ARTICLE

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A Metawater Company

Meeting Stringent Phosphorus Requirements With Pile Cloth Media Filtration

Phosphorus limits for wastewater discharged into surface waters are constantly being reevaluated by state authorities based on federal mandates. This creates a challenge for wastewater treatment plants (WWTPs), which are always on their toes trying to adjust their process to new and changing nutrient permits. The challenge also impacts engineers who have been tasked with designing an expansion or upgrade of an existing facility, or even those working on greenfield projects.

There are many ways to remove phosphorus from wastewater, which is both an advantage and a disadvantage –– the number of options can provide flexibility in the design stage but also can result in effective technologies being overlooked.

The truth of the matter is that phosphorus removal should take place across all stages of wastewater treatment. Many design engineers forget how important tertiary treatment, in particular pile cloth media (PCM) disc filters, is in polishing the wastewater and achieving permit limits.

Ways Of Reducing Phosphorus

Phosphorus can be removed from wastewater using three types of processes:

Biological removal. The vast majority of phosphates can be removed during the nutrient removal stage. Under the right conditions, systems such as biological nutrient removal (BNR), moving bed biofilm reactors (MBBRs), membrane bioreactors (MBRs), and sequencing batch reactors (SBRs) are all effective at reducing phosphorus. Well-designed and executed nutrient removal should reduce phosphate levels by 90% or more. Depending on permit limits, an additional physical and/or chemical process may be needed to remove any remaining phosphates.

Chemical removal. More properly called chemical precipitation, this process requires adding chemicals into the wastewater stream. Aluminum- or iron-based salts, such as hydrated aluminum sulfide or ferric chloride, are frequently used for this purpose. Once the chemical reacts with the phosphorus, it will form a precipitate that will either settle or float, allowing it to be physically removed.

Physical removal. Both biological and chemical removal of phosphorus rely on removing particulate phosphorus from the system. Although the majority of phosphorus is removed through clarification, tertiary filters and membrane filters can be used alone or in combination with chemical precipitation for final polishing. Physical filters are used to further remove phosphorus along with total suspended solids (TSS) during the same polishing step. When choosing a physical filter, especially a disc filter, it is important to consider the benefits of the

specific technology to ensure it works with the overall system.

Advantages Of PCM In Phosphorus Reduction

Disc filters are a popular and affordable option for tertiary treatment and polishing. However, not all disc filters work the same way. PCM (Figure 1) is a specific disc filter technology that offers notable advantages over screen filters and other technologies. Unlike mesh screen discs, PCM has a larger filtration depth in which to trap solids, including both soluble and precipitated phosphorus. This increases the chance of capturing solids, leading to higher removal rates.

There are many different types of PCM system designs. For example, when a disc filter is designed with an outside-in flow path — meaning the water flows through the cloth media into a central weir — heavier solids and precipitates are able to settle to the bottom of the tank. This allows the system to remove more solids before needing a backwash, which in turn reduces backwashes and extends the overall life of the disc.

Other important features to consider include:

Backwash process. Rather than spray the disc with a high-pressure water stream, some PCM systems with outside-in flow are backwashed using a suction stream, similar to vacuuming a carpet. This offers two advantages. The first is that the disc can be fully submerged while filtering. The second is that the backwashed solids can be recirculated to the head of the plant where they can be removed by settling with other solids.

Fiber backing. Some phosphorus precipitates, such as ferric phosphate, can be very tacky. This is ideal for flocculation but can make backwashing physical filters challenging. WWTPs should consider PCM systems that use a backing engineered to prevent even sticky or tacky solids from adhering to it (Figure 2). Not only does this increase removal rates, but it also aids in backwashing and can help extend the life of the disc.

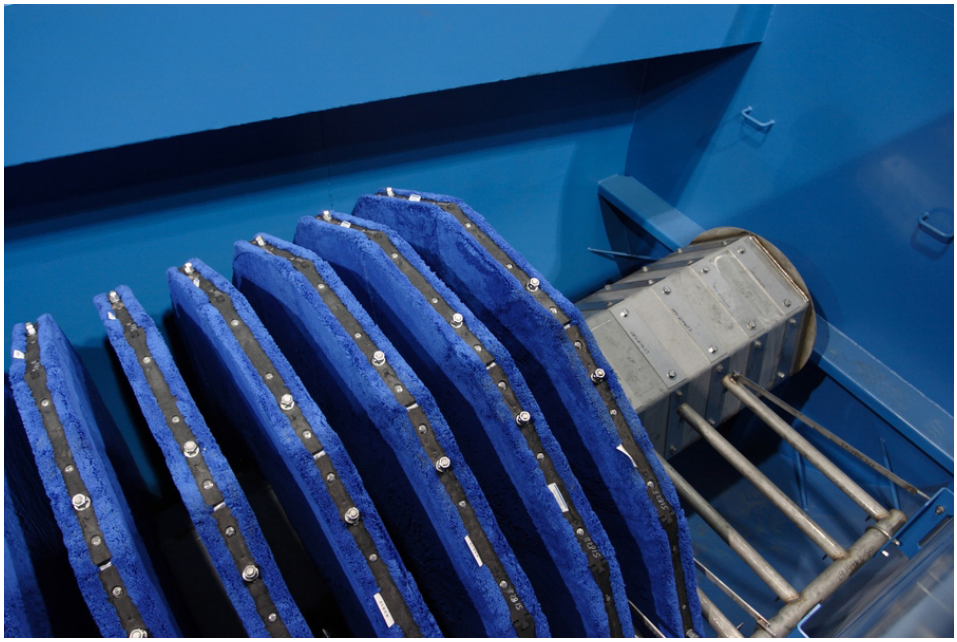

Photo courtesy of Aqua Aerobic Systems, Inc.

Figure 1. Pile cloth media (PCM) disc filters have a greater capacity to trap and remove total suspended solids (TSS) and nutrients such as phosphorus.

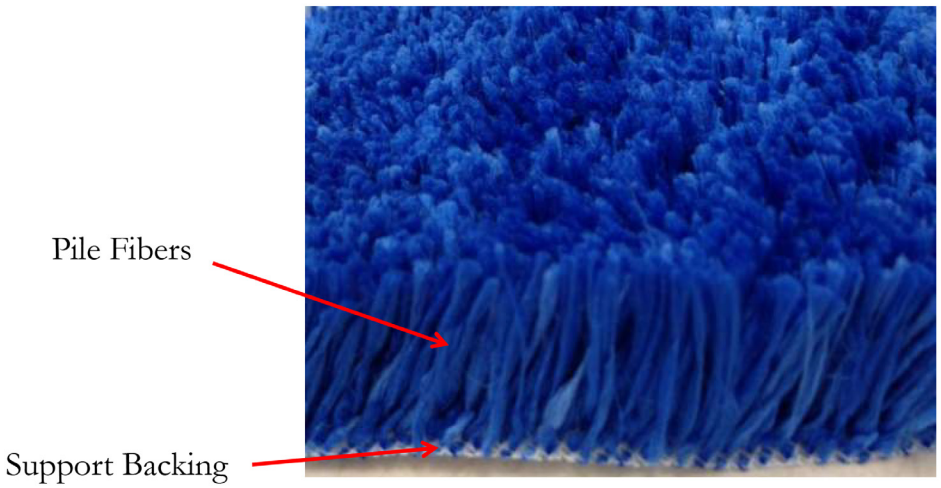

Photo courtesy of Aqua Aerobic Systems, Inc.

Figure 2. Some pile cloth media (PCM) filters are engineered with backings that resist sticky substances, such as some precipitated phosphates, which make them easier to backwash, extend their life, and save money in the long run.

Operational flexibility. WWTP plant operators understand that phosphorus levels, pH, and so much more can vary from day to day and even hour to hour. When combined with the right instrumentation, PCM disc filters can add new levels of control over the filtration process and total phosphorus removal rates. For example, during moments when phosphorus levels are low, operators can reduce or stop chemical treatment, which also saves money. Conversely, if the WWTP is close to reaching its permit limit, it can increase chemical treatment or adjust other processes accordingly. ■