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Chase Machine & Engineering

Rise of Nonwovens Fosters Innovative Assembly Processes

- The “DNA” of Your Filter and Filter Media
- Frontiers in Membrane Fouling

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For more information read the cover story on page 10 and 11.

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Introducing SpinTek's Sparklefilter™ System

Sparkle Hollow Fiber 'Bundle'

Sparklefilter™ is a proprietary drinking water system with automatic backflush capability. Hollow fiber membranes are configured in a unique module that achieves high packing density and provides excellent water quality. This high flux yet compact drinking water system with innovative anti-fouling technology uses "outside-in" hollow fiber membranes engineered for durability and burst strength to allow rigorous backflushing. While conventional systems commonly use a resilient bladder to provide backflush water for membrane cleaning, Sparkle uses an innovative dual non-resilient collapsible chamber (DNC2) called a "floating pressure cup" to generate greater backflush pressure than feed pressure. The system achieves this because the "backflush chamber" has a larger surface area than the "filtrate chamber" in the floating cup design.

When backflush pressure remains constant during the entire cleaning cycle, continuous and steady contaminant removal can be maintained. The module is easily cleaned as filtered water is sent through the fibers in reverse, flushing away all solids and biological contaminants. The automatic or manual backflushing capability provides removal of all bacteria and bio-solids with virtually no water wasted during cleaning.

While Sparkle will remove all bacteria and suspended solids that are very small in size, the performance of the filter is enhanced by an integral pre-filter for solids removal, which reduces fouling, simplifying the system and eliminating additional plumbing. In addition, other filters or absorbers can be easily added for specific contaminant removal such as arsenic, chlorine, mercury, etc., depending upon location and feed water. The system is versatile and price competitive and can be used effectively anywhere in the world: residential drinking water, whole house filtration, small municipal water systems or as a stand-alone in rural areas and developing countries with no external power source.

SpinTek Filtration, Inc. specializes in engineered solutions for industrial, commercial and oily wastewater applications. The company offers ultrafiltration (UF) tubular membrane modules and systems and compact rotary membrane systems (ST-II) using stainless steel membranes for harsh nuclear or wastewater applications. The company designs and manufactures solvent extraction (SX) media filters and CoMatrix® coalescers for copper, nickel and zinc mining operations and oil field and refinery applications worldwide.

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Editorial Advisory Board

Multi-Element, Self-Cleaning Strainers Provide Efficient 24/7 Water Treatment

For municipal water treatment, it is critical that suspended solids are continuously and cost effectively removed from wastewater. For the Lemay Treatment Plant in St. Louis, Missouri, this means utilizing the appropriate automatic, self-cleaning strainer technology as part of its process to remove contaminants and debris from wastewater before returning it to the nearby Mississippi River.

Serving a population of approximately 1.4 million, the Metropolitan St. Louis Sewer District (MSD) is responsible for operating and maintaining 9,649 miles of sewers covering 525 square miles in St. Louis. The Lemay plant can ill-afford frequent process interruptions, costly downtime and maintenance expenses, as it is the second largest of the district's seven wastewater plants with a treatment capacity of 240 million gallons per day (MGD).

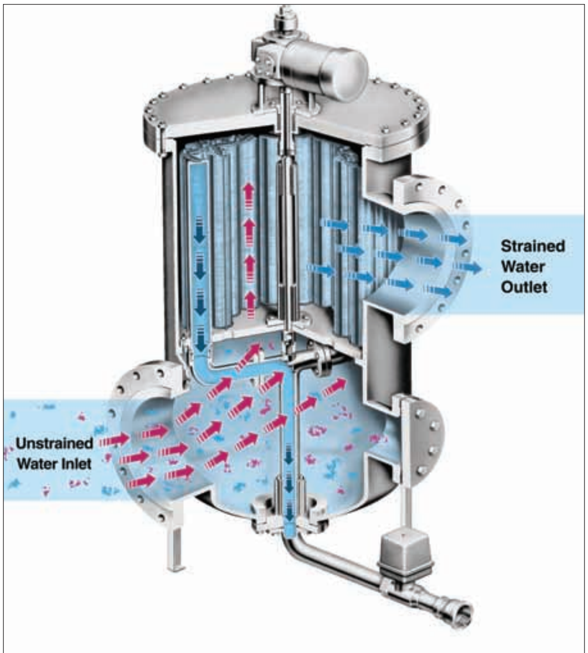
"Our self-cleaning strainers sit off three large 18-inch pipes that feed the entire process water system for the plant," explained Jon Winslow, planner/scheduler for the Metropolitan St. Louis Sewer District's Lemay Treatment Plant. "It's critical that the strainers remove solids from the water to protect critical downstream equipment such as spray bars, spray nozzles, wye strainers and tubes in heat exchangers. If the strainers shut down, the plant shuts down."

Historically, some wastewater plants have utilized automatic, self-cleaning single basket strainers, but this design suffers from specific shortcomings. Due to the limited straining area of the media, automatic strainers of single basket design can quickly become overwhelmed and clogged, increasing the pressure differential and initiating frequent backwashes. Plant operators have resorted to resetting the differential pressure switch to a higher set point to prolong the operating cycle between backwashes. However, this only accentuates the problem by having to pump at a higher pressure and thereby increasing operating costs.

In addition, because the backwash mechanism of the automatic basket design comes into close proximity to the straining media, large, suspended solids often encountered with raw water can become lodged between the media and the backwash arm causing strainer media damage and/or rupture. Due to inherent design limitations, under high differential pressure conditions, the basket often becomes deformed, further increasing the risk that the backwash mechanism will come into direct contact with the media and cause damage.

"I know of other facilities that have other types of strainers, and through word of mouth we've learned that there is a lot of labor involved with them," said Mr. Winslow. "But our multi-element water strainers from R.P. Adams are pretty much maintenance free. They just perform well and demand very little attention – it's what every plant operator expects in critical process equipment."

Multi-element, automatic self-cleaning strainers were first intro-



In 2008—as part of its $3.7 billion, multi-year Capital Improvement and Replacement Plan to expand capacity to 340 MGD—MSD's Lemay plant installed three new automatic R. P. Adams multiple-element strainers.

duced and patented by R.P. Adams in the 1960s, and are now incorporated in over 10,000 installations worldwide. These automatic self-cleaning strainers employ a multi-element, cylindrical wedge-wire design whose tubular elements provide 3-4 times the straining surface area of a typical automatic single basket strainer.

"Each tube is relatively small, but because of the high number of them they have the largest open surface area of any strainer," said Ted Gast, a chemist and general manager at Carl F. Gast Company (St. Louis, MO), a manufacturer's representative for industrial instruments and equipment serving customers in Missouri and the adjacent five-state area.

"With the way these strainers are designed, they can operate in a 2-4 PSID range," explained Mr. Gast. "The clean differential pressure is maintained until 75% of the open straining area is plugged. Then the differential pressure begins to rise until the backwash set point is reached and the cleaning cycle is initiated. Maintaining a 2 PSID pressure drop over most of the filtration cycle means reduced power consumption from feed pumps, which adds up to significant long term savings."

Additionally, the smaller diameter of the media used in the multi-tube strainers at the Lemay plant enables the strainer to safely handle differential pressures in excess of 150 PSIG. This ensures failsafe operation, whereas media found in large basket designs can lead to collapse and failure under differential pressures as low as 35 PSID.

Another significant feature of this design is in the engineering of the backwash mechanism itself, which utilizes a tube sheet to separate the straining media from the mechanism. This prevents the backwash mechanism from coming into contact with the media and damaging the elements caused by large solids becoming lodged between the media and the backwash arm.

In 2008 as part of its $3.7 billion, multi-year Capital Improvement and Replacement Plan to expand capacity to 340 MGD, MSD's Lemay plant installed three new automatic R.P. Adams multiple-element strainers.

"The original multi-element strainers from R.P. Adams had been operating for at least 23 years," recalled Mr. Winslow. "In all that time they've worked well and given us relatively trouble-free service, so we decided to stick with the same manufacturer and design for the upgrade."

"These automatic strainers do what they do and they do it well," added Mr. Winslow. "We get good service out of them."

The National Association of Clean Water Agencies has awarded the Lemay plant a Silver Award five times in this millennium. FN

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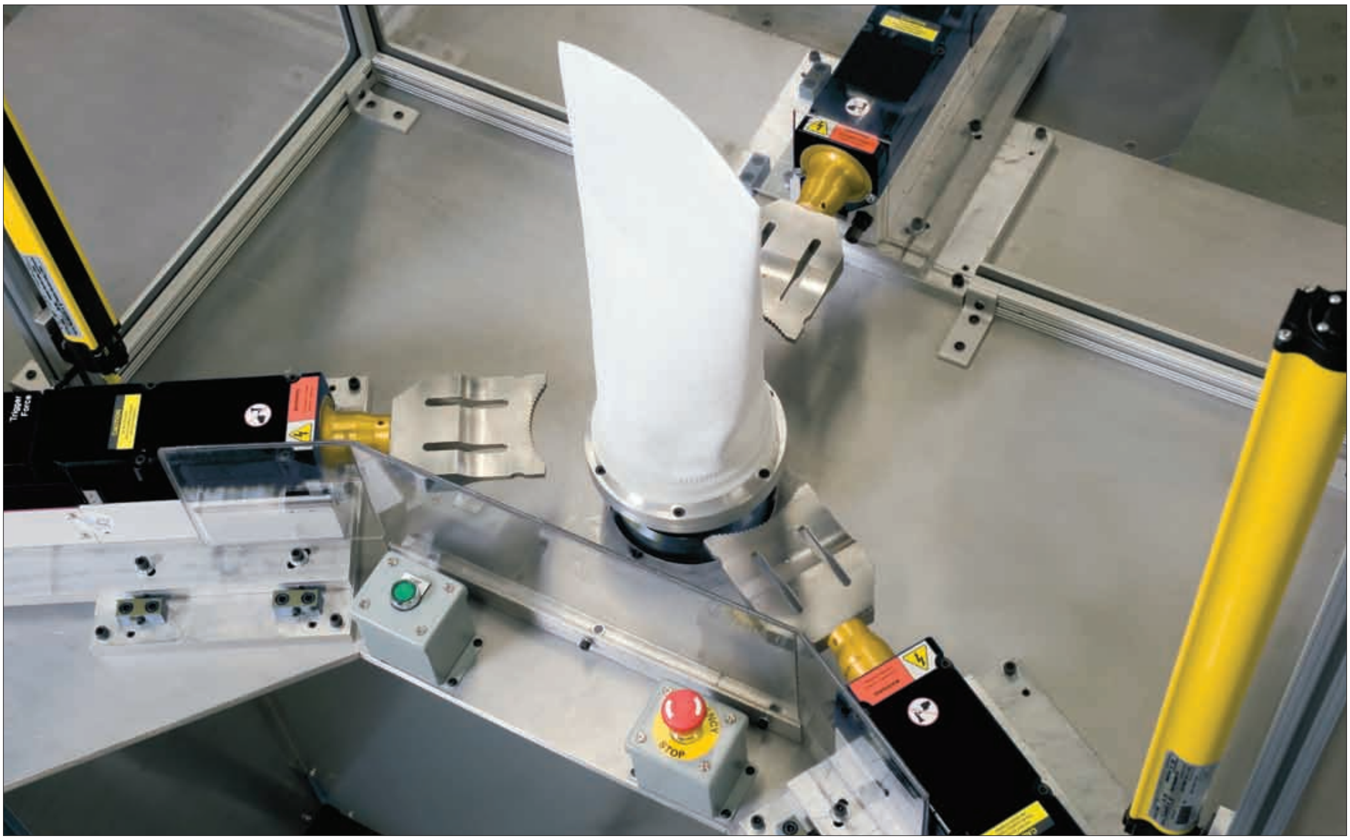
Rise of Nonwovens Fosters Innovative Assembly Processes

By Guy Gil, Sales Manager, Chase Machine & Engineering



Chase Machine and Engineering's 3-head ultrasonic ring welder provides customers the ability to attach filter bags to plastic rings without the use of needle and thread.

The shift from conventional glass and cellulose filtration media to synthetic nonwoven meltblown, spunbond, and needlepunch fabrics has opened the door for the introduction of new and exciting assembly methods. Technologies such as ultrasonics, hot air, band sealing, RF and impulse welding are becoming common practices within the industry. Engineers now select media not only based on filtration performance criteria, but also on assembly preference. Needle and threads combined with adhesives are slowly being phased out – why incorporate another component (and expense) into the final product, especially when there are safer and more environmentally friendly alternatives?

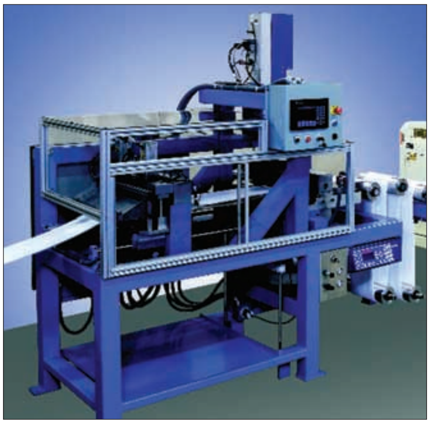
SYNTHETIC NONWOVENS

Chase Machine & Engineering have embraced the move from conventional filtration media to synthetic nonwovens. Heat sealing technologies, when incorporated into a continuous process, can reduce labor and maintenance expenses since consumables such as adhesives or sewing supplies like needles and thread are no longer required. While it is understood that some filter requirements call for the use of cellulose and glass fibers that require adhesives and/or sewing, applications that lend themselves to the use of synthetic media have generated exciting new assembly alternatives.

Ultrasonics is now commonly used in the synthetic HVAC filtration market. Chase Machine was instrumental in this transition with the development of the extended HVAC pocket filter machine, which was designed, built, and patented incorporating ultrasonic technology into the continuous assembly process. Nonwovens manufacturers realized the importance of designing media for use with ultrasonics. In the early years of development, consistency and unifor-

HVAC Pocket Filter manufactured on Chase Machine's Ultrasonic Pocket Filter Machine

Chase Machine's Materials Applications Lab allows customers to test materials and assembly methods.



Liquid Filtration Bag Machine combines hot air and ultrasonic technology to create tubes as well as seal-and-cut needlepunch or spunbond/meltblown filter media.

mity across wide meltblown and spunbond lines was a challenge. The finished product, while suitable for the filtration application, varied in its distribution of fiber. Although this never became an issue when sewing, ultrasonic welding required greater uniformity and consistency.

SEPARATE LAB

In response to this need, Chase Machine established a Materials Applications Lab, which enables companies to test materials and assembly methods before committing to full production. Working with some of the largest filtration media manufacturers in the world, Chase Machine have run thousands of feet of media to verify process improvements. Many of these improvements have gone on to benefit the marketplace.

The liquid filter bag market presents an excellent example of multiple technologies combining within the same process to improve manufacturing performance. Employing hot air welding, Chase Machine joined the two edges of a needlepunch fabric to create a tube on a continuous basis. At the same time, the company integrated ultrasonics to cut and seal the bottom of the filter, freeing the end product of loose fibers and contaminants. The process gave the end user complete control while cutting labor expenses by more than 50% and eliminating the need for ancillary consumables. What's more, the finished bag could be joined to a plastic ring using ultrasonic plunge welders and eliminating the conventional sewing method for attachment.

In the membrane market, nonwovens are chosen for their strength as a backer substrate. The synthetic component of the nonwovens affords the end user the ability to splice membranes together or even attach multiple layers to improve filtration characteristics. Ultrasonics, impulse welding, or even simple bar sealing technologies may be incorporated into a process line. Chase Machine's experience with membrane casting and hollow fiber process lines helps customers decide which technology suits their specific application best. Then they substantiate their conclusions in the Chase Materials Applications Lab.

CONCLUSION

Today's filtration industry is constantly evolving. Ongoing improvements to chemistry and manufacturing processes offer infinite possibilities for new product development. By partnering with companies like Chase Machine, which offers testing, prototyping and full-scale process solutions, the transition from concept to final product is faster now than ever before. FN

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The "DNA" of Your Filter and Filter Media

By Gerard J. Lynch, P.E. and Matthew Borsinger, IFTS Inc. USA

When used in solid-liquid and liquid-, liquid separation applications filters serve a critical function to ensure process quality and repeatability. Whether removing particulates that can damage equipment or removing water from fuel to extend system service life, improper filter design and selection can result in catastrophic failure.

Figure 1: Before and after a collapse test

The concept that filters have a specific "DNA" may seem odd but just as Deoxyribonucleic Acid ("DNA") defines the nature of the human body, there is a "DNA" associated with a filter that defines how it will perform. Filters are used to separate many different particles and liquids. The effectiveness and efficiency of filters can be determined by laboratory testing before expensive plant modifications are made for real world use. For instance, most filters and filter media have an "unloading point" that is a measureable differential pressure at which filters release trapped contaminants downstream. The correct testing can find these "unloading points". These released downstream particulates can erode or ruin an engine, cause scrap in food and beverage processing, or may even seize mechanical system components. Even an area before the burst point where the particulates down stream increase, due to change in pressure or other external conditions, can still destroy the system. Each filter has its own attributes and to determine them you need to consider multiple tests to define the "DNA" of a filter.

The testing to determine the "DNA" of a filter is much more inclusive than simple initial efficiency, mean pore flow or bubble point testing techniques. While these provide a good starting point, "DNA" testing is more holistic than the above-mentioned tests that provide only one small detail about the filter. The idea of knowing more about a filter is essential in determining where the filter would perform the best and where it will perform the worst. "DNA" tests using international standards provide results that are repeatable and allow "apple to apple" comparison with other filters and their applications.

The "DNA" of a filter is formed from the results of various tests depending on the process application.

The tests that help form the "DNA" of the filter include:

- Burst or Collapse Point Test
- Initial Differential Pressure Test
- Efficiency Over Time Test
- Dirt Holding Capacity Test
- Porosity Test
- Wettability and Contact Angle Test
- Bubble Point and Fabrication Integrity Test
- Roughness Test
- Mean Pore Flow Test
- Water Separation Efficiency Test

With the results of these tests the characteristics of the filter will come to light.

CONTRIBUTING FACTORS

Burst or Collapse Point (ASTM D3786, ISO 4020, ISO 2941, SAE J80)

Filters maintain the cleanliness of fluid in a fluid power system by removing insoluble contaminants. A filter element is the porous device that performs the actual process of filtration.

The capability of the filter element to maintain a specified fluid cleanliness level depends on its performance and structural integrity, and its ability to withstand non-steady-state conditions (e.g., cold starts and decompression surges). The filter element's resistance to collapse or burst is a measure of its ability to withstand such effects.

The burst or collapse point test uses a device that injects fluid into the system either continuously or intermittently (sometimes known as "batch loading"). The fluid has a controlled amount of test contaminant that does not exceed 5 % of the element's estimated contaminant capacity, at intervals of at least 2 minutes, while maintaining the specified test flow rate and test temperature. The contaminant used is injected in a uniform manner and at low enough concentration so that the pressure measurement equipment can detect any structural failure.

Flow rate and differential pressure are measured across the filter as a function of contaminant mass added (by mass or time) until the differential pressure across the element (filter assembly differential pressure minus housing differential pressure) meets or exceeds the specified collapse or burst pressure rating or until failure.

The filter element collapse or burst pressure rating is verified if:

a) There is no visual evidence of failure in the element's structure, filter medium and seals, when tested, i.e. as described in ISO 2942

b) There is no abrupt decrease in the slope of the differential pressure versus contaminant mass added curve prior to the specified collapse/burst pressure rating.

Initial Differential Pressure

This test deals with a simple differential pressure across the filter as the system is running. This test does not give much information about the filter's performance over time but is a standard test, which can give information useful in designing a system. The Initial Differential Pressure test defines a baseline against which to gauge other tests and applications.

Efficiency Over Time

The efficiency over time test tells you how well the filter removes particulates over a set period of time. This test is usually done with a continuous or batch amount of particulate added to the stream at even intervals and a particle counter downstream to determine how many particulates make it through the filter.

Porosity

Porosity tells how many holes are in a filter media sheet. This test can tell you how much void area there is on a single sheet of a filter media. This is a standard test for all filters.

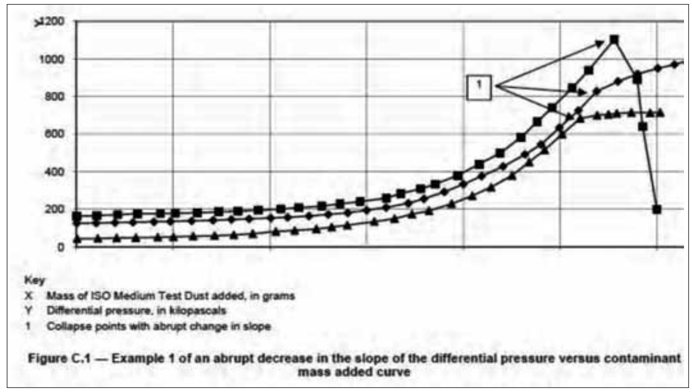

Figure 2: Abrupt decrease in the slope of the differential pressure vs. contaminant mass added curve indicated contaminant release and possible structural failure

Wettability

The wettability of a filter determines how the filter interacts with the liquid. Wetting is the ability of a filter to reduce the surface tension of the liquid with which it is in contact. This information will make it easier to understand the differential pressures and how the filter interacts with specific liquids.

Bubble Point, Fabrication Ingtegrity Test

(ASTM F316, ISO 2942, ISO 4020, JIS K 3832, SAE ARP 901)

The International Standard specifies that a bubble-point test method is acceptable to measure for filter elements used in fluid power systems. It can be used either to verify the fabrication integrity of a filter element (by checking the absence of bubbles) or permit the localization of the largest pore of the filter medium by determining the first bubble point. The pressure at which the first bubble point occurs at is re-

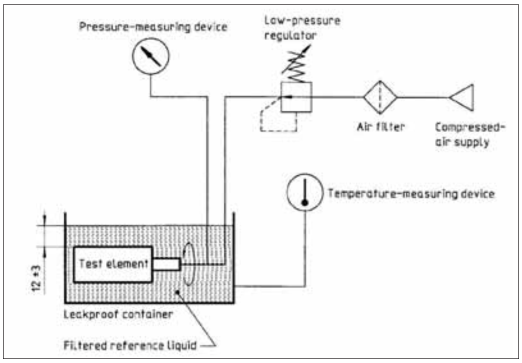

Figure 3: Typical bubble-point testing apparatus

lated to the largest pore size. It, therefore, defines the acceptability of the filter elements for further use or testing.

This test is best performed under controlled conditions in a laboratory to ensure that it is done correctly. The results also have little to no meaning if they are not done by a certified lab because the standards are specific to a process that is done with many checks and balances. Extra air bubbles that come from the pipes or just a valve that is not sealed well can ruin this test. Results need to be certified by a registered and accredited lab in order to insure the methods used comply with industry standards.

Roughness

A measurement of the filter media surface roughness is used to determine how the liquid will run over the surface of the filter media. The roughness can tell you more about how the differential pressure will change due to frictional forces and also the efficiency because of the ability of the filter to catch particles.

Permeability

The permeability test determines the ability of a liquid to move through a filter. The test will determine how well the liquid moves through the filter and in what time period it is able to move through the filter under constant conditions.

Water Separation Efficiency Test

(ISO 16332, SAE J 1488..)

Modern fuel injection systems, installed in passenger cars as well as in heavy duty or off-road vehicle applications, require high and stable separation efficiencies for all insoluble contaminants in the fuel to ensure a prolonged service life. Beside solid contamination, undissolved water, in finely or coarsely emulsified form, can also reduce the lifetime of injection systems. Suitable fuel filters, having a high level of water separation efficiency, are an absolute necessity for system longevity, especially with Bio-fuels.

Factors found to affect the separation efficiency of undissolved water in the field include:

- The fuel quality, which is strongly influenced by the performance of additives in the fuel itself

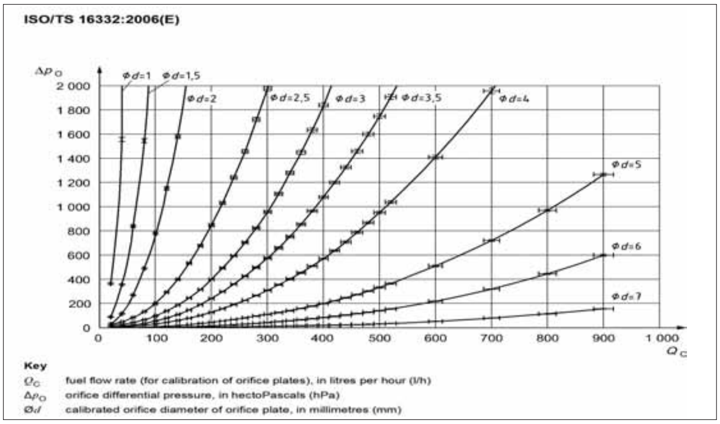

Figure 4: Diameter of emulsification device

- The actual characteristics of the fuel/water-emulsion
- The specific flow rate of the system
- The type of media in the filter element
- The size and design of the filter housing itself

Different fuels and additives can be used to test the filter. To ensure laboratory test results are comparable, these various parameters have to be taken into account in the test method in order to reduce their influence on the test results. The optimal droplet size has to be determined by testing using proper measuring sensors. In the ISO standard different orifice plates/sizes are used to produce consistent water test droplets.

CONCLUSIONS

Only a few tests have been summarized above and there are many more that can provide essential information about a filter or filter media. There are also tests that are specific to the industry, application and fluid in which the filter will be used. Knowing the "DNA" of a filter helps you determine all areas that will affect filter performance in the intended application. A client with a filter media who doesn't know the best environment will benefit from filter testing and this can help determine possible target applications. The laboratory tests performed on filters have excellent reproducibility and can be used to compare and benchmark filter performance anywhere in the world. FN

Gerard J. Lynch, P.E. and Matthew Borsinger are with International Filter Testing Services Inc., (IFTS Inc. USA) in Springfield, New Jersey. Jerry Lynch serves as President and Matt Borsinger as a Chemical Engineering intern. IFTS is an independently regulated laboratory and research center for liquid filtration and separation science. IFTS has locations in Europe, USA and China, providing filtration testing and research services to many industries. The management at IFTS has compiled a world class team of scientists, engineers and technicians in the field of Solid-Liquid Separation. IFTS provides a global resource for professionals working in Solid-Liquid Separation (SLS).

Techniques to Add Filtration to Save Money on Metalworking Coolant Usage

By James J. Joseph, JOSEPH MARKETING, Williamsburg, VA

This article is the second of three parts offering ideas on how to add filtration systems to existing coolant reservoirs without investing large sums of money and save on the costs of coolant disposal. The three techniques are install:

1. A sidearm coolant cleaning device to an existing reservoir with no filtration. (Published in the July/ August 2009 issue)

2. A coolant "polishing" device to improve the clarity of an existing filtration system.

3. An off-line coolant recovery system for batches removed from individual machines.

During difficult economic times each of these techniques are possible with a minimum investment and the potential of a "quicker" payback from the money saved by reducing the number of coolant dumps and disposal. This second approach does not have the reduction of dumping as large a factor as in the first technique (when no filtration existed), because the system already has a cleaning device in place. However, this concept is working on the fact that the system must be dumped at a frequency where a reduction in the number of dumps would result in a cost saving. Its main goal is to improve the clarity of an existing system without spending large sums of money to revamp the whole facility. It suggests that it is possible to use the funds normally spent for dumping as a budget to improve the system which would reduce the dumping frequency to a point where a net savings is realized.

SIDEARM COOLANT POLISHING DEVICE

Sidearm filtration (known as bypass or kidney loop) is when a cleaning device works off a single reservoir to clean the fluid and send it back to the same reservoir. Figure 1 shows an added cleaning unit working off the cleaned liquid reservoir to further clean the coolant. Although the term filtration is used, the units could be any cleaning mechanism including filters, centrifuges, magnetic separators or retention tanks. However, most of the time filters are used as polishing units because they have a greater flexibility to intercept material migrating through the primary cleaning device.

DETERMINE THE BUDGET RANGE

The premise of this approach is to see if the money spent for dumping and disposing of dirty coolant can be used to install a polishing filter, which would improve the coolants' clarity and dumping would be less frequent. The combination would yield a lower annual cost. This is based on the fact that trucking or treating waste coolants is viable, and in compliance with the environmental laws. If they are not, then the economics take on a completely different set of inputs. There will be advantages in tool life, machine maintenance and lower scrap, but these items can only be estimated and usually take too long to quantify. These rewards will be measurable (and could be significant) after the polishing filter is in place. Since the majority of the costs are related to dumping, disposing and replenishment, efforts to determine their costs should yield a general idea of the money involved. The calculations can be simple arithmetic for a given system:

1. Calculate the volume of liquid dumped and disposed in one year.
2. Determine the cost of disposing of each gallon (trucking away, waste treatment).
3. The volume of disposed fluid by the cost per gallon will give an annual cost.
4. Add labor costs for each dump for the same year if they are significant.
5. Add the cost of the fluids, which are needed to replenish the dumped coolant.
6. The total will be the target for the annual expenditures.

Of course the quantities of fluid should be large enough to justify some action. That does not mean the facility has to be a large process. It could be a relatively small volume operation, which is dumped often, possibly in monthly cycles.

For example, a typical metalworking operation with a 5,000-gallon reservoir, which is dumped every 8 weeks, costs about $39,600 per year. The recognizable inputs for a typical situation includes: coolant disposal cost of $1.00 per gallon, new

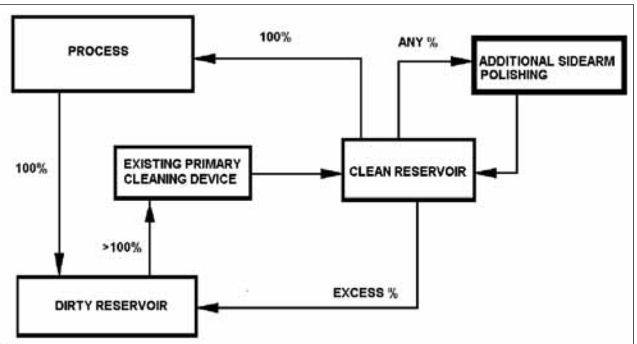

Figure 1. Added cleaning unit working off the cleaned liquid reservoir to further clean the coolant

INTERVAL	IN	TOTAL IN FLUID	REMOVED BY PRIMARY FILTER	LEFT IN SYSTEM AFTER PRIMARY	SENT TO POLISH FILTER	REMOVED BY POLISH FILTER	TOTAL REMOVED BY BOTH FILTERS	LEFT IN SYSTEM
1	1000	1000	950.0	50	12.5	11.9	961.9	38.1
2	1000	1038.1	986.2	51.9	13.0	12.3	998.5	39.6
3	1000	1039.6	987.6	52	13.0	12.3	999.9	39.7
4	1000	1039.7	987.7	52	13.0	12.3	1000.0	39.7
B-1				39.7	9.9	9.4	–	30.3
B-2	Production Stops			30.3	7.6	7.2	–	23.1
B-3	Polishing Continues			23.1	5.8	5.5	–	17.6
B-4				17.6	4.4	4.2	–	13.4
B-5				13.4	3.3	3.1	–	10.3
B-6				10.3	2.6	2.5	–	7.8
B-7				7.8	2.0	1.9	–	5.9
B-8				5.9	1.5	1.4	–	4.5

Figure 2. Math model of combination primary and polishing filters

coolant concentrate at $8.00 per gallon, and the mixed coolant concentration at 4 percent. This does not include some labor costs, which may be applicable.

Even if the money is saved quickly there usually is not enough cash to revamp the existing system, which would extend the life of the coolant indefinitely; plus it would take too much time. Therefore, it is more realistic to see if a sidearm polishing unit could be added to compensate for the weaknesses of the existing unit, and achieve the goal where the combination of installing/operating the polishing filter and the lower number of dumps can save money.

SIDEARM POLISHING OPTIONS

Sidearm polishing selections are usually based on the number of times, within a given time period, the reservoir's volume is sent through the cleaning device; i.e. 1,000 gallons at a rate of 50GPM has a turnover every 20 minutes. Then the turnover flow rate can be converted to a percent of the process flow. Both criteria play an important role in determining the sidearm polishing flow rate. Large tanks may have settling and a low sidearm polishing flow rate may not induce enough turbulence to keep the unwanted material suspended.

Determining the sidearm flow rates as a percent of process flow rates allows the use of field data, which is reflected in the math models of systems as shown in Figure 2. The table shows an installation where 1,000 units of contaminant are generated at the process. The unit has a full flow filter and a 25 percent flow-polishing filter is added to enhance the performance of the total system. The residue of contaminants with the polishing filter is remarkably lower that what can be expected with just the primary unit, 52 versus 39.7.

The table also reveals that the polishing filter can function even when production is down to reduce the contaminate level even further. The down time polishing is significant since the ability to "catch up" may result in dumping the fluid just once a year. If the cost to install and operate the 25 percent polishing system and the one dump a year is less than the previous number of dumps, the project is economically justified.

CLEANING DEVICES

The most common devices installed as sidearm systems are:

- Flat bed pressure filters with roll media
- Cartridge filters with disposable elements
- Bag Filters with disposable bags
- Centrifuges
- Flat bed vacuum filters

Other devices, which could serve but are not as common, include flat bed gravity filters and magnetic separators for ferrous operations.

Selection and sizing of the device must consider the manufacturers guidelines for the application or benchmarks established with similar installations.

In addition, there are other opportunities to minimize equipment costs. A number of reconditioned "used" cleaning devices are now available at a lower cost. Many filtration suppliers offer leasing and rental programs payable in monthly increments. It may be possible to use a transportable sidearm module and move it among a number of tanks on a routine schedule.

FOLLOW THROUGH

Granted, this method is outlining a different approach for justification to invest in filtration to save money. This cursory review offers a guide on how to quickly measure the magnitude of the economics. However, once the range of economics is established, the need to cover the details is important to insure the logic is sound. Not all primary cleaners are created equal. Some will not qualify for any number of reasons. Others may not necessarily follow the math model, but still be a feasible candidate. The concept should be reviewed by all involved and by outside resources if more know-how on filtration options is needed.

Here are just a few of the fundamental questions, which should be asked for follow through.

Are the reservoirs dumped for reasons other than suspended contaminants?

Will a reduced dumping volume change the cost per gallon to treat or truck away?

What turnover rate will be practical?

Will available down time allow the polishing filter to continue to operate? FN

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Vacuum and Pressure Filtration

By Kyle Nowicki, Process Engineer, FLSmidth Minerals

Filtration equipment appears in mineral processing, power generation, and environmental flow sheets around the world. This article will discuss the fundamentals of filtration testing and how the data is used to select the type and size of filter best suited for an application.

The two types of filtration technologies that will be discussed are vacuum and pressure filtration. The main difference between the technologies is the driving force applied to initiate filtration. Vacuum filters use a vacuum pump to create a pressure differential across a filter cake, while pressure filters force the feed slurry in a chamber at high pressure to initiate cake formation and de-watering. Another difference is that vacuum filters operate continuously while pressure filters operate in a batch process. Pressure filters generally have more success with difficult filtering materials due to the higher applied filtering force.

SAMPLE CHARACTERIZATION

The first step when conducting a filtration test campaign is sample characterization. The filter feed solids concentration and particle size distributions significantly affect the filterability of the material and will dictate the required filter characteristics. Typically, materials with higher feed solids concentrations and coarser particle size distributions have higher filtration rates, which result in less required filtration area.

Sample characterization allows the test engineer to predict how the material will filter, which will indicate the type of equipment to be used. The test campaign should be developed in a way to simulate full-scale operation. Initial testing will indicate the feasibility of using a particular type of filter for the application.

VACUUM FILTRATION

The most commonly occurring vacuum filters are drum, disc, and horizontal belt filters (HBF). The HBF is the most recently developed filter design and consists of a belt supported by rollers on each end. The filter operates under the same principles as drum and disc filters but has a flat, horizontal orientation as opposed to rotary.

All vacuum filter cycles consist of cake formation and discharge along with one or more of the following cycles:

1. Deliquoring/Dewatering
2. Washing
3. Air Drying
4. Steam Drying

Only the de-watering portion of the cycle will be described in detail, as the additional cycles would be too extensive for treatment in this article.

Once the process flow diagram and the objectives of the filtration testing are determined, filter leaf tests can begin. There are two types of filter leaf arrangements that are used to simulate full-scale equipment. The “top feed” method simulates horizontal belt filter operation and “bottom feed” for drum and disc filter operation. Both arrangements utilize a filter leaf, a vacuum receiver, a vacuum pump, and a gas meter. The process variables of the top feed method are feed slurry volume and dry time. The variables of bottom feed method are cake formation time and dry time. The top feed and bottom feed arrangements are illustrated in Figures 1 and 2, respectively.

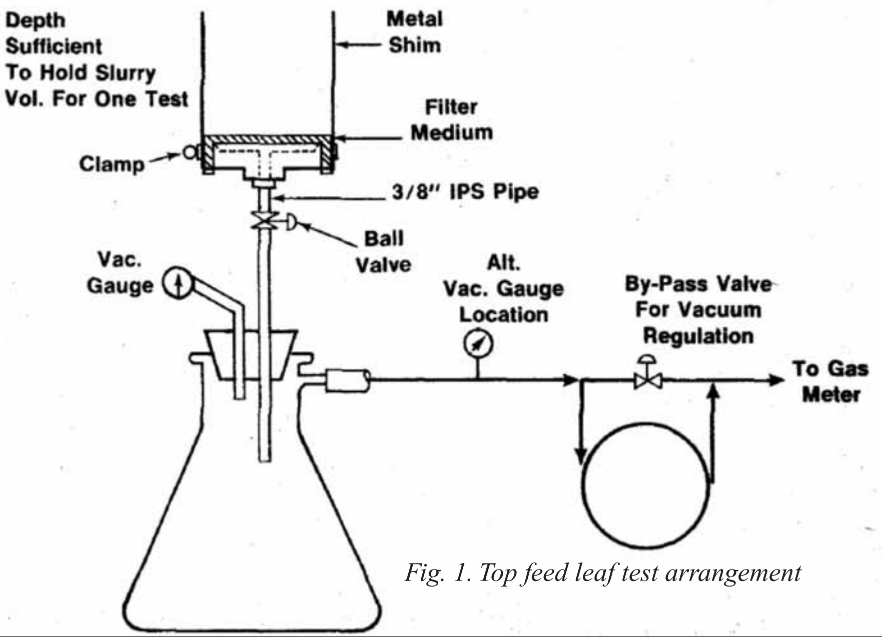

Fig. 1. Top feed leaf test arrangement

Before a full series of tests are conducted, the optimum filter media must be selected. This is accomplished by performing leaf tests on various filter media under the same process conditions. Filter media construction is based on several different properties including: material, type of finish, weave, air permeability, and particle retention. Media selection is based on the following observations:

1. Cake Formation Time

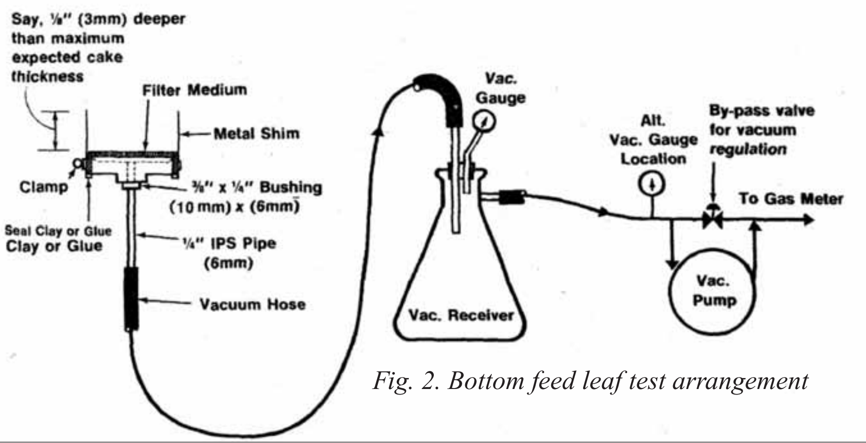

Fig. 2. Bottom feed leaf test arrangement

2. Filtrate Clarity
3. Filter Cake Release
4. Media Blinding

The media should exhibit the highest overall performance of the four different properties in order to be selected for further testing.

The objective of the leaf testing is to develop correlation curves that relate cake thickness to dry cake loading, W (expressed as lbs/ft2); cake dry solids weight to cake formation time; and cake moisture to drying time divided by cake loading or Moisture Correlation Factor. The information derived from the correlation curves is used to determine the filtration rate and the required filtration area. Sample correlation curves are shown in Figures 3 - 5.

The process variables of the leaf testing (de-watering only) include: form volume/time, dry time, and vacuum level. The form and dry vacuum levels should be adjusted with varying altitude as air pressure will affect the attainable vacuum. Vacuum levels and air flow rates are recorded for sizing the vacuum pump and receiver.

The form time, dry time, filtrate volume, cake thickness, and the wet weight of the cake are recorded. The samples are then dried, weighed and the solids concentration calculated.

The correlation curves are used to select a cake thickness and final cake moisture, which yields the total cycle time. The dry cake loading and cycle time are entered into the following equation to calculate the design filtration rate (expressed as $lb/hr\text{-}ft^2$).

Filtration Rate = $W \times 60 \times SF/Ø_T$
Where: W = Dry Cake Loading
60 = Time Conversion
SF = Safety Factor
$Ø_T$ = Total Cycle Time

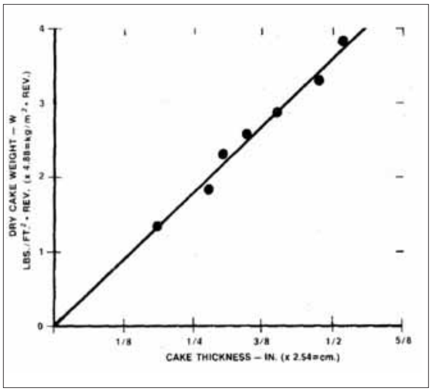

Fig. 3. Dry Cake Density

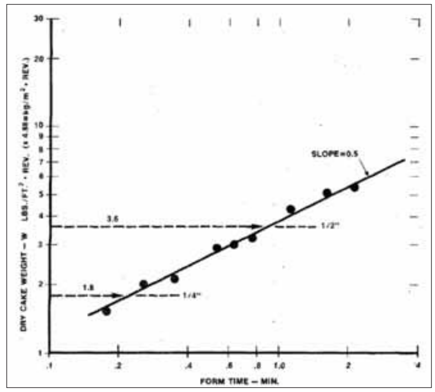

Fig. 4. Dry Cake Weight Formation Time

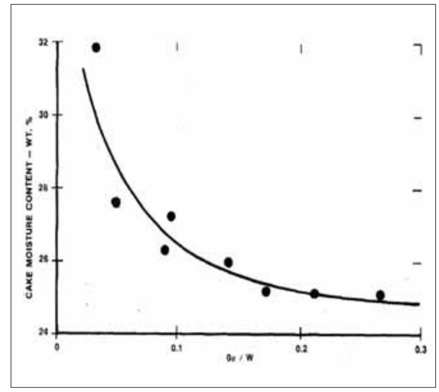

Fig. 5. Cake Moisture Correlation

A safety factor is incorporated into the design filtration rate to allow the filter to maintain performance through slight feed variations. The magnitude of the safety factor varies based on filter feed characteristics. The design filter solids loading (lb/hr) is divided by the filtration rate (lb/hr-ft^2) to generate the required filtration area.

PRESSURE FILTRATION

All pressure filter cycles consist of cake formation and discharge along with one or more of the following cycles:

1. Pre-Squeeze
2. Washing
3. Air Drying
4. Final Squeeze

Again, there are two methods used to simulate the full-scale equipment. The bench test apparatus is a small single chamber that allows for different cake thickness and feed pressures, as well as simulation of membrane plate operation. The filter leaf test arrangement is shown in Figure 6.

Filter media selection is also the first step in a pressure filtration test campaign. The bench test is conducted by pumping feed slurry into the double-sided chamber. Filtrate production is measured with respect to time while the chamber is filling. It is very important that a completely consolidated cake is formed during the cake formation step as the final cake moisture and equipment sizing will be affected. Once the chamber is full the pumping is stopped. The final step is to conduct a cross-flow air blow from one side of the chamber to the other to dewater the cake to the desired moisture. The filtrate production is measured with respect to time as before. In the case of the membrane squeeze option, a mechanical squeeze is applied to the cake before and after the air dry.

Typically, the recessed chamber option is tested first due to simple filter design and higher available slurry feed

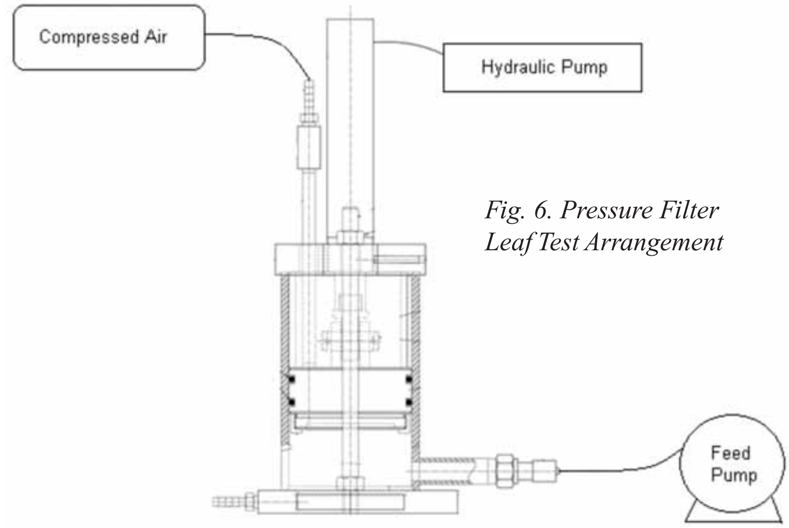

Fig. 6. Pressure Filter Leaf Test Arrangement

pressure. Thin cake chambers are tested first and depending on the filtration time, thicker chambers can be tested. If the target cake moisture is not achieved with the recessed chamber option and the filter cake is compressible, the membrane squeeze may provide the sufficient mechanical force to further de-water the filter cake. The filter arrangement that achieves the target cake moisture with optimum cake thickness and cycle time is selected for full-scale sizing.

The required filtration volume is calculated by dividing the filter solids loading (lb/hr) by the dry bulk cake density (lb/ft3) and by the number of cycles per hour, which will yield the required filtration volume per cycle.

SUMMARY

Bench-scale leaf testing is the most effective method to obtain the information required to size full-scale filters. If the test plan is developed properly and the tests conducted according to standard procedures, the results are repeatable.

A variety of industries require filtration technologies that fit a particular application. Having multiple filter types, arrangements, and footprints available allows customers to select the filter that best suits their flow sheet. FN

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New Water Purification Technology Reports for Duty in the U.S. Army

The United States Army is using state-of-the-art membrane water purification technology to support highly mobile military operations and humanitarian missions. The new lightweight water purifier (LWP) can be easily transported to remote locations to produce safe drinking water from almost any available raw water, including highly turbid surface water, brackish water and seawater. The LWP can also purify water contaminated with nuclear, biological and chemical warfare agents. Mechanical Equipment Company, Inc. (MECO), Sugar Land, Texas, designed and manufactures the unit for the U.S. military.

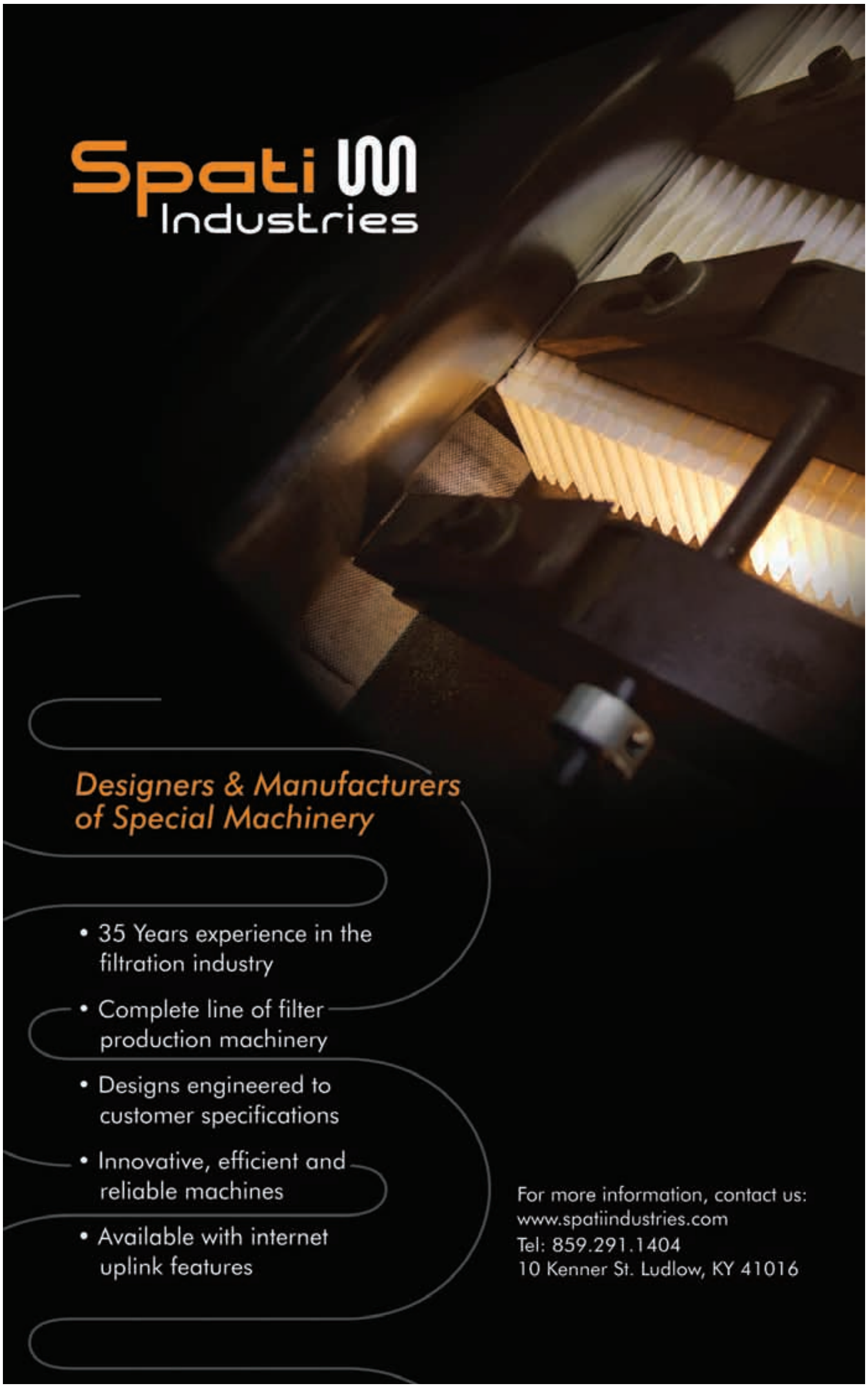
It takes only four soldiers to carry the LWP, which is so simple to operate that a two-person team can assemble it and begin producing water in just 45 minutes, using water from a river, lake, pond, or ocean. The entire system can be transported in the cargo space of a Humvee and by a single haul of a medium-lift utility or assault helicopter such as the UH-60 Black Hawk.

The LWPs have been developed to treat the very high salt concentrations found in the Middle East, where water in the Arabian Gulf reaches 45,000 parts per million (ppm) of salt, and some dessert water holes reach 60,000 ppm. Earlier desalination systems had been designed for conventional seawater salt concentrations of 35,000 ppm.

The compact LWP unit will produce 125 gallons per hour (gph) from fresh or brackish water and 75 gph from seawater, sufficient to support company/battalion-sized units in the field. The exact number of people the LWP unit can sustain depends on whether it is being used solely for drinking water, or will be used for cooking, cleaning, showers, or laundry.

EVOLUTION OF TREATMENT

Water filtration technology used in transportable water treatment systems has evolved significantly since its beginnings more than sixty years ago, when thermal desalination systems were used by the Marine Corps. in the invasion of Iwo Jima.



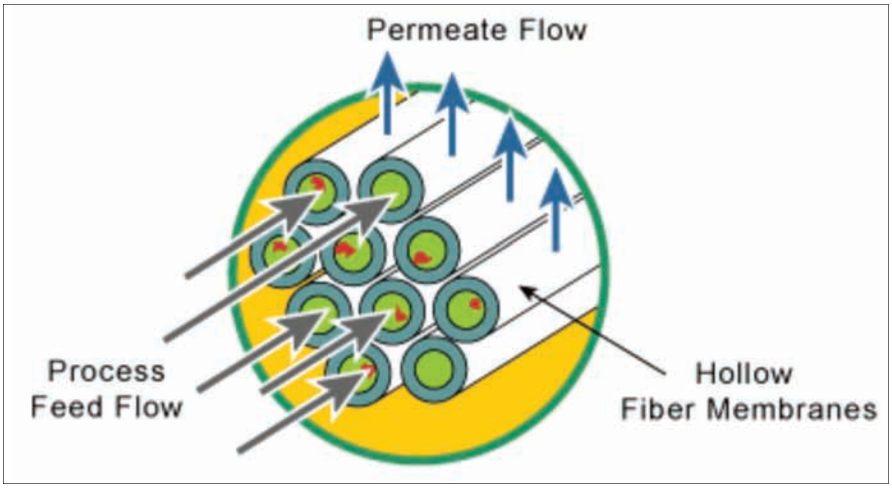


Figure 1: The tangential flow of the feed water across the membrane surface mitigates fouling in the ultrafiltration membranes.

The new LWP combines two types of membrane filtration: ultrafiltration (UF) for pretreatment, followed by reverse osmosis (RO). UF is a low pressure process for separating larger size solutes from aqueous solutions using a semi-permeable membrane. RO relies on a pressure differential to force a solution (in this case, water) through a membrane that retains the solute on one side and allows the pure solvent to pass to the other side. RO membranes reject dissolved and suspended materials, including monovalent salts. Since essentially all dissolved and suspended material is rejected by the membrane, the RO permeate is pure water.

This design replaces the Army's previous generation of portable water processing equipment, which pretreated the RO feed water with multi-media filters (MMF) and disposable cartridge filters.

The MMF and cartridge filters can only remove suspended solids between approximately 1-5 microns, allowing some particulate breakthrough and causing quick fouling of the RO membranes. Also, the cartridge filters require frequent replacement, sometimes every half hour. In addition to the labor involved in replacing the filters, the continual resupply of consumable items can be a dangerous logistical challenge in remote locations and under combat conditions.

UF PRETREATMENT OF RO FEED WATER

The UF membrane process eliminates the need to replace and resupply disposable filters. The 5-inch diameter UF cartridges contain hollow fiber membranes with an internal diameter of 35-milli-inch (mil). The membranes and the cartridge housing are composed of polysulfone, a high strength polymer thermoplastic with excellent chemical stability under a wide range of temperatures.

The UF membrane, a ROMICON® ROMIPURE® UF cartridge from Koch Membrane Systems, Inc. (KMS), Wilmington, Massachusetts, USA, consistently produces filtrate water with a tenfold improvement in turbidity over MMF and cartridge filters. The UF membranes remove turbidity, suspended solids, bacteria and other microorganisms from the feed water that can foul the downstream RO membranes. The higher quality filtrate water prolongs RO membrane life and dramatically extends the time between RO cleanings, regardless of the feed water conditions.

In addition to limiting the fouling of the RO membranes, the UF membrane has important features that limit its own fouling. The hollow fiber cartridges operate from the inside to the outside during filtration (see Figure 1). The feed water (retentate) flows through the center of the hollow fiber, and the filtered water (permeate) passes through the fiber wall to the outside of the membrane fiber. The tangential flow of the retentate sweeps across the membrane surface and continually acts to limit membrane fouling.

The UF hollow fiber cartridge's structural integrity and construction enables it to withstand permeate back flushing and the reversing of retentate flow, cleaning processes that are highly effective in restoring flux rates. Its hollow fiber geometry allows for a large amount of membrane surface area in a compact module and this high packing density means large volumes of water can be filtered using minimal space and power, both of which are critical advantages.

A high-pressure pump driven by a diesel engine draws water from a 40-gallon filtrate tank on the UF module and feeds the RO module under pressures of up to 1,200 pounds per square inch (psi) to provide backwash and fast flush capabilities for the UF membrane, while allowing continued operation of the high-pressure pump.

RO PRODUCES PURE WATER

The RO module consists of seven FLUID SYSTEMS® TFC®spiral RO elements manufactured by KMS. The membrane elements, which are widely used aboard ships and on drilling rigs, feature a proprietary thin film composite polyamide designed to increase efficiency and reduce costs. The pressure vessels are constructed of titanium.

The RO membranes remove dissolved and suspended materials, including organics and salts. Only molecules in the range of 5 angstroms (0.0005 micron) will pass through the membrane. Approximately 30 percent of the RO feed water is recovered for use as drinking water, and the remaining concentrate (or brine) is discharged as reject. The RO permeate is then passed through a chemical module, where it is metered and disinfected with chlorine.

RELIABLE FILTRATION

About half of the 380 LWP units ordered by the U.S. Army are in use supporting U.S. Army field troops in Iraq and Afghanistan. For example, the 82nd Airborne Division is using a number of LWP's in Iraq to provide water for their mobile kitchens. This is safer and more practical than the older method of using bottled water, which required extensive logistical and security support to ensure that the water made it to the remote sites untainted.

Prior to field deployment, seven prototype systems were built and subjected to rigorous and exhaustive testing by the U.S. Army, including 5,000 hours of operating time and 1,600 miles of cross-country transportation testing in the back of a Humvee. The design and testing process led to important system refinements and improvements, including designing the system to sustain several freeze-thaw cycles, conditions that go well beyond the environmental requirements of most water purification systems.

"The KMS membranes have been remarkably resistant to fouling," said John Klie, MECO's Government Business Development Manager. "We worked closely with KMS engineers to develop and optimize an automated backflushing method that has practically eliminated the need for chemical cleaning operations."

According to Kyaw Moe, the MECO LWP Program Manager who provides training and technical assistance to the Army specialists who operate the LWP units, "I was recently in contact with members of the 10th Mountain Division headquartered at Camp Liberty, Iraq," said Mr. Moe. "They have been using the LWP in combat conditions for over a year, producing clean water without the need for a single chemical cleaning procedure."

On top of simplifying the process, using fewer chemicals means the water tastes better. "The water produced by the LWP is very palatable," said Mr. Klie. "The challenge with older conventional systems has been over-chlorination, which gives water a 'swimming pool' taste. The LWP's automated chlorine dosing system prevents this from occurring, and produces a drinking water taste very similar to commercially available bottled water."

AN ECONOMICAL SOLUTION

The LWP has proven to be a highly economical solution in Iraq, where the cost of supplying bottled water to the troops can be as high as $5 per gallon. Water produced by conventional first-generation purification systems costs approximately $1 per gallon, including the cost of disposable filters, chemicals and fuel, while the LWP produces water at 7 cents per gallon, primarily the cost of diesel fuel to operate the system and chemicals for minimal, periodic cleaning.

The LWP provides a self-supporting water purification method for Special Forces and other remote military and humanitarian missions that eliminate the need for difficult, expensive and dangerous water resupply. FN

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Koch Membrane Systems Selected to Provide Seawater RO System

Koch Membrane Systems, Inc. (KMS) a pioneer in membrane technology, filtration systems, system design and process expertise for nearly half a century, has been selected to provide a seawater reverse osmosis (RO) system for Minera Esperanza's copper-gold mine, at Michilla Port, Chile. The overall project, which was awarded to Nicolaides S.A., will provide drinking water to the mining camp. Construction of the system is expected to be completed in the fall of 2009.

"By using a seawater reverse osmosis system, Minera Esperanza can provide a safe and plentiful water supply to its workers," said Sergio Ribeiro, KMS' Commercial Director for South America. "The system has a number of features that make it ideal for this site, including its small footprint, lower power consumption due to an energy recovery device, high productivity and excellent permeate quality."

The project consists of two MegaMagnum® RO MM2 equipment skids with a total of 20 MegaMagnum seawater elements. The water supplied to the copper-gold mine begins with seawater drawn from the Pacific Ocean. The seawater is pumped for about a mile to a water treatment unit and then through the RO system. The final permeate is disinfected with chlorine, making it acceptable for drinking water. The permeate flow rate is 520,000 gallons per day; maximum feed total dissolved solids (TDS) is 45,000 ppm; and the required chloride concentration is less than 250 ppm in the finished water.

MegaMagnum elements are the standard for large diameter RO projects. Among the many benefits of the KMS design are significantly reduced footprint, project costs, and installation time. Since large diameter RO systems use one-seventh the number of elements compared to standard 8-inch systems, maintenance costs associated with connections and O-rings are reduced. KMS has made loading and unloading of MegaMagnum elements safe and easy with the use of a hand-operated winch. Typically, it takes less time to empty one pressure vessel containing MegaMagnum elements than the comparable number of 8-inch pressure vessels.

Based in Wilmington, Massachusetts, Koch Membrane Systems, Inc. is a Koch Chemical Technology Group, LLC company, and a global leader in membrane filtration technology and engineering support for close to half a century. FN

Frontiers in Membrane Fouling

By Haluk Alper, President, MyCelx Technologies, Gainesville, GA

It has been estimated that fouling of RO membranes has an impact in excess of a $1 billion/year. The problem is well known, but the causes are incompletely understood. Some of the factors involved in fouling (colloidal and particulate matter) have been studied in some detail. The sum of what is understood is not able to account for the observed behavior of membrane units in service (Paul & Abdul, 1990). Typical sequence of membrane operation is illustrated in Table 1.

Time	RO Performance	RO Membrane Surface
1 – 8 hours	Highest Water Flux. Permeate TDS may be high during initial rinsing, then lowers, then rises slightly.	Clean membrane surface. Rapid sorption of dissolved organics, colloids and bacteria. Physical compaction of membrane.
1 - 14 days	Sharp Water flux decline (up to 10-15%). Permeate TDS may stay the same, go up or may even decrease.	Additional sorption of colloids and bacteria. Microbial growth and multiplication. Biopolymer synthesis.
2 weeks	Gradual flux decline. When end of life water flux reduces by 10% to 15% or feed/concentrate differential pressure increases by 10 – 15%, a chemical cleaning is required to bring water flux back to the expected flow rate based upon a standard gradual flux decline slope (Fig. 3).	Biofilm gradually develops in thickness. Concentration polarization enhanced. Membrane may deteriorate.

Table 1. Paul, D. & Abdul, R. (1990). Reverse osmosis: Membrane fouling – the final frontier. Ultra Pure Water, 7: 25-36.

Why should there be a severe (discontinuous) decline in flux on the first day? Why should this decline in flux continue in a relatively uniform (continuous) manner until the onset of biofilm formation? This article will discuss two factors, which may account for some of this behavior.

EXOPOLYSACCHARIDES

Recent DNA sequencing of ocean water has revealed the presence of an amazing diversity and density of microbial life. Most of the characterized species have never been seen (very small). Other work has shown that membrane decomposition products have multiple fates. Most are adsorbed onto sediment, but a fraction is solubilized. Cellular membranes have a number of molecular constituents, which have evolved to interact with and operate at interfaces. Exopolysaccharides are the most external constituent and are involved in cell adhesion to surfaces. This is a viscous, mucousy, highly visco-elastic material that has both oleophilic and oleophobic components and is able to transform its three-dimensional conformation based on the surface energy of the surrounding medium and on steric factors.

Exopolysaccharides can drastically affect the flow characteristics of water over a surface. Production of exopolysaccharides is increased when microbes are stressed. Purification of water, as in pretreatment operations, is a stressing factor and will result in the microbe trying to protect itself from adverse osmotic conditions by production of more exopolysaccharide. An example of the ability of

Change in charge distribution of PCE between 1 ppm and 1 ppb

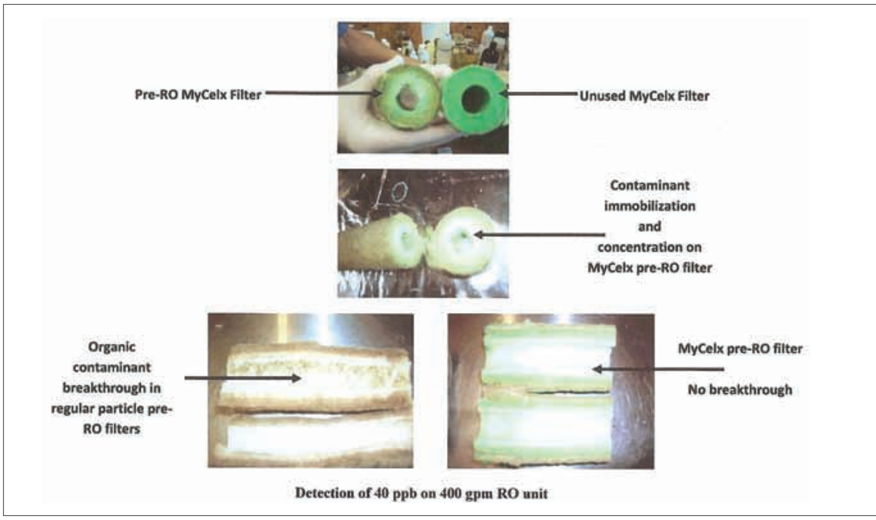
Figure 1

exopolysaccharides to alter the flow characteristics of water over a surface is illustrated by the fact that the US Navy has to dry dock destroyers yearly (recently scuba divers are also employed for this purpose) in order to remove 1 lb. of brown algae from the hydroplane surfaces on the bottom of the ship. This material is so viscoelastic that it decreases the maximum speed of the destroyer from 22 knots to under18 knots and it increases fuel consumption from 100% to 120%. Certainly if only a fraction of a pound of exopolysaccharide can have this effect on a Naval destroyer, the impact of a small amount of this material on a membrane surface, in relation to flow characteristics and pressure, cannot be overlooked. The presence of exopolysaccharides in water (even at extremely low concentrations) and the effect they can have on surface energy and flow characteristics when adsorbed or otherwise incorporated into the membrane, may contribute to the sudden and extreme change in membrane performance within the first day.

Under the exopolysaccharide layer, membrane proteins might also be of interest in regard to their ability to affect surface energies at interfaces. Cell adhesion molecules and proteins involved in ion transport are examples. Cellular membrane materials have evolved to operate at hydrophilic/hydrophobic interfaces. These compounds have multiple three-dimensional conformations and can exhibit variable rheological and solubility behavior. A tube constructed of Teflon will exhibit a negative capillary pressure. In this case, the contact angle with the interface will exceed 90 degrees. Water will not rise in this tube and will actually have a lower level than the liquid level. Adhesion of a mono-molecular layer of membrane protein will render the surface hydrophilic and the contact angle will become much less than 90 degrees. Water will rise in this tube to a level nearly equal to that in a glass capillary tube. Assuming an average size of 1,000 angstroms and an average molecular weight of 100,000 Daltons, it would only require in the range of ten to the negative fourteenth mole to form a mono-molecular film on 1 m^2 of material. Exopolysaccharides and membrane proteins are generally not detected using common analyses performed in RO pre-treatment.

ORGANIC FOULING

The effect of membrane proteins and exopolysaccharides on the surface properties of RO membranes may be a factor which can account for the drastic change in membrane behavior observable within the first day. Subsequently, there is a more gradual, continuous decline, which seems to indicate a mechanism whereby the fouling agent is gradually building up, as opposed to a drastic inversion of surface properties. A possible source of this buildup is organic contamination. When one discusses organic fouling with membrane users and companies, oftentimes it is related that there is no organic contamination due to numerous pre-treatment steps and based upon analysis, which is always kept at below 1 ppm. This line of thinking overlooks a few critical factors, which results in a false sense of security. Although 1 ppm sounds like a low number, it amounts to 1 pound per million pounds or approximately 120,000 gallons. A typical system composed of 40 RO elements running at a flow rate of approximately 400 GPM processes 576,000 gallons or 4.78 million pounds of water.



Detection of 40 ppb on 400 gpm RO unit

Theoretically 1 ppm would be approximately 4.78 pounds or 54 grams/element per day. This amount of organic fouling would drastically impact the performance of any RO membrane. At one particular site, MyCelx* filters were employed in the last stage of pre-filtration in order to capture gasoline and diesel range organics which had managed to elude pre-treatment. Within a ten-day period, each filter removed 24 grams of diesel and gasoline range organics, which would normally have gotten through to the membrane (see pictures). Working back, this amounts to approximately 40ppb of organics in the influent stream to the RO. This is well below the sensitivity of most testing, assuming the 40ppb is presented in a continuous form. It is also possible that this amount of material could have accumulated due to a few isolated events. Assuming a relatively continuous presentation of the diesel range organics, one might wonder how it is possible for these relatively water-insoluble compounds to have made it past multiple pre-treatment steps intended to remove them. One contributing factor may be that molecular conformation and charge distributions change as the water becomes more dilute/pure (see Figure 1.). These changes result in polarization and conformational adjustments, which cause molecules that would be considered water-insoluble in the bulk phase to behave as if they were more water-soluble. It is likely that a fraction of these compounds is adsorbed or otherwise incorporated into the membrane. The accumulation of organics at this stage could be one of the sources of nutrition, which supports biofilm formation and may simply contribute to flux reduction due to its accumulation.

DISCUSSION AND CONCLUSION

The flow of water over a surface is highly influenced by the chemical and physical characteristics of that surface. Extremely small quantities of surface-active agents are required in order to drastically alter surface characteristics and rheology. The swift decline in membrane performance in the course of a few hours to one day appears to indicate the presence of some sort of surface-active phenomenon on the membrane surface within that time. Exopolysaccharides should at least be eliminated as the culprit in this case. This will require cutting edge work, as standard methods of analysis do not exist and sampling methods have not been developed. The change in solubility behavior of organic compounds, generally considered insoluble or slightly soluble, may be a contributing factor in the difficulty of detecting organic fouling agents and the decreasing effectiveness of pre-treatment modalities as the water gets cleaner. All of the water-insoluble compounds on which simulations were performed exhibited a drastic change in bond polarity as the dilution was taken from 1 ppm to 1 ppb, resulting in structures that behaved more hydrophilically. In this soluble state, adsorbants are not effective. As water desalination becomes more and more critical, it is important to be able to operate in an economic and energy-efficient fashion. An understanding of membrane performance and operation is critical to achieving this. There is still much work to be done. FN

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Tank Level Gauges/Switches for Cryogenic/Liquefied Gas Level Indication

Mid-West's gaugues/switches

Mid-West Instrument, Inc. of Sterling Heights, Michigan, U.S.A. has added single and double switch options to its line of tank level gauges specifically designed for Cryogenic/Liquefied Gas. Like the non-switch units, the single or double switch Model 116 indicating switches feature a Dry Bellows design with internal bi-directional relief valves with no liquid fill required to protect the unit from overrange. DP ranges from 0-80" H2O to 0-600" H2O (0-200 mbar to 1.5 bar).

Additional Benefits:

- Drop-in replacement for existing units
- Works for vertical or horizontal tanks
- 1000 PSI SWP is optimum for CO^2 applications
- Switches are Rated at 4 Amps @ 30 VDC, 5 Amps @ 120 VAC SPDT
- A highly visible Flag option is available to indicate "reorder" or "alarm" fluid conditions
- Custom dial faces (logo, dual or tri scale)
- Customer approved cleaning for oxygen service available
- Two week delivery on standard units FN

For more information contact:
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Email: sales@midwestinstrument.com
Website: www.midwestinstrument.com

Preview | FILTECH 2009

150 Exhibitors at FILTECH

More than 150 companies from all over the world will fill 5,200 square meters of exhibition space and show their latest products to an audience of buyers, sellers, users, designers, R&D experts, plus the academic world for three days, when the expo kicks off October 15. The FILTECH 2009 Conference features close to 200 technical papers from 34 countries and will provide a representative survey of current research findings and state-of-the-art developments for the solution of separation targets in a wide range of sectors.

FILTECH 2009 is held in the city of Wiesbaden, Germany. Wiesbaden's proximity to Frankfurt International Airport guarantees easy access especially for international visitors; it is the largest airport in continental Europe and is only 30 minutes away by car or by train. With more than 50% foreign visitors from over 40 countries FILTECH offers exhibitors and delegates a unique chance to discover new markets as well as a platform for an international exchange. More than 90% of the space available was booked by August. Companies still interested in exhibiting can check with FILTECH's website for stand availability.

Current research findings, global developments, and new approaches to solving problems with respect to the methods for the classic mechanical separation of liquids, the precipitation of solids from gas, and membrane filtration methods take center stage at the four-phase congress. Engineers, managers and scientists of all specialty fields of the filtration and separation industry are invited to listen and discuss the newest research results and innovations of the international experts.

The U.S. Department of Commerce has invited U.S. companies to join the U.S. Pavilion in Hall 4. The U.S. group stand offers a cost effective way for U.S. companies to discover new markets worldwide. Space is still available. Stands are allotted on a first come first serve basis, the organizer said. FN

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Emission Solutions Focus at AFS Event

The 4th Bi-Annual Emission Solutions in Transportation American Filtration & Separations Society 2009 Fall Conference will be held October 5-8th in Ann Arbor, Michigan, USA, at the Kensington Court Inn. This conference has become a mainstay of the AFS in recent years as new government regulations continue to be instituted for low emission cars, truck and other sectors where exhaust particularly from diesel soot and NOX are concerned.

The conference is designed specifically for both the engineer and mangers that have a vested interest in current and new technologies and future needs in emission solutions. The program is created to cover almost every aspect of the industry an engineer will encounter and need to know. It begins with idea creation and innovative concepts through final testing procedures and the updated status of governing and future regulations from CARB, EPA, etc. The audience will consist of senior executives, business, technical and research managers from OEM's, industry suppliers, filtration and separations manufacturers and supplier companies, all with a single objective; to identify future industry opportunities.

CONFERENCE OVERVIEW

The regulators continue to up the ante and emission control technology improvements seem to follow. It all started in the 1980's and accelerated in the 1990's. Participants at the conference will be presented with the following topics:

- Numerical Modeling and Simulation for Exhaust Systems
- Modeling Fibrous and Porous Media
- Crankcase Emission Reduction
- Crankcase Coalescing Filtration
- Testing of Engine Filters
- Filter Media in Engine Filtration
- Emission Measurement and Reduction
- Emerging DPF Technologies for 2010
- Engine Fuel Filtration
- Diesel Fuel Filtration for Emission Control
- Engine Induction Evaporative Emissions Controls
- Clean Fuel Technology
- Standards and Test Methods
- Advances in Filter Media Development for Diesel Exhaust Systems
- Specialty Filter Media and Special Methods for Emissions Reduction
- Cabin Filtration
- Diesel Exhaust Catalysts
- Emerging DPF Technologies for 2010
- Engine Air Filtration
- The Role of Nanotechnology in Emission Reductions

Featured speakers at the conference are Cleophas Jackson, Assistant EPA Director for the Compliance and Innovative Strategies Division in EPA's Office of Transportation and Air Quality; Ken Howden, U.S. Department of Energy; Dr. David Cole, Chairman, Center for Automotive Research; Charlie Freese, Executive Director, General Motors Powertrain Engineering; Dr. Dennis Assanis, University of Michigan, Director, W.E. Lay Automotive Laborator and Kevin W. Westerson, Director RT&E, Cummins Filtration.

The AFS will offer 6 Short Courses on October 5th, the day prior to the start of the conference covering topics of broad interest to the industry. Subjects include: Basics in Liquid Filtration, Basics in Air/Gas Filtration, Basics in Microfiltration, Basics in Ultrafiltration, Engine Emissions and Particle Counting and Advanced Engine Filtration. FN

For more information visit: www.afssociety.org

The World of Filtration Is Headed to Chicago in November

As the business of filtration continues to play an even more important role in industrial and consumer applications in every corner of the globe, the Filtration 2009 International Conference & Exposition – the world's largest filtration event – will bring thousands of industry professionals to Chicago's Navy Pier for a three-day Conference and trade show.

Scheduled for November 17-19 in the Windy City, more than 100 exhibitors from all links in the filter supply chain will be showcasing the latest products, technologies and end products for filtration; while an extensive three-day Conference Program will cover diverse aspects of filtration technology, new products and research.

INDA, Association of the Nonwoven Fabrics Industry, the organizer of the annual event, expects close to 1,700 attendees from 30 countries to gather in Chicago for Filtration 2009 to network, attend the Conference and walk the aisles of the Navy Pier exhibition hall.

"As it returns to Chicago after a successful show in Philadelphia last year, Filtration 2009 will certainly live up to its reputation as the most important and largest gathering of the global filtration business this year," said INDA President Rory Holmes.

And, Mr. Holmes pointed out, Filtration 2009 comes at a time when the products made and sold by exhibitors and attendees are taking on increased importance in our everyday lives. "As the colder weather approaches, the industry focus is once again going to be on interior air quality as well as the improvement in individual health with control of airborne particulates and diseases. The business of filtration is at the forefront of this battle and it will certainly be a topic of discussion at Filtration 2009."

The Filtration show rotates between the Midwest and the Northeast and, as a result, each year fifty percent of the attendees are new from the previous show. This allows for a unique exchange of ideas among attendees and exhibitors while facilitating meetings among the local business community every two years.

In addition to the Exposition, the Filtration 2009 Conference will provide insight into the latest technical developments in filtration from some of the industry's leading companies and research institutions.

"The Filtration 2009 Conference is the best place in the world this year for filtration executives to learn about the

developments that will continue to drive this business in the 21st Century," added Mr. Holmes. "The Conference this year is highlighting Opportunities and Value sessions as well as a new segment on Gas Phase Filtration. We have two keynote speakers: Rick Eastman from Baird Securities and Ben DuPont from yet2.com."

Always one of the highlights of Filtration 2009 will be the annual Best Booth Competition, which will recognize the best booths in both the Large and Small Booth categories. This gives all exhibitors the opportunity to be recognized for the effort they put into their displays at Filtration 2009. FN

For more information on the Filtration 2009 International Conference & Exposition visit: www.inda.org/events/filt09

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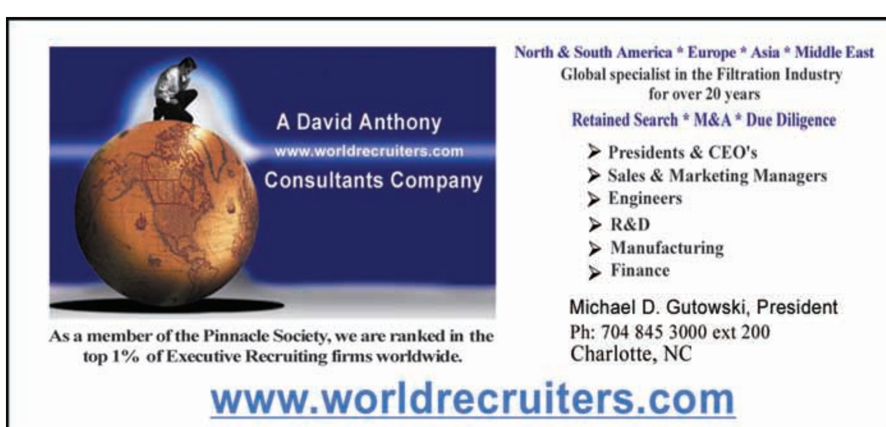
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