3M Filtration Products

TECHNICAL REPORT

Comparison of 3M Filtrete™ Media with TEBF Media

3M

Introduction

This report is intended to compare the performance and charge stability of two commonly used electret filter media, 3M Filtrete™ media and an electret media made of Tribo-electrified blended fibers, which is referred to as TEBF media in this paper. For a filter user, it is very important to know the performance of filter media in order to select the best filter media for a specific application. Stability of electret media is another very crucial factor. If the performance of an electret filter decays over time or degrades due to changes in environmental conditions, people or equipment being protected by the filter may lose proper protection.

3M Filtrete media is an electret media made of charged fibers. Filtrete fibers are made by splitting a charged polypropylene film. Split-fibers are rectangular in shape. A patented charging process allows Filtrete media fibers to attain the highest charge density. Filtrete media can capture particles with either positive or negative charges. In addition, due to the presence of strong electrical fields in Filtrete media, neutral particles can be polarized and captured as they enter the vicinity of charged fibers.

In contrast, the TEBF media compared in this study is made from a different process. It consists of 60% polypropylene fibers and 40% modified acrylic fibers. Both fibers are round fibers. Electrostatic charges on these fibers are produced through a triboelectrification process. TEBF media also relies on electrical attraction to remove airborne particles.

To evaluate performance and stability of Filtrete media and the TEBF media, three filter tests were performed and at least 5 samples were used in each test. The three tests are;

1. Efficiency/Pressure Drop
2. Humidity
3. Shelf-life

Conclusions

1. For the same basis weight, the efficiency of the TEBF media was lower than the efficiency of Filtrete media. At the same time, the pressure drop of Filtrete media was higher than the pressure drop of TEBF media.
2. The efficiency of the TEBF media decreased significantly under humidity attack. Filtrete media was found to be virtually unaffected by humidity. Due to its degradation under humidity attack, TEBF media may not be suitable for applications in humid environments.
3. The TEBF media performance decayed significantly due to aging. For example, after being stored for 7-months under normal room conditions, (22°C ± 2°C and 40% R.H. ± 20% R.H.) the TEBF media (100 g/m^2) showed more than 20% decrease in efficiency. Shelf life had a minimal effect on Filtrete media.

1. Efficiency and Pressure Drop Test

This test was made to compare the filtration performance of the TEBF and Filtrete media. Testing was performed using a TSI Model 8110 Automated Filter Tester. The challenge aerosol was a NaCl aerosol with a mean diameter of 0.1 μm and geometric standard deviation of 1.9. Filter media were tested at four different face velocities: 5 cm/s, 20 cm/s, 50 cm/s, and 75 cm/s.

This test was performed immediately after filter media was received. 10 samples of each media was randomly selected from the same lot of filter material. The filter efficiency and pressure drop of each sample was measured using the test method described above. The average value of 10 samples at each test condition was calculated and presented in the following figures.

Figure 1 and Figure 2 show efficiencies and pressure drops of TEBF and Filtrete media with basis weights of 100 g/m^2 and 200 g/m^2 respectively. For the same basis weight, the efficiency of the TEBF media was found to be lower than the efficiency of Filtrete media, while the pressure drop of Filtrete was found to be higher than the pressure drop of the TEBF media.

Figure 1. Comparison of Efficiency

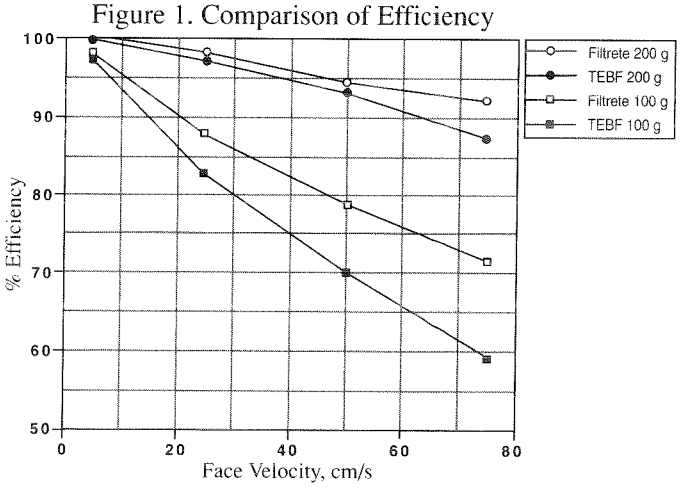
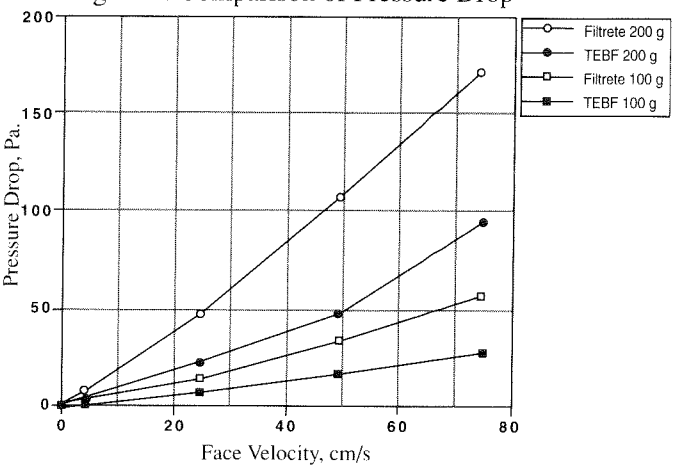


Figure 2. Comparison of Pressure Drop



2. Humidity Test

This test was designed to investigate the effect of humidity on the TEBF and Filtrete media. To study the effect of humidity, testing was conducted using a TSI 8110 with 0.1 μm NaCl particles at a face velocity of 25 cm/s. Testing was done in three steps.

Step 1. Measure the initial efficiency of filter media.

Step 2. Condition filter media at 100% R.H. for different exposure lengths, 0.5 hour, 1 hour, 2 hours, 4 hours, 6 hours, 12 hours, and 24 hours.

Step 3. Measure filter efficiency again after humidity conditioning.

Figures 3 and 4 illustrate net changes in filter efficiencies for individual samples of 100 g/m^2 and 200 g/m^2 media respectively. Seven samples of Filtrete and the TEBF media of each basis weight were tested. Though some variation in these samples exists, a general trend is evident. Examination of the overall trend exhibited that the efficiency of the TEBF media decreased significantly under humidity attack while Filtrete media showed minimal change under the same attack. For example, the 100 g/m^2 TEBF media showed more than an 8% decrease in efficiency with humidity exposure within the first half hour. In some applications, such as anesthetic circuitry, the filter media may be exposed to extremely humid air flow. The use of TEBF media in these applications may not be appropriate.

3. Shelf-Life Test

To study the effect of shelf-life, the efficiency of fresh filter media was measured immediately after the media was received. Results of this testing are detailed under Efficiency and Presure Drop Test. The media was then stored under normal room conditions (22°C ± 2°C and 40% R.H. ± 20% R.H.). After seven months, half the samples were removed from storage and efficiency was measured again. Tests were performed using a TSI 8110 with 0.1 μm NaCl particles at face velocities of 25 cm/s, 50 cm/s, and 75 cm/s.

Figures 5 and 6 show efficiencies of fresh media and aged media with basis weights of 100 g/m^2 and 200 g/m^2 respectively. This testing showed that the TEBF media had a significant reduction in efficiency. Within the velocity range of 25 cm/s to 75 cm/s, efficiencies of the 100 g/m^2 TEBF media decreased by more than 20% whereas efficiencies of Filtrete media only changed by 2%.

Figure 3. Comparison of Humidity Effect (100 g/m^2 Media)

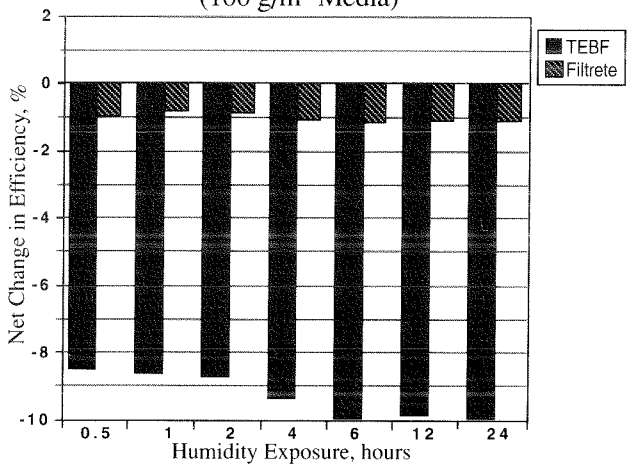


Figure 4. Comparison of Humidity Effect (200 g/m^2 Media)

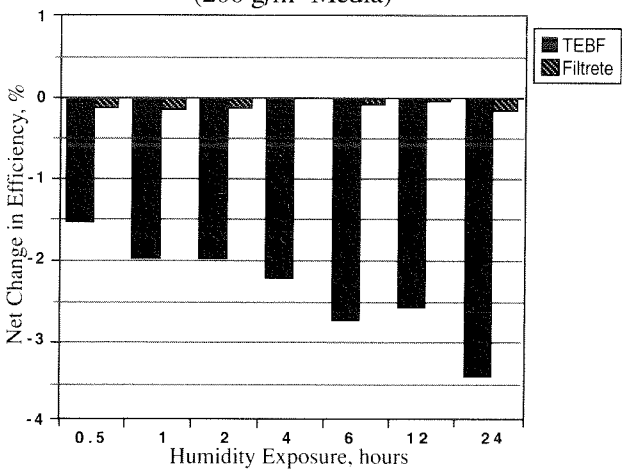


Figure 5. Comparison of Shelf Life (100 g/m^2 Media)

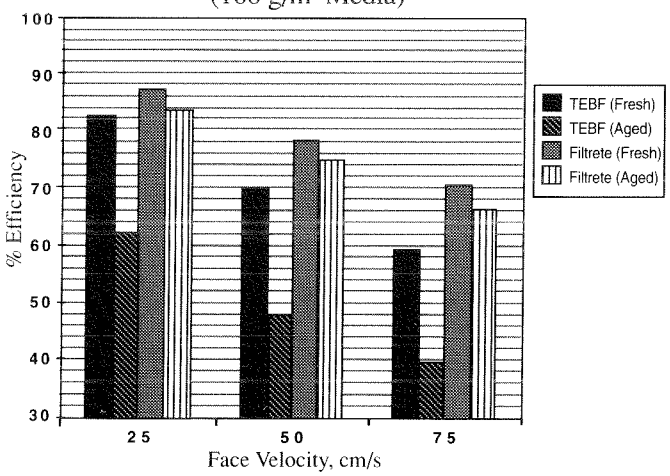
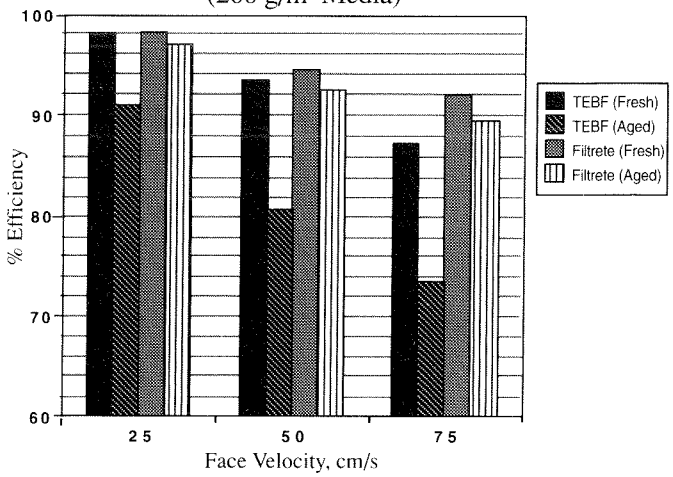


Figure 6. Comparison of Shelf Life (200 g/m^2 Media)



Summary

This study was carried out to investigate the performance and charge stability of Filtrete media and a TEBF media. For the same basis weight, the efficiency of Filtrete was higher than the efficiency of the TEBF media, and the pressure drop of Filtrete media was higher than the pressure drop of the TEBF media. The humidity test showed that the efficiency of the TEBF media decreased significantly under humidity attack. Filtrete media was found to be virtually unaffected by humidity. It was also found that the efficiency of the TEBF media decayed significantly over time. In comparison, shelf life had a minimal effect on Filtrete media.

If you have additional questions or need information on other technical reports, contact Filtration Products Technical Service toll free at 1-800-648-3550.

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