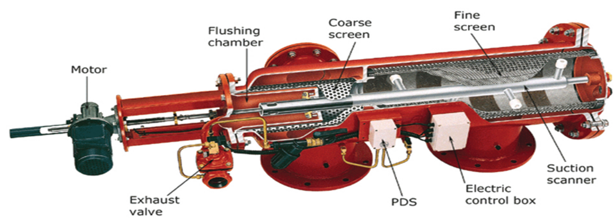
Filtration Trends & Application Advice

As the Particles Get Smaller, the Need for Knowledge Gets Bigger

by Matt Migliore

The most obvious evolutionary trend in filtration technology today is the capability to remove finer and finer particles from the process fluid stream. The rise of nanotechnology has created a need for removing particles of 100 nanometers or even smaller, and the filtration industry has responded with solutions capable of capture down to the ionic and atomic levels. Support for such small particle sizes does not come without its drawbacks though, as such membranes are extremely susceptible to damage and fouling from larger particles and debris. Thus, while end-users have many more powerful filtration technologies to choose from today, they must also possess a more complete understanding of their filtration needs to ensure the proper specification of a solution for a given application.



Automatic self-cleaning screen filters protect sensitive membranes downstream by removing particles down to the 10-micron level of filtration, then automatically backflushing through scanner nozzles. Self-cleaning cycles, or specialized sensors, can provide real-time insight on the condition of the feed source.

Identifying Your Filtration Needs

According to Jim Lauria, vice president of sales and marketing for Amiad Filtration Systems (*www.amiadusa.com*), to ensure success it is important to approach each filtration application, particularly those where fine particles are involved, in a staged fashion. “You want to look at what you want to remove, and apply the solution that way,” says Lauria. “What do you remove first? What do you remove next? You really need to understand what your filtration needs are.”

Lauria says end-users must be careful to only use a filter to remove those particulates for which it is designed. As such, he says coarser filtration should be placed in front of fine particle filters to protect the more sensitive systems from coming into contact with harmful materials. He says end-users must also be mindful to balance the economics and the complexity of the filtration system against the need to protect the finer membranes and provide the necessary purity of end product.

Bob McIlvaine, president of McIlvaine Company (*www.mcilvainecompany.com*), a research firm that covers the filtration market, says capture is also an important consideration for end-users filtering fine particles in their process streams. “Particles that small can be absorbed directly into the blood stream, so it’s very important not only to filter, but also to capture,” he says. Along with capturing the particles, Lauria says proper disposal is equally important. He says while it is in the best interest of the end-user to consolidate particles as much as possible to conserve space, a concentrated mass of potentially harmful fine particles presents a far more significant danger to the environment than the particles do individually dispersed.

Analyzing Your Application Environment

According to Lauria, most filtration performance issues stem from the end-user not knowing what the source stream really is and, as a result, not knowing what it is they are actually trying to remove. In an effort to address this issue, Lauria says Amiad recommends all end-users perform a thorough analysis of the filtration application prior to specifying a solution. He says this analysis should take into consideration such key application characteristics as particle size and particle size distribution, particle deformability, and an analysis of the process feed streams. Lauria says feed stream analysis, which is oft overlooked, is key, as it can provide detailed information on how the source water might change throughout the process and establish worst-case scenarios so the end-user can design the system to handle all possible process conditions.

“A lot of times folks don’t even know what [the worst cases] are,” says Lauria. “Source water coming from a river or a lake is particularly susceptible to a worst case as environmental conditions change, and you have to examine a sample over time — one month, two months, six months, or a year.”

In helping its customers identify worst-case scenarios, Amiad leverages application-specific questionnaires. The questionnaires are tailored to the specific type of filtration application the end-user is specifying, drawing on Amiad’s past experiences working in those environments to establish the appropriate design.

Lauria says filtration problems can

often be traced to a backward implementation strategy, whereby the users implement a treatment before they actually diagnose the application environment. On the other hand, he says if the end-users do the necessary up-front analysis to determine what it is they're trying to remove from the process stream, the filtration system will likely perform as expected.

While end-users have many more powerful filtration technologies to choose from today, they must also possess a more complete understanding of their filtration needs to ensure the proper specification of a solution for a given application.

Prefiltration & Diagnostics

In applications where fine particles are involved, prefiltration has become a necessity. Along this line, Lauria says Amiad offers a completely automated, self-cleaning prefiltration system that is capable of initiating a cleaning process when the fluid stream reaches pressure of a certain PSI.

Amiad also offers features in some of its systems that are capable of providing the end-user real-time information on the status of the inline process. He says this capability is particularly helpful when there is a change in the makeup of the feed source or an upset in the upstream process. Such changes in application characteristics can pose significant danger to the filtration system, and being able to detect process changes before they reach the membrane can help prevent failure and avoid unnecessary downtime. "Automation systems that provide some diagnostic information on the process as a whole can be really helpful," says Lauria. "You see the problem before it actually hits the filter."

The Risk of Overfiltration

With all of this new, high-powered filtration technology coming to market, end-users can be susceptible to overfiltration in their applications. Understanding the application prior to implementing a treatment can help the end-users protect against employing more filtration than they really need.

Some examples of possible overfiltration scenarios include wine and paint making. For example, McIlvaine references a wine maker that recently employed a high-purity filtration system on its process line in the hope of removing unsightly particles from its end product. Ultimately, he says the filtration system did remove the particles, but it also affected the taste and the clarity of the wine.

In paint, McIlvaine says particles play a critical role in determining the vibrancy of the desired color. So, he says, paint makers are generally very mindful about the possibility of overfiltration, as capturing particles that are too small could distort the color of the end product.

Ultimately, the user must be cautious when employing a filtration system not only to remove those particles that could have a negative effect on the end product, but also to maintain the particles that are critical to the end product's quality.

The Future of Filtration

Going forward, Lauria says end-users can expect to see support for finer and finer particle filtration, as the microelectronics industry continues to push toward smaller form factors on a range of products. As the parts in electronics continue to get smaller and faster, Lauria says the demand for purer liquids will continue to rise.

According to McIlvaine, the trends to watch in the filtration industry over the next 10-20 years will be continued development in reverse-osmosis (RO) membrane technology; hot gas filtration for coal gasification; membrane bioreactors; and wastewater treatment and reclamation.

In the area of RO membranes, McIlvaine says recent developments have been made in the capability RO systems have for energy recovery, which makes this method of filtration more attractive to the end-user. As such, McIlvaine expects to see significant growth in the RO market going forward.

Meanwhile, McIlvaine says hot gas filtration technology is generating optimism at the Department of Energy (*www.doe.com*) as a possible enabling technology for clean coal. These filtration systems allow particles to be burned at higher temperatures, thus enabling more efficient particle capture and potentially reducing the release of greenhouse gases in coal gasification processes.

Regarding membrane bioreactor technology, McIlvaine is particularly bullish. Membrane bioreactors — which are essentially a hybrid technology that combines the traditional septic tank process of water treatment with a membrane filtration system — have shown double-digit growth over the past six years, and McIlvaine expects to see this strong growth continue in the future, as membrane bioreactors offer a more economical alternative to typical sewer systems.

McIlvaine also sees significant growth opportunities in China for tertiary wastewater treatment and reuse technologies. He says China is an excellent market for these systems, as it does not experience nearly the amount of rainfall the United States does and will need to find more ways to treat and reuse its limited water supplies as more and more people move from China's rural areas into its cities.

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