Pall Corporation

Case Study

Pall's Field Tests Demonstrate Effectiveness of Pall's Coalescer to Protect Condensate Stabilizer

Application

The condensate stabilizer separates the lightest components from the hydrocarbon condensate in order to make it safe for storage and for transportation. The condensate leaving the three-phase separator always contains free (undissolved) water that needs to be eliminated prior to entering the stabilizer to ensure smooth operation.

Many different technologies exist to separate liquids from liquids, but conventional liquid/liquid separators (e.g. electrostatic coalescers, separators with mesh pads, cartridge coalescers) may exhibit a very limited performance if the liquid/liquid mixture is stable. For example, commodity cartridge coalescers are capable of separating emulsions with an interfacial tension (IFT) typically no lower than 15-20 dyne/cm, resulting in water carryover in the presence of more stable emulsions. Field measurements and plant surveys carried out by Pall downstream of existing separators confirmed these findings. Results from three site surveys performed in the Middle East and North Africa regions are shown in the table below.

Problem

The condensate stabilizer requires an efficient protection to minimize the ingression of water and solid contaminants. The salt laden water can indeed cause corrosion and dissolved salts can deposit ('salting'), causing fouling issues inside the column and the reboiler. Solids can deposit and cause fouling as well. An inadequate protection of the stabilizer may result in shutdowns for cleaning purposes, process upsets due to more difficult fine tuning of the stabilizer operation, product quality issues (LPG, condensate), risk of corrosion in export storage tanks and pipelines, etc.

An efficient condensate dewatering may be difficult to achieve when the IFT is low. The IFT is strongly affected by the presence of dissolved chemicals that are used in upstream production activities (e.g. corrosion inhibitors, hydrate inhibitors, etc.) which have surfactant properties and tend to lower the IFT. It is very common that the IFT between the water and the condensate is lower than 5 dyne/cm.

Such an emulsion containing micron size water droplets would typically not settle within a few hours.

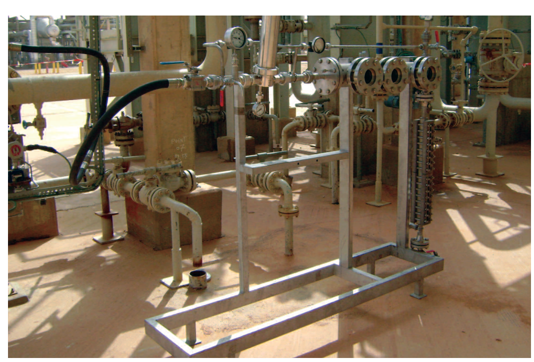
Over the past year Pall has conducted several site surveys in North Africa and in the Middle East to help plants understand the root causes of the problems experienced in their stabilizer and downstream. Site A was suffering from salt deposits inside the column causing plugging and resulting in a shutdown every 3-4 months for water wash to dissolve the salts. Site B was experiencing the plugging of the heat exchanger upstream of the column as well as deposits in the reboiler, malfunctioning of the stabilizer, and corrosion issues in the export lines. Site C was facing frequent deposits inside the reboiler of the column, causing an important maintenance step requiring cleaning. All these problems appeared to be related to significant carryover of free water to the stabilizer.

Table 1: Site survey results

Site	A	B	C
Flow rate m^3/h (gpm)	70 (308)	330 (1452)	25 (110)
Pressure barg (psig)	29.5 (428)	29.5 (428)	32 (464)
Temp. °C (°F)	36 (97)	65 (149)	44 (111)

Field test results

The site surveys were carried out by Pall's engineers from its Scientific & Laboratory Services (SLS) team which provides technical assistance. SLS mobilized test equipment for on-line measurement of liquid and solid contamination. Measurements were made at different locations including downstream of the existing separator (i.e. upstream of the stabilizer). The coalescer test unit used to assess the water content in the condensate is shown below.



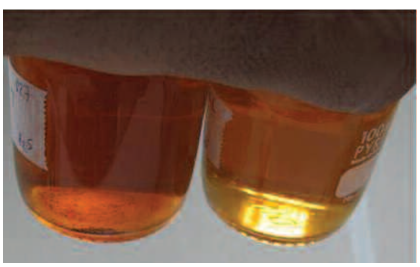
Pall's coalescer test unit used for assessing water content in condensate

Results of tests carried out downstream of the existing separator are shown below.

Table 2: Test results downstream of the existing separator

Site	A	B	C
Visual appearance inlet Pall coalescer	Strong haze	Moderate to strong haze	Strong haze
Visual appearance outlet Pall coalescer	Clear & bright	Clear & bright	Clear & bright
Total water content (ppmw) inlet Pall coalescer	400-500	1800-4800	500->10,000
Total water content (ppmw) outlet Pall coalescer	n/a	390	30-80

Condensate samples collected at Site C at the outlet (left) and inlet (right) of Pall's coalescer test unit



Condensate samples collected at Site B at the inlet (left) and outlet (right) of Pall's coalescer test unit

At each site a very significant water carryover was confirmed from the upstream separator, highlighting the inability of conventional separators to effectively separate water from condensate. The condensate entering the stabilizer still contained a lot of free water, from about 0.5 m^3/h (2.2 gpm) at Site A to more than 2 m^3/h (8.8 gpm) at Site C, which clearly explains the various problems reported by the three plants.

The condensate exiting the existing separators is very hazy in appearance because of the remaining presence of free (un-dissolved) water in the form of fine droplets. Pall's coalescer demonstrated its ability to separate these fine droplets. The visual appearance of the condensate exiting Pall's coalescer is clear & bright, which indicates that the remaining free water content in the condensate is near the solubility limit. Typically, the free water content is below 20 ppmw, as was measured at Site B. The total water content as reported in the table reflects both the soluble and the insoluble (free) water. The soluble water content is dependent on the condensate composition and the operating temperature, which explains the difference in the results at Site B and Site C as condensate from Site B (at the coalescer outlet) contained a higher total water content due to a higher aromatic content and temperature.

Conclusion

In the condensate dewatering application, the free water is typically present in the form of very fine droplets because of low IFT. Although they are fine, they are detrimental to the stabilizer. Typically, conventional separators are unable to efficiently protect the stabilizer because of their inability to separate emulsions with an interfacial tension lower than 15 dyne/cm.

Pall's PhaseSep® coalescers are capable of separating both large and micron-size water droplets from the condensate, making this technology the most reliable and cost-effective solution for condensate dewatering applications. PhaseSep coalescers are a proven solution that have demonstrated incomparable performances in the numerous critical liquid/liquid separation applications found in the oil & gas, refining, and petrochemical industries.

Pall has scientific and laboratory capabilities to support its customers locally in the Middle East and North Africa regions through its SLS department. Locally-based mobile test equipment and field engineers can be mobilized to any plant to assist in optimizing the operation of their critical assets.

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

Pall Middle East
+971 4 3406204 telephone
info-MiddleEast@pall.com

Pall bureau de liaison Alger
+213 21 35 5866 telephone
NorthAfrica@pall.com

Pall France
+33 1 3061 3800 telephone
industrialFR@pall.com

*Filtration. Separation. Solution.*SM

Visit us on the Web at www.pall.com

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.

FCCSCONDENEN Printed in the USA December 2009