

## Selection of Most Suitable Filter to Reuse Contaminated PFC Solution

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### 1. Introduction

Due to its convenient handling, now days the PFC decontamination technology is becoming very popular. Particles that are micron size or smaller generally adhere tenaciously due to secondary valence forces with other solid surfaces, and cannot be removed by simple mechanical means. However, contacting particle-contaminated surfaces with a dilute solution of fluorinated surfactant of high molecular weight in an inert perfluorocarbon (PFC) liquid under sonic shear conditions resulted in effective removal of micron or sub-micron sized particles from solid surfaces.

The SEM (Scanning Electron Microscope) and OM (Optical Microscope) analysis results showed the size range of hot particulate adhered at the surface of research facilities were between 0.1 to 10  $\mu\text{m}$ .

When PFC decontamination technology is applied to removal of radioactive contaminated particulate adhered at surface during the operation of nuclear research facilities, it is necessary to develop a filtration equipment to reuse of PFC solution due to high price, also to minimize the volume of second wastewater.

When we investigated removal efficiency and flux with different particle sizes for some filters PP (Poly Propylene), ceramic, and PVDF (Poly Vinylidene Fluoride etc.) size 0.2 at laboratory by Stirred Cell Model 8050.

### 2. Methods and Results

#### 2.1 Experimental method

The size of hot particulate in hot cell was measured by SEM and OM and results of measurement showed that range of size of hot particulate adhered at the surface of research facilities was 0.1~10  $\mu\text{m}$ . Therefore, 0.1~10  $\mu\text{m}$  of mock particulate was used for filtration experiment. Filtration experiment was executed with stirred cell model 8050 to investigate removal efficiency and flux by 0.2  $\mu\text{m}$  of ceramic, PP, PVDF filters.

#### 2.2 Price comparison on filters

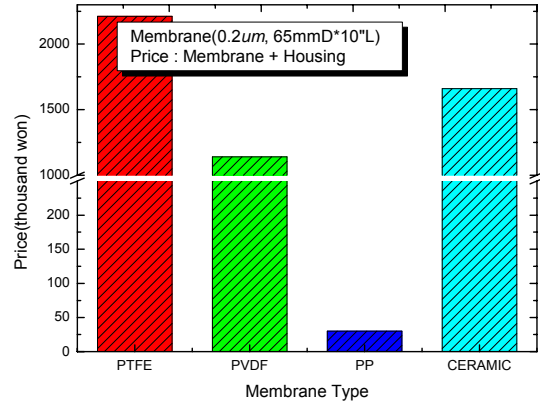


Fig. 1. Price comparison on some filters

Prices of PTFE, PP, PVDF, and ceramic filters were compared each other. Price is a total sum of filter membrane and housing. Membrane uses 0.2  $\mu\text{m}$  of 65mm D x 10" L filter. Results of comparison show that PTFE is highest and PP is lowest.

#### 2.3 permeate by ceramic filter

Permeate volume(mL) of PFC solution by 0.2  $\mu\text{m}$  ceramic filter along mock particulate size and time under 5psi was measured as Fig. 2. 0.3-5  $\mu\text{m}$  of  $\text{Al}_2\text{O}_3$  was used as mock particulate within PFC solution. Permeate volume of more than 30 mL( 80%) showed after 3 minutes. Also, permeate volume increases as size of mock particulate increases. But ceramic filter was highly stable at radioactivity in comparison of PVDF and PP of a macromolecule which generate  $\text{H}_2$  gas in alpha radioactivity environment.

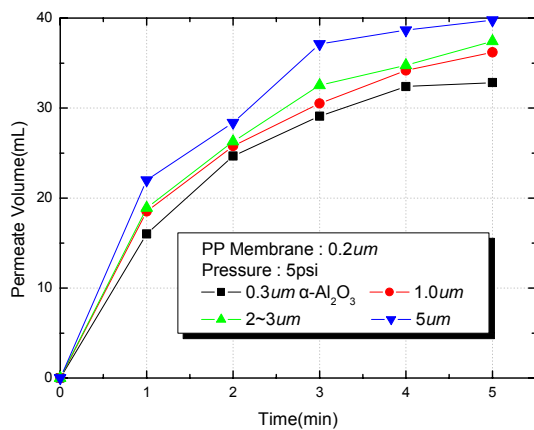


Fig. 2. Permeate volume along size of mock particulate by PP filter

#### 2.4. Permeate by Polypropylene filter

Permeate volume(mL) of PFC solution by 0.2 μm ceramic filter along mock particulate size and time under 5psi was measured as Fig. 2. 0.3 - 5 μm of Al<sub>2</sub>O<sub>3</sub> was used as mock particulate within PFC solution. Permeate volume of more than 30 mL(80%) showed after 3 minutes. Also, permeate volume increases as size of mock particulate increases.

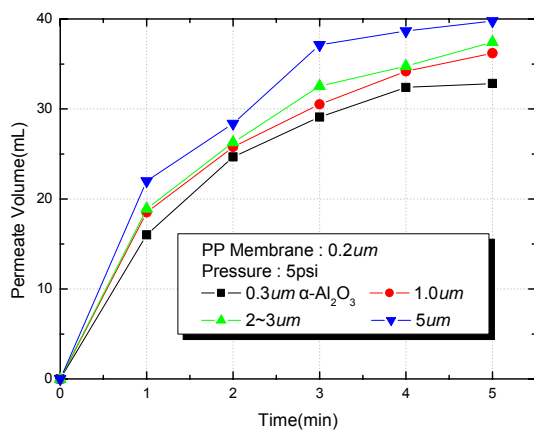


Fig. 3. Permeate volume along size of mock particulate by PP filter

#### 2.5 Flux by Poly vinylidene fluoride filter

Permeate volume(mL) of PFC solution by 0.2 μm ceramic filter along mock particulate size and time under 5psi was measured as Fig. 2. 0.3-5 μm of Al<sub>2</sub>O<sub>3</sub> was used as mock particulate within PFC solution. Permeate volume of more than 35 mL(90%) showed

after 3 minutes. Also, permeate volume increases as size of mock particulate increases.

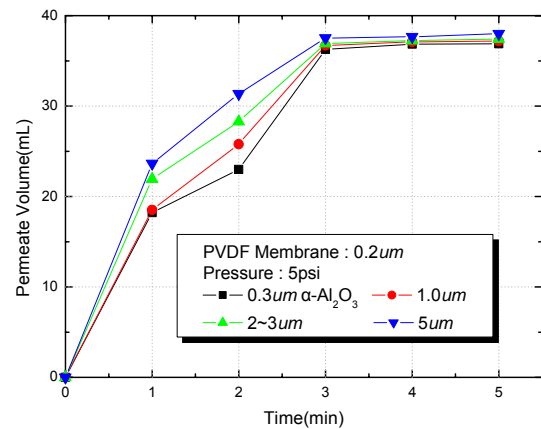


Fig. 4. Permeate volume along size of mock particulate by PVDF filter

### 3. Conclusion

The range of size of hot particulate adhered at the surface of research facilities measured by SEM was 0.1~10 μm. Results of filter experiments showed that filtration efficiency of PVDF(Poly vinylidene fluoride), PP(Polypropylene), Ceramic filter was more than 80% under 5psi. PVDF filter showed a little higher permeate volume than ceramic and PP filters. Also, price of PP filter was lowest. But ceramic filter was more stable in alpha radioactivity environment.

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