ARTICLE

Depth By Design: How OptiFiber Cloth Filtration Media Achieves Superior Filtration And Lower Cost Of Ownership

In wastewater treatment plants (WWTPs), tertiary treatment using cloth media filters acts as a final barrier to ensure the final effluent meets regulatory requirements. Cloth media filtration helps stabilize water quality amidst ever-changing influent composition and disruptions to the secondary treatment process. While many operations recognize the need for this final polishing step, a common and costly misconception prevails: all cloth media filtration (CMF) processes are fundamentally the same. The term "disk filter" is often used broadly to lump together a range of technologies, including microscreens (both cloth and stainless steel) and pile cloth media, which are very different. Even among pile cloth medias, performance can vary widely. Thus, while it may be tempting to save money by using lower-cost media, doing so can compromise effluent quality.

That's why, for the past 35 years, Aqua-Aerobic Systems, Inc. has invested in making OptiFiber® Cloth Filtration Media the top-performing cloth media. OptiFiber media stands out for its superior technical design and measurable quality, resulting in a premium solution with the lowest total cost of ownership (TCO).

Surface Filtration Vs. Depth Filtration

In the world of water and wastewater filtration, technologies can generally be sorted into two categories: surface filtration and depth filtration. The concept of surface filtration is that the filter consists of a single barrier, a flat-sheet with engineered holes of a specific size. All particles smaller than that hole size will pass through and larger particles will be omitted. The issue with this method of filtration is the lack of uniformity of the solids in typical water and wastewater applications. Long but skinny particles, for example, may still pass through the filter even though they are much larger in one dimension than the hole size of the screen. Further, because there is only a single discreet barrier, there is also a singular opportunity for suspended solids to be removed.

Depth filtration, on the other hand, takes a different approach. There is not a specific barrier with depth filtration but rather a three-dimensional labyrinth of filtration media that forces the liquid to be filtered through this complex network, resulting in the suspended solids having many opportunities to make contact with the filter media and ultimately being captured within it. The deeper and denser the filter medium, the better the filtration result. This approach has been widely used with traditional sand filtration but, likewise, is the working principle behind pile cloth media.

Figure 1. Aqua-Aerobic OptiFiber media uses woven fibers that rise perpendicular to the backing. When wet, they become matted and create a complex structure with innumerable surfaces for capturing solids.

Filtration By Design

While the principles of depth filtration would apply to any pile cloth media used in a similar application, there is a lot more that goes into making a functional media than just providing sufficient fiber density to achieve the targeted solids removal.

For example, whereas some pile cloth media used on the market are knit media, OptiFiber media is a woven cloth media product, which uses a discreet monofilament backing material with large openings (Figure 2). During backwash, these openings allow for much greater flow to scour the pile cloth, resulting in more thorough backwashes, allowing the

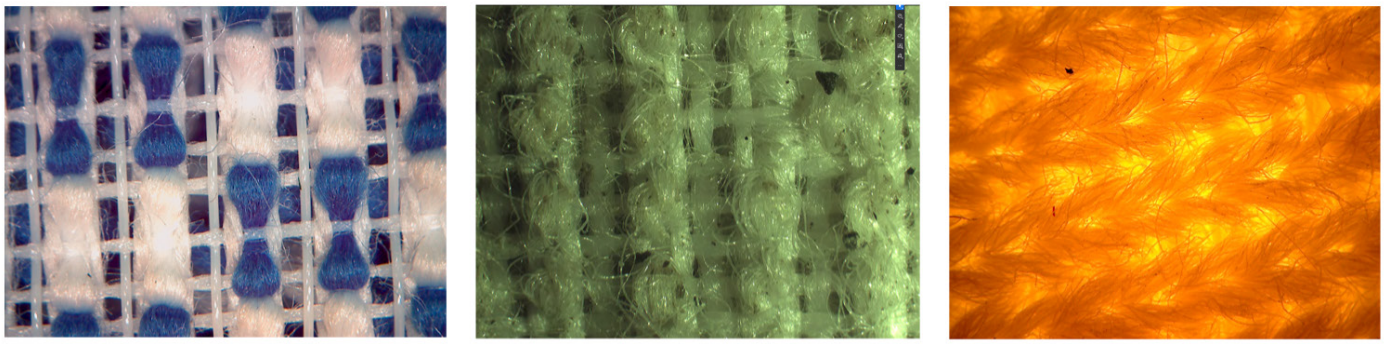

Figure 2. The large opening backing of OptiFiber media (left) allows for more efficient backwashing than other types of woven cloth media (middle) and knit cloth (right).

filter to recover to a lower basin level after a backwash cycle. By comparison, knit cloth backing is tighter and more closed, which can restrict flow during backwash. This increases opportunities for biofilm accumulation, further interfering with backwash flow.

Even among different types of woven pile cloth media, there are many parameters that can be adjusted to yield changes to performance both for contaminant removal and for longevity. Recently, OptiFiber PES-14® cloth filtration media was tested as the benchmark, along with several other microfiber cloth medias consisting of the same fiber diameter but with altered backing designs and fiber lengths. Of the other four media tested, only one, known as MF2, was able to essentially match the solids removal of OptiFiber PES-14, while the other arrangements yielded appreciably worse removal efficiencies. While MF2 was able to achieve good solids removal efficiencies, that benefit came at a substantial cost. Specifically, MF2 suffered from lower filter recovery and generated substantially more (3x to 5x) backwash waste by the end of the 180-day trial (Figure 3).

One of the key takeaways from this work: Having adequate depth filtration within the pile layer while maintaining sufficiently open backing is essential to achieve the dueling objectives of attaining superior solids removal and optimizing long-term operating costs.

Gen 5 Media And Beyond

This open-backing concept is so important that in 2024, Aqua-Aerobic

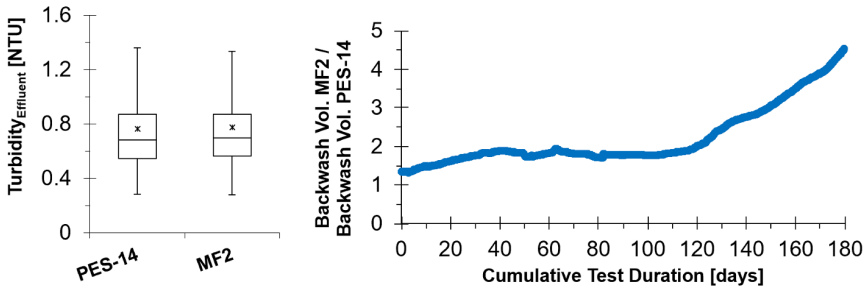

Figure 3. Comparison of benchmark OptiFiber® PES-14 media versus MF2, a specific experimental media that achieved similar effluent quality to PES-14 (left) but at the cost of much more backwash waste (right).

debuted its Gen 5 backing design, which quadrupled the open area of the backing, increasing backwash flow and minimizing biofilm growth. This development comes on the heels of many years of testing and developing to achieve the desired balance between high solids removal efficiencies and optimal backwash efficiency. The current Gen 5 OptiFiber cloth media can last well beyond what is considered the standard lifespan among disk filters. OptiFiber media often lasts over 10 years, meaning only one replacement is typically needed during the equipment's 20-year lifespan. In addition, higher quality and more reliable filtration can save money by reducing the amount of ultraviolet light or chlorine needed for subsequent disinfection steps. The combination reduces the TCO compared to lower-priced alternative systems.

Built On Testing And Support

As part of its commitment to innovation and quality, Aqua-Aerobic Systems invests over 10% of profits back into R&D, which includes a focus on advancing its cloth filtration media technology. All potential new cloth material undergoes endurance testing before going to market. This testing simulates 20 years of filtration by running through 500,000 backwash cycles and includes ASTM strength testing for 200 lbs. of force and 60 lbs. of strain. In fact, the latest fifth-generation cloth was pushed successfully to 1 million backwash cycles (equivalent to 40 years of operation). All performance testing results are reviewed and overseen by a third party, which can provide a shareable report to clients.

To ensure their products perform as expected in the field, Aqua-Aerobic maintains a robust team of approximately 50 field service people and offers 24-hour customer service support. Its support team draws on experience from thousands of filters and high employee tenure to resolve complex challenges. By prioritizing proven cloth media like OptiFiber, WWTPs can ensure long-term reliability, lower operating costs, and consistently produce high-quality effluent that meets regulatory demands. ■