‘Revolutionary’ Filtration Put To The Test

A Q&A with Mike Dejak, Executive VP, Eco-Tec Inc.

By Kevin Westerling, Editor

There are many cool aspects of my job, not the least of which is learning — and sometimes even breaking news — about the latest technologies in oil and gas. When I heard from Mike Dejak, executive VP of Eco-Tec, that the company’s new technology could “revolutionize filtration” for the produced water market, I was anxious to learn more about it. However, I was also duty-bound to you, the reader, to investigate the validity of such claims. In this Q&A, I asked Dejak about the industry indicators that suggested a need for Eco-Tec’s new product, the details of its operation, and proof of performance and value.

Dejak has a long history in the business, having spent his last 37 years with Eco-Tec. Throughout his career, he has been involved in global responsibilities as the company has developed, designed, built, sold, and serviced its water purification and chemical recovery products in more than 50 countries around the world to a wide range of industrial clients.

What major issue in the produced water market did Eco-Tec identify, and why is it a problem?

New oil production is coming either from areas where the wells are increasingly more difficult and more expensive to drill and the reservoirs are tighter with lower permeability, or from older, mature fields where a greater amount of oil can be recovered using enhanced oil recovery (EOR) techniques. In both cases, it is increasingly more important to protect the reservoir asset by keeping it clean — and this points to improved filtration of any water injected into these wells and reservoirs.

The major issue is the growing awareness in the industry that the quality of water being used for injection into oil reservoirs — for either pressure maintenance or for water floods, alkaline/surfactant/polymer (ASP) floods, water and gas (WAG) floods, or even water used for fracking shale — should be better than it has been in the past. Passage of solid dirt particles into the well and reservoir cause them to plug, which translates into reduced oil production. That, in turn, necessitates stopping production and doing an acid treatment or some other form of workover to restore the well’s performance. In some cases, the solids may affect the life and total recoverable oil potential of a reservoir. Increasingly, specifications for water being injected into such wells are being defined by a particle-size cutoff at about 2 microns, with many specifications requiring that the water be filtered such that 95-98% of the particles greater than 2 microns are removed.

What is the conventional method for dealing with water injected into oil reservoirs?

Traditional filters (nutshell, sand, cartridges) generally will not meet this 2-micron requirement because they are not effective in removal of particles below 5 microns, and in some cases even 10 microns. Therefore, alternative filtration technologies are being considered, including membrane filtration such

as microfiltration or ultrafiltration using polymeric or ceramic membranes. However, these are costly to install and maintain, and are challenged by oil fouling.

What new solution did Eco-Tec develop to address this issue?

The Spectrum Micro Media Filter. It is a backwashable filter with a virtually permanent particulate media consisting of a coarse media (nutshells are commonly used for this purpose when treating oily produced water) and a lower layer of proprietary micro media (i.e., very small particles) of a very dense, inert material. The layer of micro media acts to "polish" the water, which passes through the coarse media and results in significant removal of small dirt particles, down to a sub-micronic size.

In our pre-interview, you said the Micro Media Filter could "revolutionize filtration." What impact do you predict for oil and gas industry?

With the capability to filter any water being injected into wells and formations to a much greater degree than before, without having to make a drastic technology change or significantly increase capital expenditures (CAPEX) over the previous practice, the industry should benefit in reduced well and reservoir downtime for maintenance and workovers, and greater production from reservoirs over a longer period. This translates into billions of dollars annually in potential benefits.

Has it been proven in the field?

The technology has been used and proven over the past 15 years in other process industries such as steel processing, aluminum processing, and hydrometallurgical operations. It has also been used for pretreatment of water to produce high-purity, demineralized boiler feed water in the power generation industry, where such filtration is required to protect downstream processes. Over the past three years, it has been used in treatment of oilfield produced water as pretreatment for packed-bed ion exchange softeners, which are feeding steam generators for heavy oil production.

What data can you provide to illustrate its effectiveness?

In 2012, a field test was conducted in which produced water going into and coming out of filters at eight heavy oil production sites in California. Four sites had traditional media filters (sand or nutshell) and four had Spectrum Micro Media Filters. These were all production sites, and the filters were in their normal operation. This was not pilot testing but collection of actual performance data on filters that had been in operation for more than a year. Data was collected to determine the oil removal (total and free), solids removal, and turbidity reduction of the filters. The comparative data is summarized in Figure 1 and shows that the Spectrum Micro Media Filter removed 99.8% of particles that could be measured by a Standard Method test (1.2 micron Millipore paper), compared with only about 75% by traditional filters. Figure 2 is the result of a particle size analyzer and shows that the Spectrum Micro Media Filter effectively removed virtually all particles down to 1 micron. The most impressive result of the testing is a photo of the 1.2 micron Millipore discs used for measuring the suspended solids concentrations (Figures 3 and 4). It is easy to see how much more effective the Micro Media Filter was in removing solids and free oil compared to the traditional filters.

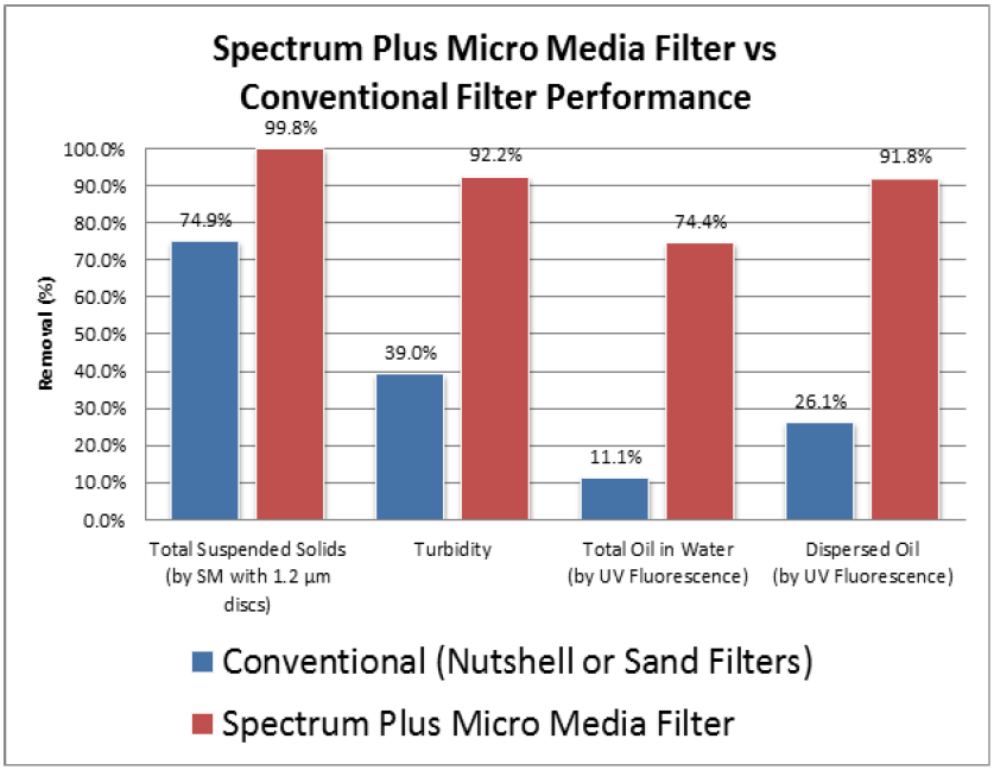

Figure 1

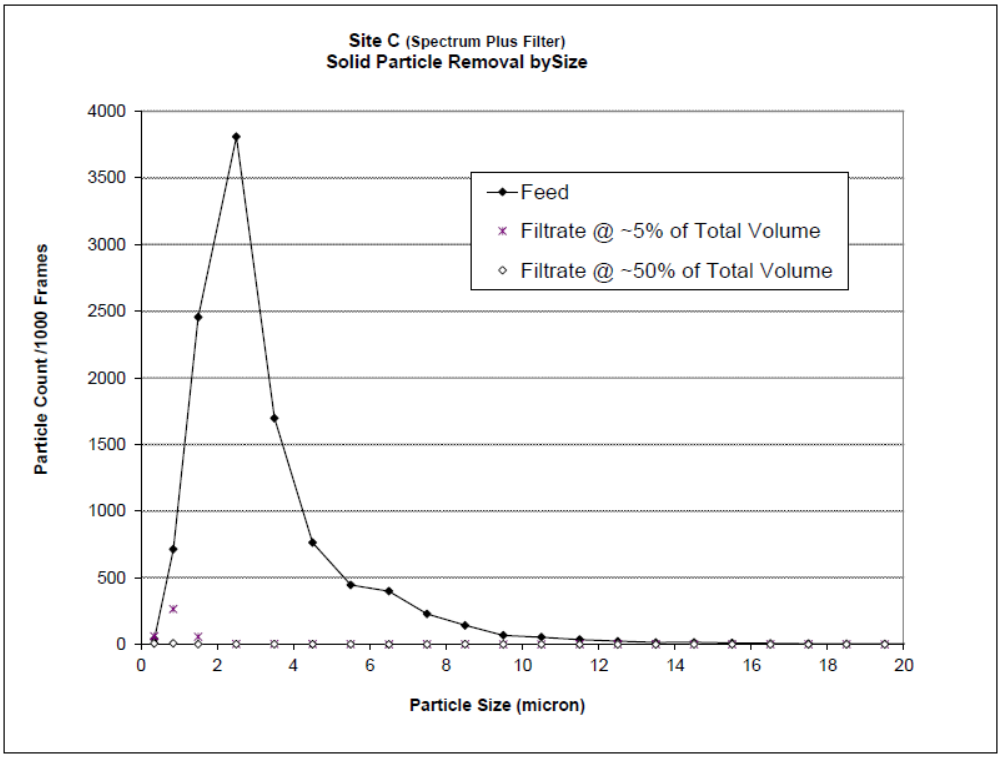

Figure 2

Millipore filter discs from Conventional Filter Sites

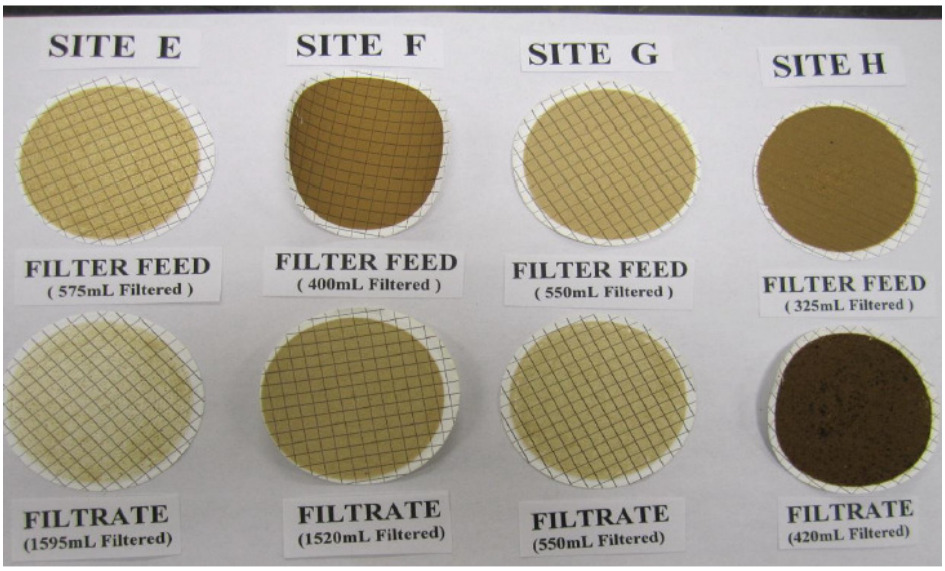

Figure 3

Millipore filter discs from Spectrum Micro Media Filter Sites

(Note filtrate volumes!)

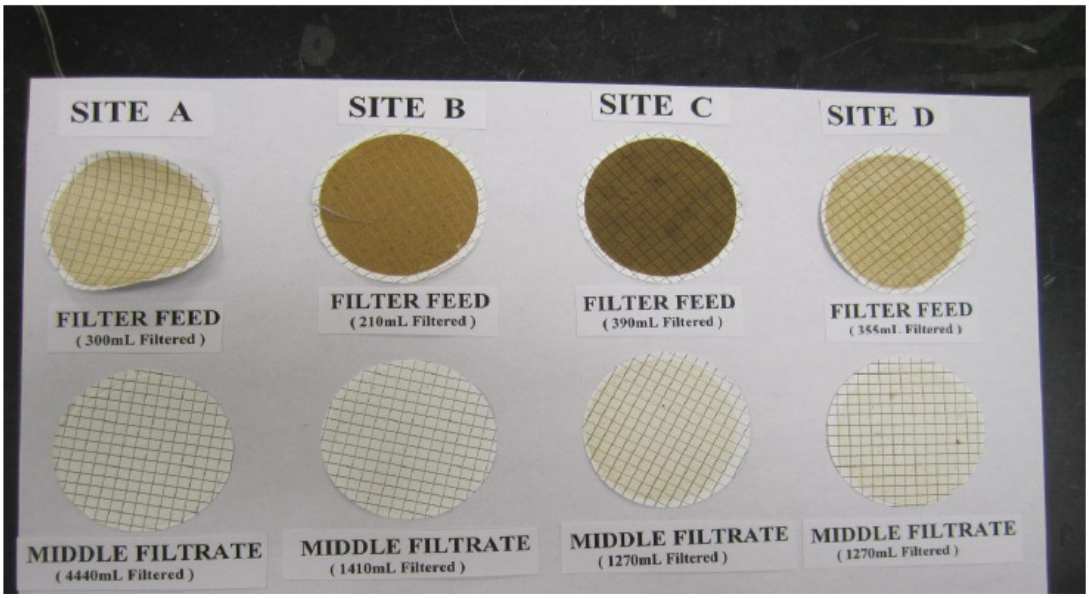

Figure 4

How easy is it to convert to or institute this technology?

For new requirements it's quite easy. The Spectrum Micro Media Filter looks and operates in many ways like a traditional backwashable, permanent media filter and is installed as complete equipment (media, vessels, piping, controls, and skid). In the case of a retrofit, it is not possible to simply replace media in a traditional filter vessel, as there are a number of internal modifications and control features required to make the process work effectively.

What are the financial implications of adopting the new Spectrum solution?

Spectrum Micro Media Filters are competitively priced with traditional nutshell filters, and yet provide superior performance. They are much more economical with regard to CAPEX and OPEX (operational expenditures) than membrane filter systems (polymeric or ceramic, microfilters, or ultrafilters). With the Micro Media Filter, the performance approaches that of a membrane filter. However, instead of having pores in the media that are permanently cast in the membrane manufacturer's factory — and which must be continuously kept clean — the pores in a Micro Media Filter are opened up and "recast" every time the filter backwashes. Therefore, there is no decline curve in performance, but rather it stays constant over time.

Where do you see this technology having the most impact, both geographically and by O&G segment?

This technology will impact O&G production by improving performance and reducing costs globally wherever EOR techniques are deployed. For example, whenever produced water is directly injected into a well either for water flooding or pressure maintenance into a reservoir formation that is tight and has low permeability, the producer will realize the benefit of better water filtration for injection in reduced well maintenance, longer-term production, and improved total oil recovery.

This improved filtration capability will also benefit other EOR techniques, such as when the produced water has to undergo subsequent processing like ion exchange softening (for feed-to-steam generators in heavy oil production), or when mixed with chemical additions (ASP flooding). Another need for effective, economical filtration of produced water is when excess produced water may be discharged to the surface for irrigation or some other water reuse scheme using reverse osmosis or other downstream treatment processes.