Pall Corporation

Case Study

Pall Technologies Deliver Stable Operation of Amine Unit at Low Operating Costs

Application

A major Oil Company operates a refinery in continental Europe, which includes three amine trains: in the gas plant; in the HDS unit; and in the FCC unit. From the initial plant design the amine unit in the FCCU was only equipped with a coarse filter on the lean side.

Background

The amine unit in the FCCU had been facing repeated foaming issues. The refinery identified that this was caused by a combination of the ingression of liquid hydrocarbons with the sour fuel gas and by the formation of fine particles of corrosion products in the amine loop. As a consequence of foaming, the refinery was experiencing issues with the H_2S spec in the treated gas, and carry-over of heavier hydrocarbons with the fuel gas. The refinery had to limit the amine unit capacity to 35 ton/h instead of 40 ton/h, a 12.5% reduction. This reduction directly limited fuel gas production, with the potential to restrict FCCU output at significant financial risk to the refinery.

Different types of filter technologies (bags, pre-coat, self-cleaning) had been trialed unsuccessfully by the refinery, until a clean-up or 'depollution' of the amine solution was undertaken in collaboration with Pall, in order to solve foaming issues by eliminating the solid and hydrocarbon contamination circulating in the amine. A mobile unit was connected on the rich amine loop, comprising a particulate filter to eliminate solid particles, a liquid/liquid coalescer to eliminate free & emulsified liquid hydrocarbons, and a carbon bed to eliminate the dissolved hydrocarbons.

The progress of the depollution and the cleanliness of the amine solution were monitored by the refinery's laboratory with foam tests. The benchmark foam collapse time was 7 seconds for new amine solution, while the collapse time of the actual amine solution was 60 seconds. After the first 24 hours of depollution, the foam collapse time was reduced to 20 seconds; after 72 hours it was down to 9 seconds. As a result of the much cleaner amine solution, the refinery was able to return to operating this train at the design capacity of 40 ton/h. The depollution highlighted that the carbon bed located downstream of the coalescer did not bring further improvement to the foaming of the amine solution, meaning that the solid and hydrocarbon contaminants were successfully eliminated by the particulate filter and the coalescer. A few months later, the refinery decided to install a particulate filter in the rich amine to maintain low levels of solid contamination. Pall supplied an Ultipleat® High Flow filter, with 10 micron absolute-rated filter cartridges.

Challenge and Solution

A few years later, the refinery undertook an upgrade project on the FCCU, in which the amine unit was identified as a bottleneck due to continued sensitivity to foaming. Following the successful depollution of the amine solution which highlighted the benefit of keeping the liquid hydrocarbon contamination low, the refinery decided to install a liquid/gas coalescer upstream of the contactor, to eliminate the condensed hydrocarbons from the fuel gas before it mixes with the amine solution. The company also had very positive feedback from another refinery of the group, where the same Pall coalescer technology was successfully used in this application. In addition, the refinery decided to install particulate filters upstream and downstream of the existing carbon bed in the lean amine. Pall supplied a high-efficiency SepraSol™ coalescer upstream of the contactor, and two Ultipleat High Flow filters, with 10 micron absolute-rated filter cartridges, either side of the carbon bed.

Feedback and Benefits

The refinery reported very satisfactory operation of the filters and coalescer, as well as substantial improvements of the operation of the amine unit itself. The benefits included:

- No more foaming incidents
- No more anti-foam consumption
- Less frequent amine blow down
- Better amine regeneration
- Stable quality of the amine solution, despite the presence of Heat Stable Salts
- Reduced risk of FCCU restrictions due to amine plant issues

The refinery also reported very low and stable consumption of filter and coalescer cartridges. The coalescer cartridges were first replaced during a turnaround, after six years of successful operation. The filter cartridges are replaced every three months on average on the rich amine filter, and every 12 months on average on the lean amine filters. The corresponding yearly operating cost, under normal operating conditions and at the time of purchase, for the filter and coalescer cartridges is below US $25,000.

Conclusion

Solid particles and liquid hydrocarbons are detrimental to the good operation of amine units, and operating issues they create can significantly affect plant revenue. Stable operation of the amine unit is possible through efficient and consistent control of the cleanliness of the amine solution. This can be achieved by the combination of 1) a high-efficiency liquid/gas coalescer upstream of the contactor and 2) absolute-rated particulate filters installed in the recirculating amine. The use of efficient filter and coalescer technologies is key to maintaining consistently low levels of solid and hydrocarbon contaminants in the amine solution. Nevertheless, this experience shows that the use of efficient technologies does not necessarily involve high operating costs.

These benefits were realized as a result of the strong long-term relationship between Pall and the refinery operator, and the process knowledge Pall personnel displayed.

Pall Corporation

Fuels and Chemicals

25 Harbor Park Drive
Port Washington, NY 11050
+1 516 484 3600 telephone
+1 888 873 7255 toll free US

Portsmouth - UK
+44 (0)23 9233 8000 telephone
+44 (0)23 9233 8811 fax
industrialeu@pall.com

Singapore
+65 6389 6500 telephone
sgcustomerservice@pall.com

Filtration. Separation. Solution.SM

Visit us on the Web at www.pall.com

Better Lives. Better Planet.SM

Pall Corporation has offices and plants throughout the world. For Pall representatives in your area, please go to www.pall.com/contact

Because of technological developments related to the products, systems, and/or services described herein, the data and procedures are subject to change without notice. Please consult your Pall representative or visit www.pall.com to verify that this information remains valid. Products in this document may be covered by one or more patent numbers. For a complete list of Pall's patents please visit http://www.pall.com/main/about-pall/patents.page

FCREFEUREN Produced in the USA February 2015