

HEPA

가

Evaluation of Pressure Drop and Service Life for HEPA Filter

, , , , 가, , ,
, , , , , , .

150

V-pleat type 가 separator type . 가
 V-pleat type 가 28 separator type
2 .

Abstract

Pressure drop and service life of high efficiency particulate air(HEPA) filters were evaluated for economical utilization and radioactive waste reduction of filters used in PIEF. AS a result of the evaluation, V-pleat type HEPA filter was lower than separator type in the initial pressure, and the time reaching to the replacement pressure of V-pleat type HEPA filter took 28 months. Consequently, service life of V-pleat type HEPA filter appeared longer two times than that of separator type HEPA filter.

1.

(HEPA filter) 가
,
.
(pre-filter)가 .
(dust loading capacity) 가 . 가
(filter media) .

PNL(Pacific Northwest Laboratory)

63%가 , 15%,
13%, 5%, 4%, 가 1% .^[1]

separator type, V-pleat type
separator type

Dimple type 가
separator

20%가

minipleat

"V"

V-pleat type

Dimple type

V-pleat type

separator type

가

V-pleat type

separator type

, separator type

가

2.

가.

(pin hole)

가

가 가

가

25 daPa

2 50 daPa

50 daPa

가

Regulatory guide 1.14

0.05%

가

가

1

Bergman

2 HEPA filter

1

Letourneau

Bergman

가

가

[2]

$$\Delta P = 16 \mu X \left(\frac{F^\alpha}{R^2} + \frac{m}{P^\rho V_f r^2} \right)^{1/2} \left(\frac{F^\alpha}{R} + \frac{m}{P^\rho V_f r} \right) V \text{ ----- (1)}$$

$$\Delta P = \Delta P_o + 16 \mu V X \frac{d_f^{1/2}}{R} \frac{m}{P^\rho V_f r} \text{ ----- (2)}$$

ΔP : Pressure drop (Pa)

ΔP_o : Pressure drop of clean filter (Pa)

μ : viscosity of gas (Ns/m²)

V : Velocity of gas (m/s)

X : fiber thickness (m)

R : fiber radius (m)

F^α : volume fraction of original fibers

P^ρ : volume fraction of trapped particles (= $\frac{m}{P^\rho V_f}$)

R : Radius of original fibers(mm)

r : Radius of particle Trapped(mm)

m : mass of particle collected(kg)

P^ρ : density of particle(kg/m³)

V_f : volume of filter taken up by particles(m³)

Fig. 1

3,400 m³/h

3

[3]

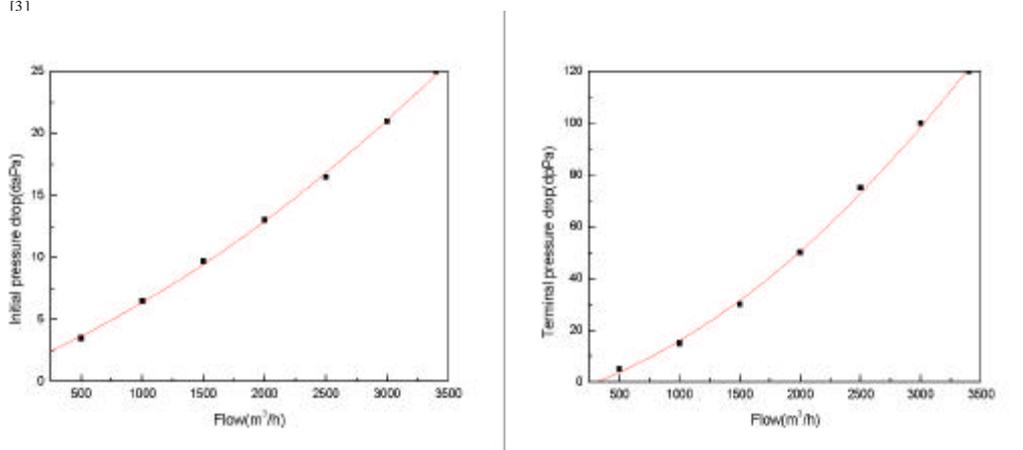


Fig. 1 Initial and terminal pressure drop as a function of flow.

- : 35 50 $\mu\text{g}/\text{m}^3$
- : 70 100 $\mu\text{g}/\text{m}^3$
- : 140 200 $\mu\text{g}/\text{m}^3$

$$\Delta P_c = \Delta P_1 + \frac{CT}{100} (\Delta P_2 - \Delta P_1) \text{----- (3)}$$

- ΔP_c : terminal pressure drop in service condition(daPa)
- ΔP_1 : initial pressure drop at service flow (daPa)
- ΔP_2 : terminal pressure drop at service flow(daPa)
- C : concentration of the air to be filtered($\mu\text{g}/\text{m}^3$)
- T : service time(year)

가

. 가 가

(610x610x292mm)

(separator) separator type minipleat "V" V-pleat
 type . Separator type V-pleat type 가
 가 V-pleat type 가
 separator type 가

100 가 ,
 가 76 . Fig 2

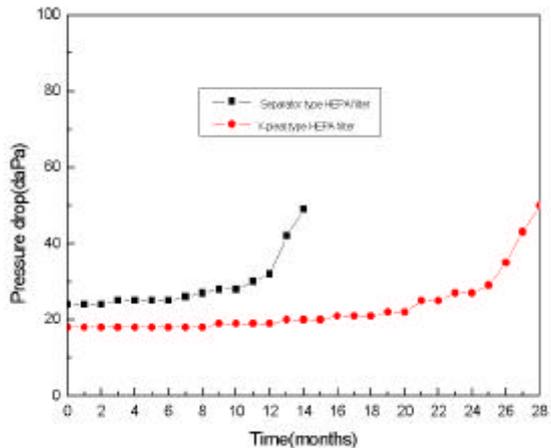


Fig. 2 Pressure drop changes with service time at PIEF in KAERI.

Fig. 2 separator type 24 daPa ,
 50 dPa 14 V-pleat type
 18 daPa separator type ,
 28 V-pleat type ,
 2 .
 M.W. First . 가
 1,700 m³/h 3,400 m³/h (V-pleat type) 1,700
 m³/h (separator type) 8
 1,700 m³/h 15.2 daPa 16.7 daPa
 , 3,400 m³/h 21 daPa 40.6 daPa .
 27.9 daPa 58.9 daPa .^[4]
 V-pleat type 가

3.

가 . V-pleat type 가 separator type
 V-pleat type 가 28 , separator type 가 14
 V-pleat type 가 2 .
 . 가
 V-pleat type 가 .

- [1] E. H. Carbaugh, "A Survey of HEPA Filter Experience", 17th DOE Nuclear Air Cleaning Conference Dencer, 1982.
- [2] P. Letourneau, et al., "Prediction of HEPA Filter Pressure Drop and Removal Efficiency During Dust Loading", 20th DOE/NRC Nuclear Air Cleaning Conference, 1988.
- [3] SOFILTRA Catalogue, SOFILTRA-POELMAN.
- [4] M. W. First and D. Leigh, "Performance of 1,000 and 1,800 CFM HEPA Filters on Loading Exposure to Atmospheric Dust Loading", 15th DOE Nuclear Air Cleaning Conference, 1978.