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Sulfuric Acid TODAY

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Fall/Winter 2016

Fertilizer giant OCP integrates growth with environmental, social stewardship Page 7

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Begg Cousland, Benvitec announce alliance

GLASGOW, United Kingdom—Begg Cousland Envirotec in the United Kingdom and Benvitec Environment in Belgium announced a strategic alliance in the field of mist elimination. The Benvitec BlueFil® range of phase separation technology mesh will now be part of the range of filtration and gas scrubbing solutions offered by Begg Cousland Envirotec, exclusively in certain countries worldwide.

Benvitec Environment thermoplastic BlueFil® mist eliminators are widely used in fume scrubbers in phosphoric acid and MAP/DAP plants and sometimes in sulfuric acid plants.

Begg Cousland Envirotec designs and manufactures knitted wire meshpads, fiber bed candle filter type mist eliminators, and gas scrubbing technologies under the Begg Cousland brand, famous for over 60 years.

Now the two companies have joined forces to maximize the potential applications of the BlueFil® range, and to offer significant process and quality improvements to users of other materials in scrubbing systems in fertilizer, metallurgical, and chemical industries. The BlueFil® media will now be incorporated into a new generation of gas cleaning equipment by Begg Cousland Envirotec.

For more information, please visit www.beggcousland.co.ul or www.benvitec.be.

Monitoring sulfuric acid concentrations online

MAGDEBURG-BARLEBEN, Germany—In various industries, monitoring sulfuric acid concentrations is vital for quality management, sustainable resource efficiency, and increased safety. Precise and reliable monitoring places high demands on the analysis. To determine concentrations, sonic velocity meters have proven to be ideal, as sonic velocity provides a strong and unambiguous measurement of the concentration of sulfuric acid and oleum in the production-relevant concentration ranges.

With the LiquiSonic® analyzer by SensoTech, sulfuric acid and oleum concentrations are continuously monitored in real time using just one single sonic velocity sensor that is installed directly in the pipe. Its robust construction with Hastelloy C-2000 sensor material makes the sensor completely maintenance-free. Due to the chemical and physical properties of sulfuric acid and oleum, the LiquiSonic® technology provides highly accurate and clear results. The measurement accuracy is up to ± 0.03 percent and the results are updated every second. The LiquiSonic® controller displays and stores real-time information. Via 4-20 mA signal, digital outputs, serial interfaces, fieldbus, or ethernet, the controller can be integrated into the network and control system.

The analyzer monitors acid concentration during various sulfuric acid production processes, including, for example, double contact double absorption (DCDA) and wet sulfuric acid (WSA). Moreover, LiquiSonic® analyzers are used in synthesis gas drying, fertilizer production, decomposing ore mining, and etching and pickling baths of the chemical and steel industry.

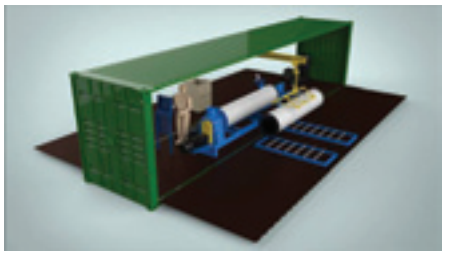
The LiquiSonic® analyzer by SensoTech monitors sulfuric acid and oleum concentrations during production with only a single sonic velocity sensor.

For more information, please visit sensotech.com.

Clark Solutions opens new manufacturing plant in Chile

SANTIAGO, Chile—By October of this year, Clark Solutions is launching a new manufacturing facility in Chile. The plant, located in Pudahuel, in the greater Santiago area, will manufacture Clark Solutions Fiberbed™ candle mist eliminators, Maximesh™ wire mesh mist eliminators, as well as a complete line of alloy products.

The location will also maintain inventories of two- and three-inch ceramic MaxiSaddles™ as well as Clark Solutions BPC™ low pressure drop packing.



Clark Solutions' mobile candle manufacturing unit can be transported on-site for emergency situations.

The Fiberbed™ candle manufacturing unit is a special chapter. With a mobile design protected by several patents, the plant has a unique ability to wind parallel or angled candles, or a mixture of both in a single candle.

It also monitors and controls fiber tension and pressure drop on-line, guaranteeing unmatched product performance. Every candle is tested and pressure drop curves are generated for each individual unit.

"After more than 20 years working in Chile selling products mostly made in Brasil, we believe it is time for us to establish a manufacturing unit, in order to offer this important market the same quality products but with substantially shorter lead times. The plant's purpose is to serve Chilean and Peruvian markets as well as to serve as an export platform for other countries," said Alex Bastida, Clark Solutions Chile CEO.

For more information, visit www.clarksolutions.com.br. ❑

SINGLE SOURCE FOR SULFURIC ACID PRODUCTS AND TECHNOLOGIES

Interpass absorption tower designed for a 900 MTPD sulphur burner acid plant designed, constructed and installed by Clark Solutions

- **Mist Eliminators:** MaxiMesh® wiremesh and FiberBed® fibre bed
- **Acid Distributors:** Through & Downcomers and Pipe Distributors
- **Tower Internals:** MaxiSaddle® ceramic packing and MaxiDome® ceramic support

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Pudahuel - Santiago - Chile

Finding the root cause of acid carryover

By: Vitor A. Sturm[1], Bruno B. Ferraro[1], Michael D. Montani[1,2], and Nelson P. Clark[1]
[1]Clark Solutions, São Paulo, SP, Brazil
[2]Polytechnic School of the University of Sao Paulo, São Paulo, SP, Brazil

When foggy gas, acid draining, and burnt sticks are observed, the immediate concern of all operators is mist eliminator efficiency. Properly sized and built, previously tested, and carefully installed mist eliminators are extremely reliable pieces of equipment. In most cases, mist eliminators should be the last and not the first concern, especially when evaluating their costs.

This article shows a successful case in which filters were not responsible for observed acid carryover.

Problem identification

Stick tests, as shown in Figs. 1 and 2, are the simplest qualitative way to reveal fine mist carryover and/or acid droplet reentrainment (dark wet spots), an inefficient SO_3 absorption, or submicron mists (uniform wood burn) inside an absorption or drying tower. An ideal stick test retrieves a clean stick.

Fig. 1 shows, from left to right, a 1-minute stick test realized at the drying (DT), interpass (IPAT), and final (FAT) towers of a 600 MTPD sulfur burning sulfuric acid plant. It is easy to see that the IPAT was operating with significant carryover—the stick was so dark and wet that it is almost impossible to pinpoint possible causes. A major mist eliminator vendor immediately suggested that candles were not working properly and that replacement was necessary.

Fig. 1: Original stick test.

Operating with these conditions may result in downstream damage. Clark Solutions and the customer chose a programmatic problem solving approach to identify possible issues and correct flaws, prior to condemning the candles.

Fig. 2: Closer stick test view shows dark spots (acid droplets).

Fig. 3: Tube sheet support beams cut to fit bolts.

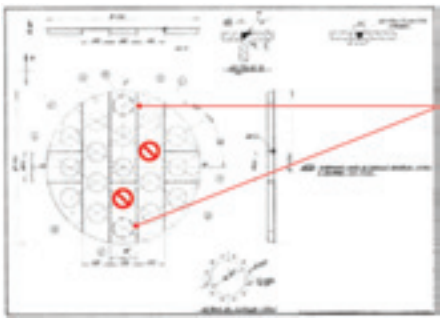

Fig. 4: Project different from as-built.

September 2015 inspection

In September 2015, the plant was shut down for a brief inspection. The IPAT inspection identified several cuts along the support beams, most probably because of a modification to fit candle filters that were acquired with different flange bolting hole patterns. Originally, the tube sheet was designed to support seventeen candles with 16 flange bolts on each candle. However, a different situation was found, with a mix of 12 and 16 flange bolts as well as two blockages at tube sheet center. When observing these conditions there was suspicion of possible tube sheet warping.

Besides the cuts made in the support beam, there were changes in the original tube sheet project.

Downcomers

Most downcomers were heavily fouled, directly affecting acid flow on distribution troughs. This caused heavy acid overflow and resulted in intense acid-mechanical carryover toward candles that overloaded due to draining capacity. All downcomers were cleaned and/or repaired.

Downcomer extensions are attached by pins that must be properly designed to avoid fouling. Teflon pins are shown in Fig. 6. Properly designed pins keep debris that may be circulating with the acid from blocking the downcomers. All pins were replaced with Clark Solutions designed pins.

Improper trough fixation can result in unbalanced troughs, which causes vibration and damage, and results in acid spills and carryover.

Fig. 5: Fouled downcomers.

Fig. 6: Downcomer pins and trough fixation.

Sketch	Pins	Situation
	10% area obstruction hard edges	Old
	3% area obstruction soft edges	New

Table 1: Pin exchange.

Tube sheet drain seal legs

All IPAT tube sheet drain seal legs were completely fouled and blocked by sulfate, preventing continuous drainage of collected acid by the tube sheet mist eliminators. At the time, the only way to drain collected acid was through a side drain, which operators opened once every shift. All draining seals were changed with newly designed ones, properly sized for the operating pressure drops in a more open design to reduce fouling effects.

Since there were candles of different types and suppliers inside the IPAT, there was not a pattern on the mist eliminators. Fig. 11 shows two hole patterns on the same flange. In addition, some candles included an internal reinforcement structure and others did not.

In September, 18 Fiberbeds® were bought from Clark Solutions. Because a new tube sheet with one single candle bolting hole pattern was scheduled to be installed in 2016, the candles were designed and built with a stainless steel pedestal so that they

Fig. 7: Old draining seals.

Fig. 8: Installed new draining seals.

Fig. 9: New draining seals.

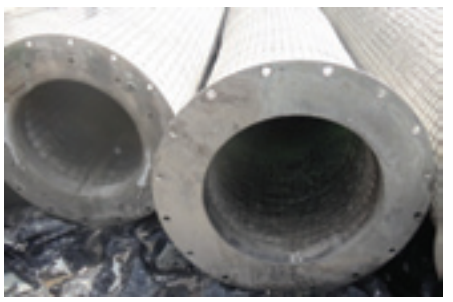

Fig. 10: Old candles with different hole patterns and internal structure.

Fig. 11: New Fiberbed® with pedestals to fit different hole patterns.

could be adapted and reused in the future.

Due to the short working timeframe in September, it was not possible to implement further actions. After starting the plant, a new stick test was conducted. The improvements were noticeable, but not complete, so another inspection was scheduled for January.

January 2016 inspection

In January 2016, the plant was shut down for a brief inspection prior to the new tube sheet installation. Due to both the mist eliminators' weight in operation and the support beams' "cut windows" (Fig. 3), the tube sheet showed warping, creating preferential gas paths between the filter's flange and the tube sheet.

The January inspection revealed that the Teflon gaskets on some filter candles were clearly not tight, indicating warping and gas passage. Fig. 15 shows that even anti-acid bricks were removed to fit bolting. Even 6 mm full face Teflon gaskets were not able to correct the spacing caused by the tube sheet warping, confirming that a new tube sheet was necessary.

In order to improve acid distribution in the IPAT acid troughs, new flow-control orifice plates were designed. Differences in the plate designs are shown in Fig. 17. The plates were changed during the January inspection. After these orifice plates' modification, smoother flow was observed over all acid troughs, eliminating overflow and minimizing acid entrainment.

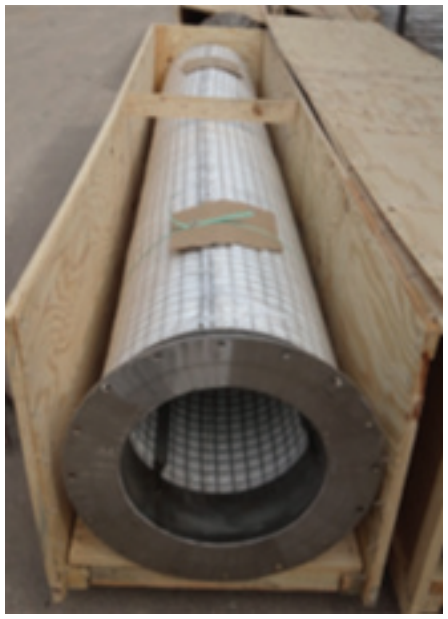

Fig. 12: New Fiberbed® detail with pedestal and internal structure.

Fig. 13: Stick test comparison for first intervention.

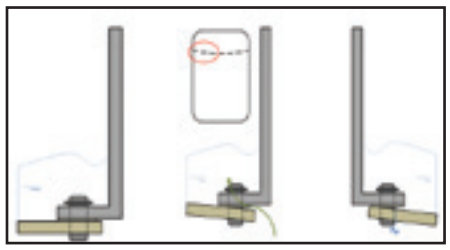

Fig. 14: Tube sheet warping scheme.

Fig. 15: Warping detail.

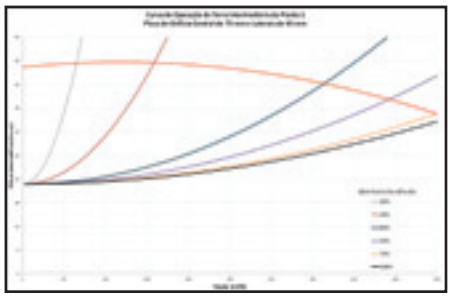

Fig. 16: Design comparison of orifice plate.

Fig. 17: Old (below) and new (above) orifice plates.

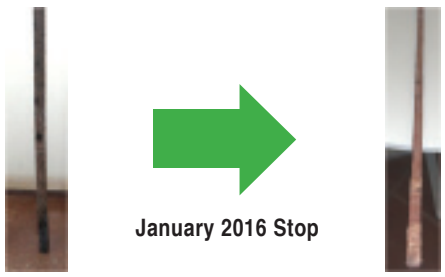

Fig. 18: Stick test comparison for second intervention.

Fig. 19: New tower head with new tube sheet.

Tube sheet replacement and final results

Because of the warped and damaged structure of the IPAT tube sheet, a full replacement was made in May 2016. The new tube sheet was designed to evenly support 19 filter candles as shown in Fig. 19.

After the tube sheet replacement, a proper stick test was finally achieved. The black marks in the final stick test are typically seen as a result of acid residue in the line. All candle filters that were installed in September 2015 had their pedestals adapted to the new candle bolt hole standard and were installed in the new tube sheet as planned. The plant has now prevented further damage of downstream equipment and is properly operational.

Fig. 20: Stick test comparison for final intervention.

Conclusion

Fine mist carryover, acid droplets reentrainment, and inefficient SO^3 absorption can result from many sources, including uneven acid distribution (distributor or packing flaws), fouled drain seal legs, bad mist eliminator installation, gasket leakage, tube sheet preferential gas paths, and others. If only the mist eliminator candles were exchanged in these situations, the stick test would show little to no improvement.

When observing acid content downstream from towers it may be necessary to inspect and evaluate the plant, considering dry tower inefficiency, water leaks, bad acid or gas distribution inside towers, intense acid fine mist condensation, as well as other non-conformities discussed in this article. Clark Solutions is always available to conduct such inspections.

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