SpinTek
Centrifugal Membrane Filtration

APPLICATION BULLETIN SPIN493

Testing of CoMatrix™ Tower for Organic Removal and Filtration of Electrolyte

SpinTek Systems has been working diligently in various areas of filtration, coalescing and pollution control for the copper solvent extraction industry. Recent work has concentrated on the filtration and removal of organic from the electrolyte stream that is essential for efficient plant operation. The project development team was headed by Mr. Ken Severing, SpinTek V.P. Operations, who has had extensive experience in the design, fabrication, installation and operation of conventional SX Filters worldwide.

An obvious need was discovered to improve the performance of the organic removal and filtration process prior to electrowinning. The current SX filter design is expensive, provides for very little clean organic recovery, and uses a significant amount of backwash water.

The SpinTek objectives for this new organic removal filter were:

a) Reduce capital cost by 60% over conventional SX filters.
b) Reduce current backwash consumpton by at least half.
c) Find a better method for recovering the coalesced organic in a more concentrated form.

In addition to the need for improved coalescing of the organic, it was important to remember the primary purpose of existing SX filters, i.e., filtration. Since the SX filters remove significant particulate matter from the electrolyte, it was critical that the new system filter as well as the existing design.

The results of this test were used in the finalization of the SpinTek CoMatrix system design that utilizes a matrix plate coalescer, followed by an open tank area, coalescing media, and filtration media.

EQUIPMENT

It was determined during the feasibility phase that successful design and operation of a new organic removal and filtration system would need to be extensively tested in the field to experience the real world problems associated with operating in a copper mine.

The requirements of the new system had to be:

a) Simple to operate.
b) Highly reliable.
c) Capable of handling the high flow rates encountered in the solvent extraction copper industry.

Two separate 6" PVC columns were first built and field-tested to determine the viability of the new SpinTek CoMatrix system. The units were operated on various solvent extraction streams to measure the performance of different types of media, plate separators and tower-height requirements.

The data accumulated from these initial tests were used to design the test unit that generated the data presented in this report. The unit is 12" in diameter to provide a

could be designed that would be much lower in cost than the current SX filters. If this could be accomplished, the design would begin to address methods of improving the operational efficiency in the plant.

Another objective of the new system was to produce a highly-concentrated organic for recovery and reuse in the plant. The current SX design, while having a method of organic recovery, has an extensive amount of organic tied up in the media beds. The only method of recovering this organic is to backwash the filter and try and recover organic through subsequent separation and purification processes performed on the backwash water.

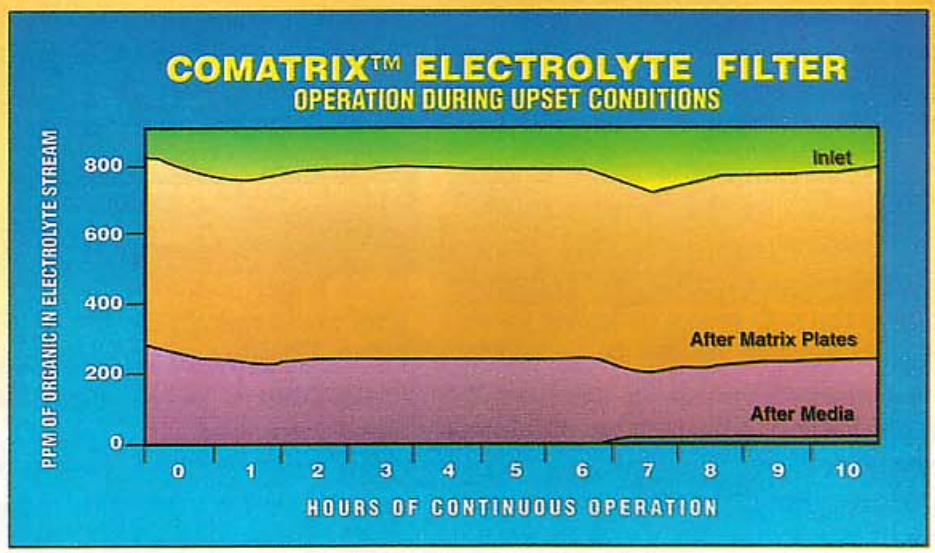
A major reduction in the amount of backwash water would also serve the industry well. The reduction of backwash provides several added benefits such as water conservation, less water to extract organic from, and more on-line time for the coalescing/filtration system.

It was also the objective of the test to determine both the operation of the new system on normally operating electrolyte streams of 30-40 ppm organic and also 800 ppm organic levels that could be experienced during plant upsets.

TEST

The testing was performed on site at a solvent extraction plant in the southwest United States. The plant operates a number of SX filters and provides an excellent model of a well run plant with normally low organic levels in the electrolyte.

The 12" diameter stainless steel CoMatrix unit was installed, parallel with the existing SX filters. The stream was taken at the same pressure as that fed to the existing filters. The effluent from the CoMatrix was then sent back to the feed tank since this was a test unit but a production CoMatrix would send the effluent to electrowinning, same as a SX filter, without the need for additional pumping.



The CoMatrix was operated at 25 gpm per square foot, which is five times the normal flow rate of existing SX filters. The unit was operated continuously and the effluent organic level was monitored as it entered the unit, after the matrix plate section and after the media beds. This test was to determine the length of run that could be obtained on a CoMatrix filter operated with 30 ppm of organic in the electrolyte stream.

After testing was completed on the 30 ppm organic level, the unit was moved to a settler effluent where it was possible to obtain a feed stream of electrolyte that was significantly higher in organic. The feed stream from this location averaged 800 ppm organic. The stream was used to simulate the operation of the CoMatrix filter during a plant upset.

RESULTS

The CoMatrix operation on the low organic electrolyte was monitored and the flow rate was maintained at 25 gpm/sqft. The matrix plate section of the unit consistently removed 60%-75% of total organic entering the unit (Chart A). This translated to a reduction of the feed organic level of 30 ppm down to a level of 10 ppm prior to the media bed.

The media beds were then able to further lower the organic level down to the non-detectable level which was the same level of organic removal as the large SX filters installed at the plant. The run length before breakthrough of organic, signaling the need to backwash the media, averaged 8 hours. This is a 33% reduction in run length compared to a SX filter, but the actual throughput between backwashes was increased by 330% with the same effluent quality. The CoMatrix had the same filtration media as the SX filters to obtain the same level of particulate removal.

When the feed concentration of organic was raised from 30 ppm to 800 ppm the CoMatrix operated similarly to the previous low organic runs. The matrix plates continued to remove from between 60%-75% of the organic prior to the media beds (Chart B). The media beds then proceeded to filter and coalesce the remaining organic to a non-detectable level. The run length decreased from the previous low organic runs of 8 hours down to 6 hours before backwashing was required.

During the runs on both the low and high organic electrolyte streams, it was possible to obtain coalesced organic at the top of the system which could be easily discharged from the system for recovery.

A complete drain down and backwashing cycle was performed at the completion of a run and the system returned to service.

SUMMARY

It was successfully demonstrated that a new coalescing/filtration system could be designed and operated on actual electrolyte streams and meet the objectives of lower capital and operating costs, reduced backwash requirements and easily recovered organic. The new CoMatrix showed that with proper coalescing matrix plates in the *same vessel as the media beds* it is possible to operate the system at 25 gpm/sqft which is 5 times faster than most existing SX filters. As an example, a plant considering five 12' SX filters could instead install one 12' or two 8 1/2' CoMatrix systems with an overall savings of 65% in capital and shipping costs.

The reduction of backwash frequency of the CoMatrix results in significant savings for solvent extraction plants. A detailed analysis is provided in Section A of this report to demonstrate that a plant operating with an electrolyte stream of 2,800 gpm can potentially reduce an average backwash consumption of 41.2 million gallons down to 12.4 million gallons. This reduction of backwash water by 70% leads to significant water conservation, more easily recovered organic and less off-line time for the filters.

The CoMatrix system demonstrated that an electrolyte coalescing filter system could be built that handles both normal plant operation and the higher organic loads encountered when the plant experiences an upset. The CoMatrix normal run length of eight hours was only reduced to six hours when the feed organic loading was raised from 30 ppm to 800 ppm.

The vastly improved coalescing ability of the CoMatrix also includes the proper media to filter the electrolyte stream down to 10 micron.

To further demonstrate the ability of the CoMatrix system for organic removal and filtration, additional field units capable of operation at 20 gpm are being built. These units will be tested on various applications within a solvent extraction plant, including raffinate streams. Interested parties can contact Mr. Bill Greene of SpinTek at (714) 236-9190 for more information about this new and exciting process for the copper industry.

SECTION A

EXAMPLE OF COMATRIX BACKWASING EFFICIENCY:

A normal electrolyte stream of 2,800 gpm would typically use five 12' diameter SX filters. Based on a 30-40 ppm influent to the SX filters, backwashing would occur every 12 hours.

A single CoMatrix system would be used for the 2,800 gpm flow and requires backwashing every 8 hours.

The backwashing of the CoMatrix takes the same amount of time and backwash water as a conventional SX filter.

SX Filters Backwash Cycle

5 SX filters x 2 Backwashes/day = 10 Backwashes/day

10 Backwashes/day x 10 min x 1,130 gpm BW flow = 113,000 gpd

CoMatrix Backwash Cycle

1 CoMatrix filter x 3 Backwashes/day = 3 Backwashes/day

3 Backwashes/day x 10 min x 1,130 gpm BW flow = 33,900 gpd

Over a one-year period of time this difference is 41.2 million gallons for the SX filters and 12.4 million gallons for the CoMatrix or a water savings of 70%.

Also, since the CoMatrix filter recovers approximately 2/3 of the organic in a concentrated stream, less recovery time is lost for the retrieval of the organic. On a 2,800 gpm electrolyte stream with 30 ppm of organic present, this represents 30,000 gallons per year of recovered organic that is recovered as a concentrated stream and not as part of the backwash water. The remaining 10,000 gallons of organic recovered is part of the backwash water similar to conventional SX filters.

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square footage of 0.8 feet. The target for the processing flow rate was 25 gpm/sqft, based on earlier field tests, which translated to a 20 gpm flow rate for this particular test unit. The unit is constructed of 316 stainless steel with PVC distributors and piping. Valving on this field test unit is manually operated.

The CoMatrix test unit is equipped with numerous sample ports to monitor system performance and has a port for easy removal of captured organic to allow for easy cleanup and backwashing of the media beds. The unit is free standing and capable of operating on the main electrolyte feed stream, the same as the existing SX filters, without the necessity of any additional pumping. It is extremely important to test the new CoMatrix system on the existing electrolyte stream without the need of additional pumps, batch tanks, etc. These added components not only complicate testing but can also alter the results.

DESCRIPTION OF THE COMATRIX OPERATION

The electrolyte stream enters the top of the CoMatrix system and is dispersed through the matrix plate coalescing section of the system. This section coalesces the organic as the electrolyte moves down through the system and provides extensive surface area for the coalesced organic to rise to the upper dome of the CoMatrix. This matrix plate section removes approximately 60%-75% of the organic from the electrolyte stream.

The coalesced organic continues to collect in the dome of the CoMatrix until a preset quantity is present. Once sufficient amounts of organic have been collected, the system senses that this has occurred and automatically opens a discharge valve to let the organic flow to a recovery tank.

As the electrolyte and the remaining uncoalesced organic pass through the matrix plate, there is an unobstructed section of the tank that is encountered. This section allows time for additional organic to float back into the matrix packing and up into the recovered organic section of the system.

The electrolyte then enters the media section of the CoMatrix. The CoMatrix has dual media to offer excellent filtration of the electrolyte and coalescing capability for the remaining organic. The coalescing occurs in the first layer of media and this first media also helps in the gross filtration of the electrolyte.

The second media layer contains finer material that performs the majority of the filtration. The media provides for a nominal filtration level of 10 microns.

OBJECTIVE OF TEST

The objective of the new CoMatrix system test was several-fold. The first objective was to determine if a new system