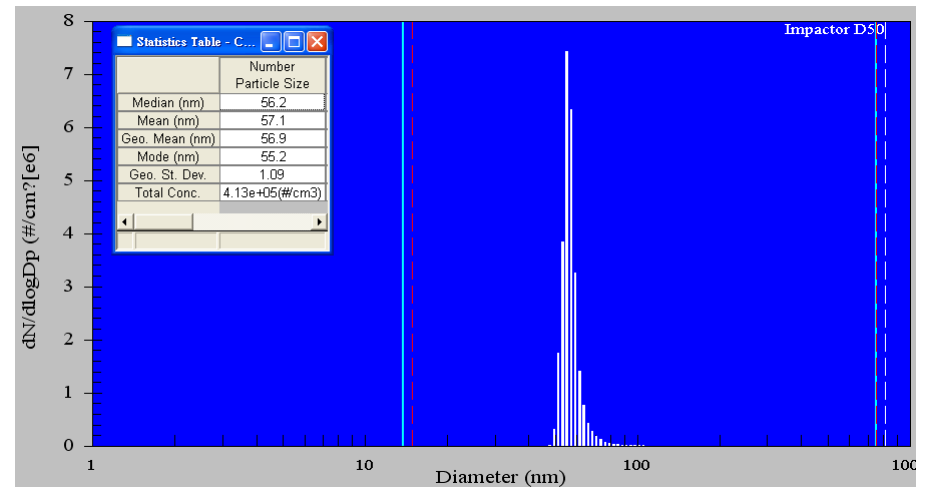
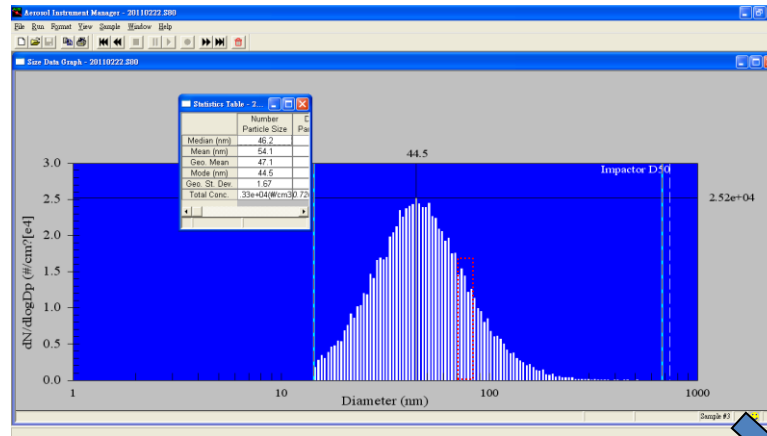
Differential mobility analyzer, DMA

- 用途：特定粒徑微粒篩選器

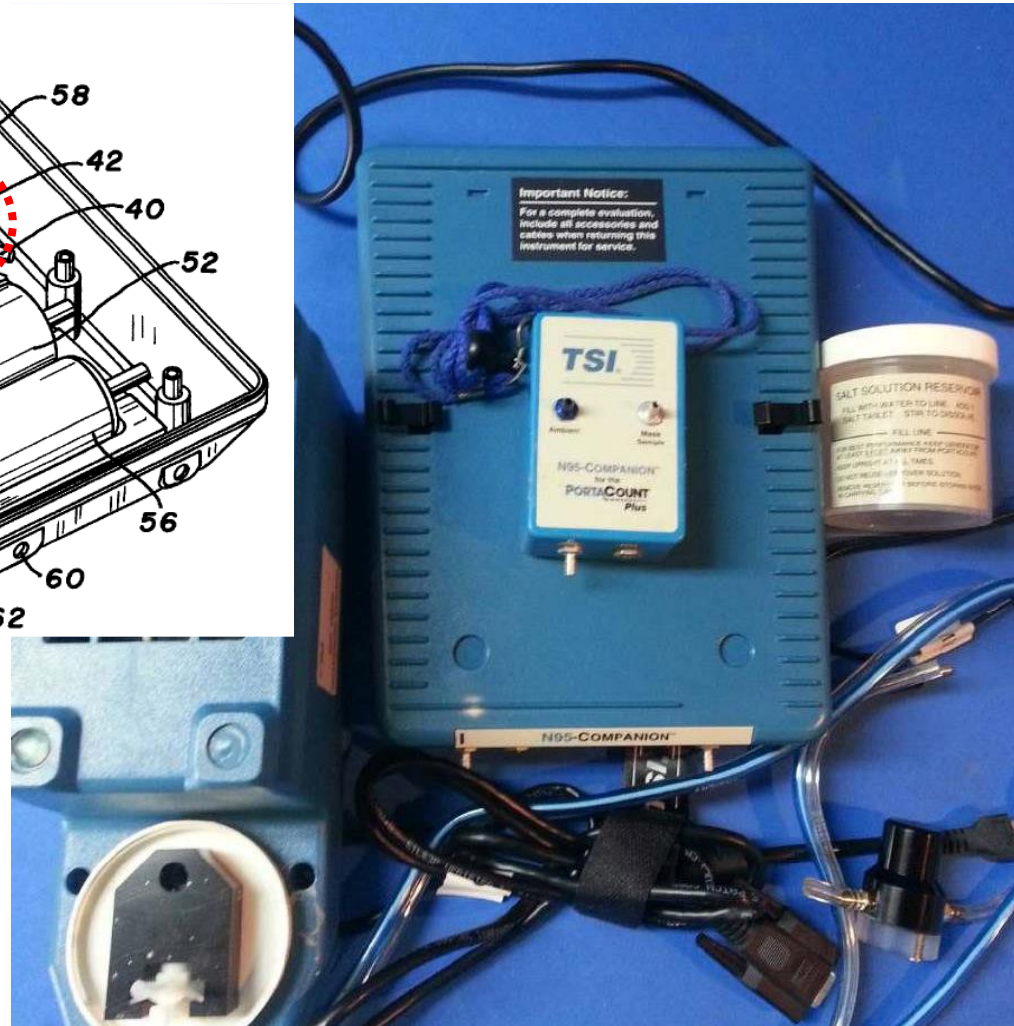
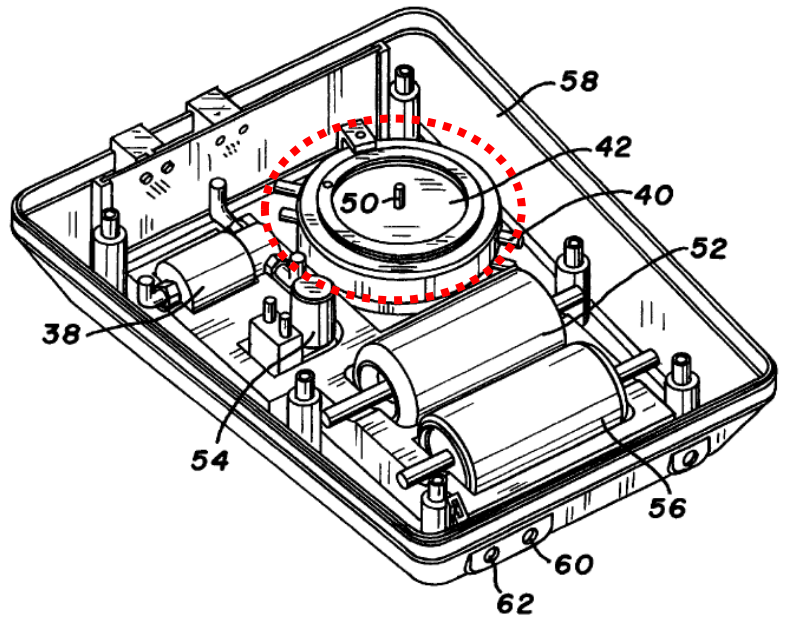


Inside the Model 3081

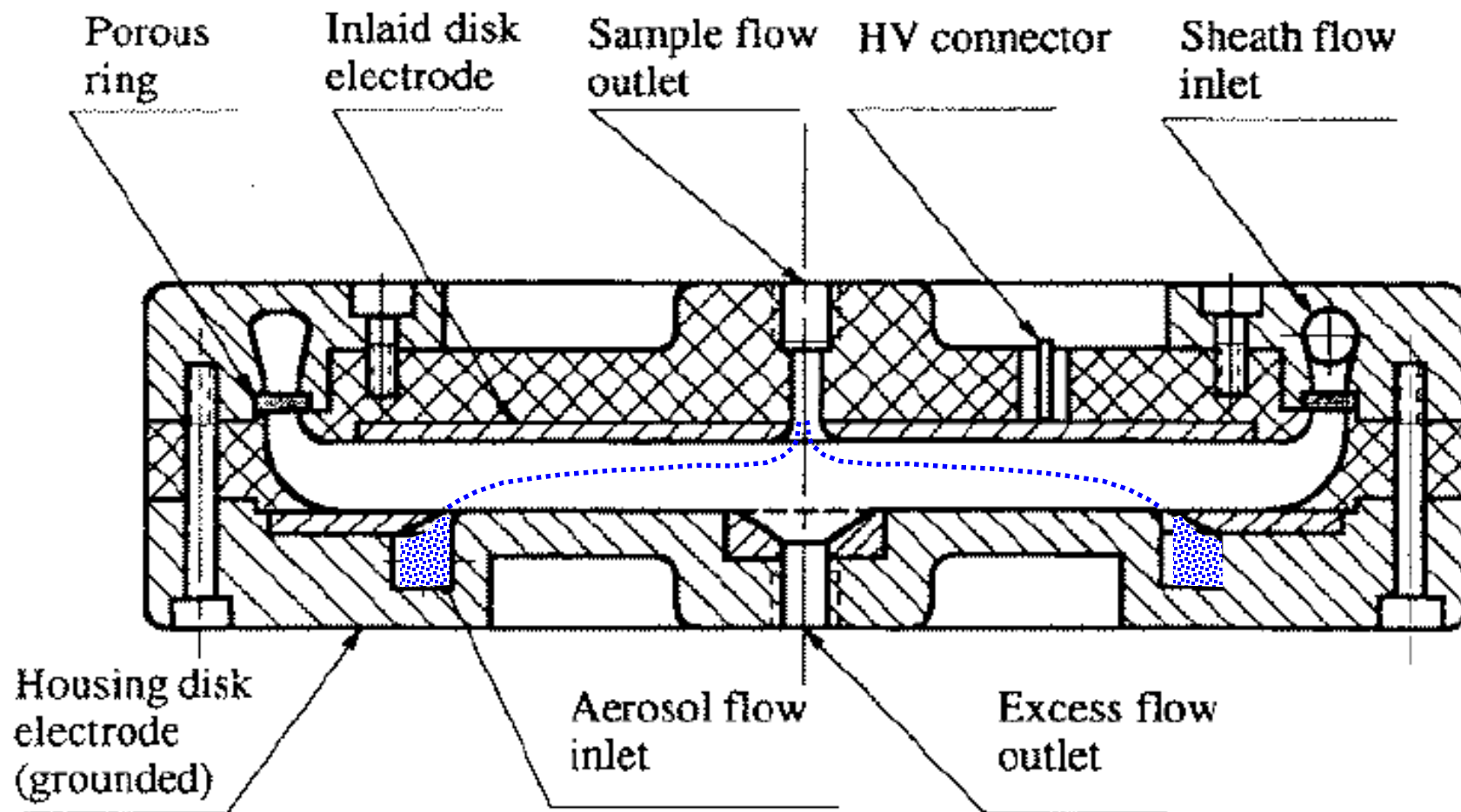
- 1 Charged polydispers aerosol enters the DMA.
- 2 The center rod attracts positive particles.
- 3 The center rod repels negative particles to the wall.
- 4 Uncharged particles exit with the excess air.
- 5 Positively charged particles within a narrow mobility range exit as monodisperse aerosol.



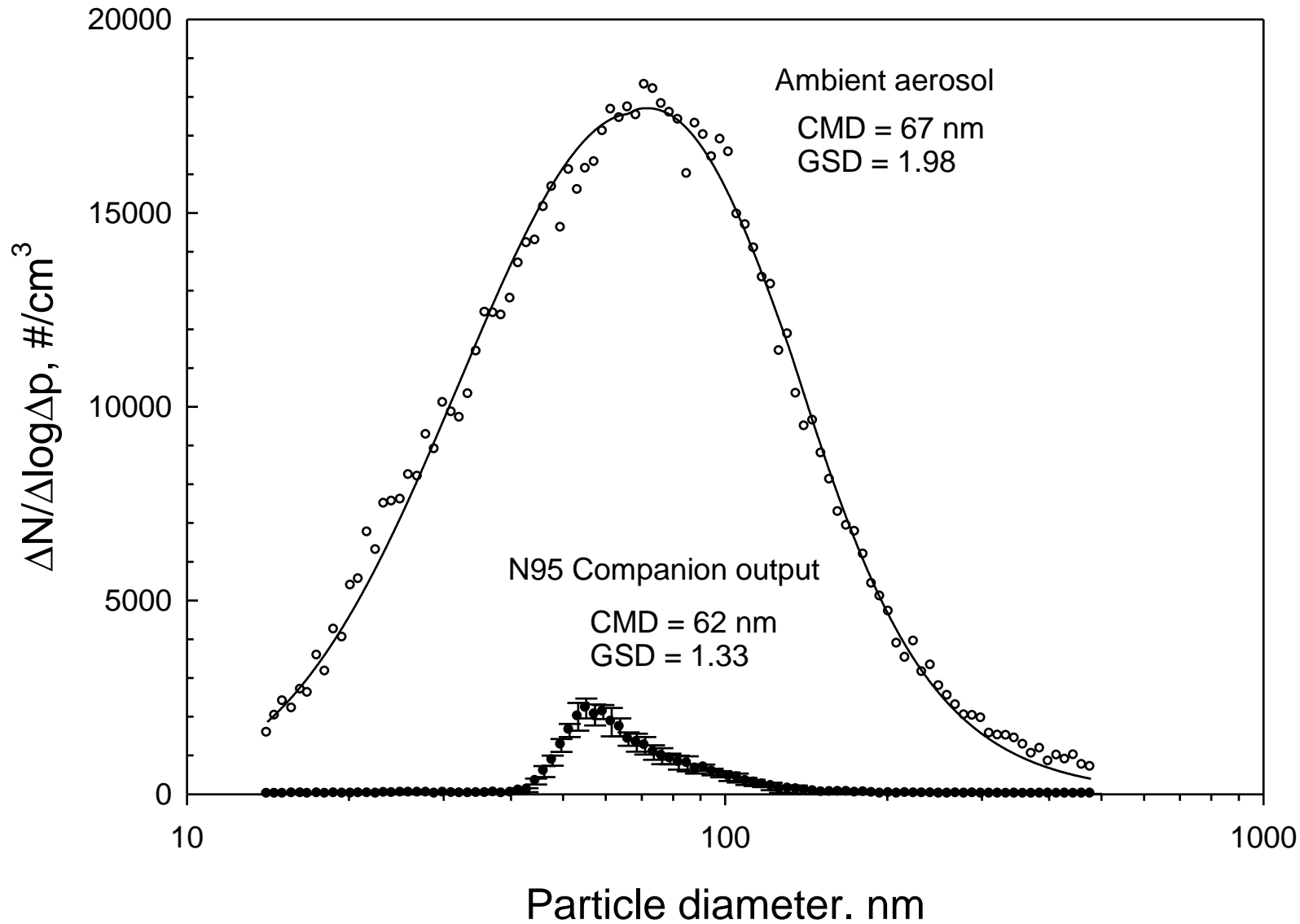
TSI 8095 N95-Companion™



Radial differential mobility analyzer



N95 Companion輸出微粒粒徑分布



TSI 8026 Particle generator



Generated Particle Statistics

Geometric Standard Deviation (GSD)

2.2 (nominal)

Count Median Diameter (CMD)

0.04 micrometers (nominal)

TSI 8020+N95 companion



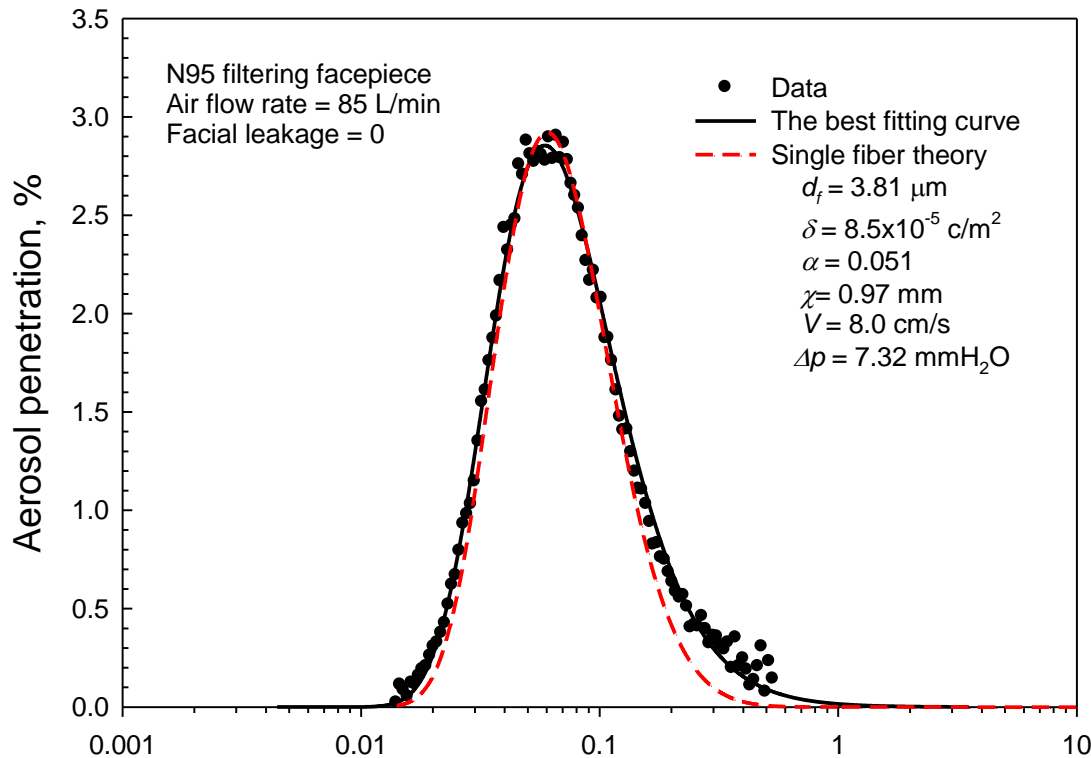
Size range allowed to pass through N95-COMPANION

Size range capability of the PORTACOUNT

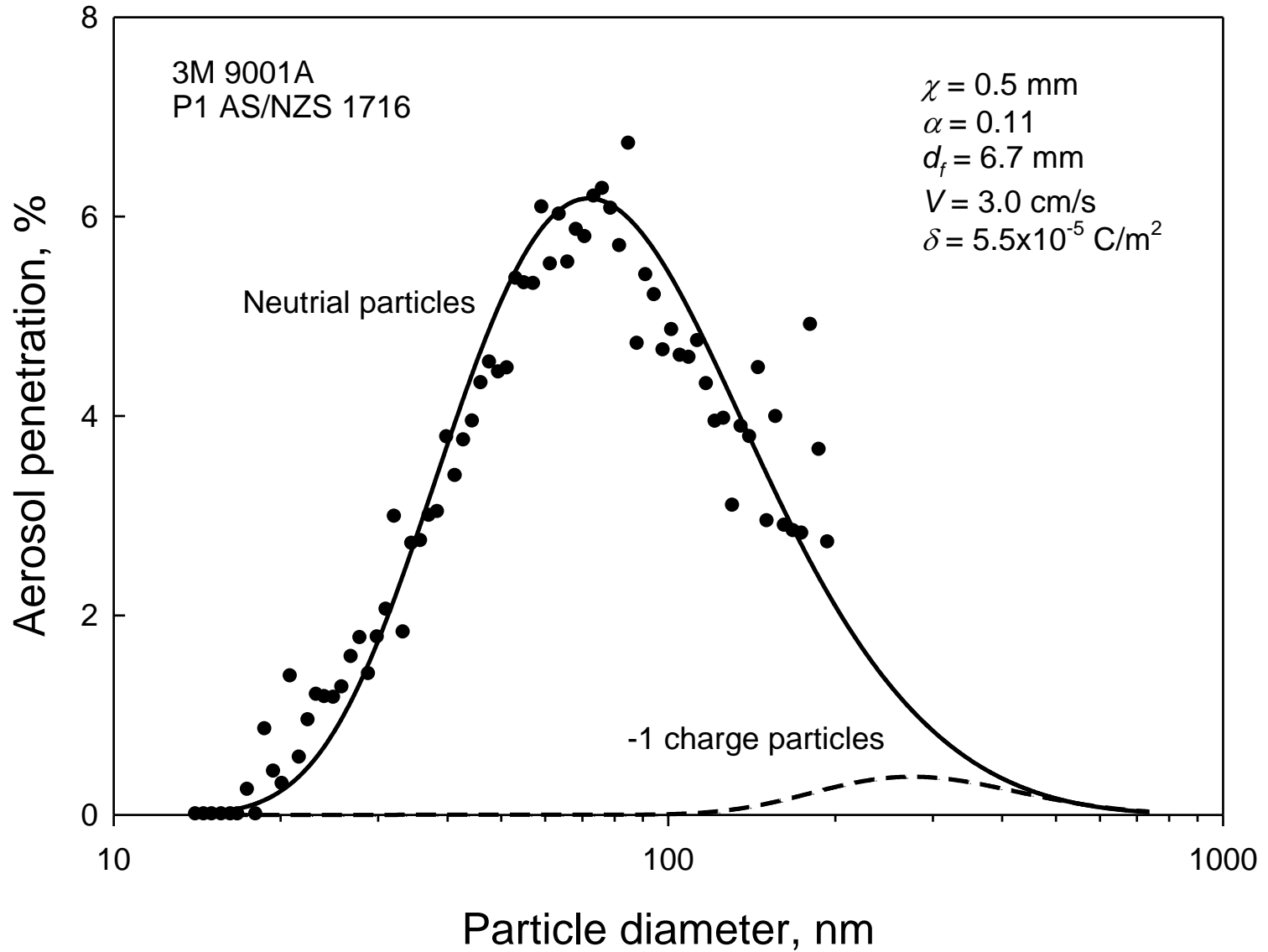
Size range existing in ambient air



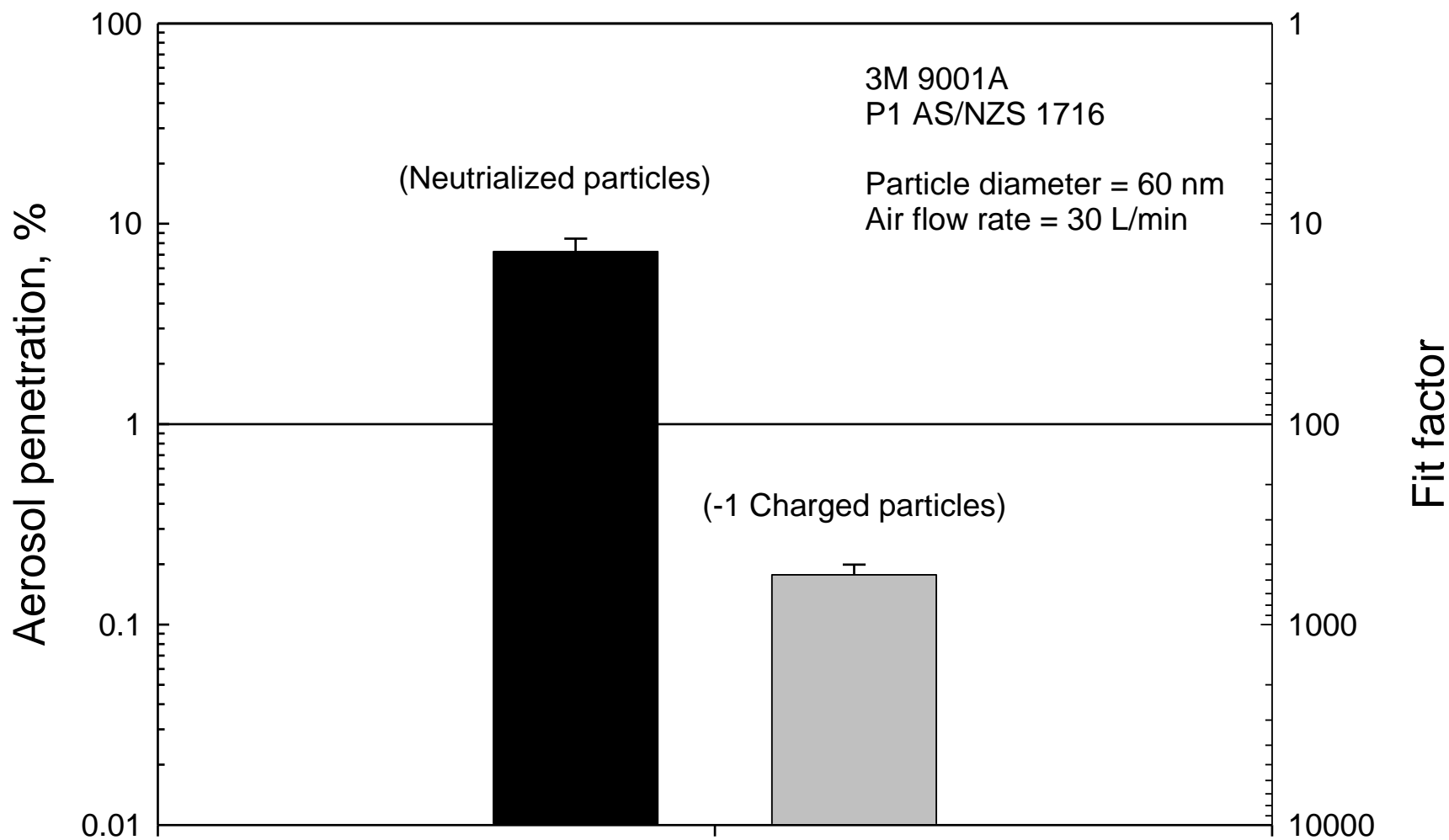
Particle Size (μm)



某P1口罩對不帶電微粒與帶電微粒的穿透率曲線



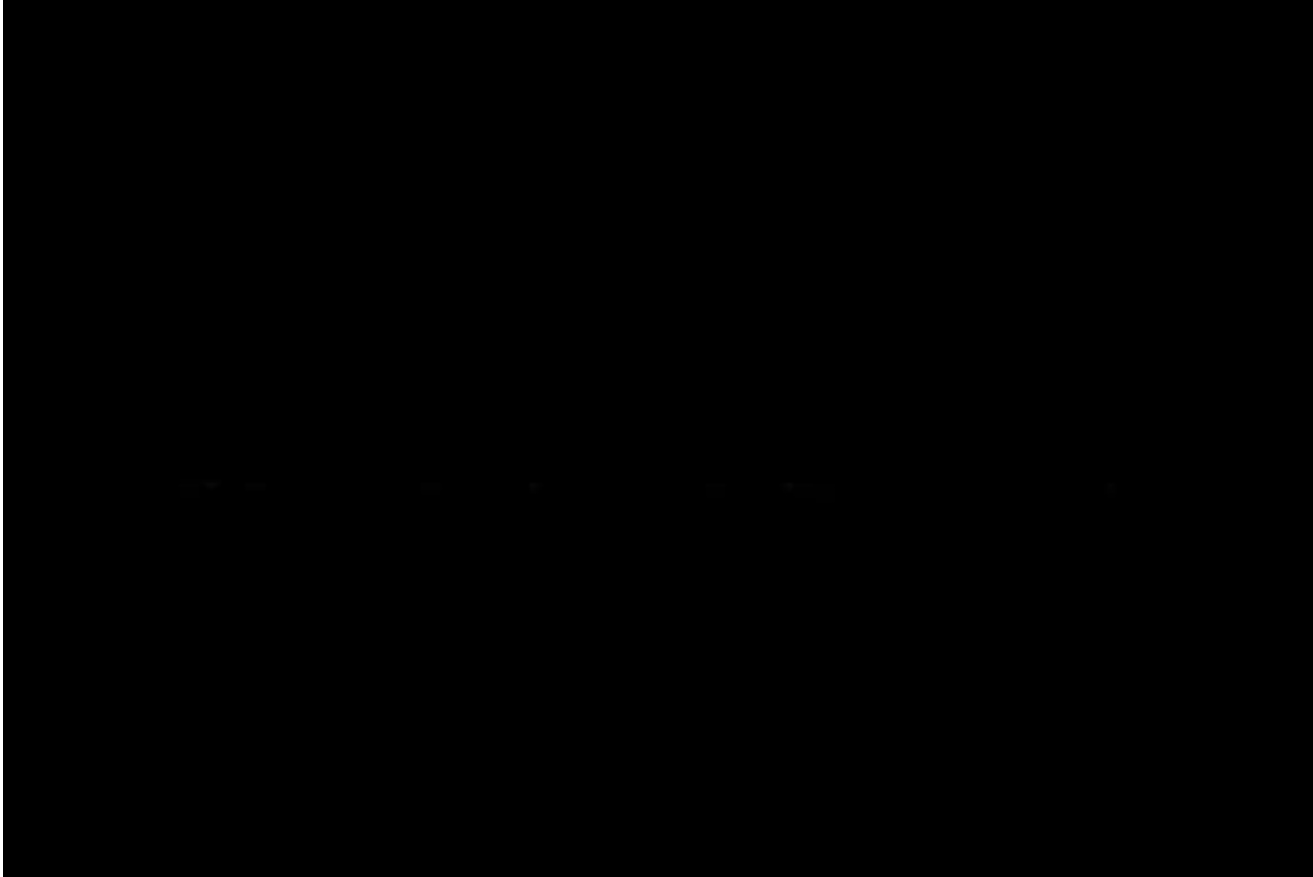
以60 nm帶電與不帶電微粒測試P1口罩的密合度結果



密合度測試的動作搭配

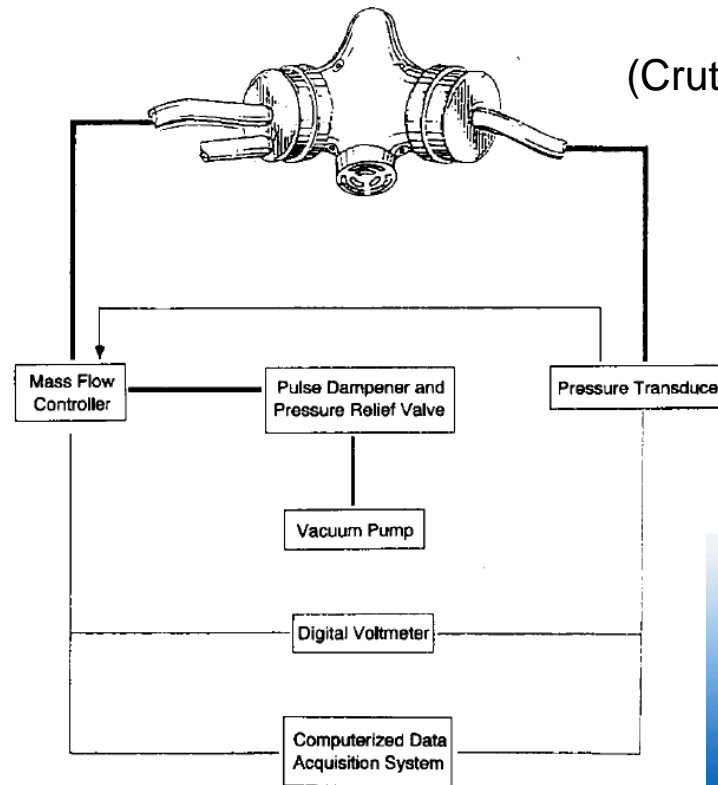
	定性	定量
1. 正常規律呼吸	✓	✓
2. 規律深呼吸	✓	✓
3. 左右轉頭(在每一側停留一至二個呼吸動作)	✓	✓
4. 上下點頭(在每一端點停留一至二個呼吸動作)	✓	✓
5. 說話(從100倒數)	✓	✓
6. 作鬼臉(皺眉頭或大笑)	✗	✓
7. 彎腰至摸到腳趾(腿可彎)	✓	✓
8. 正常規律呼吸	✓	✓

定量密合度測試

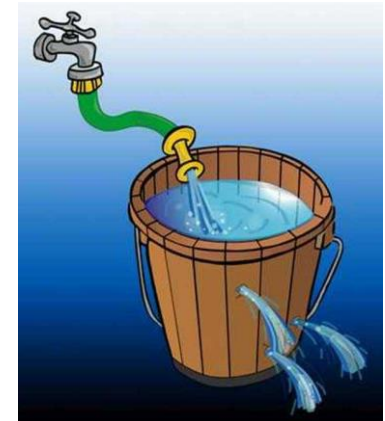


定量密合度測試

- Controlled Negative Pressure (CNP)



Air Lines ———
Feedback loop ———>
Electrical lines ———



定量密合度測試

- Controlled Negative Pressure (CNP)

- ↳ 模擬一般使用狀況下面體內所產生的負壓
 - 15 mmH₂O / 53.8 L/min (inspiratory flow rate)
(出廠設定)
 - 自我建立
- ↳ 受測者必須學會閉氣10秒鐘
- ↳ 在每個動作完成後再立即屏住呼吸進行測試
- ↳ 所得的測值為「相當密合度值」
- ↳ 不適用於拋棄式口罩




定量密合度測試

• CNP REDON

↳ 測試設備與方法與CNP相同，差異在動作項目：

動作項目	動作內容	密合度測試時的姿勢
臉部朝前	站著不說話，正常呼吸30秒	面朝前，屏住呼吸10秒鐘
彎腰	像是要用手指頭去碰腳指頭的方式彎腰，30秒	臉部與地面保持平行，屏住呼吸10秒鐘
搖頭	來回用力甩頭並喊叫數次，每次連續3秒鐘	面朝前，屏住呼吸10秒鐘
REDON 1	取下面罩，鬆開繫帶，再重新戴上	面朝前，屏住呼吸10秒鐘
REDON 2	取下面罩，鬆開繫帶，再重新戴上	面朝前，屏住呼吸10秒鐘

Which fit test should be used?

RPE (Type and Class)	Fit Testing Method			
	Ambient Particle Counting	Quantitative Test chamber	Controlled Negative Pressure ^b	Qualitative ^a Taste Smell ^c
 <p>Filtering facepiece</p> <p>FFP1 FFP2 N95 FFP3 N100</p>	<p>None of the listed methods are applicable for these RPE types.</p>	<p>None of the listed methods are applicable for these RPE types.</p>	<p>None of the listed methods are applicable for these RPE types.</p>	<p>None of the listed methods are applicable for these RPE types.</p>
 <p>Half mask respirator</p>				
 <p>Full face mask respirator</p>				

