



부직포 응용 **1-** 에어필터

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# 개발 제품 성능목표

$\Delta P = 15 \text{ mmAq}$

차압

$\varepsilon = 99.997\% \sim @ 0.1 \mu\text{m}$

여과효율

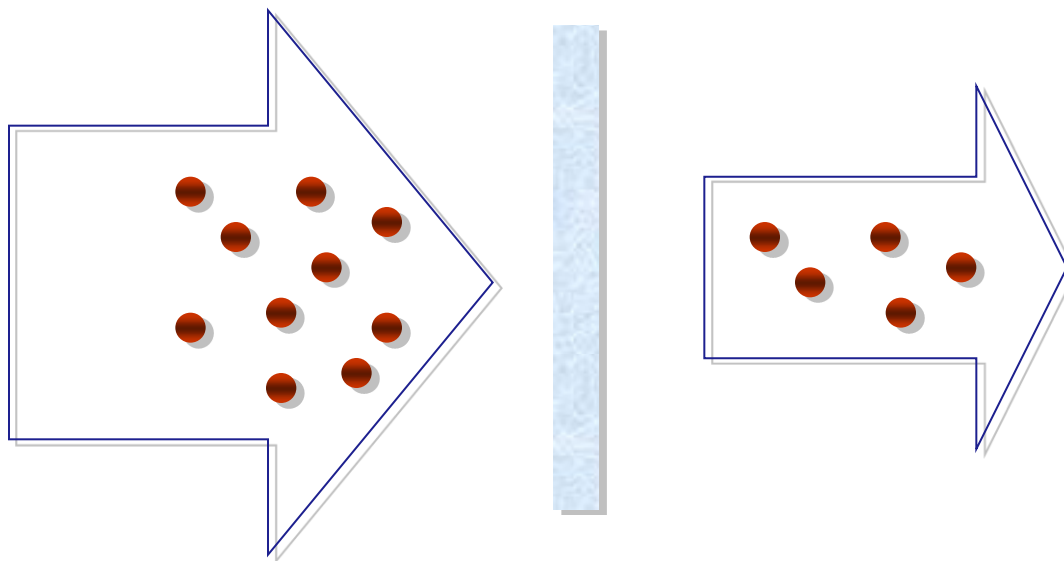
일본화학섬유검사협회 (KAKEN) 시험법

소취성능

ULPA급 나노복합 필터



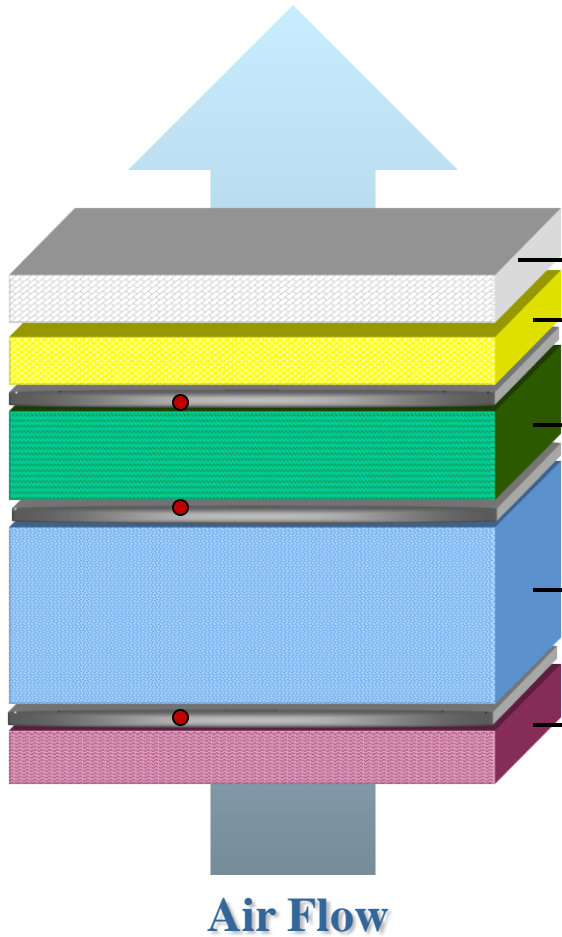
# 에어 필터 성능 평가 기준



1. 높은 여과효율
2. 낮은 압력 손실
3. 내열성



# 제품 개요



## Nano-fiber Layer(정전층)

- ~0.1 $\mu$ m size 먼지 제거, 전기방사

## Melt-blown Layer(정전층)

- Meltblown, PP, 적층량: 20g/m<sup>2</sup>, 0.1~1 $\mu$ m 먼지제거

## Needle Punching Layer(정전층)

- Needle Punching, PP, 적층량: 40~100g/m<sup>2</sup>, 1~10 $\mu$ m size 먼지 제거
- 방사→cutting→N/P 부직포→정전부여(웹상태)
- 극세 Fiber, Bulky→차압저감, 통기도 향상

## Active Carbon

- 기능성 소취 물질층, (암모니아, Nox, Sox) 제거
- 적층량: 200g/m<sup>2</sup>, 활성탄, 음이온 발생, 40~60 mesh

## Pre-filter

- Needle Punching, PET 단섬유, 적층량: 80~100g/m<sup>2</sup>
- Low Melting Fiber 30%, Regular Melting Fiber 70%
- 10 $\mu$ m의 굵은 먼지제거, 두께: 0.3mm

## Hot Melt

- 친환경, 무독성·인체친화적(생리대, 기저귀)
- 송진 주 원료(인체무해,친환경)



# 공정 개요



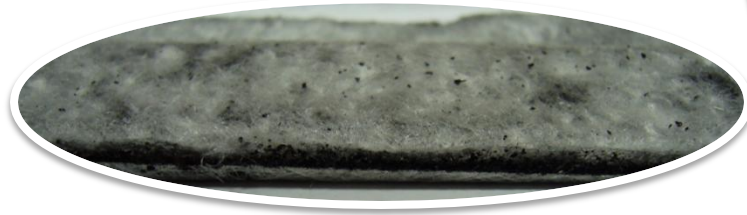
Prefilter용  
needle-punching 생산



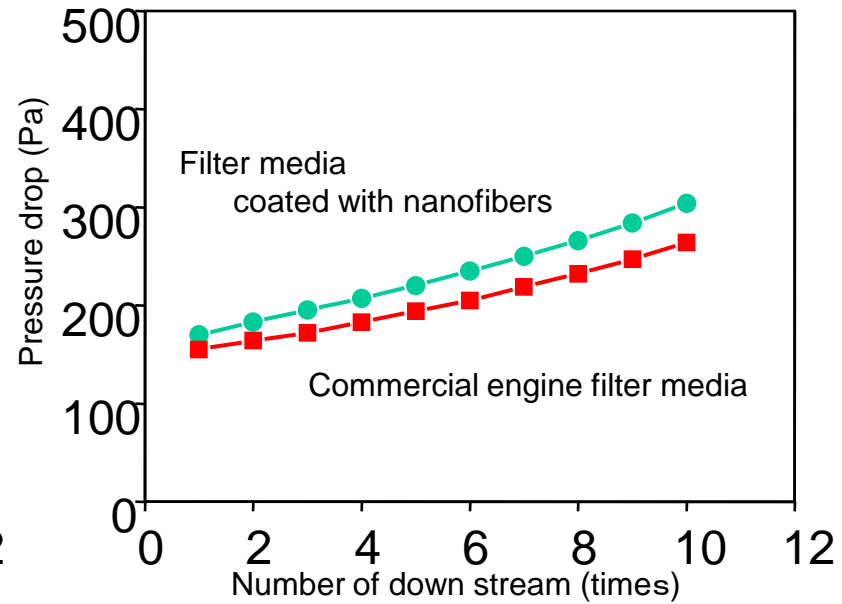
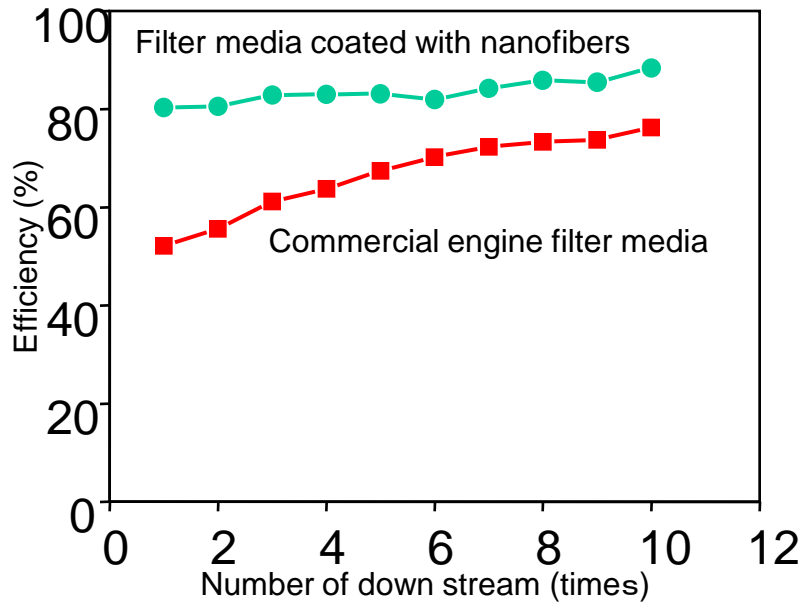
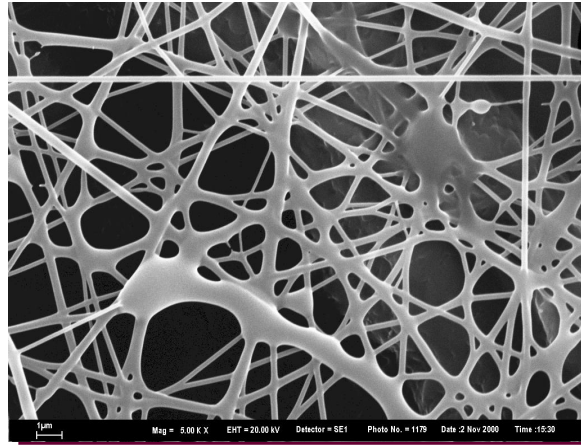
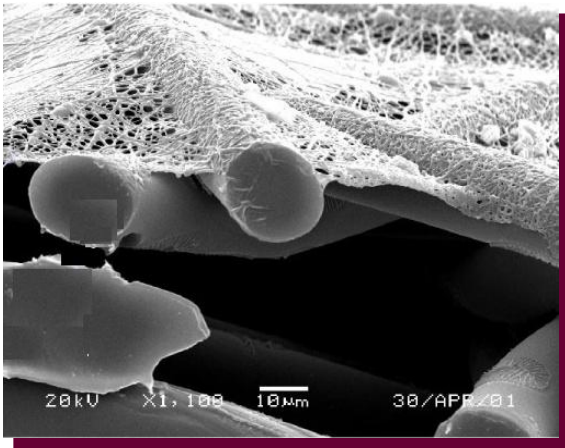


## 활성탄 부착

- 소취, 독성제거 등의 효과를 부여하는 활성탄을 필터에 부착
- 인체에 무해한 Hot-melt를 이용하여 친환경복합필터 제조
- 활성탄의 충전률(g/cm<sup>2</sup>)을 극대화
- M사의 복합필터는 0.07g/cm<sup>2</sup>의 충전률을 보임



# Filter Media





전기방사 조건

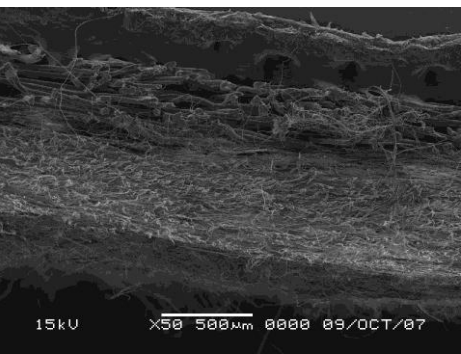
Parameter	Values
Polymer	Polyacrylonitrile
M <sub>w</sub>	4.5×10 <sup>6</sup>
Solvent	Dimethylformamide
Concentration (wt.%)	18
Viscosity (cp)	1592
Electric conductivity (μs/cm)	151.7
Electric voltage (kV)	25
Tip to collector distance (cm)	15
Collector	Plane copper
Capillary diameter (mm)	0.51
Spinning time (min)	a : 30, b : 60, c : 90
Temperature (°C)	25
Relative humidity (%)	46

필터 성능 평가 조건

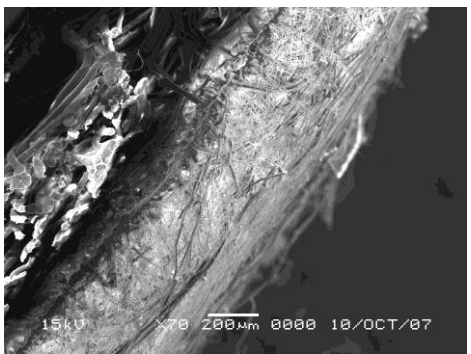
Parameter	value
Test aerosol	NaCl
Temperature(°C)	20
Relative humidity(%)	25
Face velocity(cm/sec)	1, 3.16, 5.33, 13
Test sample area(cm <sup>2</sup> )	100.06
Particle size(μm)	0.1, 0.12, 0.16, 0.2, 0.25, 0.3



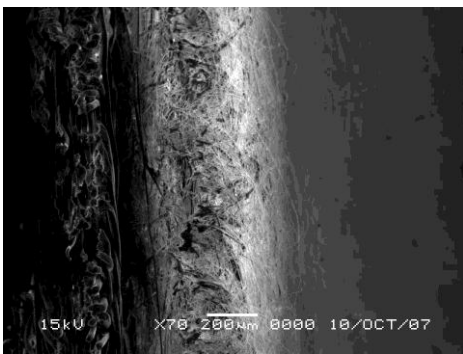
필터의 단면과 표면



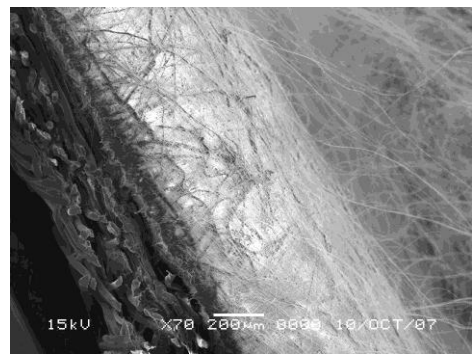
MB



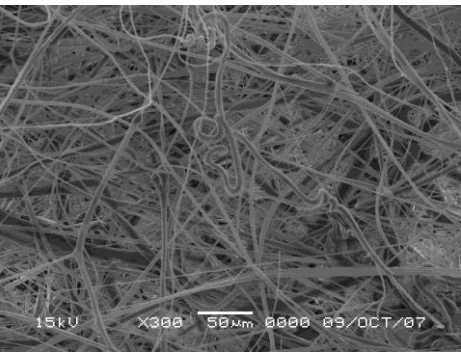
HN-a



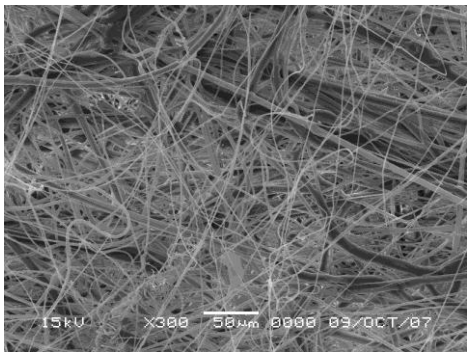
HN-b



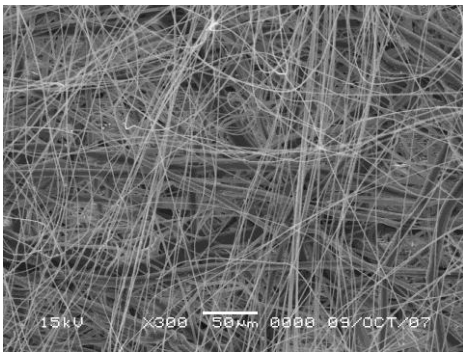
HN-c



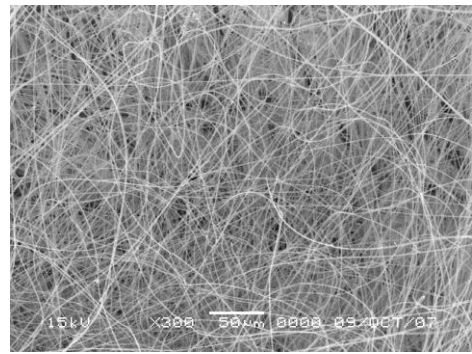
MB



HN-a



HN-b



HN-c



# 필터용 나노 웹 생산

## 필터 물성

	PP Meltblown	PP Meltblown + PAN electrospun web		
		HN-a	HN-b	HN-c
Basis weight (g/m <sup>2</sup> )	160	161.06	161.98	162.81
Thickness (μm)	811.66	854.48	900.84	947.35

## Quality factor

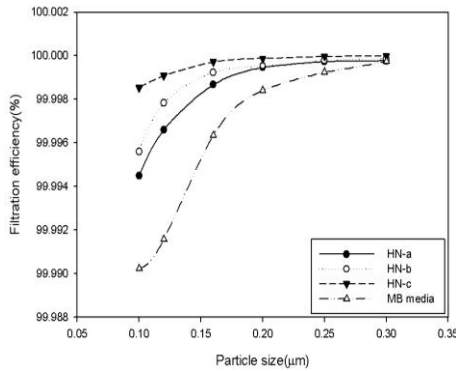
차압과 여과효율을 모두 고려한 필터 성능지표

$$q_F = \frac{\ln(1/P)}{\Delta p}$$

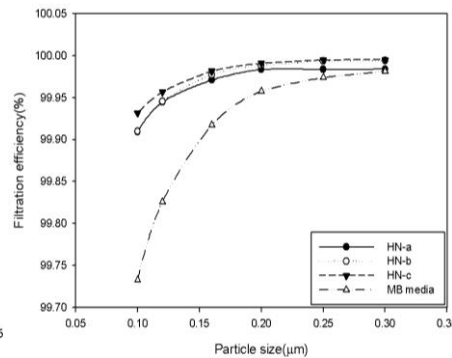
$q_F$  : quality factor

$P$  : 투과율 = (1-여과효율),  $\Delta p$  : 차압

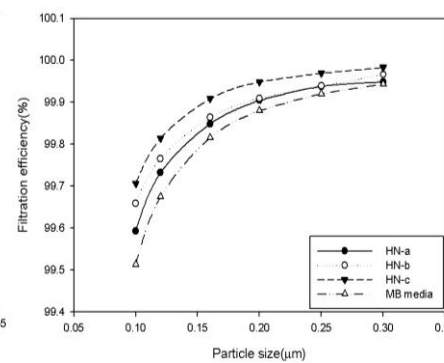
## 공기유속에 따른 성능변화 - 여과효율



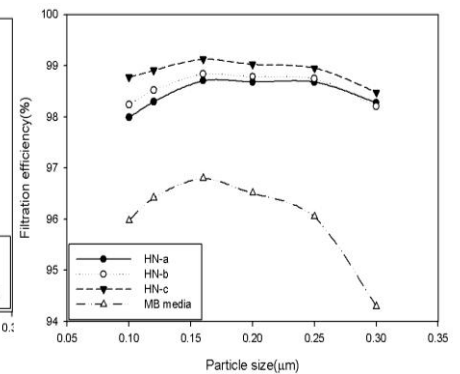
1cm/s



3.16cm/s



5.33cm/s

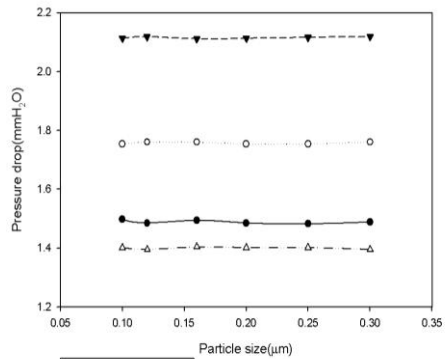


13cm/s

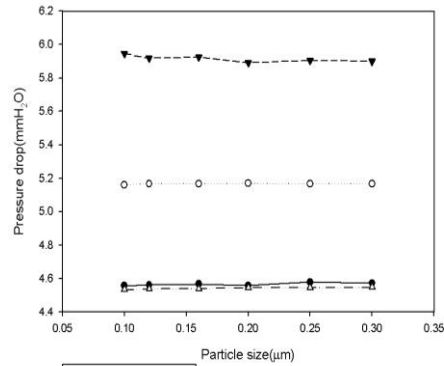


# 필터용 나노 웹 생산

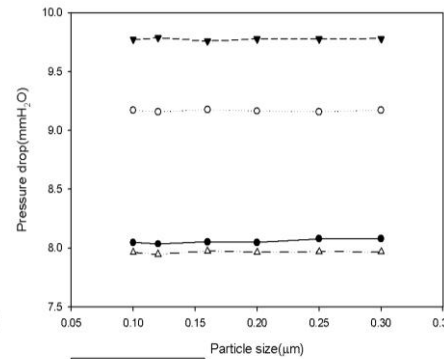
## 공기유속에 따른 성능변화 - 차압



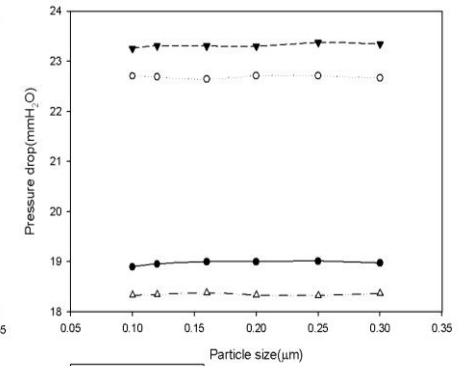
1cm/s



3.16cm/s

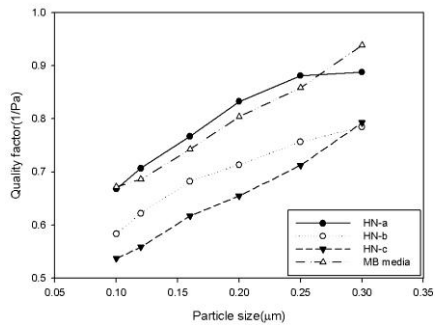


5.33cm/s

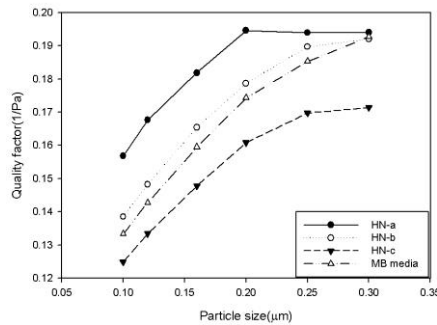


13cm/s

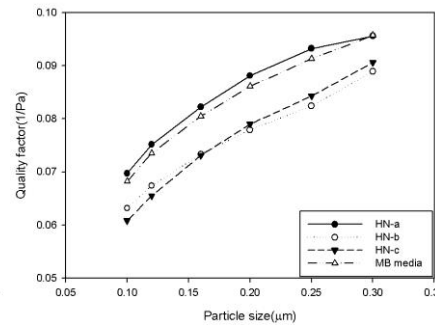
## 공기유속에 따른 성능변화 - Quality factor



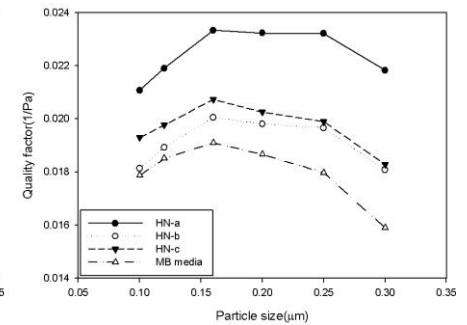
1cm/s



3.16cm/s



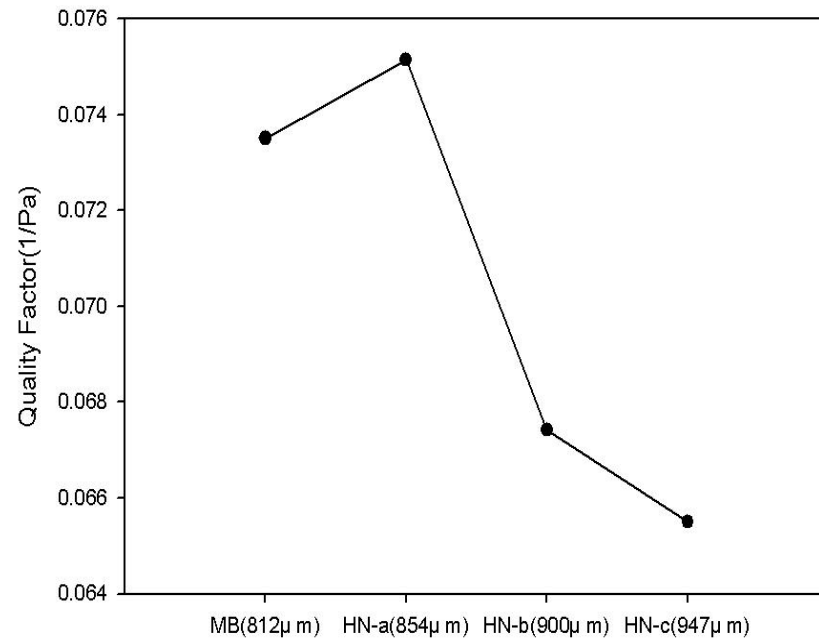
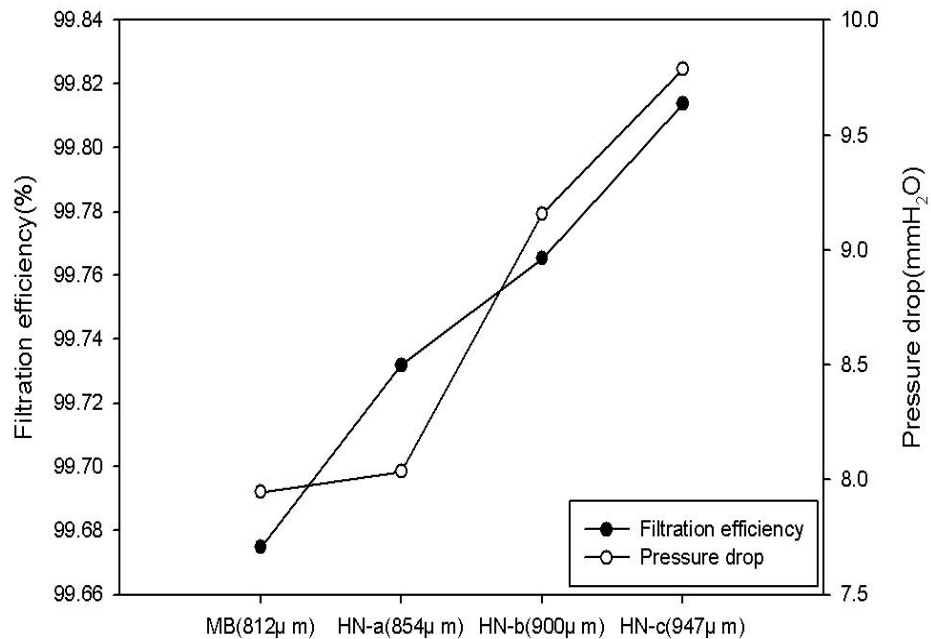
5.33cm/s



13cm/s

# 필터용 나노웹 세사

## 성능 평가

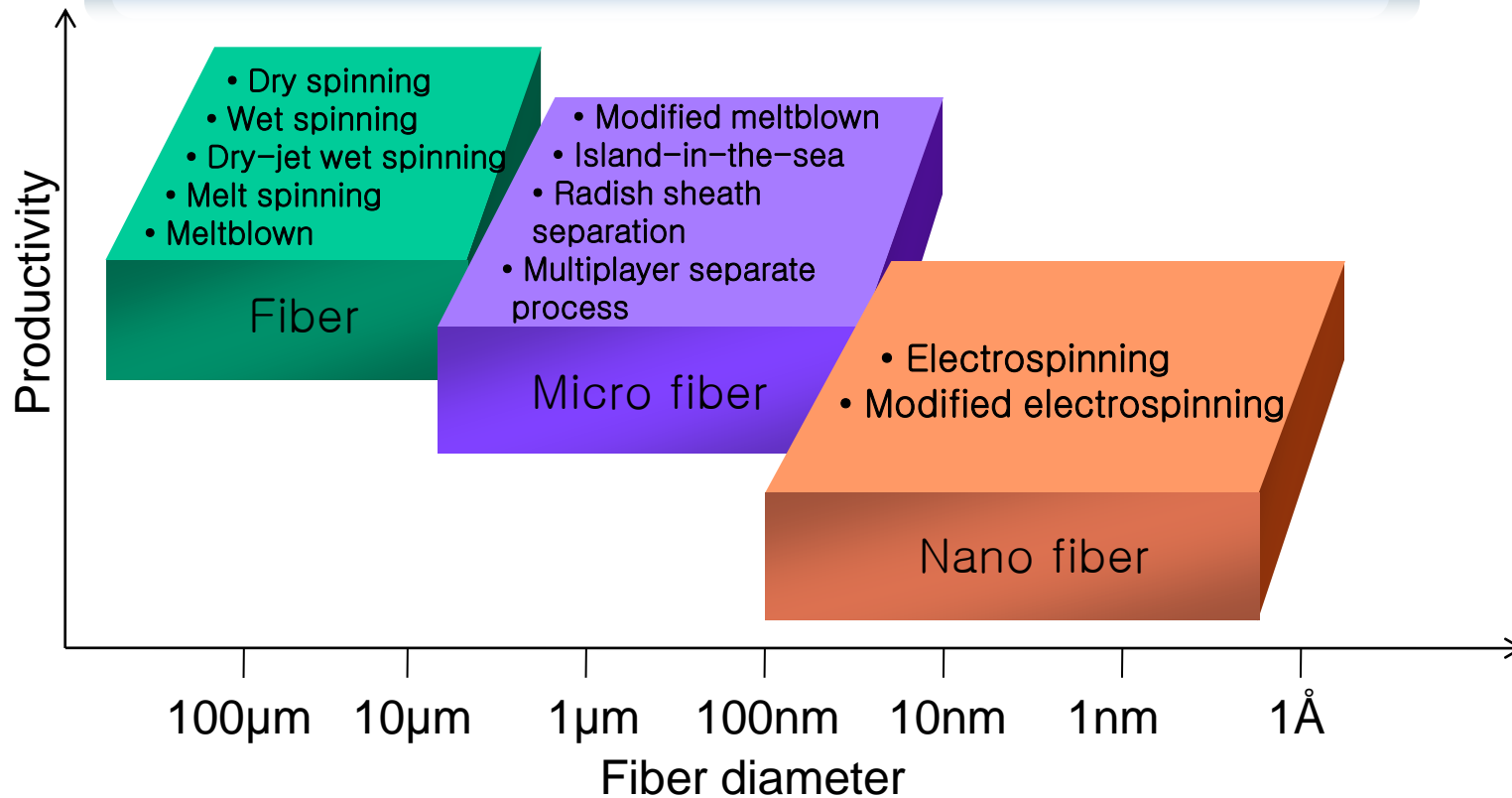


Face velocity 5.33cm/s, particle size 0.3μm 조건에서 필터간 성능 비교



# Nanofibers?

- Term used for fibers with diameters less than 0.5 microns.
- Typical nanofibers have a diameters between 50 and 500 nanometers





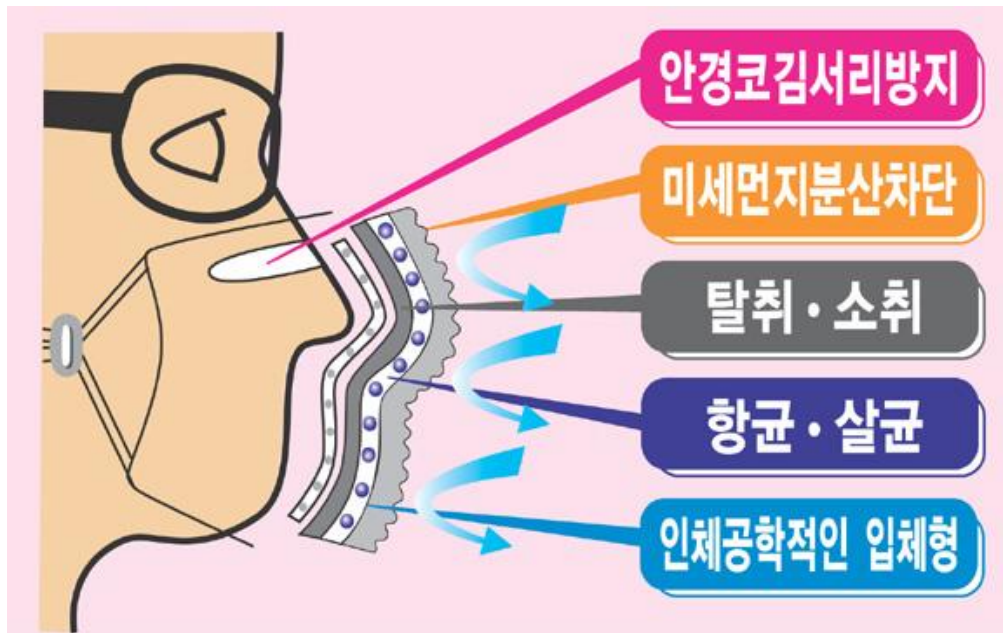
- LG 전자 공기청정기 (모델명: LA S050SS) 필터 공급물량 확대
  - ✓ 5,000만원 신규 매출 (5,000원/개 \* 10,000개) 발생



Filter



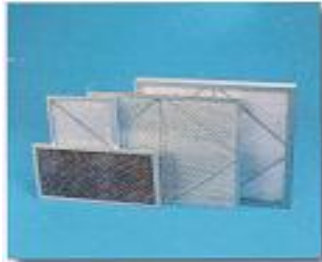
LA S050SS



마스크의 예



# 적용 제품



Panel Filter



정전 Filter



DAF-2000BP,665B,Oven Filter



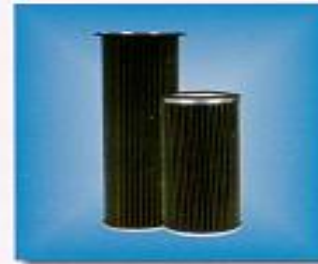
DAF-500, 700,1000



Medium Filter



가스터빈용 Air Filter



카트리지



DAF-1500,1800R,2000E



Medium Filter(Pocket type)



Hepa Filter



Door Trim



공기정화용 Filter,흡음재





**Thank You !**